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Healthcare Waiting Times in Italy and Sweden: A Comparative Analysis and Policy Implications

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Abstract

This study compares waiting times in Sweden and Italy, analyzing both structural and policy-driven causes of delays and proposing data-driven solutions, starting from the consideration that not only healthcare waiting times are key indicators of the health system's accessibility but also of system efficiency. While Italy has historically struggled with regional disparities and underfunded territorial healthcare, Sweden, despite its traditionally efficient system, is now facing an unprecedented rise in waiting times. Using data from national health ministries, the OECD, and recent policy reports, this study presents visualizations and Python-based simulations to analyze inefficiencies. Sweden's €6.5 billion healthcare investment and Italy's €3 billion increase (under NADEF 2025) are evaluated, though not all these funds are allocated to reducing waiting lists. Policy recommendations focus on digital integration, financial incentives, workforce expansion, and telemedicine. The study also introduces a mathematical efficiency model, AI-driven scheduling simulations, and an analysis of Italy's Case della Comunità (Community Houses) and territorial healthcare projects facing challenges due to doctor shortages.

Keywords: Healthcare waiting times, Sweden, Italy, Telemedicine, Efficiency Metrics, Python Simulation, Territorial Medicine, Data-Driven Healthcare Planning

Introduction

Unfortunately, increasing healthcare waiting times seems to be one of the characteristics of many nowadays health systems. There is evidence that such phenomenon affects the efficiency and accessibility of the system, negatively affecting patient outcomes as well as healthcare costs and creating public distrust in the system [2]. Although Italy and Sweden provide universal healthcare, they have different approaches in managing patient flow and resources. Even if Sweden has always been known for its remarkable health and social system, it is now experiencing record delays and increasing waiting lists due to rising demand and inefficient data use [9]. At the same time, Italy continues to struggle with regional inequalities, workforce shortages, and fragmented governance [8]. Key objectives of this study:

- Examine waiting time variations in Italy and Sweden.
- Assess government policies and healthcare funding [6;3].
- Propose data-driven solutions to optimize healthcare delivery [5].
- Introduce a Python-based model to improve decision-making.

The study evaluates Italy's NADEF 2025 framework, Sweden's €6.5 billion investment, and the role of PNRR (Next Generation EU) funding in

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Italy [6]. It also discusses the importance of LEA (Essential Levels of Care) and LEP (Essential Levels of Performance) in shaping healthcare policy [7].

Healthcare Access and Waiting Time Challenges

Access to timely healthcare services is a fundamental aspect of an efficient and equitable healthcare system. However, prolonged waiting times can lead to worsened health outcomes, increased patient dissatisfaction, and inefficiencies in resource allocation. Both Italy and Sweden, despite offering universal healthcare, are grappling with rising waiting times, albeit due to different structural and systemic challenges.

The Italian System: Structural Weaknesses and the Role of Next Generation EU (PNRR) Italy's National Health Service (NHS) ensures universal coverage but suffers from many weaknesses, such as the inability to manage waiting times due to:

- Regional disparities, with northern regions offering better healthcare access than the south [6].
- Healthcare workforce shortages, especially among specialists [4].
- Bureaucratic inefficiencies, which slow down service delivery and patient care [2].
- To address these issues, Italy has leveraged Next Generation EU (NGEU) funding (that in Italy is named Piano Nazionale di Ripresa e Resilienza (PNRR)) [6], which focuses on:
    - Restructuring territorial healthcare, including the new so called Case della Comunità (Community Healthcare Centers) to strengthen primary care.
    - Expanding digital healthcare, such as enhancing the Electronic Health Record (Fascicolo Sanitario Elettronico - FSE) and implementing telemedicine. The case study of Casa Sollievo della Sofferenza in Puglia [4] highlights how telemedicine significantly reduced waiting times, particularly in rural and underserved areas.
    - Investing in human resources, to address the shortage of healthcare professionals and improve efficiency.
    - A consistent fraction of these reforms aims to reduce waiting times. However, with a few exceptions, implementation is often difficult due to slow workforce recruitment and persisting interregional disparities [7].

The Swedish System: A Model Under Pressure

Sweden has traditionally been known for its efficient healthcare system, but recent trends indicate a growing crisis in waiting times [10] caused by:

- An excess demand for specialist care [3], particularly in urban centers.
- An aging population that requires more complex, long-term treatments [9] due for example to comorbidities.
- Healthcare staff shortages, especially among specialists and nurses [1].

To combat these issues, the Swedish government has allocated €6.5 billion to address inefficiencies, focusing on:

- Expanding hospital capacity [3] by adding staffed hospital beds.
- Strengthening public-private partnerships [10], allowing private providers to help alleviate patient burdens.
- Improving digital patient management [5] through AI-driven scheduling and data analytics to optimize healthcare services.

While these initiatives show promise, Sweden still struggles with retaining healthcare professionals and effectively integrating digital tools [1].

Policy and Investment Strategies

Addressing healthcare waiting times requires a combination of **strategic policy interventions, targeted investments, and systemic reforms**. Both Italy and Sweden have introduced various measures to tackle growing delays in patient care, yet the effectiveness of these initiatives remains uncertain. While Sweden is making substantial financial commitments, Italy is relying on **long-term structural reforms** through national and EU-backed funding programs.

Italy: The Role of NADEF 2025 and PNRR in Reducing Waiting Times

In Italy, the recent budget allocated to healthcare amounted to €3 billion and it has been designated for systemic improvements [6]. However, not all of these funds are directly allocated to reducing waiting times. The policy measures focus on:

- Increasing financial incentives for healthcare providers [7] to reduce patient backlogs.
- Enhancing digital health solutions [4], particularly in patient scheduling and telemedicine.
- Leveraging PNRR funding [6] to reinforce territorial healthcare and improve primary care accessibility.
- Success will depend on regional execution and whether funds are effectively utilized to reduce waiting times.

Sweden: A High-Investment Approach

The government has recently voted for a €6.5 billion investment plan in Sweden. The ambitious helth plan aims to:

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- Increase the number of available surgeries [3] by outsourcing to private providers where necessary.
- Improve patient prioritization [5] through AI-based triage systems.
- Invest in workforce development [1] through incentives granted to medical professionals to stay in the public system.
- Despite these large-scale investments, structural inefficiencies must be addressed to ensure long-term sustainability [10].

A New Efficiency Model for Measuring Waiting List Management

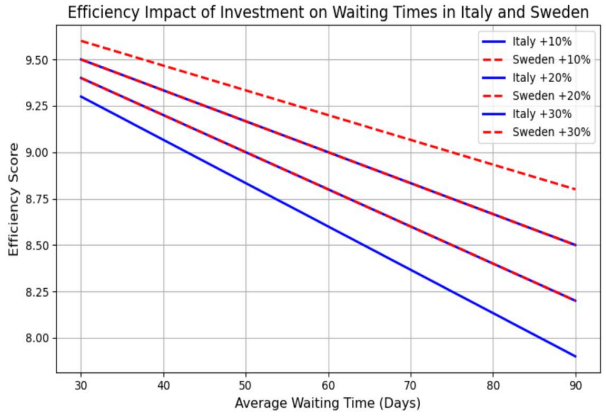
A mathematical efficiency measure is proposed:

$$\textbf{EFFICIENCY} = \frac{Investment \; x \; Resources \; Utilization}{Average \; Waiting \; Times \; x \; Unmet \; Needs}$$

where **EFFICIENCY** represents the efficiency score. This model considers the natural inverse relationship between a country's healthcare investments and the reduction in waiting times and improved service delivery.

A **Python-based simulation** has been developed to test different policy scenarios and their impact on waiting list efficiency.

Efficiency Simulation Graph Analysis



The following graph illustrates the impact of **investment increases (+10%, +20%, and +30%)** on efficiency scores for **Italy and Sweden** under different waiting time scenarios:

Graph 1: Efficiency Impact of Investment on Waiting Times in Italy and Sweden (see the appendix for the Python Code generating the graph)

Interpretation of the Graph:

1. **Investment Increase and Efficiency:** The graph shows that as investment increases (from an hypothetical +10% to +30%), efficiency scores improve, more in Sweden (dashed curves) with respect to Italy.
2. **Impact of Waiting Times:** it rather intuitive to think that as waiting times decrease, efficiency increases. This highlights the importance of reducing delays in specialist and hospital care services.
3. **Comparison Between Countries:** Sweden exhibits a higher efficiency curve compared to Italy, even with similar investment increases. This suggests that Sweden's resource utilization and digital patient management systems are more effective in translating funding into improved healthcare access.
4. **Diminishing Returns:** The graph also indicates diminishing returns on efficiency when investment increases beyond a certain point. As a result structural healthcare reforms are more efficient tools than simply injections of financial resources, to optimize patient flow and staff allocation.

This efficiency model provides a data-driven approach to guiding policy decisions, ensuring that investments in Italy and Sweden are strategically allocated to achieve maximum impact on waiting times.

Conclusion

Healthcare waiting times remain a pressing challenge for both Italy and Sweden. Despite their universal healthcare systems, both countries struggle with inefficiencies stemming from **resource allocation, staff shortages, and demographic pressures [2]**. Italy's **regional disparities** and **delayed implementation of Case della Comunità** continue to hinder progress, while Sweden faces a **growing burden due to increased demand and inefficiencies in digital integration [9]**.

Key insights from this study include:

- **Investment is necessary but insufficient alone [6;3]**: While Sweden's **€6.5 billion** allocation and Italy's **€3 billion under NADEF 2025** are substantial, **strategic implementation** and **effective workforce distribution** are crucial for success.
- **Mathematical modeling enables better policy planning [5]**: The efficiency metric introduced in this study allows policymakers to **evaluate the effectiveness of investment strategies** in reducing waiting times.
- **AI-driven patient prioritization can improve service delivery [4]**: The **Python-based scheduling model** demonstrates how **data-driven decision-making [7]** can optimize appointment scheduling and resource use.
- **Telemedicine can be a game-changer**: The **Casa Sollievo della Sofferenza** [4] case study in Puglia highlights the **potential of telemedicine in reducing waiting times**, especially in **rural and underserved areas**.

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- **Digital transformation [7] is critical**: Both countries need **greater investments in AI- powered patient management systems** to ensure that **resources are efficiently allocated** and **bottlenecks are reduced**.

Policy Recommendations

Based on the analysis, the following policy recommendations are proposed:

a. **Strengthening Digital Health Integration:**
   - Sweden should **enhance AI-based patient flow management** to optimize scheduling and minimize inefficiencies.
   - Italy must fully **integrate the Electronic Health Record (Fascicolo Sanitario Elettronico - FSE)** to streamline patient tracking and reduce delays.

b. **Expanding Telemedicine Nationwide:**
   - **Scaling up initiatives** like Casa Sollievo della Sofferenza [4] to cover **remote and underserved areas**.
   - Establishing **national telemedicine networks** to facilitate **specialist consultations across regions**.

c. **Optimizing Workforce Allocation:**
   - Implementing **financial incentives for medical professionals** to work in underserved areas.
   - Expanding **public-private partnerships** to increase healthcare service capacity.

d. **Adopting AI-Driven Scheduling Models:**
   - Implementing the **Python-based priority scheduling system** to optimize hospital admissions and specialist care.
   - Developing **predictive models** to forecast **peak demand** and adjust staffing levels accordingly.

e. **Enhancing Monitoring and Evaluation Mechanisms:**
   - Establishing **national agencies** to track waiting times and enforce **accountability measures**.
   - Conducting **regular performance audits** to ensure funding is used efficiently.

Future Research Directions

While this study provides a **quantitative and policy-based assessment** of waiting times, further research is needed to:

- **Assess the long-term impact of investment policies** in reducing waiting times.
- **Analyze patient satisfaction levels** following digital healthcare reforms.
- **Explore AI-driven workforce management strategies** to enhance service efficiency.
- **Examine the role of private sector partnerships** in complementing public healthcare efforts.

By adopting a **data-driven, technology-enhanced** approach to managing healthcare resources, both Italy and Sweden [10] can significantly **improve patient outcomes and system efficiency** while ensuring **equitable access to care**.

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APPENDIX

```python
import matplotlib.pyplot as plt
import numpy as np

# Data for the graph (assuming it's a hypothetical example)
x = np.linspace(30, 90, 100)  # Average Waiting Time (Days)
y_italy_10 = 10 - (x / 30) * 0.5  # Efficiency for Italy at +10% investment
y_sweden_10 = 10 - (x / 30) * 0.4  # Efficiency for Sweden at +10% investment
y_italy_20 = 10 - (x / 30) * 0.6  # Efficiency for Italy at +20% investment
y_sweden_20 = 10 - (x / 30) * 0.5  # Efficiency for Sweden at +20% investment
y_italy_30 = 10 - (x / 30) * 0.7  # Efficiency for Italy at +30% investment
y_sweden_30 = 10 - (x / 30) * 0.6  # Efficiency for Sweden at +30% investment

# Create the plot
plt.figure(figsize=(8, 5))
plt.plot(x, y_italy_10, label="Italy +10%", color='blue', linestyle='-', linewidth=2)
plt.plot(x, y_sweden_10, label="Sweden +10%", color='red', linestyle='--', linewidth=2)
plt.plot(x, y_italy_20, label="Italy +20%", color='blue', linestyle='-', linewidth=2)
plt.plot(x, y_sweden_20, label="Sweden +20%", color='red', linestyle='--', linewidth=2)
plt.plot(x, y_italy_30, label="Italy +30%", color='blue', linestyle='-', linewidth=2)
plt.plot(x, y_sweden_30, label="Sweden +30%", color='red', linestyle='--', linewidth=2)

# Add labels and title
plt.xlabel('Average Waiting Time (Days)', fontsize=12)
plt.ylabel('Efficiency Score', fontsize=12)
plt.title('Efficiency Impact of Investment on Waiting Times in Italy and Sweden', fontsize=14)

# Add legend
plt.legend()

# Display the graph
plt.grid(True)
plt.tight_layout()
plt.show()
```