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Referral waiting time analysis at paediatrics wards in Region Västra Götaland

Master's thesis in Quality and Operations Management

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SUMMARY

Variation in waiting time connected to the referral process is an aspect that a healthcare provider battles within the endeavour of providing treatment services for incoming patients. VGR (Region Västra Götaland) is a healthcare provider currently facing this issue. One reason for this is a deficit in understanding the causes of variation in the referral process, which consequently has elicited an increased variation in patient waiting time.

This study aims to explain why and where, in the referral process, causes of variation emerge and, moreover, how to manage the causes of variation. A literature review provided substance and deeper insights into how the referral process works and possible factors that generate causes of variation in the patient referral time. A Gemba walk was undertaken to obtain a holistic overview of the referral process at VGR. The method used for this thesis was a case study involving quantitative and qualitative data. The quantitative data presented an overview of what the distribution of the number of referrals looks like across different units in the county of Västra Götaland. Furthermore, the quantitative data showcased the length of waiting time for incoming patients. Answers and insights from the semi-structured interviews represented the qualitative data.

From the empirical findings, a specific disease and two units in the VGR organisation were chosen for further analysis due to considerable differences between the two in terms of waiting meantime for patients in the referral process and the number of incoming referrals. The analysis entailed a discussion and reflection on the causes of variation for the two chosen units. The causes of variation were categorised as internal and external variation, implying that if the cause of variation occurs within the unit, respectively, outside the unit. These variations were then split into controllable or non-controllable variations to understand how to manage the variation. Recommendations and suggestions based on the results have been laid out, attributed to the categorisation of variation.

Keywords: Referral time, referral, variation, hospital, healthcare, specialist.

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Acronyms

BUM – Barn- och ungdomsmedicinsk mottagning/child and adolescent medical clinic

GP – General practitioner

PCP – Primary care physician

Ppk – Process performance capability

RMR – Regionala medicinska riktlinjer/ Regional medical guidelines

Std dev – Standard deviation

VGR – Region Västra Götaland

Nomenclature

Specialist – A physician that has trained knowledge within a certain medical field.

Paediatrician – In this case study, the paediatrician is referred to as a specialist.

Assessing Paediatrician – A paediatrician that assesses incoming referrals

ReferID – Referral identifier

Others - Refers to BUP (Barn och ungdomspsykiatrin), habilitation, school nurses and private clinics.

The names of the BUM's locations within VGR have been denoted in letters to ensure anonymity. A total of 13 BUM units have been denoted by letters, as follows:

- BUM *A*
- BUM *B*
- BUM *C*
- BUM *D*
- BUM *E*
- BUM *F*
- BUM *G*
- BUM *H*
- BUM *I*
- BUM *J*
- BUM *K*
- BUM *L*
- BUM *M*

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1. Introduction

1.1 Problem Background

Increased variation in referral rates and increased costs due to inefficiency in the referral process are growing issues for healthcare services (Bowling & Redfern, 2000). Although there has been a growing consensus in the literature to manage the issues, little work has been implemented. The referral process can be described as "General practitioners (GPs) act as gatekeepers between the primary level and the specialised healthcare system for non-acute patients" (Safi et al., 2022).

Sweden is regarded as having one of the best healthcare systems (Karolinska university hospital, 2021), with free access to care for its inhabitants. In the quest to sustain a sound healthcare system, Sweden's population have increased over the last few years (Statistiskska centralbyrån, 2023.) This has increased the demand for healthcare services (Karolinska institutet, 2022). Thus, reaching a point where the implications have morphed into a strained situation in healthcare services.

VGR (Region Västra Götaland), a contributor and, provides progression within the spectrum of healthcare, culture, and public transport to the people in the county of Västra Götaland. According to Ekonomifakta (2022), the number of inhabitants in the county of Västra Götaland is increasing in a similar fashion as the general population in Sweden, thus adding more pressure to sustain proper healthcare. Because of the increased population in the county of Västra Götaland, VGR is under more pressure to meet the increased demand in their fields. The organization consists of roughly 56, 000 employees and is responsible for satisfying the desires and goals stated by the government. VGR is currently facing challenges regarding the waiting time connected to the referral process. According to SKR (2022), the time between when a referral is written after the first interaction with a doctor to receiving the needed care from a specialist is referred as waiting time. VGR is battling with providing healthcare for its citizens in a timely manner and having the capacity to provide quality healthcare for the increased population in the county of Västra Götaland. VGR's primary resources depend on funding from the government, which has remained unaltered in recent years (personal communication, February 28, 2023). Ultimately, the increasing population of children in the county of Västra Götaland has created a conflict for VGR to cope with the rising demand and provide a good healthcare service.

BUM (Barn och ungdomsmedicinsk mottagning) is part of the VGR organization that is branched to target specialized care for children ranging from six months to 18 years old and has

numerous locations in Gothenburg and the county of Västra Götaland. Several BUM units are currently battling to reduce waiting times in the referral process. Employees at VGR claim (personal communication, March 3, 2023) that treating patients in this age range is even more difficult than treating patients who are over 18. This is due to the children's ongoing evolution in relation to their growth and general health. According to the staff at VGR (personal communication, March 3, 2023), human beings are fully developed when they reach their adult years, at 25 years old.

1.2 Aim

This study aims to understand the sources of variation in patient referral waiting time. As a result, this thesis will provide an understanding of the plausible factors for variation in the referral process that create increased waiting time for patients.

1.3 Research questions

The following research questions are going to be addressed in this study:

- What does the variation in referral waiting time look like across all units at BUM?
- Why do some units have shorter or longer waiting times?
- How to deal with the sources of variation?

1.4 Delimitation

This thesis will only examine patients ranging from 6 months to 18 years old. Information from the literature regarding all types of referral processes will be analysed. In this thesis, "waiting time" is defined as the waiting time from when a referral is sent to the first interaction with a specialist. The observed data on waiting time was retrieved between the years 2020 and 2022.

2. Literature review

This section serves as a background to provide the theoretical background to discuss the results. The literature review covers two key topics related to healthcare: the referral process (Section 2.1) and a theoretical background on variation (Section 2.2). A summary of articles on factors that influence the referral process is provided in Section 2.3.

2.1 The referral process

2.1.1 Standardized referral process

Having the general practitioner as a gatekeeper in the referral process is essential for screening patients, with the purpose of selectively serving treatment to needed patients. This, consequently, requires a medical decision that will dictate if the patient needs extended care and, thus, a referral to be sent. Uncertainty can influence how the general practitioner will make a medical decision. In order to mitigate the uncertainty, questions and scrutiny are needed to make a proactive decision. Thus, the article written by Wilkin and Smith (1987) outlines a model for how a general practitioner could manage referrals for a patient. The first section of the model presented is to collect generic information by having the general practitioner ask an initial question regarding the exhibited symptoms. Subsequently, selecting two pathways is possible: The general practitioner feels that more information is necessary to make an ultimate decision. Thus, the available practitioners' resources (skills, time, and knowledge) and the perception of the judgment made by general practitioners or colleagues will dictate whether a referral is made or not. The second pathway is that the general practitioner has the necessary information to make an ultimate referral decision. Although there are straight pathways in the framework, Wilkin and Smith (1987) mention that it is important to bear in mind that in practice, the answers to questions will be in a probabilistic form rather than a simplistic yes or no.

Furthermore, Wilkin and Smith (1987) highlight the importance of thoroughly examining referral decisions, suggesting observing how many patients were referred and the arrived decision to conduct a referral. Overall, the general questions guide the general practitioner to a reasonable medical decision that will further enhance the patient's treatment and experience. Wilkin and Smith (1987) clarified that this is regarded as applicable and appropriate for the most common and complex diagnoses a general practitioner experience from incoming outpatients.

Newton et al. (1992) underscore what a referral should contain but also emphasize the difference between what constitutes a good referral between the specialist and the general practitioner. One joint consensus that general practitioners and specialists agree on, according to Newton et al. (1992), is the essence of garnering feedback generated by the dialogue between general practitioners and specialists. They further mention what aspect of the referral is always or usually important among general practitioners and specialists. The prominent aspects brought up are the following: the patient's relevant medical history, current medications, and any ongoing treatments or interventions. Additionally, the referral letters should also contain clear and concise information regarding the diagnosis, test results, and treatment plan, including any changes or adjustments made to the patient's care**.** Westerman et al. (1990) also support the assumption that feedback is positively aspired by both specialists and general practitioners.

According to Westerman et al. (1990), referrals are the primary means of contact between healthcare peers. It is a standard way of communicating, whether by paper letter or electronically. This kind of communication allows for the effective explanation of cases and problems ranging from very complex to simple. It allows the two parties to make extensive descriptions of their assumptions about a problem. Moreover, the referral can act as a means of education between the two parties (Westerman et al., 1990). O'Donnell (2000) argues there is still missing a joint consensus on what constitutes a good referral and lack of evidence about the patient's long term outcome following a referral.

The healthcare journey for patients typically begins at the primary care and then progresses to more specialized care if necessary. The general practitioner at the primary care provider, who can be considered a gatekeeper, plays a crucial role in this process by evaluating the patient's needs and referring them to appropriate specialists as needed. The role of the general practitioner is an important aspect of the healthcare system and can impact a patient's overall care experience (Davies et al., 2011). The exchange of information between general practitioners and specialists is important for sustaining quality treatment for patients.

2.1.2 Quality of the referral letter

In general, one of the current issues with the referral process is the lack of quality in written referrals. The main reason for the lack of quality is the referral contained the wrong information (Jenkins, 1993). The information contained signs and symptoms that could be misinterpreted wrongly. The description of the symptoms that the practitioner carried out is at risk of needing to be understood in the referral. Consequently, Jenkins (1993) suggest introducing a standardized referral.

Jenkins (1993) argues that the need for more referral quality and the various barriers created is due to miscommunication along the referral process. The referral needs to contain sufficient information, leading to the physician's experiencing dissatisfaction with the quality and timing (Gandhi et al., 2000). An issue regarding communication barriers is the difference in what the

physicians think is essential to communicate. The article highlights this but also that the referral system, with the patient's factors not associated with the information, needs to be developed. When it comes to communication issues, when the referral description initiates, it is crucial to focus on the quality of care for the patient and, more importantly, the physician's satisfaction towards the referral process. In order to reduce inappropriate referrals, it is essential to improve communication before the referral is written (Gandhi et al., 2000). The focus is for the physician to have enough time to put in the correct important information in the referrals and be able to take good notes (Gandhi et al., 2000).

2.1.3 Process mapping

A method to fully understand a business is to map the current processes in the organization. Anjard (1998) underscores the value of doing a process map to alert where critical quality improvement is needed in the process.

Moreover, the method to visualize the processes, i.e., a process map, is conducted for the purpose of visualizing each work step to gain knowledge that could further enhance the process, Damelio (2011). Furthermore, Damelio (2011) echoes the importance and initiative of making a process map for organizational progress. One main reason is to improve the communication and understanding of the involved parties throughout the process.

2.1.4 Process mapping in healthcare

Trebble et al. (2010) mention that visualising a process allows the provider to understand the patient's perspective in healthcare. However, there is ambiguity regarding the knowledge of doing a process map in healthcare and whether it would reach its full potential. The potential reason for the lack of research and attempts to do process maps in the healthcare space is the clinicians limited time to devote time and effort to eliciting a process map. However, the findings by Trebble et al. (2010) provided a conceptual framework on how to conduct a process map for a better understanding of the process in the healthcare setting. The conceptual framework is comprised of five steps.

1. Preparation, planning and process identification.

Imply that involving parties (Patients, service users) should be identified and involved in this process map.

2. Data and information gathering

The collection of data using different approaches is suggested in this step. This can be through direct observation, interviews or patient experience.

3. Process map generation

This step implies input and perspectives from all parties and roles.

4. Analysis

Analysation to identify possible gaps or room for improvement is to be conducted. It is attributed that information obtained from the process map should be scrutinized for accuracy and quality error.

5. Taking it forward

The finalised process map is intended to act as a guide for process improvement initiatives.

2.1.5 Cross functionality in healthcare regarding referral process

A larger organization is often comprised of different individuals, teams and units that work together for the same endeavour, to achieve innovative ideas and strategic goals. To manifest this, it is imperative to establish cross-functional collaboration within the organisation. Cross-functional collaboration can be defined, according to Holland et al. (2000) as "a group of people who apply different skills, with a high degree of interdependence, to ensure the effective delivery of a common organization objective." Holland et al. (2000) further emphasise that the key point is the interdependence, it is vital for team members to work together proactively. Benefits attributed to cross functionality is enhancement in customer value, better quality information, and organizational learning. However, challenges and obstacles are important to bear in mind, different behaviours, values, norms, and cultures between functions can act as barriers to completing a successful establishment of cross functionality within the organization. Hence, it can induce negative outcomes such as hostility and distrust during interaction and impede necessary decision-making (Holland et al., 2000).

Bodenheimer et al. (1999) describe that the current referral process at care organizations uses primary care physicians (PCPs) as gatekeepers, thus controlling access to speciality care for incoming patients. They imply that this narrative of treating incoming patients in the referral process with PCPs as sole gatekeepers has created a negative consensus among specialists who believe that the gatekeeper role is restricting the resources specialists can offer.

Bodenheimer et al. (1999) suggest that a primary care redesign is needed in order to facilitate the PCPs' work and amplify appropriate access to incoming patients and chronically ill patients. The suggested redesign is the following: PCPs should instead serve as coordinators, collaborating with specialists and patients to provide thorough and coordinated treatment. According to them, this shift in perspective calls for changes in the healthcare system, such as integrating technology to facilitate communication between PCPs and specialists and incentivizing coordination rather than gatekeeping. Thus, it is suggested to provide education and support for PCPs to develop their coordination skills. Moreover, Keating et al. (1998) highlight that paediatricians who were in regular contact with the specialist perceived that their understanding of communication was better, contrary to those with less contact with the specialist. Harding et al. (2022) suggest using multi-disciplinary teams where trained allies carry out the assessment of patients to reduce the workload on the PCPs and thus increase treatment capacity.

However, resistance is more common than rare when implementing a new way of thinking within hospitals. An underlying reason is the rigid characterization of healthcare, with a rigid structure and firm boundaries between different professions. Moreover, Bodenheimer et al. (1999) emphasize that clear communication between the primary care provider (PCP) and the

specialized care provider (SCP) has long been acknowledged as a crucial aspect of successful healthcare collaboration. Communication breakdowns between these two providers are a main cause of unclear assumptions regarding their respective duties and responsibilities (Bodenheimer et al., 1999). As a result, maintaining effortless contact between PCPs and SCPs is critical to achieving optimum patient care results.

Healthcare encounters a spectrum of difficulties and is facing crossroads in overcoming these challenges. Labitzke (2015) mentions several challenges spanning from a labour shortage to higher quality standards, the integration of outpatient care, and new medical and information technologies. An example brought up by Labitzke (2015) of where barriers to communication and collaboration can occur is between physicians, nursing staff, and administrative staff. These challenges further accumulate the complexity of problems treating patients in healthcare. Amidst all this, people with creativity need to be able to work together to solve the complexity of the problem. Often, the professions that need to work collectively consist of people with different disciplines, such as, e.g., physicians, nurses, specialists, and occupational therapists (Labitzke)., 2015).

2.1.6 How to deal with inconsistencies in the referral process

Beekman et al. (2022) explain the various aspects of asthma referrals, where a tool called the Asthma referral identifier (ReferID), tries to crack the continuous circle of delayed referrals and inconsistent care for patients with asthma. ReferID is a 4-item questionnaire aimed to help identify patients with uncontrollable and possibly severe asthma. Beekman et al. 2022 state that asthma patients do not receive referrals that leads to appropriate care from specialists in time. As a result, it increases healthcare costs and poor outcomes (Beekman et al., 2022).

The initial conclusion is that barriers exist to waiting time for appointments and referrals. It could damage the quality of life for asthma patients waiting (Beekman et al., 2022). These could be the severity of the condition, patient demand and the healthcare system's efficiency. So, the drawn-out waiting time could increase the health costs but also the condition of the patient (Price et al., 2017).

A solution presented is to use the ReferID, a tool designed for healthcare workers to identify patients that suffer from poorly controlled asthma and to be referred for more intensive management by specialists (Beekman et al., 2022). The ReferID can also facilitate these patients when they are identified to the specialists. To ensure that the patients receive timely and appropriate care for the asthma symptoms such as shortness of breath, cough, chest tightness and wheezing (Beekman et al., 2022).

Another solution is to support the primary care providers by supplying them with training to improve asthma management and follow the best practices. Introducing digital health solutions could also lead to patients having the potential to access care remotely (Beekman et al., 2022;

Price et al., 2017) state. However, Price et al. (2017) add that the problem could be addressed by having more robust self-management programs and peer support and helping the patient become more empowered and manage their condition effectively. It will reduce healthcare resources (Price et al., 2017).

The ReferID could help with the assistance of education regarding asthma self-manage for the patients. The education for the patients is about the proper use of inhalers, asthma triggers, and how to monitor asthma symptoms. It will reduce the weight of asthma in the healthcare system and improve the outcomes of the patients (Beekman et al., 2022). The ReferID could also help with the monitoring of asthma outcomes over time. It includes medication use, keeping track of asthma symptoms, and using healthcare, which can assist in patient identification that may require extra assistance and interventions to manage their asthma (Beekman et al., 2022).

2.2 Theoretical background on variation

2.2.1 The concept of variation

When it comes to variation in clinical research, it has been non-prioritized, where it has counted on mean values or averages (Bergman et al., 2015). Variation has been used as a mean to judge the statistical significance of the mean values. The problem with this is that the target values change over time, where the definition changes and it becomes hard to compare with history that is being lost. Measuring generic variation is one source of variation. However, it is important also to measure behavioral, epigenetic variation and even cultural variation perhaps. These different types of variation are not being taken into account in current clinical research (Bergman et al., 2015). To address the variation in healthcare is to use approaches such as continuous quality improvement, standardization, and patient-centered care. Bergman et al. (2015) emphasizes also that reducing variation should not only be focused on but also creating changes for the healthcare system to become better at responding to changing demands.

2.2.2. Variation in health care

Although there is existing literature regarding variation in referral rates, O'Donnell (2000) infers that it remains unexplained what causes variation in referral rates. O'Donnell (2000) proceeds to mention that referral rates can instead be used as a means to generate dialogues to obtain joint working between primary and secondary care. Franks et al. (2000) propose that differences in physician training and years of practice, practice setting, financial incentives, and patient preferences can all contribute to variability in referral rates. Franks et al. (2000) suggest that understanding these factors can help improve the quality and efficiency of healthcare delivery by identifying strategies to reduce unnecessary referrals and ensure that patients receive appropriate care. Franks et al. (2000) proceed to discuss the potential impact of referral

rates on healthcare costs and patient outcomes, highlighting the need for further research to identify practical approaches to improving referral practices. Keating et al. (1998) also mention that paediatricians who perceive that they have limited training or knowledge in the specialized field have the propensity to refer fewer children to a specialist. Furthermore, according to Keating et al. (1998), the variation in the amount referral rate was associated with the degree of contact the paediatricians had with the specialist.

Noon et al. (2003) extend the notion that patients in healthcare are gravitating towards being customers, thus expecting increased availability of appointments and a quicker turnaround of results. However, they mention that a trade-off between the endeavour of providing good service and the resource for providing services is necessary to consider. Despite having the aspiration of satisfying patients and working towards that, randomness is something inevitable. External and internal events can disturb operational excellence (Noon et al., 2003).

Moreover, Noon et al. (2003) explain that the randomness derived from demand and services is what causes variation and, hence, impels the operational difficulties in the healthcare service. They proceed to infer that understanding the role variation has in the healthcare service will ultimately carve out a path to improvement. Waiting in line is the most notable example a regular patient might experience due to variation. Waiting lines result from uncertainty when demand for service exceeds the provider's capability, ultimately resulting in a line or delay in service.

Gitlow & Gitlow (2013) emphasize that there are two different types of variation. Common variation and specific variation. They define common variation as a variation that is inherent within the operations of a hospital, which can arise due to the hospital's design and management processes. Furthermore, it is important to acknowledge that it is the responsibility of top management to address and resolve these common causes of variation since the management is the one who conceives the cause of common variation. Thus, they infer that it is only through the management initiative to change the process that will ultimately reduce the common cause variation. Suggested factors that catalyse common cause variation is the hiring of new employee, training, stress, management style, policies, and procedures. Special variation is often due to occurrences of causes that are external. According to Gitlow & Gitlow (2013) it is notably important, that there is a clear distinction between what is regarded as a common and special variation. The ramifications of treating a common cause variation as a special cause in a process can elicit the risk of poor policies and actions that can create an inferior process. Neuhauser et al. (2011) suggest that management has the potential to reduce variation by facilitating the identification of special-cause variation and by changing healthcare procedures. This can be accomplished, among other things, by encouraging the implementation of clinical practice standards.

A factor that influences the general practitioner's decision to refer patients to specialists is parental influence. Requests from parents to initiate a referral or even re-initiate a referral by insinuating that a new referral is needed, even though a referral has been made. Kunin et al. (2018) emphasize that general practitioners who have the propensity to be influenced by

parents' requests for referrals have the tendency to write more unnecessary referrals than needed. Contrary to general practitioners who do not perceive parental influence, they tend to write fewer referrals. Kunin et al. (2018) argue that the behaviour of writing referrals regarding the parental request is a possible response from the general practitioner to cohere ethical considerations and respect the parent´s desire. They proceed to stress the point that the quandary that the general practitioner faces connected to a referral decision is due to the psychological factors. The experienced pressure of conducting a referral is a subjective matter that is closely aligned with the parent´s desire. An underlying cornerstone of the initial pressure that comes from the parents is that the parent might not feel confident in the general practitioner's judgement and decision-making of referral (Kunin et al. 2018).

2.2.3 Process capability process (PPK)

When the out-of-specification material is being produced, improvement opportunities are made. However, it costs a lot for the company because of the extra steps needed, such as re-work to sell it for a lower price to the customer (White et al., 2021). To monitor this, having an index for process performance that is to the specifications is helpful. A natural index that could be used is the Ppk which considers both the long-term standard deviation and the process average. Having only the lower specification limit (LSL) or upper specification limit (USL) for quality measures is normal. To calculate Ppk the formula is shown in Figure 1 (White et al., 2021).

$$Ppk = \min\ (Ppk, Ppl)$$

$$Ppu = \frac{(USL - \bar{x})}{3S}$$

$$Ppl = \frac{\bar{x} - LSL}{3S}$$

Figure 1 The formula for Ppk, Ppu and Ppl

Suppose there is only USL, then the Ppk=Ppu. If only LSL exists, then the Ppk=Ppl (White et al., 2021). Regarding the formula of Ppl and Ppu, the variable $\bar{x}$ represents the process average, and the variable S is the total standard deviation calculated based on the long-term standard deviation. The Ppk value tells us that if the material produced is off-specification, the Ppk value is low, where the reasons for this according to White et al. (2021), it is more probable that one cause or a combination of issues between the three elements of process health: Excessive common cause variation, off-target process, or unstable process (White et al., 2021).

The guidelines for interpreting the Ppk are if the value is poor, it is less than one. If the Ppk value is adequate or ok, the value is between 1 to 1,33. If the Ppk value is high, it is higher

than 1,33 (White et al., 2021). When the Ppk value is, poor other indices such as Ppl or Ppu must be considered to determine whether it is a common, stable or target issue. What is essential with the guideline is how much data is generated in the time period (White et al., 2021). What is suggested to reduce errors is at least 100 data points. What is essential is not only the amount of data but also how much amount of time it covers. If there is a short time frame with many data points for calculating Ppk, it is not a reliable indicator for process performance over the long term (White et al., 2021).

2.3 Summary of literature for articles impacting referral process

The chosen factors were based on articles content that impact the general practitioners or the specialist's work directly, which consequently influence the referral process.

Table 1 Summary of literature for articles impacting referral process

Literature supporting the following factors	**Factors that might impact waiting time or variation in the referral process**					• **ADULT (A)** • **CHILDREN (C)** • **NOT MENTIONED (NM)**
	Working condition	**Experience as a general practitioner**	**Lack of resources**	**Communication between the specialist and the practitioner**	**Lack of content in the referral**	
• **BEEKMAN ET AL. (2022)**	X	X	X			NM
• **HARDING ET AL. (2022)**				X		A/C
• **KUNIN ET AL. (2018)**		X		X		C
• **PRICE ET AL. (2017)**	X	X	X			NM
• **LABITZKE, G. (2015)**				X		A
• **FRANKS, ET AL. (2000)**		X				NM
• **GANDHI ET AL. 2000**				X	X	A
• **BODENHEIMER, T., ET AL. (1999)**				X		A
• **KEATING. D (1998)**		X		X		C
• **J. NEWTON ET AL. (1992)**				X		A
• **WESTERMAN ET AL. (1990)**				X		A/C

3. Method

3.1 Research design

A case study design was conducted on the organization VGR on the reasons why the waiting time varies between the different units, where the case study is performing an examination that is intensive on the setting, with this research also being based on quantitative- and qualitative research, it can be hard to determine between a case study design and a cross-sectional design (Bell et al., 2019).

What distinguishes a case study is that the researcher is concerned with the unique features of the case, which is an idiographic approach. In comparison, a nomothetic approach is used in the cross-sectional study, focusing more on producing statements that apply regardless of place and time (Bell et al., 2019). The objective of a case study is for the researcher to explain the interest of the object being researched thoroughly.

3.2 Gemba walk and process map

The terminology Gemba means "precious place of work" (Dana, 2015). Gemba is a management technique for managers to instil their standards and leadership into the actual workplace where value is created, which leads to proximity and a better sense of the activity within the organization (Dalton, 2019). Some of the actions of the Gemba walk are to have dialogues with the employees to get in touch with the problem directly, observe activity and a chance to ensure quality and safety in the workplace. Dalton (2019) continues to infer that Gemba walks act as a springboard for vertical information flow between higher senior managers and actors on the frontline.

To grasp how the operative work in the organisation VGR, a Gemba walk was made. Dialogues with employees with knowledge about the referral process was carried out. It catalysed a direct understanding of how the organization works, where issues can be identified, and the referral process.

Subsequently, a process map was executed to understand the activities and potential bottlenecks that could be identified. The process map was inspired by the framework that was proposed by Trebble et al. (2010). There were five steps Trebble et al. (2010) for executing the process map. Firstly, the involved parties were identified through information gathered from the project sponsor. In this case, the involved parties were patients, secretaries, nurses, and assessing paediatricians (paediatrician that assess incoming referrals). Secondly, data gathering was

conducted through interviews and making observation on the operational work. The second step gathered input from the parties involved in the process, nurses and paediatricians involved in the referral process. In the third step, the mapped process was analysed based on the gathered information. Bottlenecks and possible issues in the process were identified, and ultimately, the analysed process map acted as a guide for possible improvements in the process. Followingly, the tool Microsoft Visio was used to visualise the process map.

3.3 Literature review

A literature review was necessary to provide relevant substance for this thesis. The time period for searching for literature findings that would generate topics in the literature review was from January to March, 2023. The literature review was conducted to set a firm foundation and provide a comprehensive understanding of the topic concerning healthcare and referral analysis. In line with the chosen topic, it was paramount to have clarity with the presented research questions to elicit relevant search words. With much available information, it was essential to be selective when choosing sources and information that could solidify a strong literature review. A proposed alternative by Bell et al. (2019) on how to obtain trusted information for creating a literature review for a dissertation was Google Scholar. Consequently, acting as the central source for providing information for this thesis. Moreover, the search engine at Chalmers Library and the search engine Web of Science were utilized to obtain relevant information for this dissertation. The search words used for identifying the relevant literature were "referral time", "referral", "variation", "hospital", "healthcare"," patient", "paediatrician", "quality", "coordination", "cross-functionality", “general practitioner” and "waiting time".

Subsequently, material in terms of information and data regarding the topic provided by the VGR acted as an auxiliary in identifying relevant literature that could be obtained. Moreover, insight from interviews and discussion with involved parties at VGR induced new areas within the topic that could further enhance a strong case for the thesis.

Emphasis on reading critically was ultimately a key factor in being selective with the obtained information. Thus, determining if the literature is relevant to the research questions.
Therefore, the abstract, introduction, and conclusion were judged in consecutive order, which helped to choose the best literature. It is important to bear in mind that the quality of existing research was paramount when conducting the literature review; thus, Web of Science acted as a facilitator to ensure this. A journal impact factor above one was emphasized when choosing relevant information for the literature section.

3.4 Quantitative method

For this thesis, the quantitative data provided by VGR was used to amplify the understanding of the variations in referral time. A statistician (employed at VGR) made the data readable for

the authors. In order to analyze the data, the program JMP is used, a statistical analysis tool to visualize and stratify the data.

3.4.1 Data collection

For this thesis, information in data logs included:

- Disease code
- Waiting meantime
- Units
- Number of children per unit

For this case, the data is for all patients diagnosed from 2020 – 2022. This data has been refined by a statistician at VGR to make the data easier to process in JMP. The goal is to understand the variation in waiting time between units for the most common diseases. An abductive approach has been taken for this thesis, and a deductive approach has been taken for the quantitative analysis. According to Bell et al. (2019), the data collection is led by specific research questions from theoretical concerns. Four factors were chosen for the data collection: waiting time, disease code, units, and number of children.

The diagnosis must be first selected, which has been coded to make it easier to connect the code to the relevant disease. The prioritization was based on the total number of referrals. The following important factor was the units selected based on the chosen disease. For the selection of the units, two factors were important. Firstly, the average waiting time at each BUM unit, where the prioritization is upon the more prolonged waiting time. Secondly is the number of children per unit to determine which units were reasonable to compare.

3.4.2 Data analysis

For the data analysis the chosen method was firstly the Pareto principle rule, which is, according to Juran (2020), that 80% of the consequences come from 20% of the causes. It is a tool to make it easier to sort out the vital few contributing most to the consequences. In this case, the focus is on the diagnoses contributing most to the waiting time. Another method used is the process performance index, also known as Ppk where the index is used for a certain quality measure, where the value can be regarded as poor, adequate, and good (White et al., 2021).

A histogram was done to put the variable disease code as the x-axis and the waiting meantime as the y-axis. In order to screen, the initial data was filtered with the Pareto principle based upon 80% of the y-axis and where it crosses with the x-axis. This method found the disease code with the highest waiting time. After this, the most relevant disease code was chosen and consulted with the organization supervisor. After that, the units that would be compared needed to be chosen. A histogram was done once again, with the Y-axis being the waiting meantime and the units being the X-axis. The Pareto principle was used to screen the data to find the units with the highest waiting meantime. Then with the units within the range, the variable number

of children per unit was used to find units that had a similar amount to exclude it from being a factor that could affect. The selected units were finally chosen, responsible for a similar number of children (look at Appendix B).

3.5 Qualitative method

Qualitative methods are a set of research techniques used to understand and interpret social phenomena by collecting and analysing non-numerical data (Bell et al. 2019). One way of collecting non-numerical data is through semi-structured interviews, which were utilized for this thesis. The outline of a semi-structured interview is when the researcher has predetermined questions that act as a guide to asking questions for the interviewee (Bell et al. 2019). The format of these questions is structured to give the interviewee free leeway in responding. It is important to bear in mind that new questions outside the scope of the guide may appear in the sense of inspiration from the interviewees' answers. The semi-structured interviews for this thesis served as a basis for providing new insights and information on the activities involved in the referral process, thereby also completing a more accurate process map.

3.5.1 Data collection

The semi-structured interviews enabled the gathering of data that could expand the topics touched upon in the literature review and provide further proximity to the VGR organization. For this thesis, the process selection of units to conduct interviews was made twofold. The first step was to observe the distribution of amount written referrals and the waiting meantime for a patient. This distribution of data was observed in the quantitative phase and, ultimately, making observations between units across the county of Västra Götaland. The second step, a comparison of how many children each unit is responsible for was reviewed to make a fair comparison between different units. Comparing units that serve a similar number of children ensures a fairer assessment of their performance, as each unit has a certain amount of resources derived from the number of children they serve.. Data on the count of children was collected in December 2022.

For this thesis, a purposive sampling approach was followed. The essence of purposive sampling is to choose participants who can offer the most relevant and usable information in response to the posed research questions (Bell et al. 2019). The participants for this study were paediatricians and nurses with strong knowledge of asthma who are involved in the daily activities of the referral process connected to asthma. Two paediatricians and two nurses associated with the asthma referral process were interviewed. One paediatrician and one nurse from each unit. By virtue of relevance, the participants had to fill in the criteria to work in the chosen units. Bell et al. (2019) mention that when having a purposive sample approach, there is no upper or lower limit number of interviews that has to be executed. Bell et al. (2019) suggest

that the sample size should be adequate to collect sufficient data to accomplish data saturation and redundancy.

The semi-structured questions were created based on the findings in the literature review. Furthermore, questions were generated by insights from the Gemba walk and discussions with employees at the VGR organization. Interviews followed a similar template to observe deviation or split assessment in answers that could generate new insights and discussion material. The interview had two focus areas. The first section of the interview examined the participants' backgrounds and years of experience in their profession. The second section gave profound insight into the current referral process. The time for each interview was approximately 60 minutes, and it is also suggested by Bell et al. (2019) that the length of an interview should be between 45-70 minutes.

3.5.2 Data analysis

The data collected through semi-structured interviews generated an extensive richness of information that created a necessity for an analytical pathway. The data were analyzed in a thematic fashion. According to Bell et al. (2019), thematic analysis is a qualitative data analysis method that entails finding themes in the collected data to allow a greater comprehension of the posed research question. The process comprises reading and analyzing the data to identify meaningful themes and then organizing these patterns into cohesive and understandable categories. Moreover, themes can be derived from theory-related material. Hence, thematic analysis was the most appropriate approach to analyze the collected data.

The semi-structured interviews were recorded to obtain a full grasp of the interviewee's answers and followingly transcribed. The language used in the interview was in Swedish. The interviews were also recorded to obtain complete clarity and ensure that valuable information was not missed. When the participants' answers were transcribed, a translation to English was done. The translation was done through *Deepl* to secure content translation. To ensure that nothing was lost in the translation the content was subsequently back translated. The ultimate step when analyzing the interviews was to find how the answers coincided and diverged from each other and if there were any new insights into the responses.

Answers with similarities across the different interviewees were then categorized into different topics. This enabled visualizing the outcome of the theory from the qualitative data, and also obtain new insights that could provide further clarity for the research questions posed.

3.6 Quality Criteria

This section is comprised of how the quality criteria have been examined regarding validity, reliability and transferability for the reader.

3.6.1 Validity

Triangulation has been used for this thesis to ensure that the case study research induced the best possible outcome. According to Bell et al. (2019), triangulation is an approach to navigating towards a problem with several methods or data sources, which can provide more confidence in the findings within research.

In this study, data sources from the literature review and quantitative and qualitative methods have been combined to obtain information from multiple angles. Data analysis has been done using JMP to give an objective view of what factors to focus on regarding the choice of disease and units. Subsequently, semi-structured interviews have been done with the findings gained from the data analysis and literature review.

3.6.2 Reliability

With the selection of articles relevant to the literature, every source has been examined in the Web of Science to have at least higher than one on the scale of journal impact. Our supervisor advised this to ensure the articles chosen are reliable. Regarding meetings with the examiner and supervisors, every discussion has been summarized, and notes have been taken. Furthermore, pictures of figures and different thoughts have been visualized on whiteboards, which have sparked further creativity in discussion and brought clarity to communication.

In the semi-structured interviews, the respondents were somewhat prepared and informed about the topic. When conducting the research, there was a clear focus in the beginning regarding the topic, instead of choosing a generic topic. It leads to semi-structured interviews, where more specific issues are addressed (Bell et at. 2019).

3.6.3 Transferability

Transferability often entails that the study is applicable to other contexts Bell et al. (2019). For this thesis, outcomes of the quantitative data are comprised for the VGR region during the time range 2020- 2022, thus, making the data applicable for other units across the VGR operation regarding the disease asthma.

Information collected in the literature review is comprised of the referral process globally which can create uncertainty if the obtained information is fully applicable at units in the VGR organization. The qualitative data is contextual-based information which cannot guarantee that the qualitative data applies to other units; however, inspirations can be drawn from the chosen units.

In general, the study serves information and recommendation in tune with the referral process for the selected disease code at the selected units. The study cannot promise a similar outcome

to be applied to other diseases and other units since other units and diseases have different preparation processes or capacities.

3.7 Ethical considerations

A fundamental aspect of research is to conduct it with the coherence of ethical principles. Bell et al. (2019) emphasize that ethical consideration should be an integral part of a research process, permeate the research and act as a roadmap on how to obtain information rightfully. According to Bell et al. (2019), ethical principles are divided into four main areas. Accordingly, the thesis complied with the ethical consideration at the outset mentioned by Bell et al. (2019). The first area within the scope of ethical principles is "harm to participants". In the case of business research, harm is suggested to the participants in the research are in no possible way in danger as an outcome of actively choosing to participate in the research project. Bearing this in mind, the authors of this thesis assessed this risk. Hence, conducting the interviews so that the respondents were anonymous and the aspect of receiving data complied with the laws and regulations not to disclose sensitive patient information. Moreover, units in the thesis have been named to letters to further ensure that the identity of the interviewees does not get disclosed. The second area of ethical consideration is the "lack of informed consent." This is critical when collecting initial data from respondents: that they are given enough information about the research to make an informed decision about whether to participate in it. Furthermore, the authors presented the research before initiating interviews with the respondent to collect relevant and concise data about the topic.

The third aspect of ethical principle is "invasion of privacy", protection of privacy for each participant in the research. To ensure that this cornerstone of ethical principles was fulfilled, the authors made sure that the participant could withdraw any of their responses and interrupt any questions regarded as inconvenient for the respondent. "Preventing deception" is the last ethical principle presented by Bell et al. (2019). It happens when the "researchers represent their research as something other than what it is". It was avoided by regularly communicating with involved staff from the organisation VGR to sustain clarity and bilateral trust for what is presented in the research.

4. Results

4.1 Results from the quantitative data

4.1.1 Referrals in general

A broader understanding of how the organization VGR has dealt with the number of referrals from year to year provided clarity that the long waiting times have been and are still pressured by the number of incoming referrals. Figure 2 below, shows that an increase of referrals by approximately 24% between 2020 and 2021 occurred. An underlying factor for this was due to units from the Södra Älvsborg region (a region in the county of Västra Götaland) being added to the organization in February 2020 (personal communication 24 March 2023), which as a result, led to an increased number of referrals. Figure 3 shows how the number of referrals has increased monthly. In August 2020, there was a notable increase in referrals. The increased number of referrals occurred in August (2020) due to Södra Älvsborg changing the journal system, which might have caused double registrations in the system.

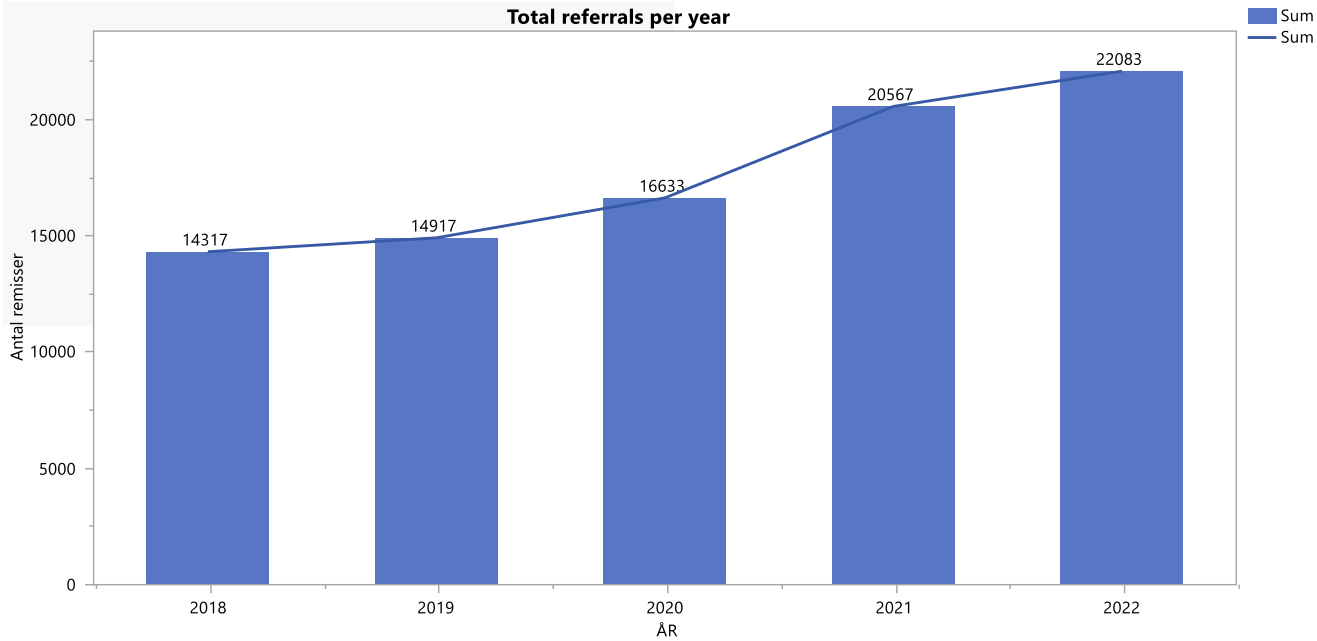


Figure 2 Total referrals per year at BUM during 2018 – 2022

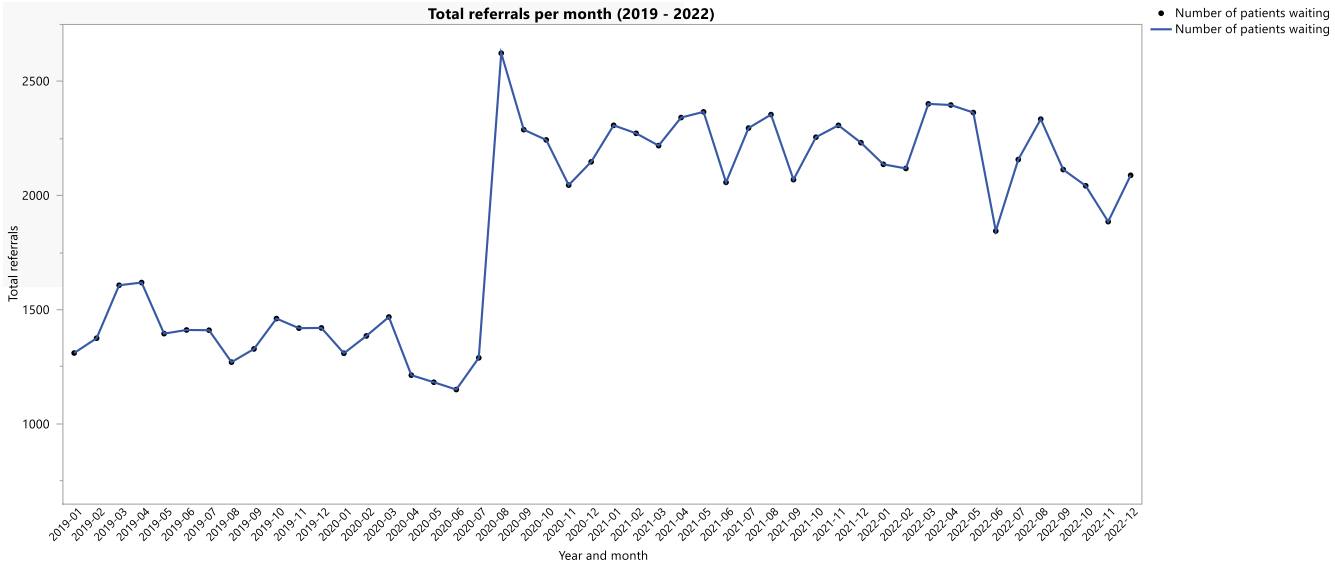


Figure 3 Total referrals per month at BUM during 2019 - 2022

4.1.2 The choice of disease

The choice of disease to focus on was made by the Pareto principle. Figure 4 shows the disease code with the most referrals. The most common disease code is J45 which is asthma, and that disease was chosen. Z03 was close, but the disease code is very generic, and different types of diseases were included, which meant that it was disregarded for the process of choice of disease.

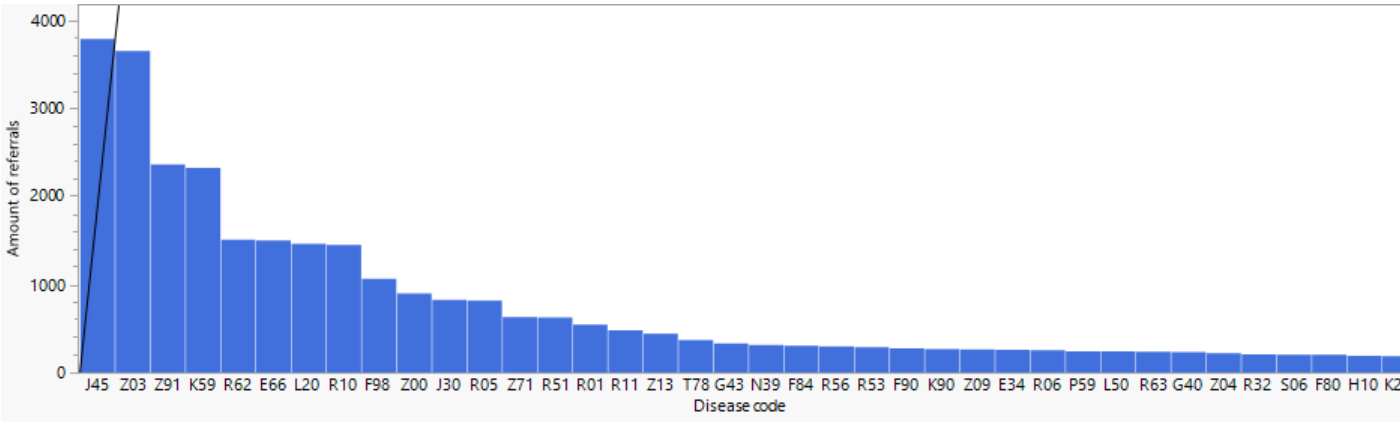
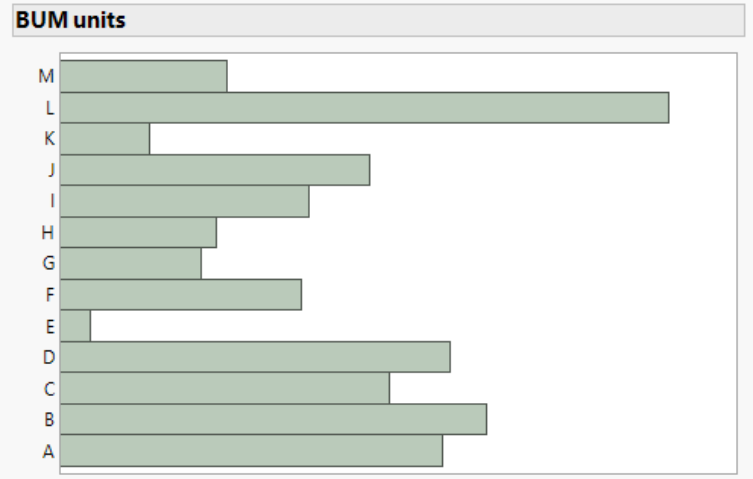


Figure 4 Distribution of disease code based on referrals

4.1.3 The choice of units

The number of referrals varied across the units in the county of Västra Götaland. A total of 3791 referrals being managed connected to the disease code J45 (Asthma) during the time - period 2020-2022. A considerable variation in handled referrals was observed, where BUM *L* showed a higher number of referrals compared to the rest of the units (see Figure 5). Therefore, it was intriguing to investigate and include BUM *L* in this thesis. This notion generated an

interest to investigate other units with a comparable size of responsibility concerning the number of children as of BUM *L*, this to gain insight into why other units (BUMs) with a similar amount of responsibility deviate considerably in the number of incoming referrals for the disease J45. BUM *A* was then chosen to be compared with BUM *L*. According to Figure 6, BUM *L* and BUM *A* are responsible for a similar number of children. BUM *L* is responsible for 26 239 and BUM *A* 26 123 children. Additionally, it was determined through consultation with VGR personnel that BUM *A* was the most appropriate comparison in this context. Figure 7 shows the ratio of incoming referrals to the number of children, referred to as 'RC ratio', for each unit at BUM. Where BUM *L* had the second highest ratio and BUM *A* a relatively lower ratio compared to other BUM units.



Frequencies

Level	Count	Prob
A	378	0,10850
B	422	0,12113
C	326	0,09357
D	386	0,11079
E	30	0,00861
F	239	0,06860
G	140	0,04018
H	154	0,04420
I	247	0,07090
J	307	0,08812
K	88	0,02526
L	602	0,17279
M	165	0,04736
Total	3484	1,00000

Figure 5 Distribution of referrals at each BUM for J45 in a diagram and number form

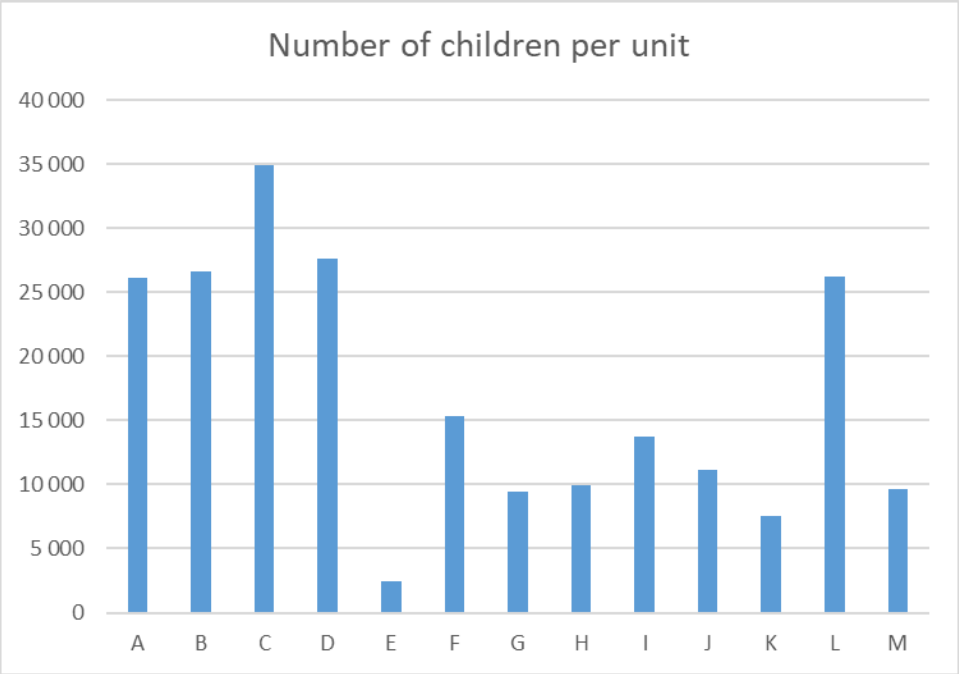


Figure 6 Number of children per unit at BUM

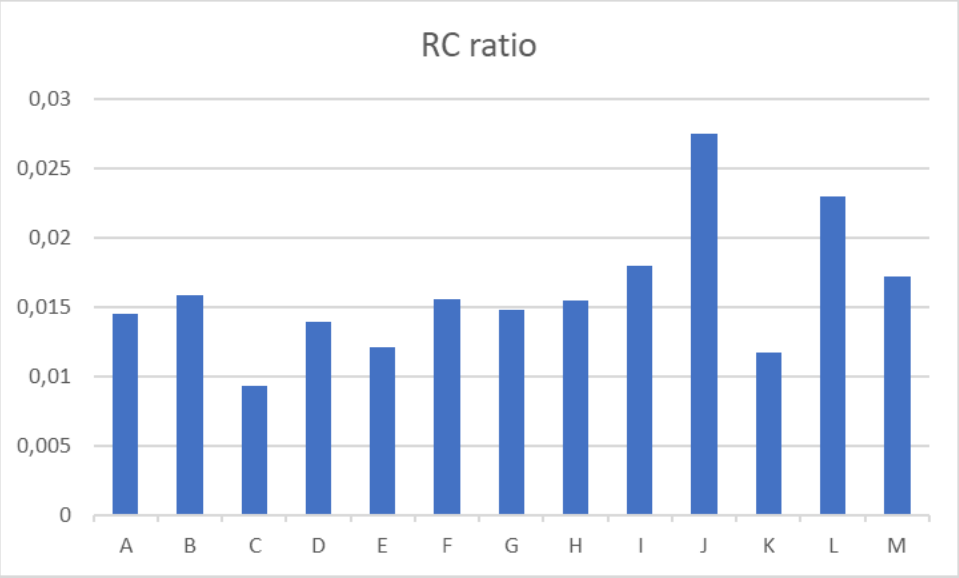


Figure 7 The ratio between incoming referrals and number of children across all units at BUM

4.1.4 Variation between clinics in waiting meantime

After the disease code J45 and the two units were chosen, a comparison of the waiting meantime was conducted. Figure 8 shows that BUM *L* has the most prolonged waiting meantime of approximately 74 days. The choice for the second unit were those within the Pareto principle, which was very close in the difference for the waiting meantime. Furthermore, to obtain a more significant difference in waiting meantime, BUM *A* was chosen with a waiting meantime of approximately 68 days compared to BUM *B*, which had approximately 69 days.

Figure 8 shows the waiting meantime between the different units regarding the waiting meantime for J45, where Figure 9 below shows the exact waiting meantime in days.

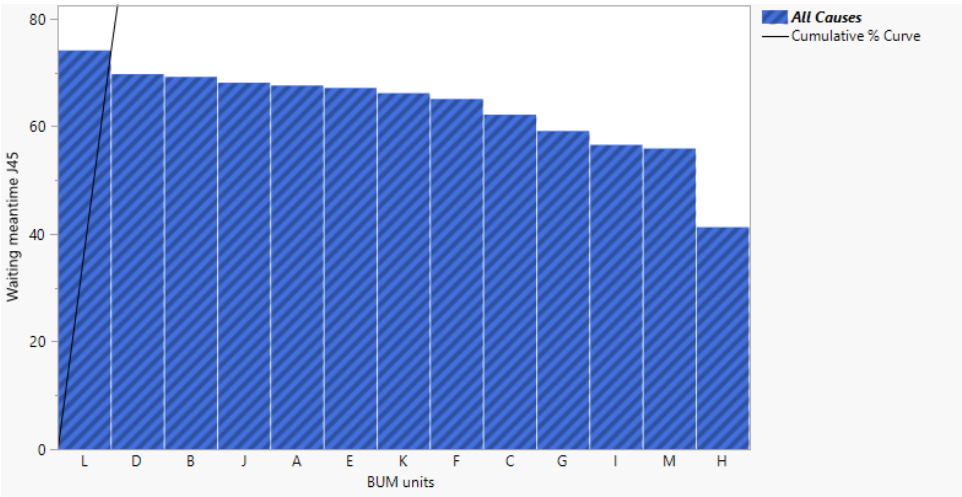


Figure 8 Distribution of waiting meantime at each unit

BUM Units	Days
L	74
D	70
B	69
J	68
A	68
E	67
K	66
F	65
C	62
G	59
I	57
M	56
H	41

Figure 9 Distribution of waiting meantime in numbers at each unit

4.1.5 Variation between each unit regarding waiting meantime relative to the standard deviation

According to Bergman et al. (2015), variation has been non-prioritized, the focus has been on means and averages, where target value changes over time. For this reason, the variable standard deviation has also been accounted for when comparing the waiting meantime across each unit, which is shown in Figure 10, and the standard deviation in numbers at each unit is shown in Figure 11. Looking at Figure 10, BUM L seems to have two peaks (mode values), which might indicate that there are two different processes operating at the same unit.

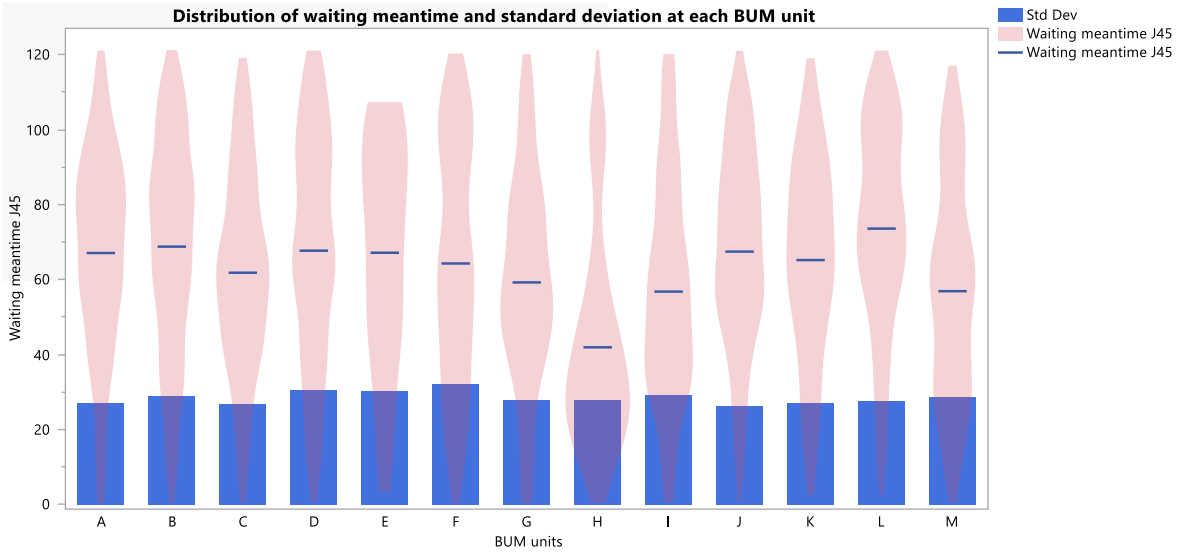


Figure 10 Distribution of waiting meantime and standard deviation at each BUM unit

BUM Units	Days
A	27
B	29
C	27
D	31
E	30
F	32
G	28
H	28
I	29
J	26
K	27
L	28
M	29

Figure 11 Distribution of standard deviation in numbers at each unit

4.1.6 Process capability – On Unit L and Unit A

It is essential to look at how capable the process is regarding the specification limits, where the capability was assessed towards an upper specification limit of 90 days. Figure 12 shows the process capability index of both units across the time period 2020 – 2022. Where Ppk (Unit L) is BUM *L* and Ppk (Unit A) is BUM *A*. The Ppk values for both units are poor because of being under one according to the guidelines (White et al., 2021). The progression for BUM *L* is on the up, but it has not recovered well since 2020. Whereas for BUM *A*, the progression has been on the down since 2020.

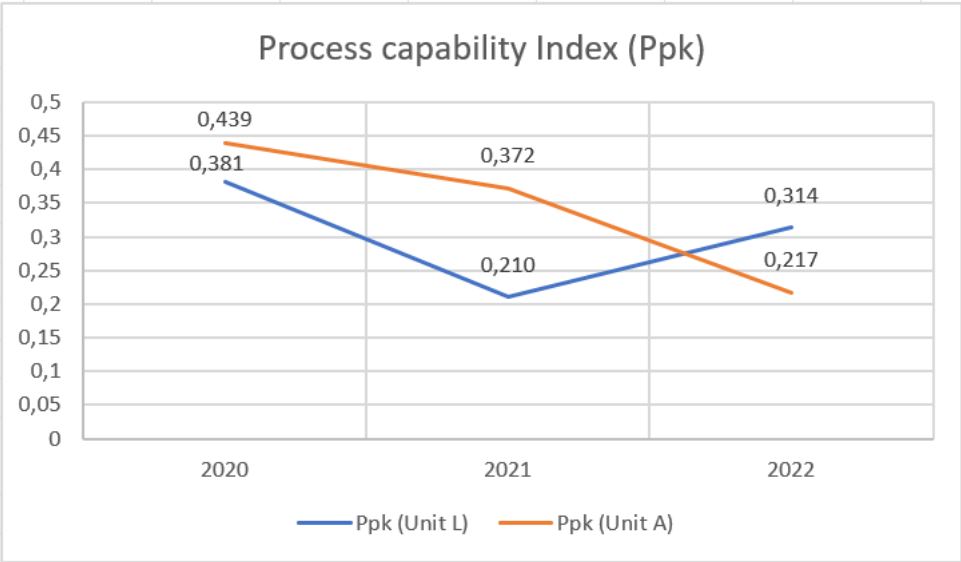


Figure 12 Visualization of the Ppk value at BUM *A and L during 2020 - 2022*

4.2 Result from Gemba walk

Two different referral processes are showcased in this section—one for BUM *A* and one for BUM *L* in the VGR organization. Information regarding the process has been extracted from the explicit discussion with employees and through the Gemba walks at *A* and *L*. The current state of the referral process involves numerous parties, professions, and activities. Therefore, the process has been segmented into two sections for simplicity. The first segment for the referral process is the start of the referral process to the referral agreement. The second segment is the BUM unit receiving referrals until the waiting time ends.

4.2.1 Start to referral agreement

The first segment of the referral process is dependent on external parties from the BUM units. Thus, this segment of the process is identical for all the BUM units in the VGR organization.

4.2.1.1 Start

The referral process starts when the patient (age 6 months- 18 years old) feels that medical attention is needed for its own well-being. The patients' parents might in some instances take the initiative to suggest that medical attention is needed for the patient. Severity of disease, children's age and condition of the children are all factors that influence directly which medical facilities that they will ask for medical care. For this referral process, the patient can seek out medical care at three different facilities shown in Figure 13 below. Hospitals, primary care, and Others are the available medical facilities that children (age 6 months- 18 years old) of all spectrums can seek out medical attention.

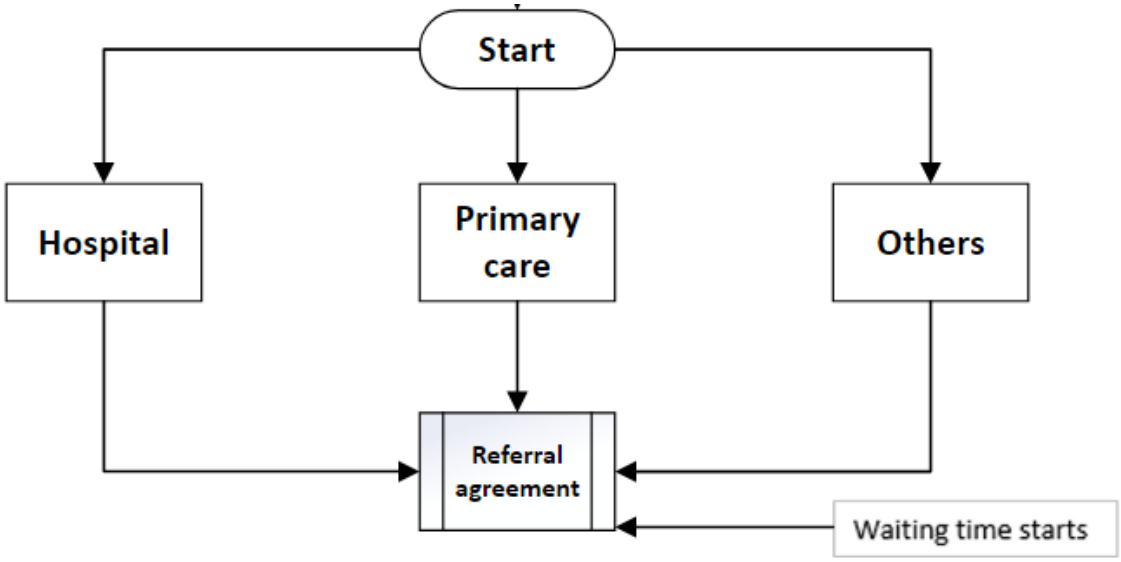


Figure 13 Start of the referral process

4.2.1.2 Medical facilities

Children that need emergency care and have symptoms that can be life-threatening seek out medical attention at the hospitals within the county of Västra Götaland. This is often-called inpatient care, meaning the patient needs direct hospital admission. Explicitly stated by staff at VGR, approximately 25% of all the patients in the referral process are passed through the hospital. Subsequently, when the patient is treated at the hospital and gets the assessment that further specialized medical care is pivotal for the patient, a referral agreement between the patient and the physician is made. Followingly, the referral is sent to the BUM that the patient is admitted. Each patient is admitted to a specific BUM based on the patient's place of residency.

The second facility where patients are seeking medical attention is primary care. Approximately 50% of all patients seek out medical attention through primary care. Primary care is strategically displaced around the city of Gothenburg and all over the county of Västra Götaland. The objective is to have a primary care facility in each district. Patients are advised to seek out medical attention at their closest facility. In the primary care, often referred to as outpatient care, is a medical facility open for all the inhabitants in the county of Västra Götaland. The primary care's objective is to provide consultation and make a medical assessment if the incoming patient must have further medical care or that the symptoms and the expressed concern do not require medical attention. Patients with mild symptoms or concerns that are not life-threatening are referred through the primary care. Likewise, in the hospital, a referral agreement between the physician and the patient is made before being sent to BUM.

Lastly, patients are referred through “Others”. Others, in this case, encompass BUP (Children and Young Persons – Psychiatry Clinic), school nurses and habilitation. BUP is an organization that solely offers children psychological care between the ages of 0-18. If children with psychological care are assessed as needing further specialized care that can be severe to their physical well-being, the patient is referred through BUP. In some instances, children can

express medical concerns in the school; thus, the school nurse makes the assessment that further medical attention is needed. Followingly, a referral agreement between the patient and the school nurse is made and sent to BUM that the patient is admitted to. Habilitation is also included in "Others" and is an organization that offers care for children with permanent functional impairments between the ages of 0-18 (Västra Götalandsregionen, 2017). A medical facility for children with disabilities that seek medical attention, where a physician will make a referral agreement with the patient, consequently sending the referral to a BUM. Furthermore, private clinics conduct medical attention for patients too and are included in the category "others". A physician in the private clinic provides similar medical attention as the physician in primary care and it is estimated that 25% of the patient volume of all the referrals is passed through "Others".

4.2.1.3 Waiting time

When the referral agreement is made, the person responsible for executing the referral (school nurses and physicians (general practitioners)) is obligated to send the referral within three working days to BUM. Most importantly, after a referral agreement is made, the waiting time for the patient starts (Personal communication March 24, 2023). According to the waiting guarantee, the patient should have received medical care within 90 days (1177.se, 2023).

4.2.2 Time between BUM *A* receives referral to waiting time ends

When BUM *A* receives referrals from various medical facilities and parties, a secretary in BUM *A* controls and assures that the referral is valid. Followingly, the secretary registers the referral in the specific BUM. The referrals received are either received digitally or in paper format. Most of the referrals are sent digitally from the counterpart. It is only when a referral is sent from a private clinic that it is received in paper format (Figure 14).

When the referral has been controlled and is deemed to be valid, the secretary sends the referral to the assessing paediatrician for final evaluation of the content in the referral. BUM *A* has solely one assessing paediatrician that handles all the incoming referrals. At the current state, the assessing paediatrician at BUM *A* works 50% and therefore manages incoming referrals on certain days, Mondays, and Thursdays. The assessing paediatrician is obliged to observe and oversee a referral within three working days.

At this stage in the process, the assessing paediatrician faces the crossroads of approving the referral, that the patient needs enhanced specialized care, or dismissing the referral and thus not scheduling a future appointment with the patient. If, at this point, the assessing paediatrician decides that scheduling of appointment is necessary for the patient based on the description in the referral, a priority on the appointment must be made. The outline of priority order is divided into prio 1,2, and 3. The assessed severity of the illness that the assessing paediatrician believes the patient is exposed to determines the outcome of the priority order.

Prio 1 is the most severe condition of a patient, and prio 3 being the less assumed severity the patient is perceived to have. A patient scheduled into prio 1 must receive an appointment with specialized care within one month (30 days). Patients that are categorized into prio 2 are expected to receive an appointment within the time span of two months (60 days). Lastly, patients that are placed into prio 3 are scheduled to receive an appointment within the time span of 90 days, which corresponds to the waiting guarantee that is promised for the patient.

The secretary receives the assessing paediatrician's priority categorization on the referral and uses the suggested priority categorization as a basis to book appointments within the obliged waiting time that the patient is expected to receive medical attention. There can be situations where the secretary might need assistance in scheduling appointments due to a lack of knowledge in medical judgment, thus, receiving assistance from time to time from one of the seven available nurses to schedule appointments.

However, there have been instances where patients have not received an appointment within the promised waiting guarantee period. No outcomes of consequences occur towards the healthcare provider or reimbursement for the patients if the waiting guarantee is exceeded. After the screening process of referrals and the prio order has been done, the assigned patient is appointed to a specialist. By default, the waiting time ends here.

The second outcome when screening the incoming referrals is that the incoming referral can be dismissed based on numerous reasons:

- The information in the referral cannot be assessed due to a lack of understanding of the content in the referral. This leaves the assessing paediatrician at BUM with the only choice to send back the referral and consequently, the referral process ends, and a new referral must be conducted. The waiting time ends by default of ending the referral process.
- The assessing paediatrician at BUM considers that the information from the incoming referral does not require further medical attention, thus, chooses not to make a further appointment and that the referral process ends for the patient.
- Another reason can be that the description in the referral issued by the general practitioner at the primary or hospital is considered to be for asthma, but the assessing paediatrician at BUM regards the description to be for another disease, and thus sends the referral back to the general practitioner. The assessing paediatrician at BUM suggests that a new medical attention is required for the patient.

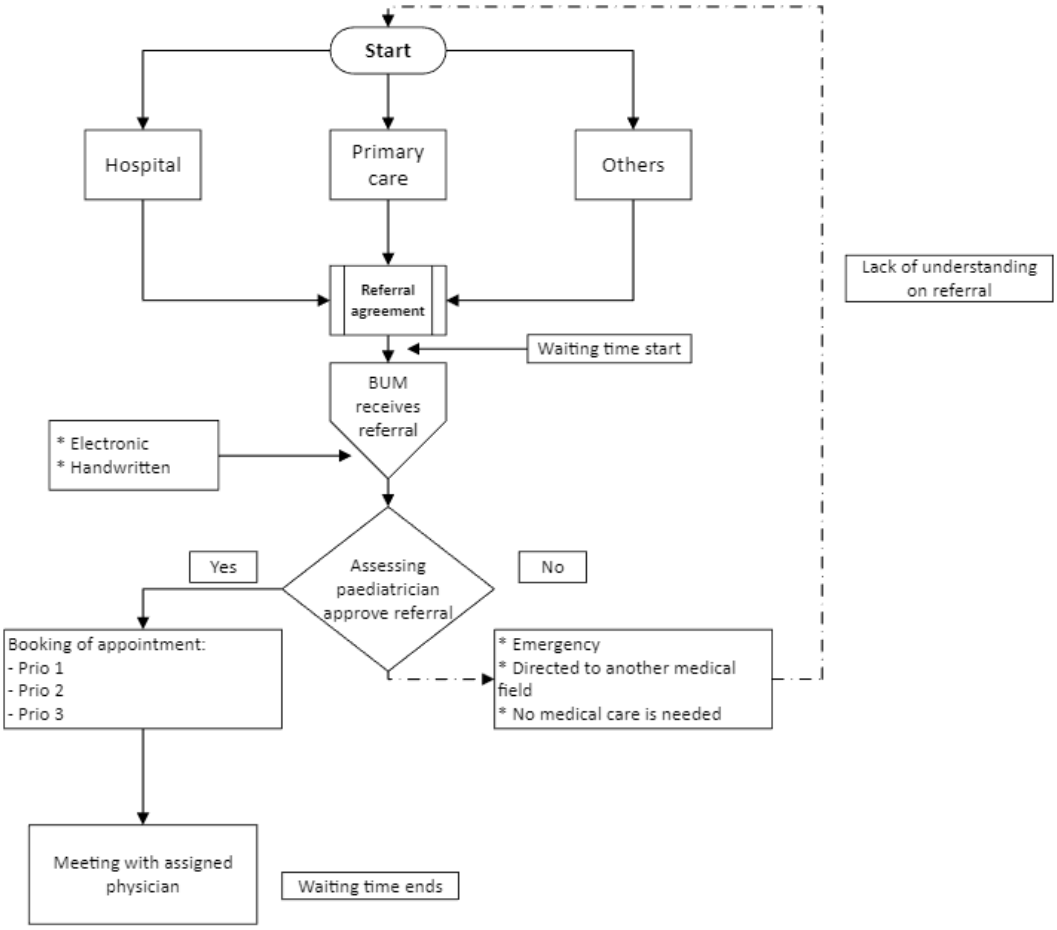


Figure 14 Referral process at BUM *A*

4.2.3 Time between BUM *L* receives referral to waiting time ends

BUM *L* receives referrals from different medical facilities and parties; a secretary in BUM *L* checks that the referral is valid. Followingly, the secretary registers the referral at BUM *L*. The referrals received are either received digitally (electronic referral) or in paper format (handwritten referral). It is only when a referral is sent from a private clinic that the referral is received in paper format.

When the referral has been controlled and is approved to be valid, the secretary sends the referral to the assessing paediatricians for final evaluation of the content in the referral. The main difference between the two units, BUM *A* and BUM *L*, is the number of employed assessing paediatricians. At BUM *L*, there is a total of four assessing paediatricians that handles the incoming referrals.

The assessing paediatricians' tasks at BUM *L* are similar to BUM *A's*. The incoming referrals are either dismissed for the same reasons as mentioned for BUM *A*, or the referral is approved and is prioritized in line with the different prio groups 1, 2 and 3. Subsequently, the referrals are sent to the secretary and a nurse for booking the referrals with labelled prio groups (see Figure 15). The nurse schedules all the prio 1 referrals whilst the secretary manages the

scheduling of all the prio 2 and prio 3 referrals. This leads to the last step, which is for patients to show up for the scheduled meetings, and the waiting time ends.

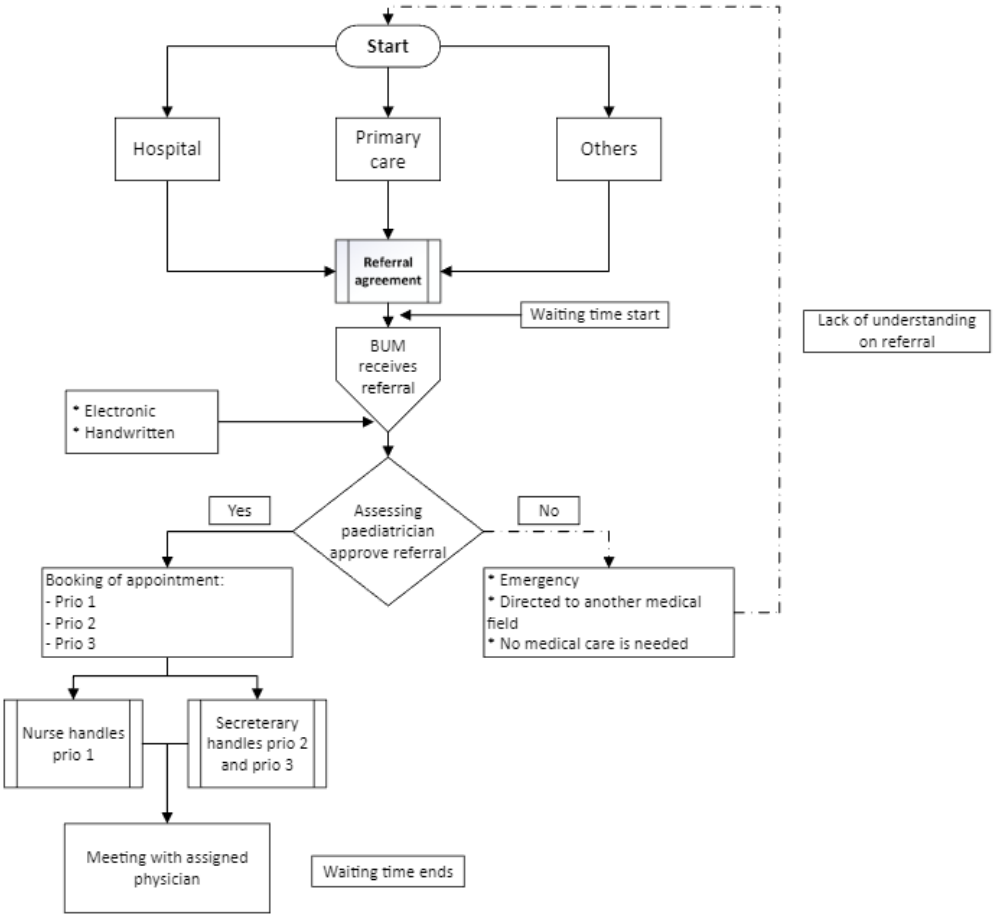


Figure 15 Referral process at BUM L

4.3 Results from the qualitative data

The qualitative data collected from the interviews provided a deeper understanding of possible aspects that could contribute to the variation between the units. The purpose is to identify deviations between areas that helps explain the quantitative data, and commonalities between answers are also accounted for. The questions for the semi-structured interviews were inspired by the Gemba walks and information collected from the literature review. Thus, could identify areas between interviewees that could contribute to variation in the waiting time and the number of referrals received. The areas were:

- *Experience of paediatricians(specialist), general practitioners and nurses*
- *Parental influence*

- *Working methods*

In the interviews, the interviewees were also asked to provide their own subjective thoughts on what can cause the variation in waiting time and number of referrals between units. Therefore, a separate section has been allocated in this chapter for the interviewee's own thoughts on reasons for variation in waiting time and number of received referrals. Importantly to note that the substance for the following section is based on employees' (interviewee's) own perspectives and experiences for the referrals process connected to asthma. The identified areas have been structured accordingly for both units investigated.

4.3.1 BUM *A* Interview

The following subsections are answers collected solely from the BUM unit *A*, from the paediatrician and nurse:

4.3.1.1 Experience

Much of the literature review supports the basis that the experience of involved professions in the referral process, such as, specialists, and general practitioners, influences the outcome of waiting time and variation connected to the referral process. The BUM *A* paediatrician concurs that experience can lead to better judgement. The paediatrician proceeds to mention that there have been instances where the experience has led to making decisions for referrals that need to be prioritized quicker. Despite the benefits of accumulated experience, the paediatrician states it is important to *"keep yourself updated in some way, with what changes are happening and medication and all that. Sometimes, if you've worked for a long time, you can get a little too much into your own old ruts"*. Consequently, the paediatrician mentions that new graduate paediatricians also have the ability to make good risk assessments regarding incoming referrals but are more inclined to reconcile with colleagues before making a final decision.

4.3.1.2 Parental influence

The paediatrician mentions parental influence can come in a sense where parents of the children can send a self-referral to request an appointment; if a cancellation occurs, that will open up a time, thus receiving a faster appointment. The paediatrician says this could be a way for parents to get their children a faster appointment but emphasizes that it depends on *"parents who are strong enough to do it."* The nurse agrees with the argument that parents have a slight influence on the patient's first appointment with a specialist.

"Then we may have received a referral that is assessed to be three months, then the parents call and have a hard time and want to come earlier. Then we can make a small adjustment and perhaps offer them an earlier appointment if we get another cancellation or so. (Nurse at BUM unit A, 2023)

4.3.1.3 Working methods and routine

Routines and working methods determine how standards and outcomes are attained. Differences in this aspect can thus contribute to variation. At BUM *A*, there is only one assessing paediatrician, implying that there is only one paediatrician that assesses all incoming referrals. The time allocated for assessing incoming referrals is expressed to be around 30 minutes. The workload is said to be reasonable and convenient.

Regarding compliance and coherence with RMR, the paediatrician mentions that the RMR for asthma is quite good and clear, proceeds to mention that there is no knowledge or experience of BUM A working outside RMR.

The nurse's working schedule, the day starts off with receiving telephone calls from patients or parents who need counselling. Requests for earlier appointments, confirmation of patient referral and counselling of a children's medication are among the topics that are involved in the received telephone calls. All the information from the phone calls is later mediated to the paediatrician. The rest of the tasks that can be completed during the day are to do function tests that are called spirometry. This work is directed to patients known to have asthma, and usually, it is patients with chronic diseases. Spirometry is expressed by the nurse to take approximately between 45 to 60 minutes.

4.3.1.4 Reasons to variation of waiting time

The paediatrician argues that differences in routines of assessing incoming referrals vary across different units, thus contributing to variations in waiting time. The paediatrician extends this notion by mentioning own experiences where different patterns of assessing referrals are handled. The paediatrician mentions that in other units, instances of assessing and subsequently categorising referrals in a certain prio group for many of the patients for the sake of doing it quickly, *"a simplicity in assessing everyone in the same way. Hence, not a synchronised referral assessment throughout all the units."*

Another cause of variation the paediatrician mentions is the rationale that other units have multiple assessing paediatricians and work in a group can create discrepancies in how the assessment of referral is done. Where every assessing paediatrician makes their own individual assessment and emphasize that there *"must also be a certain degree of uniformity"* in assessing referrals.

The nurse attributes the causes of variation in waiting time due to the late cancellation of patients due to illness or other causes that leads to a missed appointment and consequently make it difficult to find a new available time for that patient since the schedule for available times is fully booked. However, the root cause that is brought up for the variation in waiting times according to the nurse is *"that we have too many referrals in relation to doctors' appointments."*

4.3.2 BUM *L* Interview

This qualitative analysis of the BUM *L* interview consists of summarizing and putting together the essential points regarding the various factors the interview has been based upon.

4.3.2.1 Experience

Regarding experience, the factor was understanding how it can impact the referral process. In this unit, the paediatrician brings up that experience is vital regarding the patient's decision. Where the paediatrician says, *"And to also be able to try to find those who actually do not fall within the usual framework in some way, I think experience is absolutely very important."*

Another factor regarding the paediatrician's experience was the length of time at the position in primary care and other positions when issuing referrals; that could be an advantage but also a disadvantage. One interviewee says "*If you have worked in a certain way for many years, it can also be more difficult to relearn. So, it probably is. Experience can probably be both good and bad actually*."

The nurse also agrees that experience is essential regarding how long someone has worked in a relevant position. The interviewee specified that if a doctor has worked for several years but that position is not relevant, the experience will not matter. One nurse says *"It also depends on how much you have worked or where you have worked before? And then you start slowly and have your own patients and then you get. You get guidance from your experienced colleagues here, so to speak."*

The nurse, however, also states regarding issuing referrals that those primary cares with an experienced district medical officer are those units that tend to give the newer colleagues better guidance. These are also the units that send fewer referrals.

4.3.2.2 Parental influence

From the interviews, the paediatrician did not seem to think it influences how the referral is written.
"No, not really, because that's how I think the referral is written. Then you can also send your own referral. That's another way to come to the clinic, that the parents can write a self-referral that we also assess."

However, the paediatrician at the end of the interview mentioned that the parents could affect the doctors that write the referrals, especially at the primary care, which leads to the influx of referrals increasing, thus leading to more time being spent to assess referrals and potentially some that can unnecessarily be booked. Where the paediatrician states *"It is not so easy for the health center to deal with it and then they want our help and that is perfectly okay. But those patients also end up on the waiting list."*

The nurse also agrees with the paediatrician on that it is how the referral is written. But the nurse brings up that the communication between the nurse and parents can be a factor, where parents who tend to call and ask about the referral and the appointment time. If the nurse is not as experienced, it could affect the time when they get the appointment. The nurse says, *"It is clear that my experience and my ability to argue and explain to parents. It's easier for me than for a colleague who hasn't worked for so long".*

The nurse also states that they help each other to handle the parents in the best way, with the more experienced nurses handling the calls if needed, but the doctors are not involved. Where the nurse says *"So sometimes it is the case that I may call up or one of my experienced colleagues may call up."*

4.3.2.3 Working methods and routine

At BUM *L*, there are four assessing paediatricians, and three nurses have high knowledge of asthma. One of the paediatricians is currently on sick leave. The assessment of incoming referrals is assessed by a schedule, as can be seen in Table 2, where the assessing paediatricians have a specific day or two assigned to assess referrals booked for 30 minutes. They are, alternatively, doing consultation time with the primary care physician, which is also booked for 30 minutes that specific day, as shown in Table 2 below. In total, four assessing paediatricians assess incoming referrals from the different medical facilities.

Table 2 The schedule of BUM *L* regarding referral assessment and consultation time

Weekday	Referral assesment	Consultation time
Monday	X	B
Tuesday	X	C
Wednesday	B	X
Thursday	C	Y
Friday	B	y

From the interview with the paediatrician, an important point was brought up regarding RMR and the deviations in the treatment and follow-up of asthma regarding age. Where if the referral states that the treatment is for Asthma and the patient is age twelve or under it must be investigated by a paediatrician.

"It says that all asthma under the age of twelve is investigated by a paediatrician from the actual investigation. And we do that, as we never refuse a referral if we see that someone is under twelve. Then it says that it is a follow-up of asthma grade 1 to 2." (Paediatrician at BUM L, 2023)

When it came to the nurse regarding RMR, the thoughts the nurse has are the grey area surrounding what is characterized by the different stages of the asthma symptoms, when it is mild, and which symptoms make it severe. Where the nurse says *"When do you have mild asthma and when is it moderate and when is it severe? It's a small question of definition that can be a bit difficult and can be interpreted in different ways."*

4.3.2.4 Reasons for variation in waiting time

When it came to the different reasons for the variation in waiting time, the question was easier for the paediatrician to answer, whereas it was hard for the nurse to understand.

The paediatrician saw this as a question of resources. Where there is a large population base, but the resources may not match the demand. Where the paediatrician says *"I think it's a question of resources how many doctor's appointments you have for a doctor's visit that you have to complete. Do you have a large population base but may not have the right resources for it?"*

The paediatrician also points out that there needs to be more doctor appointments for incoming referrals, which means that the waiting time increases. The interviewee says, *"I think it's probably a lot of this, that you have too few doctor's appointments".*

5. Discussion

This chapter discusses the results obtained from the Gemba walk, quantitative and qualitative data, from the perspective of the literature. The intended outcome is to provide relevant analysis to the posed research questions. The chapter is divided into two subsections: one that will reflect upon a comparison of the two investigated units (BUM *A* and BUM *L*), and the second subsection, a discussion of causes of variation.

5.1 Analysis of Units

In this subsection, a comparison of the two chosen units will be discussed in terms of comparing the working schedule for employees, comparing the workforce, and ultimately comparing the process capability obtained from the quantitative data.

5.1.1 Comparing schedules

Comparing working routines was carried out to find possible causes of variation. The Gemba walk and discussions with staff at the respective unit acted as the basis for understanding how the working schedule and routines are laid out. The interviews confirmed the observations from the Gemba walk and provided further proximity to the working schedule.

It was evident that the working routines diverged between the two units. In BUM *A*, one assessing paediatrician manages the assessment of all incoming referrals. Whilst in BUM *L*, there are four different assessing paediatricians that manage incoming referrals. At BUM *A*, the routines of managing the incoming referrals are done on Mondays and Thursdays on a weekly basis; whilst, at BUM *L*, the four assessing paediatricians rotate between each other on managing incoming referrals on certain days (see Table 2). Hence, one could argue that differences in the assessment of referrals are more possible to occur at BUM *L* compared to BUM *A*, since BUM *A* has the same assessing paediatrician that will assess all the incoming referrals. This can be a contributing cause that can lead to variation in the number of referrals that are approved for final appointment. Keating et al. (1998) argue that paediatricians that perceive that they have limited knowledge in the specialized field tend to refer fewer patients. This can be the case for BUM *L*, which has four different assessing paediatricians that manage the incoming referrals, by default influencing the number of approved referrals that lead to an appointment. If all the paediatricians have aligned training and the same years of experience, it could ultimately mitigate the variations in the assessment of referrals.

Differences in the priority order for referral scheduling between the two units were apparent. When referrals have been approved by an assessing paediatrician and prioritized for a patient, the patient is scheduled based on the suggested prio rank from the assessing paediatrician. The scheduling of patients is managed differently between the two units. BUM *A* has one secretary that manages the scheduling of all referrals approved by the assessing paediatrician, whereas in BUM *L* it works differently. Scheduling of all referrals in BUM *L* is divided between a nurse who handles all the prio 1 referrals, and a secretary who manages the scheduling of all the prio 2 and prio 3 referrals.

BUM *A* having solely one person responsible for reaching an impeccable management in scheduling patients eliminates the factors of miscommunication, mismatches, and uncertainty in scheduling. Having two different people with different backgrounds in scheduling can generate discrepancies and uncertainties in planning the scheduling of patients. Labitzke (2015) mentions that possible barriers in communication between nursing staff and administrative staff can occur. Differences in professions can act as obstacles to reaching a state of collaboration between individuals. This is something that BUM *L* can draw inspiration from to ensure that miscommunication and uncertainties between the secretary and nurse are mitigated.

From the interview at BUM *A*, it was revealed, from the paediatrician's own experience that assessing paediatricians at different units handle the prio ordering differently, thus catalyses the effect of variation between the different units, which was showcased by the quantitative data (see Figure 9). A lack of a standardized manner across units in prioritizing and scheduling referrals can be hypothesized to be a cause for variation.

Moreover, it is important to note that BUM *L* allocates 30 minutes each day for consultation, which entails that an assessing paediatrician at BUM *L* mediates information and consults the general practitioner at the primary care. This type of consultation is supported by the article by Bodenheimer et al. (1999) that suggest that primary care physicians (PCPs) ought to collaborate with specialists (paediatricians in this case) to provide thorough and coordinated treatment for the patient. Hence, Bodenheimer et al. (1999) emphasise that clear communication between the primary and specialized care providers is paramount to creating a fruition of patient care results. Newton et al. (1992) and Westerman et al. (1990) also propose that feedback between the general practitioners and specialists is desired between the two professions.

5.1.2 Comparison of quantitative data at BUM Unit *A* and *L*

When comparing the process capability for BUM *L* and *A*, the waiting meantime and process capability were done for both units. The aim was to gather facts about the waiting time at both units. Moreover, to look at the value of Ppk, to see how well the units uphold the healthcare guarantee of 90 days. It was to get more information regarding the difference in waiting time between the two units. The results regarding waiting mean time from Figure 11 showed that for BUM *A*, the waiting meantime was approximately 68 days, and for BUM *L*, the waiting

meantime was approximately 74 days. The standard deviations were also compared to account for changes in means, where for BUM L, the standard deviation was 28 days, and for BUM *A*, the standard deviation was 27 days.

The results in Figure 1 showed the Ppk value for BUM *L* and BUM *A* over three years for 2020 - 2022. The result of BUM *L* has varied from 0.381 to 0.210, but it is on an upward trajectory now. Where a reason is that BUM *L* joined VGR in 2020, where it might take time to adapt to how VGR works and has had up and down as the trajectory suggests. In contrast, the result of BUM *A* has varied from 0.439 to 0.217, where the trajectory is on the down. The interpretation of this seems odd, where the downtrend of the Ppk is not supported by the data obtained from the Gemba walk and the qualitative data.

When it comes to the guidelines and how to interpret these results regarding the validity of the process capability results, White et al. (2021) state that it is essential to determine how many data points have been generated under the observed time period in order to reduce errors, 100 data points are suggested. White et al. (2021) also state that the time period is a factor if a lot of data points have been provided. However, if it has been over a short period, it is not a reliable long-term process performance indicator. In this case, more than 100 data points have been generated for both units, in each year as can been seen in Appendix A over three years to provide better visualization of the process capability of both units.

5.2 Causes on variation

This subsection discusses the causes of variation in the referral process. This is to identify why a particular variation emerges in the first place and where th2e variation emerges in the referral process. Thus, understanding if the BUM operation can mitigate or even eliminate certain variations that cause a longer waiting time. The causes of variations are divided into two sections: internal causes of variation and external causes of variation. In this context, an internal cause of variation is defined as a cause that can only emerge within the BUM organization, which encompasses factors that can generate causes of variation between the time a referral reaches the secretary for validity assessment until the waiting time ends (see Figures 14 and 15). An external cause of variation is defined as the cause of variation in the referral process conceived outside the BUM organization. In the following subsections, —the identified causes from the result section are analyzed using literature review (Chapter 2).

5.2.1 Internal cause

The internal cause of variation occurs at the BUM unit. One identified cause of variation in the referral process is the screening process of referrals. The screening process of the referral entails that an assessing paediatrician reviews a referral. The assessment is done by the assessing paediatrician at the BUM unit, thus acting as a gatekeeper to dictate if a patient needs further care. The only assessment material that the assessing paediatrician has is based on the incoming

referral from the different medical facilities (hospitals, Others, and primary care). At the assessment process the paediatrician determines the number of referrals being managed and scheduled for a first appointment, hence, influencing the variation of scheduled appointments. Another identified internal cause of variation is the scheduling of referrals in the BUM units.

5.2.1.1 Experience

Keating et al. (1998) mention that paediatricians that perceive that they have limited training or knowledge in a specialized area are more inclined to make fewer referrals. Answers surfaced from the interviews are peripherally aligned with Keating et al. (1998), where the paediatrician at BUM *A* mentions that having a certain amount of experience in the profession can ultimately lead to a better clinical judgement. The paediatrician at BUM *A* proceeds to mention that the years of experience have facilitated making assessments of prio 1 patients. Although years of experience in the profession benefits the paediatrician in making better referral assessments, the paediatrician at BUM *A* mentions that it is important to keep one self-updated on changes in the medical field to create a stronger basis for the assessment of referrals. The paediatrician at BUM *L* also concurs with the argument that years of experience as a paediatrician is paramount to making the right decision for the patient.

Gitlow & Gitlow (2013) mention that the variation inherent in the operation in the healthcare space arises due to the top management. Management style and training can be impelling factors that cause variation within the operation conceived by top management. The nurse at BUM L also mentions that primary care that experienced medical officers run provides better guidance for newer colleagues and is more inclined to have a better outcome. Thus, inspiration could be drawn for this to lay out a suggestion that accord in training and management style for newly hired paediatricians across the two investigated BUM units, potentially mitigating the variation that emerges due to differences in management style and training of newly hired paediatricians.

5.2.1.2 Working methods and schedule

The two investigated BUM units, BUM *A* and BUM *L*, had variations in the mean waiting time until the first visit, which was 68 days and 74 days, respectively. After a close investigation through Gemba walk, it was notable that the working routines differed. Since the working routines and schedule are within the BUM units, it is regarded as internal variation. Gitlow & Gitlow (2013) mention that working procedures are a possible cause of variation inherent in the operation. Followingly, Gitlow & Gitlow emphasise that it is important for top management to take the initiative to address the working procedures that catalyse variation.

Another possible cause of variation that can emerge is the prioritization of referrals. For instance, at BUM *L*, the secretary and nurse manage the scheduling of incoming patients, leaving room for uncertainties since they are two different people with different backgrounds. One way of reducing factors of variation in the scheduling of patients between the two units is

that BUM *L* has a similar approach to BUM *A* in order to mitigate possible mismatches or uncertainties in the scheduling of patients, where either a nurse or secretary is managing the scheduling of patients. It is preferable to have a nurse manage the scheduling of patients since nurses are more equipped with knowledge regarding the medical aspects of asthma, thus making the most appropriate bookings based on a medical aspect. However, essential to bear in mind that reducing the workforce for scheduling incoming patients can cause a deficit in coping with scheduling appointments for patients in demand.

5.2.2 External cause

5.2.2.1 Parental influence

According to Kunin et al. (2018), parental influence affects the practitioner's decision to refer patients to a specialist. It is an external cause outside of BUM's regulation regarding the first visit. In the interview at BUM *A*, the paediatrician mentions that patients' parents could make self-referrals. This referral is listed as prio 3, and depending on how determined the patient's parents are to get an early appointment, it could affect the patient's first appointment with the paediatrician. For the BUM units, cancellations happen, and if the parent calls continuously, the parent will have a higher chance of getting time to fill up a cancellation.

However, a point mentioned in the interview at BUM *L* by the paediatrician is that parents influence the practitioners in primary care by not trusting their judgement of their child. This aligns well with what is said by Kunin et al. (2018), which highlights that the general practitioners that are affected by the parent's requests for a referral are those that write unnecessary referrals. It is also confirmed in the interview at BUM *L* by the paediatrician, that the written referral can be seen by the paediatrician judging the referral. It is also argued by Kunin et al. (2018), that the general practitioners affected by the parent's request have a response in how the referral is written due to respecting ethical considerations but also granting the parent's request in writing a referral. The problem then becomes that the referrals end up on the waiting list and take up time for other referrals that could be more serious.

The nurse from BUM *L* also brought up a perspective regarding parental influence in how the nurse is responsible for phone calls. The nurse mentions that depending on the nurse's experience, it could affect how they handle the parent's requests and desires. Which, consequently, could potentially influence them to get an appointment. Kunin et al. (2018) mention that it is the parent's lack of trust in the general practitioner in their decision-making and judgement. The potential solution should be focusing on gaining parents' confidence in the medical facilities in how they decide regarding their assessment for asthma. The nurses' experience is also vital to make the right medical decisions for the parents. All of this is to ensure that the influx of referrals is not increased by unnecessary referrals that consumes the paediatrician's time.

5.2.2.2 Incoming referrals

Another external cause is incoming referrals for BUM *A* and *L*, where according to Figure 5, the total number of referrals for BUM *A* and *L* is 378 respectively 602. There is around a 65% difference in the total referral amount for two units with the similar number of responsibility of children. It is an external cause because it is outside the BUM operation, the number of referrals received is a variation at the beginning of the referral process. In the qualitative interview with BUM *L*, the nurse highlights that the experience of the district medical officer at the primary care affects the number of referrals being sent, because of how the primary care is run depending on the experience of the district medical officer. One factor could be how the direction of leadership influences the health care workers of primary care—creating a particular type of culture where standards are being followed. This will then, indeed, lead to fewer referrals being sent, where unnecessary referrals are not being sent and where the doctor has a better understanding of when a referral should be sent.

5.2.2.3 Quality of referral letter

Another variation is the quality of referral letters the BUM units receives. According to Figure 14 and 15, in the referral process, the referral is sent back to where it was originated if it is not clear enough for the assessing paediatrician to assess. This as a result leads to increase in waiting time, which leads to more time and resources being utilized by the units at BUM. It is an external cause because it is outside BUM's regulations, the variation occurs in the referral process before the BUM units receive the referral. According to Jenkins et al. (1993), the quality of the referral letter can be caused by miscommunications in the referral process, where the information used in the referral is not sufficient and not containing enough information to be assessed. Moreover, Gandhi et al. (2000) state that the problem lies in insufficient information provided in the referral. The problem is that the medical facilities need more time to put in the correct information and make the necessary notes. This means the focus should be for the general practitioner to have enough time putting in the correct important information before the referral is written to reach a better quality of patient care (Gandhi et al., 2000).

5.2.2.4 Lack of resources

Data collected from the interview with the paediatrician at BUM *L*, a lack of resources is interpreted as resources that do not match the demand. In this context, the BUM offers insufficient doctor appointments to the needed patient group. Beekman et al. (2022) describe that increases in healthcare costs are closely attributed to asthma patients not receiving a specialist appointment in time. This drawn-out waiting time effectively increases healthcare costs and, more importantly, the prolonged waiting time can impact the patient's condition in a negative way, according to Price et al. (2017). One way of mitigating the inconsistency of patients receiving referrals containing a waiting time later than needed Beekman et al. (2022) propose an Asthma referral identifier (referID). The referID outcome is to swiftly identify patients that are experiencing severe asthma. If the medical facilities that send the referral to

BUM draw inspiration from Beekman et al. (2022) proposal regarding referID, a possible outcome could be that the sent referral is more precise and thus can facilitate the work for the assessing paediatricians to make a better assessment of the incoming referral. This could ultimately lead to assessing paediatricians at the BUM units making better priority selection for the patient, hence, the patient receiving appropriate care in time.

5.3 Recommendations for improvements and suggestions

In this section, recommendations for improvements and suggestions are presented. The content of the recommendations for improvements are attributed to the information Subsection 5.2. The recommendations are denoted as controllable variations, meaning that the BUM organizations can directly mitigate and perhaps even eliminate the causes of variations, hence, proposing recommendations for BUM units at VGR. Suggestions in this section are denoted as non-controllable variations, implying that the causes of variations are not something the BUM units can directly mitigate or eliminate. Figure 16 below showcases how the identified variation has been broken down into controllable and non-controllable causes of variation, leading to recommendations and suggestions.

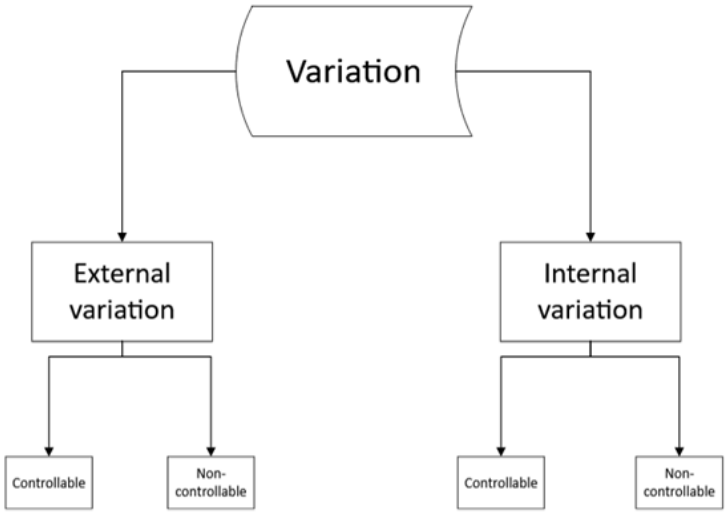


Figure 16 Breakdown of causes of variation

5.3.1 Controllable variation

5.3.1.1 Experience of paediatricians

Since the screening of referrals occurs at the BUM unit, where the assessing paediatricians approve the referrals will ultimately influence the rate of scheduled appointments. From the empirical findings and the literature, it was noted that years of experience could affect the rate of referrals leading to an appointment. Thus, also making a better clinical judgement. Therefore, it is recommended that the BUM units hire assessing paediatricians that have strong perceived knowledge and enough experience to understand if referrals need to be

scheduled or not. This will directly impact the flow rate of referrals that leads to an appointment. Consequently, it could lead to unnecessary appointments being avoided. Gitlow & Gitlow (2013) also mention that management style and training could be causes of variation. Therefore, it is recommended that the two investigated BUM units have a similar training and management style for new incoming paediatricians to carve out the path of a similar assessment of patients and ultimately mitigate the variations between the two units.

5.3.1.2 Parental influence via experience of nurse

The nurses in BUM are responsible the phone-calls from concerned patients' parents. The receiving phone- calls entails the scheduling of patients and which patients to prioritize based on their priority. The years of experience of the nurse handling these calls could impact the outcome for each concern the patients' parents have. Moreover, according to the interview at BUM *L* a nurse that is inexperienced could get influenced to make an inferior decision.

This is an internal cause within BUM's regulation and also controllable, the variation in the experience of nurse is something that BUM units can mitigate. The suggestion is to focus on having experienced nurses that can in pressurized situations make the correct medical decisions for the parents, in order to impede unnecessary referrals.

5.3.1.3 Working methods

A recommendation for BUM *L* is to draw inspiration from BUM *A*, regarding the scheduling of patients. As of right now BUM *L* have two different people with different backgrounds that schedules the prioritized referrals based on the assessing paediatrician's medical assessment. It is recommended that only one person schedules the referrals. However, it is important bear in mind the risk of reducing the workforce which could effectively risk of not being able to cope with demand in scheduling patients. Since it can mitigate drawbacks such as, uncertainties in scheduling and mismatches in booking of appointments. More importantly it is proposed that a nurse who have strong knowledge within asthma to make the scheduling of appointments.

5.3.2 Non-controllable variation

5.3.2.1 Incoming referrals

One suggestion initiative that can be focused on is regarding the variation of incoming referrals. This is an external cause that is non-controllable for BUM. Because of it being outside of BUM's organization. The reason being that the referrals are sent in the referral process as in Figure 13, where the patient goes to a medical facility which can be the primary care, hospital, and others. A referral agreement is made between the general practitioner and patient, the waiting time starts. This happens before it is received by a BUM unit. This means that it is not

something that is controllable for BUM, making it not possible to mitigate directly or eliminate. This is because the BUM units do not have a say in which referrals are sent and how many referrals can be sent.

Therefore, the suggestion is to focus on having experienced district medical officers in the primary care which stand for 50% of all incoming referrals. This will lead to the primary care being better run, which indirectly leads to fewer referrals being sent. This is something that can benefit the BUM units a lot, which leads to less stress for the assessing paediatricians' workload and the resources being used more efficiently, because of having to assess fewer referrals.

5.3.2.2 Quality of the referral letter

Another suggestion is regarding the quality of the referral letter; this is an external cause that is non-controllable for BUM. The reason is that this part of the referral process, according to Figure 2, is performed when a referral agreement has been made between the general practitioner in the medical facilities and the patient, which is also when the waiting time starts. The general practitioner is required to write a referral and provide the necessary information for the assessing paediatrician at the assigned BUM for the intended referral. This is something that happens before the referral is received by BUM in the referral process. This means it is not something that BUM units can mitigate or eliminate. The focus lies on medical facilities such as primary care, hospitals, and others. The suggestion for this improvement initiative is to focus on the general practitioner having enough time before the referral is written, to put in the necessary information and give the required quality of care. If the time is good for the general practitioner, then the quality of care improves (Gandhi et al., 2000), where the referrals have the necessary and relevant information for the paediatrician in the BUM unit to make the proper medical assessment.

5.3.2.3 Lack of resources

Beekman et al. (2022) proposed a referID, which suggests that general practitioners at various medical facilities could take advantage of to determine whether incoming patients have severe asthma. This could ultimately enhance the description of the referral to the assessing paediatrician, which could in turn make a better assessment of which priority group the patient should be placed in. Hence, reducing the uncertainties in the referral process. This could also prevent some referrals from being sent back to the different medical facilities, and thus reduce the experienced waiting time for the patient but also reduce the workload for the general practitioner and paediatrician. By reducing the back-and-forth referrals due to lack of understanding will now free up space for making assessments of other referrals.

5.4 Limitations

In this chapter the limitations from literature review, method chapter, quantitative data, qualitative data and Gemba walk will be discussed.

5.4.1 Quantitative data

For the quantitative data collection, the VGR organization does not gather data regarding whether it is prio 1, 2 or 3. The collected data is not categorized, meaning one could argue that the data is skewed because of needing to know how much of the data is for prio 1,2 or 3. It means that the reference point of 90 days is only for the waiting guarantee, which is if the referral is marked as a prior 3, this leaves room for further investigation for VGR to undertake. In the mission to understand why causes of variation are happening between different BUM units.

Regarding the process capability index Ppk, some changes were made later in the case study, where it went from looking at the overall Ppk-value over three years, 2020-2022. To look at the Ppk-value on a year-to-year basis to see the trajectory of the Ppk-value. It makes it easier to see how the Ppk-value has varied during these years. It was done, however, after the qualitative interview and Gemba walk was done. Furthermore, a potential thesis for the future could be to look at why the Ppk-value changes as it has done for BUM *A* and *L* over these years.

5.4. Qualitative data

Interviews at BUM *L* were executed a bit later than expected, consequently leaving the authors with a smaller time frame to analyse the results from BUM *L* and creating a more substantial discussion section. Furthermore, the first qualitative interview with the paediatrician at BUM *A* was a bit limited in terms of the time frame. Moreover, qualitative data from the general practitioner at the three medical facilities (hospitals, others, and primary care) was not included in this thesis due to being outside the scope of the project sponsor's authority in scheduling interviews. Interviews with the general practitioner at these medical facilities could have acted as an auxiliary to understand how the factor, years of experience of the general practitioner, causes the variation of the referral process.

5.4.3 Gemba

Conducting Gemba walks provided useful insight into how the professions (nurses, paediatricians, and secretaries) work and how the operative work is handled in the referral process. Yet, more profound insights could have been discovered if a Gemba walk had been done at the medical facilities primary care, hospitals, and others too, since that is the start of the referral process. Answers obtained from the interviews indicated that the experience of the GP (general practitioner) at the various medical facilities could influence the quality of the referral. The GP operates at the initial stage of the referral process, which was not covered by the Gemba walk for this study. Thus, it is suggested that an investigation be conducted at the various medical facilities connected to the referral process for asthma. Another limitation of the Gemba walk was that the authors did not follow an active case of a patient going through a referral process, meaning, a patient starts the journey at one of three medical facilities

(hospital, others, and primary care) and finishes the process with an appointment. By default, how the involved parties execute their work is not observed either. Thus, creating gaps in observing how different professions work in real-time.

6. Conclusion

This thesis aims to understand the sources of variation in patient referral waiting time. It has been done by combining literature and empirical data to get an overview of the possible factors for variation in the referral process affecting waiting time for the patient. This chapter concludes the study by answering each research question. Moreover, this part also presents what future research can be pursued.

RQ1: What does the variation in referral waiting time look like across all units at BUM?
Regarding this research question, empirical data needed to be collected for performing a quantitative analysis, where the data collection had different factors for the empirical findings. Firstly, the disease was chosen with Figure 4 showing that Disease code J45 had the most referrals compared to all disease codes. The factors needed for the data collection were the waiting meantime and units for all patients for the disease code J45. The decision regarding choice of disease code was also based on the consultation with the subject matter expert at VGR. By first sorting out, to have all the referrals with J45, then making a Pareto diagram, with the units in the x-axis and waiting meantime in the y-axis. It was to show the distribution of all units and the variation in the waiting meantime within and between them, as in figure 8.

The empirical findings in the quantitative research were then presented in the results in Figure 9, which shows the distribution of the chosen disease code J45 (asthma) across all the BUM units. The unit with the longest waiting meantime is BUM *L*. The shortest waiting meantime is BUM H, which was not chosen as the second unit, because of focus being on the units having similar capacity, where both units have similar number of children. The second unit chosen was BUM A, which had similar capacity to BUM L and the shortest waiting mean time to the alternative units with similar capacity. This was also based on the consultation with VGR.

RQ2: Why do some units have shorter or longer waiting times?
For this research question, there are two parts, the first part is to find out which units have longer and shorter waiting meantime, which was partly addressed in RQ1. Then the second part (RQ2) is to find out the reasons for the differences in waiting meantime.

The first part, which has been partly addressed in the first research question, presented in the results in Figure 8**.** Moreover, for this thesis, there were two units that the focus was on to get a deeper understanding of why some unit has shorter or longer waiting time. A process capability analysis was done on the Ppk value for the chosen units to show the variation across three years. It showed both units' trajectories, showing that although BUM *A* has a shorter waiting time, the Ppk value showed the trajectory is on the way down. BUM *L* had the longest waiting meantime of all units, but the Ppk value showed the trajectory on the way up.

The results showed differences in how both units have different working methods and schedules to handle incoming referrals, whereas BUM *A* has one assessing paediatrician assessing all referrals. In contrast, BUM *L* has four different assessing paediatricians assessing the incoming referrals. It is stated by Keating et al. (1998) that paediatricians perceive that they have limited knowledge in the specialized field and lean more towards referring fewer patients. Based on this, for BUM *L*, having four different assessing paediatricians reviewing the referrals leads to the number of approved referrals that lead to an appointment being affected. This can be mitigated if the paediatricians have aligned in similar training and had several years of experience. This to potentially mitigate the variation regarding the assessment of the referrals.

RQ3: How to deal with the sources of variation?

For this thesis, six improvement initiatives have been recommended in Section 5.3. Three of these are controllable and something BUM units should focus on in managing. Moreover, the other half is non-controllable for BUM units since it is outside BUM's regulations.

The proposed initiative from this thesis is to focus on the assessing paediatrician's experience. Where the empirical findings and literature points out that years of experience is a factor that affects the referrals leading to an appointment by making a better clinical judgement. The recommendation is for the two analysed BUM units to have a more standardized approach regarding training and management of the new incoming assessing paediatricians to create a similar path for assessing patients to mitigate the variations between the units in the mean waiting time.

Another recommendation is to focus on having nurses with enough experience to mitigate the parental influence in the referral process. From the empirical evidence in the qualitative research, the nurses' experience influences the variation of the waiting meantime of the referrals. The nurse handles the phone calls with the parents, and the nurse's experience between the different units influences the variation of which referrals to get an appointment or cancel bookings.

In BUM *L*, there are two different professions with different backgrounds that schedule the prioritized referrals to mitigate the drawbacks of uncertainties and mismatches in booking appointments. The recommendation is for one person to schedule the referrals, whereas the proposition is for a nurse with a strong knowledge of asthma to schedule the appointments. However, important to bear in mind that this can lead to a deficit in capacity of scheduling patients.

External causes that are non-controllable have been laid out as suggestions towards the variations in incoming referrals, referral letter quality, and lack of resources. Variation in incoming referrals for BUM, the suggestion is to focus on having experienced district medical

officers in primary care to combat the variation. The quality of the referral letter, the advice is to focus on the general practitioner having enough time to put in the necessary information before the referral is written at the medical facilities. The last improvement initiative is regarding the lack of resources, the suggestion is for the medical facilities to write the referrals by introducing a tool called ReferID, a questionnaire for the general practitioner to help describe symptoms and referrals regarding asthma. All of this is outside BUM's regulations, but still affects the variation in the waiting time for the BUM units.

6.1 Future research topics

For future research, the VGR organization could investigate why the trajectory of the Ppk value for the two units looks as it is. It would be interesting to see why the BUM *A* Ppk-value was downward in 2020 – 2022. Another interesting topic that needs more investigation for VGR could be to start collecting data on the different prior groups and then make a distribution of the variation on waiting meantime for each prio group for every unit to get a deeper understanding of how well the prison are meeting their requirements and how big gap it is for each prio group**.** It would be interesting to conduct a study on how the various medical facilities come to conclusion for making a referral, to broadly understand the variation of sent referrals.

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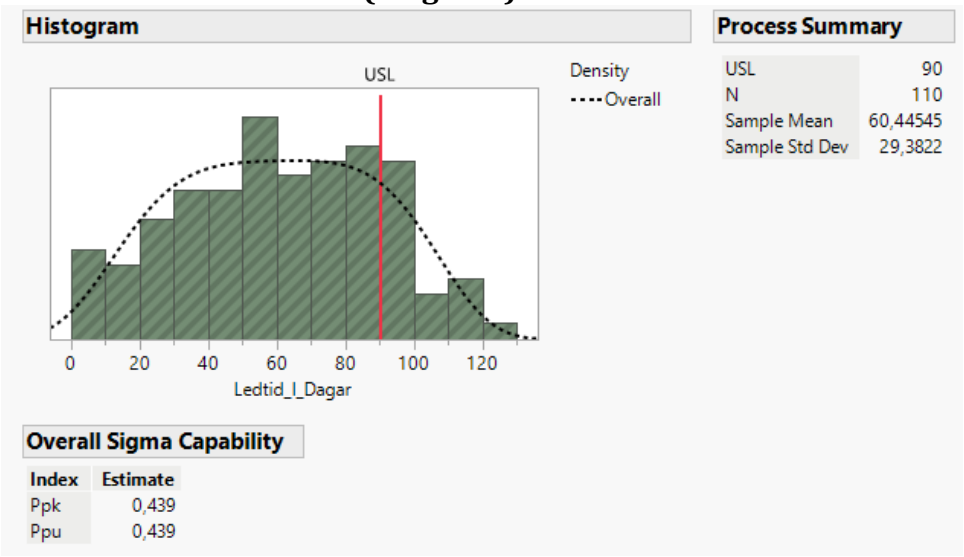
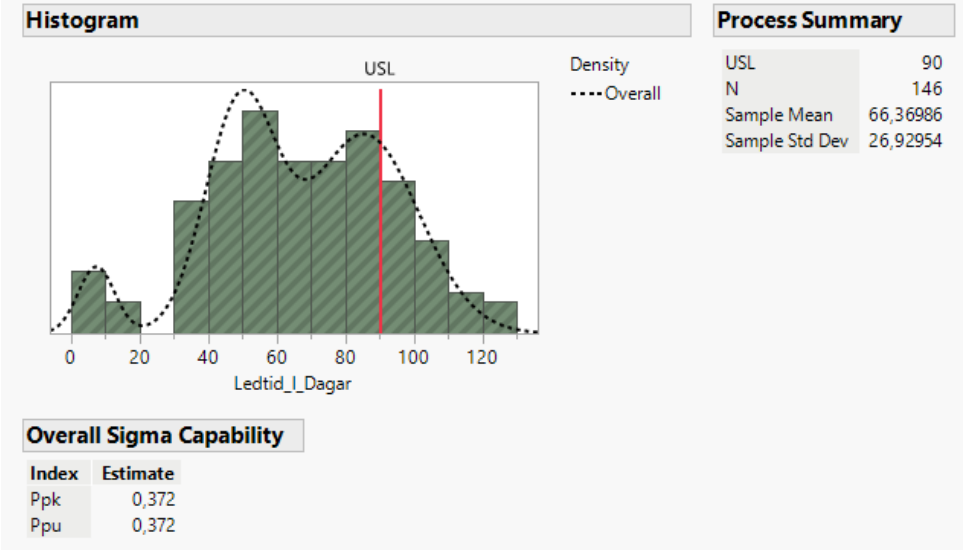
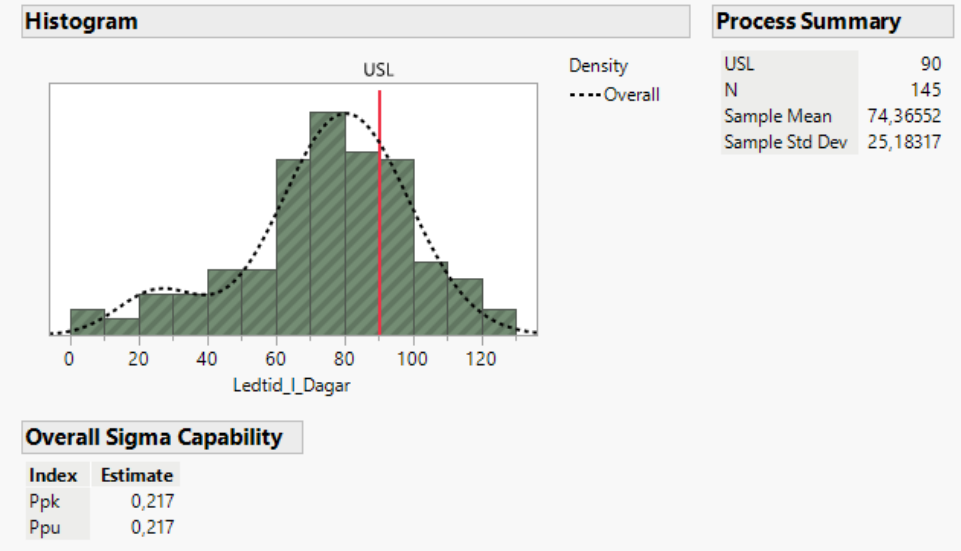
Appendix A

Diagrams for Ppk at BUM *A* and *L*

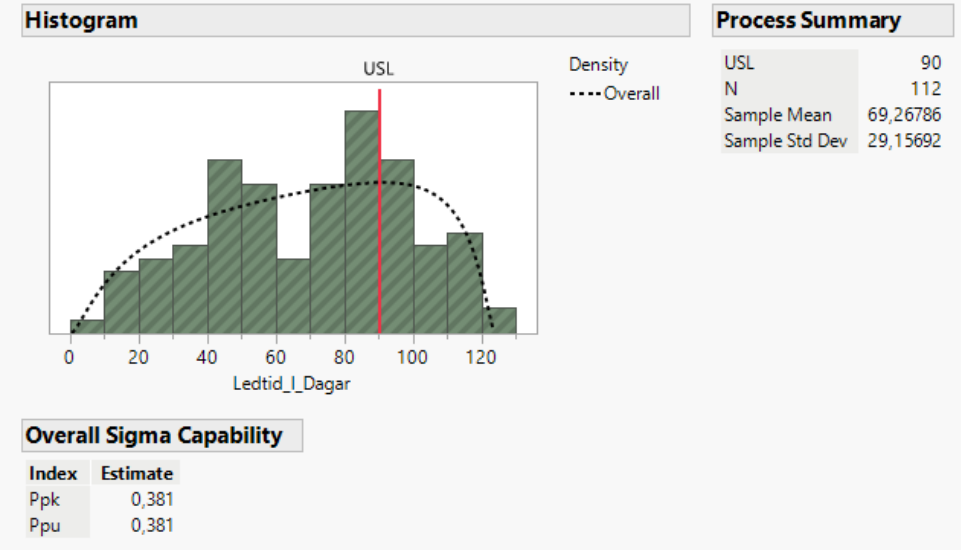
PPK BUM *A* 2020 – 2022 (3 figures)

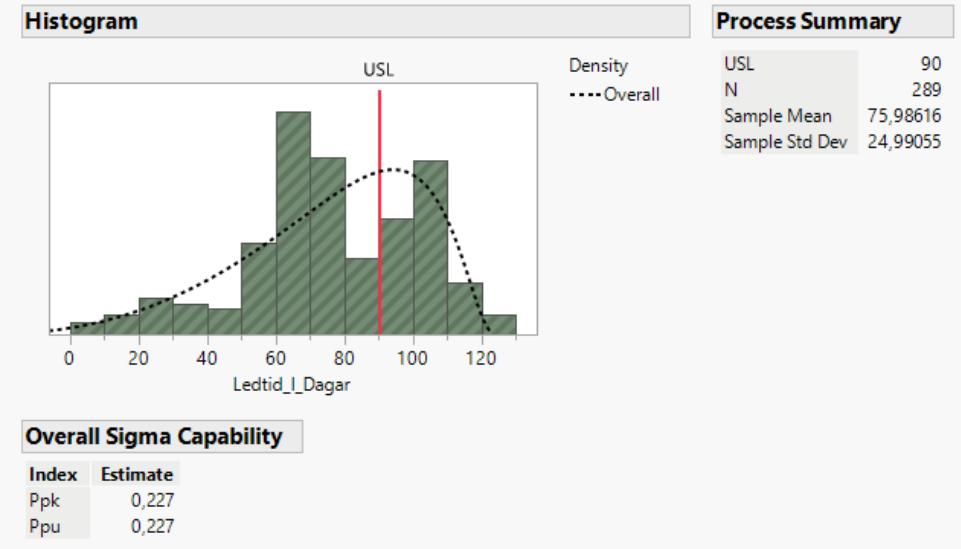




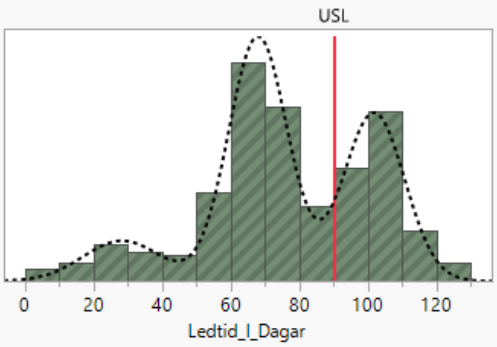


Process capability BUM *L* (2020 – 2022) 3 figures





Histogram



Density
Overall

Process Summary

USL	90
N	289
Sample Mean	75,98616
Sample Std Dev	24,99055

Overall Sigma Capability

Index	Estimate
Ppk	0,314
Ppu	0,314

Appendix B

Number of children per unit in numbers

A	*26 123*
B	*26 624*
C	*34 913*
D	*27 639*
E	*2 489*
F	*15 327*
G	*9 477*
H	*9 971*
I	*13 724*
J	*11 148*
K	*7 495*
L	*26 239*
M	*9 603*
Total amount of children	*220 772*

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