Open Access model as an intervention to improve outpatient waiting time management

Nunzio Zotti, Francesca Di Serafino, Grazia Luchini, Silvia Briani, Angelo Baggiani, Alberto Tulipani, Jacopo Guercini*

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This study analyzes Azienda Ospedaliero-Universitaria Pisana's implementation of the Open Access model for managing outpatient waiting lists. The Open Access model aims at guaranteeing services within three days and works by daily progressive opening of scheduling slots. The analysis focuses on policies that rule the access to specialist visits and diagnostic tests, revealing significant increase in the percentage of visits within national times standards. Waiting times for first availability drastically decreased with the introduction of the Open Access model. Effective management of waiting lists is essential for timely access to healthcare services. Digital tools and proper monitoring structures are crucial in detecting anomalies and ensuring a well-functioning decision support system.

Keywords: patient waiting times, outpatient visits, outpatient waiting lists, access to care, health care organization, lean healthcare management.

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SOMMARIO

1. Introduction

Among health managers, the perception of waiting times and patient dissatisfaction has been an ongoing and

* *Nunzio Zotti*, Department of Translational Research and the New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy.

Francesca Di Serafino, Department of Translational Research and the New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy.

Grazia Luchini, Azienda Ospedaliero Universitaria Pisana (AOUP), Pisa, Italy.

Silvia Briani, Azienda Ospedaliero Universitaria Pisana (AOUP), Pisa, Italy.

Angelo Baggiani, Department of Translational Research and the New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy.

Alberto Tulipani, Azienda Ospedaliero Universitaria Pisana (AOUP), Pisa, Italy.

Jacopo Guercini, Azienda Ospedaliero Universitaria Pisana (AOUP), Pisa, Italy. *Corresponding Author*: Jacopo Guercini. Azienda Ospedaliero-Universitaria Pisana, Pisa, Italy. Tel. 050 993082; Fax. 050 993990; E-mail: jacopo.guercini@ao-pisa.toscana.it.

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frequently discussed topic of concern (Okuda, Yasuda and Tsumoto, 2017). The increasing demand for healthcare services, coupled with limited resources and the need to invest efforts in error prevention, has led to the reorganization of healthcare operations (Camgoz Akdag *et al.*, 2018).

In the context of the regional organization of health care, the management of waiting lists certainly constitutes one of the most critical aspects of a healthcare system, especially for the Italian one organized as a universal healthcare system, institutionally deputed to respond to citizens' demand for medical services in conditions of equal access and in times compatible with the treatment needs required by the specific health conditions of each of them. Waiting lists represent the excess of demand that the system can ensure in a specific time frame. Patients are thus placed on waiting lists for a service that should still be guaranteed within a reasonable period, also according to the current legislation. Improvement in patients' waiting time will have a positive impact on both patients' satisfaction and the overall quality of healthcare services (Almomani and AlSarheed, 2016) (McCarthy, McGee and O'Boyle, 2000).

Waiting time for outpatient services is generally defined as the time between the booking of an outpatient specialist service and when it is provided. Waiting time, however, can be calculated *ex ante*, which indicates the best time offered to the user at the time of booking (first availability), or *ex post*, which indicates the actual time the patient waited to receive the service.

Outpatient clinics play a crucial role in various activities, requiring effective information management, accurate data utilization, efficient resource allocation, and timely execution of processes to ensure smooth patient flow within the clinic (Hall, 2013) (Rohleder *et al.*, 2011).

Nonetheless, as described by Noon, Hankins and Côté (2003), the variability in patient arrival times and service durations often leads to patient waiting, despite having reserved time slots. Additionally, many outpatient clinics follow the practice of scheduling multiple patients concurrently, ensuring the availability of patients for doctors or other valuable and limited healthcare resources. However, if all scheduled patients arrive on time or early, significant patient waiting becomes unavoidable.

The efficient and effective implementation of policies to govern the phenomenon of waiting lists requires the adoption of appropriate organizational booking facilities characterized by the principles of transparency of the so called *agenda* (booking diary – a computerized or paper-based tool used to manage the booking calendar for services) as well as the criteria of flexibility, in order either to contain the risk of underutilization of the care facilities and also to maximize the compliance with the maximum clinically appropriate waiting time (ranged by the physician on a scale of priority). Likewise, it is necessary to have adequate control structures aimed at detecting any anomalies in a timely manner and, above all, to monitor the proper functioning of the entire system of access to care through inclusion on the list.

Waiting lists are a significant concern within the Italian healthcare system. A substantial majority of Italians, over

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70%, perceive long waiting times as a major challenge. While the majority express satisfaction with the quality of care received, the prominence of waiting lists poses a threat to the prestige and public trust in the healthcare system. Reports received by Cittadinanzattiva (2019) indicate that delays and waiting times for treatments accounted for 58.2% of complaints, while for diagnostic tests comprised 33.2%. It is well-known that patients resort to private healthcare facilities, or physicians' private practice within public facilities (*intramoenia*, as stated in Italian law), to bypass prolonged waiting periods for specialist visits and diagnostic examinations. To mitigate this issue, it is essential to establish a coordinated approach that unifies the service providers and streamlines the demand for services. This can be achieved by adopting a centralized Single Booking Center (in Italian *Centro Unico di Prenotazione*-CUP) that acts as a focal point for scheduling appointments. Traditional planning models tend to protect current capacities by pushing demands into the future, while the Open Access model prioritizes immediate access to care while safeguarding future capacities. By implementing differentiated pathways for patients requiring specialist visits or further investigations, overlapping and delays can be minimized. Swift access to initial appointments is crucial for patient well-being, and the Open Access model, successfully implemented in Pisa, aims to accomplish this within three days. For subsequent visits or follow-ups, the focus shifts from "waiting lists" to "booking lists," where patients receive appointments directly from the attending physician's support staff, avoiding additional visits to the CUP. This approach ensures continuity of care and optimizes resource allocation within the healthcare system.

In recent years, there has been a growing recognition of the need for more efficient and effective management of waiting lists. To address this challenge, innovative models have been developed and tested to improve the overall process.

To ensure the successful implementation of these models, facilities have started incorporating them into their implementation plans. This strategic foresight allows organizations to proactively manage and anticipate customer demand while simultaneously adjusting their service offerings accordingly. By aligning demand and supply, healthcare facilities can optimize their resources, allocate them more efficiently, and provide timely access to outpatient services.

Also no-show rates can benefit from OA model, expecially in underserved populations with high baseline no-show rates. While OA brings marked improvements for practices with high no-show rates, its effectiveness diminishes for those with lower baseline no-show rates. (Rose, Ross, Horwitz, 2011).

Following Lean healthcare management theories, many approaches have made-up to face the excess of demand and the lack of resources. As shown by Lot *et al.* (2018), deep Lean analysis of outpatient flows lead to understand the variable understanding to creation of delays and worsening of balancement in access to care. In some cases, it could make sure that countermeasures will be taken, reducing waiting times for patients.

Similarly, it has been proved that a significant improvement in waiting

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times may be achieved by applying an analythical approach, even without increasing resources (Johannessen e Alexandersen, 2018). The most common outcomes of Lean in healthcare include time-savings and timeliness of service. (Barnabè, Guercini and Di Perna, 2019).

The Lean intervention is a highly effective approach to boost an organization's ability to create value. It achieves this by reducing waste, optimizing processes, and enhancing operational efficiency. By eliminating non-value-added activities and streamlining operations, Lean empowers organizations to meet customer needs more effectively. It fosters a culture of continuous improvement, where employees actively contribute to identifying and addressing inefficiencies. Through standardization and visual management techniques, Lean provides clarity and accountability, enabling teams to work more efficiently. These interventions also emphasize employee empowerment and engagement, encouraging them to take ownership and to contribute with innovative ideas. By promoting streamlined flow and flexibility, Lean enables organizations to respond swiftly to customer demands and adapt to changes. Moreover, Lean interventions often result in significant cost reductions, which can be reinvested in value-adding activities. Overall, Lean has a proven track record of enhancing an organization's value creation capabilities, making it more competitive, customer-centric, and sustainable (Condel, Sharbaugh and Raab, 2004).

The application of Lean principles in healthcare has been demonstrated crucial in improving patient flow within the Emergency Department (ED). Embracing the lean approach is essential for enhancing the delivery of high-quality emergency care and ensuring patient satisfaction (Chan *et al.,* 2014) (Holden, 2011).

Pursuing Lean management principles, one such approach gaining popularity is the concept of Open Access (OA). This term refers to a system where patients can access services (visits or exams) without unnecessary delays or hurdles. By implementing OA, healthcare system aims to enable individuals to receive timely care and support when needed.

Given this, the Azienda Ospedaliero-Universitaria Pisana (AOUP) adopted OA model, in collaboration with General Practitioners, which provides health services delivery within 3 days with daily sliding (and for clinically motivated cases to 5/7 days) of outpatient services monitored by the Regional Plan for Waiting List Management (PRGLA 2019-2021, DGRT n. 604, May 6th 2019) based on balancing supply and demand on a predefined geographical area of guarantee.

The OA model implemented at the University Hospital in Pisa represents a significant shift in addressing waiting lists in healthcare. It focuses on efficiently managing patient flows and segmenting different types of services, rather than simply increasing resources. This model has been developed in collaboration with ASL Toscana Nord-Ovest (ATNO), the local healthcare company, as part of an integrated care system.

The key to its success lies in separating initial visits from follow-up visits, accurately assessing monthly demand for specific services, maintaining a bal-

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ance between demand and supply, and implementing a dynamic scheduling system. This system ensures that the first visit is scheduled within three days and guarantees timely scheduling of follow-up visits for patients already under hospital care.

The experience and success of this model was well described by Carlo Tomassini, the former general director of the Azienda Ospedaliero-Universitaria Pisana, in a book titled "Waiting Lists in Healthcare. The Solution of Open Access". Indeed, it has effectively reduced waiting times from 7-8 months to just 3 days in the Azienda Ospedaliero-Universitaria Pisana, for certain services that are required to be timely guaranteed. The Open Access model challenges the conventional belief that increasing resources and supply is the only solution to waiting lists. Instead, it emphasizes the importance of understanding and managing the constant and predictable demand for healthcare services. By aligning supply with demand in real-time, the model ensures timely access to care, increases patient satisfaction, and avoids unnecessary reliance on external private providers. While the Open Access model cannot be immediately implemented across the entire region, as it requires extensive involvement from medical professionals and healthcare facilities, its success in Pisa demonstrates its potential to revolutionize waiting list management and improve healthcare services (Tomassini, 2019).

OA is based on Lean methodology, aiming to minimize waste and optimize processes, based on patient flow segmentation, organizing efficiently different visits and exams considering patients' needs.

OA was introduced for the first time in AOUP in 2015, when Cardiology outpatients clinics felt a necessity for improvement. Subsequently it was extended to other 12 outpatient services with high-demand wating lists, such as abdomen US-scan, breast unit US-scan, ophthalmology, thorax CT-scan, neurology, ENT, etc.

The services organized with the Open Access model are dedicated to GP prescriptions for residents in predefined areas on the basis of the PRGLA, adjusted by agreements signed with ATNO and authorized by the Tuscany Region. To maximize the efficiency of the three days shifting in booking slots, normally the offer should be evenly distributed over the entire week.

Prioritization by the physician is a classification system to differentiate access to appointments in relation to the user's health condition and thus the severity of the clinical status.

To ensure universal access to services, the implementation of the Open Access model requires the activation of a parallel *agenda,* in standard model of booking, dedicated to residents outside of the geographical area of guarantee.

The field is an alphabetical character on the prescription with the following coding:

- U = Urgent (as soon as possible or, if deferrable, within 72 hours);
- B = Brief (within 10 days);
- D = Deferrable (within 30 days for visits or within 60 days for instrumental services);
- P = Programmable (within 120 days).

The AOUP Outpatient Steering Committee closely monitors, on daily

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basis, the proper utilization of the booking slots and notifies the AOUP Departmental contacts and the directors of the facilities concerned for the agenda involved in order to plan a re-evaluation of the offer. On daily basis, the balance of supply and demand is monitored for services provided in OA mode through specific reporting by the Outpatient Steering Committee. The report is shared with the Directors and Coordinators of facilities delivering services guaranteed in Open Access model for appropriate evaluations. In case of difficulties, there is an economic allowance in the AOUP budget, specifically aimed at the provision of additional services to ensure waiting times within given limits.

AOUP has currently implemented the Open Access model for the following services:

Type of services currently offered in Open Access model in AOUP
Cardiology visits (including Electrocardiogram and Echocardiography)
Vascular surgery visit
Endocrinological visit
Neurological visit
Ophthalmologic visit
Orthopedic visit
Gynecological visit
Otolaryngological visit
Urological visit
Dermatological visit
Gastroenterological visit
Pulmonary visit
General surgery visit
Rheumatological visit
Allergology visit
Chest CT scan
Breast ultrasound
Thyroid ultrasound
Musculoskeletal ultrasonography
Colonoscopies
Esophagogastroduodenoscopies

The analyses conducted had to take into account the impact of the Covid-19 pandemic spread on the sustainability of healthcare provision, resulting in the need for reorganization of the latter due to limitations in access to hospital and healthcare facilities.
Our experience is intended to be useful to the literature because of its methodology in addressing the issue

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of waiting times and patient access to health care services through a completely new model. The absence of previous studies on this specific topic could make it a pioneering contribution to the field of healthcare management, as well as provide insights and framework for addressing the challenges of waiting lists in healthcare. Our work is not only intended to add to the existing body of knowledge, but also to be a reference for future research and potential applications of the OA model in healthcare systems facing similar problems of patient access and waiting times.

2. Methods

2.1. Data preparation

To give quantitative evidence of the phenomenon, we observed the outpatient data flow of the AOUP, from January 1st, 2019 to December 31st, 2021, considering only the services monitored for waiting times in the 2019-2021 PRGLA.
To accomplish the aim of the study, we conducted an analysis of waiting lists for visits and diagnostic services prescribed by GPs limited to the 7 branches of specialties where OA was introduced in the middle of 2020: Allergology, General Surgery, Endocrinology, Gastroenterology, Orthopedics, Pneumology, and Rheumatology. The data from the waiting lists were provided as 15-days means, representing the period from the 1st to the 15th day of the month or from the 16th day to the end of the month. This approach yielded two values for each month, allowing us to track the changes over time.
Although OA is applied in part of the ATNO, the AOUP model was chosen because of the effects that can be evaluated in a restricted health care setting, such as a hospital. Collaboration with general practitioners (GPs) and the rest of the ATNO could demonstrate the timeliness of health service delivery, so this case might provide a platform to study the practical application and results of the OA model in an integrated health system.

We started by identifying the exact date of start of OA for each branch, resulting as follows:

Visit	OA start	15-days reference period
Allergological visit	06/07/20	July, 1st-15th
General Surgery visit	15/06/20	June, 1st-15th
Endocrinological visit	22/06/20	June, 16th-end of the month
Gastroenterological visit	22/06/20	June, 16th-end of the month
Orthopedic visit	22/06/20	June, 16th-end of the month
Pneumological visit	22/06/20	June, 16th-end of the month
Rheumatology visit	15/06/20	June, 1st-15th

We obtained the necessary data from the TAT Regional information flow. This system actively monitors the performance of Tuscan University Hospitals and Local Health Authorities. To facilitate a clearer understanding and analysis, we extracted the raw data and organized it into Microsoft® Excel format.

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2.2. Descriptive analysis

A pre/post analysis was then hypothesized picking the period of one year before and one year after the introduction of OA: 48 15-days periods were then obtained, 24 pre-OA and 24 post-OA. To mitigate biases arising from changes in access to care (such as reduction of hospital visits during the Covid-19 pandemic), we weighted average, variance and standard deviation on the number of visits that made up volumes of patient flow.

To analyze the data obtained, we used RStudio (© 2009-2022 RStudio, PBC), dividing them into pre and post groups. In this way, for each branch were established two initial datasets, one for pre-OA and another for post-OA, including number of visits, time of observation, % of adherence to National standard times and days of waiting.

There wasn't any outpatient activity in the Pneumology branch for 3 periods of 2020, due to Covid-19 pandemic and its impact (May 1st-15th, May 16th-end and June 1st-15th). The same hiatus was found in the Allergology branch, where activities were stopped for one period (June 16th-end, 2020). To cope with these biases, 3 previous periods in the pre-OA group were added for Pneumology and 1 for Allergology, in order to gain the sample size of 24 as stated.

For each waiting list and each two-week period, we considered both the absolute waiting time expressed in days and the % of adherence to National Plan for Waiting List Management (PNGLA 2019-2021, Intesa Stato-Regioni, February 21st 2019). Thus, we obtained a total of 4 smaller datasets for each branch, as listed here:

1) % of adherence pre-OA
2) % of adherence post-OA
3) Waiting days pre-OA
4) Waiting days post-OA

Weighted average (WA), weighted variance (WV), weighted standard deviation (SD), and standard error of the mean (SEM) were calculated for each dataset with the following formulas:

1) WA <– weighted.mean(values, weight)
2) WV <– weightedVar(values, weight)
3) SD <– weightedSd(values, weight)
4) SEM <– SD/sqrt(N)

"Values" contained spot data of % of adherence or days of waiting.
"Weight" contained data from number of visits provided in each period.
"N" was set to 24, referring to the 24 15-days periods pre-OA, and as many of them post-OA.

For each specialty we obtained 16 values as follows:

1) WA
   a) pre
      1. WA of percentage of adherence pre-OA
      2. WA of days of waiting pre-OA
   b) post
      1. WA of percentage of adherence post-OA
      2. WA of days of waiting post-OA
2) WV
   a) pre
      1. WV of percentage of adherence pre-OA

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2. WV of days of waiting pre-OA

b) post

1. WV of percentage of adherence post-OA

2. WV of days of waiting post-OA

3) SD

a) pre

1. Weighted SD of percentage of adherence pre-OA

2. Weighted SD of days of waiting pre-OA

b) post

1. Weighted SD of percentage of adherence post-OA

2. Weighted SD of days of waiting post-OA

4) SEM

a) pre

1. SEM of percentage of adherence pre-OA

2. SEM of days of waiting pre-OA

b) post

1. SEM of percentage of adherence post-OA

2. SEM of days of waiting post-OA

Employing weighted WA, WV, SD and SEM calculations, a total of 112 values resulted, considering the 7 specialties above mentioned. These weight by number of visits in each period, makes sure to take into account eventual variations in patient flow among different years' periods. Additionally, we used unpaired one-tailed t-tests to compare waiting times and adherence before and after the implementation of the OA model for each specialty.

2.3. t-test

Considering the obtained values of WA, SD and N, a pre/post analysis was performed for each specialty using unpaired one-tailed t-test, to compare both the days of waiting time and the percentage of adherence, too. Combining pre-OA and post-OA periods, we calculated t (t), degrees of freedom (df), standard error of a difference (SED) and p-value (p).

By incorporating these statistical methods, we would ensure a robust and data-driven analysis of the impact of OA on waiting times in healthcare.

2.4. Control charts

To better understand the variation between the pre-OA and post-OA periods, control charts were also undertaken using the "ggplot" package installed in RStudio. This was useful for visualizing and assessing the differences in WA, as well as the Upper Control Limit (UCL) and Lower Control Limit (LCL).

So, given WA and SD for each indicator, UCL and LCL were calculated as follows:

UCL <– WA + (1 * SD)
LCL <– WA – (1 * SD)

These limits represented statistically calculated thresholds that indicated the range within which the observed data points should fall under normal circumstances.

By comparing the position of the data points in relation to these control limits, any notable changes or abnormalities in the data could be visually highlighted.

3. Results

3.1. Descriptive analysis (% of adherence)

In the field of Allergology, the implementation of the OA model brought

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about a notable improvement in the percentage of adherence to standard. Prior to the adoption of OA, the percentage of adherence (WA) stood at 72.30%. However, following the implementation of OA, there was a remarkable increase, with the adherence rising to 95.81%. This significant improvement was statistically significant, as evidenced by a p-value < 0.0001. In the context provided, it appears that there have been changes in the values of WV as well as the SD and SEM. Initially, the WV was 0.0137, but it decreased to 0.0038, indicating a shift or improvement in WV over time. Similarly, the SD also underwent a change, decreasing from 0.1172 to 0.0614. The SEM was initially 0.0239 and then 0.0125. t-value was –8.7097 with 34.7307 degrees of freedom.

Significant differences were observed also in the percentage of adherence for General Surgery visits between the pre-OA and post-OA periods. The percentage of adherence WA increased from 89.29% in the pre-OA period to 97.35% in the post-OA period (p < 0.0001). Additionally, there were changes in the WV and SD: WV decreased from 0.0041 to 0.0017 in the post-OA period and the SD also decreased from 0.0638 to 0.0413. The SEM for the percentage of adherence showed a decrease from 0.0130 to 0.0084 in the post-OA period. The t-value for the percentage of adherence in General Surgery visits was –5.1999 with 39.4074 degrees of freedom.

Looking at Endocrinology visits, there was an increase in WA of percentage of adherence, from 85.03% to 94.95% between the two periods analyzed (p < 0.0001). In terms of WV, it increased from 0.0039 to 0.0055, but conversely, SD decreased from 0.0626 to 0.0742. The SEM ranged from 0.0128 to 0.0151. Despite the increase in WV, these findings highlight the positive impact on percentage of adherence in Endocrinology visits. t-value was –5.0058 with 44.7170 degrees of freedom.

Gastroenterology visits demonstrated an improvement in the percentage of adherence WA, increasing from 69.54% in the pre-OA period to 97.75% in the post-OA period (p < 0.0001). Moreover, the WV decreased from 0.0204 to 0.0033. The SD also decreased from 0.1430 in the pre-OA period to 0.0579 in the post-OA period. The SEM passed from 0.0292 to 0.0118. In summary, these findings lead to a t-value of –8.9570 with approximately 30.3551 degrees of freedom.

As for Orthopedics visits, there were relatively stable adherence rates with WA ranging from 83.55% to 96.18% (p < 0.0001). The WV decreased from 0.0039 in the pre-OA period to 0.0032 in the post-OA period. and the SD decreased from 0.0624 to 0.0570. SEM decreased from 0.0127 in the pre-OA period to 0.0116 in the post-OA period. t-value was –7.3201 with 45.6243 degrees of freedom.

With regard to Pneumology, there was a significant increase in the WA percentage of adherence for visits, rising from 75.36% in the pre-OA to 96.71% in the post-OA (p < 0.0001). WV decreased from 0.0111 to 0.0030 and SD decreased from 0.1054 to 0.0551. The SEM decreased from 0.0215 in the pre-OA period to 0.0112 in the post-OA period. The t-value for pneumology visits was –8.793 with 34.7170 degrees of freedom.

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Finally, Rheumatology visits showed the most significant improvement in terms of adherence percentage, with a substantial increase from 68.82% to 98.11% of WA ($p < 0.0001$). WV decreased from 0.0040 in the pre-OA period to 0.0019 in the post-OA period and the SD decreased from 0.0631 to 0.0437. The SEM decreased from 0.0129 in the pre-OA period to 0.0089 in the post-OA period. t-value was −18.6829 with 40.9364 degrees of freedom.

For each branch, control charts have been undertaken regarding percentage of adherence to National standard times, showing commendable improvements of WAs, as well as UCLs and LCLs, visually evident as well. (*Graph. 1-7*)

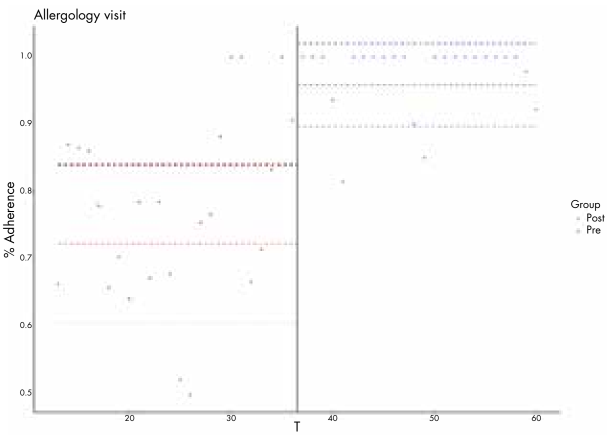

Fig. 1
Allergology percentage of adherence to National standards (WA)

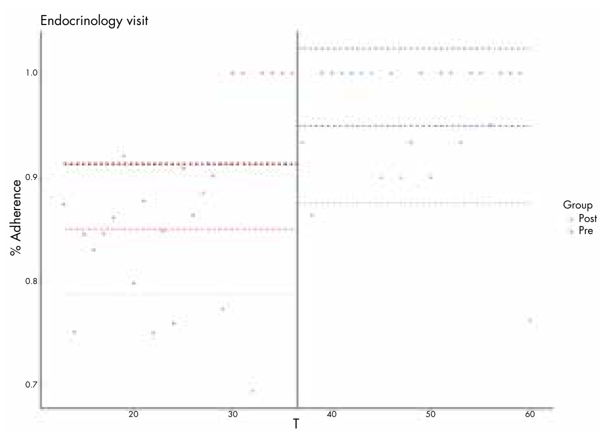

Fig. 3
Endocrinology percentage of adherence to National standards (WA)

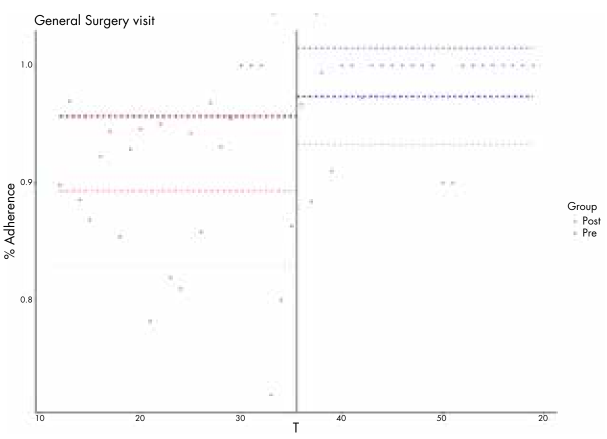

Fig. 2
General Surgery percentage of adherence to National standards (WA)

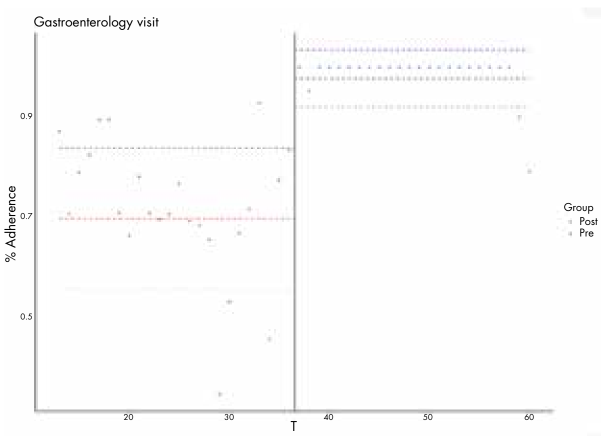

Fig. 4
Gastroenterology percentage of adherence to National standards (WA)

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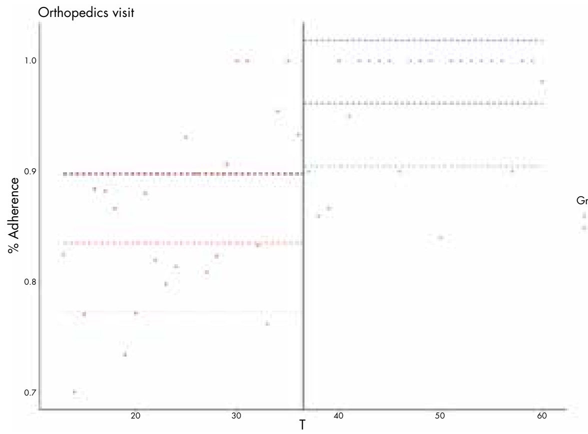

Fig. 5
Orthopedics percentage of adherence to National standards (WA)

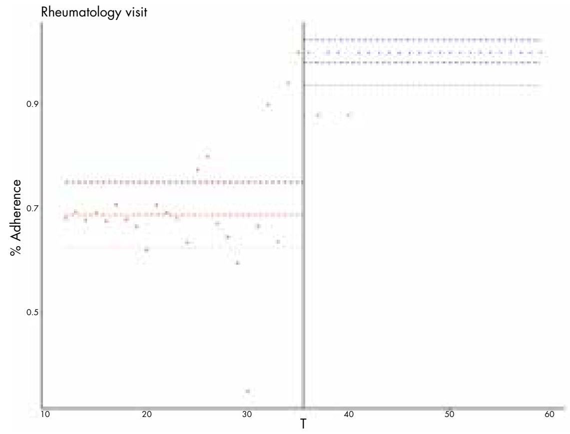

Fig. 7
Rheumathology percentage of adherence to National standards (WA)

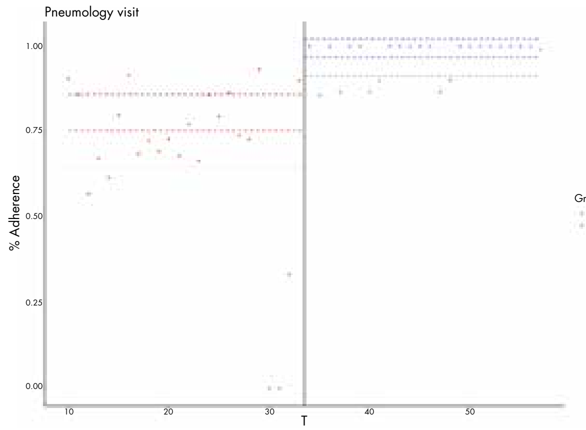

Fig. 6
Pneumology percentage of adherence to National standards (WA)

3.2. Descriptive analysis (days of waiting time)

In the field of Allergology, there was a significant improvement in waiting times. The WA decreased from 71.12 days to 3.57 days ($p < 0.0001$). Additionally, the WV decreased from 1234.0799 in the pre-OA to 33.2605 in the post-OA, and SD dropped from 35.1295 to 5.7672. The SEM decreased from 7.1708 in the pre-OA to 1.1772 in the post-OA. t-value was –7.9700 with 24.2389 degrees of freedom.

In General Surgery, waiting times also showed a significant decrease between pre- and post-OA. The WA decreased from 10.45 days to 3.14 days (p <

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0.0001). The variability (WV) reduced from 21.7684 to 2.4435, the SD passed from 4.6657 to 1.5632 and the SEM decreased from 0.9524 to 0.3191. The t-value was –7.2808 with 28.0992 degrees of freedom.
As for Endocrinology, waiting days experienced a significant reduction. The WA decreased from an average of 31.82 days before OA to 3.96 days after OA ($p < 0.0001$). The WV decreased from 89.8508 to 17.9539, the SD dropped from 9.4790 to 4.2372, and the SEM decreased from 1.9349 to 0.8649. t-value was –13.1485 with 31.8388 degrees of freedom.
Gastroenterology also witnessed a substantial decrease in waiting times. In fact, the WA dropped from 41.47 days before OA to 3.87 days after OA ($p < 0.0001$). The WV decreased from 304.3444 to 23.5640, SD decreased from 17.4455 to 4.8543, and the SEM decreased from 0.0292 to 0.0118. The t-value for Gastroenterology visits waiting days was –10.1735 with 36.5403 degrees of freedom.
The WA of Orthopedic visits waiting times decreased from 27.32 days (pre-OA) to 4.05 days (post-OA) with a $p < 0.0001$. The WV decreased from 89.5149 to 3.8455, SD reduced from 9.4612 to 1.9610, and the SEM passed from 1.9313 to 0.4003. t-value was –11.7985 with 24.9725 degrees of freedom.
In the case of Pneumology visits, the WA of waiting times consistently decreased from 86.11 days before OA to 4.63 days after OA ($p < 0.0001$). The variability (WV) decreased from 594.1680 to 1.4612, SD passed from 24.3756 to 1.2088, and the SEM decreased from 4.9756 to 0.2467. The t-value for pneumology visits was –16.3572 with 23.1131 degrees of freedom.

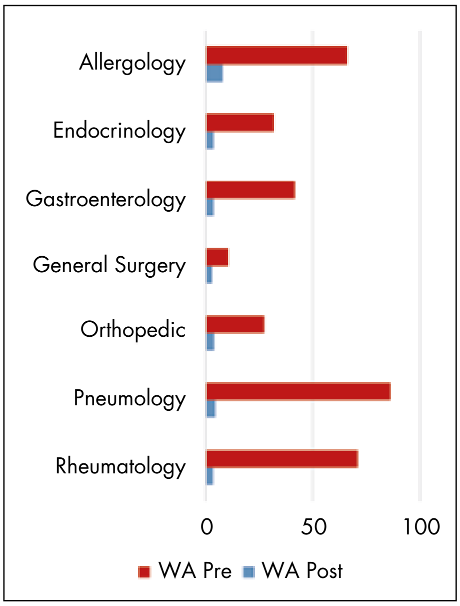

Fig. 8
Comparison between pre-OA and post-OA waiting days WA

Finally, also Rheumatology visits showed a significant reduction in waiting times between pre-OA and post-OA: the WA decreased from 71.12 days to 3.57 days ($p < 0.0001$). The WV decreased from 298.2177 to 0.3337, SD ranged from 17.2690 to 0.5777 and the SEM passed from 3.5250 to 0.1179. t-value was –19.1530, with 23.0515 degrees of freedom.
In *Graph.8*, WA of waiting days before the implementation of OA is compared with the post-OA period.
Detailed results are shown in *Tab.1*, including N, WA, WV, SD, UCL, LCL, t-test results, df, SED and p.

4. Discussion

A general variation in WA values is evident, increasing in case of percentage of adherence to national standards and lowering in case of days of waiting. Statistically, these variations are followed by a consistent decrease in WV, SD and SEM. A lower WV indicates that the values were more closely

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	Allergology				General Surgery				Endocrinology				Gastroenterology			
	% Adherence		Waiting time		% Adherence		Waiting time		% Adherence		Waiting time		% Adherence		Waiting time	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
N	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000
WA	0.7230	0.9581	63.9127	7.9967	0.8929	0.9735	10.4528	3.1399	0.8503	0.9495	31.8221	3.9551	0.6954	0.9775	41.4740	3.8693
WV	0.0137	0.0038	1234.0799	33.2605	0.0041	0.0017	21.7684	2.4435	0.0039	0.0055	89.8508	17.9539	0.0204	0.0033	304.3444	23.5640
SD	0.1172	0.0614	35.1295	5.7672	0.0638	0.0413	4.6657	1.5632	0.0626	0.0742	9.4790	4.2372	0.1430	0.0579	17.4455	4.8543
SEM	0.0239	0.0125	7.1708	1.1772	0.0130	0.0084	0.9524	0.3191	0.0128	0.0151	1.9349	0.8649	0.0292	0.0118	3.5610	0.9909
UCL	0.8401	1.0193	101.0422	13.7639	0.9567	1.0149	15.1185	4.7031	0.9129	1.0238	41.3011	8.1923	0.8384	1.0354	58.9195	8.7235
LCL	0.6058	0.8968	30.7832	2.2295	0.8290	0.9322	3.7872	1.5768	0.7877	0.8753	22.3432	-0.2821	0.5524	0.9195	24.0285	-0.9850
t	-8.7097		-7.9700		-5.1999		-7.2808		-5.0058		-13.1485		-8.9570		-10.1735	
df	34.7307		24.2389		39.4074		28.0992		44.7170		31.8388		30.3551		36.5403	
SED	0.0270		7.2668		0.0155		1.0044		0.0198		2.1194		0.0315		3.6963	
p	<0,0001		<0,0001		<0,0001		<0,0001		<0,0001		<0,0001		<0,0001		<0,0001	

	Orthopedic				Pneumology				Rheumatology			
	% Adherence		Waiting time		% Adherence		Waiting time		% Adherence		Waiting time	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
N	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000	24.0000
WA	0.8355	0.9618	27.3258	4.0555	0.7536	0.9671	86.1149	4.6271	0.6882	0.9811	71.1199	3.5676
WV	0.0039	0.0032	89.5149	3.8455	0.0111	0.0030	594.1680	1.4612	0.0040	0.0019	298.2177	0.3337
SD	0.0624	0.0570	9.4612	1.9610	0.1054	0.0551	24.3756	1.2088	0.0631	0.0437	17.2690	0.5777
SEM	0.0127	0.0116	1.9313	0.4003	0.0215	0.0112	4.9756	0.2467	0.0129	0.0089	3.5250	0.1179
UCL	0.8979	1.0188	36.7870	6.0165	0.8590	1.0222	110.4905	5.8359	0.7513	1.0248	88.3889	4.1453
LCL	0.7731	0.9048	17.8645	2.0945	0.6583	0.9120	61.7394	3.4183	0.6251	0.9374	53.8509	2.9899
t	-7.3201		-11.7985		-8.7935		-16.3572		-18.6829		-19.1530	
df	45.6243		24.9725		34.7170		23.1131		40.9364		23.0515	
SED	0.0172		1.9723		0.0243		4.9817		0.0157		3.5250	
p	<0,0001		<0,0001		<0,0001		<0,0001		<0,0001		<0,0001	

Tab. 1
Comparison of pre-OA and post-OA, both for percentage of adherence to National standards and waiting time

clustered around the mean, showing greater consistency and uniformity of data. The reduction in WV leads to reduction in SD, too, underlining how the data are less scattered in the post-OA period, implying a greater level of consistency.
A decrease in SEM from the pre-OA suggests an improvement in the precision or accuracy in estimating the averages. A smaller SEM indicates a greater level of confidence in the reliability of the sample mean as an approximation of the population mean. The precision of the mean adherence estimate is represented by these SEM values. We witnessed an increase of SEM only in the case of the Endocrinology visits' percentage of adherence: despite this, the difference is too small to bring significant implications.
The extremely low p-value of < 0.00001 in all fields indicates strong statistical evidence in terms of a significant difference between the means of the two groups considered.
The significant t-values suggest that there is a substantial difference between the pre-OA and post-OA conditions. The negative t-values indicate that the WA of the post-OA group is significantly lower than the mean of the pre-OA group (in case of days of waiting) or higher (in case of percentage of adherence to National standards). These results provide strong evidence that the intervention had a significant impact on the measured variables in the study, highlighting an improved efficiency and enhanced precision in managing waiting times for visits, demonstrating the positive impact of the OA model.
OA can be considered an innovative solution that helps addressing the challenges posed by increasing healthcare costs and the ever-growing demand for patient care. (Boelke, Boushon and Isensee, 2000).
The results showcased a significant improvement in waiting times across all the considered specialties. This positive outcome signifies a notable leap forward in the efficiency and effectiveness of healthcare delivery, ultimately leading to enhanced patient satisfaction and overall improvements in healthcare outcomes. This achievement is a token of the unwavering dedication and hard work of all healthcare professionals involved in the implementation of the waiting list recovery process, put in place during the CoViD-19 pandemic.
It is noteworthy that the branches of General Surgery and Endocrinology have not witnessed such substantial increase in adherence rates as other branches, but it is crucial to recognize that even before the introduction of OA they were already achieving good results in terms of waiting times. Our findings indicates that these specialties have maintained their high standards and continued to improve, as the statistical data explain.
Furthermore, it is important to address the limitations that arose, due to the absence of data before 2018. This lack of historical data prevented us from conducting a comprehensive assessment of the OA initiatives that were put in place prior to the time frame under examination. The unavailability of large historical data restricts our ability to accurately compare and evaluate the effectiveness and impact of these earlier initiatives. Consequently, it becomes challenging to fully ascertain the extent of their success or identify specific areas that may require

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further improvement. In order to mitigate these limitations in future times, it is crucial to implement robust monitoring and evaluation systems that capture real-time data and insights, feeding abundantly the databases. By closely monitoring the performance of the initiatives and regularly evaluating their outcomes, we can gather meaningful data and make informed decisions aimed at future improvements. This proactive approach ensures that our assessments are accurate, comprehensive, and based on reliable information.

The OA model implemented at the AOUP represents a ground-breaking and transformative approach to tackle the persistent challenge of waiting lists in healthcare. Departing from conventional strategies that primarily emphasize augmenting resources, this innovative model centers on the efficient management of patient flows and the strategic segmentation of various types of services. Through a collaborative effort between AOUP and ATNO, the Local Health Authority, this model has been developed and integrated into a comprehensive and unified care system.

The OA model embodies a significant departure from traditional healthcare paradigms by placing a strong emphasis on optimizing patient pathways and streamlining service delivery. Rather than solely focusing on increasing the capacity of healthcare facilities, the model seeks to eliminate bottlenecks and enhance the overall efficiency of care provision. This paradigm shift ensures that patients receive the most appropriate care in a timely manner, mitigating the adverse effects of lengthy waiting lists.

The collaboration between AOUP and ATNO underscores the commitment to a holistic and patient-centred approach. By leveraging the expertise and resources of both entities, the OA model seamlessly integrates within the existing healthcare infrastructure. This integration allows for a comprehensive and coordinated care system that promotes continuity of care, eliminates unnecessary delays, and optimizes resource allocation.

Central to the OA model is the strategic segmentation of healthcare services. Rather than employing a one-size-fits-all approach, services are categorized and prioritized based on urgency and complexity. By effectively triaging patients, the model ensures that those with critical needs receive immediate attention, while also providing appropriate care pathways for those with less urgent conditions. This targeted segmentation optimizes resource utilization and enables healthcare providers to allocate their expertise efficiently.

Furthermore, the OA model embraces technological advancements to support its objectives. Digital solutions, such as appointment scheduling systems and electronic health records, are leveraged to streamline administrative processes, reduce paperwork, and enhance communication between healthcare professionals. These technological innovations empower patients with greater control over their healthcare path and enable healthcare providers to deliver services with enhanced precision and efficiency.

This is why the implementation of the OA model at AOUP signifies a paradigm shift in addressing waiting lists in healthcare.

While OA aims to provide timely and equitable access to healthcare services,

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it is crucial to address issues that can hinder its smooth operation. One such issue is the improper or excessive use of diagnostic tests. Healthcare facilities must ensure that these tests are utilized appropriately and judiciously.

One challenge is the potential misuse of available resources, when patients opt for diagnostic tests for routine check-ups instead of utilizing them for necessary first-line access when there is a health issue. This can lead to unnecessary utilization of resources and may result in delays for patients who genuinely require immediate attention. It is essential to educate patients about the appropriate use of diagnostic tests and promote responsible healthcare-seeking behavior.

This challenge arises when individuals request first-access services for preventive purposes rather than for addressing an actual medical need. While preventive care is undoubtedly important, OA should primarily prioritize immediate healthcare needs and ensure timely access for those who require urgent attention. Balancing preventive care with the provision of first-line services can be a delicate task, requiring careful management and resource allocation.

Additionally, the issue of misdiagnosis or incorrect identification of symptoms can impact the demand management of the healthcare system. If patients repeatedly receive incorrect diagnoses or fail to identify their symptoms accurately, it can lead to a surge in unnecessary demands for specialized care, causing strain on the system's resources. It is crucial to improve diagnostic accuracy through continuous medical education, training, and effective communication between healthcare professionals and patients. Addressing these challenges requires a comprehensive approach that focuses on promoting appropriate utilization of resources, educating patients about the proper use of healthcare services, and enhancing diagnostic accuracy. By ensuring the appropriateness of care, the healthcare system can effectively manage demand and allocate resources efficiently, thereby optimizing patient outcomes and overall system performance.

Moreover, when implementing OA, it is crucial to establish clear boundaries in terms of time and geography. This means defining a specific timeframe within which the access is allowed and determining the geographic locations from which access is permitted. By doing so, it becomes possible to effectively plan and allocate resources to meet the expected demand within that timeframe and geographic area.

One reason for circumscribing the territorial range is to estimate the breadth or extent of the service. OA cannot be applied indiscriminately to access from all geographic locations, as it would be challenging to predict and accommodate the volume and intensity of demands. By confining the scope to a specific territory, it becomes more manageable to estimate the magnitude of the service and allocate appropriate resources accordingly.

Moreover, this approach aligns with the principle of ensuring first-access performance at a zonal or regional level. By defining a specific territorial context, the responsibility for providing timely first-access services can be assigned to respective regions or zones. This not only promotes efficient resource utilization but also helps maintain a balance within the

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healthcare system, allowing for specialization and effective management of patient flows.

By circumscribing the temporal and territorial aspects of OA, it becomes possible to achieve a reasonable estimation of the service's scope, allocate resources effectively, and ensure timely access to first-line healthcare services within specific regions or zones. This approach contributes to optimizing the overall healthcare system and enables efficient management of patient care.

That said, one of the concerns raised about OA has been the potential of discrimination in access to care based on residency, perceived as favouring certain individuals over others. However, it is important to note that the prioritization based on residency is often implemented for practical reasons, in order to manage resources effectively and ensuring that healthcare services are accessible within a defined geographic area and that individuals have timely access to first-line care within their designated zone. This approach aims to maintain a balance in resource allocation and ensure that individuals receive the necessary care within a reasonable timeframe.

OA is fundamentally driven by the goal of improving access to care within the public healthcare system and reducing reliance on private healthcare. By facilitating prompt access to services and discouraging inappropriate shortcuts, it aims to optimize the utilization of resources and promote equitable healthcare delivery.

Overall, wider implementation of OA is desirable to prevent significant disparities in access to care within regions or nationally. It should be accompanied by robust governance mechanisms and strategic planning to ensure fairness, effectiveness, and transparency in its implementation. By addressing concerns, optimizing resource allocation, and promoting equal access to care, OA can contribute to enhancing healthcare systems and improving health outcomes for all individuals.

Our findings provide healthcare researchers with critical insights into the impact of the OA model, highlighting its potential to improve the efficiency of waiting times, as demonstrated by variations in key metrics. Researchers can delve into these results to uncover the underlying mechanisms. The consistent statistical significance observed across various fields strengthens the evidence supporting the effectiveness of OA in reducing waiting times and enhancing compliance with national standards, thereby enhancing the credibility of their studies.

Our study emphasizes the transformative potential of the OA model in significantly reducing waiting times for healthcare services. Healthcare practitioners should consider the implementation of OA, while remaining attentive to challenges such as the misuse of diagnostic tests and the need to balance preventive care. Clearly defining time and geographical boundaries is essential for resource allocation. In summary, our research offers valuable insights and practical guidance for the successful implementation of OA, benefiting both researchers and healthcare practitioners in improving healthcare systems.

5. Conclusion

In our context, OA has proven to be an effective method in reducing wait-

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ing times for outpatients' visits, achieving the goals set by regulations and Regional/National plans for action. The effort put into recovering waiting lists is well worth it, considering the results achieved. Equally important is the follow-up and monitoring process to sustain these attained standards and address any potential changes that may arise over time.
The implementation of OA has also demonstrated its efficacy in improving access to healthcare services, minimizing delays, and ensuring that patients receive timely care. By adopting this approach, healthcare institutions can optimize their resource allocation, streamline patient flows, and reduce the burden on the healthcare system.
However, it is essential to emphasize the significance of ongoing follow-up and monitoring to maintain the high standards that have been achieved. By regularly assessing the outcomes of OA initiatives, healthcare providers can identify areas that require improvement and make necessary adjustments to uphold and enhance the efficiency of the system. This proactive approach helps to sustain the positive impact of reduced waiting times and reinforces the commitment to continuously improve the quality of care provided to patients.
Additionally, the monitoring process plays a crucial role in detecting any potential deviations or changes that may occur over time. By closely monitoring the implementation of OA, healthcare organizations can identify emerging trends, assess their implications, and promptly respond to any variations or challenges that may affect waiting times or patient care. This ongoing evaluation enables healthcare providers to make data-driven decisions and adapt their strategies to ensure the effectiveness and success of the OA approach.
The OA model challenges the conventional belief that increasing resources and supply is the only solution to approach waiting lists. Instead, it emphasizes the importance of understanding and managing the constant and predictable demand for healthcare services. By aligning supply with demand in real-time, the model ensures timely access to care, increases patient satisfaction, and avoids unnecessary reliance on external private providers.
Reasonably, the OA model may not be implemented in the same manner across the entire Region, neither in the entire Nation, as it requires extensive involvement from medical professionals and healthcare facilities. However, the success in Pisa demonstrates its potential to innovate waiting list management and improve healthcare services, giving interesting insights into similar models suitable to different realities.

Furthermore, the reduction in overload of outpatient facilities through OA can lead to better flow and utilization of resources, reducing costs and enhancing overall system performance. The OA model in healthcare showcases how lean management principles can be effectively applied to enhance access, efficiency, and resource optimization, ultimately leading to a more effective and patient-centered healthcare system.

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REFERENCES

Almomani I., & AlSarheed A. (2016). Enhancing outpatient clinics management software by reducing patients' waiting time. *Journal of infection and public health, 9*(6): 734-743. DOI: 10.1016/j.jiph.2016.09.005.

Barnabè F., Guercini J., Di Perna M. (2019). Assessing performance and value-creation capabilities in Lean Healthcare: insights from a case study. *Public Money & Management*.DOI: 10.1080/09540962.2019.1598197.

Boelke C., Boushon B., & Isensee S. (2000). Achieving open access: the road to improved service & satisfaction. *Medical group management journal, 47*(5): 58-68.

Camgoz Akdag H., Kaya C. O., Savuran G., & Canturk N. Z. (2018). Application of lean principles in hospitals: a process design in an emergency department. *Industrial Engineering in the Industry 4.0 Era: Selected papers from the Global Joint Conference on Industrial Engineering and Its Application Areas, GJCIE 2017, July 20-21, Vienna, Austria* 265-278. DOI: 10.1007/978-3-319-71225-3_23.

Chan H., Lo S., Lee L., Lo W., Yu W., Wu Y., Ho S., Yeung R., & Chan J. (2014). Lean techniques for the improvement of patients' flow in emergency department. *World journal of emergency medicine, 5*(1): 24-28. DOI: 10.5847/wjem.j.issn.1920-8642.2014.01.004.

Cittadinanzattiva. Osservatorio civico sul federalismo in Sanità. *Rapporto 2019.*

Condel J. L., Sharbaugh D. T., & Raab S. S. (2004). Error-free pathology: applying lean production methods to anatomic pathology. *Clinics in laboratory medicine, 24*(4): 865-899. DOI: 10.1016/j.cll.2004.07.001.

DGRT n. 604 del 06-05-2019, Allegato A: "Piano Regionale Governo Liste di Attesa (PRGLA) 2019-2021".

Hall R.W. (2013). *Patient flow: Reducing delay in healthcare delivery*. New York: Springer. DOI: 10.1007/978-1-4614-9512-3.

Holden R. J. (2011). Lean Thinking in emergency departments: a critical review. *Annals of emergency medicine, 57*(3): 265-278. DOI: 10.1016/j.annemergmed.2010.08.001.

Intesa Stato-Regioni 21-02-2019: "Piano Nazionale di Governo delle Liste di Attesa (PNGLA) 2019-2021".

Johannessen K. A., & Alexandersen N. (2018). Improving accessibility for outpatients in specialist clinics: reducing long waiting times and waiting lists with a simple analytic approach. *BMC health services research, 18*(1), 827. DOI: 10.1186/s12913-018-3635-3.

Lot L. T., Sarantopoulos A., Min L. L., Perales S. R., Boin I. F. S. F., & Ataide E. C. (2018). Using Lean tools to reduce patient waiting time. *Leadership in health services (Bradford, England), 31*(3): 343-351 DOI: 10.1108/LHS-03-2018-0016.

McCarthy K., McGee H. M., & O'Boyle C.A. (2000). Outpatient clinic waiting times and non-attendance as indicators of quality. *Psychology, Health & Medicine, 5*(3), 287. DOI: 10.1080/713690194.

Noon C. E., Hankins C. T., & Côté M. J. (2003). Understanding the impact of variation in the delivery of healthcare services. *Journal of healthcare management/American College of Healthcare Executives, 48*(2): 82-98. DOI: 10.1097/00115514-200303000-00004.

Okuda M., Yasuda A., & Tsumoto S. (2017). The effects of waiting time, length of stay, and hospital remodeling on the structure of patient satisfaction. *Serviceology for Smart Service System: Selected papers of the 3rd International Conference of Serviceology,* 287-297. DOI:10.1007/978-4-431-56074-6_32.

Rohleder T. R., Lewkonia P., Bischak D. P., Duffy P., & Hendijani R. (2011). Using simulation modeling to improve patient flow at an outpatient orthopedic clinic. *Health care management science, 14*(2): 135-145. DOI: 10.1007/s10729-010-9145-4.

Rose K.D., Ross J.S., Horwitz L.I. (2011). Advanced access scheduling outcomes: a systematic review. *Arch Intern Med.*, Jul 11, 171(13): 1150-9. DOI: 10.1001/archinternmed.2011.168.

Tomassini C.R. (2019). *Liste di attesa in sanità: La Soluzione dell'Open access*. Roma: Il Pensiero Scientifico.

MECOSAN – ISSN 1121-6921, ISSNe 2384-8804, 2024, 130 DOI: 10.3280/mesa2024-130oa18959