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How do Quality Improvement, Lean Practices, Knowledge Management

and Digitalization in the Healthcare Industry affect Patient Satisfaction?

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How do Quality Improvement, Lean Practices, Knowledge Management and Digitalization in the Healthcare Industry Affect Patient Satisfaction?

Final Work in Academic Context presented to Universidade Católica Portuguesa to obtain a master's degree in Management with a specialization in Service Management

by

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Resumo

A crescente relevância atribuída à satisfação do paciente em instituições de saúde ao longo dos últimos anos suscita uma considerável reflexão sobre as estratégias implementadas para alcançar tal propósito. A convergência das filosofias Lean e da digitalização emerge como um meio promissor para promover um aumento sustentável na satisfação do paciente.

Neste contexto, a presente dissertação visa minuciosamente analisar o impacto da implementação dos princípios Lean e da digitalização nos Centros de Saúde portugueses sobre a satisfação dos pacientes.

Apesar da extensa análise dedicada à metodologia Lean nas instituições de saúde portuguesas, há uma notável carência de informações acerca da implementação da digitalização nestes contextos e de seu impacto na experiência do paciente. Este estudo, portanto, almeja preencher essa lacuna, proporcionando uma contribuição significativa para pesquisas futuras, mediante a exploração dos benefícios, desvantagens e obstáculos subjacentes à adoção da digitalização nos centros de saúde.

No intuito de atingir este objetivo, concebeu-se um questionário como instrumento fundamental para a presente pesquisa. Este instrumento engloba questões estrategicamente formuladas para sondar as perceções dos utentes dos Centros de Saúde em relação aos tópicos abordados. Através desta abordagem, busca-se discernir as vantagens e desvantagens preeminentes dessas implementações, bem como identificar grupos demográficos que reagem de forma mais favorável ou desfavorável a tais transformações."

Palavras-chave: Lean Thinking; Gestão de Saúde; Digitalização na Saúde; Satisfação do Paciente; Gestão de Instalações

Abstract

The increasing importance attributed to patient satisfaction in healthcare institutions over recent years has given rise to considerable reflection on the strategies implemented to achieve this purpose. The convergence of Lean philosophies and digitalization emerges as a promising means to promote a sustainable increase in patient satisfaction.

In this context, this dissertation aims to thoroughly analyze the impact of implementing Lean principles and digitalization in Portuguese Health Centers on patient satisfaction.

Despite the extensive analysis dedicated to the Lean methodology in Portuguese healthcare institutions, there is a notable lack of information about the implementation of digitalization in these contexts and its impact on the patient experience. This study, therefore, aims to fill this gap by providing a significant contribution to future research by exploring the benefits, disadvantages, and obstacles underlying the adoption of digitalization in healthcare centers.

To achieve this objective, a questionnaire is designed as a fundamental instrument for this research. This instrument encompasses questions strategically formulated to probe the perceptions of Health Center users concerning the topics covered. Through this approach, we seek to discern the advantages and disadvantages of these implementations, as well as identify demographic groups that react more favorably or unfavorably to such transformations.

Keywords: Lean Thinking; Healthcare Management; Digitalization in Health Service; Patient's Satisfaction; Facilities Management

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List of Abbreviations

SST – Self-Service Technologies

DV – Dependent Variable

IV – Independent Variable

df – Degrees of Freedom

1. Introduction

1.1. General Framework

In recent years, the healthcare sector has undergone a profound transformation with the widespread adoption of digital technologies. The digitalization wave has not only revolutionized medical treatments and diagnostics but has also extended its influence on various aspects of the patient's experience. As healthcare providers increasingly integrate digital solutions into their daily operations, there is a growing need to understand how these technological advancements affect the satisfaction levels of patients, a crucial measure of the overall quality of healthcare services.

This thesis delves into the intersection of digitalization and patient satisfaction, with a specific emphasis on the check-in and check-out processes within healthcare settings. Traditionally regarded as routine administrative procedures, the check-in and check-out processes have become focal points for innovation as healthcare organizations leverage digital technologies to streamline workflows and enhance patient experiences.

This study aims to comprehensively examine the impact of digitalization on patient satisfaction, offering insights into the nuances of both the check-in and check-out phases. By addressing key questions surrounding the adoption, implementation, and effectiveness of digital processes, this research seeks to contribute valuable knowledge to healthcare practitioners, policymakers, and researchers striving to optimize patient care in the digital age. The implications of digitalization are assessed regarding operational efficiency, patient-staff interactions, and overall satisfaction.

Ultimately, the findings of this study aim to inform evidence-based recommendations that can guide healthcare providers in enhancing their digital check-in and check-out processes. By understanding the intricacies of patient satisfaction in the context of digitalization, healthcare organizations can aspire to create a seamless, patient-centered experience that aligns with the evolving expectations of modern healthcare consumers.

1.2. Objectives and Research Methodology

The purpose of this research is to analyze the correlation between digitalization and patient satisfaction, focusing on the check-in and check-out processes.

To reach conclusions regarding the subject, a quantitative research method is designed in the form of a questionnaire. The questions present in this questionnaire are created after a careful review of multiple articles that possess similar research topics, combined with questions that were relevant to the study.

This survey is published online among different platforms, therefore the spectrum of individuals that answered varied. For that reason, the study is not considered blocked by anyone.

Although the survey presented had the aim to understand the relation between digitalization and patient satisfaction, the questions are not only directed to the overall satisfaction, but also to the factors related to the digitalization processes that, positively or negatively, affected this satisfaction. It is important to understand not only *how* satisfaction changes among different variables, but *why* satisfaction changes among different variables.

1.3. Macrostructure

The primary objective of this research is to present a complete analysis of the topic at hand and to provide readers with a detailed and comprehensive understanding of the subject matter. To achieve this objective, the structure of the work has been specifically designed to facilitate readers' comprehension. This research is divided into 6 chapters.

Starting in Chapter 2, the literature review explains the theoretical concepts and processes that are the basis for understanding the study. In this case, the literature review provides introductions to the concepts of lean healthcare, digitalization, self-service technologies, and patient satisfaction within the healthcare sector, exploring the existing correlations among these elements.

Chapter 3 presents the problem definition and research questions, indicating the challenges and gaps that this research aims to address. The key research questions that this work is going to investigate are also stated.

Chapter 4 of the report focuses on the research method. This chapter explains the methodology used to collect and analyze data. It discusses the selection of the approach and emphasizes its suitability for the study. It also describes the measures taken to ensure the reliability of the results.

The Experimental Results are presented in Chapter 5, where the findings are analyzed and discussed, resulting in answers to the research questions evocated before.

Lastly, Chapter 6 concludes the study by summarizing the key findings, discussing their implications for healthcare management, and suggesting approaches for future research.

2. Literature Review

2.1. Lean Thinking

2.1.1. Definition of Lean

Womack and Jones suggest that perfection is achieved when organizations strive to continuously improve their processes by reducing waste, minimizing errors, and providing customers with exactly what they need. The central aim of Lean is to generate value for the customer by eliminating non-value-adding actions in the process, often denoted as "waste."

The Lean Thinking approach is a five-stage process that starts with identifying customer-defined value, analyzes it to eliminate non-value-adding actions, creates an uninterrupted product flow, eliminates bottlenecks, allows customers to pull products as needed, and aims for perfection through continuous improvement and waste reduction. When each stage adds value and delivers the desired output without delay, the process becomes perfect (Womack & Jones, 1997).

2.1.2. Lean Healthcare

In their book, Womack and Jones suggest that Lean production can be utilized not only in production manufacturing but in different areas, just by correctly adapting their principles.

Since the Lean principles were so effective, it is normal that different industries started to implement them in their companies. The healthcare industry is no exception, where the efficiency of Lean methodology has already been

implemented. This can be shown through stock management, logistics, diagnostic exams, patient flow, waiting times, and administrative services, among others (Ribeiro, 2013). Ribeiro (2013) has made a detailed analysis of various studies regarding the application of Lean methodology in the healthcare industry, and this research concluded that in a general way, all studies have shown positive results and concluded that Lean applies to the healthcare sector. From the presented results, the author highlighted the waiting times reduction, the quality and efficiency improvement, and the flow improvement, as well as an increase in patient satisfaction.

2.2. Digitalization

2.2.1. Digitization and Digitalization

According to Gartner's IT Glossary, digitization refers to the conversion of information from analog to digital form (Bloomberg, 2018). This shift from analog to digital has been a fundamental aspect of the technological revolution, reshaping how information is stored, processed, and transmitted across various sectors.

Examples of digitization can include scanning physical documents into PDFs, converting printed images into files, and converting physical reports into data that allows easier analysis (NextService, 2020).

While digitization refers to a conversion in information, digitalization refers to a conversion in processes, by employing digital technologies and information to transform business operations (Bloomberg, 2018). In a certain way, business activities will be reorganized around digital technologies to create more efficient processes.

Moving from traditional paperwork to using digital tools for project management, communication, and customer service is a result of the implementation of digitalization in a company.

It is safe to say that, although different concepts, they are closely related. When the goal is to digitalize a business, digitization will occur no matter what, since the information, that was once stored physically, is now captured in digital form (NextService, 2020).

2.2.2. Digitalization in the Healthcare Sector

Digitalization has significantly impacted various sectors, such as education, consulting, transportation, and retail. A fundamental sector where digitalization is increasing is healthcare services, where the process has gained big importance, especially since the spread of the Internet network 20 years ago (Carbonaro et al., 2021).

It is common to have the assumption that health expenditure growth is only directly related to population aging. However, according to Nghiem & Connelly (2017), the main drivers for this growth are technological progress and the increasing demand for new medical technologies.

Implementing new health technologies presents significant financial challenges for healthcare institutions, but they also bring quality improvements for patients and healthcare providers, highlighting the challenges they face (Moro Visconti & Martiniello, 2019).

According to Mumtaz et al. (2023), examples of digitalization in the healthcare sector might include telemedicine (remote clinical services), wearable tech (collecting health and fitness data), interactive computers, Electronic Health Records, and Artificial Intelligence.

2.2.2.1. Benefits of Digitalization

When discussing the beneficiaries of digitalization in the healthcare section, there are three main types of stakeholders: administration, healthcare providers, and patients. While some benefits only impact one of these, others can have an impact on more than one.

In the first place, technologies can reduce bottlenecks in administrative processes (Kudyba, 2010). This will alleviate waiting times for patients and help providers not worry about bureaucratic procedures.

Secondly, according to Locatelli et al. (2012), hospital digitalization is considered one of the most effective ways to improve service quality while reducing costs.

In research made by Painter et al. (2023), it highlights the significant advantage of health digitalization in terms of ease of access. Patients report increased accessibility through digital health services, including remote consultations, which eliminates barriers. Health apps also provide patients with greater control over their health and responsibilities, making self-management a significant benefit.

In general, technology is proven to save time, costs, and energy for all of those involved (Saifudin et al., 2021). Digital innovations are perceived as an opportunity to improve the quality of care while at the same time containing costs (Agarwal et al., 2010), which is considered a benefit for all kinds of stakeholders.

2.2.2.2. Concerns of Digitalization

It is clear that, although digitalization provides multiple benefits associated with quality and costs, it also has some disadvantages that are worth analyzing to decide the worth of implementing it.

As healthcare undergoes a digital transformation, concerns about data security have become a focal point in discussions surrounding the implementation of digital technologies in healthcare (Harvey & Harvey, 2014). The vast amount of sensitive patient information stored and exchanged electronically has given rise to a heightened awareness of the potential risks and challenges associated with this subject.

Data security concerns are primarily about potential breaches that could compromise patient confidentiality. Healthcare institutions are increasingly targeted by sophisticated cyberattacks, with hackers exploiting digital system vulnerabilities to gain unauthorized access to sensitive data. These breaches not only threaten patient privacy but also have financial implications.

Another significant concern related to the implementation of digitalization is the potential for a reduction in direct communication between healthcare providers and patients. The shift towards digital platforms, such as telemedicine, can inadvertently create barriers to effective and personalized communication.

Traditional face-to-face interactions between patients and healthcare providers provide human connection that digital platforms may struggle to replicate, leading to depersonalization and potentially impacting the patient experience by losing the empathetic aspects of in-person communication. In reality, according to Glauner et al. (2021), face-to-face interaction is the dominant requirement for the acceptance of communication in healthcare systems. Therefore, people will accept digitalization in healthcare only if it continues to exist as a personal interaction.

The introduction of telemedicine, while expanding access to healthcare services, may contribute to a sense of distance between providers and patients. The absence of physical presence can make it challenging for healthcare professionals to gauge certain aspects of a patient's condition or emotional state,

potentially leading to a less holistic understanding of their needs (Ftouni et al., 2022).

Moreover, information overload in digital health raises concerns about confusion and anxiety among patients due to overwhelming health-related data. Without clear communication channels, patients may struggle to interpret the information, hindering their active participation in health decision-making. This is a concern especially since a study conducted by Deloitte (Deloitte, 2021) reveals a significant gap in digital literacy among citizens and healthcare providers, with one in four Portuguese individuals lacking sufficient knowledge to effectively use digital solutions.

2.2.3. Healthcare Digitalization in Portugal

Healthcare digitalization in Portugal started earlier than most countries. In 2009, the Digital Health Agency was created to keep up with the development of digital health services. The eHealth system allows patients to perform diverse actions: appointment registration, auto-recording results of health parameters, access to laboratory results, and asking for prescriptions (EIT Health, 2023).

Multiple digitalization actions have already been implemented in Portugal, including mandatory e-prescriptions and, concerning telemedicine, a recent study from EIT Health shows that 84% of healthcare organizations have implemented at least one telehealth project. Additionally, the Health National Service provides an official app to all citizens that allows them to perform different tasks regarding their health.

Furthermore, from an administrative perspective, in certain healthcare centers and hospitals, patients can now skip the waiting line for the administration process and use digital kiosks to report their arrival for an appointment and making the payment, reducing waiting times and movement flows.

According to Ricardo Constantino, Head of Health and Public Sector at NTT Data Portugal, the country has been making remarkable progress regarding healthcare digitalization, with institutions already utilizing information systems to support administrative, financial, and clinical processes.[1] The Recovery and Resilience Plan allocated over 1.3 billion for the requalification of health public services, with 300 million specifically related to the digital component.[2]

Portugal is trying to implement digital platforms for all citizens and all health tasks. As it is possible to observe in Figure 1, the proportion of internet users for health-related activities increased by 11.4 pp compared to 2020. In 2022, the prevalence of health-related internet activities also saw an increase, surpassing the EU-27 average recorded in 2020. The proportion of people who accessed personal health records was the category that increased the most compared to 2020, by 23.8 pp (INE, 2022).

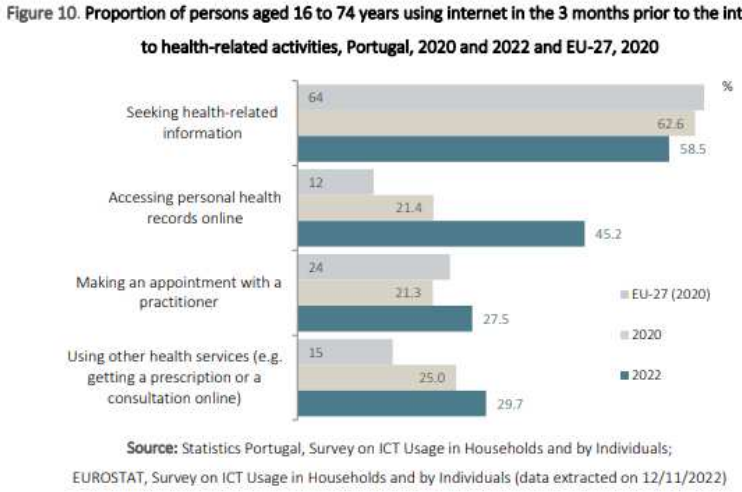

Figure 1: Proportion of people using the Internet for health-related activities

[1] Transição Digital na Saúde, sns.gov.pt. https://www.sns.gov.pt/noticias/2023/04/19/transicao-digital-na-saude-2/, April 19 2023.

[2] Fernandes, M. 2023. Digitalização do setor da saúde em Portugal teve "um progresso assinável", itinsight.pt. https://www.itinsight.pt/news/digital/digitalizacao-do-setor-da-saude-em-portugal-teve-um-progresso-assinavel, February 2, 2023.

In conclusion, digitalization in the healthcare sector has been a fundamental part of Portugal's expenses. Not only has the country already implemented several measures concerning this topic, but until 2026 we will be able to observe other improvements on this matter due to the Recovery and Resilience Plan.

2.3. Digital Check-in and Check-out Processes

2.3.1. Self-Service Technologies

One of the main types of digitalization is Self-Service Technologies (SSTs), which have emerged as transformative innovations across various industries, revolutionizing the way businesses interact with consumers.

According to Meuter et al. (2000), SSTs are technological interfaces that allow customers to produce a service that is independent of the direct involvement of employees. The transition from traditional processes to self-service methods is gaining recognition, driven by advancements in speed, convenience, and cost-effectiveness. SSTs were identified as one of the ten ground-breaking ideas shaping the world back in 2009 (Kiviat, 2008).

People can switch from old to new processes, that don't require the effort of anyone but themselves. Touchscreens, the Internet, preparing taxes, self-check-in, and account management—all of these are considered SSTs options that remove the need for human service encounters and can provide time savings, service quality, and cost reductions.

2.3.2. Self-Check-In Kiosks

A self-check-in kiosk is a type of SST since it's a digital machine that eliminates the direct involvement that customers have with employees. It allows individuals to self-report their attendance in various kinds of industries, such as airports, hotels, and healthcare. From a customer's point of view, self-check-in kiosks can reduce the time used on the service and offer more convenience. From a service provider's point of view, it can increase efficiency, reduce human capital, and be a competitive advantage (Painter et al., 2023).

2.3.2.1. Self-Check-In Kiosks in the Healthcare Sector

Although self-service kiosks have been widely used in various industries to extend service offerings, boost throughput, and increase revenue streams, the healthcare sector has been slow to embrace this technology (Pack, 2014). There is very little literature that provides evidence-based outcomes of kiosk implementations in terms of clinical care, cost-savings, or process efficiency (Lesselroth et al., 2011).

Previous studies have shown the major benefits of this type of automation. In the first place, self-check-in kiosks help the staff to reduce their involvement with time-consuming activities that are not as important (Pack, 2014) – in that way, staff can be more focused on interacting carefully with patients, helping them while answering their questions.

According to Kokkinou & Cranage (2013), the queuing theory suggests that adding a resource to an existing service delivery system would increase its capacity and reduce waiting times. Hence, it is evident that another advantage of such digitalization is the reduction in waiting times at check-in kiosks compared to traditional administrative check-in counters (Mahmood et al., 2020).

Although the benefits are not only financial (Lesselroth et al., 2011) but also concerning the employees and patients, there are also disadvantages associated with this subject. Williamson (2016) states that one of the biggest problems concerning the electronic self-check-in is that the system is "emotionally distant" since it doesn't allow interaction between the patient and the receptionist, which can lessen patients' anxiety in moments of uncertainty.

Furthermore, another concern is that patients may also avoid self-check-in kiosks if they are demotivated due to certain situations – if patients experience failures during the use of this technology, they will abandon the kiosk (Meuter et al., 2000).

2.3.2.2. Self-Check-In Kiosks in Portugal

Digitalization has been a fundamental part of improvements in public healthcare centers.

In 2020, a financing system was designed, and incorporated in COMPETE 2020[3], to strengthen the institutional capacity of public entities and interest parties.

According to AMA, the Agency for Administrative Modernization, the Support System for the Modernization and Training of Public Administration (Sistema de Apoio à Modernização e Capacitação da Administração Pública) supports operations aimed at achieving thematic objectives and investment priorities. These objectives include improving access to IT and strengthening the institutional capacity of public entities and interested parties. Additionally, the

[3] An institution that grants incentives to promote competitiveness and internationalization, promoting the consolidation of competitive advantages.

system aims to enhance the efficiency of the public administration itself(*Portugal 2020*, 2014).

After being a candidate for funds within this financing project, ARS Norte obtained the approval for an investment of €997.226,77 to implement self-check-in kiosks in the Primary Healthcare Centers of the region. According to the public institution, this investment contributes to the simplification and modernization of the check-in process for patients (*Sistema de Gestão de Atendimento Automático Nos CSP – ARS Norte*, 2018)

2.3.3. Digital Payment Methods

Not only self-service kiosks can provide the patient with the ability to register attendance, but some can also give the chance for the patient to pay for the service delivery.

In private hospitals and healthcare centers it's possible to pay for the service at the kiosk with the patient's credit card, as well as through other options such as apps and bank transfers (Faturas e Pagamentos, n.d.). In public healthcare centers, since the pandemic, the Government decided to suspend the fees for consultations and examinations (eportugal.gov.pt, 2022).

2.4. Patient Satisfaction

2.4.1. Concept of Patient Satisfaction

Over the years, the concept of patient satisfaction has undergone various interpretations, leading to inconsistencies and differing descriptions.

Nonetheless, some definitions have gained general acceptance within the healthcare community (Aydin, 2018).

One of the earliest definitions, presented by Ware et al. (1983), characterizes patient satisfaction as a personal evaluation encompassing healthcare facilities and provider services. Their emphasis on subjectivity highlights the significant role of an individual's perception in shaping their assessment of the care they receive.

Linder-Pelz (1982) contributes to the discourse by suggesting that patient satisfaction stems from positive evaluations across different aspects of healthcare. This perspective acknowledges the multifaceted nature of satisfaction, recognizing that various factors contribute to the judgment.

In 1983, Fitzpatrick & Hopkins defined patient satisfaction as a result of the gap between expected and perceived characteristics of a service. This definition introduces the notion that satisfaction is influenced by the variance between expectations and perceptions for the service.

In the contemporary landscape, organizations across various sectors, including healthcare, are increasingly prioritizing client-centered processes and experiences. In line with this trend, the concept of patient satisfaction has evolved to incorporate this emphasis.

Morgan et al. (2015) redefine patient satisfaction as a metric measuring healthcare's effectiveness in achieving true patient-centered care.

These definitions assume that patients place importance on certain aspects of their healthcare experience, and that these priorities differ from one patient to another. This highlights the subjective nature of patient satisfaction, where personal perceptions and expectations greatly influence how patients assess the quality of their healthcare. In today's world, where technology is advancing rapidly and patient expectations are changing, it is essential to recognize these

diverse viewpoints on patient satisfaction in order to provide care that is truly patient-centered.

2.4.2. Measurement of Patient Satisfaction

Nowadays, quality is increasingly recognized as a crucial factor in service evaluation, with customer satisfaction serving as a standard for both public and private service providers, driven by the growing awareness of consumers' rights in goods and services (Santos, 2017). This wasn't always the case, as a few decades ago there was an omission of systematic measurement of patient satisfaction, justified by the state of patients, their lack of necessary knowledge, the rapid pace of events, and methodological problems related to measuring patient satisfaction.

The assessment of patients' perceptions regarding the quality and process of healthcare delivery is increasingly considered an essential element in evaluating healthcare interventions and service quality (Crow et al., 2002). This is evidenced by the increasing use of different methods designed to measure concepts such as patient satisfaction and patient experiences.

Various methods of analyzing patient satisfaction can be used. Naturally, the ones used will affect the result achieved - however, based on principles of independence and impartiality, certain criteria are utilized in international studies commonly accepted in the scientific community as valid for evaluating patient satisfaction in the hospital industry.

The methods available for assessing patient satisfaction can include interview-based measures, multi-item questionnaires, and single-item measures. Whereas the first two methods provide detail for a rigorous research study, the latter offers simplicity and speed, reducing patient burden (Speight, 2005).

The Patient Satisfaction Questionnaire short form (PSQ-18), created by Marshall & Hays (1994), is considered a short-form version of the 50-item Patient Satisfaction Questionnaire III (PSQ- III). The PSQ-18 contains 18 items assessing each of the seven dimensions of satisfaction with medical care (previously measured by the PSQ-III), including general satisfaction, technical quality, interpersonal manner, and accessibility.

In Europe, the European Task Force on Patient Evaluations of General Practice (EUROPEP), was developed to enable the comparison of general practice care, by identifying aspects that are generally evaluated positively by patients and providing feedback to general healthcare providers to stimulate their improvement (Grol et al., 2000). For the accomplishment of these objectives, the Task Force created a questionnaire with 23 validated questions addressing different aspects of care.

The Primary Care Assessment Survey (PCAS) is a questionnaire completed by patients and puts into practice official definitions of primary care, including the one proposed by the Institute of Medicine Committee on the Future of Primary Care (Safran et al., 1998). The PCAS measures seven domains of care through 11 summary scales, including accessibility, comprehensiveness, clinical interaction, interpersonal treatment, and trust.

In a summarized way, it can be concisely expressed that in the assessment of patient satisfaction, there is the understanding that global satisfaction is not measured as an isolated variable, but rather by a set of some elements.

2.4.3. Factors Influencing Patient Satisfaction

Patient satisfaction is a complex construct influenced by various factors, including interpersonal interactions and institutional policies. Understanding these factors is crucial for healthcare providers to improve care quality.

Researchers have explored various aspects contributing to patient satisfaction, emphasizing the importance of different dimensions within healthcare settings.

One crucial factor influencing patient satisfaction is the physical facilities of a healthcare institution (Gasquet et al., 2004). Different authors have explored this dimension, recognizing that the environment in which healthcare is delivered significantly impacts a patient's overall experience. The quality and aesthetics of physical facilities play a role in shaping perceptions of care, including the cleanliness of the space, the availability of seats, and the ease of finding the desired locations.

Waiting time is a significant factor in patient dissatisfaction and has been extensively studied by Morgan et al. (2015), and Thompson et al. (1996), as delays can lead to frustration and negatively impact the overall perception of the healthcare experience. In addition, according to Morgan et al. (2015), the perceived waiting time is more important than the actual waiting time for the patient satisfaction rating. Addressing these issues and seeking improvement is crucial for enhancing patient satisfaction and optimizing healthcare service delivery.

Several scholars have emphasized the importance of medical and nursing care in shaping patients' experiences. They have found this factor to be the most crucial one for patient satisfaction (Fitzpatrick & Hopkins, 1983; Goula et al., 2019).

Accessibility is another critical dimension explored by Goula et al. (2019) and Labarère et al. (1999). The ease with which patients can access healthcare services, including appointment scheduling, admission process, access to locations, and overall convenience (Ferreira et al., 2023), plays a pivotal role in determining patient satisfaction. Improving accessibility ensures that patients can navigate the healthcare system with greater ease, positively affecting their overall experience.

Certain authors have also highlighted interpersonal skills, such as communication and relational dynamics, as influential factors in patient satisfaction (Gasquet et al., 2004; Raposo et al., 2009; Westaway et al., 2003). Effective and understandable communication between healthcare providers and patients contributes to building trust and fostering a positive healthcare experience.

In conclusion, patient satisfaction is linked to various factors that collectively define the healthcare experience. Understanding and addressing these dimensions are imperative for healthcare institutions striving to provide patient-centered care and enhance overall satisfaction. By recognizing the significance of each factor, institutions can implement strategies to optimize patient experiences and foster a healthcare environment that meets patient expectations.

2.4.4. Importance of Patient Satisfaction in Healthcare

As previously stated, numerous factors impact patient satisfaction when interacting with various services within the healthcare industry. This satisfaction is significant as it is reflected in the patients' feedback about the service they received, as well as their likelihood of returning to the same healthcare institution or seeking out another one. Vuori (1987) states that patient satisfaction is crucial for achieving the goals of health care since it has an impact on the patient's decision to follow prescribed treatments and seek future professional health care. Therefore, positive encounters are more likely to foster loyalty, influencing individuals to continue seeking care from the same healthcare centers (Newsome & Wright. G. H., 1999) – conversely, negative experiences can result in patients seeking alternative providers, disrupting the continuity of care and potentially compromising health outcomes. As companies try to differentiate themselves

from their competitors, service quality can be used as a weapon of strategic differentiation to build a sustainable competitive advantage, being a vital determinant of patient satisfaction (Alrubaiee & Alkaa'ida, 2011).

In a healthcare landscape increasingly characterized by patient-centered approaches, addressing patient satisfaction is imperative. As patients are the ones who select their healthcare providers, their satisfaction becomes a crucial determinant in shaping their choices (Johansen et al., 2021). By prioritizing patient satisfaction, healthcare centers not only enhance their current service delivery but also lay the foundation for continued trust and collaboration with patients, fostering a positive healthcare-seeking culture.

2.4.5. Impact of Digitalization on Patient Satisfaction

The advent of digital technologies has revolutionized healthcare delivery, introducing new possibilities and challenges. Throughout the years, digitalization and its correlations with patient satisfaction have been studied to understand how patients react to such a change in healthcare processes.

Firstly, according to Pogorzelska & Chlabicz (2022), digital technology, by allowing patients to keep track of appointments, procedures, and results, has allowed patients to be more knowledgeable regarding their bodies and work together with healthcare professionals in a more efficient way.

The article also highlights one of the biggest challenges of implementing digitalization in healthcare, stating that not all patients are suitable for digital channels due to web access difficulties and lack of technological knowledge. This potentially leads to patient dissatisfaction if institutions fail to provide accessibility and convenience for these individuals.

Although telemedicine significantly influenced satisfaction with the convenience of remote healthcare access, providing patients more flexibility, challenges accompany these advancements. Some studies indicate that, in general, follow-up patients are less satisfied than new patients (Pogorzelska & Chlabicz, 2022) - this might happen due to their previous experience with in-person appointments, which may be more reliable. Telemedicine services, while not replacing traditional health services, integrate them to enhance their effectiveness, efficiency, and appropriateness (Ferorelli et al., 2022). Balancing convenience with personal connection is crucial for addressing concerns and ensuring a positive impact on patient satisfaction, as it does not replace traditional health services.

There are varying opinions on how digitalization impacts the relationship and communication between patients and healthcare providers. Those who support technology believe that digital platforms provide better care, while others have a more negative outlook on digital transformation, stating that it can make it easier to forget about people (Johansen et al., 2021).

3. Problem Definition

3.1. Problem Definition

In contemporary healthcare settings, the integration of digital technologies has significantly transformed patient care. Of particular interest is the impact of digitalization on patient satisfaction, specifically in check-in and check-out processes. The traditional patient journey involving manual administrative procedures is evolving with the infusion of digital tools such as digital platforms, mobile applications, and electronic health records. However, the nuanced effects of these changes on patient satisfaction have not been comprehensively explored.

The primary problem addressed in this research is the implications of digitalization on patient satisfaction during the crucial phases of check-in and check-out. The core inquiries guiding this investigation revolve around understanding the multifaceted nature of the patient experience in the context of digital advancements.

It is important to understand how patients respond to digitalization in healthcare centers. This facilitates the identification of potential challenges and opportunities within the healthcare system.

Ultimately, this understanding serves as a guiding compass for healthcare organizations seeking to leverage digitalization effectively, creating a more patient-centric and satisfactory healthcare experience for all stakeholders involved.

3.2. Research Questions

Given the insights gained from defining the research problem, the following research questions are aimed to be answered:

Research Question 1: How do patients perceive and experience the use of self-check-in kiosks in healthcare settings?

Research Question 2: How are traditional and digital payment methods integrated into the healthcare payment systems and how do they influence patients' satisfaction?

Research Question 3: What factors contribute to patient satisfaction in the context of healthcare digitalization?

Research Question 4: Are there challenges or conflicts in the integration of self-check-in kiosks and payment methods in healthcare settings?

4. Research Method

4.1. Method Definition

Choosing a methodological paradigm is crucial when conducting research. It determines the tools we use, the data we collect, and how we interpret the results.

The current study will adopt a quantitative approach, specifically employing the use of questionnaires to collect data that can be utilized to effectuate enhancements in the healthcare sector and, in that way, improve patient outcomes. According to Aliaga & Gunderson (2003), quantitative research methods are described as the explanation of an issue or phenomenon through the collection of data in numerical form and the analysis of this data with the help of mathematical methods. Therefore, a quantitative research method deals with the analysis of variables to obtain conclusions regarding a certain problem.

A survey is one of the most used quantitative methods. After the sampling, design, and administration of a questionnaire, the aim is to gather information from the population under study and analyze it to better understand their characteristics (Sukamolson, 2007). Surveys can be customized to collect crucial information on patients' experiences within the healthcare industry.

4.1.1. Data Collection and Measurement Instruments

For this study, a survey was available online via multiple digital platforms, such as Facebook, Instagram, and Twitter, for two weeks in November. Due to the method used to disseminate the questionnaire, it was possible to gather more and more diversified information regarding the topic of the research.

Before administering a questionnaire, it is imperative to ascertain the appropriate sample size, as it directly influences the precision of the findings. To calculate the sample size needed for this study, we use the Equation (1) (Jung, 2014):

$$Sample\ size = \frac{(Z-score)^2 * StdDev * (1-StdDev)}{(confidence\ interval)^2} \quad (1)$$

The Z-score in this formula represents how far away from the average our data is. This value is correlated to the confidence level that we want to have in our research. The Standard Deviation represents the dispersion or variability in the expected answers. The confidence interval allows the researchers to define what is the maximum difference allowed between the average of their sample and the average of the total population.

As mentioned above, the confidence level will affect the Z-Score used. In this research, the aim is to have a confidence level of 90%, therefore the Z-Score associated is 1.65. The standard deviation of 0.5 is commonly used among researchers due to its versatility and practicality in various fields of study. (Kibuacha, 2021). Furthermore, the research has a 10% confidence interval.

As seen in Equation (2) we can determine that, to have a confidence level of 90%, 69 answers to the questionnaire are needed.

$$Sample\ size = \frac{0{,}6806}{0{,}01} = 68{,}06 \quad (2)$$

In conclusion, we have more than the sample size required to achieve the 90% confidence level, since 205 responses are collected.

4.2. Correlation Analysis

Correlation analysis is a statistical method used to measure the strength and direction of a linear relationship between two or more variables. It helps to quantify how much one variable changes concerning another. The result of a correlation analysis is expressed as a correlation coefficient that quantifies the degree to which variables are related. The result of a correlation analysis is expressed in the form of a correlation coefficient that indicates the degree of correlation between variables. While analyzing and identifying potential causal relationships and patterns in the data, this tool can provide valuable insights for decision-making purposes.

4.3. Regression Analysis

Regression analysis is a statistical tool that helps us understand the relationship between different variables. Although it originated in the field of statistics, it is now widely used in various fields, including healthcare sciences.

This technique enables the examination of how a specific variable, known as the dependent variable (DV), responds to variations in other variables, termed the independent variables (IV). It proves to be an indispensable tool for research across diverse scenarios (Aiken & West, 1991).

Different types of regression analysis include simple linear regression, which involves one dependent variable and one independent variable, and multiple linear regression, which has multiple independent variables. Withing the latter, multiple linear regression is a linear equation with multiple variables influencing a single variable, while multivariable regression is a broader term that includes regression models with multiple independent and dependent variables.

4.3.1. P-value

The p-value, or probability value, is a measure used in statistical hypothesis testing to determine the evidence against a null hypothesis, that represents a default assumption that there is no effect. In hypothesis testing, researchers make a hypothesis about a population parameter and collect sample data to test it.

The p-value quantifies the strength of the evidence against the null hypothesis. A smaller p-value indicates stronger evidence against the null hypothesis. This means that if the p-value is less than a chosen significance level, then the null hypothesis is rejected, suggesting that the observed data is unlikely under the assumption that the null hypothesis is true. If the p-value is greater than the chosen significance level, there is insufficient evidence to reject the null hypothesis.

4.3.2. Significance F

The F-statistic, represented as "f", is a crucial metric in regression analysis used to determine whether a regression model or a set of predictor variables is statistically significant in explaining the variation in the dependent variable. It is calculated by comparing the variability unexplained by the model to the variability explained by the regression model. A significant regression model is one in which the estimated F-statistic is large enough to exceed a critical value. The F-statistic is commonly used in hypothesis testing, where it is used to refute the null hypothesis and offers important insights into the relationships between the variables.

5. Experimental Results

5.1. Dataset Characterization

To collect data, a questionnaire was designed that was accessible on different digital platforms, such as Facebook, Instagram, Twitter, and email, between the months of November and December.

This questionnaire comprised 28 questions, with eight focused on the demographic profile of the respondents and the remaining focused on the core theme of the study. In total, 205 answers were collected, and the results were examined and analyzed to conclude the study.

In this research, we are examining the relationship between two types of variables: the dependent variable and the independent variable. Our goal is to understand how changes in the independent variable affect changes in the dependent variables.

In this case, there are 23 independent variables and 4 dependent variables that concern patient satisfaction. These variables are specified and explained in Appendix B.

5.2. Descriptive Analysis

To find out more about the socioeconomic and demographic characteristics of the survey respondents, we carried out an extensive descriptive analysis. This study attempts to give a thorough, quantitative explanation of our data so that we can comprehend our response group better. The figures presented below have been generated by Google Forms following the completion of the survey.

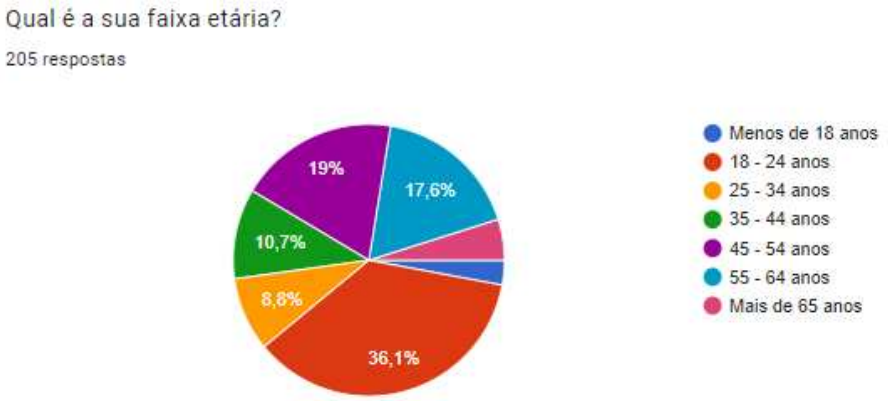

Figure 2: Age distribution of respondents

Figure 2 shows that there's a good distribution of age among the respondents. Young adults from 18 to 24 years old make up 36.1% (74 people) of the total answers. The smaller percentages are related to people who are less than 18 years old and more than 65 years old.

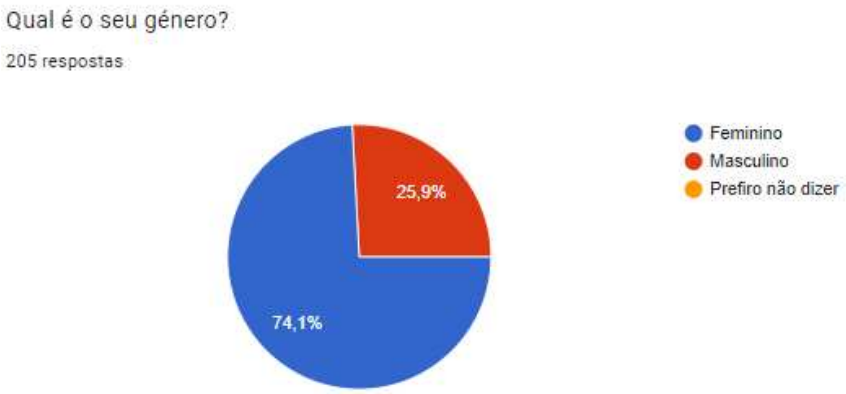

Figure 3: Gender distribution among respondents

From Figure 3 it is possible to understand that women gave almost three-quarters of the answers. 53 people of the masculine sex answered, making up 25.9% of the total answers.

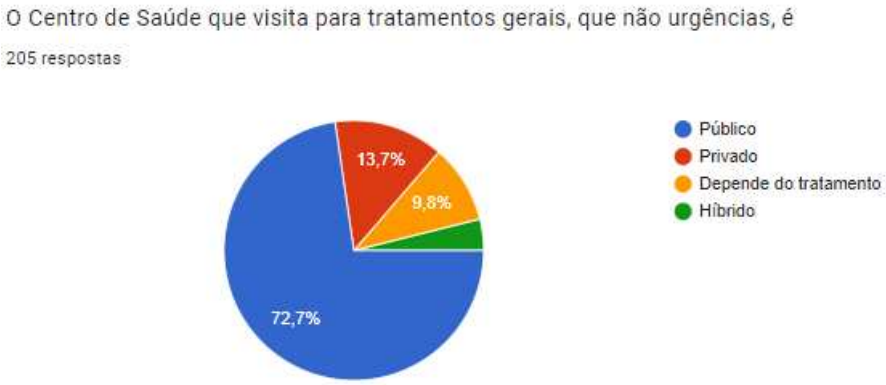

Figure 4: Type of healthcare centers

Figure 4 shows that 149 people visit a public healthcare center, while 28 people visit a private healthcare center.

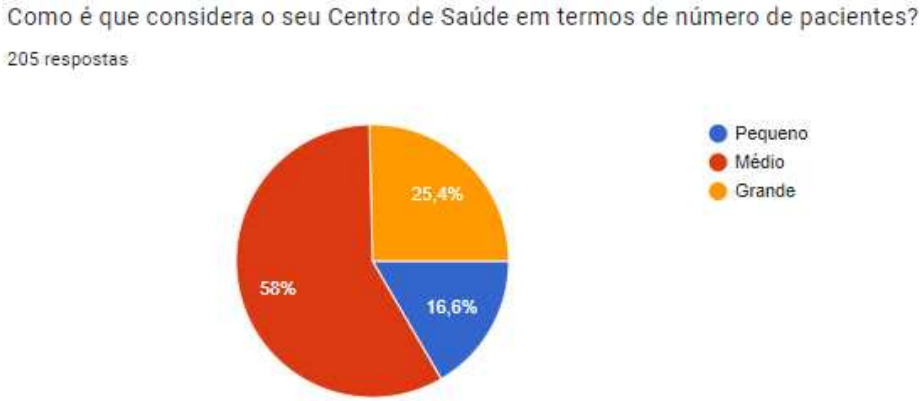

Figure 5: Size of healthcare centers

In Figure 5, there's a distribution of answers regarding the size of the respondents' healthcare centers. The majority of them categorize their healthcare institution as medium-sized.

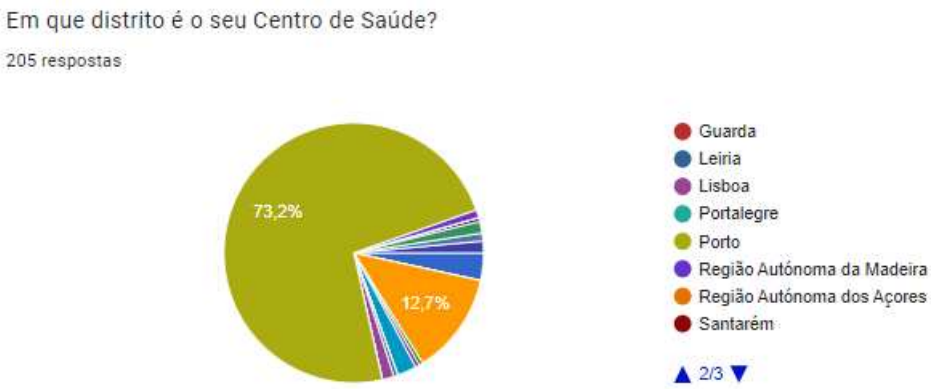

Figure 6: District of healthcare centers

Figure 6 shows that 150 people answered that the district of their healthcare center is Porto. The second biggest answer is Braga.

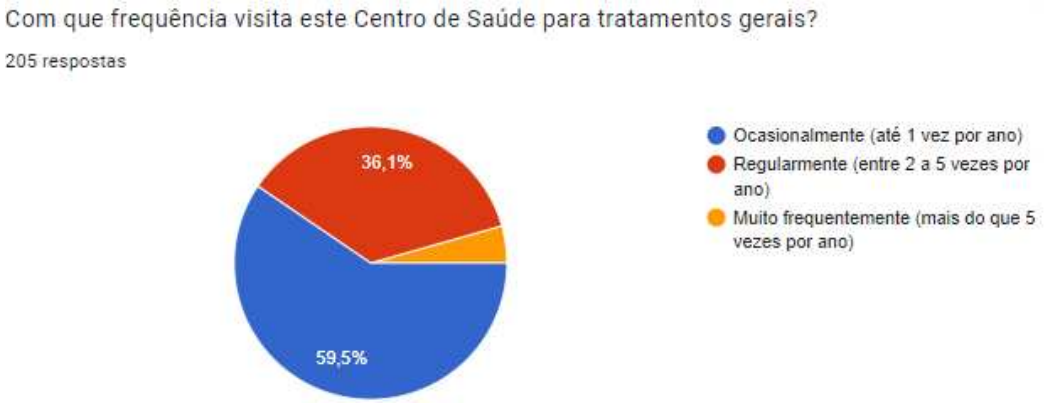

Figure 7: Regularity of visits to the healthcare centers

Figure 7 shows that while 59.5% of the respondents only visit their healthcare center up to 1 time per year, 74 people visit regularly – between 2 and 5 times per year.

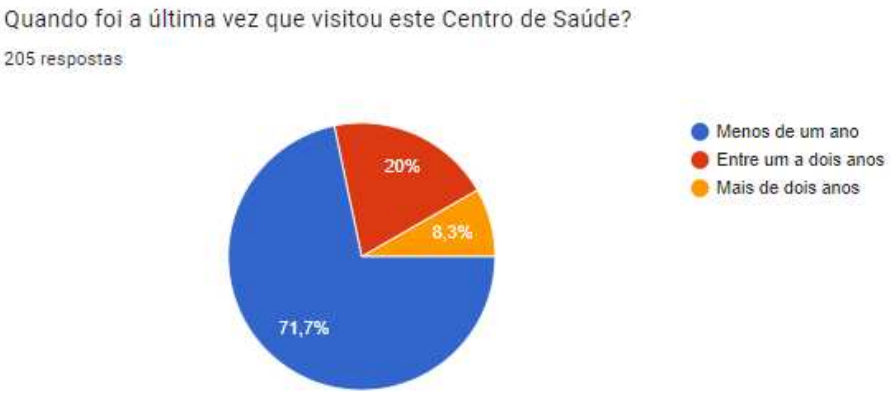

Figure 8: Last visits to the healthcare centers

Figure 8 shows that almost 150 respondents visited their healthcare center for general treatments in the last year. Only 17 people have not visited their healthcare center for more than two years.

Figure 9: Appointment scheduling methods

Figure 9 shows that the majority of people schedule their appointments in person or through a phone call.

5.3. Analyzes and Discussion

5.3.1. Correlation Analysis

Correlation coefficients are statistical measures that indicate the degree to which variables move about each other. These coefficients range from -1 to 1, where -1 represents a perfect negative correlation – when one variable increases, the other decreases -, and 1 represents a perfect positive correlation - when one variable increases, the other also increases. The value 0 represents no correlation between the two variables.

The correlation matrix under consideration is available in Appendix C. Our focus lies on identifying values greater than or equal to the absolute number of 0.5, which denote moderate positive or negative correlation.

On the table, it is possible to find moderate or high correlations in 3 dependent variables.

In the first place, the satisfaction with digitalization efforts is positively correlated with the speed and efficiency of admission processes, indicating that an increase in one variable leads to an increase in the other.

In addition, looking at the matrix, there's a positive correlation between the satisfaction with the available options at the healthcare centers and the available and preferred payment methods.

There's also a positive correlation between the satisfaction of the patients with the transparency and clarity of the payment methods and the preferred payment method, as well as between the first and the satisfaction with the available options.

It is important to remember that correlation is not causation. A strong relationship between two variables does not necessarily indicate a cause-and-effect relationship.

5.3.2. Regression Analysis

In order to understand how the independent variables influence each dependent variable, a regression analysis is conducted through the IBM SPSS Statistics software.

DV 1: Satisfaction with the speed and efficiency of the admission process

Figure 10 shows that the answer that the majority of the patients sample gave regarding satisfaction with the speed and efficiency of the admission process was 3 out of 5, followed by 4 out of 5, representing moderate to high satisfaction.

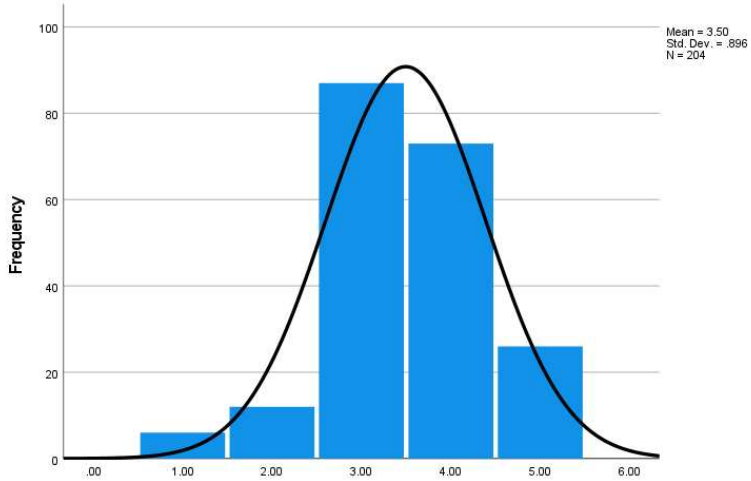

Figure 10: Responses to the question related to DV 1, which denotes satisfaction with the speed and efficiency of the admission process

Table 1 presents key statistics derived from the regression analysis along with their respective meaning.

Model Summary	Values	Meaning
R	0,573	The IV's together have a moderate relationship with this DV
R Square	0,329	Some of the variability in the DV is explained by the IV's (32,9%)
Adjusted R Square	0,243	The model moderately explains variability in the DV after adjusting for predictors.
Standard Error	0,77970	On average, the observed values deviate from the predicted values by 0.77 units

Table 1: Key statistics related to the model to estimate DV 1, which stands for satisfaction with the speed and efficiency of the admission process, and their meanings

Table 2 illustrates the significance level of the regression model formulated for estimating DV 1, namely, satisfaction with the speed and efficiency of the admission process. With a corresponding p-value of almost 0.00, the variables taken together have a significant impact on predicting the mentioned type of satisfaction. Therefore, we can say with a certain level of confidence that there is evidence of a relationship between the independent variables and the dependent variable.

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	53.567	23	2.329	3.831	.000
Residual	109.428	180	.608		
Total	162.995	203			

Table 2: Significance level of the regression model to estimate DV 1, standing for satisfaction with the speed and efficiency of the admission process

Table 3 shows the relationship between the variables, which are explained in Appendix B.

IV 21, which relates to payment for appointments at healthcare centers, has the most positive impact on satisfaction with the speed and efficiency of the admission process. The available payment methods are also a variable that positively influences the dependent variable in question. This means that every increase in these variables will increase the satisfaction.

On the other side, the IV associated with the easiness of finding the self-check-in machines negatively influences satisfaction with the speed and efficiency of the admission process. Hence, if the majority of our sample indicates that locating the self-check-in machine is easy (the first option provided in the question), it is likely to result in higher satisfaction levels.

Regression Analysis	Unstandardized Beta	Coefficients Std. Error	Std. Coefficients Beta	t	Sig.
IV 1	.018	.037	.036	.482	.630
IV 2	.256	.132	.126	1.935	.055
IV 3	-.073	.072	-.067	-1.003	.317
IV 4	.048	.090	.034	.531	.596
IV 5	-.004	.014	-.021	-.316	.752
IV 6	.079	.115	.051	.681	.497
IV 7	.042	.103	.030	.406	.685
IV 8	.039	.056	.049	.696	.487
IV 9	-.167	.063	-.195	-2.655	.009
IV 10	.005	.133	.003	.038	.970
IV 11	-.043	.173	-.019	-.248	.804
IV 12	.141	.116	.079	1.211	.227
IV 13	.084	.087	.076	.969	.334
IV 14	-.003	.139	-.002	-.021	.983
IV 15	.538	.259	.202	2.081	.039
IV 16	-.331	.089	-.327	-3.722	.000
IV 17	-.344	.303	-.115	-1.138	.257
IV 18	-.020	.079	-.030	-.251	.802
IV 19	.042	.080	.068	.518	.605
IV 20	.119	.061	.177	1.932	.055
IV 21	.465	.151	.232	3.082	.002
IV 22	.081	.037	.158	2.156	.032
IV 23	.007	.051	.011	.138	.890

Table 3: Regression analysis for DV 1, which stands for satisfaction with the speed and efficiency of the admission process

DV 2: Satisfaction with the digitalization efforts

Figure 11 shows us that the most answered option was, similar to Figure 10, 3 out of 5, presenting moderate to high satisfaction with the digitalization efforts.

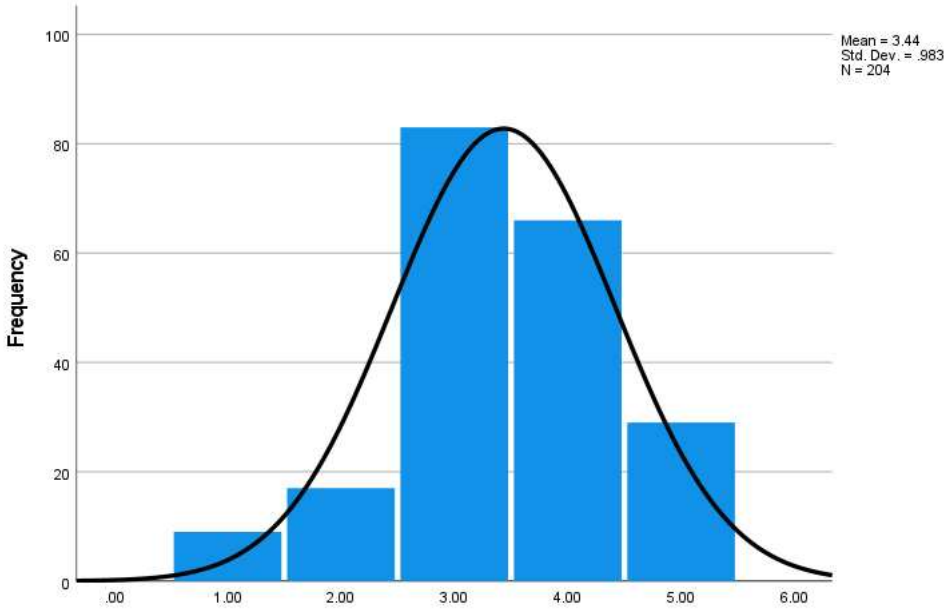

Figure 11: Responses to the question related to DV 2, which denotes satisfaction with digitalization efforts

Table 4 presents key statistics derived from the regression analysis along with their respective meaning.

Model Summary	Values	Meaning
R	0,583	The IV's together have a moderate relationship with this DV
R Square	0,340	Some of the variability in the DV is explained by the IV's (34,0%)
Adjusted R Square	0,255	The model moderately explains variability in the DV after adjusting for predictors.
Standard Error	0,84837	On average, the observed values deviate from the predicted values by 0.84 units

Table 4: Key statistics related to the model to estimate DV 2, which stands for satisfaction with the digitalization efforts, and their meanings

Table 5 illustrates the significance level of the regression model formulated for estimating DV 2, namely, satisfaction with the digitalization efforts. With a corresponding p-value of almost 0.00, the variables taken together have a significant impact on predicting satisfaction with the digitalization efforts of the healthcare centers and there is evidence of a relationship between the independent variables and the dependent variable.

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	66.620	23	2.897	4.024	.000
Residual	129.551	180	.720		
Total	196.172	203			

Table 5: Significance level of the regression model to estimate DV 2, standing for satisfaction with the digitalization efforts

Table 6 shows the relationship between the variables, which are explained in Appendix B.

IV 4, which refers to the size of the healthcare center, has the greatest positive impact on DV 2. This means that increasing this variable will boost satisfaction with digitalization efforts.

The easiness of finding the self-check-in machines also negatively influences the mentioned satisfaction. Therefore, if the majority of our sample indicates an ease of finding the self-check-in machine, the satisfaction will be higher.

Regression Analysis	Unstandardized Beta	Coefficients Std. Error	Std. Coefficients Beta	t	Sig.
IV 1	.046	.041	.082	1.116	.266
IV 2	.127	.144	.057	.881	.380
IV 3	-.097	.079	-.081	-1.232	.219
IV 4	.237	.098	.155	2.413	.017
IV 5	-.007	.015	-.030	-.448	.655
IV 6	-.050	.126	-.029	-.397	.692
IV 7	-.054	.112	-.035	-.478	.633
IV 8	.036	.061	.042	.596	.552
IV 9	-.193	.069	-.206	-2.820	.005
IV 10	-.300	.145	-.173	-2.071	.040
IV 11	.100	.188	.041	.533	.595
IV 12	.092	.126	.047	.725	.469
IV 13	-.019	.094	-.016	-.206	.837
IV 14	.134	.151	.062	.887	.376
IV 15	-.028	.281	-.009	-.098	.922
IV 16	-.453	.097	-.408	-4.680	.000
IV 17	.379	.329	.115	1.152	.251
IV 18	.026	.086	.035	.299	.765
IV 19	-.027	.087	-.040	-.307	.760
IV 20	.118	.067	.161	1.767	.079
IV 21	.073	.164	.033	.448	.655
IV 22	.027	.041	.047	.651	.516
IV 23	-.028	.055	-.039	-.506	.613

Table 6: Regression analysis for DV 2, which stands for satisfaction with the digitalization efforts

DV 3: Satisfaction with the available payment methods

According to Figure 12, nearly 90 people from the sample did not answer the question as they do not pay for the appointment. However, for those who pay, the healthcare centers have a satisfactory range of payment methods available.

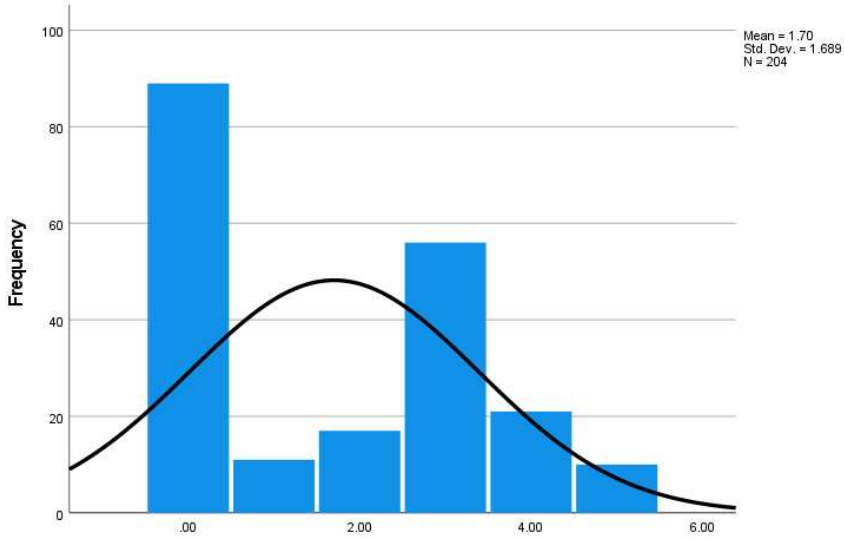

Figure 12: Responses to the question related to DV 3, which denotes satisfaction with the available payment methods

Table 7 furnishes essential statistics derived from the regression analysis alongside their interpretations.

Model Summary	Values	Meaning
R	0,729	The IV's together have a moderate relationship with this DV
R Square	0,531	A good amount of the variability in the DV is explained by the IV's (53,1%)
Adjusted R Square	0,471	The model moderately explains variability in the DV after adjusting for predictors.
Standard Error	1.22788	On average, the observed values deviate from the predicted values by 1.22 units

Table 7: Key statistics related to the model to estimate DV 3, which stands for satisfaction with the available payment methods, and their meanings

Table 8 illustrates the significance level of the regression model formulated for estimating DV 3, namely, satisfaction with the available payment methods. With a corresponding p-value of almost 0.00, the variables taken together have a significant impact on predicting the mentioned satisfaction.

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	307.376	23	13.364	8.864	.000
Residual	271.384	180	1.508		
Total	578.760	203			

Table 8: Significance level of the regression model to estimate DV 3, standing for satisfaction with the available payment methods

Based on the data presented in Table 9, it has been observed that IVs 22 and 23 have a significant positive impact on satisfaction with DV 3. These factors are related to the availability and preference of payment methods. This means that patients who have access to more than one payment method, including a self-check-in machine at their healthcare center, and prefer using this platform, are more satisfied with the available payment methods. However, if patients face difficulty in finding the self-check-in machines, it may negatively affect their satisfaction with the available payment methods.

Regression Analysis	Unstandardized Beta	Coefficients Std. Error	Std. Coefficients Beta	t	Sig.
IV 1	.099	.059	.103	1.679	.095
IV 2	-.031	.208	-.008	-.151	.880
IV 3	.011	.114	.005	.093	.926
IV 4	-.120	.142	-.046	-.843	.400
IV 5	0.003	.022	.008	.152	.880
IV 6	-.072	.182	-.025	-.397	.692
IV 7	.153	.163	.058	.943	.347
IV 8	-.014	.088	-.010	-.163	.871
IV 9	.028	.099	.017	.283	.777
IV 10	.254	.209	.086	1.212	.227
IV 11	-.437	.272	-.104	-1.603	.111
IV 12	-.208	.183	-.062	-1.139	.256
IV 13	-.212	.137	-.101	-1.549	.123
IV 14	-.370	.218	-.100	-1.696	.092
IV 15	-.055	.407	-.011	-.136	.892
IV 16	-.401	.140	-.210	-2.863	.005
IV 17	.334	.476	.059	.701	.484
IV 18	-.123	.124	-.099	-.995	.321
IV 19	.080	.126	.069	.635	.526
IV 20	.220	.097	.174	2.274	.024
IV 21	-.532	.237	-.141	-2.239	.026
IV 22	.329	.059	.342	5.575	.000
IV 23	.547	.080	.444	6.831	.000

Table 9: Regression analysis for DV 3, which stands for satisfaction with the available payment methods

DV 4: Satisfaction with the transparency and clarity of the payment process

Figure 13 shows that the big majority of respondents are satisfied with the transparency and clarity of the payment process.

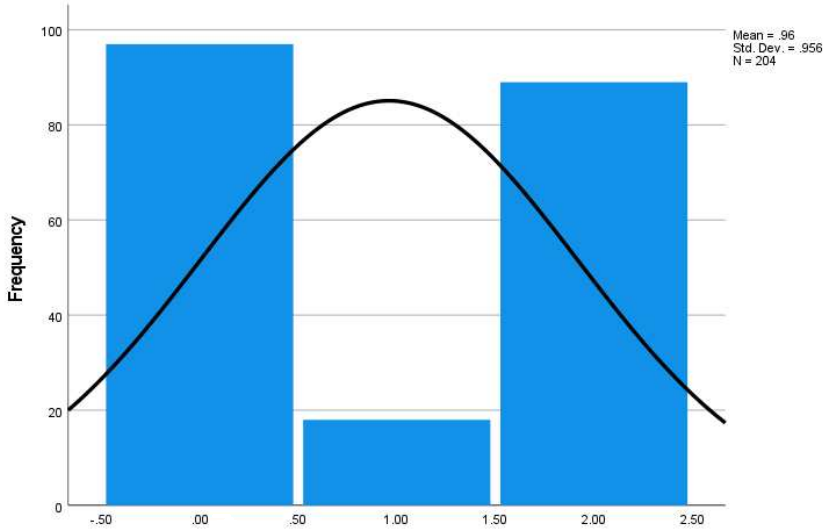

Figure 13: Responses to the question related to DV 4, which denotes satisfaction with the transparency and clarity of the payment process

Table 10 presents key statistics derived from the regression analysis along with their respective meaning.

Model Summary	Values	Meaning
R	0,747	The IV's together have a moderate relationship with this DV
R Square	0,558	A good amount of the variability in the DV is explained by the IV's (55,8%)
Adjusted R Square	0,501	The model moderately explains variability in the dependent variable after adjusting for predictors.
Standard Error	0,67535	On average, the observed values deviate from the predicted values by approximately 0.67 units

Table 10: Key statistics related to the model to estimate DV 4, which stands for satisfaction with the transparency and clarity of the payment process, and their meanings

Table 11 illustrates the significance level of the regression model formulated for estimating DV 2, namely, satisfaction with the transparency and clarity of the payment process. With a corresponding p-value of almost 0.00, the variables taken together have a significant impact on predicting the mentioned satisfaction.

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	103.589	23	4.504	9.875	.000
Residual	82.098	180	.456		
Total	185.686	203			

Table 11: Significance level of the regression model to estimate DV 4, standing for satisfaction with the transparency and clarity of the payment process

As in the previous model, it was observed that variables 22 and 23 have the most positive impact on the satisfaction of DV 4. This indicates that patients who have access to multiple payment options, including a self-check-in machine, and prefer to pay through this platform, are more satisfied with the transparency and clarity of the payment process. However, it was also found that the ease of finding the self-check-in machines has a negative impact on the aforementioned satisfaction.

Regression Analysis	Unstandardized Beta	Coefficients Std. Error	Std. Coefficients Beta	t	Sig.
IV 1	.063	.032	.115	1.925	.056
IV 2	-.019	.115	-.009	-.166	.868
IV 3	.046	.063	.039	.727	.468
IV 4	-.033	.078	-.022	-.416	.678
IV 5	-.001	.012	-.003	-.051	.960
IV 6	-.191	.100	-.116	-1.914	.057
IV 7	-.009	.089	-.006	-.100	.921
IV 8	-.039	.049	-.046	-.794	.428
IV 9	.039	.055	.043	.718	.474
IV 10	.092	.115	.055	.796	.427
IV 11	-.384	.150	-.161	-2.566	.011
IV 12	-.273	.101	-.143	-2.713	.007
IV 13	-.072	.075	-.061	-.956	.340
IV 14	-.253	.120	-.121	-2.108	.036
IV 15	.185	.224	.065	.824	.411
IV 16	-.239	.077	-.221	-3.098	.002
IV 17	.144	.262	.045	.548	.584
IV 18	-.036	.068	-.051	-.524	.601
IV 19	.070	.070	.107	1.014	.312
IV 20	-.001	.053	-.002	-.024	.981
IV 21	-.384	.131	-.179	-2.936	.004
IV 22	.129	.032	.237	3.975	.000
IV 23	.334	.044	.479	7.585	.000

Table 12: Regression analysis for DV 4, which stands for satisfaction with the transparency and clarity of the payment process

5.3.3. Discussion of Findings

The section presents the findings of the analysis aimed at understanding the impact of independent variables on patient satisfaction in Portuguese healthcare centers. The research includes four dependent variables: satisfaction with the admission process's speed and efficiency, satisfaction with digitalization efforts, satisfaction with available payment methods, and satisfaction with the transparency and clarity of the payment process.

Key findings can be summarized as follows:

- Satisfaction with Admission Process Speed and Efficiency: There is moderate satisfaction, with significant factors including the need to pay for an appointment and the available payment methods positively influencing satisfaction. The ease of finding self-check-in machines negatively influenced satisfaction.
- Satisfaction with Digitalization Efforts: Similarly, there is moderate to high satisfaction, with the size of the healthcare center positively affecting satisfaction. The ease of finding self-check-in machines negatively influences satisfaction.
- Satisfaction with Available Payment Methods: for those who pay, there is moderate satisfaction. Variables related to payment methods, especially the variety of available options, significantly influence satisfaction. Again, the ease of finding self-check-in machines has a negative impact.
- Satisfaction with Transparency and Clarity of the Payment Process: a majority are satisfied with the transparency and clarity of the payment process. The availability of more than one payment method and the ease of finding self-check-in machines significantly influence satisfaction levels.

Overall, the facility of finding self-check-in machines and the diversity of payment methods consistently influenced patient satisfaction across different areas.

6. Conclusions

6.1. General Conclusions

The goal of this research was to discover how patients react to the digitalization and lean techniques that have been implemented in healthcare centers in Portugal. For this research, we develop a questionnaire and conduct correlation and regression analyses to investigate the impact of diverse independent variables on four dependent variables.

The analysis revealed that the majority of the independent variables included are not significant for the patient's satisfaction. However, a specific variable demonstrates relevance across all dependent variables: the ease of locating the self-check-in machines. In every regression model, it was clear that this variable is a relevant predictor of patient satisfaction.

Regarding the dependent variables concerning the payment processes, the two main predictors of satisfaction are the available payment methods at the healthcare centers and the preferred payment methods of each respondent.

These conclusions are somewhat aligned with the literature review made on this research, since the main predictors of satisfaction in previous articles are related to accessibility in healthcare facilities.

In summary, these findings offer a well-defined path for future investigation. It's evident that patients support digitalization and prefer it when receiving care in hospitals; nonetheless, for this to occur, users must have access to digital platforms that are simple to locate and use.

6.2. Theoretical Contributions

This research makes significant contributions to the existing body of knowledge in the intersection of lean practices, digitalization, and healthcare, particularly focusing on the impact on patient satisfaction. By exploring the implementation of self-check-in kiosks in healthcare settings, this study contributes to the understanding of how lean principles can be applied in an industry that has traditionally been characterized by complex processes and paperwork.

Healthcare, being a highly regulated and dynamic sector, presents a unique context for the implementation of lean principles. Understanding the theory behind the integration of lean practices helps us apply them effectively across various industries, leading to greater efficiency, productivity, and innovation in our work.

Furthermore, the research contributes to the discourse on digitalization in healthcare, shedding light on the specific role of self-check-in kiosks in enhancing patient experience. By delving into the intricate dynamics between technological advancements and patient satisfaction, the study adds nuance to the broader discussions surrounding the digital transformation of healthcare services.

6.3. Managerial Implications and Recommendations

For healthcare managers and practitioners, the findings of this research offer valuable insights that can inform strategic decision-making. The successful implementation of self-check-in kiosks necessitates a comprehensive understanding of the operational changes required. Managers should consider

investing in staff training programs to ensure a smooth transition and to address any potential resistance to change among professionals.

The study suggests that healthcare organizations should view lean practices and digitalization as cultural transformations, fostering a culture of continuous improvement and embracing digital solutions. Prioritizing user-centered design and accessibility, soliciting patient feedback, and employing effective communication strategies are crucial for satisfaction and ensuring the technology meets their needs.

6.4. Limitations and Future Research

While this study aimed to explore the impact of quality improvement, knowledge management, lean techniques, and digitalization on patient satisfaction in the healthcare industry, it is essential to acknowledge certain limitations that may have affected the depth and breadth of our analysis. The lack of access to internal data within healthcare centers hindered the study's ability to fully understand the role of lean principles in improving patient satisfaction outcomes.

It’s important to highlight the need for further investigation into the relationship between quality improvement initiatives and patient satisfaction in healthcare. It emphasizes the importance of understanding the mechanisms through which these methodologies influence patient perceptions of care quality and satisfaction levels. Additionally, future research should focus on knowledge management strategies within healthcare organizations and their implications for patient satisfaction. These findings could enhance our understanding of factors influencing patient satisfaction in the healthcare industry and enable targeted interventions to optimize patient-centered care delivery.

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Appendix

Appendix A: Survey Conducted

SURVEY
DEMOGRAPHIC INFORMATION
1. Qual é a sua faixa etária? (What is your age?)
2. Qual é o seu género? (What is your gender?)
3. O Centro de Saúde que visita para tratamentos gerais, que não urgências, é (The healthcare center that you visit for general treatments, not emergencies, is)
4. Como é que considera o seu Centro de Saúde em termos de número de pacientes? (How do you consider you healthcare center in terms of number of patients?)
5. Em que distrito é o seu Centro de Saúde? (In which district is your healthcare center?)
6. Com que frequência visita este Centro de Saúde para tratamentos gerais? (How frequently do you visit this healthcare center?)
7. Quando foi a última vez que visitou este Centro de Saúde? (When was the last time you visited this healthcare center?
8. Como é que normalmente marca uma consulta neste Centro de Saúde? (How do you normally schedule an appointment in this healthcare center?)
HEALTHCARE DIGITALIZATION
9. O quão confortável se sente ao utilizar plataformas digitais para tarefas/funções relacionadas com a saúde? (How comfortable do you feel about using digital platforms for health-related tasks?)
10. Acredita que a passagem de certas tarefas/funções manuais para digitais no setor da saúde podem promover um aumento da eficiência das instituições de saúde? (Do you believe that the digitalization of certain tasks in the healthcare sector can lead to an increase of the efficiency in the institutions?)
11. Acredita que a passagem de certas tarefas/funções manuais para digitais no setor da saúde podem promover uma melhor comunicação com os prestadores de cuidados de saúde? (Do you believe that the digitalization of certain tasks in the healthcare sector can promote a better communication with the healthcare providers?)
12. Tem preocupações relativas à segurança e privacidade dos seus dados ao utilizar plataformas digitais de saúde? (Do you have concerns related to security and data privacy while using digital platforms for healthcare?)
THE CHECK-IN PROCESS
13. Das opções abaixo, selecione as que podem ocorrer no seu Centro de Saúde. Se ambas forem possíveis, por favor selecione ambas. (From the options below, select the ones that can occur in your healthcare center. Please select both, if both are possible.)
14. Qual das opções acima mencionadas prefere para completar o seu check-in no Centro de Saúde? (From the options mentioned above, what option do you prefer to complete your check-in in the healthcare center?)
15. É fácil para si encontrar os locais abaixo referidos no seu Centro de Saúde? (Is it easy for you to find the locations mentioned below in your healthcare center?)

16. Escolha a resposta que acha mais adequada para cada citação. (Choose the answer more adequate for each citation below)
17. Numa escala de 1 a 5, o quão satisfeito está com a rapidez e eficiência do processo de admissão no seu Centro de Saúde? (On a scale from 1 to 5, how satisfied are you with the speed and efficiency of the admission process in your healthcare center?)
18. Numa escala de 1 a 5, o quão satisfeito está com os esforços de tornar os processos digitais no seu Centro de Saúde? (On a scale from 1 to 5, how satisfied are you with the digitalization efforts in your healthcare center?)
THE PAYMENT PROCESS
19. No seu Centro de Saúde, precisa de pagar por uma consulta? (In your healthcare center, do you need to pay for an appointment?)
20. Se tem de pagar a sua consulta, quais são os métodos de pagamento disponíveis no seu Centro de Saúde? (If yes, what are the payment methods available in your healthcare center?)
21. Se tem de pagar pela sua consulta, qual é o método que prefere para realizar o pagamento? (If yes, what is your prefered payment method?)
22. Se tem de pagar pela sua consulta, o quão satisfeito está com as opções que estão disponíveis para pagamento? (If yes, how satisfied are you with the available options for payment?)
23. Se tem de pagar pela sua consulta, quão satisfeito está com a transparência e clareza do processo de pagamento no seu Centro de Saúde? (If yes, how satisfied are you with the transparency and clarity of the payment process in your healthcare center?)

Appendix B: List of Variables

Variable	Explanation
IV 1	Age
IV 2	Gender
IV 3	Type of healthcare center
IV 4	Size of healthcare center
IV 5	District of healthcare center
IV 6	Number of visits to the healthcare center
IV 7	Last time that visited the healthcare center
IV 8	How the patient normally schedules an appointment
IV 9	Comfortability about using digital platforms for health-related tasks
IV 10	The belief that the digitalization of certain tasks in the healthcare sector can lead to an increase in the efficiency of the institutions

IV 11	The belief that the digitalization of certain tasks in the healthcare sector can promote better communication with the healthcare providers
IV 12	Concerns related to security and data privacy while using digital platforms for healthcare
IV 13	Options available for the admission process at the healthcare centers
IV 14	Preferred method of the admission process at the healthcare center
IV 15	Easiness to find the reception
IV 16	Easy to find the self-check-in machines
IV 17	Easiness to find the waiting room
IV 18	The respondents believe that the self-check-in machine reduces the waiting time of the check-in process in the healthcare center
IV 19	The respondents believe that the digital machine used in the check-in process is intuitive and easy to use
IV 20	The respondents believe that there is information clarity throughout the entire check-in process at the healthcare center
IV 21	Need to pay for an appointment in the healthcare center
IV 22	Payment methods available in the healthcare center
IV 23	Preferred payment methods
DV 1	Satisfaction with the speed and efficiency of the admission process
DV 2	Satisfaction with the digitalization efforts in the healthcare center
DV 3	Satisfaction with the available options for payment
DV 4	Satisfaction with the transparency and clarity of the payment process

Appendix C: Correlation Analysis

	IV 1	IV 2	IV 3	IV 4	IV 5	IV 6	IV 7	IV 8	IV 9	IV 10	IV 11	IV 12	IV 13	IV 14
IV 1	1,000													
IV 2	-0,094	1,000												
IV 3	-0,104	0,138	1,000											
IV 4	0,016	-0,116	-0,056	1,000										
IV 5	0,197	-0,199	-0,109	0,101	1,000									
IV 6	0,189	-0,111	-0,116	0,091	0,143	1,000								
IV 7	-0,138	0,064	0,107	-0,007	-0,068	-0,450	1,000							
IV 8	-0,055	-0,049	0,036	0,159	0,021	0,051	-0,033	1,000						
IV 9	0,198	-0,007	-0,051	0,028	0,065	0,081	-0,035	-0,298	1,000					
IV 10	0,248	-0,097	-0,151	0,022	0,005	0,053	-0,072	-0,043	0,415	1,000				
IV 11	0,150	-0,107	-0,012	0,025	0,005	0,024	-0,084	-0,113	0,219	0,549	1,000			
IV 12	-0,221	-0,031	0,064	0,026	-0,065	-0,077	0,127	0,061	-0,078	-0,153	-0,114	1,000		
IV 13	0,066	-0,053	-0,095	0,170	0,062	0,199	-0,218	0,172	-0,006	-0,006	0,084	-0,008	1,000	
IV 14	-0,181	0,013	0,116	0,021	0,053	0,110	0,033	0,151	-0,181	-0,139	-0,072	0,022	0,255	1,000
IV 15														
IV 16														
IV 17														
IV 18														
IV 19														
IV 20														
DV 1														
DV 2														
IV 21														
IV 22														
IV 23														
DV 3														
DV 4														

DV 4	DV 3	IV 23	IV 22	IV 21	DV 2	DV 1	IV 20	IV 19	IV 18	IV 17	IV 16	IV 15
0,160	0,128	0,048	-0,049	0,114	0,020	0,023	-0,242	-0,315	-0,369	-0,031	-0,207	0,041
0,039	0,015	0,087	-0,045	-0,038	-0,014	0,058	0,057	0,086	0,035	0,061	0,148	0,046
0,174	0,131	0,220	0,165	-0,224	-0,087	-0,125	-0,124	-0,063	0,011	0,023	0,065	-0,023
-0,010	-0,002	0,018	0,114	0,033	0,195	0,111	0,023	-0,050	-0,039	-0,029	-0,100	0,017
-0,107	-0,090	-0,167	-0,060	0,188	0,045	0,015	-0,093	-0,151	-0,127	-0,030	-0,164	-0,079
-0,114	-0,059	-0,027	-0,049	0,192	0,117	0,144	0,006	-0,066	0,021	0,090	-0,261	0,018
0,100	0,115	0,137	0,068	-0,217	-0,142	-0,124	-0,004	0,134	0,133	0,032	0,304	0,043
0,005	0,039	0,107	0,027	-0,113	0,190	0,124	0,023	-0,034	0,077	0,106	-0,117	-0,024
0,008	-0,024	-0,105	-0,085	0,090	-0,273	-0,202	-0,116	-0,178	-0,173	0,103	-0,014	0,162
-0,034	-0,019	-0,112	-0,085	0,090	-0,228	-0,076	-0,078	-0,060	-0,113	0,111	0,015	0,220
-0,040	-0,015	-0,014	0,090	-0,014	-0,092	-0,053	-0,144	-0,119	-0,141	0,095	-0,052	0,185
-0,167	-0,084	-0,018	0,049	0,021	0,064	0,101	0,085	0,057	0,155	-0,024	0,049	0,022
-0,064	-0,066	-0,038	0,012	0,124	0,287	0,293	0,073	-0,101	-0,014	0,020	-0,528	-0,032
-0,052	-0,016	0,168	0,053	-0,009	0,179	0,142	0,191	0,205	0,290	-0,043	-0,141	-0,061
0,025	-0,023	-0,034	-0,050	0,027	-0,047	0,033	-0,047	-0,101	-0,107	0,738	0,144	1,000
0,013	0,027	0,126	0,129	-0,210	-0,407	-0,342	0,135	0,364	0,284	0,192	1,000	
0,044	0,019	0,000	0,037	-0,053	-0,029	-0,064	-0,094	-0,149	-0,144	1,000		
-0,098	-0,037	0,082	-0,031	-0,018	0,009	0,079	0,632	0,820	1,000			
-0,025	0,031	0,112	-0,058	-0,058	-0,037	0,060	0,696	1,000				
-0,130	-0,005	-0,070	-0,088	0,116	0,139	0,222	1,000					
-0,014	0,037	-0,056	0,008	0,268	0,649	1,000						
0,015	0,020	-0,048	-0,001	0,118	1,000							
-0,453	-0,417	-0,451	-0,376	1,000								
0,436	0,509	0,423	1,000									
0,622	0,601	1,000										
0,845	1,000											
1,000												