Transformative Synergies: Partnership and Collaborative Governance for best Breast Cancer Patient Journey

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Abstract. This study presents the development and validation of a breast cancer patient journey as a real-world demonstration of how public-private collaboration can address digital government challenges while advancing Industry 4.0 and Government 4.0/5.0 paradigms. Using Curitiba, Brazil, as a pilot city, the initiative highlights how technologies, standards, and governance frameworks can foster social cohesion and reduce health inequalities by improving breast cancer care. By leveraging AI-driven tools, participatory governance, and data interoperability, the project aligns population health goals with economic efficiency, ensuring accessible and high-quality care. The results demonstrate the potential of collaborative digital health strategies to enhance public health equity and inform scalable governance models for broader applications across sectors. This research offers a replicable framework for advancing digital transformation in health systems, focusing on preventive and cost-effective interventions to promote resilient and inclusive health ecosystems.

Keywords. Pilot Project, Breast Cancer Journey, Ecosystem Governance, Triple Helix, KPI´s

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1. Introduction

According to the World Health Organization (WHO) no one should face breast cancer alone. Breast cancer is the most common cancer globally, with approximately 2.3 million new cases annually. It remains a leading cause of morbidity and mortality worldwide, necessitating a comprehensive approach that integrates public, private, and civil society stakeholders working together to reduce this burden (WHO, 2025),

In the United States, approximately one in eight women will be diagnosed with breast cancer during their lifetime. Only this country estimated that 310,720 women and 2,800 men will receive a diagnosis of invasive breast cancer, but the approach for early detection and treatment have significantly improved survival rates, especially when the disease is caught in its earliest stages. According to Cancer

Statistics (2025), female breast cancer mortality peaked in 1989, and recent studies reveal likely declines in breast cancer mortality and stable prevalence of mammography as primarily diagnostic research (SIEGEL et al, 2025, Breast cancer facts & stats., 2019)

In Brazil, breast cancer primarily affects women over 50 and is the leading cause of cancer-related deaths among women. Men represent a smaller group, accounting for about 1% of cases. The National Cancer Institute (INCA) highlights the growing need for improved systems to address these disparities (INCA, 2024).

Curitiba, a Brazilian city, has pioneered a patient-centric pilot project aimed at aligning digital transformation with social impact goals. By fostering partnerships across the public and private sectors, the initiative tackles health system fragmentation and promotes interoperability, guided by Value-Based Health Care principles.

This collaboration involves the municipality, patient organizations, and a pharmaceutical company working with experts and academic researchers to create an innovative solution for breast cancer care. Focused on leveraging digital tools and preventive strategies, this initiative drives transformation in healthcare, reducing inequalities and improving population health. The Curitiba pilot demonstrates how collaboration and technology can catalyze impactful change, offering a model for broader replication.

2. Materials and Methods

The focus of this initiative on the digital journey of breast cancer patients in Curitiba, Paraná, Brazil was based on the Triple Helix model, which emphasizes collaboration between government, industry and academia and served as a basis for using consolidated WHO standards to improve and implement a data exchange platform and promote interoperability.

This study adopts a single-case design, since context-rich field research enhances practical usefulness, so the study aims to generate insights considering real-world impact. By focusing on Curitiba's pilot, the study captures complex dynamics often missed in broader, decontextualized approaches. This practice allows the identification of leading-edge practices, which, once understood and explained, can inform the adaptation and replication of similar initiatives in comparable settings (Merchant, 2012).

Based on principles of triple helix model, the project's innovation addresses systemic inefficiencies and promotes equity through the initiative, highlighting the transformative potential of collaborative digital health strategies through resource-directing indicators, such as increasing screening coverage by 35% in underserved areas, with AI tools identifying high-risk cases for immediate follow-up.

Table 1 below presents the context found and the actions taken. In this context, the municipality and its patient organizations and a pharmaceutical company that funded the project funded experts and academic researchers who contributed to the design of an innovative solution.

Table 1: Approach and Actions Taken

Journey	Detection and Screening	Diagnosis	Therapeutic Planning	Treatment Delivery	Education, Follow-Up and Survivorship
Context	Low screening rates in underserved areas due to fragmentation in service delivery.	Delays in confirming diagnoses due to bottlenecks in laboratory processing.	Limited integration of patient data across systems led to fragmented treatment plans.	Inconsistent reporting of adverse events and treatment outcomes.	Gaps in long-term patient monitoring post-treatment.

Actions	Collaborative efforts between municipal health departments, NGOs, and technology providers launched mobile mammography units equipped with AI-based imaging tools. Data was integrated into the municipal e-SUS APS platform and analyzed to prioritize follow-ups.	Public-private partnerships established expedited diagnostic workflows using centralized databases and automated case triage in the Federal Breast Cancer systems	Multisectoral tumor boards utilize interoperable platforms adhering to standards to co-design personalized treatment pathways. Patients were actively involved through digital consultation tools.	Deployment of patient-reported outcome (PRO) systems and real-time monitoring apps allowed seamless integration with federal health registries	A coordinated follow-up program, supported by local community organizations, offered education and support through interactive platforms. Data from wearable devices were incorporated into municipal health dashboards.

3. Results

The initiative is projected to deliver significant advancements in breast cancer care by integrating digital health solutions. Analysis of the current and desired patient journeys shows that leveraging AI-enabled management tools to prioritize high-risk cases can increase screening coverage in underserved areas by 35%. These tools also enhance equity by focusing resources on populations with limited access to healthcare.

Adherence to best practices for early detection and intervention is expected to significantly reduce the average time to diagnosis, enabling earlier interventions. Patient satisfaction and adherence to treatment plans are targeted to improve by 20%, leading to more timely initiation of therapy. Enhanced monitoring systems, including real-time tracking of treatment outcomes, are anticipated to reduce emergency admissions caused by adverse events, further improving care efficiency and equity.

For example, AI-supported workflows can address diagnostic delays by streamlining processes, shortening the time to diagnosis, and promoting adherence to treatment plans through education and digital engagement. This approach is expected to yield a 20% improvement in therapy initiation within recommended timeframes. Additionally, strengthened adherence to follow-up care, supported by interoperable data systems, can lead to measurable gains in five-year survival rates, showcasing the transformative potential of collaborative digital health strategies.

To strengthen the evaluation's rigor, considered KPIs were aligned with internationally recognized frameworks, such as ICHOM, and validated through iterative consultations with local experts, public health managers, and patient organizations. Data sources included municipal health records, e-SUS APS, and patient-reported outcomes integrated via interoperable platforms.

By linking these outcomes to Key Performance Indicators (KPIs)—such as expanded screening coverage, reduced diagnostic delays, and improved treatment adherence—the project highlights the role of digital governance in promoting equitable healthcare systems and addressing disparities in access and outcomes, as detailed in Table 2.

Table 2: KPI´s and expected results

Phase	Detection and Screening	Diagnosis	Therapeutic Planning	Treatment Delivery	Education, Follow-Up and Survivorship
KPI´s	Screening coverage increased by 35% in targeted areas, with high-risk cases flagged for immediate follow-up.	Measuring of time frame average time to diagnosis reduced days, improving early-stage detection rates/ according to best practices	Improving patient satisfaction and adherence to treatment plans, with a 20% increase in therapy initiation within recommended timeframes.	Enhancing tracking of therapy effectiveness and reduced emergency admissions related to adverse events.	Improving adherence to follow-up care, with a measurable increase in five-year survival rates.

The collaboration between the Curitiba municipality, patient organizations, a pharmaceutical company, and academic experts to redesign breast cancer care exemplifies how accurate data collection serves as the cornerstone for implementing affordable, actionable KPIs and metrics in public health systems. By prioritizing precision in data capture, integration, and analysis, this initiative demonstrates how Brazil's fragmented healthcare ecosystem can evolve into a cohesive, patient-centered model while addressing systemic inequities. The points listed below explain its transformative potential:

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1. Data Accuracy as the Foundation for Affordable KPIs

Accurate data collection ensures that KPIs are reliable, relevant, and cost-effective. In Brazil's decentralized system, inconsistencies in tracking patient outcomes across municipal, state, and federal platforms often lead to inefficiencies. For example:

Municipal-level data (e.g., screening rates, follow-up adherence) must align with state-level data (e.g., access to mammography, chemotherapy quotas) and federal databases (e.g., mortality rates, funding allocations).

By standardizing metrics using global frameworks like ICHOM, the project ensures that KPIs reflect outcomes prioritized by patients (e.g., survival rates, quality of life, care continuity) rather than purely administrative targets.

This alignment reduces duplication, minimizes manual data reconciliation costs, and enables governments to allocate resources based on evidence-driven priorities, a critical step for affordability in resource-constrained settings.

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2. Interoperability and Real-Time Insights

The project's integration of open standards for interoperability bridges siloed systems, allowing seamless data exchange across care levels. For instance:

- A patient's diagnostic data from a municipal clinic can instantly inform state-level treatment authorization, while federal systems monitor population-level trends.
- AI-driven analytics process real-time data to identify bottlenecks (e.g., delays in biopsy results) or disparities (e.g., low screening rates in rural areas), enabling proactive interventions.
- By automating data flows, the system reduces administrative overhead and ensures KPIs (e.g., time-to-treatment, patient satisfaction) are updated dynamically, avoiding the costs of retrospective audits.

3. Patient-Centered Outcomes and Equity

Adopting ICHOM's framework shifts focus from volume-based metrics (e.g., number of screenings) to value-based outcomes (e.g., reduced recurrence rates, psychosocial support access). Accurate patient-reported data ensures metrics reflect lived experiences, such as:

- Financial toxicity (e.g., out-of-pocket costs for low-income patients).
- Geographic barriers to care (e.g., travel times to oncology centers).
- Cultural factors influencing treatment adherence.

These insights allow policymakers to design targeted, equitable interventions, such as subsidized transportation for rural patients or telehealth follow-ups—strategies that maximize impact per dollar spent.

4. Scalability and Cost-Effective Governance

The Curitiba pilot leverages modular, open-source technologies to create a replicable model. For example: AI algorithms trained on local data can predict demand for therapies, optimizing procurement and reducing waste and federated learning allows hospitals to share insights without compromising patient privacy, lowering R&D costs for new treatments. This approach avoids proprietary system lock-in, ensuring scalability to other regions or disease areas (e.g., diabetes, prenatal care) at minimal marginal cost.

5. Reducing Financial Risks Through Predictive Analytics

Accurate historical and real-time data enables predictive modeling to anticipate budget impacts. For instance:

- Early detection rates correlate with lower long-term costs; investing in screening KPIs today reduces late-stage treatment expenses tomorrow.
- AI identifies high-risk populations for preventive campaigns, curbing avoidable hospitalizations.

By linking KPIs to financial sustainability, the system aligns clinical goals with fiscal responsibility, a key tenet of Government 4.0/5.0.

6. Strengthening Social Cohesion via Transparency

Public trust in healthcare systems erodes when data is opaque or perceived as biased. This Project fosters transparency by:

Sharing de-identified outcome data with patient organizations, ensuring accountability. Using dashboards to visualize progress on KPIs (e.g., reduced mortality disparities across socioeconomic groups). Such transparency builds collective ownership among stakeholders, reinforcing social cohesion and incentivizing sustained collaboration.

While the study emphasizes the positive outcomes of the Curitiba pilot, it also recognizes critical challenges inherent to digital health transformation. These include data privacy concerns in cross-institutional exchanges, regulatory fragmentation across government levels, and high initial implementation costs for infrastructure and training. Addressing these barriers required strict adherence to national data protection laws (LGPD), phased deployment strategies, and strong stakeholder alignment—factors essential for scalability and sustainability.

4. Conclusions

In this context, the municipality, patient organizations, and a pharmaceutical company collaborated with experts and academic researchers to develop an innovative solution. This partnership, focused on the breast cancer care line, exemplifies how digital governance can foster social cohesion and reduce health disparities by implementing preventive, cost-effective, and patient-centered processes aimed at improving population health.

In Brazil, navigating the breast cancer care journey requires seamless integration between municipal, state, and federal systems. Municipal systems manage initial tracking and follow-up data, state platforms regulate access to specialized exams and treatments, and federal databases store centralized information for monitoring and financing. The Curitiba pilot project establishes a new paradigm for interoperability, bridging these levels of care and spheres of government to create a cohesive, patient-centered healthcare model.

This initiative is the first in Brazil to combine global standards with the ICHOM (International Consortium for Health Outcomes Measurement) framework for patient-centered breast cancer care. By focusing on outcomes that matter most to patients, the project highlights the importance of collaborative efforts among health professionals, specialists, and patients. The adoption of these standardized measures represents a global commitment to improving quality of care, enhancing the quality of life for patients, and driving advancements in breast cancer treatment (ICHOM, 2025).

To achieve these goals, the project integrates open standards for interoperability, enabling real-time information exchange across municipal, state, and federal levels. Leveraging AI and global benchmarks, it establishes a replicable, sustainable model for digital governance in healthcare, with the potential to be scaled to other lines of care and regions.

The results highlight the transformative potential of digital health strategies under the Government 4.0/5.0 paradigm. By aligning technological innovation with social and economic goals, the framework uses AI-driven indicators to minimize financial impacts while keeping the patient at the center of the process. This approach underscores how digital governance can build equitable, efficient, and resilient healthcare systems, fostering social cohesion and reducing disparities across diverse populations.

The Curitiba initiative could prove that accurate data collection is not a technical afterthought but a strategic enabler of affordable, equitable healthcare. By harmonizing global standards with local realities, Brazil can transform its public health systems into agile, patient-centered networks. The project's success hinges on three pillars:

1. Interoperability to unify fragmented systems.
2. Outcome-focused metrics to prioritize value over volume.
3. AI-driven governance to minimize costs and maximize impact.

As this model scales, it offers a roadmap for low- and middle-income countries to leverage digital innovation as a tool for equity—proving that precision in data collection is inseparable from progress in population health.

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