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Hospital productivity in the first year of the Wellbeing services county reform

Case Wellbeing services county of Central Ostrobothnia

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ABSTRACT:
At the beginning of 2023, a major administrative reform was made in Finland as the responsibility for organizing healthcare, social welfare and rescue services was transferred from the municipalities and joint municipal authorities to the wellbeing services counties. The aim of the reform was to tackle the growth of expenses, ensure equal services and narrow differences in health and wellbeing. The beginning for the wellbeing services counties has not been easy and the financial difficulties of the wellbeing services counties have been featured heavily in the news.

This thesis has two research questions. The first research question is answered during the literature review, and it is included in the thesis to build industry specific knowledge. Research question 1 is: Which factors are associated with productivity challenges in healthcare? Based on the literature review, especially resource management and the availability of the resources rises as factors which challenge healthcare productivity. Literature does not provide evidence for the best practice how to support efficiency improvements in public health systems. Public health systems differ from each other internationally, making comparison between countries difficult.

The second research question and the main objective for the thesis is answered during the empirical part of the thesis. The second research question is examined from the case organization's point of view. Case organization in this thesis is Wellbeing services county of Central Ostrobothnia Soite. Research question 2 is: How has hospital productivity changed in Soite in the first year of the Wellbeing services county reform. Hospital productivity in this thesis means productivity in non-psychiatric specialties.

Exploratory data analysis (EDA) is used in this thesis to answer research question 2. The EDA framework used in this thesis includes three steps: 1) display the data, 2) identify salient features and 3) interpret salient features. This thesis uses mixed methods as both quantitative and qualitative techniques are used. Data collection in this thesis had three main parts. The first part was data collection through Hospital productivity 2023 statistical report and its related time series review. The second part was requesting data concerning intermediary outputs from case organization. The third part was data collection through interviews via e-mail.

Hospital productivity in Soite was at its worst in 2023 during the timeframe 2019–2023 under review. However, productivity in 2023 in Soite was the second best among central hospitals. The most salient feature arisen from the data analysis was the decreased number of hospital care days in 2023 compared to earlier years.

KEYWORDS: Operations management, Productivity, Hospital, Healthcare, Wellbeing services counties

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TIIVISTELMÄ:
Vuoden 2023 alussa Suomessa tehtiin suuri hallinnollinen muutos, kun vastuu terveydenhuollon, sosiaalihuollon ja pelastuspalveluiden järjestämisestä siirrettiin kunnilta ja kuntayhtymiltä hyvinvointialueille. Muutoksen tavoitteena oli hillitä kustannuskasvua, varmistaa yhtäläiset palvelut ja kaventaa eroja terveydessä ja hyvinvoinnissa. Hyvinvointialueiden alku ei ole ollut helppo ja hyvinvointialueiden taloudelliset ongelmat ovat olleet vahvasti esillä uutisissa.

Tässä tutkielmassa on kaksi tutkimuskysymystä. Ensimmäiseen tutkimuskysymykseen vastataan kirjallisuuskatsauksessa ja se on sisällytetty tutkielmaan rakentamaan toimialakohtaista tietämystä. Tutkimuskysymys 1 on: Mitä tekijöitä yhdistetään tuottavuushaasteisiin terveydenhuollossa? Kirjallisuuskatsauksen perusteella erityisesti resurssienhallinta ja resurssien saatavuus nousevat tekijöinä, jotka haastavat terveydenhuollon tuottavuutta. Kirjallisuus ei tarjoa näyttöä parhaista käytännöistä, joilla voidaan tukea tehokkuuden parantamista julkisissa terveydenhuoltojärjestelmissä. Eri maiden julkiset terveydenhuoltojärjestelmät eroavat toisistaan tehden maiden välisestä vertailusta vaikeaa.

Toiseen tutkimuskysymykseen ja tämän tutkimuksen päätavoitteeseen vastataan tutkielman empiirisessä osassa. Toista tutkimuskysymystä tarkastellaan tutkimuksen tapausorganisaation näkökulmasta. Tapausorganisaatio tälle tutkimukselle on Keski-Pohjanmaan hyvinvointialue Soite. Tutkimuskysymys 2 on: Kuinka sairaalan tuottavuus on muuttunut Soitessa hyvinvointialueuudistuksen ensimmäisenä vuonna? Sairaalan tuottavuus tässä tutkielmassa tarkoittaa tuottavuutta somaattisilla erikoisaloilla.

Tutkimuskysymykseen 2 vastataan tutkivan data-analyysin (EDA) avulla. Tässä tutkielmassa käytetty EDA-viitekehys sisältää kolme vaihetta: 1) tietojen näyttäminen, 2) olennaisten piirteiden tunnistaminen ja 3) olennaisten piirteiden tulkinta. Tässä tutkielmassa käytetään sekamenetelmiä, sillä sekä määrällisiä että laadullisia tekniikoita käytetään tutkielmassa. Tutkielmassa tiedonkeruu koostui kolmesta pääosasta. Ensimmäisessä osassa kerättiin tietoja Sairaaloiden tuottavuus 2023 tilastoraportilta ja siihen liittyvästä aikasarjatarkastelusta. Toisessa osassa pyydettiin tapausorganisaatiosta tietoja liittyen välituotoksiin. Kolmannessa osassa tietoja kerättiin sähköpostihaastatteluiden avulla.

Sairaalan tuottavuus Soitessa oli huonoimmillaan vuonna 2023 tarkasteltavan aikajakson 2019–2023 aikana. Vuoden 2023 sairaalan tuottavuus Soitessa oli kuitenkin toiseksi paras keskussairaaloiden joukossa. Olennaisimpana piirteenä data-analyysissä nousi esille vuoden 2023 hoitopäivien vähäisempi määrä verrattuna aiempiin vuosiin.

AVAINSANAT: Operations management, Productivity, Hospital, Healthcare, Wellbeing services counties

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1 Introduction

1.1 Background

At the beginning of 2023, a major administrative reform was made in Finland as the responsibility for organizing healthcare, social welfare and rescue services was transferred from the municipalities and joint municipal authorities to the wellbeing services counties (Ministry of Social Affairs and Health, 2025). The wellbeing services counties were formed mainly based on the division into regions and there are 21 wellbeing services counties (Ministry of Social Affairs and Health, 2025). Exceptions to the regional division are that the region of Uusimaa is divided into four wellbeing services counties, the city of Helsinki will continue to have responsibility for organizing healthcare, social welfare and rescue services on its area and the HUS Group will have responsibility to organize specialized healthcare in the region of Uusimaa (Ministry of Social Affairs and Health, 2025). Tackling the growth of expenses, ensuring equal services and narrowing differences in health and wellbeing were justifications for why the wellbeing services county reform was necessary (Ministry of Social Affairs and Health, 2025).

According to the Ministry of Finance (n.d. -a), the wellbeing services counties are self-governing regions whose supreme decision-making body is the county council. Elections for the county council are held every four years, and the residents of counties have the right to vote in county elections, in which representatives are chosen to the county council. Although the wellbeing services counties are self-governing regions, they do not have the right to collect taxes and the majority of their funding comes from the central government. The wellbeing services counties can decide how they use the money they receive from the central government as the funding from the central government is universal and the funding is also imputed (Ministry of Finance, n.d. -b).

According to the Ministry of Finance (n.d. -b), the funding is calculated by taking into account multiple criteria which are weighted by: number of residents in the wellbeing services county, coefficients which describe the need for healthcare and social welfare

services and coefficients which describe regional conditions. Also, some of the funding is determined by the criteria for promoting health and well-being. The funding base of healthcare and social welfare services will be raised annually based on an estimated rise in the level of costs and service demand while the funding base of rescue services will be raised based on an estimated rise in the level of costs. Due to the self-governing nature of the wellbeing services counties and long-term operational development, it is important that the funding is predictable. The imputed funding granted for the wellbeing services counties will also be adjusted retroactively annually to reflect the actual costs at the national level. The objective of tackling the growth of the expenses is also included in the imputed funding model (Ministry of Social Affairs and Health, 2024, p. 14).

The beginning for the wellbeing services counties has not been easy. The financial difficulties of the wellbeing service counties have been featured heavily in the news, both regionally and nationwide. A challenging start has been made concrete by the fact that the combined deficit of the wellbeing services counties for the year 2023 was over 1,3 billion euros (State Treasury, n.d. -a). The deficit accumulated on the balance sheet of the wellbeing services county in 2023 must be covered by the end of 2026, otherwise the Ministry of Finance may initiate an evaluation procedure (Ministry of Finance, n.d. -c). Evaluation procedure basically means evaluation if the wellbeing services county has financial and service delivery capacity to fulfil its tasks. So, it is important to improve efficiency and find cost savings through productivity and economic measures to avoid the evaluation procedure. By organizing its activities cost-effectively, the wellbeing services county can maintain its self-governing nature.

1.2 Objectives and research questions

As one of the reasons for the wellbeing services county reform was to tackle the growth of the expenses, studying productivity of the first operating year of the wellbeing services counties and comparing it to the earlier years provides interesting subject for the study. Economically sustainable operations and tackling the growth of expenses

compared to the growth of service demand is one of the national objectives for organizing healthcare and social welfare (Ministry of Social Affairs and Health, 2024, p. 14). Productivity measures of healthcare and social welfare have a significant impact for sustainability of general government finances as the funding for the wellbeing services counties is more than a quarter of the government's budget (Ministry of Social Affairs and Health, 2024, p. 14). So, as healthcare and social welfare accounts a major proportion of the central government finances, studying and understanding what productivity means in their concept is crucial.

This thesis has two research questions. The first research question will be answered during the literature review part of the thesis. As the financial difficulties of the wellbeing services counties have been heavily featured on the news, challenges associated with the productivity in context of wellbeing services counties is an interesting research topic. The aim of the first research question is also to build more industry specific knowledge. Therefore, the first research question is:

RQ1: Which factors are associated with productivity challenges in healthcare?

The second and the main research question of this thesis will be answered during empirical part of this thesis. The object of the empirical part of the thesis is to examine how productivity has changed in the first year of the wellbeing services county reform compared to previous years. Changes in productivity will be analyzed from the perspective of a case organization. Case organization for this thesis is Wellbeing services county of Central Ostrobothnia Soite. Finnish Institute for Health and Welfare (THL) publishes annually statistical report about hospital productivity, where hospital productivity is measured in non-psychiatric specialties. Therefore, the hospital productivity statistical report 2023 and its related time series review will be an essential part of the data analysis. Previous years are comparable to present as the data has been annually collected from hospitals. The hospital under review in this thesis is Central Ostrobothnia Central Hospital. The second and the main research question is:

RQ2: How has hospital productivity changed in Soite in the first year of the Wellbeing services county reform?

In this thesis, hospital productivity means productivity in non-psychiatric specialties. In this thesis exploratory data analysis is conducted to answer RQ2. In addition to earlier mentioned hospital productivity data, data considering the yearly number of intermediary outputs was requested and received from the case organization. The first part of the data analysis includes the usage of quantitative techniques in order to identify salient features of the data. The interpretation of salient features includes interviews. Therefore, this study uses mixed methods methodology as both quantitative and qualitative techniques are used.

1.3 Scope and limitations

As wellbeing services counties are responsible for organizing multiple services which differ from each other, objectives for the thesis must be well defined in order to be able create a coherent study. First, rescue services were left out of this thesis since they only account for a minor proportion of total funding for the wellbeing services counties. Also, the concept of productivity might be hard to connect to the rescue services due to nature of rescue services. As literature review was started it was found out that articles considering productivity in healthcare were found more easily than articles considering productivity in social welfare services. Because of that, RQ1 was limited to consider healthcare. RQ2 was limited in terms of hospital productivity as official statistical reports considering hospital productivity were easily accessible.

As the empirical part of this thesis will be made specifically from Soite's point of view, the results are applicable specifically to Soite, thus the results cannot be generalized to other wellbeing services counties. However, by using the methodology used in this thesis, the research should be reproducible in the context of individual wellbeing services county.

One relevant limitation for this thesis is that the latest hospital productivity statistics published are from the year 2023 and hospital productivity 2024 will be published in late 2025. So, there is data available only from one year after the wellbeing services county reform. So, if changes in productivity are found in the empirical part of this thesis, it may not be possible to state if there is a trend or if the possibly found productivity change in the year 2023 is only an anomaly, thus excessive generalizations should be avoided.

2 Literature review

2.1 Operations management

Simply put, operations management (OM) means managing processes that produce or deliver goods and services (Greasley, 2007, p. 3). All the activities that are required for producing or delivering a product or service are included in OM (Greasley, 2007, p. 12). As the definition of OM suggests, it is a broad concept as it concerns all the activities required for producing or delivering a product or service.

According to Slack and Lewis (2020, p. 11), issues concerned in OM have typically short to medium timescale. Level of analysis in OM is more focused on resource management within or between smaller operations (micro level of the process). The level of aggregation in OM is detailed, and the focus is more on details of how certain products or services are produced. OM is mostly concerned with concrete issues which can be immediately recognized.

According to Williams and Radnor (2022, p. 1127), the origin of OM is in the manufacturing industry. However, the growth of the service industry has led to scholars calling for more OM research in non-profit and public sector organizations. Financial crises in various countries have led to massive public service budget cuts, and this may have fueled emphasis on OM in the public service industry. Public services throughout the Western world have also faced constant pressure to reduce costs and increase efficiency. Healthcare is a public service which has gained a lot of attention in OM research as OM has a lot to offer for healthcare. With the help of OM, healthcare may achieve direct benefits such cost savings, reduced patient waiting times and better access to care.

According to Choi et al. (2018, p. 1868), the aim of OM is to use methods which are helping on making optimal or at least near-optimal decisions within organization. The usage of data is an essential component in OM as many OM decisions are made based on statistical or mathematical models. Due to data-centric approach, big data analytics

is closely connected to OM and it can be regarded as one of the most prominent recent developments in the field of OM. Big data analytics sets its aim on measuring performance and creating competitive advantage by a holistic approach aimed at managing, processing and analyzing the 5V data-related dimensions, which are volume, variety, velocity, veracity and value (Wamba et al., 2017, p. 2).

According to Roels and Staats (2021, p. 745–746), the most of OM research has often neglected the importance of people in operating systems. People have often been treated as fixed and immutable resources in OM research. The authors state that this kind of approach is problematic because most of the jobs today are information based, and the proper usage of information has a significant impact on how a company succeeds. More and more jobs are becoming more service oriented, which also supports the importance of people in operational processes. Because of these reasons, the authors highlight the importance of people-centric operations in OM research. They define people-centric operations as a study how the performance of operational processes are affected by the people.

Rungtusanatham et al. (2003) identified five key areas for OM in their survey research concerning OM articles published between 1980–2000. Five key areas which they identified are: 1) just-in-time (JIT), 2) technology management, 3) operations strategy, 4) quality management, and 5) supply chain management. So, the following five subsections will examine these five key areas.

2.1.1 Just-in-time

According to Mackelprang and Nair (2010, p. 283), just-in-time (JIT) manufacturing is one of the most researched topics in the field of OM. However, the conceptualization of JIT varies in the literature; sometimes it is defined as managerial or manufacturing philosophy and sometimes it is simply referred as a set of practices (Mackelprang & Nair, 2010, p. 283). Cua et al. (2001, p. 676) identified nine practices from literature which are often

regarded as JIT practices: set-up time reduction, pull system production, JIT delivery by supplier, functional equipment layout, daily schedule adherence, committed leadership, strategic planning, cross-functional training, and employee involvement. The goal of JIT is to continually reduce and ultimately eliminate all forms of waste through JIT production and employee involvement (Cua et al., 2001, p. 676).

Inman et al. (2011, p. 344) defined JIT as a subset of lean which primarily focuses eliminating waste through planning, scheduling, and sequencing of operations. Lean is a combination of lean thinking and lean practice (Cusumano et al., 2021, p. 630). Lean thinking sets its focus on value creation by fewer resources and with less waste and the customer is always the starting point for lean thinking, i.e. what does the customer value or which problems are needed to solve for customer (Cusumano et al., 2021, p. 630). Lean practice, on the other hand, emphasizes continuous experimentation and learning to achieve value without waste and an organization characterized by lean practice is highly adaptive and capable of achieving better quality and flow with less time and effort, and at lower cost (Cusumano et al., 2021, p. 630).

According to Cusumano et al. (2021, p. 634), lean is a broad system that includes both the people and the process components, and it also involves components related to the organization (internal components) and components related supplier and customer (external components). Thus, lean cannot be seen as singular concept or equated only with waste elimination or continuous improvement. Cusumano et al. (2021, p. 634) further state that one key characteristic for lean is its ability to adapt. Although the original philosophy of lean was based on Toyota Production Systems and earlier the terms lean and JIT were often used synonymously, the logic behind lean turned out to be transferrable beyond repetitive manufacturing (Cusumano et al., 2021, p. 634). There have been lean applications in both manufacturing and service industry, and also both in private and public sectors (Cusumano et al., 2021, p. 634).

2.1.2 Technology management

Technology management is a process which consists of planning, directing, controlling and coordinating the development and implementation of the technological capabilities to shape and achieve an organization's strategic and operational goals (Cetindamar et al., 2009, p. 237). In recent years, Industry 4.0 has gained a lot of attention from industry and academia (Bajic et. al, 2021, p. 546). Utilizing modern technologies such as internet of things, cloud computing, machine learning, and big data analytics to automate processes and enhance data exchange is a key characteristic of Industry 4.0 (Tortorella et al., 2022, p. 386).

Industry 4.0 does not have a consistent definition, and its definition varies between different academic disciplines (Bajic et al., 2021, p. 546; Ivanov et al., 2021, p. 2056). The definition of Industry 4.0 from OM point of view by Ivanov et al. (2021, p. 2056) highlights Industry 4.0 being wholeness which consists of technologies, organizational concepts, and management principles that underpins a cost-efficient network which is data driven and dynamically and structurally adaptable to the changes by rapidly reorganizing its resources. Digital transformation through Industry 4.0 has generated high expectations due to the possibility of gaining competitive advantage through developing innovative products, services, and processes (Tortorella et al., 2022, p. 386). Industry 4.0 can also help an organization to achieve quality, productivity, and flexibility (Enrique et al., 2023, p. 7002).

Although Industry 4.0 is facing high expectations, there seems to be barriers which are limiting the adoption of Industry 4.0. A survey conducted by Ivanov et al. (2021, p. 2062) found that the primary limitations for Industry 4.0 are insufficient understanding of Industry 4.0, lack of access to capital needed for investments, and lack of competent personnel which also leads to need for personnel reskilling. Ivanov et al. (2021, p. 2062) further state that the results are in line with the literature. Bajic et al. (2021, p. 548) found by analyzing articles that managerial implementation challenges and technological implementation challenges are two types of issues which are challenging Industry 4.0

implementation. The lack of financial or human resources and security issues are related to the managerial implementation challenges, while technological implementation challenges are often related to the challenges at implementation of a specific technology (Bajic et al., 2021, p. 548). There is also lack of understanding which specific technologies should be adopted when quality, productivity, or flexibility is pursued (Enrique et al., 2023, p. 7002).

2.1.3 Operations strategy

Slack and Lewis (2020, p. 11) argue that OM should also be a long term and strategic issue. They describe that operations strategy is a strategic perspective of how resources and processes are managed. They further describe that operations strategy is more concerned with long-term issues and it has focus on macro level of the total operation and operations strategy often deals with more abstract issues and tries to aggregate details into broader issues. The overall purpose of operations strategy is to link an organization's process capabilities and activities with its business strategy while simultaneously enhancing the capacity of the operations system to support that business strategy (Sting & Loch, 2016, p. 1177).

2.1.4 Quality management

Organizations have adopted different quality management approaches such as total quality management (TQM), six sigma, lean production, and ISO 9001 in recent decades (Xu et al., 2020, p. 1). Xu et al. (2020) employed meta-analysis to examine correlations between quality management practices and organizational performance. Management leadership, people management, process management, product design and management, quality data analysis, supplier quality management, and customer focus were the quality management practices which they included in their study. They found that most quality management practices have a positive impact on both the overall organizational

performance and individual performance dimensions (financial performance, operational performance, customer service, and product quality). The results also suggested that management leadership and supplier quality management have the highest positive impact, so their importance should be emphasized.

According to Marchiori and Mendes (2020, p. 1135), TQM has been one of the most important strategies which has been adopted by organizations regardless of size or sector. However, the definition of TQM varies between companies and theoreticians (Dahlgaard-Park, 2011, p. 495). Despite the lack of consensus definition, according to Alanazi (2020, p. 2), it is commonly accepted that TQM is a holistic management approach and when properly implemented, desirable organizational results are achieved. According to Zhang et al. (2021, p. 1466), TQM is a people-centric management system designed to continuously improve customer satisfaction while simultaneously reducing costs. Most of the TQM definitions highlight customer focus and continuous improvement (Zhang et al., 2021, p. 1468). Continuous improvement set its aim to continuously enhance processes through systematic effort to find and apply new ways of working (Anand et al., 2009, p. 444).

2.1.5 Supply chain management

Stock and Boyer (2009, p. 690–691) noted that there is not a single consensus definition of supply chain management, and they state that varying definitions may create confusion and hinder the study and further development of supply chain management. Because of that, they reviewed 173 different definitions of supply chain management and proposed encompassing definition of it:

> The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction. (Stock & Boyer, 2009, p. 706)

It is not uncommon to confuse supply chain management with term logistics management (Council of Supply Chain Management Professionals, n.d.). Therefore, the above definition of supply chain management by Stock and Boyer accomplishes at presenting supply chain management as a comprehensive entity which is much more than just logistics management. The encompassing definition also links up well with OM as the definition highlights many key processes that are needed for producing or delivering goods or services. Also achieving customer satisfaction and maximizing profitability by efficiently managing processes are important goals for every organization.

2.2 Productivity

Productivity refers to the efficiency of production, i.e. how much output is obtained for a given set of inputs (Syverson, 2011, p. 329). This is a simple definition of productivity. So, productivity increases when the same number of inputs generates more output, or the same amount of output is obtained by using less resources. A typical approach for productivity is the aim of producing outputs with less resources (Enrique et al., 2023, p. 7004). Productivity is often expressed as an output-input ratio (Syverson, 2011, p. 329). Operational productivity includes various inputs such as labor, facilities, equipment, and inventory which are controlled by operations managers with the aim of maximizing outputs (Jacobs et al., 2016, p. 2066).

Single-factor productivity measures are used to measure units of output produced per unit of a certain input and the most common single-factor productivity measure is labor productivity (Syverson, 2011, p. 329). Although two producers may have similar production technology, they may use capital differently which leads to different labor productivity levels and because of that, total factor productivity is often used to measure productivity (Syverson, 2011, p. 330). Input in total factor productivity consists of all observable inputs used to obtain output and total factor productivity also captures variations in output which are not explained by changes in the observable inputs (Syverson, 2011, p. 330).

Although the concept of productivity is quite simple, there are many problems regarding measuring productivity and developing proper measurements for productivity (Syverson, 2011, p. 330). According to Syverson (2011, p. 330–331), there are issues regarding both output and input measures. First, many organizations produce multiple outputs which raises the question if the outputs should be aggregated to a single output measure, and if so then the question is how they should be aggregated. Issues regarding inputs can relate to labor, the choice should be made if labor is measured by number of employees, based on employee hours, or with some quality-adjusted labor measure. Syverson further states that measuring capital and intermediate materials in input also raises further questions when constructing productivity measurements.

2.2.1 Productivity in healthcare

Public health expenditures, ageing population, increasing number of chronic illnesses, and shortage of workforce are challenging healthcare industry, digitalization in healthcare is assumed to tackle these challenges and provide crucial transformation towards digitalized healthcare solutions (Niemelä et al., 2019, p. 352). Productivity in healthcare has been rising significant interest because rising healthcare costs is challenge which most of the Western countries have been facing (Kämäräinen et al., 2016, p. 288). Challenges that healthcare is facing have led to increased pressure to improve productivity and develop metrics which can measure productivity (Kämäräinen et al., 2016, p. 296). However, measuring healthcare productivity is challenging as the health services are diverse and they differ from each other, so the productivity and value is often understood differently between services (Kämäräinen et al., 2016, p. 288). Avgerinos and Gokpinar (2017, p. 33) also point out that productivity improvements in healthcare can lead not only to reduced overall costs but also to better clinical outcomes.

According to Johannessen et al. (2017, p. 118), measuring productivity of the healthcare personnel is a complex task because healthcare personnel have multiple different tasks, also specialties have differences concerning diversity in patient treatment and level of

care. The authors state that the input in productivity of healthcare personnel could be established through salary or with the other measures concerning workforce, but defining the output is a more complicated task. Johannessen et al. (2017, p. 118) further state, that individual output metrics such as number of hospitalizations, daycare treatments, and outpatient consultations are not adequate on their own; they are rather part of larger and more complex puzzle.

According to Kittelsen, Winsnes et al. (2015, p. 282), efficiency and productivity are often used synonymously. They define productivity as the ratio of inputs and outputs, while they define efficiency as a relative measure which compares actual to optimal productivity. Earlier productivity changes were associated with technological changes but later it became accepted that efficiency change can also cause changes in productivity (Hollingsworth, 2008, p. 1108). Health gains of individual patients are final outputs in healthcare and ideally health gains of individual patients would be measured when measuring efficiency in healthcare (Hollingsworth, 2008, p. 1109). However, the most studies have used different variants of intermediate outputs which have quantified to number of patients treated, and only small proportion of studies have examined changes in health status as an outcome measure (Hollingsworth, 2008, p. 1109–1110).

According to Ali et al. (2019, p. 808), output in productivity of a single hospital includes all goods and services that are delivered by hospitals. However, input can be formulated differently based on the desired resultant measure. If the labor productivity is measured, then the inputs only consist of labor. If total factor productivity is measured, then the inputs include all hospital inputs, i.e. labor, capital, and intermediate materials (such as drugs and care accessory). Thus, the productivity of an individual hospital can be measured as the ratio of the total output produced to the total input costs incurred in producing that output.

Allocating patients to Diagnosis Related Groups (DRGs) to compare similar patients in terms of cost is common to many OECD countries (Aragon Aragon et al., 2017, p. 5).

However, there are differences in DRG systems between countries. For example, Finland, Sweden, and Norway each use national version of NordDRG (a common grouping system for the hospital visits), and Denmark also used to be part of NordDRG until 2002 when they switched to the national system DkDRG (Kittelsen, Anthun et al., 2015, p. 143), which differs significantly from other Nordic systems (Kittelsen, Winsnes et al., 2015, p. 285). Even though Finland, Sweden, and Norway have similar systems, to achieve high comparability common grouping is still desired (Kittelsen, Anthun et al., 2015, p. 143). NordDRG was launched in 1996, and it is based on 10th revision of the International Statistical Classification Diseases and Related Health Problems (ICD-10) (Linna et al., 2010, p. 349). In DRG systems, diagnosis and procedure codes are used to assign each hospital discharge (Kittelsen et al., 2015, p. 285). Physicians are responsible for providing a diagnosis for the patient, but diagnosis coding practices vary among hospitals within and across countries thus making interpretation of ICD-10 diagnoses not uniform (Linna et al., 2010, p. 348).

Medin et al. (2013) analyzed studies where hospital productivity between countries had been compared and they found that the output was generally grouped into five categories: inpatient medical cases, inpatient surgical cases, day care surgical cases, day care medical cases, and outpatient visits. Most DRG systems in Europe are not comparable and to compare hospital productivity internationally, there is need for a mapping system where country specific diagnosis and procedure classifications are mapped to a generic DRG classification grouper (Medin et al., 2013, p. 85). International comparability could be a valuable goal to pursue, as it could further provide valuable knowledge about why certain countries have better healthcare productivity and whether countries with lower productivity could emulate top performers to enhance productivity. According to Finnish Institute for Health and Welfare (THL, 2024a), World Health Organization has published internationally compatible ICD-11 which replaces ICD-10 and THL has ongoing project, which started in 2023 and will end in 2026, where preparations for implementing ICD-11 will be made. So, hopefully the implementation of ICD-11 will enhance the international comparability of healthcare productivity.

There have been proposed multidimensional aims for healthcare which also include a productivity perspective. The triple aim means achieving high value healthcare by reducing per capita cost in healthcare, improving the health of population, and improving individual patient experience (Berwick et al., 2008, p. 760). So, the definition of the triple aim pinpoints the aim of improving productivity by lowering the costs while simultaneously improving the quality of healthcare by improving overall health of the population and improving experience perceived by the individual patient. Berwick et al. (2008, p. 760) also states that the triple aim components should be seen as an entity, not as individual components as the changes pursuing the goal of one component can have positive but also negative impact on other two components.

The definition of triple aim performance by Roth et al. (2019, p. 2165), highlights a hospital's capability to simultaneously achieve high performance on three dimensions: patient experience, clinical health outcomes and quality of care, and technical efficiency. Roth et al. (2019, p. 2180) found that higher percentage of physicians employed versus contract physicians and a moderate rate of bed utilization are two key drivers for achieving triple aim performance. They also found that high utilization rate of beds may improve technical efficiency, but it leads to both lower clinical quality and lower patient satisfaction.

According to Bodenheimer and Sinsky (2014, p. 575), a disengaged healthcare workforce is a barrier to achieving the triple aim. They propose to expand the triple aim with the additional goal of improving the work life of healthcare providers. With the added dimension the triple aim becomes the quadruple aim. Bodenheimer and Sinsky (2014, p. 575) state that the addition of the fourth dimension may help to achieve the other three aims. They also point out that emphasis on the fourth dimension should not overdrive patients' needs as such emphasis could generate negative consequences. Sikka et al. (2015, p. 608) also emphasize the importance of creating conditions for the healthcare workforce where they can find joy and meaning in their work, because without these, the workforce cannot perform at its full potential.

As said at the beginning of this chapter, shortage in the workforce is one challenge which the healthcare industry is facing. This raises a crucial question whether there will be enough healthcare workforce available for future demand (Johannessen et al., 2017, p. 124). According to Johannessen et al. (2017, p. 124), improving workforce productivity at clinical level should be highly emphasized because healthcare systems in many countries will face shortage of workforce in the future. Johannessen et al. (2017, p. 124) also state that efficient utilization of hospital staff is crucial for productivity because personnel costs accounts for a large proportion of total costs.

2.2.2 Challenges associated with productivity in healthcare

Kämäräinen et al. (2016) conducted a study on measuring healthcare productivity in different levels. Levels they had in their study were unit level, organizational level, and system level. Unit level includes for example wards and surgical units, and employees. Organizational level refers to hospitals and nursing homes while system level refers to regional systems as a whole or the whole country's healthcare system. The authors found that maximizing productivity at one level often leads to challenges at another levels. They state that productivity is often sub-optimized from system level point of view, meaning that productivity measures taken from unit/organization point of view do not actually contribute to the system level productivity, but rather worsen it. Because of that, the authors state that productivity should be approached with one entity which considers all levels. The authors also state a valid point that more quality indicators should be introduced and tested widely. The need for more quality indicators is based on that the quality of healthcare may suffer if healthcare performance is too much assessed in terms of productivity.

In their study on improving home care, Groop et al. (2017, p. 12) identified several undesirable effects which are connected to the productivity challenges. They found that there are problems in both resource management and availability of resources. One problem in resource management is that resources are often reserved at the wrong time

of the day. This might lead to idle, thus making activities inefficient. Another thing that the authors found is that the caregivers have a high level of absenteeism which leads to capacity shortages which cannot be predicted. Dynamic resource allocation cannot also be taken advantage of since the caregivers are often stuck with their team. Capacity shortages often must be dealt with by leasing external workforce which increases costs and makes the activities less efficient.

According to Erhard et al. (2018, p. 1), understaffing and overstaffing are common challenges in hospitals because daily requirements for care have a high level of uncertainty and fluctuation, and because of that, scheduled workforce in hospitals often does not match the demand. They also describe that prior studies have shown that both understaffing and overstaffing have been shown to generate negative impacts. Understaffing for example decreases quality of care, increases waiting times for patients, it also may increase the number of absences in personnel due to illness and burnout, and it may also increase turnover rate in personnel (Erhard et al., 2018, p. 1). Overstaffing on the other hand raises the cost of healthcare services as the utilization level of personnel is poor when overstaffing occurs (Erhard et al., 2018, p. 1).

Based on the previous paragraph, both understaffing and overstaffing may impact negatively on productivity. While overstaffing has direct impact on productivity by increasing the costs thus reducing the productivity as the same activities could be done with less resources, understaffing also could decrease productivity as then might not be possibility of accommodating as many patients as with the properly scheduled workforce. As told on the previous paragraph, understaffing may also lead to burnout in personnel and according to Dewa et al. (2014, p. 9), physician burnout is linked to productivity decline as it may lead to personnel changing workplace or leaving from the field.

Because of the recent Covid-19 pandemic and the nature of healthcare industry, it is interesting to discuss how pandemics can have an effect on healthcare productivity. According to Coyle et al. (2021, p. 99), hospitals play a key role in pandemics as hospitals

are forefront of public health responses to pandemics. Pandemics may increase demand in a way which hospitals do not have the required capacity to answer the demand. Covid-19 led to capacity loss in hospitals as appropriate patient segregation had to be ensured and also wards had to be designed based on patients Covid-19 status (Coyle et al., 2021, p. 100–101). Coyle et al. (2021, p. 104) also found that non-Covid-19 treatments are at reduced levels until the pandemic ends. The pandemic also led to increased absenteeism and staff turnover as burnout and mental health issues increased among healthcare workers (Puiu & Bîlbîie, 2025, p. 13).

According to Deina et al. (2024, p. 2), late cancellation of appointments or no-show for appointments have been reported as common events in different healthcare clinics. Both of those events are problematic for healthcare organizations as the time reserved for the appointment has a high probability of becoming wasted. Both late cancellation and no-show leads to employee idle and decreased productivity. Personnel costs remain for the organization regardless of no-show, but output generated from the appointment will not be received. In addition to underutilization of healthcare organizations resources, no-show leads to longer waiting lists for appointments (Liu et al., 2019, p. 780). No-show also affects directly to treatment of two patients, the one who did the no-show and the one who could have been treated if cancellation would have happened in a timely manner which would have allowed rescheduling; now because of no-show they both lack of care and the waiting list does not shorten (Deina et al., 2024, p. 2).

Walters et al. (2022) identified 82 studies which had considerations for efficiency improvement at system level in public health systems. They found that the research considering efficiency improvements is not cohesive enough and does not provide evidence for the best practice how to support efficiency improvement in public health systems. The authors further state that many individual factors were identified which relate to efficiency improvements in public health systems. According to Kämäräinen et al. (2016, p. 294), system level productivity is hard to compare between different countries because financing systems, links to social sector services and health policy vary between

countries. This could be one factor why the research regarding efficiency improvements in public health systems is not cohesive enough, and why it is hard to design a comprehensive framework to support efficiency improvements.

2.3 Economic scenario planning / Economic forecasting

Economic forecasting is a statement about the future and a crystal ball would be needed if one would be really successful at forecasting (Hendry & Stevens, 2003, p. 301). Hendry and Stevens (2003, p. 302) state that there are two kinds of uncertainty associated with the future. The first kind of uncertainty is linked with events with probabilities, this kind of uncertainty can be implemented in forecasting measures. The second kind of uncertainty is a much bigger problem, the second kind of uncertainty means uncertainties which are unknown.

Traditional forecasting has been placing a high emphasis on historical data, expert advice, and market information (Choi et al., 2018, p. 1872). According to Wang (2021, p. 10), traditional economic forecasting methods have timeliness problems. Wang further states that the current statistical methods tend to catch trends too late, meaning that necessary decisions often cannot be made in a timely manner. Big data analytics may enhance forecasting methods to be more accurate (Choi et al., 2018, p. 1872). In the era of big data, forecasting methods can be enhanced by taking more account the non-stationary and time-varying characteristics in longer time series (Wang, 2021, p. 11).

According to Beckert (2021, p. 13), imagined futures play an all-embracing role in everything what organizations do. Financial planning is one of the key areas regarding imagined futures. It is important to make decisions within an organization in a way that they are aligned with the uncertainty of the future. This means that an organization must have a vision of how they perceive the future and align its activities towards the perceived future. Creation of imagined futures and application of imagined futures are two different stages in which imagined futures can be divided (Beckert, 2021, p. 11). However,

Beckert (2021, p. 11) also states that organizations often have difficulties matching those created images with the proper application of them.

Scenario analysis is a strategic management tool which aims to support decision making under uncertainty by exploring future changes and their associated impacts (Kebede et al., 2018, p. 660). Scenarios represent logical and probable sequence of events when circumstances change, and they are developed based on the projected course of events (Kebede et al., 2018, p. 660). So, based on that, economic scenario planning is developing scenarios based on the projected course of events with having economic context in them. As stated above, imagined futures play an all-embracing role in the activities of an organization. So, economic scenario planning should receive high emphasis within an organization as in the end, the ability to align activities based on changing circumstances could determine how well an organization economically succeeds. Ability to align activities based on changing circumstances could also probably affect productivity. In changing circumstances, such as in the Wellbeing services county reform, there could have been uncertainty which has been unknown, making scenario planning and forecasting harder.

3 Methodology

Choosing suitable research methodology is an important part of thesis writing. According to Suárez et al. (2017, p. 149), the usage of statistical techniques is foundation for quantitative research methodology. Quantitative research methodology is used to quantify, measure and grade the object of the study. Both objective and subjective variables can be used in quantitative research, and different techniques can be used to obtain data about these variables. For example, surveys, reports and measurements are some of the techniques which can be used to obtain data for quantitative research. Yilmaz (2013, p. 311) defined quantitative research as research that explains phenomena based on utilizing mathematical methods (especially statistics) to analyze numerical data. According to Golafshani (2003, p. 600), qualitative research is used for understanding phenomena in a specific context and qualitative research could be broadly defined as research which produces findings not arrived by quantitative methods. Data collection through interviews and observations are typical for qualitative research methods. Mixed methods research means usage of both qualitative and quantitative techniques or methods in a single study (Johnson & Onwuegbuzie, 2004, p. 17). Mixed methods will be used in this thesis as the object is to analyze numerical data and interviews are conducted based on the data analysis to test assumptions and provide more knowledge.

3.1 Research methods

According to Barsalou et al. (2023, p. 442), usage of simple graphical tools is vital for effective problem solving and exploratory data analysis (EDA) is an approach which includes usage of simple graphical tools mentioned. EDA is used to identify salient features within the data and EDA can be further used for hypothesis generation. An essential characteristic of EDA is to examine data graphically to gain insights. Those gained insights can be further investigated with confirmatory data analysis by using other statistical methods. This means that the purpose of the EDA is to mainly generate ideas. The

purpose of EDA is to generate hypotheses while the purpose of confirmatory data analysis is to test prespecified hypotheses (De Mast & Trip, 2007, p. 301).

According to De Mast and Trip (2007, p. 301), descriptive data analysis concerns presenting the data to reveal salient features and descriptive data analysis is used summarize a dataset using descriptive statistics. With the help of descriptive statistics, data can be summarized with the simpler form of quantitative measures (Kaliyadan & Kulkarni, 2019, p. 83). Kaliyadan and Kulkarni (2019, p. 83) further state that descriptive statistics can be divided into two categories which are: 1) sorting/grouping and illustration/visual display of data, and 2) summary statistics. Descriptive statistics can be divided into three major types, which are measures of frequency, measures of central tendency, and measures of dispersion or variation (Mishra et al., 2019, p. 67). According to Dong (2023, p. 22), descriptive statistics are not enough for statistical analysis on their own but descriptive statistics can be used as foundation for more specific statistical analysis.

De Mast and Trip (2007, p. 301) state that EDA goes further than descriptive statistics as EDA does not only try to present salient features of a dataset but rather is used to speculate and formulate hypotheses that could explain salient features of a dataset. De Mast and Trip (2007) provided framework with three steps for EDA in quality-improvement projects. Although this thesis is about productivity and not about quality-improvement projects, the EDA framework provided by De Mast and Trip will be basis for this thesis. According to De Mast and Trip (2007, p. 304), three distinct steps in the EDA process are:

1) Display the data.
2) Identify salient features.
3) Interpret salient features.

According to De Mast and Trip (2007, p. 304), presenting data graphically tends to show the distribution of data in a way which is more easily processed in human brains. Also tabulated raw data is much more complex for the human brain to process and

aggregated tabulated statistics may lose information about data distribution, which could be crucial for EDA.

Quantitative techniques are used in the first two steps of the EDA process in this thesis. Qualitative techniques are used on the interpretation of salient features part in this thesis as interpretation of salient features will be based on the interview answers in this thesis.

3.2 Data collection and data analysis

Data collection for empirical part of the thesis was conducted mainly in three parts. The first part included collecting data from Hospital productivity 2023 statistical report and especially from hospital productivity time series review which is published on the website of THL. The time series review includes data from five years considering activities and productivity at hospital level. The second part of the data collection concerned the data requested from the case organization as the data concerning intermediary outputs in specialized healthcare was requested and received from the case organization. Intermediary outputs used in this thesis are hospital care days and outpatient visits. Hospital care days in the received data include also day surgical cases recorded as hospital care days. Outpatient visits in the received data include four types of visits: first visit, re-visit, emergency visit and outpatient consultation. In addition, tutkihallintoa.fi website maintained by the State Treasury was utilized. The website contains, among other things, financial information concerning wellbeing services counties. Data analysis was conducted by utilizing spreadsheet techniques with Microsoft Excel. During the research process it was noted that interpreting salient features risen from the data analysis was quite challenging due to the low number of data points per variable. Therefore, three assumptions were formulated based on the data analysis and to test the validity of the assumptions, interviews were conducted via e-mail. Interviews were the third main part for data collection.

4 Results

4.1 Case organization

As mentioned earlier in this thesis, the case organization for this thesis is Wellbeing services county of Central Ostrobothnia Soite. Soite is the smallest wellbeing services county. The population base in Soite's area is approximately 68 000 and Soite consists of the eight municipalities in Central Ostrobothnia which are: Halsua, Kannus, Kaustinen, Kokkola, Lestijärvi, Perho, Toholampi and Veteli (Soite, n.d.). Central Ostrobothnia Central Hospital is also the nearest on-call hospital for approximately 200 000 people due to its geographical location (Soite, n.d.). The wellbeing services county reform meant that the municipality of Kruunupyy which had been part of the joint municipal authority Soite did not transfer to the Wellbeing services county of Central Ostrobothnia (Soite, n.d.).

By inspecting financial statement information for 2023 by service category for wellbeing services counties shows one special feature that Soite has compared to other wellbeing services counties. In the service category of total specialized healthcare, Soite has the largest amount of sales income per inhabitant with 543 € (State Treasury, n.d. -b). It is noteworthy that this service category also includes psychiatric related specialties as the service category is total specialized healthcare. Although hospital productivity statistical report does not include psychiatric specialties, the number for the total specialized healthcare service category is used here to demonstrate the entirety. The wellbeing services county with the second largest amount has sales income per inhabitant 385 € and the combined per inhabitant number of every wellbeing services county is 133 € (State Treasury, n.d. -b). This means that Soite treats a significant number of patients from other wellbeing services counties, relative to its size, when sales income is compared to the population of the wellbeing services county. Table 1 shows sales income 2023 per inhabitant in the service category of total specialized healthcare by wellbeing services county. Table 1 is based on the data retrieved from the Tutkihallintoa.fi.

Table 1. Sales income 2023 in the service category of total specialized healthcare (State Treasury, n.d. -b).

Wellbeing services county	**Service category**	**Sales income**
Wellbeing services county of Central Ostrobothnia	Specialized healthcare, total	543 €
Wellbeing services county of North Savo	Specialized healthcare, total	385 €
Wellbeing services county of Pirkanmaa	Specialized healthcare, total	319 €
Wellbeing services county of North Ostrobothnia	Specialized healthcare, total	272 €
Wellbeing services county of South Ostrobothnia	Specialized healthcare, total	249 €
Wellbeing services county of Southwest Finland	Specialized healthcare, total	166 €
Wellbeing services county of Kainuu	Specialized healthcare, total	148 €
Mainland Finland wellbeing services counties, total	Specialized healthcare, total	133 €
Wellbeing services county of Kymenlaakso	Specialized healthcare, total	117 €
Wellbeing services county of South Savo	Specialized healthcare, total	103 €
Wellbeing services county of Central Finland	Specialized healthcare, total	97 €
Wellbeing services county of Päijät-Häme	Specialized healthcare, total	84 €
Wellbeing services county of Lapland	Specialized healthcare, total	82 €
Wellbeing services county of Ostrobothnia	Specialized healthcare, total	64 €
Wellbeing services county of Kanta-Häme	Specialized healthcare, total	57 €
Wellbeing services county of North Karelia	Specialized healthcare, total	53 €
Wellbeing services county of East Uusimaa	Specialized healthcare, total	51 €
Wellbeing services county of South Karelia	Specialized healthcare, total	49 €
Wellbeing services county of Satakunta	Specialized healthcare, total	44 €
Wellbeing services county of Vantaa and Kerava	Specialized healthcare, total	35 €
Helsinki	Specialized healthcare, total	30 €
Wellbeing services county of West Uusimaa	Specialized healthcare, total	26 €
Wellbeing services county of Central Uusimaa	Specialized healthcare, total	0 €
)* The HUS Group is not in the table as it is joint county authority for wellbeing services		

Soite's high per inhabitant sales income might be due to geographical location as mentioned in previous paragraph that Central Ostrobothnia Central Hospital is the nearest on-call hospital for approximately 200 000 people, meaning two thirds of those people are from other wellbeing services counties. According to Health Care Act (1326/2010) Section 47., a person is eligible to choose the specialized healthcare unit which provides care regardless of the wellbeing services county in which the unit is located. By

inspecting intermediary outputs received from the case organization (Soite, 2025), it can be noticed that the proportion of patients coming from other regions is quite large. For the year 2023 the total number of outpatient visits from outside of the region of Soite was approximately 45 000, netting 20 percent of all outpatient visits. The total number for hospital care days provided for patients outside of the region of Soite was almost 24 000 which is 32 percent of all hospital care days. These numbers include also psychiatric specialties. In the material received from Soite, a minor proportion of both outpatient visits and hospital care days are recorded to as an unknown wellbeing services county. These have been included in the regions outside of Soite in this thesis. Figure 1 shows the number of hospital care days and outpatient visits for 2023 broken down into the area of Soite and other areas. Outputs from psychiatric specialties are included in Figure 1 and no data has been yet excluded from the data.

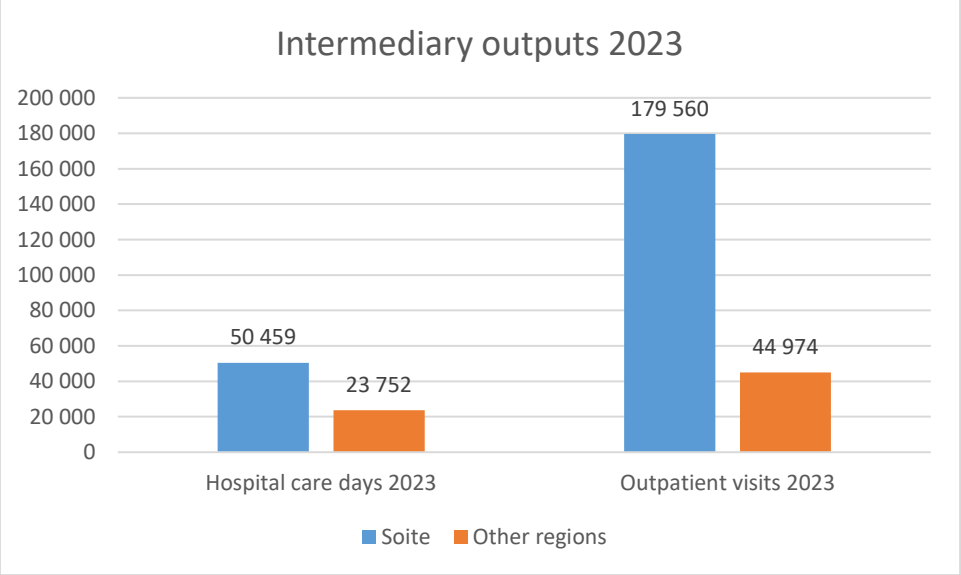

Figure 1. Hospital care days and outpatient visits at Central Ostrobothnia Central Hospital in 2023 (Soite, 2025).

Now that the case organization has been introduced and also its special feature compared to the other wellbeing services counties has been highlighted, it is time to move on to present the hospital productivity statistical report.

4.2 Hospital productivity 2023 – statistical report

The purpose of the hospital productivity statistical report is to be a tool for comparison, guidance, evaluation, decision making and planning of non-psychiatric specialized healthcare in hospitals (Tuukkanen & Matveinen, 2024, p. 29). According to Tuukkanen and Matveinen (2024, p. 29), the statistical report is based on healthcare register information which wellbeing services counties deliver to THL and on cost data which are separately collected. Healthcare register information is based on diagnosis and procedure codes which are recorded to electronic health records. Cost data is collected from different levels (wellbeing services county, hospital and specialty) and cost data is based on financial statement data, income statements regarding specialties and internal cost accounting reports. There may be hospital-specific differences in both recording and extracting diagnosis and procedure codes from electronic health records to the healthcare register information data to be submitted to THL and in the extraction and allocation of cost data by specialty. These possible differences may affect the results of the statistical report.

Care activities are examined by patient groups in the operational and productivity data and used grouper for patient groups is NordDRG Full (Tuukkanen & Matveinen, 2024, p. 29). The NordDRG Full grouper is used in both cross-sectional analysis and in the time series and all years in the time series are grouped with the same grouper to ensure comparability (Tuukkanen & Matveinen, 2024, p. 30). Time period for the productivity review has been earlier agreed with the hospital districts to be five years (Tuukkanen & Matveinen, 2024, p. 32). Therefore, the same five-year period is also used in this thesis. In the time series review productivity has been measured as the change in hospital's own operations between 2019–2023, while in the cross-sectional analysis productivity is compared to other similar units in the year 2023 (Tuukkanen & Matveinen, 2024, p. 31).

Before moving on to the actual analysis, it is necessary to go through a few concepts and definitions used in the statistical report. According to Tuukkanen and Matveinen (2024, p.24–28):

Input = The total cost of the care at hospital level or specialty level. Cost data is submitted annually to THL accordance with separate data collection instructions.

Episode = The whole treatment process of the patient which includes all intermediary outputs to address a specific health problem of the patient within one calendar year.

Weighted episode = The severity of the treatment involved in the episode is taken into account, meaning patients who are more difficult to treat than average increase the number of episodes when weighted.

Output = The total output is obtained by calculating the sum of the weighted episodes at hospital level or specialty level. The statistical report has both episode output and treatment period output. This thesis focuses only on the episode output and excludes the treatment period output.

Episode output (number) = The sum weighted by the average cost of the hospital group for different types of weighted episodes, meaning Output = Weighted episodes * Average cost of episode for all hospital groups.

Real costs = The effect of inflation is taken into account in real cost comparison by either inflating or deflating all comparable cost data into same time money. The cost data in the statistical report is deflated to 2019 price levels. Deflating means changing the value of money backwards by means of indexing.

Productivity = output to input ratio.

4.3 Hospital level productivity

In the cross-sectional analysis for 2023, it was found that Central Ostrobothnia Central Hospital had the second highest episode productivity with the index of 109 which means

that episode productivity at Central Ostrobothnia Central Hospital was nine percent higher than the average episode productivity for central hospitals (Tuukkanen & Matveinen, 2024, p. 15). For comparison, in the cross-sectional analysis for 2019, Central Ostrobothnia Central Hospital had the third highest episode productivity with the index of 110 (Häkkinen et al., 2021, p. 19). Based on this, episode productivity of Central Ostrobothnia Central Hospital compared to other central hospitals has been at a similar level in the first and last year of the time series review.

Now that this has been dealt with, the following step is to move on to examine productivity changes in the context of Central Ostrobothnia Central Hospital. Before moving on it is worth mentioning that the data considering treatment period productivity was excluded from time series review as this thesis focuses on episode productivity. Also, data considering intermediary outputs in hospital productivity time series review was excluded because this thesis inspects intermediary outputs received from the case organization. Also, figures and tables are self-made based on the materials used for the analysis but references in captions will tell which material is used for the figure or table.

According to hospital productivity time series review (THL, 2024b), Central Ostrobothnia Central Hospital's episode productivity for 2023 is a little worse compared to the first year of the time series review as the episode productivity index for the year 2023 was 98. As the time series review measures productivity changes in the hospital's own operations, the first year is the baseline for the review. This means when indexes are used to compare other years to the first year, the index for the first year is 100. The years 2020 and 2021 both have an episode productivity index of 103 meaning productivity in those years were better compared to the first year of the time series review. Episode productivity was already a little worse in 2022 with the index of 99. Episode productivity ratio for 2019 was 1,19 and for 2023 1,17. Figure 2 illustrates how episode productivity has changed during 2019–2023 in Central Ostrobothnia Central Hospital.

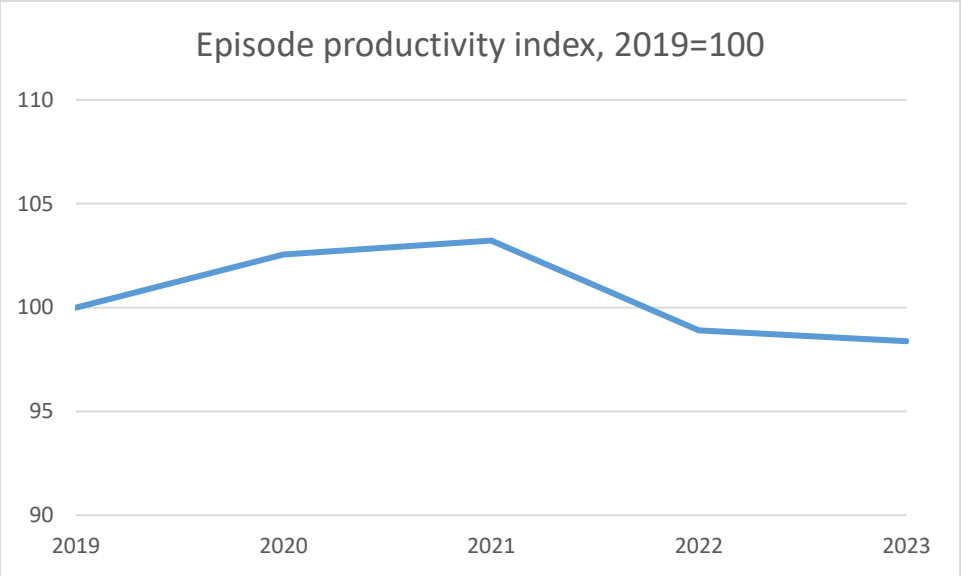

Figure 2. Episode productivity index 2019–2023 (THL, 2024b).

According to hospital productivity time series review (THL, 2024b) episode output index was higher between 2020–2022 than in the first year of the time series review and year 2023 was the only year when the index was under 100 as the index was 99. In the same time frame, 2020 was the only year when deflated costs were lower than in the first year of the time series review. Figure 3 illustrates how indexes for episode output and deflated costs have been developed between 2019–2023.

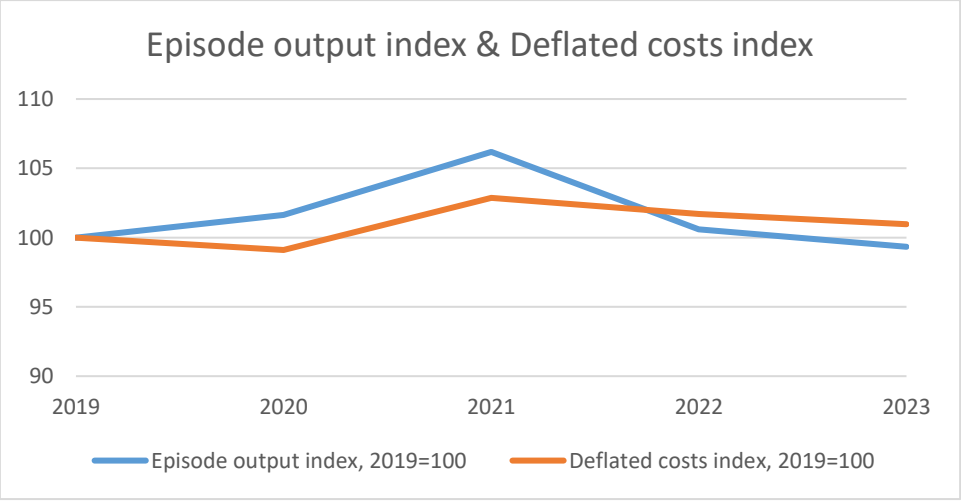

Figure 3. Development of episode output and deflated costs indexes 2019–2023 (THL, 2024b).

According to hospital productivity time series review (THL, 2024b), the total costs in non-psychiatric specialties for the Central Ostrobothnia Central Hospital in the first year of time series review were 93,1 M€. In the last year of the time series review the total costs were 106,9 M€. This means that between 2019 and 2023 total costs increased almost 14 M€ and almost 15 percent. However, the costs of 2023 deflated to the 2019 price levels were 94,0 M€, meaning deflated costs increased only 0,9 M€ and approximately one percent. This shows that inflation has significantly risen the costs during the timeframe under review. Figure 4 illustrates the development of costs and deflated costs between 2019–2023 in non-psychiatric specialties at Central Ostrobothnia Central Hospital.

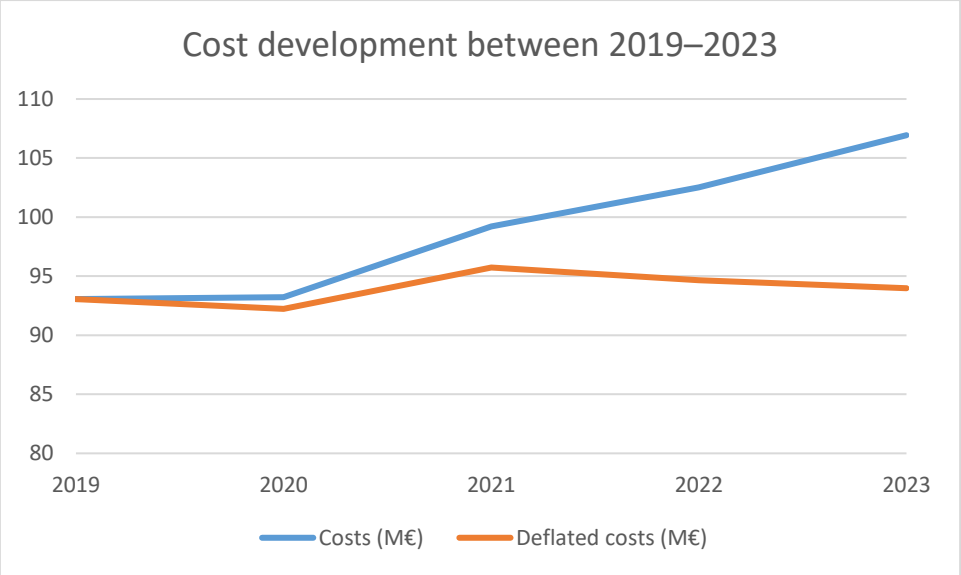

Figure 4. Development of costs and deflated costs 2019–2023 (THL, 2024b).

Data considering psychiatric specialties was excluded from the data received from the case organization as hospital productivity statistical report includes only non-psychiatric specialties. After psychiatric specialties were excluded from the data, no further screening was done on data considering hospital care days. According to the data received from the case organization (Soite, 2025), in 2019 there was over 1 400 hospital care days registered in the specialty of physiatry while in 2020–2023 hospital care days registered in the specialty of physiatry were a few dozen per year. Meaning in 2019 hospital care days registered in the specialty of physiatry represented over two percent of all hospital care

days and in 2020–2023 they represented only a fraction of all hospital care days. However, hospital care days in the specialty of physiatry are included in hospital care days in this review. If they were not included in the hospital productivity 2019 report, this distorts slightly the results in this thesis. Table 2 shows the proportion of hospital care days registered in the specialty of physiatry between 2019–2023.

Table 2. Proportion of hospital care days registered in the specialty of physiatry 2019–2023 (Soite, 2025).

	2019	**2020**	**2021**	**2022**	**2023**
Hospital care days, total	64 591	60 414	61 702	62 691	56 720
96 Physiatry hospital care days	1 430	32	67	81	57
96 Physiatry, % of all hospital care days	2,2 %	0,1 %	0,1 %	0,1 %	0,1 %

According to the data received from the case organization (Soite, 2025), specialty of general medicine had a fairly large share of all outpatient visits in 2019, but its proportion of all outpatient visits decreases annually over the period under review. In 2019 over 29 000 outpatient visits were registered to the specialty of general medicine which was over 15 percent of all outpatient visits. In 2023, only 215 outpatient visits were registered for the specialty of general medicine. Table 3 shows the proportion of outpatient visits registered in the specialty of general medicine between 2019–2023.

Table 3. Proportion of outpatient visits registered in the specialty of general medicine 2019–2023 (Soite, 2025).

	2019	**2020**	**2021**	**2022**	**2023**
Outpatient visits, total	192 395	184 366	187 632	187 930	181 250
98 General medicine outpatient visits	29 165	21 147	13 518	11 138	215
98 General medicine, % of all outpatient visits	15,2 %	11,5 %	7,2 %	5,9 %	0,1 %

This big change in outpatient visits in the specialty of general medicine shows that there have been changes in recording practices. Based on the data received from the case organization (Soite, 2025), between 2019–2022 a lot of outpatient visits in the specialty of general medicine were from medical rehabilitation units. A large proportion of them supposedly should be registered to primary healthcare. This view was also supported by the case organization when contacted (Soite, personal communication, May 12, 2025). Therefore, these outpatient visits were screened out from the data. There was also some other individual outpatient visits registered in the specialty of general medicine which were also screened out. Basically, most of the outpatient visits in the specialty of general medicine which were not screened out from the data, considered visits in pediatric emergency clinic. As data was delivered from Soite, it was informed that between 2019–2021 part of the outpatient visits in pediatric emergency clinic were registered to the specialty of general medicine (Soite, personal communication, April 2, 2025). Some of the data were not screened out as the name of the unit in that row indicated it belongs to specialized healthcare. After that, unknown specialties (only singular outpatient visits were registered in unknown specialties) and some specialties with singular outpatient visits were also screened out. Table 4 shows how many outpatient visits were in the data before screening, after screening, how many outpatient visits were screened out and what percentage of outpatient visits were screened out.

Table 4. Outpatient visits 2019–2023 after screening out data (Soite, 2025).

	2019	**2020**	**2021**	**2022**	**2023**
Outpatient visits	192 395	184 366	187 632	187 930	181 250
Outpatient visits after screening	172 217	171 517	176 164	176 844	181 196
Screened outpatient visits	20 178	12 849	11 468	11 086	54
Percentage of screened out	10,5 %	7,0 %	6,1 %	5,9 %	0,0 %

As table 4 shows, over 10 percent of all outpatient visits in 2019 were screened out from this review as almost 20 200 outpatient visits were screened out. The proportion of outpatient visits screened out reduces yearly during the period under review as 12 849 and

seven percent of outpatient visits in 2020 were screened out, 11 468 and approximately six percent of outpatient visits in 2021 were screened out, 11 086 and approximately six percent of outpatient visits in 2022 were screened out and only 54 of outpatient visits in 2023 were screened out. This shows that recording practices have been refined during the period under review. Screening out the data probably will have an impact on the results as before screening out the data, the amount of outpatient visits in 2023 were approximately six percent fewer than in 2019. After the data screening, the amount of outpatient visits in 2023 is approximately five percent higher than in 2019. The screened data was also indexed similarly to data in hospital productivity time series review, meaning index in 2019 is 100 and other years are compared to 2019. After this, when referring to the data received from the case organization, for outpatient visits it refers to the data after screening.

According to the data received from case organization (Soite, 2025), hospital care days have decreased during the timeframe under review while outpatient visits have increased. In 2019 there were 172 217 outpatient visits and 64 591 hospital care days at Central Ostrobothnia Central Hospital. Numbers for 2023 were 181 196 outpatient visits and 56 720 hospital care days. Based on this, there were almost 9 000 more outpatient visits and almost 8 000 less hospital care days in the first operating year of the wellbeing services counties compared to the first year of the timeframe under review. As a percentage change this means in 2023 there were approximately five percent more outpatient visits and approximately 12 percent less hospital care days than in 2019. Between 2020–2023 there were every year less hospital care days than in 2019 with the year 2023 least amount of hospital care days. Outpatient visits on the other hand had the highest number in 2023 and only in 2020 were there less outpatient visits than in 2019. Figure 5 illustrates how the index for outpatient visits and hospital care days have developed between 2019–2023.

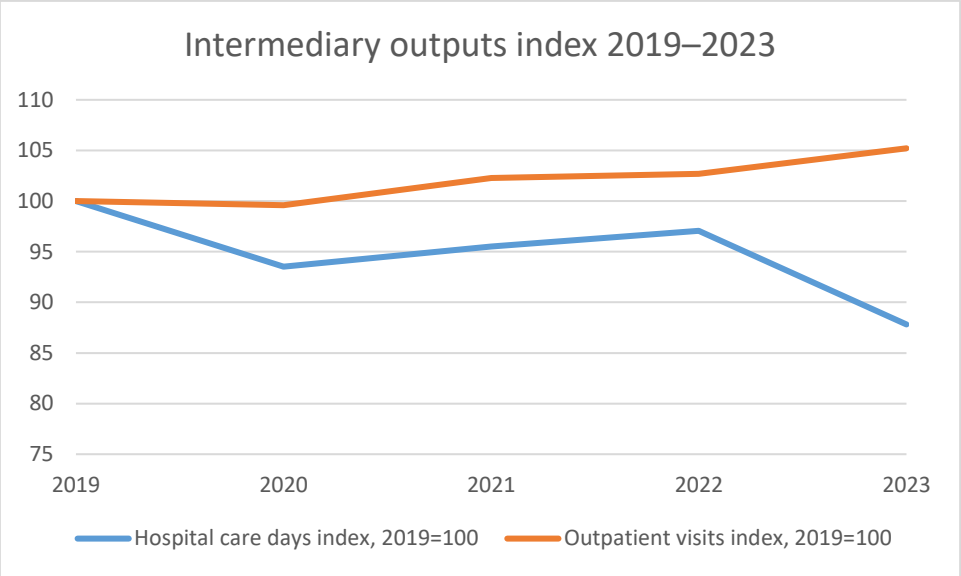

Figure 5. Intermediary outputs index 2019–2023 (Soite, 2025).

Figure 5 shows that hospital care days are at lowest point in 2023 and outpatient visits are in highest point in 2023. This raises an interesting question whether the decrease in hospital care days or the increase in outpatient visits is due to a change in the use of services by patients from Soite's region, a change in the number of patients from other regions, or both. According to the data received from the case organization (Soite, 2025), outpatient visits have increased for patients from Soite's region as there have been every year more outpatient visits than in 2019. Highest amount of outpatient visits from patients from Soite's region was in 2023 with 140 601 visits and the lowest amount in 2019 with 130 410 visits. Outpatient visits of patients from other regions on the other hand were fewer every year compared to 2019, expect in 2022. The fewest number of outpatient visits from other regions was in 2023 with 40 595 visits. In a context number for 2019 was 41 807, meaning approximately three percent decrease. Figure 6 illustrates how the index for outpatient visits has developed between 2019–2023 broken down by patients' area of residence.

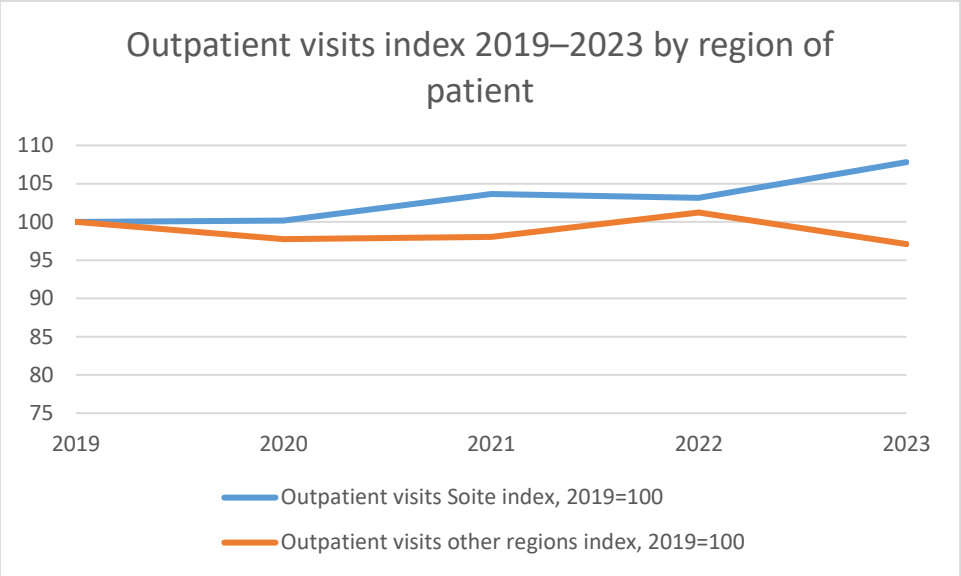

Figure 6. Outpatient visits index 2019–2023 by region of patient (Soite, 2025).

According to the data received from the case organization (Soite, 2025), it can be noticed that the index for hospital care days has changed more in other regions than in Soite's region. While proportional change in the year 2020 was rather similar for both Soite and outside regions with Soite's index dropping six percent and other regions' dropping seven percent, indexes for years 2021–2023 differed a lot. The biggest difference between indexes was in 2023 as the index for Soite was 92 and for other regions 79. This is a huge decline in hospital care days provided for patients from other regions. For a context, the number of hospital care days provided for patients from other regions in 2019 was approximately 21 200, in 2022 19 200 and in 2023 16 700. Meaning in 2023 the number of hospital days provided for patients from other regions declined approximately 21 percent compared to the first year of the time series review and approximately 13 percent compared to the year 2022. As found already earlier, the total number of hospital care days has decreased 12 percent from 2019 while deflated costs have not been reduced. This could indicate that there has been overstaffing, which was one factor found in the literature review that challenges healthcare productivity. Although outpatient visits have increased from 2019, hospital care days probably are on average more expensive to produce than outpatient visits. Figure 7 illustrates how the index for

hospital care days has developed between 2019–2023 broken down by patients' area of residence.

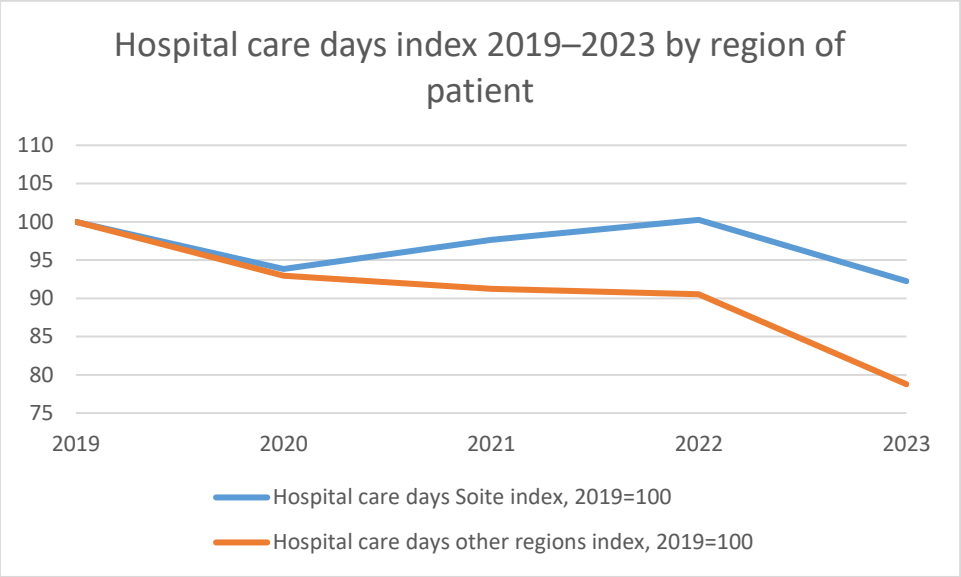

Figure 7. Hospital care days index 2019–2023 by region of patient (Soite, 2025).

As indexes for outpatient visits in figure 6 and for hospital care days in figure 7 show, yearly change in indexes has been mostly different for Soite's region and other regions. According to the data received from the case organization (Soite, 2025), the proportion of hospital care days provided for patients from other regions has decreased every year during the timeframe under review. The proportion in 2019 was 32,8 percent while in 2023 it was 29,4 percent. So, the proportion of hospital care days provided for patients from other regions from all hospital care days was almost three and half percentage points less in 2023 compared to 2019. The proportion of outpatient visits from other regions from all outpatient visits was almost two percentage points lower in 2023 compared to 2019 as the proportion was 24,3 percent in 2019 and 22,4 percent in 2023. The proportions in both hospital care days and outpatient visits were at highest in 2019 and at lowest in 2023. Figure 8 illustrates how outpatient visits and hospital care days provided to patients from other regions as a proportion of total outpatient visits and hospital care days has changed between 2019–2023.

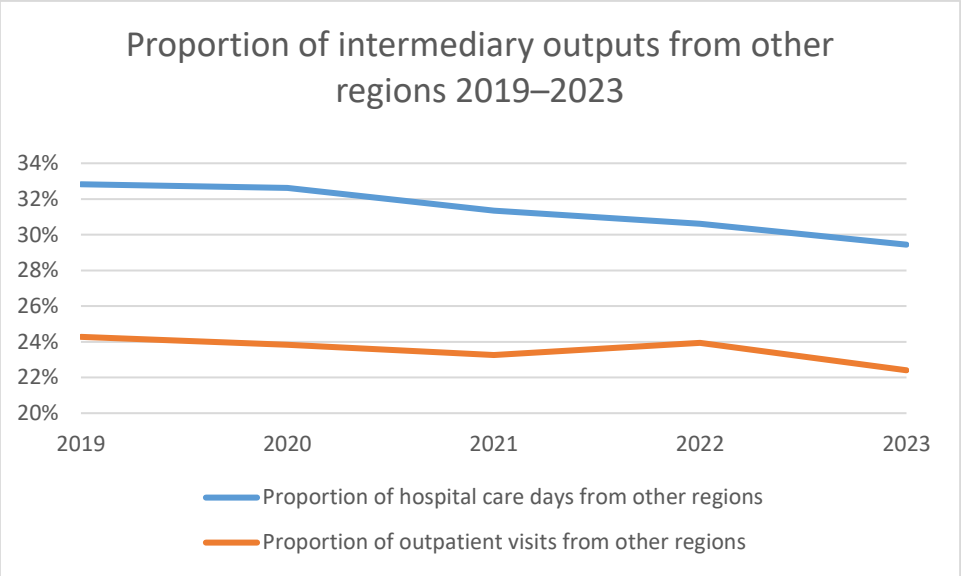

Figure 8. Proportion of intermediary outputs from other regions 2019–2023 (Soite, 2025).

It is interesting to notice that while hospital care days have decreased approximately 12 percent from 2019 and outpatient visits have increased approximately five percent, episodes and weighted episodes have not changed as much. According to hospital productivity time series review (THL, 2024b), there were approximately three percent less episodes and approximately one percent less weighted episodes in 2023 compared to 2019. Figure 9 illustrates yearly count of episodes and weighted episodes between 2019–2023.

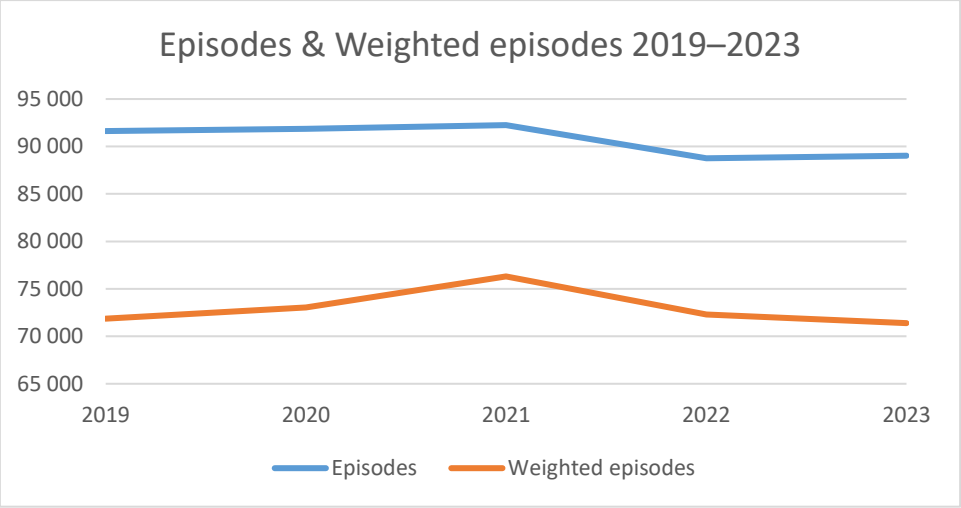

Figure 9. Episodes & weighted episodes 2019–2023 (THL, 2024b).

Interestingly the number of episodes and combined number of intermediary outputs does not seem to go hand with hand. For example, in 2020 there was the least amount of combined intermediary outputs while in 2020 there was the second most episodes. On the other hand, in 2022 there was the most combined intermediary output while in 2022 there was the smallest number of episodes. This could indicate that there are yearly differences in how many intermediary outputs are needed for average to treat patients as episode includes the whole treatment process of the patient. Table 5 includes the number of episodes and combined intermediary outputs with yearly ranks.

Table 5. Yearly episodes and combined intermediary outputs with ranks (THL 2024b; Soite, 2025).

Year	Episodes	Rank	Combined inter-mediary outputs	Rank
2019	91 615	3	236 808	4
2020	91 872	2	231 931	5
2021	92 253	1	237 866	3
2022	88 758	5	239 535	1
2023	89 040	4	237 916	2

Based on the visual representation of the data, for the year 2023 the decreased number of hospital care days could be considered as abnormal compared to the earlier years on review. As mentioned earlier, hospital care days in 2023 were approximately 12 percent fewer than in 2019. Also, 2023 had approximately nine percent less hospital care days compared to the average number of hospital care days between 2019–2022. The decreased number could be at least partially connected to the wellbeing services county reform as proportionally the decrease was larger on hospital care days provided for the patients from other regions. The number of hospital care days in 2023 seems to be the most salient feature of the data especially if year 2023 is compared to the earlier years.

The second salient feature seems to be the increased number of outpatient visits in 2023 compared to earlier years and it could potentially explain why productivity has not

decreased that much even though hospital care days in 2023 had such a large decrease compared to earlier years.

It could be argued that the third salient feature could be that deflated costs were higher in 2023 than in 2019 while episode output is at its lowest in 2023. This could be tied to overstaffing compared to service demand in 2023 which was earlier already briefly pondered. More specifically, this could be linked to the decreased number of hospital care days, meaning that there could have been empty beds in the wards, but personnel sized to the full capacity.

Has productivity been worse in 2023 compared to earlier years of the timeframe under review? Yes, it has been slightly worse in 2023 compared to earlier years as it can be seen directly by just looking at numbers. Just looking at numbers or figure 2 it does not seem significantly worse compared to earlier years combined, although the drop from the years 2020 and 2021 levels could potentially be somewhat significant. The next chapter considers how identified features from the data could be further interpreted.

4.4 Discussion about interpreting salient features

Finding suitable statistical tests to support data analysis and to interpret salient features found turned out to be difficult. First, as the data considers yearly numbers, each variable in the data has only five data points. As there are such a little number of data points, outliers would alter the results a lot. Second, data considering time beginning from well-being services county reform is only from singular year, thus only singular year could be compared to earlier four years of the data. De mast and Trip (2007, p. 308) also emphasized the importance of contextual knowledge in interpretation of salient features. Therefore, interviewing experts from the case organization seems to be a logical way to test assumptions arising from the data analysis.

Before final assumptions are formulated, values from 2023 are compared to average values between 2019–2022 and average values on whole timeframe under review. These comparisons are not meant to be statistical tests; comparisons are made for illustrative purposes only.

When comparing variable numbers from 2023 to average numbers between 2019–2022 it is noticed that many 2023 values differ from 2019–2022 average more than the standard deviation for 2019–2022. For example, of the variables found from hospital productivity time series review (THL, 2024b), number of episodes and episode productivity ratio in 2023 is almost one and half the 2019–2022 standard deviation less than the 2019–2022 average. About this, it could possibly be considered that due to fewer number of episodes, worsened episode productivity in 2023 was slightly deviant compared to average for 2019–2022 or at least that the direction could be concerning. Of the variables found from intermediary outputs received from the case organization (Soite, 2025), it is found that differences comparing 2023 numbers to the average for 2019–2022 are larger. For example, the total number of outpatient visits in 2023 is over two and half times the 2019–2022 standard deviation more than the 2019–2022 average. On the other, the total number of hospital care days in 2023 and number of hospital care days provided for other regions patients in 2023 are over three times the 2019–2022 standard deviation less than the 2019–2022 average. So, it could be said that 2023 numbers for both outpatient visits and hospital care days are deviant compared to 2019–2022 average. These numbers just discussed are presented on table 6. Calculations for outpatient visits and hospital care days are made based on the data received from the case organization and the rest were calculated from the data which is found from hospital productivity time series review.

Table 6. Year 2023 compared to 2019–2022 average (THL, 2024b; Soite, 2025).

Variable	Avg 2019–2022	SD 2019–2022	2023	Difference (2023 - Avg 2019–2022)
Weighted episodes	73 376	2 015	71 389	-1 988
Episodes	91 125	1 599	89 040	-2 085
Episode output	113 374 884	3 113 148	110 303 862	-3 071 022
Deflated costs	93 920 494	1 571 756	93 969 517	49 023
Episode productivity ratio (Episode output/Deflated costs)	1,2071	0,0245	1,17	-0,0333
Outpatient visits, total	174 186	2 707	181 196	7 011
Outpatient visits, Soite	132 691	2 509	140 601	7 911
Outpatient visits, other regions	41 495	692	40 595	-900
Hospital care days, total	62 350	1 761	56 720	-5 630
Hospital care days, Soite	42 489	1 294	40 021	-2 468
Hospital care days, other regions	19 861	919	16 699	-3 162

However, when comparing year 2023 to the whole timeframe under review with 2023 included in the timeframe, differences are smaller. This demonstrates well that values from one year can have significant impact on the results if there are not many data points in the material. For example, of the variables found from hospital productivity time series review (THL, 2024b), number of episodes and episode productivity ratio were highlighted when year 2023 numbers were compared to 2019–2022 average. Now that 2023 is included in timeframe to be compared, both the number of episodes and the episode productivity ratio in 2023 are approximately the 2019–2023 standard deviation less than the 2019–2023 average. Of the intermediary output variables received from the case organization (Soite, 2025), differences were also smaller than when 2023 was compared to the average of 2019–2022. The total number of outpatient visits in 2023 is approximately one and half times the 2019–2023 standard deviation more than the 2019–2023 average. Also, all three hospital care days variables in 2023 are approximately one and half times the 2019–2023 standard deviation less than the 2019–2023 average. Table 7 below is similar to table 6 except in table 7, 2023 is compared to the 2019–2023 average.

Table 7. Year 2023 compared to 2019–2023 average (THL, 2024b; Soite, 2025).

Variable	Avg 2019–2023	SD 2019–2023	2023	Difference (2023 - Avg 2019–2023)
Weighted episodes	72 979	1 958	71 389	-1 590
Episodes	90 708	1 670	89 040	-1 668
Episode output	112 760 680	3 025 723	110 303 862	-2 456 818
Deflated costs	93 930 299	1 361 357	93 969 517	39 218
Episode productivity ratio (Episode output/Deflated costs)	1,2005	0,0259	1,17	-0,0266
Outpatient visits, total	175 588	3 915	181 196	5 608
Outpatient visits, Soite	134 273	4 152	140 601	6 328
Outpatient visits, other regions	41 315	722	40 595	-720
Hospital care days, total	61 224	2 944	56 720	-4 504
Hospital care days, Soite	41 995	1 573	40 021	-1 974
Hospital care days, other regions	19 228	1 623	16 699	-2 529

Assumptions arisen from the data analysis are formulated in the next chapter. In order to interpret features which seem salient, interview questions based on the assumptions are made and answered in the next chapter.

4.5 Interpretation of salient features

As already discussed, productivity in Central Ostrobothnia Central Hospital in 2023 was the worst during the timeframe under review. Although productivity in 2023 cannot, however, be considered as bad as productivity in Central Ostrobothnia Central Hospital was the second best among central hospitals. Not many assumptions can be made based on the data analysis and on the literature review, but at least a few assumptions can be made. The validity of the assumptions is tested through interviews. The most salient feature arisen from the data analysis was the decreased number of hospital care days in 2023 as the total number of hospital care days in 2023 was approximately 12 percent less than in 2019. The decrease in hospital care days provided for other region's patients was even more alarming as the number in 2023 was 21 percent less compared to 2019, and 13 percent less compared to 2022. Therefore, the first assumption is:

Assumption 1: The main reason for the decreased productivity in 2023 is the reduced number of hospital care days compared to previous years, especially the decreased number of hospital care days provided for the patients from other regions.

The second salient feature arisen from the data analysis is the increased number of outpatient visits in 2023 compared to the earlier years. However, the assumption is that the number of outpatient visits impacts less on productivity than the number of hospital care days. The number of outpatient visits could change in more harmony with the costs, meaning if the number of visits go up then costs go up as there could have been more personnel and similarly if the number of visits go down then costs go down as there could have been less personnel. On the other hand, especially the decreased number of hospital care days when the costs have not been going down could indicate that there has been overstaffing, hence decreasing productivity. Although comparing intermediary outputs to the episodes, which includes the whole treatment process of the patient, is not simple and the number of episodes and intermediary outputs did not go hand with hand when compared with each other. Nevertheless, the second assumption is:

Assumption 2: Changes in the number of hospital care days have a greater impact on productivity than changes in the number of outpatient visits.

During the data analysis it was noticed that recording practices have changed during the timeframe, thus making data processing harder. Luckily the most significant changes were informed by case organization when the data was delivered. Nevertheless, this shows that context knowledge and organization-specific knowledge has great importance on data analysis process and without the information of changed recording practices, screening out visits from the data would have been really hard. The third assumption is:

Assumption 3: Interpreting the hospital productivity requires contextual knowledge as well as organization-specific knowledge.

Based on the assumptions, six interview questions were formulated. Interviews were conducted via e-mail. Interview questions 1–6 were asked from the medical director of the case organization. Interview questions 4–6 were also asked from the statistical unit of the case organization, but answers were received only for questions 5–6 from the statistical unit.

Interview question 1: How would you describe changes in productivity in the first year of the Wellbeing services county reform compared to earlier years?

Medical director: “The decrease in inpatient hospital stays continued in both university hospitals and central hospitals. In central hospitals, the decline in emergency visits also continued compared to earlier years. The implementation of elective care through means other than in-person appointments has significantly increased during the review period from 2019 to 2023.”

Interview question 2: What would you consider as the biggest reason for decreased productivity in 2023?

Medical director: “In Soite, higher use of specialized medical care indicates a shift in integration from primary to specialized care level, resulting in above-average productivity in specialized healthcare. This shift of integration towards specialized healthcare was at its peak in 2023. In addition, as the occupancy rates of inpatient wards and the number of outpatient visits began to decline due to the wellbeing services county reform, these factors together led to a decrease in productivity.”

Interview question 3: Does changes in the numbers of hospital care days and outpatient visits affect similarly or differently to productivity?

Medical director: “In general, the cost deviation caused by usage both hospital care days and outpatient visits, indicates higher usage than average per inhabitant in Soite – therefore, my opinion is that they have similar effect on productivity.”

Interview question 4: How do you see the role of contextual knowledge in interpreting hospital productivity?

Medical director: “When assessing hospital productivity, it is essential to first consider need-adjusted episodes. The impact of integration on productivity is given less attention, and due to its individual variation, making comparisons or evaluating effectiveness is challenging.”

Interview question 5: How do you see the role of organization-specific knowledge in interpreting hospital productivity from that organization’s perspective?

Medical director: “The assessment and understanding of our central hospital's productivity — and especially its closely related cost-effectiveness — should be significantly better than it currently is. The general lump-sum funding model of the wellbeing services counties also challenges the use of productivity as a management metric.”

According to the representative of the statistical unit: The role of organization-specific knowledge is especially emphasized if specialty level productivity of two different regions is examined in parallel. Recording practices, both in euros and in service events, have a significant impact on central hospital comparisons. Organization-specific knowledge helps to understand how local processes, care practices or division of labor are reflected in statistics. This kind of examination should be emphasized especially at the extremes of the productivity distribution. Without organization-specific knowledge, productivity figures can lead to a misleading picture of the true efficiency of operations. In addition, the own region’s patient profile and the extent or level of treatment may differ from other regions and these factors must be taken into account in the

interpretation. Therefore, local expertise is a key part of utilizing statistics to support management and development.

Interview question 6: How do the changes in recording practices affect the comparability with previous years?

Medical director: “In Central Ostrobothnia, the organizational reform was already carried out in 2017 by harmonizing information systems, so changes in documentation practices do not have a significant impact on the assessment.”

According to the representative of the statistical unit: Both organizational and operational changes often affect statistics. Changes in recording practices, both between years and during the year, have a significant impact on the comparability of productivity figures. For example, if recording practices for service events or cost allocation for a care episode in specific specialty is changed, it can artificially increase or decrease productivity without changing the actual efficiency of operations. This is particularly evident in productivity comparison by specialty. This kind of change could happen in a ward which operates at the interface between primary healthcare and specialized healthcare. In this kind of case, interpretation of trends or direction of development without context knowledge can lead to wrong conclusions. It is important to document the changes and if needed, correct or explain time series data so that comparability is maintained and statistics support reliable management.

4.6 The validity of the assumptions

The first assumption formulated based on the data analysis was:

Assumption 1: The main reason for the decreased productivity in 2023 is the reduced number of hospital care days compared to previous years, especially the decreased number of hospital care days provided for the patients from other regions.

The first two interview questions considered assumption 1. The answer received for the interview question 1 considered more the wellbeing services counties in general but also topics which partly related to the assumption 1 rose. For example, the decrease in inpatient stays was mentioned for both university hospitals and central hospitals. In answer received for the interview question 2, decline in occupancy rates of inpatient wards with declining number of outpatient visits were mentioned as factors which together led to a decrease in productivity.

Interestingly, in the material received from the case organization, the year 2023 had the most outpatient visits. Although, it was mentioned in the answer received for the interview question 1 that the implementation of elective care through means other than in-person appointments has significantly increased during the timeframe under review. As informed by the case organization when requested material was delivered, outpatient visits in the material include outpatient consultation as a visit type. This could indicate that later years in the timeframe may include digital contacts recorded as visits, which makes the number of visits higher.

The decrease in the number of hospital care days provided for the patients from other regions was not mentioned directly but it can directly be seen from the numbers, thus it can be linked to the mentioned decline in occupancy rates of inpatient wards. However, the decline in occupancy rates of inpatient wards was mentioned together with declining number of outpatient visits. Because of these factors, assumption 1 could not be accepted as it was stated. It might be accepted as “The decreased number of hospital care days in 2023 compared to previous years and the decreased number of hospital care days provided for the patients from other regions are part of the reason for decreased productivity in 2023”.

The second assumption formulated based on the data analysis was:

Assumption 2: Changes in the number of hospital care days have a greater impact on productivity than changes in the number of outpatient visits.

Interview question 3 considered assumption 2. In the answer received for the interview question 3, the opinion that hospital care days and outpatient visits have a similar effect on productivity was given. The earlier mentioned increased elective care through means other than in-person appointments, and as there was outpatient consultations included in the data as a visit type, could explain why the number of outpatient visits in 2023 was the highest of all in the data. Nevertheless, based on the answer received for the interview question 3, assumption 2 is rejected.

The third assumption formulated based on the data analysis was:

Assumption 3: Interpreting the hospital productivity requires contextual knowledge as well as organization-specific knowledge.

Interview questions 4 and 5 considered assumption 3. The medical director pointed out in the answer for interview question 4 that there is not much attention given to the impact of integration on productivity. It was further pointed out that due to integrations individual variation, it is challenging to make comparisons or evaluate effectiveness. For the interview question 5, the medical director pointed out that in Soite, both assessment and understanding hospital productivity should be significantly better than it is now. The funding model for the wellbeing services counties was also mentioned to challenge the usage of productivity as management metric.

In the answer received from the statistical unit for interview question 5, organization-specific knowledge was emphasized in cross comparison situations. In the answer, it was suggested that the role of organization-specific practices should be examined especially at the extremes of the productivity distribution. It was also stated that by looking at only productivity figures, it can give a misleading picture of the true efficiency of operations

if there is no organization-specific knowledge. Based on the answers, assumption 3 can be accepted.

Interview question 6 was not directly connected to any assumptions, it was more just a bonus question of how the changes in recording practices affect the comparability with previous years. The medical director pointed out that in Soite organizational reform was already made in 2017, so the changes do not have significant impact. In the answer from the statistical unit, it was stated that changes both between and during the year have a significant impact on the productivity figures. It was further pointed out in the answer received from the statistical unit that changes could artificially change the productivity figures with no real change in operations. This could be linked in with earlier mentioned the impact of integration in productivity which was mentioned by the medical director. In the answer received from the statistical unit, the importance of correcting or explaining time series data was also highlighted. So, the answers could indicate that in a bigger picture, changes in recording practices are not so significant from the managerial point of view. On the other hand, individual changes are likely to be more significant in the statistical unit where possible corrections to the time series data are made in order to ensure comparability.

5 Conclusions

5.1 Conclusions

The first topic covered in the literature review was OM. OM was included in the start of the literature review to provide industrial management context for the thesis and to introduce a larger concept to which productivity is integrally linked to. After that the concept of productivity was introduced and after that productivity in healthcare was discussed. Then it was proceeded to investigate what challenges are associated with productivity in healthcare. Lastly, it was briefly discussed about economic scenario planning and economic forecasting. These were briefly discussed because in changing situations such as in the Wellbeing services county reform, an organization's ability to align its activities to changing circumstances could affect productivity.

This thesis had two research questions. The first research question for the thesis was answered in the literature review part of the thesis. It was included in the thesis due to financial difficulties of the wellbeing services counties, which have been heavily featured on the news. It was also included in the thesis to build knowledge of the industry-specific challenges in productivity. The first research question was:

RQ1: Which factors are associated with productivity challenges in healthcare?

Many of the factors associated with productivity challenges in healthcare considered resource management and availability of the resources. Groop et al. (2017, p. 12) found that in homecare, resources are often reserved at the wrong time of the day and caregivers have a high level of absenteeism, leading to unpredictable capacity shortages which are answered by leasing expensive external workforce. According to Erhard et al. (2018, p. 1), hospitals also have challenges to match the demand which often leads to understaffing or overstaffing. Understaffing, in addition to the impact on quality or availability of care, may increase absenteeism or turnover rate in personnel. Overstaffing on the other raises unnecessarily the costs. So, both understaffing and overstaffing may

impact negatively on productivity with overstaffing more directly linked to decreased productivity. Both late cancellation of appointments and no-show for appointments are also common events in healthcare clinics and they both lead to employee idle, thus decreasing productivity (Deina et al., 2024, p. 2).

Walters et al. (2022) found that many individual factors can be identified which relate efficiency improvements in public health systems but the research considering efficiency improvements is not cohesive enough and does not provide evidence for the best practice how to support efficiency improvements in public health systems. Kämäräinen et al. (2016, p. 294) pointed out the difficulty of comparing system level productivity due to varying financing systems, links to social sector services and health policies. As already discussed in the literature review, this could be one factor why best practices to support efficiency improvements in public health systems are hard to define. In the study by Kämäräinen et al. (2016), it was also found that productivity measures taken from unit/organization point of view may not improve system level productivity but rather worsening the system level productivity.

Based on the literature review, especially resource management and availability of the resources rises as factors which challenge healthcare productivity, or at least at organization or unit level. This could be due to the nature of the healthcare industry, where there is likely a lot of uncertainty about the future, thus making matching the demand hard. The assessment of productivity in healthcare based on the literature review seems to be a difficult task. The assessment of productivity in healthcare is likely to differ how much technical efficiency, quality of care or health gains of the patients is weighted on the assessment. Based on the literature, those three are hard to combine as a metric for productivity. It is clear that productivity has to be somehow measured, and it seems that some form of intermediary output is often used as the measurement. Nevertheless, it is a valid question to ask that how the efficiency of healthcare would be most sensible to measure? In the end, the aim should be that people are so healthy that services are needed as little as possible.

The second research question and the main objective for this thesis was examined in the empirical part of the thesis.

RQ2: How has hospital productivity changed in Soite in the first year of the Wellbeing services county reform?

EDA was employed to answer the second research question. The EDA framework provided by De Mast and Trip (2007) was used as the basis for this thesis, and the framework includes three steps: 1) display the data, 2) identify salient features and 3) interpret salient features. The EDA process in this thesis can be divided into two main parts. The first part considered visual representation of the data in order to identify salient features of the data. The first part in this thesis included data analysis of quantitative data found from hospital productivity statistical report 2023 and its related time series review and intermediary output data received from the case organization. During the process it was noticed that statistically testing identified salient features proved challenging, therefore assumptions based on the data analysis and the literature review were formulated and interviews via e-mail were conducted in order to test the validity of the assumptions. The formulation of the assumptions and the interviews can be seen as the second main part of the EDA process in this thesis.

Hospital productivity in Soite was at its worst in 2023 during the timeframe 2019–2023 under review, that could be seen straight away. However, productivity in 2023 in Soite was the second best among central hospitals, so productivity in 2023 in Soite cannot be considered bad. The most salient feature arisen from the data analysis was the decreased number of hospital care days in 2023 compared to earlier years. There were almost 8 000 and approximately 12 percent less hospital care days in 2023 compared to the first year of time frame under review. The percentage decrease among other regions patients treated in Soite was even larger as the number of hospital care days provided for patients from other regions in 2023 were approximately 21 percent less compared to

2019. As already discussed, assumptions were formulated in order to interpret salient features arisen from the data analysis. Three assumptions were:

Assumption 1: The main reason for the decreased productivity in 2023 is the reduced number of hospital care days compared to previous years, especially the decreased number of hospital care days provided for the patients from other regions.

Assumption 2: Changes in the number of hospital care days have a greater impact on productivity than changes in the number of outpatient visits.

Assumption 3: Interpreting the hospital productivity requires contextual knowledge as well as organization-specific knowledge.

Assumption 1 could be only partly accepted based on the interview as the decrease in number of hospital care days was mentioned with decreased number of outpatient visits and the decreased number of hospital care days provided for the patients from other regions was not separately mentioned. Based on the data received from the case organization, the number of outpatient visits in 2023 was highest in 2023 during the timeframe 2019–2023. So, this could indicate that there have been digital contacts included as outpatient visits in the data making the number higher. Assumption 2 was rejected based on the interview as according to the answer, hospital care days and outpatient visits have similar effect on productivity. Assumption 3 was accepted based on the interview answers. Organization-specific knowledge was especially highlighted in the answer received from the case organization's statistical unit as only looking at the productivity figures can give a misleading picture of true efficiency of operations.

5.2 Discussion

The research instrument is considered reliable when the results of a study can be reproduced under a similar methodology (Golafshani, 2003, p. 598). The empirical part of the

thesis concerned specifically the case organization of the thesis, meaning similar results may not occur if similar research were done from some other wellbeing services county's point of view. However, by using a similar methodology, the research should be reproducible in the context of individual wellbeing services county, but it will most likely have different results.

Validity in mixed methods research has not been researched as much as in qualitative or quantitative research (Long, 2017, p. 201). Validity in quantitative research means whether the research measures what was intended to measure (Golafshani, 2003, p. 599). As mixed methods were used in this thesis it is kind of hard to say how the validity of the thesis was. On the other hand, it could say that it was measured what was intended but no statistical tests were employed to confirm findings. Therefore, assumptions were formulated and to test the validity of assumptions interviews were conducted. By comparing assumptions to interview answers, it could be maybe said that validity in this thesis was at moderate level. This thesis has attempted to be transparent by highlighting the challenges which were faced with data interpretation.

As the EDA framework used in this thesis is practically used for idea generation it has its upsides and downsides. On the upside, there is no need for prespecified hypotheses. On the downside, in this kind of data analysis process, the researchers own interpretation of whether the feature in the dataset is salient or not is emphasized. So, this can lead to different results based on one's interpretation whether some features are salient or not. The level of expertise in the subject under study can also have an effect in EDA.

The literature review part of the thesis was maybe too little connected to the empirical part of the thesis. Although the aim of the literature review part of the thesis was more to build understanding for the concept of productivity in the context of healthcare and to answer research question 1. Nevertheless, if the literature review and the empirical part would have been better connected, it would probably have improved the quality of the thesis.

Also in hindsight, a more sensible empirical part for the thesis could have been examining productivity challenges from the case organization's point of view and comparing findings to the findings from the literature review. This could provide an interesting topic for the study. Also, some kind of cross-comparison study between healthcare organizations could be interesting to see to what extent there are organizational differences in perceived productivity challenges. Due to financial struggles the wellbeing services counties have been facing, how to make operations more cost-effective without decreasing the quality of care should also be highly emphasized in future research.

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