ICCI-LA

Iniciativa Integrada para el Control de Cáncer en América Latina
Integrated Cancer Control Initiative in Latin America

Addressing the rising burden of cancer in Brazil: Challenges & opportunities

An Analysis of Brazil's Health System
and Cancer Control Policies

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GLOSSARY

ASR – Age-Standardized Rate

AUGE – Acceso Universal a Garantias Explicitas or Universal Acess to Explicit Guarantees

CENABAST – The Central Supply Clearinghouse

CVD – Cardiovascular Disease

CNS – Central Nervous System

CONCORD-3 – A program for worldwide surveillance of trends in cancer survival, led by the London School of Hygiene and Tropical Medicine. CONCORD-3 is the latest study, published in The Lancet in 2018.

COVID-19 – Coronavirus disease 2019

FONASA – National Health Fund (Public Health Insurance)

GDP – Gross Domestic Product

GES – Garantia Explicita en Salud or Explicit Health Guarantees

GLOBOCAN – Global Cancer Observatory

HPV – Human Papilloma Virus

LAC – Latin America and the Caribbean

IARC – International Agency for Research on Cancer

ICCI-LA – Integrated Cancer Control Initiative in Latin America

Intl$ – International dollars

ISAPREs – Health Insurance Institutions (Private Health Insurance)

MINSALUD – Ministry of Health of Chile

NCD – Non-Communicable Disease

OOP – Out-of-Pocket

PAHO – Pan-American Health Organization

PHC – Primary Healthcare

PM2.5 – Particulate Matter 2.5 micrometers and smaller

PPP – Purchasing Power Parity

SARS-CoV-2 – The virus responsible for causing COVID-19

SNSS – National Health Services System

SS – Health Services

UHC – Universal Health Coverage

WHO – World Health Organization

1. Executive Summary

Objectives

The aim of the Integrated Cancer Control Initiative in Latin America (ICCI-LA) study is to help improve Brazil's response to the rising burden of cancer, as part of its Constitutional commitment to health as a human right and as part of the international push for universal health coverage. The objectives of this report are to discuss the overall context of the Brazilian health system related to cancer, present major health system challenges identified by stakeholders, and identify policy options as suggested by the leading experts involved in the ICCI-LA study.

Methods

The primary methods of inquiry used by the research team include a review of published literature and datasets on the Brazilian health system and cancer burden, an online survey conducted among subject-matter experts to ascertain primary challenges and opportunities within the Brazilian health system around cancer, and a virtual stakeholder workshop which facilitated expert discussion around the topic.

Findings

According to the Global Cancer Observatory (GLOBOCAN) that includes estimates by International Agency for Research on Cancer (IARC), a research agency of the World Health Organization (WHO), Brazil had an age-standardized rate (ASR) of 215.4 new cases of cancer per 100,000 people in 2020. Brazil and Argentina have the highest ASR of incidence for cancer in Latin America with more than 200 cases per 100,000 people. Similarly, Brazil has the second highest ASR of mortality among selected Latin American peer countries at 91.2 deaths per 100,000, lower than Argentina, but higher than Mexico, Colombia, and Chile.

The primary challenges, identified through a survey of responses from 27 stakeholders and contributions from 52 participants involved in virtual roundtable discussions, were organized into four health system areas: 1) Organization and Governance, 2) Financing, 3) Resource Management, and 4) Service Delivery. A common challenge identified in both stakeholder surveys and virtual workshops was inefficiency in healthcare delivery alongside poor allocation of resources, which can hinder quality of care. Other issues included: fragmentation of the health system and ineffective financial organization, as well as weak coordination and collaboration among different administrative levels and health institutions, and a lack of focus on prevention and primary care.

Policy options to address the identified challenges were also categorized by the four health system areas. Suggestions for improving Resource Management included (i) enacting public policies for cancer care to ensure better collaboration between agencies, (ii) restructuring resource allocation to create means for improving continuity in cancer care, (iii) enacting policies that prioritize cancer prevention, and (iv) conducting cost-effeciveness assessments to restructure existing resources and healthcare budgets.

Policy options for strengthening Organization and Governance included (i) enacting new reforms to update current cancer laws, (ii) improving collaboration and cooperation among different actors within government entities and between stakeholders, (iii) creating an independent institution to monitor and

manage cancer care in the country, (iv) expanding regional capacity, and (v) implementing policies to engage stakeholders and the public in decons pertaining to cancer funding and care delivery.

Financing policy proposals included (i) implementing policies to increase the national budget allocated for cancer, (ii) increasing funding to establish an independent agency that can undertake timely research to inform policy, (iii) implementing policies that consider the long-term impacts of supporting comprehensive cancer management, and (iv) addressing equity issues between public and private sectors.

Policy options for service delivery included (i) implementing reforms to existing cancer laws to improve quality of care, (ii) improving provider training around cancer care, and (iii) establishing comprehensive and integrated information services focused on quality assurance.

Recommendations

The study collaborators propose nine overarching recommendations for the Brazilian health system to consider in order to address the rising burden of cancer and the challenges that exist to enable the introduction of changes for improving cancer care.

Highest Priority

1. Improve coordination of cancer care and control and reduce fragmentation of services by creating integrated service delivery networks for cancer.

2. Improve the existing cancer registries and establish a national population-based registry.

3. Conduct a comprehensive analysis to identify priorities for cancer care and control and to improve the efficiency and equity of resource allocation.

Higher Priority

4. Develop a multidisciplinary innovation hub in Rio Grande do Sul to design, develop and implement innovations to improve cancer care, control and outcomes and learn from this experience to replicate elsewhere in the country.

5. Restructure the delivery of cancer services to enable provision of consistently high quality and equitable cancer services.

6. Improve the effectiveness, efficiency, equity and responsiveness of cancer care by developing and implementing digital care pathways.

Medium Priority

7. Strengthen multisectoral actions that prioritize prevention interventions for cancer.

8. Improve training of healthcare providers on multisectoral approaches to cancer care and service delivery.

9. Restructure payment model for healthcare providers by introducing pay for performance and improved outcomes.

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2. Introduction

The objectives of the Integrated Cancer Control Initiative in Latin America (ICCI-LA) are to (i) identify and fill the knowledge gaps in relation to the burden of cancer and health system responses to cancer prevention, care and control in selected countries (ii) determine the main challenges that need addressing in these countries (iii) detail potential interventions that are needed at country level to develop an effective response, and (iv) build an inclusive coalition of stakeholders to mount a sustained and lasting response in order to improve health outcomes, enhance financial protection and reduce inequalities. Brazil is the fourth country of focus for ICCI-LA.

The purpose of this study is to analyze the health system challenges related to the rising cancer burden in Brazil. The objectives of this report are to discuss the overall context of the Brazilian health system related to cancer, present major health system challenges identified by Brazilian stakeholders via a survey and in-person meetings, and identify policy options identified by leading experts in Brazil and international experts involved in the ICCI-LA study to improve Brazil's response to the rising cancer burden.

This study used a mixed methods approach to ascertain primary challenges and opportunities within the Brazilian health system related to cancer. The methods of inquiry included: a literature review of published data, a novel online survey conducted among topic experts in Brazil, and, four virtual stakeholder workshops with leading health system and cancer experts in Rio Grande do Sul in Brazil.

The framework for health systems analysis used in the literature review extends earlier approaches (1–5) and emphasizes a systems view (6) when analyzing context and health system performance. The analytical framework has been used in single-country and multi-country analyses (7,8) to explore contextual factors and health systems functions that interact to influence the achievement of health system goals and objectives. Appendix A provides more details on the framework and each section of the analysis used in this report.

This report is organized in 3 major sections. The first section presents an analysis of the health system context in Brazil related to cancer, including the changes in demographic, epidemiological, political, and legal/regulatory environment which influence the trajectory of change in the health system. The second section is a health system analysis that identifies the challenges for the health system related to cancer and presents policy options identified by stakeholders to address these challenges. The third section is focused on a set of recommendations and the proposed next steps to improve the response of the Brazilian health system to address to the rising burden of cancer

3. Methods

In order to achieve a detailed understanding of the context, health system, and the challenges and opportunities related to management of cancer in Brazil, the study used a mixed methods approach to research (detailed explanation of the methods is provided in Appendix B) and three major sources of information:

1. A literature review and analysis of published articles, policies, and datasets;

2. A novel online survey conducted among topic experts; and

3. Four virtual stakeholder workshops.

The Harvard researchers worked with collaborators in Brazil to establish a core team to undertake the study. The data were collected and analyzed between January and May 2021. During the data collection and analysis process, there was constant guidance and feedback from the Brazilian collaborators and the different working groups involved in the four stakeholder workshops.

The State of Rio Grande do Sul was choose to participate in this first study. This state has around 11.4 million inhabitants, which corresponds about 5.4% of the Brazilian population, the 6th most populous state in Brazil. In 2018, a survey lead by the Oncology Observatory, in partnership with the Federal Council of Medicine, which analyzed data from the Mortality Information System (SIM), showed that cancer is the leading cause of death in 10% of Brazilian cities and Rio Grande do Sul has the largest number of municipalities where cancer is the leading cause of death.

4. Analyzing the Cancer Context in Brazil

This section provides an analysis of the health system context in Brazil. In this section we discuss demographic, epidemiological political and regulatory context related to cancer, including an overview of Brazil's national cancer control plan. We also provide in Appendix C additional analysis of demographic and epidemiological transition, political, legal and regulatory environment, and economic, socio-cultural and technological factors affecting Brazilian health system context.

4.1. Demographic and Epidemiological Transition

In the GLOBOCAN analysis of Brazil's cancer burden, incidence is defined as the number of new cases occurring in a specified time period in a geographic area (1). It is important to note that incidence is calculated only among individuals who are at risk for a specific outcome. Crude incidence figures, while useful in some regard, portray an incomplete contextualization as they they do not account for the substantial differences in population sizes and age structures between countries or regions, particularly important for analyzing the burden of large countries like Brazil against those in less populous countries like Chile. Consequentially, age-standardized rates (ASR) of incidence per 100,000 people are used in this report to approximate the average risk of developing cancer in a way that allows comparisons between countroes and regions with different population sizes and age structures.

Primary prevention strategies aim to reduce incidence of cancer, though increasing incidence rates do not necessarily reflect failure of the health system in cases where the expansion of early detection or testing programs and better data management (for example through the introduction of population based registries) reveal more closely the true incidence rates as more cases are tested, discovered, reported and registered (1). The methodology for reporting mortality mirrors that in the incidence section, with current mortality estimates denoting 2018 age-standardized rates per 100,000 people.

4.1.1.   Cancer Incidence

In 2020, the age standardized incidence rate of cancer in Brazil was estimated to be 215.4 new cases of cancer per 100,000 people. Among selected Latin American countries, namely Argentina, Chile, Colombia, and Mexico, this figure ranks as the second-highest. The ASR of incidence in Brazil (215.4 new cases per 100,000 people) is similar to that in Argentina (218.2 new cases per 100,000), but higher than that in Colombia (182.3), Chile (180.9) and Mexico (140.4), which have lower incidence rates.

Figure 1: Estimated Age Standardized Incidence Rate of Cancer per 100,000 People in 2020, All Cancer Types (Source: IARC Cancer Today).
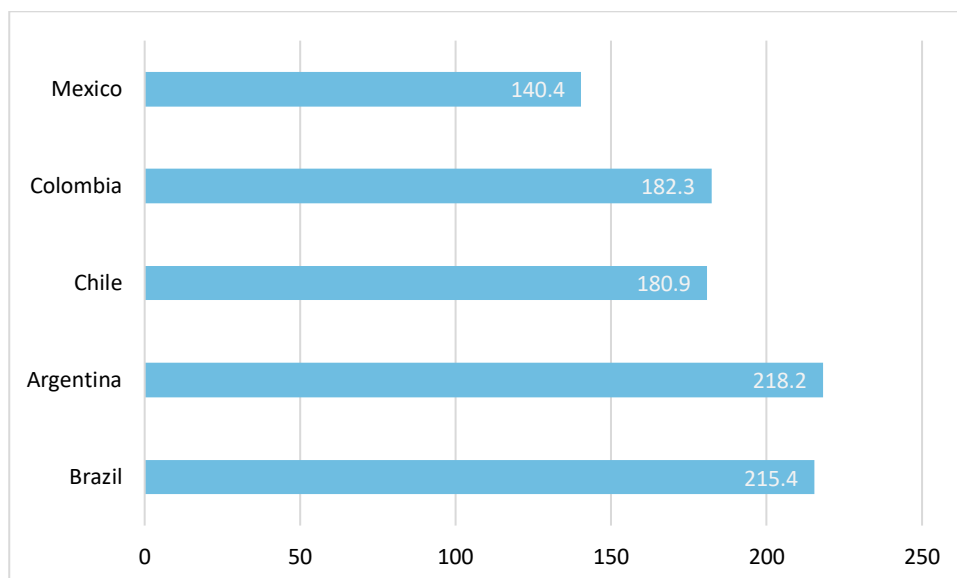
An examination of the ASR of cancer incidence by specific cancer types shows that Brazil's 5 most common cancer types in 2018 were prostate cancer (74 new cases per 100,000), breast cancer (62.9), colorectal cancer (19.6), lung cancer (13), and cervical cancer (12.2). No other cancer type has a higher rate than 10 new cases per 100,000. Figure 2 displays Brazil's top 10 cancer types by age standardised incidence rate.

Figure 2: Estimated Age Standardized Incidence Rate of 100,000 People in Brazil in 2020 (Source: IARC Cancer Today).
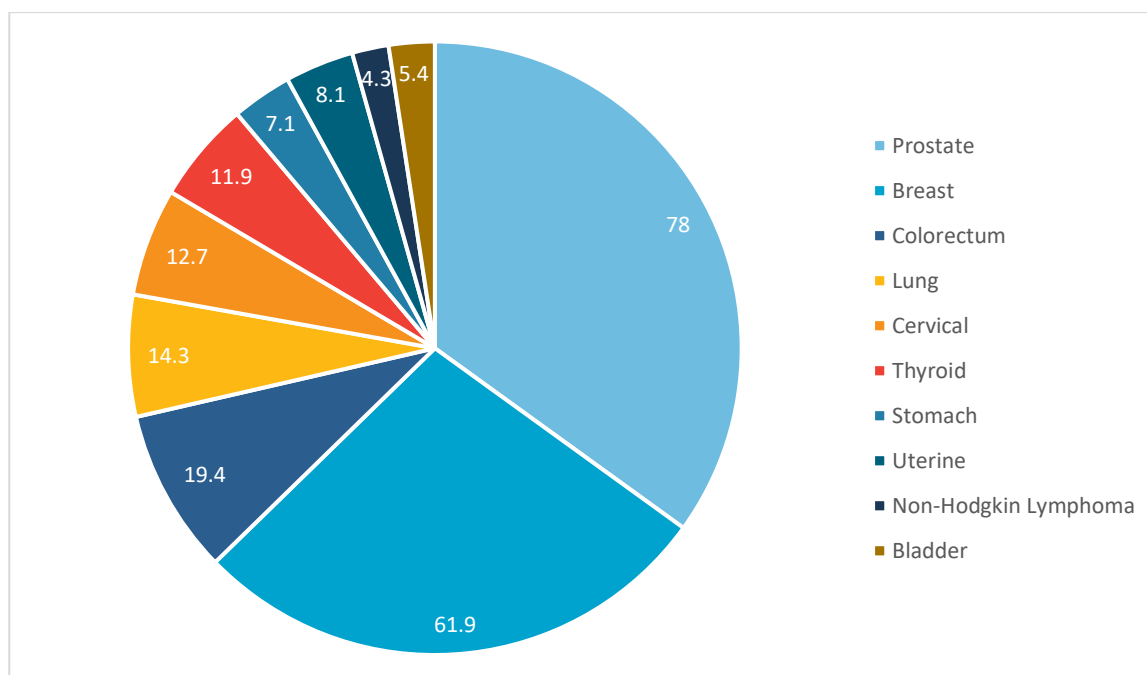
Comparing this burden of cancer to other large Latin American countries, Brazil has a very high age standardised incidence rate for prostate cancer. Brazil's 78 new cases of prostate cancer per 100,000 people in 2020 is much higher than the rates for Argentina (42.0 new cases per 100,000), Chile (56.7), Colombia (49.8), and Mexico (42.2). Breast cancer is also a major problem in Brazil at 61.9 cases per 100,000, with only Argentina having a higher rate of 73.1 cases per 100,000. Chile (37.4), Colombia (48.3), and Mexico (40.5) each have noticeably lower rates.

Figure 3 compares the top 10 cancers by ASR of incidence in Chile, Argentina, Brazil, Colombia and Mexico. Figure 4 compares the top 5 cancers by ASR of incidence in these countries.

Figure 3: Estimated Age Standardised Incidence Rate of Cancer per 100,000 People in 2020, by Cancer Type (Source: IARC Cancer Today).

	Brazil	Argentina	Chile	Colombia	Mexico
Prostate	78	42.0	56.7	49.8	42.2
Breast	61.9	73.1	37.4	48.3	40.5
Colorectum	19.4	25.1	19.9	16.9	10.6
Lung	14.3	19.2	12.2	10.5	5.3
Cervical	12.7	16.7	11.1	14.9	12.6
Thyroid	11.9	8.0	4.8	9.1	8.1
Stomach	7.1	6.3	13.1	12.8	6.2
Uterine	8.1	7.6	6.5	8.1	7.6
Non-Hodgkin Lymphoma	4.3	6.2	5.3	7.0	5.0

| Bladder | 5.4 | 5.6 | 5.6 | 3.0 | 2.4 |
| **Total Incidence of Cancer** | **215.4** | **218.2** | **180.9** | **182.3** | **140.4** |

Figure 4: Estimated Age Standardized Incidence Rate for Cancer per 100,000 People in 2020, by Cancer Type (Source: IARC Cancer Today).
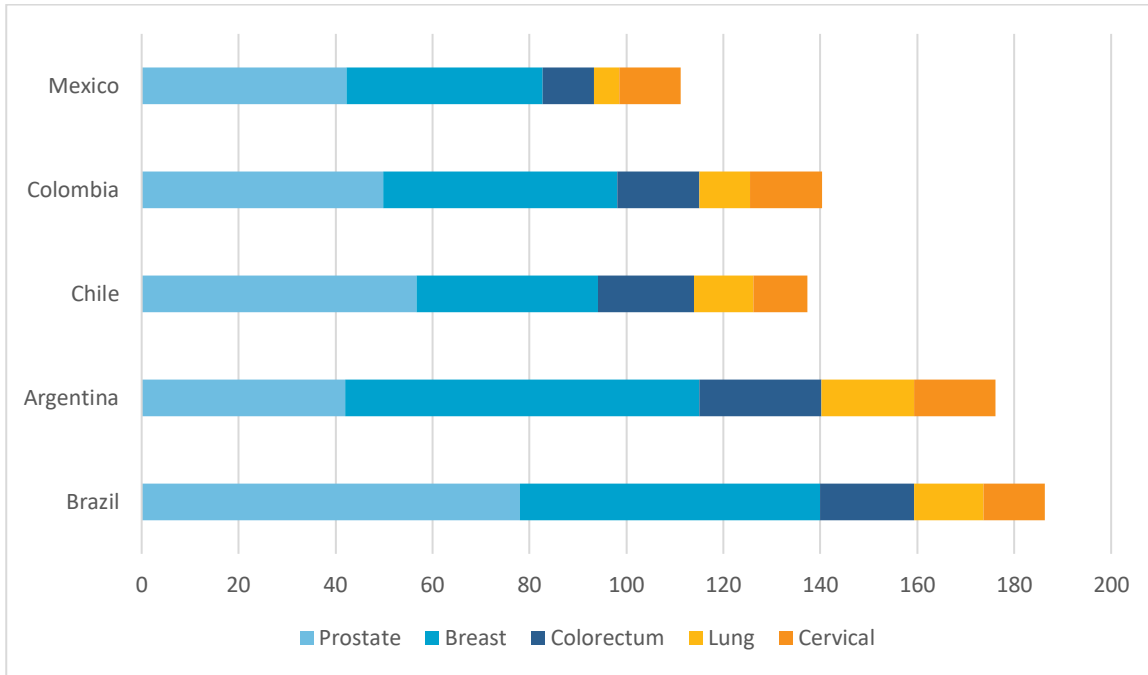
The ranking of age standardised incidence rates for cancer differs slightly between countries. Figure 5 outlines the top 5 incident cancers by ASR for each of the Latin American countries selected for comparison. There are distinct similarities while there are differences. For example, prostate, breast, and colorectal cancers are the 3 most common cancer types in the countries studied. Lung cancer and cervical cancer also rank relatively highly in most of the selected contexts. The age standardised rate of stomach cancer is a disproportionately high for Colombia and Chile, while lung cancer is not in the top 5 for Colombia and Mexico. In Mexico, thyroid cancer is among the top 5 cancer types by ASR of incidence but does not appear in the top 5 in the comparator countries.

Figure 5: The top five cancers ranked by Age Standardized Incidence Rates per 100,000 people in Chile and selected countries in Latin America (Source: IARC Cancer Today).

Rank	Brazil	Argentina	Chile	Colombia	Mexico
1	Prostate	Breast	Prostate	Prostate	Prostate
2	Breast	Prostate	Breast	Breast	Breast
3	Colorectum	Colorectum	Colorectum	Colorectum	Cervical
4	Lung	Lung	Stomach	Cervical	Colorectum
5	Cervical	Cervical	Lung	Stomach	Thyroid

4.1.2. Incidence Comparisons: Brazil, Latin America, and the World

The average levels of ASR of cancer incidence in Brazil (215.4 new cases per 100,000) is higher than that the average global rate (201 new cases per 100,000) and that in Latin America and Caribbean (186.5) region. However, Brazil has a significantly lower incidence rate than North America (360.7) and Western Europe (325).

Figure 6: Estimated Age Standardized Incidence Rate for Cancer for All Cancers per 100,000 People in 2020 (Source: IARC Cancer Today).
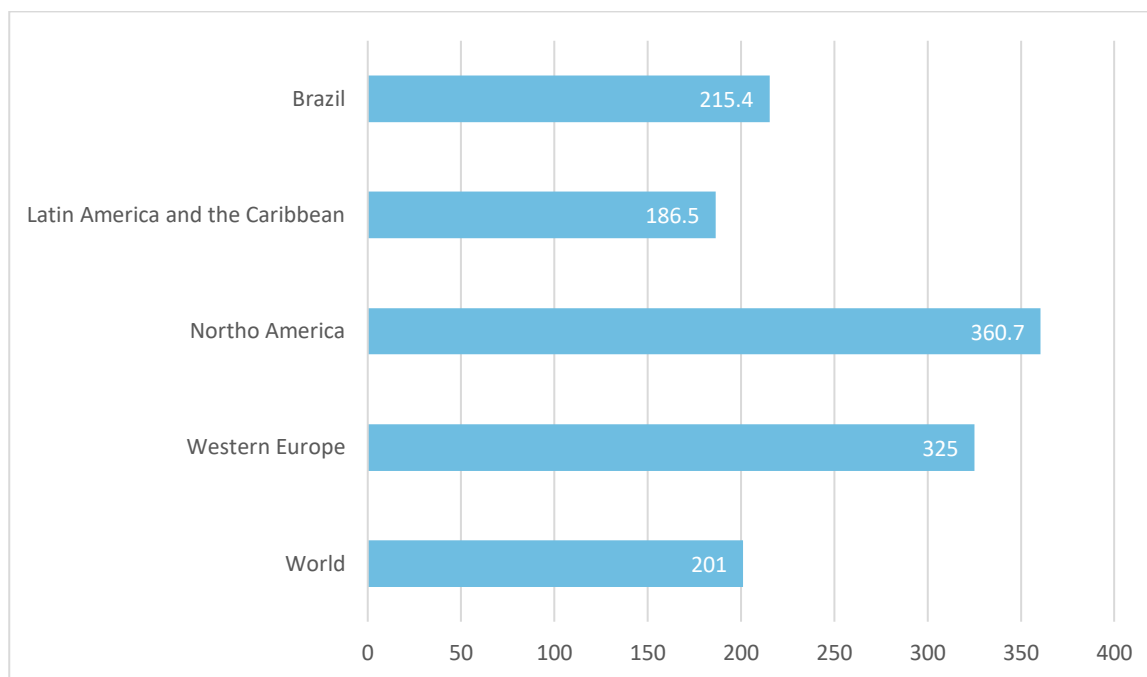
The age standardised incidence of different cancer types in Brazil varies substantially from those in different world regions. For instance, for the incidence rate of 32.6 new cases per 100,000 people lung cancer in North America and 32.7 new cases per 100,000 people in Western Europe is more than double the rate in Brazil. Conversely, the incidence of cervical cancer in Brazil (12.7 per 100,000 people) is nearly double that in North America (6.1 per 100,000) and Western Europe (7.0).

Figures 7 and 8 provide a breakdown of ASR of incidence rates for the most common types of cancer in Brazil, world regions and and globally. Figure 9 compares the ASR of incidence for the 5 most common cancer types across the different world regions and globally.

Figure 7: Estimated Number of New Cases of Cancer per 100,000 (Age Standardized) by Cancer Type in Brazil and world regions (Source: IARC Cancer Today).
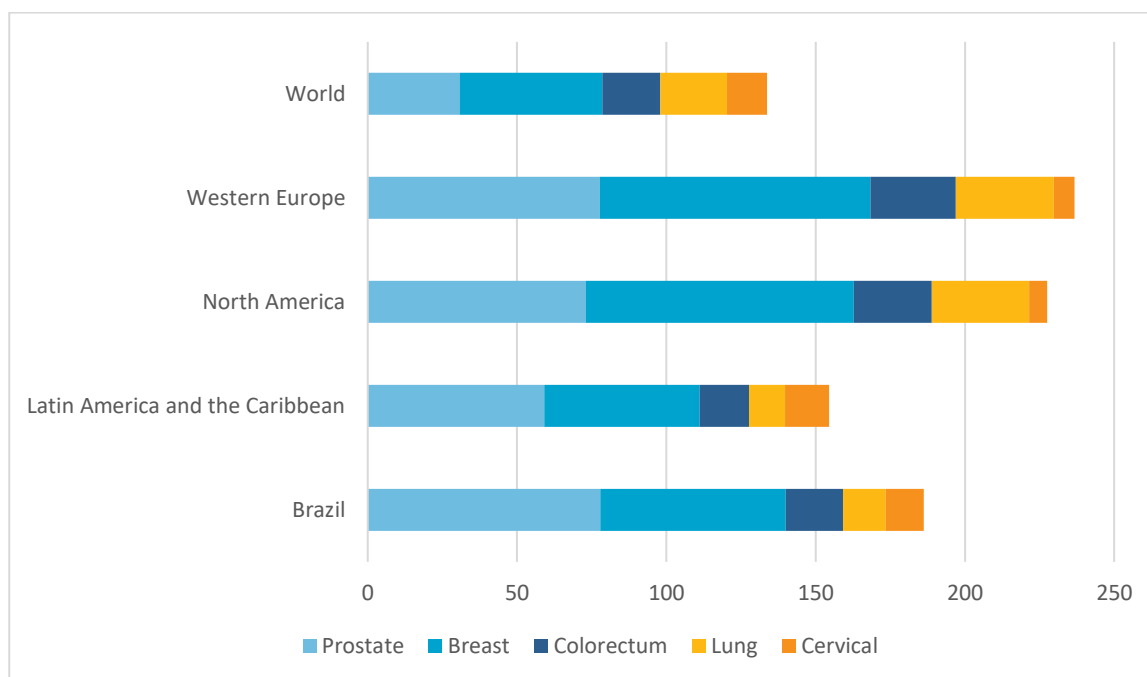
Figure 8: Estimated Number of New Cases of Cancer per 100,000 (Age Standardized) by Cancer Type in Chile and world regions (Source: IARC Cancer Today).

	Brazil	Latin America and the Caribbean	North America	Western Europe	World
Prostate	78	59.2	73.0	77.6	30.7
Breast	61.9	51.9	89.7	90.7	47.8
Colorectum	19.4	16.6	26.2	28.7	19.5
Lung	14.3	12.0	32.6	32.7	22.4
Cervical	12.7	14.9	6.1	7.0	13.3
Thyroid	11.9	8.6	12.4	9.0	6.6
Stomach	7.1	8.3	4.2	5.9	11.1
Uterine	8.1	8.2	21.1	12.9	8.7
Non-Hodgkin Lymphoma	4.3	5.2	12.0	10.2	5.8
Bladder	5.4	4.0	10.9	13.0	5.6
Total Incidence of Cancer	**215.4**	**186.5**	**360.7**	**325.0**	**201.0**

Figure 9: The top five cancers ranked by Age Standardized Incidence Rates per 100,000 Population in Brazil and world regions (Source: IARC Cancer Today).

Rank	Brazil	Latin America and the Caribbean	North America	Western Europe	World
1	Prostate	Prostate	Breast	Breast	Breast
2	Breast	Breast	Prostate	Prostate	Prostate
3	Colorectum	Colorectum	Lung	Lung	Lung
4	Lung	Cervical	Colorectum	Colorectum	Colorectum
5	Cervical	Lung	Uterine	Melanoma of skin	Cervical

4.1.3.   Cancer Mortality

While many of the cancers with the highest incidence rates are similarly ranked by mortality rate, these lists are not exactly the same. Figure 10 provides a comparison of the top 10 cancers ranked by ASR of incidence and ASR of mortality in Brazil.

Figure 10: Most Common Cancers in Brazil by Age Standardised Incidence and Mortality Rates per 100,000 population (Source: IARC Cancer Today 2020).

Incidence	
Prostate	78
Breast	61.9
Colorectum	19.4
Lung	14.3
Cervical	12.7
Thyroid	11.9
Stomach	7.1
Uterine	8.1
Non-Hodgkin Lymphoma	4.3
Bladder	5.4
Total Incidence Rate for Cancer	215.4

Mortality	
Breast	13.8
Prostate	13.7
Lung	12.3
Colorectum	9
Cervical	6.3
Stomach	5.5
Pancreas	4.4
Liver	4.3
Brain, CNS	4.2
Oesophagus	3.5
Total Mortality Rate for Cancer	91.2

In 2020, the age-standardized mortality rate for all cancers in Brazil was 91.2 deaths per 100,000 people—the third highest among the selected Latin American countries. The level in Brazil is similar to that in Argentina (106.1 deaths per 100,000) and Chile (87.4) but higher than that in Colombia (84.7) and Mexico (63.2) (Figure 11).

Figure 11: Estimated Age Standardized Mortality Rate for Cancer per 100,000 People in 2020 in Brazil and selected Latin American Countries (Source: IARC Cancer Today).
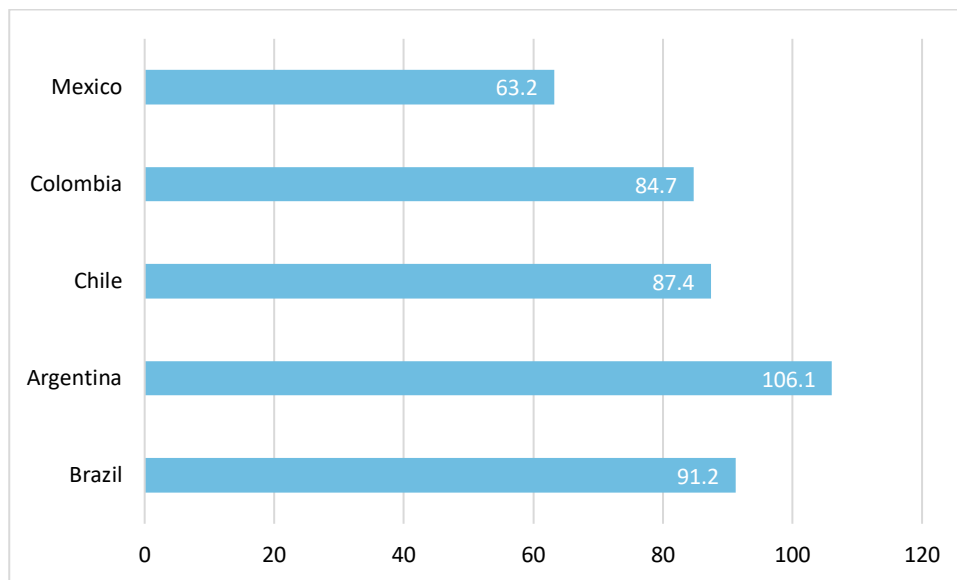
The top 6 cancers by ASR of mortality in Brazil are breast cancer (13.8 deaths per 100,000 in 2018), prostate cancer (13.7), lung cancer (9.0), colorectal cancer (6.3) and cervical cancer (5.5). No other cancer type in Brazil has an age-standardized rate above 5 deaths per 100,000 people. Figure 12 presents the estimated mortality rates per 100,000 population for the top 10 cancers in Brazil.

Figure 12: Estimated Age Standardized Mortality Rate for Cancer per 100,000 People in Brazil in 2018 (Source: IARC Cancer Today).
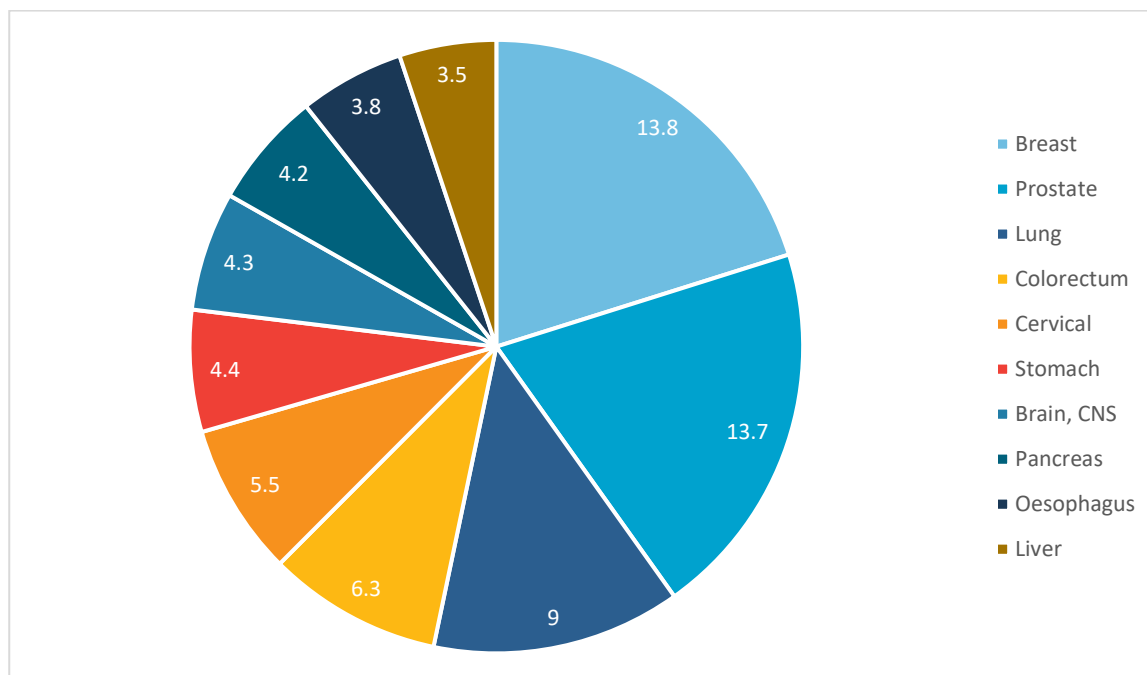
For common cancers, the estimated age standardized cancer mortality rates in Brazil is similar to that in the comparator countries in Latin America and the Caribbean (Figure 13). For instance, the highest ASR of mortality in Brazil is breast cancer at 13.8 deaths per 100,000 people, which ranks second highest among selected large Latin American countries behind Argentina (18.9 deaths per 100,000) but is similar to the estimates for Colombia (13.1). Similarly, prostate cancer has the second highest ASR of mortality in Brazil at 13.7 deaths per 100,000. This rate is similar in Chile (14 deaths per 100,000), but higher compated to the rates observed in Argentina (12.2), Colombia (11.9) and Mexico (10.6).

Figure 13: Age Standardized Mortality Rate for Cancer per 100,000 population for prostate, lung, stomach, breast and colorectal cancers in 2020 (Source: IARC Cancer Today).
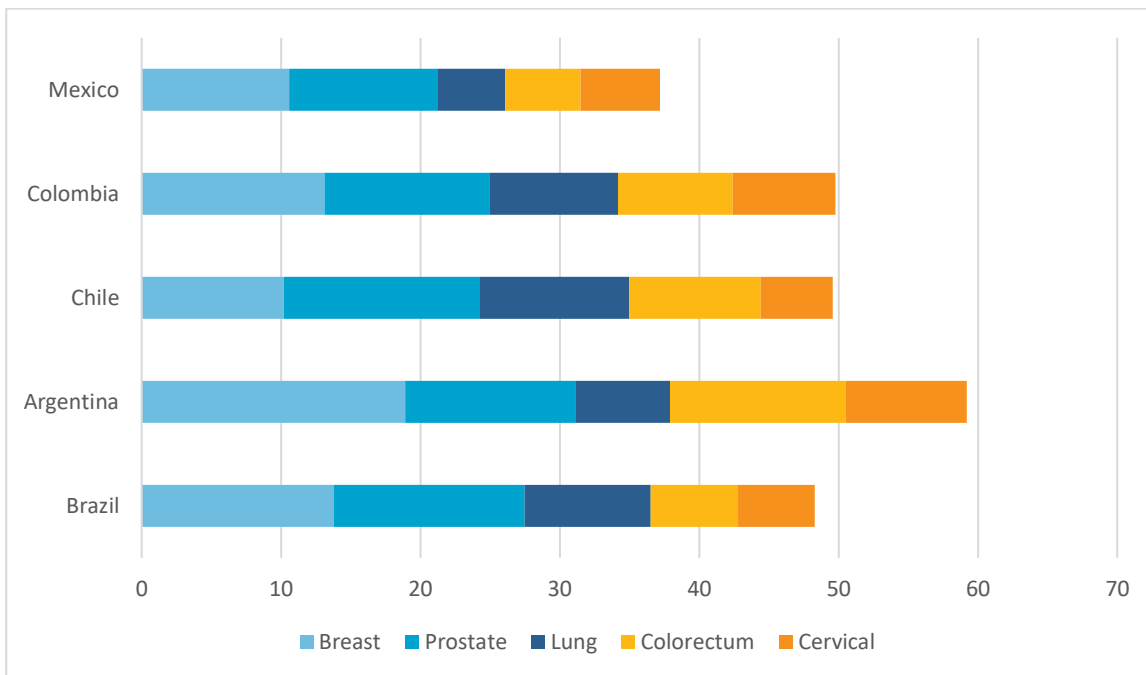
Figure 14 shows the Age Standardized Mortality Rates for Cancer per 100,000 population for the top 10 cancer types in Brazil comnpared with the rates observed in comparator countries

Figure 14: Age Standardized Mortality Rates per 100,000 Population for the top 10 Cancers in selected Latin American Countries in 2020 (Source: IARC Cancer Today).

	Brazil	Argentina	Chile	Colombia	Mexico
Breast	13.8	18.9	10.2	13.1	10.6
Prostate	13.7	12.2	14.0	11.9	10.6
Lung	9	6.8	10.8	9.2	4.9
Colorectum	6.3	12.6	9.4	8.2	5.4
Cervical	5.5	8.7	5.2	7.4	5.7
Stomach	4.4	4.9	10.0	9.9	4.7
Pancreas	4.2	7.0	5.3	4.0	3.3
Liver	3.5	3.3	4.5	3.4	5.0
Brain, CNS	4.3	2.6	2.1	2.8	1.9
Oesophagus	3.8	2.6	1.7	1.2	0.87
Total Mortality Rate for Cancer	91.2	106.1	87.4	84.7	63.2

Breast, prostate, lung, colorectal and cervical cancers ranked in the top 5 for all countries except Mexico where liver cancers appear in the top 5, while in Chile and Colombia stomach cancer is ranked in the top 5 (Figure 15).

Figure 15: Top Five Cancer Types Ranked by Age Standardized Mortality Rates per 100,000 Population in in selected Latin American Countries (Source: IARC Cancer Today 2020).

Rank	Brazil	Argentina	Chile	Colombia	Mexico
1	Breast	Breast	Prostate	Breast	Breast
2	Prostate	Lung	Lung	Prostate	Prostate
3	Lung	Colorectum	Breast	Stomach	Cervical
4	Colorectum	Prostate	Stomach	Lung	Colorectum
5	Cervical	Cervical	Colorectum	Colorectum	Liver

4.1.4.   Mortality Comparisons: Brazil, Latin America, and the World

The average age standardized mortality rate for cancer in Brazil (91.2 per 100,000 population) is similar to that in North America (87.1), above Latin America and Caribbean (86.5) but below that in Western Europe (103.3) and the World (101.7).

While North America and Western Europe have much higher age standardized incidence rates for cancer than Brazil, both regions have comparable mortality rates to Brazil (Figure 16).

Figure 16: Estimated Number of Deaths from Cancer per 100,000 Population (age standardized) in Brazil and selected worl regions (Source: IARC Cancer Today 2020).
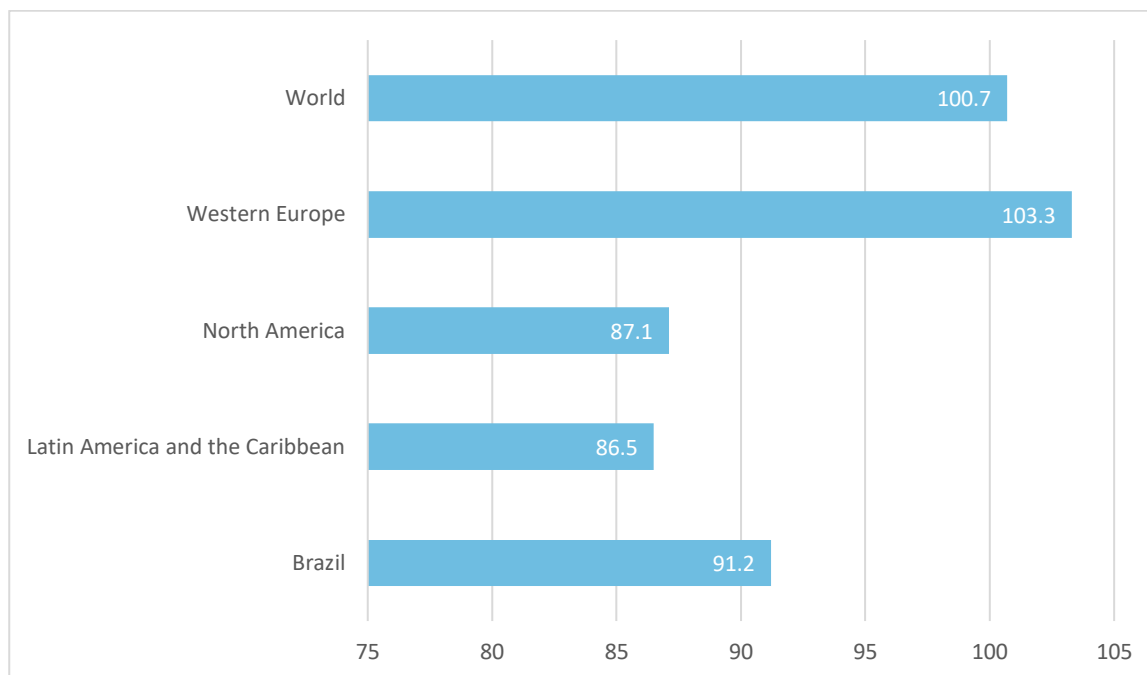
The age standardized mortality rates for different cancer types vary in different regions of the world (Figures 17 and 18). The pattern in Brazil is similar to Latin America and the Caribbean. The mortality rate for stomach cancer in Brazil (5.5 per 100,000 in 2018) is far higher than that in North America (1.8) and Western Europe (3.3) but lower than the world average (7.7).

Figure 17: Estimated Age Standarized Mortality Rate from Cancer per 100,000 Population by Cancer Type (Source: IARC Cancer Today 2020).
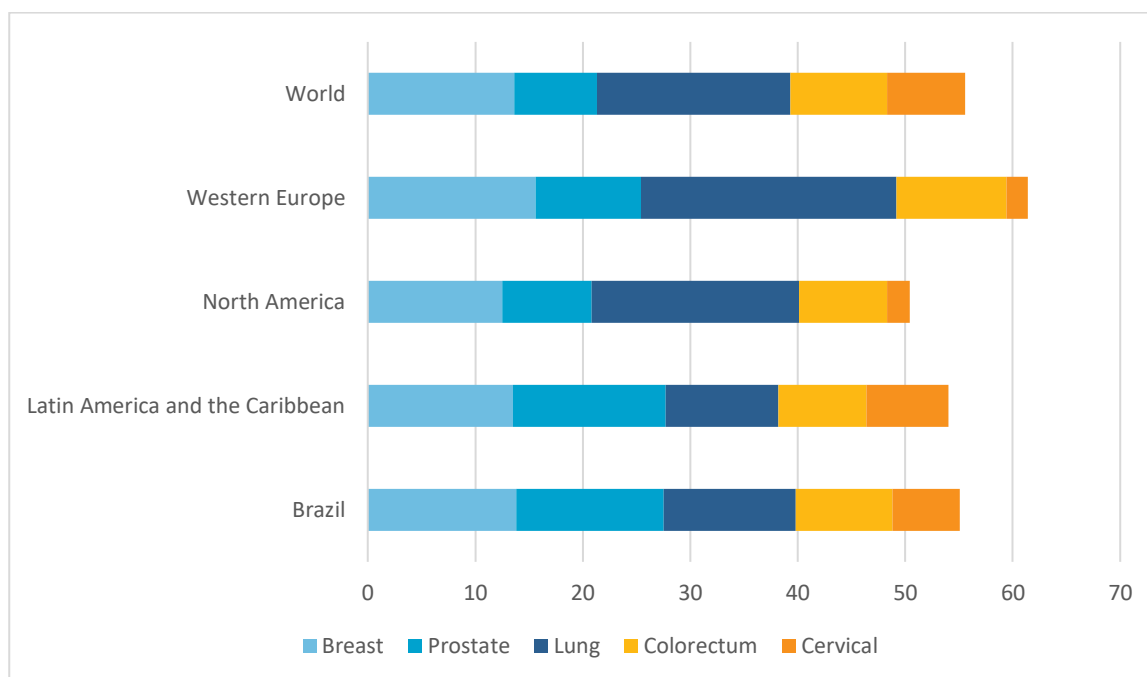
Figure 18: Estimated Number of Deaths from Cancer per 100,000 by Cancer Type (Source: IARC Cancer Today 2020).

	Brazil	Latin America and the Caribbean	North America	Western Europe	World
Breast	13.8	13.5	12.5	15.6	13.6
Prostate	13.7	14.2	8.3	9.8	7.7
Lung	12.3	10.5	19.3	23.8	18.0
Colorectum	9	8.2	8.2	10.2	9.0
Cervical	6.3	7.6	2.1	2.0	7.3
Stomach	5.5	6.4	1.8	3.3	7.7
Pancreas	4.4	4.3	6.5	7.8	4.5
Liver	4.3	4.6	4.7	4.5	8.7
Brain, CNS	4.2	2.9	3.3	3.9	2.8
Oesophagus	3.5	2.2	2.4	3.0	5.6
Total Mortality Rate for Cancer	**91.2**	**86.5**	**87.1**	**103.3**	**100.7**

Comparison of the 5 top cancers by age standardised mortality rate in Brazil with selected world regions reveals similarities and differences (Figure 19). For example, in Brazil and in each of the selected world regions countries breast, prostate, lung, colorectal and cervical cancers are in the top 5 cancer types by age standardized mortality. By contrast, breast cancer appears in the second place among the top 5 cancer types in Latin America and stomach and liver cancer appears in the top 5 cancer types in the global top 5. (Figure 19).

Figure 19: Top 5 Cancer Types in Brazil and Selected World Regions Ranked by Age Standardized Mortality Rates per 100,000 Population (Source: IARC Cancer Today 2020).

Rank	Brazil	Latin America and the Caribbean	North America	Western Europe	World
1	Breast	Prostate	Lung	Lung	Lung
2	Prostate	Breast	Breast	Breast	Breast
3	Lung	Lung	Prostate	Colorectum	Colorectum
4	Colorectum	Colorectum	Colorectum	Prostate	Liver
5	Cervical	Cervical	Pancreas	Pancreas	Stomach

4.1.5.   5-Year Net Survival for Brazil's Most Common Types of Cancer

Though cancer incidence and mortality rates are very useful metrics to consider when examining a country's cancer burden, mortality levels are influenced by incidence levels. Typically, as incidence rate declines so does the mortality rate. Hence, an alternative metric should be considered to better reflect health system performance in relation management of cancer across the care continuum. 5-year net survival for cancer patients provides an important insight into the effectiveness, equity, efficiency and responsiveness of care individuals receive for cancer.

We used the 5-year net survival figures from the CONCORD-3 study as a measure of health system performance in managing cancer. CONCORD-3 provides 5-year net survival from 2000 to 2014 for most cancers by world region and country. To model estimates in Brazil, CONCORD-3 study used data from 6 population based registries which collectively cover around 7.7% of the total population in Brazil (78). This figure is slightly below, yet comparable to those observed in Argentina (9.2%), Chile (13.8%), and Colombia (9%). Brazil's level of population coverage represents an improvement from the previous iteration of the study, CONCORD-2, where 5.7% of the population was covered. However, this level remains well-below countries like the US, whose registries used in the study cover 85.6% of the total population.

Figure 20 uses CONCORD-3 data to compare survival for the top 5 cancers in Brazil with the highest mortality rates in 2018, namely prostate, breast, lung, colon, and stomach cancers. A difference in methodology exists between the CONCORD-3 study and IARC's GLOBOCAN study. The data from IARC groups all colorectal cancers together, specifically cancers of the bowel, colon, and rectum. However, the

CONCORD-3 study disaggregates this group of gastrointestinal cancers to colon and rectal cancers Hence, Figure 20 presents data for colon cancer and not colorectal cancer.

Another point to note is that the asterisks in Figure 20 denote data points that are considered less reliable than others because 15% or more of patients were either:

1. Lost to follow-up or censored alive within 5 years of diagnosis or, if diagnosed in 2010 or later, before Dec 31, 2014.

2. Registered only from a death certificate or at autopsy.

3. Registered with unknown vital status or with incomplete dates, for example unknown year of birth, unknown month or year of diagnosis, or unknown year of last known vital status.

Figure 20: 5-Year Net Survival for Adults, Percentage of All Diagnosed Cancer Cases in Chle, Argentina, Brazil and Colombia (Source: CONCORD-3 Study).

Prostate				
	Brazil	Argentina	Chile	Colombia
2000-2004	90%	83.5%	82.6%	83.6%
2005-2009	92.5%	83.6%	84.4%	87.8%
2010-2014	91.6%	87.6%	82%	80.3%

Breast				
	Brazil	Argentina	Chile	Colombia
2000-2004	68.7%	82.3%	74.6%	72.3%
2005-2009	76.9%	82%	73.5%	79.1%
2010-2014	75.2%	84.4%	75.5%	72.1%

Lung				
	Brazil	Argentina	Chile	Colombia
2000-2004	10.7%	19.5%	7.1%	9.4%
2005-2009	7.8%	12.4%	6.3%	10.5%
2010-2014	8.5%	13.1%	4.6%	8.7%

Colon				
	Brazil	Argentina	Chile	Colombia
2000-2004	44.5%	54.2%	35.5%	45%
2005-2009	50.6%	51.2%	47.1%	41.3%
2010-2014	48.3%	54.4%	43.9%	34.5%

Stomach				
	Brazil	Argentina	Chile	Colombia
2000-2004	19.1%	21.7%	14.5%	18.4%
2005-2009	24.7%	19.3%	16.3%	17.7%
2010-2014	20.6%	21.5%	16.7%	17.1%

In Brazil, in 2010 to 2014, the cancers with the highest 5-year survival were prostate and breast cancers, which have the highest mortality rate for any cancer type. The cancers with the lowest 5-year survival were lung cancer and stomach cancer at 8.5% and 20.6% respectively. To further contextualize Brazil's performance, Figure 21 compares the country with the highest survival for the top 5 cancers in Brazil with countries that have achieved the highest survival levels for these cancers.

Figure 21: Countries with the Highest 5-Year Survival for Cancer in 2000 to 2014 and that for Brazil for selected cancer types (Source: CONCORD-3 Study).

5-Year Survival from Cancer in 2010-2014			
Type of Cancer	Country with the Highest Level of 5-Year Survival	5-Year Survival (%)	5-Year Survival in Brazil (%)
Prostate	Puerto Rico	98.4%	91.6%
Breast	USA	90.2%	75.2%
Lung	Japan	32.9%	8.5%
Colon	South Korea	71.8%	48.3%
Stomach	South Korea	68.9%	20.6%

4.1.6.   Childhood Cancer in Brazil

The study, "Sustainable Care for Children with Cancer: a Lancet Oncology Commission", published by The Lancet Oncology in 2020 estimated 5-year net cancer survival for children in Latin America and the rest of

the world. The study estimated a wide variation in survival for all childhood cancer types, ranging from 8.1% in Eastern Africa to 83.0% in North America, with an overall global average of 37.4% (10).

In September 201, the WHO Global Initiative for Childhood Cancer, has set a target of 60% 5-year survival by 2030 for childhood cancers, but, Ward et al. argue, this target is unlikely to be achieved at the current levels of coverage and scale-up, particularly for cancer types like retinoblastoma, Burkitt's lymphoma and nephroblastoma for which current survival levels are about 25% (10). For example, in South America, the overall average 5-year net survival for childhood cancer is 60.2%, but for many cancers survival levels are well below the WHO's target of 60%, including for acute myeloid leukemia (57.1%), astrocytomas (49.3%), CNS embryonal tumors (41.0%), and osteosarcomas (53.5%)(10) (Table 1).

Table 1: Estimated 5-Year Net Survival for the Top 10 Childhood Cancer Types in Brazil by Incidence (Source: Harvard Dataverse (11))

Cancer Group	Cancer Type	5 year Survival			
		Argentina	Brazil	Chile	Colombia
Leukaemia	Lymphoid	75.6%	69.4%	74.5%	74.5%
Leukaemia	Acute Myeloid	63.0%	54.8%	57.1%	58.4%
CNS Neoplasms	Astrocytoma	70.7%	37.8%	49.3%	49.9%
Lymphoma & Related	Non-Hodgkin except Burkitt	80.4%	69.8%	72.0%	74.3%
Lymphoma & Related	Hodgkin	89.0%	71.4%	76.7%	79.6%
Renal Tumors	Nephroblastoma	81.6%	61.2%	69.3%	71.3%
CNS Neoplasms	CNS Embryonal	56.9%	288%	41.0%	41.5%
Neuroblastoma	Ganglioneuroblastoma	73.9%	56.0%	63.0%	64.7%
Retinoblastoma	Retinoblastoma	83.8%	60.8%	72.3%	71.1%
Bone Tumors	Osteosarcoma	62.2%	49.9%	53.5%	55.0%

Analysis of the projected incidence levels for childhood cancers in Latin American countries and estimates of what proportion of these are likely to be diagnosed suggest that on average 70.3% of the cases in Brazil are likely to be diagnosed, compared with 68.9% in Argentina, 68.8% in Chile, and 70.9% in Colombia (11) (Table 2). The proportion of childhood cancers that are likely to be diagnosed in Latin American countries is well below the diagnosis levels likely to be achieved in Western Europe (97.2%) and North America (97.3%) (11).

Table 2: Projected Number of New Cases of Childhood Cancer in 2030 and estimates of proportions that will be diagnosed (Source: Harvard Dataverse (11))

Country	Projected incidence of childhood cancer in 2030 (95% Confidence Interval)	Estimated number of childhood cancer cases diagnosed (95% Confidence Interval)	Proportion likely to be diagnosed
Argentina	2089 (1578-2760)	1439 (1160-1729)	68.9%
Brazil	7934 (5588-10472)	5579 (4361-6826)	70.3%
Chile	648 (452-863)	446 (337-551)	68.9%
Colombia	2004 (1369-2690)	1421 (1102-1753)	70.9%

4.2. Political, Legal and Regulatory Environment

Since 1920s, Brazil has introduced several major policies and laws to expand coverage and access to cancer screening, treatment, care and control (Table 3). The literature reports that one of the first government proposals to fight against cancer in Brazil took place in 1920, which introduced compulsory notification of cancer cases and the registration of cancer as a cause of death (12).

Public entities in collaboration with philanthropic institutions established healthcare centers specialized on treating cancer patients and promoting preventive care (13). For example, in 1937 a new regulation enabled the creation of the Cancer Center in Rio de Janeiro. The National Cancer Service (Serviço Nacional de Câncer - SNC) was created in 1941. In 1957, the National Institute of Cancer José Alencar Gomes da Silva (INCA), an integrated cancer institute and hospital, was inaugurated. INCA became the headquarters of the SNC.

In the 1970s, during the military dictatorship, there was a lack of new cancer control policies. In the 1980s, the Oncology Program (Pro-Onco) was launched, with the main goal of promoting cancer control (14), but there was no effective cancer control.

The Federal Constitution of 1988 in Brazil defined in article 196 that health is a right for all and a duty of the State. From the 1990's onwards, with the transition to democratic rule and the establishment of the Sistema Único de Saúde (SUS), the Unified Health System, there was a renewed emphasis on cancer control with an acceleration in the development of new policies and regulations for cancer. Following the establishment of the Unified Health System in 1990, INCA assumed the role of the lead responsible agency for cancer control policies in the country – a role it has continued to discharge (14). The establishment of the SUS coincided with the implementation of a number of public policies to develop and structure assistance to cancer patients (15).

In this study, we undertook a comprehensive literature review and analysis to explore the evolution of major policies and regulations related to cancer prevention, treatment, care and control in Brazil since the establishment of the SUS. We categorised the content of the legal norms according to the historical period (definition; organization; expansion; integration) and purpose (structuring rules; qualification/accreditation; financing; protocols/technology). The major regulations that are considered the most relevant leading to structural changes on cancer care and control are summarised in Table 3.

Table 3: Timeline of Key Cancer Policies in Brazil (14-21)

Timeline of Key Cancer Policies in Chile	
1941	Creation National Service of Cancer (Serviço Nacional de Câncer - SNC)
1957	Inauguration The National Institute of Cancer José Alencar Gomes da Silva (INCA)
1972	INCA is reinstated to the Ministry of Health.
1988	Federal Constitution - health is a right for all and a duty of the State.
1990	Unified Health System (Sistema Único de Saúde - SUS) established
1993	Cancer care units are separated as Center of Reference (CR) I (patient with any type of neoplasm) and CR II (patients main types of neoplasms). Standardization of Specialized Centers of Radiotherapy and Chemotherapy.
1998	New criteria for registering centers of high complexity care in oncology. Stablish strategies for comprehensive service to patients with cancer and hierarchical network, focusing on flows and references. Also new cancer care center were open according to epidemiological data.
1998	CR are substituted by Center for High Complexity in Oncology (Cacon) and the inclusion of its clinics in the System of SUS Outpatient Information (SIA/SUS).
1998	National Cervical Cancer Control Program (Viva Mulher)
1999	Law No. 9,797/99 - Obligatory plastic surgery to repair the breast by SUS, in cases of mutilation resulting of cancer treatment .
1999	Creation of Assistance Programming and Regulation Oncology Centers
2000	First initiatives for the control of breast cancer, consolidating protocols of treatment
2000	Definition of Technical Regulation for Bone Marrow Transplantation
2001	Implementation National Prostate Cancer Control Program
2002	Setting parameters care coverage, including oncology
2002	Implementation of the National Program Pain Assistance and Palliative Care
2003	Inclusion of indicators in the primary care related to cervicovaginal cytopathologic exams and to the mortality rates of women for cervical and breast cancers.
2005	National Oncology Care Policy (Política Nacional de Atenção Oncológica - PNAO) structuring the patient flow of cancer care. Establishing actions to promote health, prevent cancer and organizing the system to provide an appropriate therapeutic flow of the patient.
2005	Organization Oncology Networks (Redes de Atenção Oncológica - RAO), promoting a reconfiguration of criteria for enabling high complexity oncology units.
2006	Pact for Health (Pacto pela Saúde) set of institutional reforms of the SUS agreed upon between the three spheres of management (Union, States and Municipalities) with the objective of promoting innovations in management processes and instruments, aiming to achieve greater efficiency and quality in the responses of the Unified System of Health, including cancer care.

2006	Technical regulation of the services radiotherapy
2008	The mammography law (Law 11,664) which regulates mammography from the age of 40 by SUS
2009	Update of the technical regulation of stem cell transplantation hematopoietic, including the minimum requirements for performing this therapy and strengthening all Brazilian Registry of Voluntary Marrow Donors Bone.
2009	Development of the Information System of Breast Cancer Control (Sismama), by INCA and Data SUS, a tool for proper detection actions management early breast cancer.
2011	Creation of the National Cancer Clinical Research Network (RNPCC)
2012	Expansion plan of radiotherapy
2012	Publication of the Law No. 12.732/12 - obligation to start cancer treatment within a maximum of 60 days after the diagnosis.
2013	The National Policy for Prevention and Control of Cancer (Política Nacional para Prevenção e Controle do Câncer - PNPCC) replaced PNAO providing greater emphasis on comprehensiveness of care and health information.
2013	Implementation of the Cancer Information System (Sistema de Informação de Câncer - SISCAN) within the scope of the SUS. This is a web platform version that integrates the Cervical Cancer Information Systems (SISCOLO) and Breast Cancer Information Systems (SISMAMA)
2013	Law 12880 – inclusion of oral medications for the treatment of breast cancer in the list of procedures of the National Health Agency (ANS)
2014	Creation of Referral Services for Diagnosis and Treatment of Precursor Colon Cancer Lesions of the Uterus (SRC) and Breast Cancer (SDM)
2018	Compulsory Registration Law (13,685) notification of cancer cases in public and private health networks mandatory
2019	Amends Law No. 12.732/12, so that exams related to the diagnosis of malignant neoplasm are carried out within 30 (thirty) days.

Of the major policies and regulations, two are highlighted in particular, considering their relevance and major influence on structural changes in cancer delivery and access to cancer care and control. The first, the National Oncology Care Policy (Política Nacional de Atenção Oncológica - PNAO), developed in 2005 (17) by the Health Ministry, was designed to organize the Oncology Care Network in the Brazilian States, with the objective of overcoming the fragmentation of actions related to cancer care and ensuring greater effectiveness and efficiency in cancer care and control. The policy focused on actions for developing comprehensive cancer care, including promotion, prevention, diagnosis, treatment, rehabilitation and palliative care, to be implemented in all states, considering the three spheres of management (federal, state and municipal levels) involved in healthcare planning, financing and delivery. Moreover, the policy included actions to expand coverage for cancer care with appropriate resourcing, according to the principles of universality, integrality and citizenship (14).

The second, The Law 12.732, of 11/22/12 guaranteed that patients with malignant neoplasms "receive, free of charge, in the Unified Health System (SUS), all necessary treatments and establishes a period of up to 60 days from the day on which the diagnosis is confirmed in the report to undergo the first treatment in SUS

with surgical therapy or radiotherapy or chemotherapy, according to the therapeutic need that the case requires." (18). In 2019, there was an amendment to this Law to ensure "exams related to the diagnosis of malignant neoplasm are carried out within 30 (thirty) days" (20).

4.2.1. Brazil's National Cancer Control Plan

The National Oncology Care Policy (Política Nacional de Atenção Oncológica - PNAO) of 2005 was replaced in 2013 during the Presidency of Dilma Rousseff by the National Policy for Prevention and Control of Cancer (Política Nacional para Prevenção e Controle do Câncer – PNPCC).

This new policy was created to place greater emphasis on comprehensiveness of cancer care and the development of health information systems for cancer. It aimed to reduce mortality and disability caused by cancer, decrease the incidence of some types of cancer, and contribute to the improvement of the quality of life of individuals with cancer, through promotion, prevention, early detection, timely treatment and palliative care (21).

Brazil's National Policy for the Prevention and Control of Cancer was introduced in May of 2013. The policy identified several principles and guidelines related to cancer. Specifically, in Chapter II of Ordinance No. 874 of the policy the Ministry of Health identified major principles for health promotion, prevention, care and control of cancer as well as education, use of new technologies, surveillance, monitoring and evaluation, and communication (Table 4).

Table 4: Principles and Guidelines of Brazil's National Cancer Policy, 2013 (Source: Brazilian Virtual Library of Health) (21)

Chapter II, Section I: The General Principles of the National Policy for the Prevention and Control of Cancer	
1.	Recognition of cancer as a preventable chronic disease and the need to offer comprehensive care, considering the guidelines of the Health Care Network for People with Chronic Diseases within the scope of the SUS;
2.	Organization of regionalized and decentralized care networks, with respect to access, scale and scope criteria;
3.	Training of professionals and promotion of permanent education, through activities aimed at the acquisition of knowledge, skills and attitudes of health professionals for the qualification of care at different levels of health care and for the implementation of this Policy;
4.	Intersectorial articulation and guarantee of broad participation and social control; and
5.	The incorporation and use of technologies aimed at the prevention and control of cancer in the Health Care Network for People with Chronic Diseases within the scope of the SUS must be the result of recommendations made by government agencies from the Technology Assessment Process in Health (ATS) and Economic Evaluation (AE).

Section II: Principles and Guidelines Related to Health Promotion
The following are guidelines related to health promotion within the scope of the National Policy for the Prevention and Control of Cancer

1.	Strengthening of public policies that aim to develop to the maximum the potential health of each citizen, including policies that have as their object the creation of favorable environments for health and the development of individual and social skills for self-care;
2.	Carrying out intersectorial actions, seeking partnerships that favor the development of health promotion actions;
3.	Promotion of healthy eating habits such as exclusive breastfeeding until six months of life, and increased consumption of fruits and vegetables, including educational actions and environmental and organizational interventions;
4.	Promotion of bodily practices and physical activities, such as gymnastics, walking, dancing, and sports
5.	Coping with the impacts of pesticides on human health and the environment, through health promotion practices with a preventive and sustainable nature;
6.	Development of actions and public policies to combat smoking, alcohol consumption, overweight, obesity and inadequate food consumption, considering risk factors related to cancer;
7.	Promotion of activities and practices related to health promotion to be developed in spaces that even go beyond the limits of health services, reaching, for example, schools, workplaces and homes;
8.	Advances in actions to implement the Framework Convention on Control of Tobacco Use, referred to in Decree No. 5658, of January 2, 2006;
9.	Fostering the preparation of normative documents aimed at regulating the production and consumption of products and foods whose composition contains carcinogens and/or high concentrations of calories, saturated or trans fats, sugar and salt; and
10.	Encouraging the expansion of restrictive measures to the marketing of foods and beverages with a high content of salt, calories, fat and sugar, especially those aimed at children.

Section III: Principles and Guidelines Related to Cancer Prevention
The elimination, reduction, and control of physical, chemical and biological risk factors and the intervention on their socioeconomic determinants, in addition to integrating them, constitutes the principle of cancer prevention within the scope of the National Policy for the Prevention and Control of Cancer.

1.	Encouragement to eliminate or reduce exposure to carcinogens related to work and the environment, such as benzene, pesticides, silica, asbestos, formaldehyde and radiation;
2.	Prevention of smoking initiation and alcohol use and consumption of unhealthy foods;
3.	Implementation of cancer early detection actions, through screening and early diagnosis, based on government recommendations, based on ATS and AE;
4.	Guarantee of timely diagnostic confirmation of suspected cancer cases; and
5.	Structuring of monitoring and quality control actions for screening exams.

	Section IV Principles and Guidelines Related to Surveillance, Monitoring and Evaluation
	The following are guidelines related to surveillance, monitoring and evaluation within the scope of the National Policy for the Prevention and Control of Cancer:
1.	Monitoring of risk factors for cancer, in order to plan actions capable of preventing the disease, reducing damage, and protecting life;
2.	Use, in an integrated manner, of data and epidemiological and care information available for the planning, monitoring, and evaluation of actions and services for the prevention and control of cancer, produced: a) by the various SUS information systems, including those on mortality, morbidity, outpatient and hospital procedures; b) population-based and hospital-based cancer registries; c) by population surveys and surveys; and d) by Brazilian demographic and socioeconomic statistics;
3.	Implementation and permanent improvement of the production and dissemination of information, with a view to supporting the planning of actions and services for the prevention and control of cancer;

	Section V: Principles and Guidelines Related to Comprehensive Care
	The principle of comprehensive care is within the scope of the National Policy for the Prevention and Control of Cancer. It comprises of the organization of actions and services aimed at the comprehensive care of people with cancer in the Health Care Network for People with Chronic Diseases in the scope of the SUS, based on parameters and criteria of need and guidelines based on scientific evidence. Integral care includes prevention, early detection, diagnosis, treatment and palliative care, which must be offered in a timely manner, allowing continuity of care. The following are guidelines for diagnosis, treatment and comprehensive care within the scope of the National Policy for the Prevention and Control of Cancer:
1.	- timely and safe treatment of patients diagnosed with cancer and precursor lesions as close as possible to the person's home, observing the criteria of scale and scope;
2.	II - multidisciplinary care to all users with cancer, offering care compatible with each level of care and disease evolution;
3.	III - carrying out treatment of rare or very rare cases that require a high level of specialization and greater technological capacity in national reference health establishments, ensuring their regulation and regulation; and
4.	IV - offer of rehabilitation and palliative care for cases that require it.
5.	- timely and safe treatment of patients diagnosed with cancer and precursor lesions as close as possible to the person's home, observing the criteria of scale and scope;

Section VI: Principles and Guidelines Related to Science and Technology	
The following are guidelines related to science and technology within the scope of the National Policy for the Prevention and Control of Cancer:	
6.	Establishment of methods and mechanisms for analyzing the economic-sanitary feasibility of public undertakings in the Health Industrial Complex, aimed at preventing and controlling cancer;
7.	Implementation of the research network for the prevention and control of cancer in accordance with the objectives of the National Policy on Science, Technology and Innovation in Health, in order to increase the production of national knowledge related to this area; and
8.	Implementation of scientific opinion elaboration practices, ATS and AE to support decision-making in the process of incorporating new technologies in the SUS.

Section VII: Principles and Guidelines Related to Education	
The following are guidelines related to education within the scope of the National Policy for the Prevention and Control of Cancer:	
1.	Fostering the training and specialization of human resources for the qualification of professional practices developed in all the fundamental axes contained in this Policy; and
2.	Implementation, in the State Commissions for Teaching-Service Integration (CIES), of educational projects aimed at the prevention and control of cancer in all its care and management dimensions and involving science, technology and innovation in health

Section VIII: Principles and Guidelines Related to Health Communication	
The guidelines for communication in health within the scope of the National Policy for the Prevention and Control of Cancer:	
1.	Establishment of communication strategies with the population, with Health professionals and with other social actors, which allow the dissemination and expansion of knowledge about cancer, its risk factors and the various prevention and control strategies, seeking the translation knowledge for the various target audiences; and
2.	Encouragement of actions to strengthen individual and collective capacity for communication in health, promoting changes in favor of health promotion, prevention and cancer control.

5. Health System Analysis

The purpose of this section is to present areas for improvement for the Brazilian health system in relation to cancer. To do so, we present analysis from two sources: (i) a qualitative online survey conducted with stakeholders in Brazil, particularly in Rio Grande do Sul, and (ii) analysis of discussions and feedback received during four virtual workshops with key stakeholders in Brazil, particularly in Rio Grande do Sul.

Both the survey and the workshops asked stakeholders to identify the major challenges related to cancer in Brazil, and to suggest policy options to effectively address the challenges identified.

This section will first report the challenges identified in the survey and the workshops. It will then present the policy options that were suggested to enable the Brazilian health system to overcome these challenges, in order to address the rising cancer burden in ways that are more effective, efficent, equitable and responsive.

5.1. Health System Challenges related to Cancer

A total of 27 stakeholders responded to the online survey. Survey respondents were from various backgrounds, including academia (26%), private sector (17%), civil society (20%), public sector or government (17%), healthcare provider (14%), health insurance/financing (2%), and other not specified (4%).

The priorities were identified in relation to health systems functions of Organization and Governance, Financing, Resource Management and health system outputs, namely Service Delivery for both public health and individual health services and ranked accoring to the frequency of the responses received.

The repondents identified challenges for each health system function and health system outputs. These chalenges were analysed and organized thematically into eight groups and ranked accoring to the frequency of responses received.

Organization and Governance was identified as the top priority that needed adressing followed by Financing, Resource Management and Service Delivery.

Table 5 provides a sythesis of the top 10 challenges identified by the survey respondents in order of relative importance for each of the four categories.

Table 5: Challenges for the Brazilian health system in relation to cancer organized by category and priority rank identified in the stakeholder survey

Rank within Category	Top Priority Category	Second Priority Category	Third Priority Category*	Fourth Priority Category*
	Organization and Governance	Financing	Resource Management	Service Delivery
1	Lack of focus on comprehensive cancer care	Poor budget coordination and management	Poor budget coordination and management	Lack of accessibility to cancer diagnosis and care
2	Poor policy planning and coordination	Lack of resources for providing comprehensive cancer care and control	Poor coordination, management, and planning	Low quality of cancer care and inconsistent application of standard care guidelines
3	Lack of stakeholder participation in decision making related to cancer	High costs associated with cancer care	Low quality of cancer care and inconsistent application of standard care guidelines	Lack of focus on comprehensive cancer care
4	Low quality of cancer care and inconsistent application of standard care guidelines	Low investment in cancer care and cancer research	Low investment in cancer care and research	Poor coordination, management, and planning
5	Lack of accessibility to cancer diagnosis and care	Provider payment systems that need reforming	Lack of resources for providing comprehensive cancer care and control	Inadequate investment in infrastructure and new technologies for cancer
6	Poor budget coordination and management	Lack of stakeholder participation in decion making	Provider payment systems that need reforming	Lack of resources for providing comprehensive cancer care and control
7	Provider payment systems that need reforming	Lack of focus on comprehensive cancer care	Lack of focus on comprehensive cancer care	Lack of cancer networks
8	Lack of transparency in	Lack political interest and will for cancer	Lack of accessibility to cancer diagnosis and care	Low investment in cancer care and reserach

	decion making and resource allocation			
9	Lack of centralized leadership	Lack of transparency in decion making and resource allocation	High costs associated with cancer care	Provider payment systems that need reforming
10	Poor coordination, management, and planning	Lack of accessibility to cancer diagnosis and care	Poor policy planning and coordination	Poor budget coordination and management

* The categories were ranked and scored by 27 stakeholders, resulting in the categories tallying 94, 92, 71, and 71, respectively, resulting in a two-way tie for fourth priority category.

These major challenges identified in the online survey by the repondents are similar to the ones that emerged from the discussions at the virtual stakeholder workshops that included 52 participants (Table 6). The roundtable format of stakeholder workshops allowed the participants to discuss in more detail the specific details of each challenge identified. The participants of the stakeholder workshops were able to identify specific root causes as well as some of the consequences of the challenges identified. These are presented in Table 6.

The most commonly identified challenges identified both in the survey and at the workshops were the lack of focus on comprehensive cancer care, poor coordination, management and planning, as well as issues relating to low investment in cancer care and control, regulations, policies and transparency of decision making and resource allocation.

Table 6. Challenges for the Brazilian health system in relation to cancer organized by health system area, as identified at the roundtable meetings of stakeholders

Opportunity Area	Challenge Identified	Specific Reasons and Root Causes for the Challenge identified
Organization and Governance	*Fragmentation*	• Lack of priorities to structure actions for better cancer care • Inequality in service delivery and access based on geography • Inadequate integration between primary and secondary levels • Decentralization of decision making across regions • Lack of multidisciplinary team approach for cancer care.
	Inconsistent enforcement of regulations	• Poor planning, coordination to implement existing regulations • Delayed diagnostic times; problems with health system's administration creates delays

		• Health system currently lacks the tools to properly enforce the existing laws and regulations which are not being followed • Stakeholders and relevant actors are not involved in crafting legislation and regulations.
	Equity	• Lack of data to understand the reality of cancer care in different states and population groups • Different levels of access to health services based on region and socioeconomic status • Specialized healthcare services for cancer more available in certain areas of the country • Weak mechanisms to ensure effective inclusion of stakeholders in decision-making process when developing regulations
Financial	*Poor planning*	• Lack of organization of priorities to address cancer care needs • Lack of long-term strategy • Insufficient focus on sustainability • Inefficient use of available health system assets • Social costs (i.e. premature death due to cancer, leading to a loss of productive years of life) not considered when quantifying costs of cancer. • Inefficient use of lower-cost and more cost-effective preventive services at primary care level.
	Poor use of resources	• Public are not incentivized for behaviors that lead to less waste in the health system (i.e. preventive care) • Planning and priority setting do not emphasize more cost-effective strategies and quality of services • Inefficient provider payment systems.
	Low investment in prevention	• Lack of focus on prioritizing of preventive care and early detection • Regional imbalance in relation to needs and expenditures, which are not uniform across and within states • Incentives are misaligned and result in suboptimal care and low level of activity for prevention
Resource Management	*Fragmentation*	• Lack of integrated information systems; differences at institutional level and among the states in how information and data are processed/shared • Specific challenges for collecting and accessing quality data for cancer care

		• No clear goals and integration of the role and activities of universities and scientific research and the health system
	Poor planning	• Lack of long-term strategy, insufficient focus on sustainability • Healthcare managers do not adequately prioritize issues that need attention or address them based on level of need and urgency • Inefficient use of health system assets and resources, exacerbated by lack of integration within and across health system levels
	Lack of capacity and resources	• Lack of expertise and incentives to attract and retain healthcare workers. • Lack of specialists, and insufficient staffing in some regions • Guidelines for healthcare workers outdated and need to be updated to provide more autonomy in decisions related to patient care
	Limited effectiveness of legislative framework	• Lack of enforcement mechanisms for implementation of policies related to access to services and patient care that affect patient outcomes, leading to reduced effectiveness • Poor legislation for cancer care and development of polcicies without evidence
Service Delivery	*Inefficiencies*	• Funding and resource allocation do not reflect priorities leading to mismatch between demand and supply and service gaps • Poor availability of diagnostics, leading to long waiting times for diagnostic (i.e. delivery biopsy results) • High demand for treatments (i.e. radiotherapy) with difficulties of access and poor logistic. • Networks aren't properly integrated, especially between primary and secondary levels of care
	Equity	• Consistent geographic and socio-economic barriers to access to healthcare services • Lack of understanding of patients' needs to cancer care priorities • Lack of human resources and specialized services in certain areas
	Lack of focus on prevention	• Lack of focus on screening hampers early detection of cancer

		• Policies and funding do not prioritize health promotion, disease prevention and primary care attention for cancer care • Shortage of screening services for early detection exacerbated by COVID-19

5.2. Suggested Policy Options to Address the Challenges identified

In the online survey, respondents provided policy options to address the health system challenges they identified in each of the four health system areas. The proposed policy options are summarized in Table 7 and presented in the order in which the respondents ranked them in importance for addressing the respective challenges identified for each health system area, namely: (1) Organization and Governance, (2) Financing, (3) Service Delivery, (4) Resource Management.

Table 7: Policy opportunities for the Brazilian health system in relation to cancer identified in the survey, organized by health system area.

Policy Option	Specific Policy Actions
Top Priority Policy Area: Organization and Governance	
1. Enact public policies that reinforce multisectoral, comprehensive and effective cancer care.	• Ensure cancer policies adopt a multisectoral approach and identify direct and clear responsibilities for institutions beyond those in the health sector. • Develop public health policies to expand effective management of cancer in primary care with a fous on users. • Act on complaints made by users on actions that adversely impact on health and put in place mechanisms to take rapid and effective corrective measures. • Implement a program with an emphasis on primary prevention of cancer, including routine screening. • Incentivize states and municipalities to implement public policies to guarantee cancer care.
2. Enact a national cancer law with mechanisms to enforce policies monitor implementation and ensure accountability.	• Include in a new national cancer law, that guarantee patients' rights to cancer treatment. • Define comprehensive cancer management to include diagnosis, treatment, and palliative care, with an emphasis on the provision of equitable, efficient, and effective services. • Enact policies that discourage practices that increase the population's exposure to environmental risk factors. • Improve cancer prevention and promotion to address inequalities. • Optimize the referral and counter-referral mechanisms to ensure timely and accessible follow-up of care.
3. Finance and implement a national cancer registry.	• Improve planning and distribution of resources for cancer care at all levels.

		• Create a national population-based cancer registry to establish a system with centralized collection and management of cancer data. • Make cancer data reporting mandatory. • Create systems that enable collaborative analysis of the cancer data in registries. • Improve the use of existing health data to produce reliable and useful reports for decision making.
4.	Implement initiatives to focus on cancer prevention.	• Strengthen communication in the media about cancer awareness and to encourage citizens to adopt behaviors reduce exposure to risk factors for cancer. • Involve communities, civil society, and other stakeholders in cancer awareness initiatives and in the development of cancer polcies. • Train professionals in the areas of population health and primary health care to incorporate social communication actions and the prevention of risk factors in their routines with patients and community.
Second Priority Policy Area: Financing		
5.	Implement policies to increase the national budget allocated for cancer.	• Enact legislation to increase total budget for health. • Reprioritise government budget allocation to increase resources for cancer care. • Evaluate the national budget with the goal of supporting transparent allocation of funds and management of resources.
6.	Increase funding for cancer to increase the availability and access to innovative technologies, medicines, and treatments	• Encourage the use of latest generation technology and pharmacotherapy that are cost-effective. • Accelerate cost-effectiveness evaluation of new treatments, medications, and technologies by assigned government agencies to include them in health benefits plan. o Involve expert scientific societies in the evaluation of the cost effectiveness of new technologies and medications. • Improve planning and resource allocateion to cancer care considering the costs of treatment. • Update payment rates for health services /APAC *"Autorização de Procedimento Ambulatorial"*.
7.	Institute regulations and mechanisms for inspection, surveillance and control of national and regional health budgets.	• Review and improve policies for priority setting and resource allocation. • Establish price controls for all cancer drugs. • Ensure that the cost of treatments approved for patients can be met.

8. Create economic policies that support comprehensive cancer management with an emphasis on prevention and early detection.	- Increase allocation of funding to health promotion, prevention, and early detection activities, especially for high-risk populations to balance that for treatment. - Create common guidelines for all territorial health plans to implement minimum care and treatment standards for cancer with tangible quality indicators. - Improve quality, comprehensiveness integration and analysis of data from registries and medical records to provide precise information for efficient and equitable allocation of resources for cancer care.
Third Priority Policy Area: Service Delivery	
1. Re-structure the cancer service delivery system to strengthen regional and state level health networks	- Conduct analysis of cancer care at regional level to identify ways of improving access to diagnostic, preventive and therapeutic services. - Promote the development of integrated cancer centers that can provide comprehensive cancer care.
2. Establish integrated comprehensive service delivery for cancer prevention, diagnosis, and treatment with quality assurance.	- Implement integratedl care pathways to achieve rapid referral and reduce fragmentation of care management across the care continuum. - Create incentives for healthcare provider institutions that provide high-quality cancer care treatment and services in all levels (primary, secondary and tertiary)
3. Improve planning and management of cancer care in regions and in the country.	- Develop accountability and enforcement mechanisms to ensure all actors comply with laws and regulations related to cancer services. - Ensure regular audit of insurers and healthcare service providers to evaluate the quality of cancer services provided and incentivize provision of high-quality services. - Strengthen monitoring of cancer services provided at state level to improve cost-effectiveness of services and outcomes. - Collect qualitative and quantitative data to establish priorities for healthcare services and ensure budget allocation according to needs. - Provide alternative modes of delivering healthcare in remote areas, for example, using telemedicine to improve access, care, and follow-up.
4. Improve provider education and training around cancer care and service delivery with an emphasis on a multisectoral approach.	- Require academic training and continuing education for primary care providers on cancer prevention, diagnosis and treatment - Improve and incentivize training in cancer care for healthcare professionals. - Integrate training in palliative care into continuous professional development of all physicians involved in cancer care. - Create guidelines and training for national and regional government officials on the cancer burden and strategies for managing cancer. - Allocate more resourcesfor research and education in cancer care and incentivise continuous education and professional development. - Provide educational materials to patients and families on comprehensive and effective cancer care.

Fourth Priority Policy Area: Resource Management	
5. Enact legislation to improve transparency of decisions and to eliminate improper practices.	• Decentralize control of healthcare resources to regional/state health authorities. • Strengthen mechanisms for improved surveillance, oversight (including by civil society), and control of health budget allocation and implementation health policies. • Institute ande enforce greater punitive measures for corruption offenses in health. • Improve transparency in financing, planning of activities, and management of health budget in all levels (federal, state and regional).
6. Use population-level data to estimate the cost of the disease and determine resource allocation policies.	• Systematically collect data to create a national evidence base to monitor and evaluate the performance of cancer programs, care and outcomes. • Analyze the impact of costs and quality of cancer services on cancer outcomes. • Incentivize practices and interventions that are shown to improve health outcomes.
7. Re-structure existing resource allocation systems to enable continuity in cancer care.	• Develop standardized guidelines for cancer care with expert group and enforce adherence by all actors. • Establish systems to regularly collect data to investigate best practices for cancer care that meet the standards defined by Law for the provision of healthcare services. • Identify priorities to allocate resources in effective cancer care in all treatment stages, including prevention. • Increase capacity to expand availability of first visit consultations to decrease waiting list and to reduce delay in diagnosis
8. Improve provider incentives to imrpove cancer care.	• Incentivize healthcare professionals to adhere to care guidelines. • Improve standards when hiring healt professionals, prioritizing qualified managers, healthcare professionals and staff. • Create incentives to motivate healthcare professionals for better performance, improve outcomes and to work in remote areas.

6. COVID-19 Pandemic and Implications for Cancer Care and Control in Brazil

The first confirmed COVID-19 case in Brazil was reported on 26 February 2020 and the first death on 12 March 2020. By September 2021, there were 600,000 deaths from COVID-19 (the second highest in the world after the United States) and 21 million reported cases (https://coronavirus.jhu.edu/map.html).

Brazil has had long experience of dealing with disease outbreaks, a well-established immunization program and a Unified Health System. However, early in the pandemic, the Federal government had a disastrous response to control the COVID-19 pandemic with a disorganized and confused national response that was not evidence based (22). As a result, governors for each state have been implementing different measures. Some states have decided to follow the recommendation of national and international experts to fight COVID-19. In the first year of the pandemic three ministers of health were appointed and left their position after a short tenure.

Social inequalities in Brazil have contributed to the rising number of infections during COVID-19 pandemic. The disparities in healthcare access and health outcomes were widespread due to the austerity measures introduced by the government following the economic crisis faced by the country since 2015 (23).

There is particularly high mortality from COVID-19 in the North region, in the Pardo (mixed ethnicity) and Black populations, and among males with low socioeconomic status (24). Also, considering various socio-demographic indicators reflected different mortality patterns from COVID-19 in the city In São Paulo risk of mortality was higher among males, in the Black and Pardo population groups and in those with lower socio-economic status, such as those with less education, those living in crowded household, and those with lower income (25).

Studies that examined SARS-CoV-2 antibody prevalence in cities showed very rapid escalation of the epidemic in the north and northeast region of Brazil, with higher prevalence of COVID-19 in the low income and indigenous groups (26).

Despite the restrictive and sanitary measures adopted by states and municipalities, socioeconomic inequalities and socioeconomic vulnerability rather than age and health status played an important role in the number of cases and deaths from COVID-19 (27).

The long term impact of Brazil's response to address the intersection of COVID-19 and cancer is yet to be seen. Patients delayed exams and treatments due to fear of being exposed (28). There have been reports of delays in medical appointments and elective procedures for cancer (29) as a result of COVID-19 which is a major risk for cancer patients receiving systemic treatment (30). Delays in cancer diagnosis and care have led to increased mortality and years of life lost from cancer (31).

In Brazil, since the beginning of the COVID-19 pandemic the number of cancer cases diagnosed hasve declined sharply in all Brazilian Regions. In the North there was a drop of 24.3% and in the Northeast 42.7%, while, overall the average proportion of undiagnosed cases of cancer reached 35.5% (15,000 cases per monthly) (32). The Brazilian Society of Pathology and Surgical Oncology estimated a reduction of 70% in biopsies compared to 2019. Moreover a survey conducted by the Brazilian Radiotherapy Society (SBRT) reported a reduction in excess of 50% in the number of patients undergoing radiotherapy in some radiotherapy centers (29).

The sharp fall in the number of cancer cases diagnosed and treated will have negative consequences for individuals with cancer in the coming months and years as the health system in Brazil lacks the resources and capacity to manage the excess backlog of the cases. Multisectoral action is needed to develop an appropriate response for comprehensive care, incorporate innovative actions to provide cancer care for all those in need, ensure patients have access to the right information and feel safe to seek care.

7. Recommendations and Next Steps

In this section, we provide recommendations for major set of actions that could be implemented to more effectively address the rising cancer burden in Brazil. These recommendations are organized by their priority for the health system (highest, high, or medium). For each policy recommendation, we identify potential financial cost of implementation (high, medium, or low) and estimate the length of time needed to implement (short, medium, or long term) (Figure 22).

Figure 22: Summary of policy recommendations with priority, cost, and timeline assessment.

Recommendation	Priority	Estimated Cost	Estimated Timeline
Improve coordination of cancer care and control and reduce fragmentation of services by creating cancer networks	Highest	Medium Cost	Medium term
Improve the existing cancer registers and establish a population based national registry	Highest	Medium cost	Medium term
Conduct a comprehensive analysis to identify priorities for cancer care and control and to improve the efficiency and equity of resource allocation	Highest	Medium cost	Medium term
Develop a multidisciplinary innovation hub in Rio Grande do Sul to develop and implement innovations to improve cancer care, control and outcomes and learn from the experience to replicate elsewhere in the country	High	Medium cost	Medium term
Restructure the delivery of cancer services to enable provision of consistently high quality and equitable cancer services.	High	Higher cost	Medium term
Improve the effectiveness, efficiency, equity and responsiveness of cancer care by developing and implementing digital care pathways	High	Medium cost	Medium term
Strengthen multisectoral actions that prioritize prevention interventions for cancer	Medium	Lower cost	Longer term
Improve training of healthcare providers on multisectoral approaches to cancer care and service delivery	Medium	Lower cost	Longer term
Restructure payment model for healthcare providers by introducing pay for performance and improved outcomes	Medium	Medium cost	Longer term

7.1. Highest Priority

1. **Improve coordination of cancer care and control and reduce fragmentation of services by creating networks for delivery of cancer care.** Improve coordination among healthcare providers and civil society organizations, to reinforce more effectively the Principles of National Policy for Prevention and Control of Cancer by:

   – Operating a coordinated referral and counter-referral network of cancer services across regions with clear guidelines and standards to ensure timely and accessible care.
   – Eliminating barriers to timely and appropriate management of resources for cancer care.
   – -Developing regional cancer programs to prioritize cancers with the highest burden and to meet more effectively the specific needs of each cancer type in each region.
   – Creating incentives to attract healthcare professionals to more remote areas
   – Addressing disparities in healthcare access and outcomes for cancer across regions

2. **Improve the existing cancer registries and establish a national population based registry.** The government should improve technological infrastructure of the Cancer Information System (Sistema de Informação de Câncer - SISCAN), and reinforce the importance of using data from national cancer registry to generate an evidence base to inform national, regional, and local decisions on planning, care delivery and resource management rel.ated to cancer.

   – Reinforce mandatory collection of data related to cancer at the national, regional, and local levels
   – Coordinate with the Instituto Nacional de Cancer (INCA), regional health authorities and academic institutions to ensure data related to cancer are made available to reserachers and research institutions for analysis to generate evidence.
   – Generate new evidence to better understand the cancer burden in the country and use this evidence to inform resource allocation and management based on need.
   – Invest in digital technologies to facilitate the development of digital data registries and linkage of data to on medical databases and health records.

3. **Conduct a comprehensive analysis to identify priorities for cancer care and control and to improve the efficiency and equity of resource allocation.** The government should monitor and evaluate the implementation of cancer policies at all levels of government to ascertain what has been achieved as a result of these policies:

   – Define the roles of national and regional authorities to oversee health budget management, spending, and need. These authorities should routinely audit resource flows to ensure they are allocated according to budget.
   – Improve monitoring of resource allocation, budget management, and service delivery.
   – Reorganize existing resources and reinforce the existing national cancer policies to promote effective governance of public systems.
   – Improve data quality and validity of data in the information systems for cancer by conducting audits of the public system to establish which population groups are affected by cancer and allocate budgets and resources according to need to overcome inequities between and within states
   – Monitor performance of healthcare institutions providing cancer care.

7.2. Higher Priority

1. **Develop a multidisciplinary innovation hub in Rio Grande do Sul to design, develop and implement innovations to improve cancer care, control and outcomes and learn from this experience to replicate elsewhere in the country.** The government of Rio Grande do Sul should engage stakeholders to develop a multidisciplinary innovation hub to test new ideas for cancer care that could be replicated in other regions by:

   – Generating new evidence on innovations that enable provision of efficient and effective cancer care
   – Implementing cost-effective solutions to enable more efficient use of available resources for cancer care and control.
   – Incentiving multidisciplinary research colaborations involving national and international institutions to investigate the introduction of cost-effective innovative interventions for cancer.

2. **Restructure the delivery of cancer services to enable provision of consistently high quality and equitable cancer services.**

   – Incentivize improvements in the provision of high-quality specialized cancer services with high patient satisfaction.
   – Disincentivize practices that do not adhere to standard guidelines or improve health outcomes.
   – Encourage the formation of regional integrated cancer care networks to guarantee the provision of comprehensive services.
   – Decentralize control of cancer resources to local health authorities and eliminate intermediaries when managing resources for cancer care.
   – Transfer more responsibility for primary care in cancer care control, for example in prevention, diagnosis and paliative care to help develop strong networks of cancer care.

3. **Improve the effectiveness, efficiency, equity and responsiveness of cancer care by developing and implementing digital care pathways.** The government should increase funding for cancer care and control in line with the rising burden to ensure innovative technologies, medicines, and treatments for cancer are more accessible to patients by:

   – Establish a coordinated referral and counter-referral network of cancer services across regions with clear guidelines and standards to ensure timely referral and access to the right level of care.
   – Implement a unified digital information system that integrates data for services delivered at different levels in the health system across the care continuum (prevention, promotion, treatment, rehabilitation)
   – Establish a multidisciplinary research group to develop and implement new guidelines for integrated cancer care.

7.3. Medium Priority

1. **Strengthen multisectoral actions that prioritize prevention interventions for cancer.** Cancer policies should strengthening cancer prevention and health promotion, by:

- Implementing and reinforcing prevention actions described in the National Policy for Prevention and Control of Cancer (Política Nacional para Prevenção e Controle do Câncer – PNPCC)
- Requiring mandatory screenings and guarantee accessibility to screening programs
- Investing in research focusing in population-based studies to better understand populations at risk of cancer
- Conducting community-based studies to test the effectiveness and population-based impacts of different cancer prevention and control strategies
- Focusing on prevention campaigns on vulnerable populations to address inequities
- Improve public health education and strengthening policies to address malnutrition, increase physical activities, reduce consumption of tobacco and alcohol, and reduce workplace exposure to harmful materials for cancer.

2. **Improve training of healthcare providers on multisectoral approaches to cancer care and service delivery.** All government levels should reinforce academic training and continuing education for healthcare providers around cancer prevention, diagnosis, and treatment:

- Require continuous up-to-date training and professional development around cancer for healthcare providers and government officials.
- Increase the quality of training required for certification of specialists who are licenced to provide cancer treatment
- Introduce training on cancer in undergraduate courses and in training of general physicians and nurses
- Integrate palliative care into continuous professional development of all physicians involved in the care of patients with cancer.

3. **Restructure payment model for healthcare providers by introducing pay for performance and improved outcomes.** The government should consider changing the payment system for cancer care and introduce pay for performance to improve efficiency, effectiveness, equity and responsiveness of cancer care.

- Introduce policies to incentivise healthcare providers to improve performance and be appropriately remunerated if their performance meets pre-determined measures, including improved outcomes.
- Invest in research to generate evidence on the effectiveness of pay for performance in Brazil.

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9. Appendix A: Health System Framework

Analytical Framework

The framework for health systems analysis (Appendix Figure 1) builds on earlier approaches (1-5) and emphasizes a systems view 6 in analysis of context and health system performance. The analytical framework has been used in single- and multi-country analyses (7,8) and can be used to explore contextual factors and health systems functions that interact to influence system performance and achievement of health system goals and objectives.

Appendix Figure 1: Analytical framework.
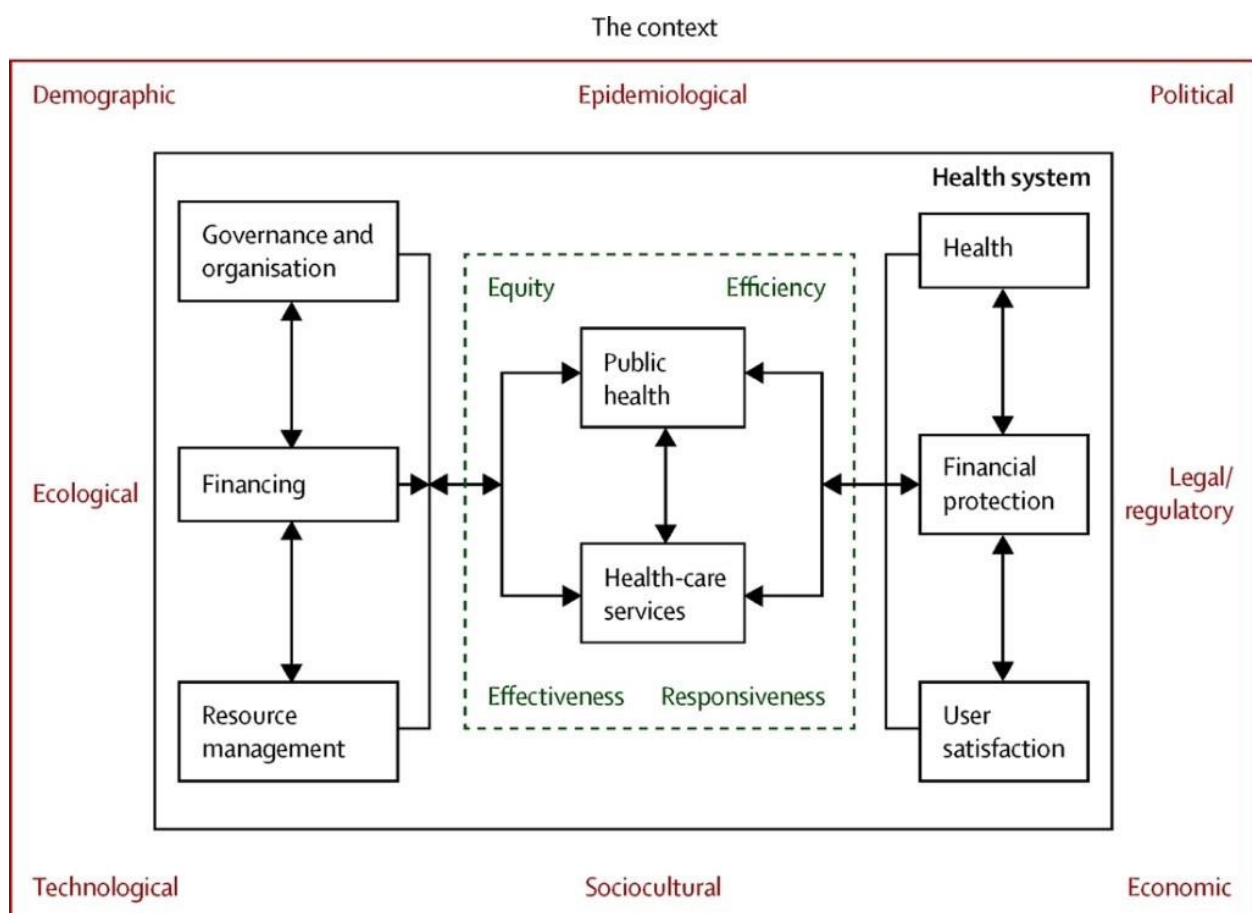
Source: Atun R et al. Lancet 2013

PART I: Context

The context refers to the interplay of the demographic, epidemiological, political, economic, legal/regulatory, ecological, socio-cultural and technological changes, which individually and through their interactions influence trajectory of change in health systems. These changes create 'opportunities' or 'threats' for health systems in the short- or long-run.

While historical antecedents, political systems and socio-cultural norms shape direction of health system reform, critical events, such as government change, economic crises (or growth) and natural or human-led catastrophes, create external shocks on health systems and provide opportunity for change and reform. Analysis of context aims to answer five questions:

1. What are the contextual changes?

2. How are these changes affecting the health system?

3. What is the likely magnitude of impact of these changes on the health system?

4. How and when will these changes impact the health system?

5. How certain is the likely impact?

In relation to "opportunities" analysis should identify contextual changes that are conducive for attaining desired health system goals and objectives in line with the values embraced by stakeholders. In relation to "threats" analysis should identify contextual changes that may hinder the attainment of desired health outcomes or may worsen health system performance.

Elements of context

- **Demographic transition**: How are the general population dynamics changing in the country of analysis (life expectancy, mortality rate, birth rate, population growth, population structure, urban and rural differences, emigration and immigration)? What are the implications of the demographic transition?
- **Epidemiological transition**: How is the epidemiological profile changing (infant mortality, maternal mortality, morbidity and mortality levels by different disease groups and population segments)? Which conditions are rising or falling (incidence, prevalence for key non-communicable and communicable diseases)? How is the prevalence of risk factors (smoking and obesity for example) and social determinants of health changing?
- **Political environment**: What are the prevailing values of the government that shape broad policy objectives, especially those related to social sectors; political stability; political economy.
- **Legal and regulatory environment**: What international treaties or important laws of the country are likely to affect the health system.
- **Economic changes**: What is the economic outlook, such as: Gross Domestic Product (GDP) growth trends, government debt levels, current account balance, inflation level, unemployment levels, income distribution, and what is the likely impact of the economic environment on the government fiscal space for allocations to public sector health budget, or on private sector investment.
- **Socio-cultural dynamics**: Relates to values and expectations of citizens; lifestyles, behavioral choices (for example smoking, diet and physical activity) and risk perceptions, which might affect the health system.
- **Ecological changes**: Relates to physical and ecological environment affecting health.
- **Technological changes**: Technological developments – for example communication and information technologies, analytic capability, geographic information systems – that can be harnessed to enhance provision of services.

PART II: Health Systems Analysis

Health systems analysis should explore performance in relation goals and objectives and analyze how health system design might affect performance.

Health System Outcomes (Goals)

1. **Population health**: concerned with both the level and distribution of health, (for example as measured by life expectancy at birth, or at age 30 or 60 years), mortality (mortality levels), or burden of disease (as measured by disability adjusted life years), as well as specific population health outcomes of interest – such as infant or under-five mortality rate, maternal mortality ratio, standardized mortality rate for key diseases, or premature mortality from key diseases.

2. **Financial risk protection**: relates to fairness in health financing (distribution of health expenditures) and extent of financial risk protection for general population and specific population segments, (levels of out of pocket expenditures as a percentage of total health spending, and impoverishing health expenditures by income quintiles).

3. **User satisfaction**: examines citizens' satisfaction with health system.

Health System Objectives in Relation to the System Outputs Produced

1. **Equity** relates to fairness in the allocation of resources or services among different individuals or groups, health service coverage, access to health services by population segments and subsequent health outcomes; it considers equality and differential ability of various groups in accessing care and treatment, and assesses whether those in equal need are treated equally, irrespective of other characteristics.

2. **Efficiency** relates to (a) Macroeconomic efficiency – level of health expenditure as a fraction of the GDP and (b) Micro-economic efficiency – 'allocative efficiency' (producing right outputs to achieve goals, i.e. what is produced for available resources in terms of a mix of services to maximize a combination of health outcomes and user satisfaction) and 'technical efficiency' (producing outputs at minimum costs, i.e. how the services are produced – inputs or costs should be minimized for target output)

3. **Effectiveness** related to the extent to which a desired outcome is achieved when a cost-effective intervention is applied to a population and includes an assessment of technical quality of clinical care and the extent to which evidence-based interventions are used.

4. **Responsiveness** relates to the ability of the health system to meet legitimate expectations of citizens in relation to perceived service quality and experience as patients.

Health System Outputs

1. **Service delivery;** The analysis should discuss organization of public health and personal healthcare services, and assess whether health system is able to effectively meet current needs: i.e., whether

the system offers comprehensive set of services, provides continuity of care, and achieves effective coordination of patients' journey in health system along the care continuum through effective referral- and counter-referral-systems. The analysis should also discuss public-private mix of services, and the balance of hospital services with those provided in primary health care and in the community.

Health System Functions

The framework identifies four health system functions, which policy makers can modify to achieve health system goals and objectives:

1. **Governance and organization**; (a) institutional relationships, in particular the role of the Ministry of Health in relation to other actors in the health system; (b) extent of decentralization, (c) extent of regulation and competition, and (d) organizational design – extent of public and private sector involvement;

2. **Financing**; the analysis should briefly discuss sources of financing, how finances are pooled, and how they are allocated to agencies or intermediary organizations (such as local authorities), and financial coverage provided for population groups. The analysis should also briefly explore which provider payment methods are used to remunerate healthcare service providers and the pros and cons of the methods used;

3. **Resource management**; The analysis should explore how and where financial, physical, human and intellectual resources are allocated, and whether resource shortages or distributional imbalances exist;

10. Appendix B: Methods

Brazil is one of countries selected to carry out the study. In order to achieve a complete approach and understanding of the context of the country, its health system and the challenges and opportunities related to the approach of cancer in the country, we used four major sources of information:

1. A literature review of published articles, policies, and datasets,

2. A novel online survey conducted among experts, clinicians, policy makers and key informants from civil society,

3. Pre-workshop planning meetings, and

4. Four virtual stakeholder workshops

The Harvard research team worked with collaborators in Brazil to establish a core team to undertake the study. The data was collected and analyzed between January and March 2021. During the data collection and analysis, there was constant guidance and feedback from the different working groups, including the stakeholder workshop.

10.1. Literature Review

A literature review was conducted by three researchers from Harvard University to quantify the burden of cancer in Brazil and compare this burden within other large Latin American countries like Colombia, Chile, Argentina, and Mexico, as well as selected high income countries like France and the United Kingdom which have well established national cancer care and control programs.

To analyze cancer incidence and mortality figures in Brazil and in selected countries and to ensure comparability, we used data from the International Agency for Research on Cancer (IARC) Cancer Today and Cancer Tomorrow (80,81), data visualization tools inclusive of 36 cancer types in 185 countries or territories of the world in 2018 as part of the GLOBOCAN project (9,24). Supporting data was obtained from the CONCORD 3 study (11), which tracks global cancer survival data for 18 cancer types in 71 countries based on population-based cancer registries.

The team performed a critical analysis of the available literature concerning the different aspects of the Brazilian health system. Sources of information were divided into three components::

- **Context:** First, we analysed major factors influencing health and cancer context in Brazil using published journal articles and reports by international organizations, such as the International Monetary Fund (61), the World Bank (62), Inter-American Development Bank (63), the Pan American Health Organization (64), Latin American agencies, as well as official government bulletins, mostly from the Ministry of Health and official websites of national and regional governments, which provide information the political, social, economic, ecological and technological context within which the Brazilian health system operates (65).

   Another main source of information was non-peer reviewed articles published in the last 5 years related to the different aspects of the health system and the cancer in Brazil. Most of these articles were published in international newspapers (Economist) (66) and Brazilian nerwspapers with national circulation (O Globo and Folha do São Paulo) (67,68), as well as local news agencies (O Globo) (69).

- **Health System:** Using available data, we analyzed the performance of the Brazilian health system in achieving health system goals (improved level and distribution of health, financial protection and user satisfaction) and objectives (equity, efficiency, effectiveness and responsiveness). We also analyzed the organization, governance, financing and resource management in the Brazilian health system and the personal health service and public health service outputs it produces to achieve health system objectives and goals. Data were gathered from published surveys, routine health administration data, and disease registries as well as national and international reports, which evaluate the different aspects of the health system and compared Brazil with other Latin American countries.

   Our primary sources of information were the Ministry of Health (65) and the National Cancer Institute (INCA) (70), an agency under the Brazilian Ministry of Health, which has bibliography and reports at the national level and from each of the country's states. INCA has published the last report on Cancer Incidence in Brazil for the year 2020. It also has related publications on some aspects of the health system in general, such as health determinants, health system resources, and epidemiological and vital profiles in the country (71).

Other data sources related to the burden of cancer in Brazil included state secretaries of health (72,73), Agência Nacional de Vigilância Sanitária (ANVISA) (74) and studies by health think thanks, such as the Fundação Oswaldo Cruz, (75)..

We also used data from PAHO/WHO (76), which shows the official data of the country, and enables comparison of the Brazilian health system within other countries in Latin American.

- **Cancer:** A primary source of information was the reports from the Instituto Nacional de Câncer, which plays a role in multiple areas of cancer prevention and control including prevention, epidemiological surveillance, treatment, information, education, and research (70). As part of the Ministry of Health, INCA delivers cancer care within the Integrated Public Health System (Sistema Unico de Saude, SUS), formulates and coordinates public policies, develops research activities, and disseminates practices on medical oncology (65). Another valuable source of information was the Strategic Action Plan to Tackle Noncommunicable Diseases (NCD) in Brazil 2011-2022, which lists and sets priorities for the measures and investments required prepare the country for rising NCD incidence over a 10-year period (69). Cancer represented one of the four major groups of NCDs addressed in the Plan with cost-effective policy recommendations to reduce the NCD burden (69). The report largely focused on improving risk factors like physical activity and diet, but also includes specific objectives related to cancer like strengthening measures of early diagnosis and treatment of cervical and breast cancers (77).

We conducted analysis of the available online data to quantify the burden of cancer in Brazil and compare this burden within other large and populous Latin American countries like Argentina, Chile, Colombia, and Mexico, as well as high-incomecountries like France and the United Kingdom which have well established national cancer programs.

To analyze cancer incidence and mortality in Brazil and in selected countries, we used data from the International Agency for Research on Cancer (IARC) Cancer Today and Cancer Tomorrow data visualization tools, which include data on 36 cancer types in 185 countries or territories of the world in 2018 as part of the GLOBOCAN project (9).

When determining estimates of cancer incidence, the GLOBOCAN study used the best available data sources of cancer incidence and mortality in a given country. Hence, the validity of national estimates largely depends on the degree of representativeness and quality of data in a particular country (9). The Brazilian cancer registries used in incidence and mortality estimates and projections were the Cancer Registry of Aracaju, Barretos Cancer Registry, Cancer Registry of Curitiba, Espirito Santo Cancer Registry, Florianopolis Cancer Registry , Cancer Registry of Goiânia, Jau Cancer Registry, Cancer Registry of João Pessoa, Poços de Caldas Cancer Registry, Recife Cancer Registry, Roraima Cancer Registry, and Cancer Registry of São Paulo City (15,16). Further details of the methodology used in the GLOBOCAN study, its estimates, and projections can be found at Bray et. al, 2018 (9).

In the GLOBOCAN analysis, incidence is defined as the number of new cases occurring in a specified period and geographic area, conveyed either as an absolute number of annual cases or as a rate per 100,000 people per year. It is important to note that incidence is calculated only among individuals who are at risk for a specific outcome. Incidence rates are used to approximate the average risk of developing cancer and allows comparisons between countries or regions with different population sizes which nominal metrics may obscure. Age-standardized rates (ASR) per 100,000 person-years enhance such comparisons across geographies by accounting for differences in population age structures. Primary prevention strategies aim

to reduce measures of incidence, though increasing incidence rates do not necessarily reflect failure within the health system in cases where the expansion of early detection, testing, or other programs result in a transient rise in incidence rates as more cases are tested and therefore discovered (9).

Mortality is defined as the number of deaths occurring in a specified region or period, with the mortality rate defined as the number of deaths per 100,000 people per year. With mortality as a product of the incidence and the proportion of patients who die, mortality rates measure the average risk of death in the population from a specific cancer. Similar to incidence, the degree of detail and quality of mortality data varies considerably between countries, with only 1 in 5 countries reporting high-quality death registrations (9).

For survival, we used the CONCORD-3 study, which presents and analysis of global cancer survival for 18 cancer types in 71 countries based on population-based cancer registries (78). These two sources provided comparable age standardized incidence and mortality rates for cancer for Brazil, other countries in Latin America, and other world regions (9).

The CONCORD-3 study, published in the Lancet in 2018, analyzed the trends in cancer survival worldwide between 2000 and 2014. CONCORD-3 included individual records for 37. 5 million patients diagnosed with cancer during the 15-year period 2000–14. Data were provided by 322 population-based cancer registries in 71 countries and territories, 47 of which provided data with 100% population coverage. The study included 18 cancers or groups of cancers: esophagus, stomach, colon, rectum, liver, pancreas, lung, breast (women), cervix, ovary, prostate, and melanoma of the skin in adults, and brain tumors, leukemias, and lymphomas in both adults and children (78).

5-year net survival provides a useful measure of health system performance in managing cancer (78). In total, the population covered by the four participating registries in Brazil was 7.7%, a figure slightly below Latin America peers like Argentina (9.2%) and Chile (13.8%) (78). This figure represents an improvement from the previous iteration of the CONCORD study (CONCORD-2), where only 5.7% of the population was covered by participating cancer registries, yet a far cry from countries like the US where coverage levels are 85.6% (78). Some of Brazil's survival estimates are considered less reliable than certain countries because 15% or more of patients were either:

1. Lost to follow-up or censored alive within 5 years of diagnosis or, if diagnosed in 2010 or later, before Dec 31, 2014.

2. Registered only from a death certificate or at autopsy.

3. Registered with unknown vital status or with incomplete dates like unknown year of birth, unknown month or year of diagnosis, or unknown year of last known vital status (46).

The team's analysis of CONCORD-3 data selected Brazil's 5 cancers with the highest mortality rates per 100,000 people in 2018, namely prostate, breast, lung, colon, and stomach cancers. The analysis was expanded to compare Brazil's 5-year net survival percentage with Latin American counterparts (Argentina, Chile, Colombia, and Mexico), as well as the countries with the highest reported survival for these cancers.

10.2. Online Stakeholder Survey

An electronic survey was conducted with stakeholders via the online survey program Qualtrics CoreXM™ (26,27). The purpose of the survey is to gather opinions from important stakeholders before the virtual

stakeholder workshop. The survey asked participants to identify major challenges for the Brazilian health system related to cancer, suggest policy options to solve those challenges, and rank the identified challenges and policies in order of importance to address. Respondents were also asked to suggest challenges and policy suggestions under four main categories of opportunity for health system reform: (1) organization and governance, (2) financing, (3) resource management, and (4) service delivery. All responses will be open-ended.

Challenges for the health system in relation to cancer were analyzed using qualitative thematic analysis. Coders categorized free text responses using pre-defined themes based on hypotheses (deductive codes) and new themes that arose organically in the data (inductive codes). Qualitative analysis of health system challenges around cancer will include three parts:

1. **Deductive coding**: First, deductive codes were used to organize all open-ended responses by the four opportunity categories for which respondents were asked to identify challenges: (1) organization and governance, (2) financing, (3) resource management, and (4) service delivery.

2. **Inductive coding:** Then, responses under each of these four categories were organized into eight sub-categories using inductive codes which label major themes that arise in the data.

3. **Frequencies of rankings:** Lastly, the frequencies in which respondents applied each rank, from most (1) to least (4) important, to challenges in each of the eight sub-categories were calculated to identify the most frequently identified challenges under each of the four opportunity categories.

Policy suggestions to improve cancer prevention and control were also deductively coded using the four opportunity categories under which respondents were asked to identify solutions: (1) organization and governance, (2) financing, (3) resource management, and (4) service delivery. Once organized into these categories, related policies were grouped together. Any policy suggestions that overlapped were consolidated to remove repetition and redundancy. Lastly, policies were ranked by the authors in their priority for the health system to enact (highest, high, or medium), potential financial cost to implement (highest, high, or medium), and length of time required to implement (short, medium, or long-term).

10.3. Brazil Virtual Stakeholder Workshop

ICCI LA organized four workshops on cancer control policies in Brazil attended by over 50 stakeholders from leading public and private organizations involved in cancer control. The workshops helped to elucidate first-hand the main challenges related to cancer and potential solutions to address the rising burden of cancer in Brazil and the challenges identified.

The stakeholders were invited to participate in facilitated roundtable discussion focused on four main areas of cancer policy: (1) organization and governance, (2) financing, (3) resource generation and management, and (4) service delivery. Each roundtable was moderated by a senior policy maker with a good knowledge of the Brazilian health system and cancer control, and a good knowledge of the institutions and stakeholders therein. The moderators were also responsible for organizing and inviting a multi-stakeholder group of participants based on background and expertise for each of the roundtables which they facilitate.

The themes emerging from the roundtables were collated and categorized for analysis and comparison with the responses for the survey, and to explore in more depth some of the issues identified in the survey. The roundtables enabled the participants to discuss and explore not only the challenges in relation to

health system functions and outputs (public health/personal services), but also, and importantly, potential solutions that could be developed to address the challenges identified.

The solutions were categorized and prioritized in discussion with the participants to develop a set of proposed policies and actions that were appropriately sequenced to improve health system performance to achieve equity, efficiency, effectiveness and responsiveness objectives for cancer and to improve cancer outcomes in terms better health (survival for example), financial protection and user satisfaction.

11. Appendix C: Analysis of Context in Brazil

11.1. Demographic and Epidemiological Transition

Brazil has undergone a significant shift in demographics within the last 70 years. In the mid-1950s, the country began a decline in population growth rates, typical in nations with significantly advanced demographic transition. In 1960, fertility rates were at 6.3 children per woman, but by 2010, fertility rates had decreased to 1.9 children per woman, below the replacement rate of 2.1 (33). Concurrently, infant mortality rates have significantly decreased, allowing for a bulge in the working-age population of Brazil (34). According to Anderson and Shneider, now is the time Brazil may take advantage of the demographic dividend. However, the window of opportunity is set to begin reversal in 2025, when population aging will accelerate (33).

Like its middle-income peers, Brazil is experiencing a double burden of non-communicable disease alongside infectious disease. Though mortality due to cardiovascular disease and cancer appear to have decreased in recent years, they remain the top health challenges in Brazil. Among infectious disease, Zika, dengue, HIV, and cholera remain endemic while other diseases like malaria, leprosy, and leishmaniasis have intensified in recent years (34). States in the northeastern portion of the country also must content with the burden of increased homicide rates within the last decade, adding another layer to the complex public health situation in Brazil (34).

11.2. Political, Legal, and Regulatory Environment

The Federative Republic of Brazil is the fifth-most populous nation in the world and accounts for one-third of the population of Latin America. Brazil is administratively subdivided into 26 states and the Federal District, which contains the capital city of Brasília. Its most recent constitution, enacted in 1988, established its current democratic government after emerging from two decades of military dictatorship running from 1964-1985 (35).

The 1988 Constitution set limits on presidential power and government censorship. In Brazil, legislative ability lies with the bicameral National Congress, comprising the Chamber of Deputies and the Federal Senate. Executive power lies with the President, elected once every four years. Judicial power is separated among a few instiutions, with the Federal Supreme Court in charge of ruling on consitutional concerns as well as those pertaining to federal civil servants of the country. The Higher Court of Justice hears non-consitutional cases and those pertaining to state governors. The judicial system is also subdivided by ordinary and special branch courts, the former consisting of state and federal courts, and the latter comprising labor, electoral, and military courts (35).

After a decade of democratic rule, with high economic inequality, high inflation, accusations of corruption comprising the first half of the 1990s followed by a period of strong economic growth in the latter half, Luiz Inacio Lula da Silva ("Lula") was elected in 2002 as the country's first democratically elected successor in over 40 years. During his administration, employment, wages, and several social reforms were prioritized. Investment in Brazil rose during this time period, and agricultural and mining sectors grew (35).

In 2010, Dilma Rousseff was the first woman to preside over Brazil elected. In 2014, she was re-elected for a new term. Brazil sustained a period of robust expansion until arounf 2011, when the economy started to

suffer the impact of the deteriorating of global economy and a contraction in the Brazilian industrial sector. Also, after an annual readjustment of the public transport tariff in the city of São Paulo in 2013, a series of protests began, which ended gaining strength and putting pressure on all spheres of government. The newly re-elected government of Dilma Rousseff began to face strong popular pressure, economic contractions in the industrial sector, allegations of corruption, as well as other demands from citizens. The Petrobras scandal, the economic recession, accusations of electoral corruption and pressure from opposition political groups led to the impeachment of President Dilma Rousseff and her removal from office in 2016.

The interim Temer administration introduced austerity measures to manage the economic crisis, but was not successful. In combination with Lula's conviction in 2017 and incarceration in 2018 (on corruption charges), public opinion swayed toward far-right populist Jair Bolsonaro, who ran on an anti-corruption platform. In 2021, the Supreme Court overturned all convictions in Lula's court case. Bolsonaro administration which assumed power in the 2020s, approached the COVID-19 pandemic with passive response of the federal government rather tham implementing evidence based, public-health policies with disastrous consequences for Brazil (35).

11.3. Economic Environment

Finance and Cancer Survival

Continuing the analysis of cancer survival estimates, the team plotted 5-year survival against financial metrics like Gross Domestic Product (GDP) per capita and health expenditure per capita. GDP per capita is calculated by dividing a country's annual GDP by its midyear population, with the original figure reported in current US Dollars (USD). Healthcare expenditure pertains to the estimated expenditure on healthcare goods and services consumed each year, also nominally reported in current USD. However, these nominal figures fail to account for the differences in the prices of goods and services in different countries and regions. Hence, purchasing power parity (PPP) is an additional adjustment to the per capita metrics that facilities a clearer comparison between countries. The PPP metrics analyzed are reported in International Dollars (Intl$), which has the same purchasing power as the US dollar has in the United States. The following analysis uses GDP per capita and health expenditure per capita, both nominal and PPP, from 2000 to 2014 in Argentina, Chile, Colombia, and the UK for additional contextualization. Analysis was limited to the period of 2000 to 2014 in order to match the survival estimates from the CONCORD-3 study.

Country-Level Expenditures

GDP per capita had increased substantially for each country included in the analysis from 2000 to 2014, despite significant periods of slower growth or decline. Of the countries selected, Colombia had the lowest 2014 GDP per capita, PPP, with Intl$1,3618.12, closely followed by Brazil at Intl$1,6358. In a higher cluster were Argentina and Chile, with a GDP per capita, PPP, of Intl$20,008.32 and $22,786.66 each. Finally, the UK had a predictably higher GDP per capita at Intl$41,259. Again, PPP figures are used in lieu of the nominal GDP per capita estimates for a more accurate comparison between countries.

Brazil's GDP per capita, PPP, increased 80.3% from Intl$9,073.98 in 2000 to Intl$16,358.39 in 2014. This percentage increase was in the middle of selected countries, below Colombia (103.4% increase 2000 to

2014) and Chile (138.5%), yet above Argentina (67.9%) and the UK (56.2%). Appendix Figures 2 and 3 graph each country's GDP per capita and GDP per capita, PPP from 2000 to 2014.

Appendix Figure 2: GDP Per Capita, Current USD (Source: The World Bank Open Data).
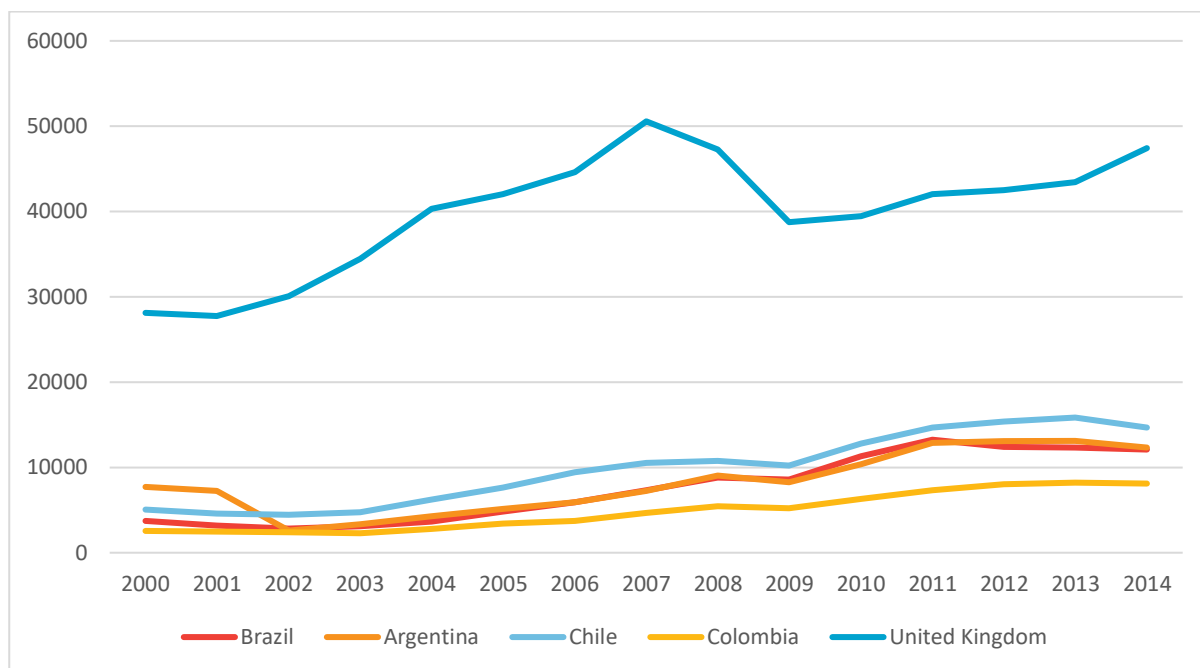
Appendix Figure 3 : GDP Per Capita, PPP, Current International$ (Source: The World Bank Open Data).
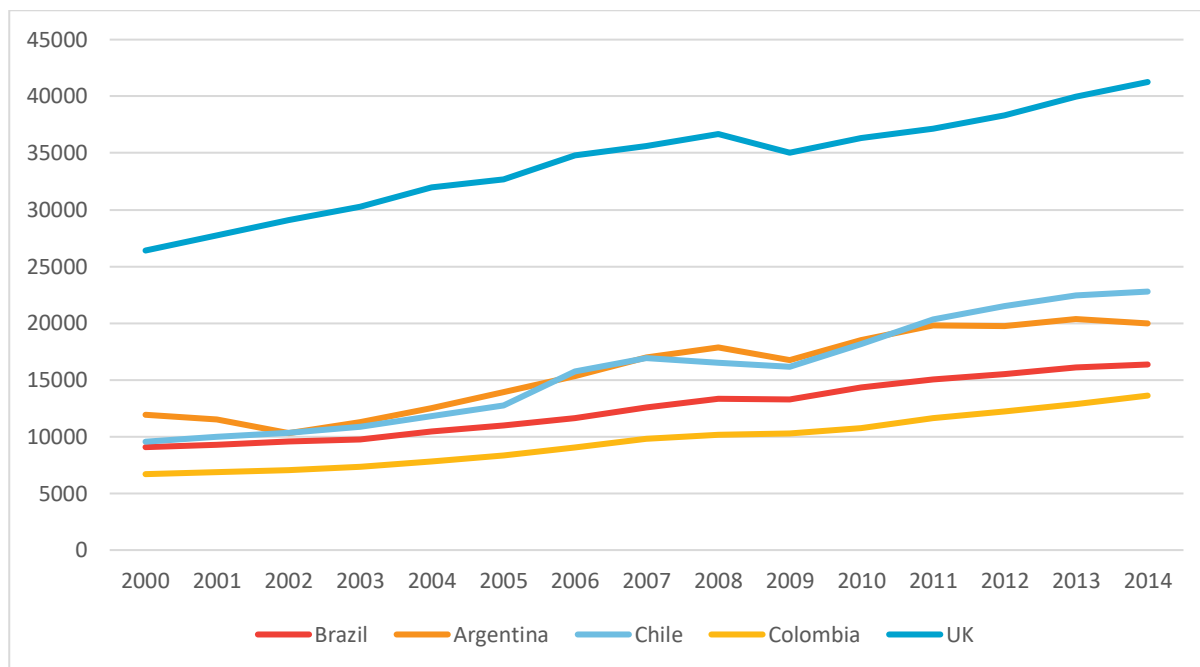
As with GDP per capita, Brazil was on the lower end for health expenditure per capita, PPP, at Intl$1,363.77 in 2014. Only Colombia (Intl$956.48) spent less on health expenditure per capita, PPP, while Argentina (Intl$1,640.34) and Chile, (Intl$1,793.68) spent slightly more per capita. The UK represented an outlier in this metric, spending a significantly higher Intl$4,003.54 per person in 2014. Despite spending a smaller amount on health expenditure per capita than many of the comparison countries, Brazil spent a higher percentage of its GDP per capita, PPP, on health. Brazil spent 8.34% of its GDP per capita, PPP, on health

expenditures per capita, PPP, in 2014. This ratio was slightly above that of Argentina (8.2%), Chile (7.87%), and Colombia (7.02%). Only the UK spent a higher percentage at 9.7% of its GDP per capita, PPP.

Each country also substantially increased its health expenditure per capita, PPP, over time. Brazil's spending grew 81.6% between 2000 and 2014, a figure significantly lower than the percentage increase seen in Colombia (177.4% increase 2000 to 2014), Chile (165.5%), and the UK (154.89%).

Appendix Figure 4: Health Expenditure per Capita, Current USD (Source: The World Bank Open Data).
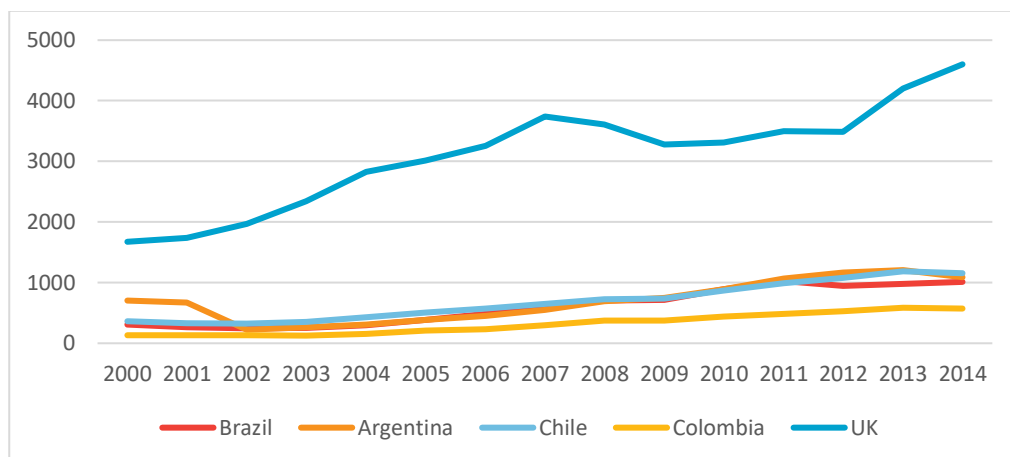
Appendix Figure 5: Health Expenditure per Capita, PPP, Current International$ (Source: The World Bank Open Data).
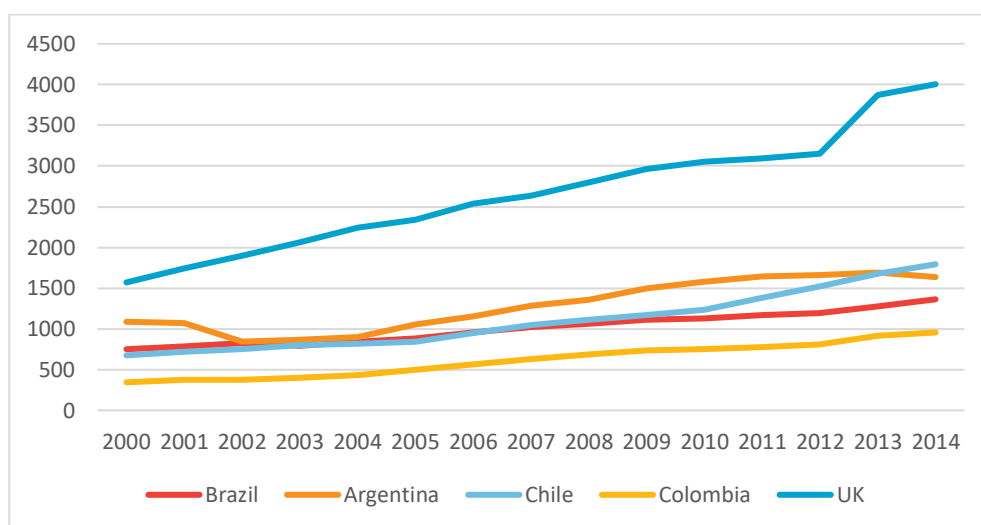
To mirror the CONCORD analysis, each of the financial metrics discussed above were segmented into 5 year averages corresponding to the years for survival estimates: 2000-2004, 2005-2009, and 2010-2014.

The specific cancer types selected for analysis are breast cancer, colon cancer, and lung cancer for which comparable data were available.

Expenditure and Breast Cancer

For breast cancer, 5-year survival in each of the comparator countries range from 72.1% in Colombia to 85.6% in the UK, with Brazil having a survival level of 75.2%. By comparison, the highest breast cancer

survival in the world from 2010 to 2014 belongs to the US at 90.2% of all diagnosed cases. Plotting survival levels against GDP per capita we find a positive correlation, with the trend clearer in PPP figures. Figures Appendix 6 and 7 show this comparison for GDP per capita and GDP per capita, PPP.

Appendix Figure 6: GDP per Capita vs Breast Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data)
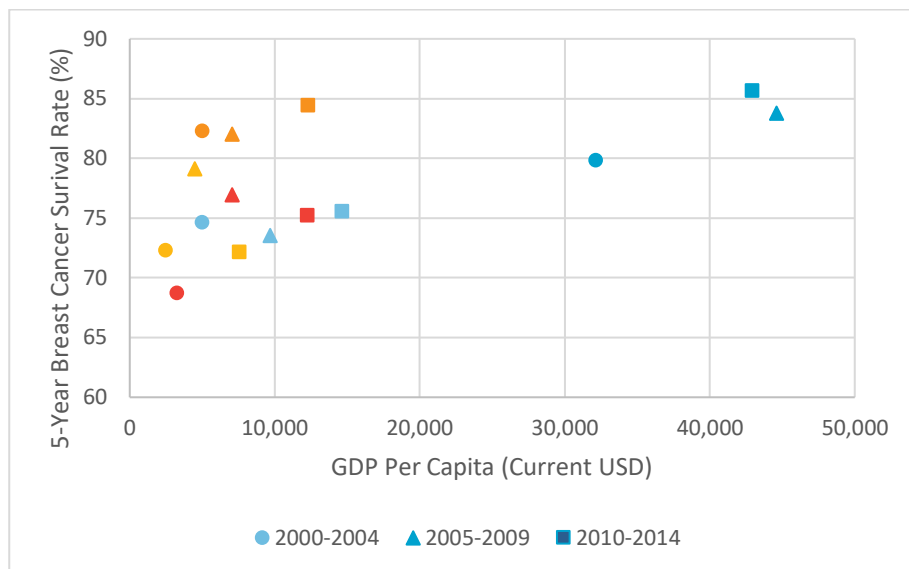
Appendix Figure 7: GDP per Capita, PPP vs Breast Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
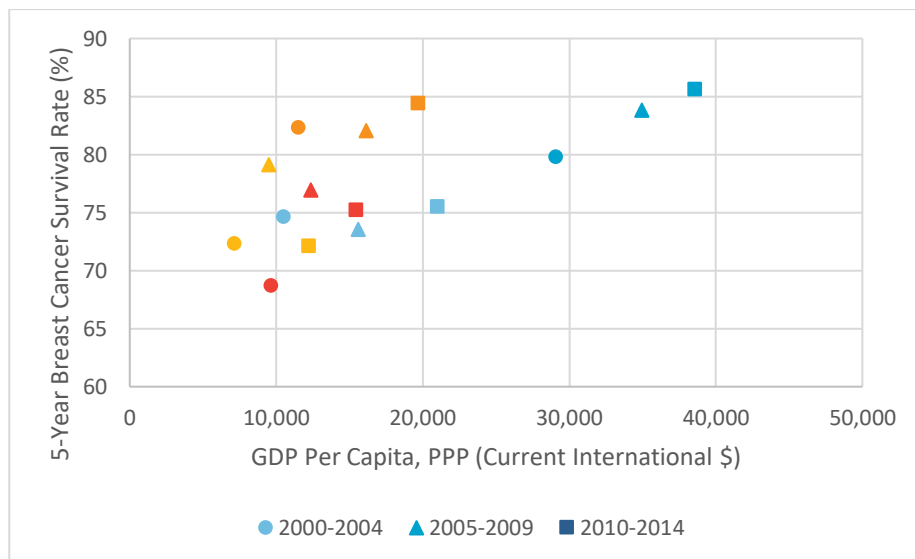
Health expenditure per capita shows a tighter positive correlation between variables, as seen in Appendix Figures 8 and 9.

Appendix Figure 8: Health Expenditure per Capita vs Breast Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).

Appendix Figure 9: Health Expenditure per Capita, PPP vs Breast Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
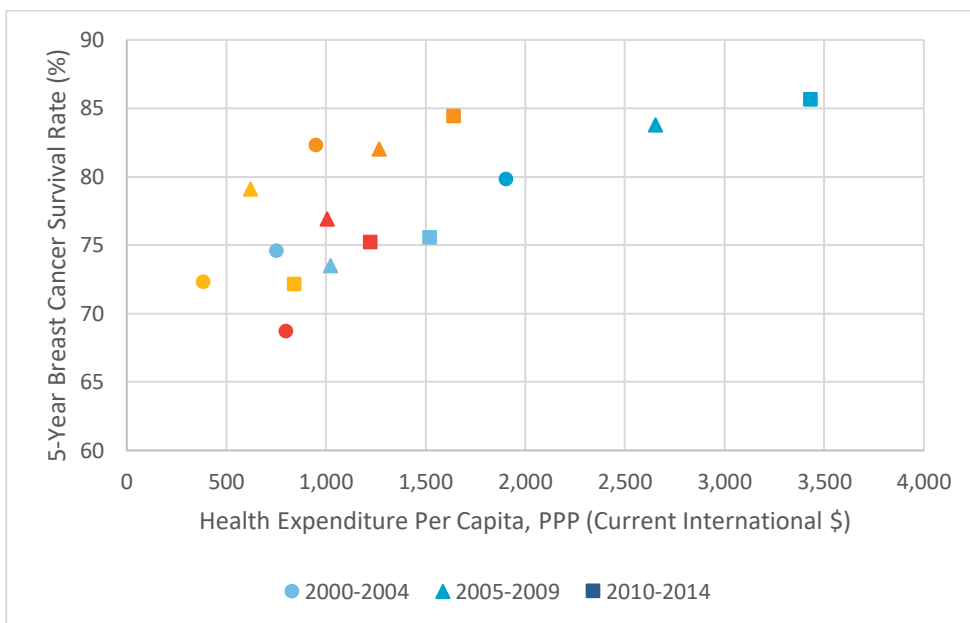
In general, the correlation is stronger in the PPP metrics which allow for a more accurate comparison between countries than the nominal GDP per capita figures. One way this is evident through the R^2 value, which is the percentage of the dependent variable variation, in this case 5-year breast cancer survival, that is explained by a linear model. In general, the higher the percentage, the better the linear model fits the data. Both PPP graphs have higher R^2 values than their nominal counterparts, with a linear trendline explaining 60% of all variation for GDP per capita, PPP versus 48.6% for GDP per capita in the data points from 2010 to 2014. With health expenditure, the trendline explained more of the survival variation than GDP per capita in the same set and yet again, the PPP metric explained the variation more than its nominal metric. Health expenditure per capita, PPP, has its trendline explain 65.5% of the variation compared to the

nominal figure trendline explaining 53.4% of the variation. Appendix Figure 10 details the inputs used for the respective scatterplot analysis.

Appendix Figure 10: Breast Cancer Expenditure Inputs (Sources: CONCORD-3 Study and The World Bank Open Data)..

Breast Cancer 5-Year Survival (% of patients diagnosed)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	68.7	82.3	74.6	72.3	79.8
2005-2009	76.9	82	73.5	79.1	83.8
2010-2014	75.2	84.4	75.5	72.1	85.6

GDP Per Capita (Current US$)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	3288.8	5027.5	5012.6	2484.2	32132.1
2005-2009	7090.8	7104.1	9705.2	4499.1	44639.4
2010-2014	12263.0	12346.5	14662.2	7604.0	42959.9

GDP Per Capita, PPP (Current Internatonal $)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	9627.7	11515.4	10502.6	7140.3	29091.8
2005-2009	12370.6	16169.9	15620.8	9522.5	34939.8
2010-2014	15471.7	19696.1	21047.6	12223.7	38608.8

Health Expenditure Per Capita (Current USD)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	274.4	434.0	358.3	134.8	2110.9
2005-2009	577.7	565.3	637.9	296.5	3376.4
2010-2014	970.5	1084.8	1058.4	524.0	3822.7

Health Expenditure Per Capita (Current USD)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	800.9	952.2	752.1	386.6	1903.8
2005-2009	1006.7	1267.9	1025.5	623.8	2652.6
2010-2014	1226.0	1643.1	1522.4	842.9	3434.4

Expenditure and Colon Cancer

Survival for colon cancer are considerably lower than breast cancer, with South Korea having the highest survival in the world in 2010-2014 at 71.8% of all diagnosed patients. Brazil, by comparison, has a 48.3% survival in the same time period. This figure falls below most of the other comparison countries, like Argentina (54.4% survival), Chile (43.9%), and the UK (60%). Like breast cancer, colon cancer survival is positively correlated with both GDP per capita and health expenditure per capita (Appendix Figure 11)

Appendix Figure 11: GDP per Capita vs Colon Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
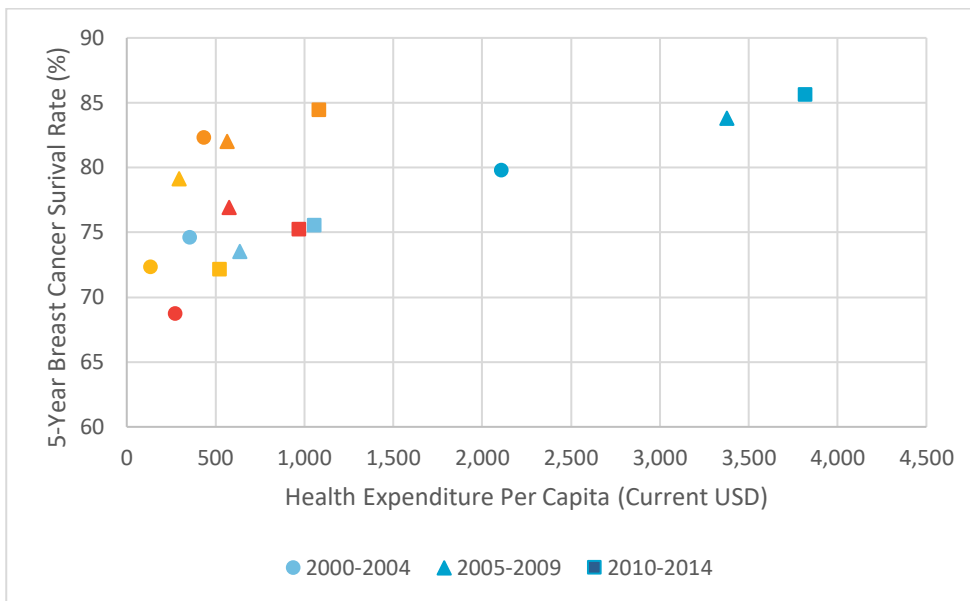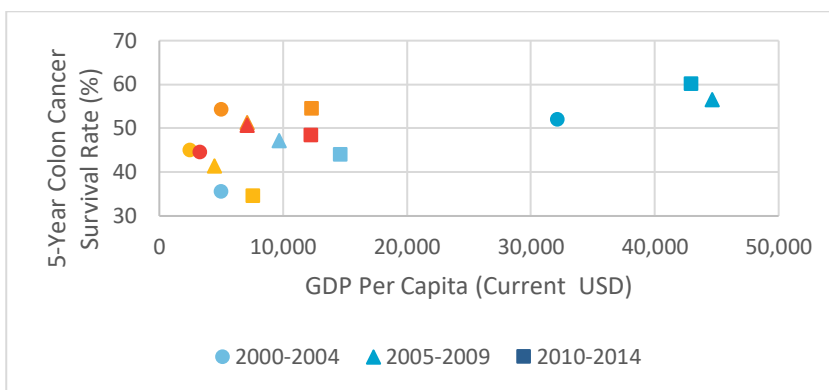

Appendix Figure 12: GDP per Capita, PPP vs Colon Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
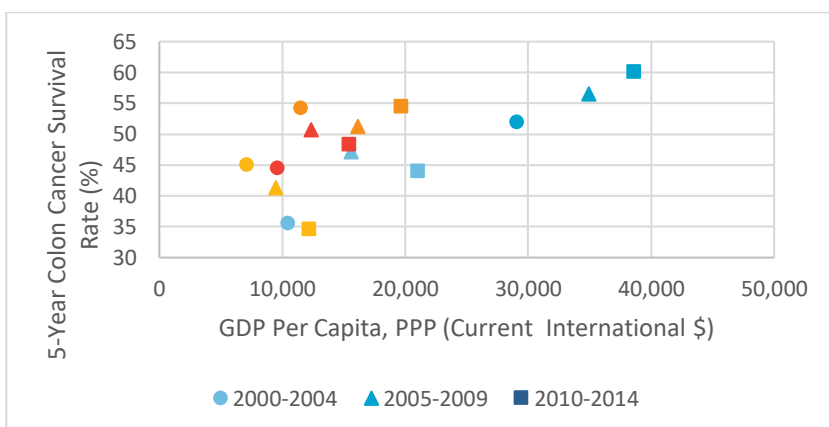
Appendix Figure 13: Health Expenditure per Capita vs Colon Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
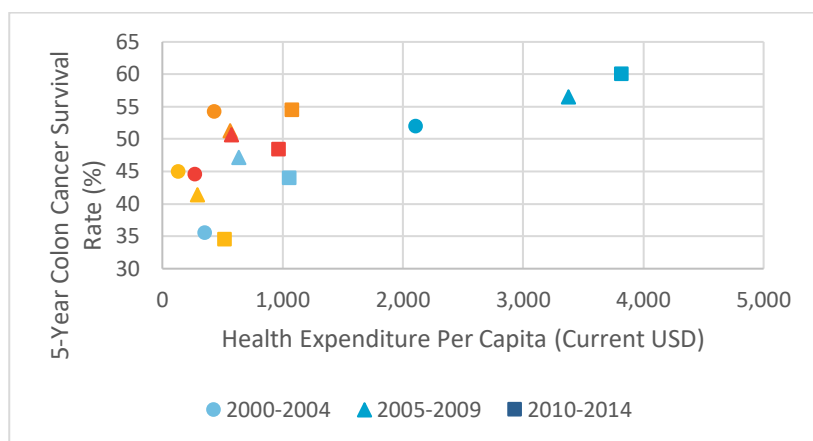
Appendix Figure 14: Health Expenditure per Capita, PPP vs Colon Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
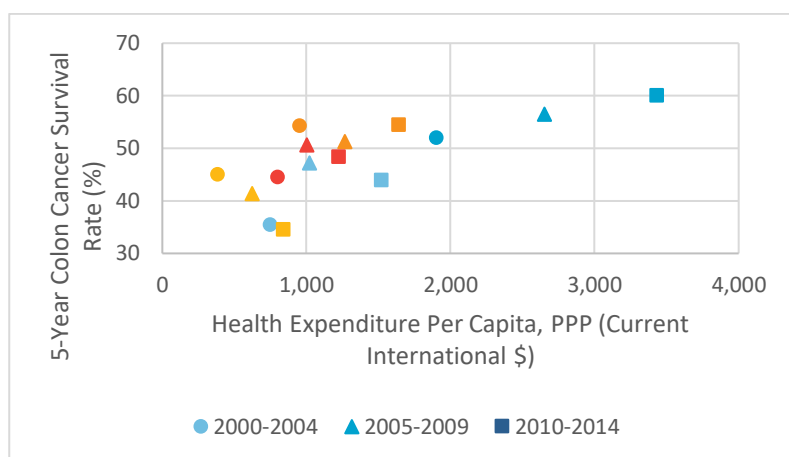
Appendix Figure 15: Colon Cancer Expenditure Inputs (Sources: CONCORD-3 Study and The World Bank Open Data).

Colon Cancer 5-Year Survival (% of patients diagnosed)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	44.5	54.2	35.5	45	52.0
2005-2009	50.6	51.2	47.1	41.3	56.5
2010-2014	48.3	54.4	43.9	34.5	60.0

GDP Per Capita (Current USD)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	3288.8	5027.5	5012.6	2484.2	32132.1
2005-2009	7090.8	7104.1	9705.2	4499.1	44639.4

2010-2014	12263.0	12346.5	14662.2	7604.0	42959.9

GDP Per Capita, PPP (Current International $)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	9627.7	11515.4	10502.6	7140.3	29091.8
2005-2009	12370.6	16169.9	15620.8	9522.5	34939.8
2010-2014	15471.7	19696.1	21047.6	12223.7	38608.8

Health Expenditure Per Capita (Current USD)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	274.4	434.0	358.3	134.8	2110.9
2005-2009	577.7	565.3	637.9	296.5	3376.4
2010-2014	970.5	1084.8	1058.4	524.0	3822.7

Health Expenditure Per Capita, PPP (Current International $)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	800.9	952.2	752.1	386.6	1903.8
2005-2009	1006.7	1267.9	1025.5	623.8	2652.6
2010-2014	1226.0	1643.1	1522.4	842.9	3434.4

Of particular note is the R2 value of the health expenditure per capita, PPP, where the trendline explains 69.1% of the variation in the 2010 to 2014 data set, the highest of any metric for colon cancer. This is followed by GDP per capita, PPP (R2 value of 63.4%), health expenditure per capita (59.7%), and GDP per capita (55.8%).

Expenditure and Lung Cancer

Lung cancer survival is significantly lower than those of breast cancer and colon cancer, with the highest survival rate in the world from 2010 to 2014 being 32.9% of diagnosed adults in Japan. Brazil's 8.5% survival during 2010 to 2014 is situated on the lower end comparison countries- with Chile (4.6% survival) below, and Colombia (8.7%), Argentina (13.1%) and the UK (13.3%) above. Plotting these survival estimates against GDP per capita and health expenditure per capita, shows a weaker positive correlation between financial metrics and lung cancer survival. Appendix Figures 16, 17, 18, 19, and 20 display these findings.

Appendix Figure 16: GDP per Capita vs Lung Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
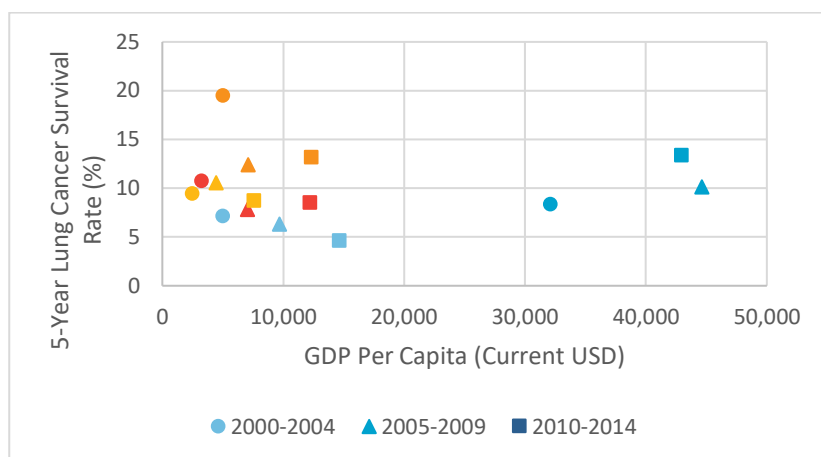
Appendix Figure 17: GDP per Capita, PPP vs Lung Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
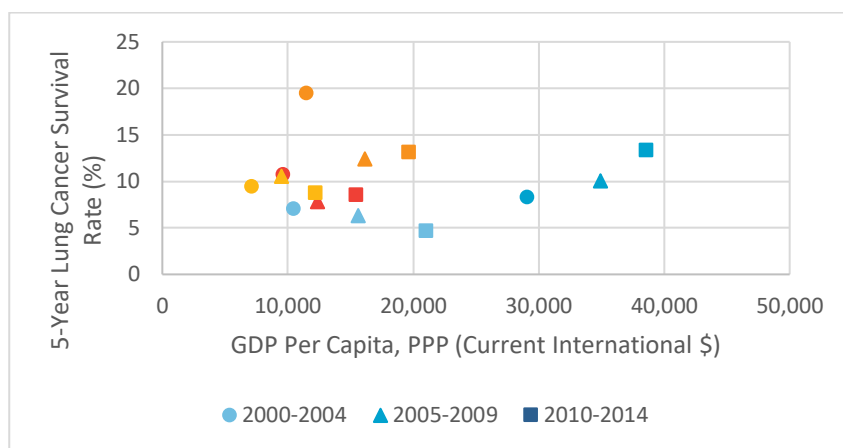
Appendix Figure 18: Health Expenditure per Capita vs Lung Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
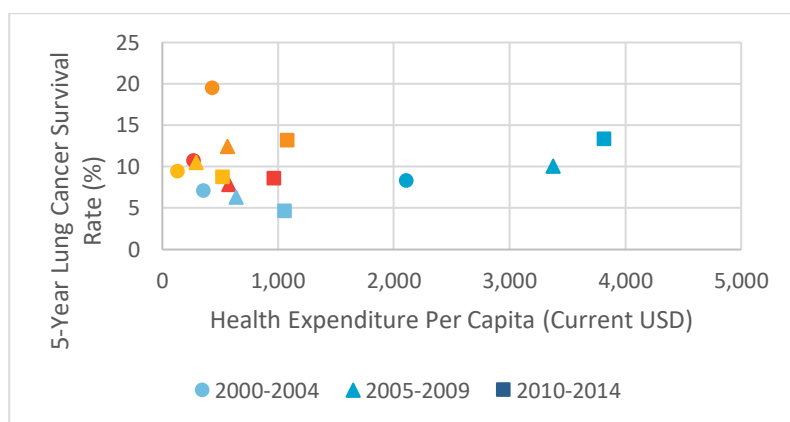
Appendix Figure 19: Health Expenditure per Capita, PPP vs Lung Cancer 5-Year Survival (Sources: CONCORD-3 Study and The World Bank Open Data).
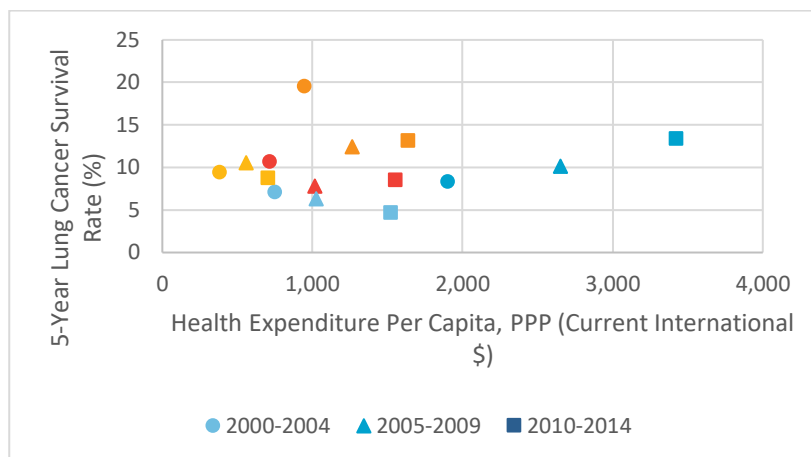
Appendix Figure 20: Lung Cancer Expenditure Inputs (Sources: CONCORD-3 Study and The World Bank Open Data).

Lung Cancer 5-Year Survival (% of patients diagnosed)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	10.7	19.5	7.1	9.4	8.3
2005-2009	7.8	12.4	6.3	10.5	10.1
2010-2014	8.5	13.1	4.6	8.7	13.3

GDP Per Capita (Current USD)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	3288.8	5027.5	5012.6	2484.2	32132.1
2005-2009	7090.8	7104.1	9705.2	4499.1	44639.4
2010-2014	12263.0	12346.5	14662.2	7604.0	42959.9

GDP Per Capita, PPP (Current International $)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	9627.7	11515.4	10502.6	7140.3	29091.8
2005-2009	12370.6	16169.9	15620.8	9522.5	34939.8
2010-2014	15471.7	19696.1	21047.6	12223.7	38608.8

Health Expenditure Per Capita (USD)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	274.4	434.0	358.3	134.8	2110.9
2005-2009	577.7	565.3	637.9	296.5	3376.4
2010-2014	970.5	1084.8	1058.4	524.0	3822.7

Health Expenditure Per Capita, PPP (Current International $)					
	Brazil	Argentina	Chile	Colombia	UK
2000-2004	717.3	947.6	750.5	383.9	1904.3
2005-2009	1019.0	1269.1	1025.4	560.2	2653.3
2010-2014	1556.2	1638.6	1522.8	707.4	3426.2

Supporting the visual interpretation of weaker correlation is the fact that the R2 values for the 2010 to 2014 trendlines are substantially lower across the board for explaining variation in lung cancer survivability. None of the values are above 32%, with health expenditure per capita having the highest at an R2 of 31.6%. The R2 values continue to decline for health expenditure per capita, PPP (30.1%), GDP per capita (25.8%), and GDP per capita, PPP (24.9%).

11.4. Socio-cultural Dynamics

Brazil's extensive history involving the trans-Atlantic slave trade from the 1500s onwards forms the basis for race relations in the country today. The slave trade would bring an estimated 3.6 to 4 million slaves to Brazil, accounting for about 40% of total slaves that would be brought to the colonies in the Americas. Relations between the Portuguese colonizers and their slaves were common, resulting in many of the mixed race individuals who were to populate the nation.

Though slavery was abolished in 1888, ideologies surrounding the superiority of "whiteness" and those of eugenics made their way from North America and Europe to Brazil around the same time period. Though such extreme ideologies have diminished in modern-day Brazil, racial inequalities continue to impact darker-skinned individuals in the nation. Black individuals face concerns ranging from microaggressions ("He is Black, but very honest") to stark differences in educational attainment or access to organ transplants. Blacks have a lower life expectancy, three times the poverty rate, and experience homicide at

twice the rate of whites in Brazil (36). Furthermore, Black individuals are more likely than even their brown peers to state that they have been victims of racial discrimination. In a 2010 LAPOP survey, 57% of Blacks compared to 88% of browns state they had never been victims of racial discrimination (36).

Gentrification has made economic disparities between low-income Afro-Brazilians even more apparent, resulting in housing that has become too expensive for many individuals to afford. Protests against these changes have further illustrated a higher incidence of police brutality against darker-skinned individuals compared to their white peers (36).

11.5. Ecological Changes

Brazil's use of natural resources has increased in recent years, and some of its infrastructure has kept up with new emerging needs while some has not. As of the mid-2010s, Brazil outpaced many of its OECD peers in securing energy via low-carbon resources. About 40% of its total energy needs and 80% of its electricity is produced from renewable energy sources. Air pollution, while having decreased in recent years, remains a concern in major metropolitan areas where concentrations of particulate matter exceed national air quality standards. Furthermore, only about half of the rural population has access to waste collection services, some of which is collected in uncontrolled sites (38).

Deforestation also remains a concern in Brazil. The nation holds the second-largest forest area in the world and experiences the world's highest annual loss in forest cover. While deforestation declined dramatically from 27,000 km2 in 2004 to about 4,800 km2 in 2014 (38), the election of President Jair Bolsonaro resulted in government deregulation of environmental degredation in favor of economic growth. Under his leadership, President Bolsonaro's administration reduced the budget for IBAMA, the Brazilian Environmental Agency, by 24 percent. Enforcement actions by this agency have also decreased by 20 percent since his election. His tenure resulted in a continuation of trends seen since 2012: a gradual increase in deforestation not seen since 2004 (39).

11.6. Technological Changes

Brazil continues to make technological changes to advance equality among its various social classes, though challenges remain as it tries to improve access for its most vulnerable communities. As of 2014, about 85% of people above the age of 10 years have access to a mobile phone, one of the main ways by which information can be disseminated. However, income continues to define whether a patient has internet access as well. About 98% of Brazil's richest social classes have access to internet, whereas only about 8% of the country's most poor have similar access (40). In response to perceived gaps in information access, the government has actively sought to provide young rural populations with information and communication technologies, projects that have benefitted about 6.4 million young people already. The government has also prioritized acquisition of computers for public schools and the creation of apps that provide information about traffic and public transport, public places with free wireless internet, and job seeking (40).

Much as in the rest of the world, the COVID-19 pandemic has spurred innovative change in how technology is used in a healthcare setting. One such instance involves the use of a telemedicine platform named "Ciudar Digital," included an "electronic medical record, access to test results, and a digital prescription interface for all doctors to use free of charge. Specifically, doctors have been able to monitor a patient's

diabetes virtually and use videoconferencing platforms, provided they have access to glycemic reports via email or other apps/platforms such as GlucoTrends. Teles et al. note that while these advances have been significant, particularly for low-income Brazilians, their sustainability remains tenuous. Business incentives to finance these changes will need developing to make these changes permanent and available to those with less access to a physical healthcare setting (41).

12.Appendix D: Projected Cancer Incidence in Brazil and Selected Comparator Countries

Total cancer incidence in Brazil is projected to rise 78.4% between 2018 and 2040 to an alarming 998,056 new cases of cancer in 2040 alone. This figure represents an additional 438,685 cases on top of the 559,371 new cases in 2018. Brazil's high rate of change is on par with many large Latin American peer countries. Colombia's total incident cancer is projected to rise by 86.5% between 2018 and 2040, Mexico by 88.6%, and Chile by 77.7% Argentina is projected to increase at a slightly slower pace, with new cases of cancer rising by 47.8% between 2018 and 2040.

Appendix Figure 21: Estimated Cancer Incidence in Brazil (2020-40) (Source: IARC Cancer Tomorrow).
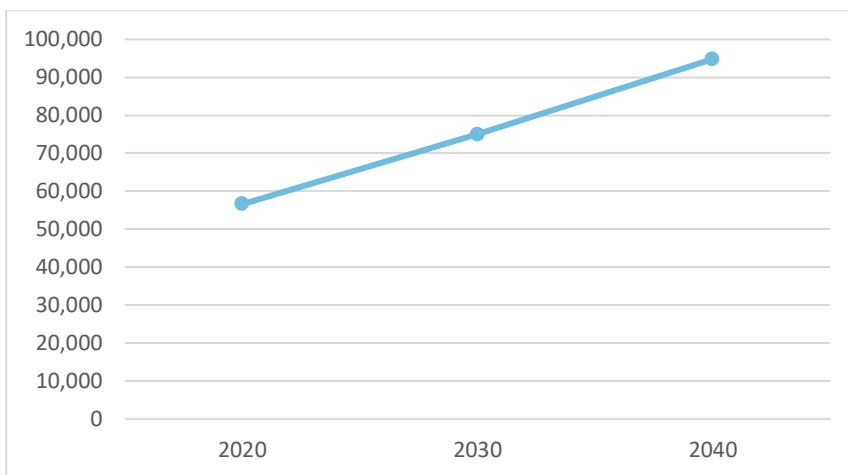
Appendix Figures 22 and 23 show the number of cancer cases projected for 2020-40. Though comparisons between countries drawn from crude numbers do not account for different population age structures or sizes, examining the percentage increases can help in understanding the shape of the region's projected cancer burden.

Appendix Figure 22: Estimated Incident Cases Over Time, All Cancer Types (Source: IARC Cancer Tomorrow).

	Brazil	Argentina	Chile	Colombia	Mexico
2020	594908	133604	56575	108954	202923
2030	789200	159776	74973	148600	274383
2040	998056	190779	94807	189988	359542

Appendix Figure 23: Estimated number of cancer Cases in Brazil and selected Latin American countries (2020-40), All Cancer Types (Source: IARC Cancer Tomorrow).
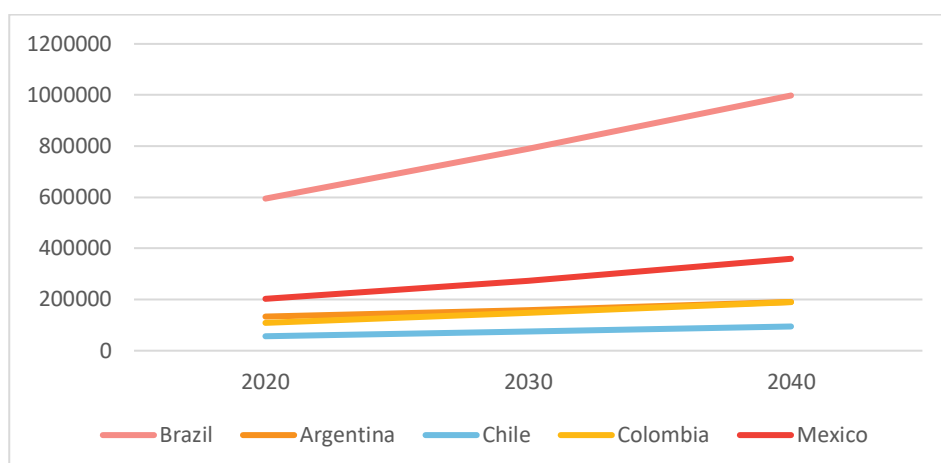
Incidence Projections in Other Regions

Compared to other regions of the world, Brazil's cancer incidence from 2018 to 2040 will increase by about the same percentage as Latin American and the Caribbean (78.6% increase from 2018 to 2040), both of which are much higher than the North American (46.3% increase) and Western European (27%) projections.

Appendix Figure 24: Percentage Increase in Number of Cancer Cases – Brazil and selected world regions 2020-40 (Source: IARC Cancer Tomorrow).

	Brazil	Latin America and the Caribbean	North America	Western Europe	World
2020	6.4%	6.0%	4.4%	2.8%	5.0%
2030	41.1%	40.1%	27.5%	16.4%	33.4%
2040	78.4%	78.6%	46.3%	27.0%	63.4%

In 2018, the Latin America and Caribbean region has a comparable number of incident cancer cases to Western Europe, with 90,000 cases separating their estimates. However, because cancer in Brazil and Latin America as a whole is projected to rise much faster than estimates in Western Europe, the gap between the two regions in 2040 is projected to be 782,211 cases.

Appendix Figure 25: Figure 13: Estimated Number of Cancer Cases – Brazil and selected world regions (2020-40), All Cancer Types (Source: IARC Cancer Tomorrow).
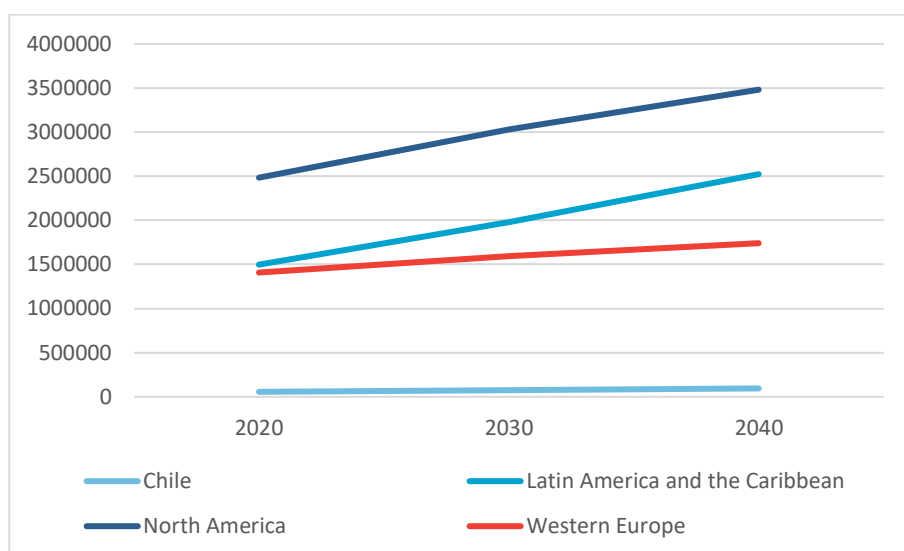
Appendix Figure 26: Estimated Number of Cancer Cases – Brazil and selected world regions (2020-40),, All Cancer Types (Source: IARC Cancer Tomorrow).

	Brazil	Latin America and the Caribbean	North America	Western Europe
2020	594908	1497913	2483719	1408162
2030	789200	1979072	3031766	1594721
2040	998056	2523200	3480754	1740989

Disaggregated Incidence Projections

Specific cancer types in Brazil that are projected to double or nearly double in number of new cases per year within the next 20 years include prostate cancer (99.1% increase 2018 to 2040), colon cancer (89.9%), lung cancer (98.3%), stomach cancer (89.5%), and bladder cancer (105.5%). Prostate cancer is of particular concern because it is already the cancer with the highest incident ASR within Brazil. These alarming trends are not necessarily unique to Brazil, with prostate, lung, and stomach cancers projected to increase over 90% in Chile, Colombia, and Brazil. Argentina, though still projected to increase substantially, has a considerably lower estimate of a 58.5% increase in prostate cancer, 54% increase in lung cancer, and 53.6% in stomach cancer.

Appendix Figure 27: Percentage Increase in Number of New Cancer Cases in Brazil and Selected Countries Between 2018 and 2040, by Cancer Type (Source: IARC Cancer Tomorrow).

	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
Prostate	99.10%	58.50%	104.40%	114.00%	127.00%	25.50%	38.50%
Breast	55.50%	39.70%	44.40%	56.60%	69.80%	12.20%	20.20%
Colon	89.90%	53.10%	85.70%	102.40%	101.30%	36.90%	41.20%
Lung	98.30%	54.00%	89.60%	113.40%	122.30%	21.90%	41.50%
Cervical	43.10%	30.20%	39.10%	50.90%	62.00%	7.40%	7.10%
Thyroid	27.60%	28.90%	25.40%	36.80%	47.30%	4.20%	13.40%
Stomach	89.50%	53.60%	92.80%	100.30%	106.30%	36.70%	46.70%
Uterine	65.70%	44.90%	52.60%	74.60%	73.50%	20.50%	25.40%
Non-Hodgkin Lymphoma	57.70%	43.80%	61.30%	79.10%	78.00%	29.40%	32.80%
Bladder	105.50%	59.40%	102.20%	123.00%	119.30%	43.50%	50.40%

Cancer types in this analysis were chosen and ordered according to age-standardized rate, a different metric than the crude number of new cases. Despite this difference, prostate cancer and breast cancer are still projected to have the highest number of new cases, with 169,252 new cases of prostate cancer and 133,118 new cases of breast cancer in 2040. **Appendix Figure 28** further breaks down the projected number of new cases for each of Brazil's top 10 cancer by ASR..

Appendix Figure 28: Projected Number of Deaths by Cancer Type, for Cancers with the 10 Highest Mortality Rates in Brazil (Source: IARC Cancer Tomorrow).

Prostate Cancer Incidence Projection

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	91653	12080	7078	13876	27078	67311	58545
2030	128706	14807	10109	20457	39894	76836	69246
2040	169252	18384	13443	27199	56864	81523	78092

Breast Cancer Incidence Projection

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	90225	22308	5628	14124	28958	57090	56601
2030	112951	26128	6778	17778	37761	60849	62142

2040	133118	30124	7787	20957	46315	63020	66612

Colon Cancer Incidence Projection

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	29907	12870	3912	6099	11204	30553	32187
2030	40866	15632	5290	8647	15660	35798	38210
2040	53084	19005	6827	11456	21053	40545	43999

Lung Cancer Incidence Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	37088	12028	4143	6358	8418	48521	54187
2030	51785	14602	5699	9306	12249	54310	64565
2040	68429	17855	7345	12498	17363	57437	74047

Cervical Cancer Incidence Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	17030	4616	1608	4046	8295	3084	3456
2030	20466	5250	1900	4990	10514	3176	3550
2040	23323	5836	2154	5815	12744	3295	3674

Thyroid Cancer Incidence Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	22227	3581	1114	5332	12701	11814	4917
2030	25411	4059	1250	6301	15505	12164	5233
2040	27405	4487	1356	6994	17851	12188	5501

Stomach Cancer Incidence Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	22375	4127	5511	7983	8091	7982	6597
2030	30537	5022	7603	11283	11394	9354	7948

2040	39663	6112	9950	14863	15565	10560	9345

Uterine Cancer Incidence Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	9675	2499	982	1694	7738	10879	10982
2030	12424	2963	1221	2257	10223	12156	12347
2040	15091	3496	1424	2764	12609	12750	13388

Non-Hodgkin Lymphoma Cancer Incidence Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	13522	3520	1571	4437	5485	15156	16417
2030	16875	4162	1991	5924	7242	17304	18934
2040	20320	4896	2403	7470	9212	19081	21160

Bladder Cancer Incidence Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	14567	3761	1440	1802	2196	16894	12690
2030	20598	4626	2019	2689	3175	20373	15534
2040	27815	5788	2722	3701	4478	23368	18373

13. Appendix E: GDP and health expenditure trends

Using CONCORD-3 survival estimates, the Harvard research team plotted 5-year net survival for major cancers against metrics for the level of economic development using GDP per capita and investment in health system as measured by health expenditure per capita. These results are presented in the main body of the report. We include below the methodology used to derive GDP and Health Expenditure figures used in the analysis.

GDP per capita was calculated by dividing a country's annual GDP by its midyear population, with the original figure reported in current US Dollars (USD). Healthcare expenditure pertains to the estimated expenditure on healthcare goods and services consumed each year, also nominally reported in current USD. However, these nominal figures fail to account for the differences in the prices of goods and services in different countries and regions. Hence, purchasing power parity (PPP) is an additional adjustment to the per capita metrics that facilities a clearer comparison between countries. The PPP metrics analyzed are reported in International Dollars (Intl$), which has the same purchasing power as the US dollar has in the United States. The following analysis uses GDP per capita and health expenditure per capita, both nominal and PPP, from 2000 to 2014 in Argentina, Colombia, Chile, and the UK for additional contextualization of Brazil's situation.

Changes in GDP per Capita

GDP per capita has increased substantially for each country included in the analysis from 2000 to 2014, despite significant periods of slower growth or decline. Of the countries selected, Brazil has the second-lowest 2014 GDP per capita at Intl$16,358, only trailing Colombia's Intl$13,618. Chile and Argentina form a more economically affluent cluster, with Chile at Intl$22,786 and Argentina at Intl$20,008. Finally, the UK has a predictably higher GDP Per Capita at Intl$41,259. Again, PPP figures are used in lieu of the nominal GDP per capita estimates for a more consistent comparison between countries.

Brazil's GDP per capita, PPP, has increased 80.3% from 2000 to 2014. This percentage increase is about average compared to other selected countries, above Argentina (67.9% increase) and the UK (56.2%) but below Chile (138.5%) and Colombia (103.4%). Appendix Figures 29 and 30 present each country's nominal GDP per capita and GDP per capita, PPP.

Appendix Figure 29: GDP Per Capita, Current USD for Brazil and selected countries (Source: Our World in Data (79))
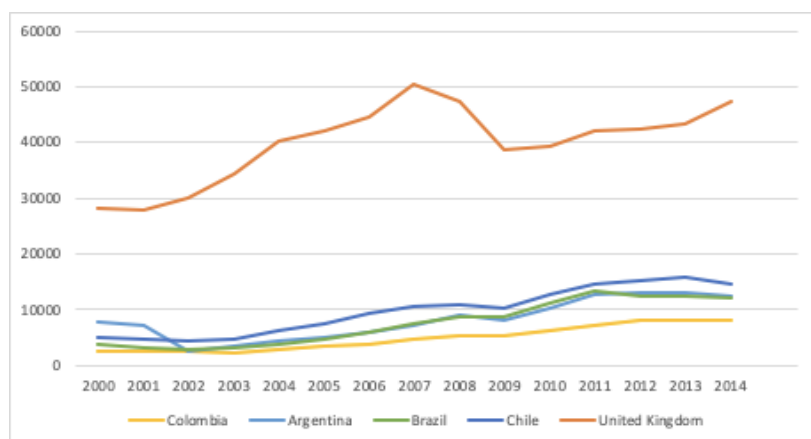
Appendix Figure 30: GDP Per Capita for Brazil and selected countries, PPP, Current International $ (Source: Our World in Data (79))
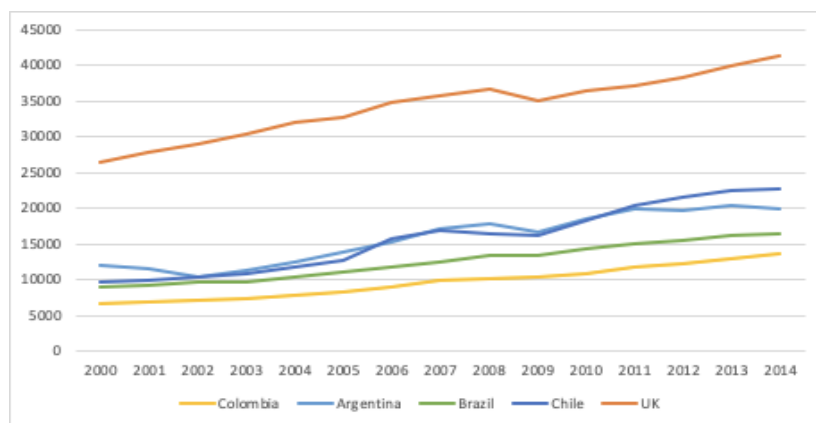
Brazil has the second-lowest health expenditure per capita, PPP, of the Latin American countries at Intl$1,640. Other countries in the comparison group, in order, are Colombia (956), Argentina (1,640), Chile (1,793), and the UK (4,003). Though it is the second-lowest nominal amount of the four Latin American nations, Chile's health expenditure per capita as a percentage of total GDP per capita (both figures PPP) is comparable to the others. Brazil has a health expenditure per capita that is 8.3% of its GDP per capita similar to that of Argentina (8.2%), Chile (7.87%), Colombia (7.02%), and the UK (9.7%).

Each country has also recently increased its health expenditure per capita. Brazil has increased at the second-lowest rate at 81.6%, with an increase from Intl$800.9 per person in 2000 to Intl$1226 in 2014. Chile (165.5%), Colombia (177.4%), and the UK are have seen significantly higher increases than Brazil, with only Argentina (51.1%) trailing it.

Appendix Figure 31: Health Expenditure per Capita, Current USD for Brazil and selected countries (Source: Our World in Data (79))
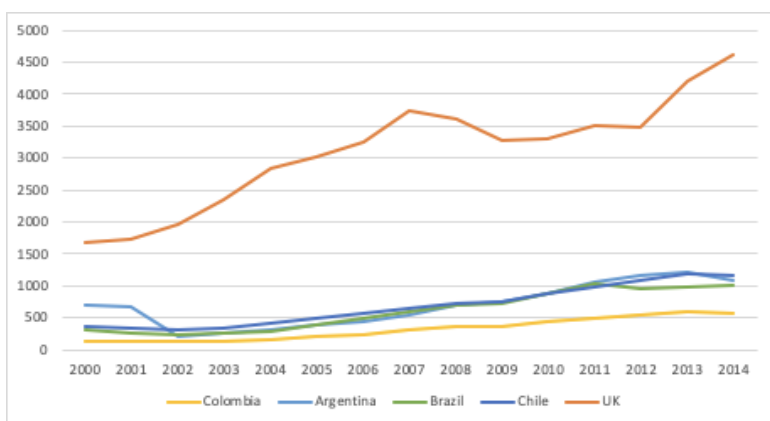
Appendix Figure 32: Health Expenditure per Capita, PPP, Current International$ for Brazil and selected countries (Source: Our World in Data (79))
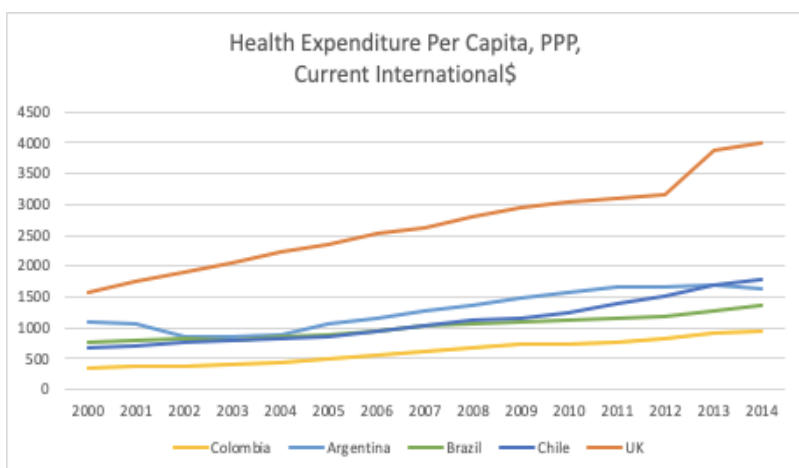
To mirror the CONCORD analysis, each of the financial metrics discussed above were simplified into 5-year averages corresponding to the years for survival estimates: 2000-2004, 2005-2009, and 2010-2014 and are presented in Table below.

Appendix Table 1: 5-year Averages of GDP Per Capita of Brazil and Selected Countries (Source: Our World in Data (79))

GDP Per Capita (Current US$)

	Colombia	Argentina	Brazil	Chile	UK
2000-2004	2484.2	5027.5	3288.8	5012.6	32132.1
2005-2009	4499.1	7104.1	7090.8	9705.2	44639.4
2010-2014	7604.0	12346.5	12263.0	14662.2	42959.9

GDP Per Capita, PPP (Current International $)

	Colombia	Argentina	Brazil	Chile	UK
2000-2004	7140.3	11515.4	9627.7	10502.6	29091.8
2005-2009	9522.5	16169.9	12370.6	15620.8	34939.8
2010-2014	12223.7	19696.1	15471.7	21047.6	38608.8

Health Expenditure Per Capita (Current USD)

	Colombia	Argentina	Brazil	Chile	UK
2000-2004	134.8	434.0	274.4	358.3	2110.9
2005-2009	296.5	565.3	577.7	637.9	3376.4
2010-2014	524.0	1084.8	970.5	1058.4	3822.7

Health Expenditure Per Capita, PPP (Current International $)

	Colombia	Argentina	Brazil	Chile	UK
2000-2004	386.6	952.2	800.9	752.1	1903.8
2005-2009	623.8	1267.9	1006.7	1025.5	2652.6
2010-2014	842.9	1643.1	1226.0	1522.4	3434.4

14. Appendix F: Projected Cancer Mortality in Colombia and Selected Comparator Countries

Brazil's total cancer deaths are projected to nearly double between 2018 and 2040, increasing 95.5% to an alarming 476,272 deaths from cancer in 2040. This represents an additional 232,684 deaths on top of the 2018 estimate of 243,588 deaths.

Appendix Figure 33: Projected Deaths Over Time in Brazil, All Cancer Types (Source: IARC Cancer Tomorrow).
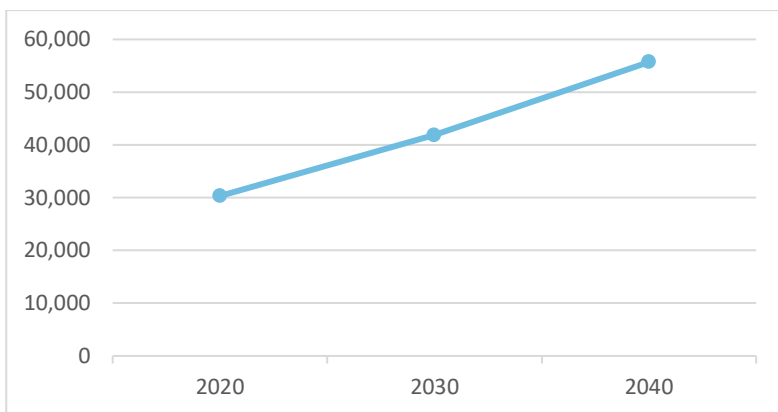
Brazil's astounding increase in cancer deaths is consistent with a troubling regional trend, with deaths from cancer projected to double or nearly double in Chile (95.8% increase 2018 to 2040), Colombia (107.8%), and Mexico (107.2%). Argentina is the only country with a lower projected increase at 53.9% from 2018 to 2040. Though percentage increase is not as robust a metric as age-standardized rates, examining them within allows for some deduction of which countries will face future challenges.

Appendix Figure 34: Projected Deaths Over Time, All Cancer Types (Source: IARC Cancer Tomorrow).
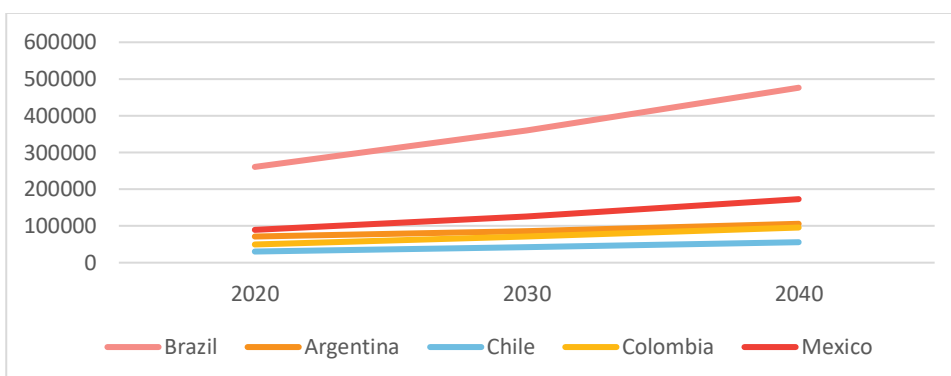
Appendix Figure 35: Projected Deaths Over Time, All Cancer Types, Selected Countries in Latin America (Source: IARC Cancer Tomorrow).

	Brazil	Argentina	Chile	Colombia	Mexico
2020	260710	71225	30314	49570	89358
2030	359967	86681	41884	70967	125763
2040	476272	105838	55698	95692	172961

Mortality Projections in Other Regions

Brazil's increase in mortality between 2018 and 2040 is similar to the Latin American and Caribbean Region's overall figure of a 93.4% increase. However, both estimates are well-above the projected increase in North America (59.2% increase), Western Europe (38.6%), and the global estimate (71.5%).

Appendix Figure 36: Percentage Increase in Number of Deaths from 2018, Selected World Regions (Source: IARC Cancer Tomorrow).

	Brazil	Latin America and the Caribbean	North America	Western Europe	World
2020	7.0%	6.5%	4.8%	3.2%	5.2%
2030	47.8%	45.5%	33.0%	20.9%	36.3%
2040	95.5%	93.4%	59.2%	38.6%	71.5%

Appendix Figure 37 shows the projected number of deaths over time for selected world regions, with the rate of increase steeper for Brazil and Latin America and the Caribbean as compared to other selected geographies. Though North America and Latin America and the Caribbean have a similar number of deaths in 2018, Latin America is expected to pass North America within the next few years and continue distancing itself from North America over time.

Appendix Figure 37: Projected Deaths Over Time, All Cancer Types (Source: IARC Cancer Tomorrow).
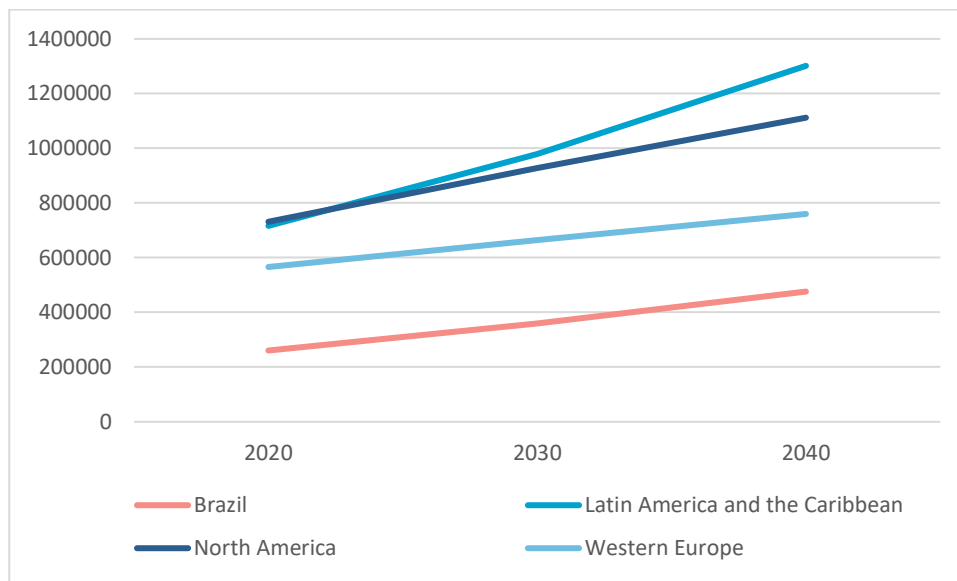
Appendix Figure 38: Projected Deaths Over Time, All Cancer Types (Source: IARC Cancer Tomorrow).

	Brazil	Latin America and the Caribbean	North America	Western Europe
2020	260710	716476	731531	566094
2030	359967	979129	928636	663088
2040	476272	1301388	1111973	760017

Disaggregated Mortality Projections

Prostate cancer already has the highest mortality rate in Brazil and is also projected to increase in crude number of deaths by the highest percentage from 2018 to 2040. In that span, Brazil is expected to experience a 147.3% increase in deaths from prostate cancer. This is not necessarily unique to Brazil, with other countries, except for Argentina, projected to increase by a similar margin. Namely, Chile's deaths from prostate cancer will increase by 154.2%, Colombia by 160.2%, and Mexico by 147%. For comparison, Western European countries are projected to increase by a smaller, but still worrying margin, with France increasing by 74.1% and the UK by 75.9%.

The pattern continues to other cancer types in Brazil, where deaths are predicted to double or nearly double for lung cancer (100% increase 2018 to 2040), colon cancer (105.5%), stomach cancer (97.6%), pancreatic cancer (105.1%), and liver cancer (98.1%). Other cancers that will also increase significantly include breast cancer (72.6% increase) and cervical cancer (57.9%). **Appendix Figure 39** details these percentage increases across countries for the top 10 cancers in Brazil by ASR. Note that colon, rectal, and bowel cancer are aggregated into colorectal cancer in some reports, while colon cancer, the most common of the three, is used in others.

Appendix Figure 39: Percentage Increase in Number of Deaths Between 2018 and 2040, by Cancer Type – Brazil and Selected Countries (Source: IARC Cancer Tomorrow).

	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
Prostate	147.30%	71.00%	154.20%	160.20%	147.00%	74.10%	75.90%
Breast	72.60%	47.50%	66.90%	78.30%	86.60%	33.90%	35.70%
Lung	100.00%	54.60%	92.90%	118.40%	124.40%	28.60%	44.90%
Colon	105.50%	57.40%	101.80%	117.70%	111.40%	50.10%	54.90%
Stomach	97.60%	55.50%	103.20%	109.60%	111.70%	44.00%	51.20%
Cervical	57.90%	35.20%	60.80%	75.90%	83.60%	20.40%	23.40%
Pancreas	105.10%	55.90%	90.50%	116.20%	119.00%	39.40%	43.40%
Liver	98.10%	55.20%	95.00%	121.50%	123.60%	37.60%	46.00%
Liver	95.00%	55.20%	98.10%	121.50%	123.60%	37.60%	46.00%
Leukemia	75.10%	45.70%	79.20%	69.00%	59.20%	49.80%	53.00%

Appendix Figure 40 continues the analysis by showing the crude number of projected deaths over time by country and cancer type. In 2040, lung cancer is projected to kill the most people in Brazil with 63,700 deaths. This is followed by prostate cancer (41,368 deaths), and breast, colon, and stomach cancer each killing about 31,000 people. The cancers included in this section of analysis were chosen and ordered by age-standardized mortality rate calculated among populations susceptible for a condition, and not their crude number of deaths. Therefore, conditions that primarily affect one population segment, like breast cancer in women, may have higher rates but a lower crude number of deaths than other cancers.

Appendix Figure 40: Projected Number of Deaths by Cancer Type, for Cancers with the Top 10 Highest Mortality Rates in Brazil (Source: IARC Cancer Tomorrow).

Prostate Cancer Number of Deaths Projection

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	18161	4099	2439	3441	7459	9339	13708
2030	27856	5243	3773	5468	11294	12043	18245
2040	41368	6797	5771	8239	17082	15670	23122

Breast Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	19567	6605	1778	3942	7353	13639	12144
2030	25561	7902	2273	5247	9970	15539	14085
2040	31825	9411	2817	6600	12847	17881	16078

Lung Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	34260	11064	3833	5693	7254	38626	39059
2030	48048	13444	5318	8412	10598	44210	47035
2040	63700	16482	6909	11435	15110	48181	54608

Colon Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	16491	7730	2416	3661	6121	14950	12202
2030	23285	9512	3381	5353	8700	18104	15143
2040	31539	11746	4570	7378	12049	21790	18269

Stomach Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	16947	3319	3719	5931	6474	5494	4646
2030	23585	4060	5245	8540	9198	6559	5693
2040	31220	4980	7069	11536	12776	7672	6782

Cervical Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	8510	2301	761	1886	4386	1492	1055
2030	10693	2659	961	2497	5882	1614	1169
2040	12759	3017	1166	3123	7568	1772	1275

Pancreatic Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	12761	4858	1685	2322	4816	13718	10391
2030	18035	5949	2314	3404	6980	16193	12426
2040	24315	7300	3008	4631	9801	18527	14398

Liver Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	12661	2193	1552	2404	7397	10414	7083
2030	17635	2678	2157	3560	10795	12287	8538
2040	23372	3280	2824	4908	15354	13848	9979

Brain, CNS Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	11323	1668	583	1250	2822	4703	4668
2030	14625	1972	736	1626	3726	5213	5286
2040	18098	2312	868	2002	4785	5564	5810

Esophageal Cancer Number of Deaths Projections

Type	Brazil	Argentina	Chile	Colombia	Mexico	France	UK
2020	10440	1960	719	772	1273	4344	8829
2030	14214	2410	1034	1155	1839	5054	10633
2040	18369	2982	1443	1606	2589	5637	12355

15. Appendix G: Projected Incidence of Childhood Cancers and Estimates of 5-Year Net Survival for Selected Childhood Cancers

After disaggregating by cancer group, Leukemia, Central Nervous System (CNS) Neoplasms, and Lymphoma are the most common childhood cancer groups in Brazil at a projected incidence of 2864, 1041, and 1282 cases respectively. Appendix Table 2 outlines the each of the 10 childhood cancer groups in Brazil by incidence, with Appendix Table 3 defining which specific cancer types comprise each cancer group.

Appendix Table 2: Projected Number of Incidence Cases of Childhood Cancer in 2030, by Cancer Group (Source: Harvard Database) (83)

Cancer Group	Projected Number of Cases in 2030
Leukemia	2864
Lymphoma & Related	1041
CNS Neoplasms	1282
Neuroblastoma	286
Retinoblastoma	269
Renal Tumors	372
Hepatic Tumors	122
Bone Tumors	430
Soft Tissue Sarcoma	540
Germ Cell Tumors	302
Carcinoma & Melanoma	299
Other & Unspecified	125

Appendix Table 3. Cancer Group Definitions

Cancer Group	Cancer Type
Leukemia	a. Lymphoid
Leukemia	b. Acute myeloid
Leukemia	c. CMD
Leukemia	d. MDS & other
Leukemia	e. Unspecified
Lymphoma & Related	a. Hodgkin
Lymphoma & Related	b. Non-Hodgkin except BL
Lymphoma & Related	c. Burkitt (BL)
Lymphoma & Related	d. Lymphoreticular
Lymphoma & Related	e. Unspecified
CNS Neoplasms	a. Ependymoma
CNS Neoplasms	b. Astrocytoma
CNS Neoplasms	c. CNS embryonal
CNS Neoplasms	d. Other gliomas
CNS Neoplasms	e. Other specified
CNS Neoplasms	f. Unspecified CNS
Neuroblastoma	a. (Ganglio)neuroblastoma
Neuroblastoma	b. Peripheral nervous
Retinoblastoma	Retinoblastoma
Renal Tumors	a. Nephroblastoma
Renal Tumors	b. Renal carcinoma
Renal Tumors	c. Unspecified
Hepatic Tumors	a. Hepatoblastoma
Hepatic Tumors	b. Hepatic carcinoma
Hepatic Tumors	c. Unspecified
Bone Tumors	a. Osteosarcoma
Bone Tumors	b. Chondrosarcoma
Bone Tumors	c. Ewing & related
Bone Tumors	d. Other specified

Bone Tumors	e. Unspecified
Soft Tissue Sarcoma	a. Rhabdomyosarcoma
Soft Tissue Sarcoma	b. Fibrosarcoma
Soft Tissue Sarcoma	c. Kaposi sarcoma
Soft Tissue Sarcoma	d. Other specified
Soft Tissue Sarcoma	e. Unspecified
Germ Cell Tumors	a. CNS germ cell
Germ Cell Tumors	b. Other extragonadal
Germ Cell Tumors	c. Gonadal germ cell
Germ Cell Tumors	d. Gonadal carcinoma
Germ Cell Tumors	e. Unspecified gonadal
Carcinoma & Melanoma	a. Adrenocortical
Carcinoma & Melanoma	b. Thyroid
Carcinoma & Melanoma	c. Nasopharyngeal
Carcinoma & Melanoma	d. Melanoma
Carcinoma & Melanoma	e. Skin carcinoma
Carcinoma & Melanoma	f. Other & unspecified
Other & Unspecified	a. Other specified
Other & Unspecified	b. Other unspecified

Further disaggregating the cancer groups into cancer types, the three most common types of childhood cancer regardless of group are lymphoid leukemia (2156 projected cases in 2030), acute myeloid leukemia (442), and astrocytoma (431) (Appendix Table 4). For astrocytomas, 5 year survival is second lowest among the top ten types of cancer, by incidence (second only to CNS embryonal tumors).

Appendix Table 4: Estimated 5-Year Survival for the Top 10 Incident Childhood Cancer Types in Brazil (Source: Harvard Database) (82,83)

Cancer Group	Cancer Type	Projected Incidence in 2030	5 Year Survival (% of diagnosed cases)
Leukemia	Lymphoid	2156	69.4%
Leukemia	Acute Myeloid	442	54.8%
CNS Neoplasms	Astrocytoma	431	37.8%
Lymphoma & Related	Hodgkin	372	71.3%

Lymphoma & Related	Non-Hodgkin except Burkitt	356	69.8%
Renal Tumors	Nephroblastoma	333	61.1%
CNS Neoplasms	CNS Embryonal	324	28.8%
Retinoblastoma	Retinoblastoma	270	60.8%
Neuroblastoma	Ganglioneuroblastoma	270	56.0%
Bone Tumors	Osteosarcoma	237	49.9%

16. Appendix H: Analysis of Brazilian Health System and Its Performance Generally and in Relation to Cancer

16.1. Health System Outcomes (Goals)

16.1.1. Population Health

The Brazilian Institute of Geography and Statistics (IBGE) census states that the country had a population of 190,755,799 in 2010. It also estimates a population of 213,171,606 in 2021, and a population of 11,62,404 in Rio Grande do Sul in the same year. Life expectancy at birth in Brazil was estimated to be 73.0 and 80.0 years in 2019 for men and women respectively, with 75.1 and 81.8 years of life expectancy at birth for people living in Rio Grande do Sul. The population is expected to grow to 229.2 million in Brazil by 2035 (42).

Between 1990 and 2015, the proportion of people 65 years of age and older increased while the proportion for children aged 0-18 decreased, suggesting movement through a demographic transition typical of nations achieving greater levels of income and development. Brazil similarly continues to note burdens of disease related to both non-communicable (NCD) and communicable disease. Currently, NCDs cause 75% of deaths in Brazil. The top five causes of death, in order of mortality rates, are ischemic heart disease, stroke, lower respiratory infections, COPD, and interpersonal violence (43). In Rio Grande do Sul specifically, the top four causes are the same. In fifth place, interpersonal violence is replaced by lung cancer (44). In terms of combined morbidity and mortality, neonatal disorders continue to plague the nation at large, placing third behind interpersonal violence and ischemic heart disease (43). However, neonatal disorders fall to seventh in Rio Grande do Sul (44). In both scenarios, neonatal disorders have dramatically decreased in incidence from 2009 to 2019.

Appendix Table 5. Population by state/district – Brazil 2010 Census (42).

State/District	Population				
	Total	Male (%)	Female (%)	Urban (%)	Rural (%)
North Region	**18,672,591**	**50.5**	**49.5**	**73.5**	**26.5**
Rondônia	1,796,460	50.9	49.1	73.6	26.4
Acre	894,470	50.2	49.8	72.6	27.4
Amazonas	4,207,714	50.3	49.7	79.1	20.9
Roraima	631,181	50.8	49.2	76.6	23.4
Pará	8,690,745	50.4	49.6	68.5	31.5
Amapá	861,773	50.1	49.9	89.8	10.2
Tocantins	1,590,248	50.8	49.2	78.8	21.2

Northeast Region	**57,374,243**	**48.8**	**51.2**	**73.1**	**26.9**
Maranhão	7,114,598	49.6	50.4	63.1	36.9
Piauí	3,281,480	49.0	51.0	65.8	34.2
Ceará	9,187,103	48.7	51.3	75.1	24.9
Rio Grande do Norte	3,534,165	48.9	51.1	77.8	22.2
Paraíba	4,039,277	48.4	51.6	75.4	24.6
Pernambuco	9,616,621	48.1	51.9	80.2	19.8
Alagoas	3,351,543	48.4	51.6	73.6	26.4
Sergipe	2,318,822	48.6	51.4	73.5	26.5
Bahia	14,930,634	49.1	50.9	72.1	27.9
Southeast Region	**89,012,240**	**48.6**	**51.4**	**92.9**	**7.1**
Minas Gerais	21,292,666	49.2	50.8	85.3	14.7
Espírito Santo	4,064,052	49.3	50.7	83.4	16.6
Rio de Janeiro	17,366,189	47.7	52.3	96.7	3.3
São Paulo	46,289,333	48.7	51.3	95.9	4.1
South Region	**30,192,315**	**49.1**	**50.9**	**84.9**	**15.1**
Paraná	11,516,840	49.1	50.9	85.3	14.7
Santa Catarina	7,252,502	49.6	50.4	84.0	16.0
Rio Grande do Sul	11,422,973	48.7	51.3	85.1	14.9
Central-West Region	**16,504,303**	**49.7**	**50.3**	**88.8**	**11.2**
Mato Grosso do Sul	2,809,394	49.8	50.2	85.6	14.4
Mato Grosso	3,526,220	51.1	48.9	81.8	18.2
Goiás	7,113,540	49.7	50.3	90.3	9.7
Distrito Federal	3,055,149	47.8	52.2	96.6	3.4

Cancer

Barbosa et al. were able to model current trends and future projections in cancer mortality among the different regions of Brazil. The table below illustrates observed and projected cancer mortality rates by region and sex, adjusted by standard world populations and expressed per 100,000 inhabitants. The Northeast Region is projected to increase the most in terms of mortality rates for both females and males.

The region containing Rio Grande do Sul, the South, will decrease their mortality rates the most for both females and males (Appendix Table 6) (48).

Appendix Table 6. Observed and Projected Cancer Mortality Rates by Brazilian Region and Sex (Source: Cancer Mortality in Brazil) (48)

Region	Observed (2006-2010)	Projected (2026-2030)
Females		
Brazil	73.25	70.27
Northeast	62.02	80.57
North	60.37	67.58
Central-west	73.26	61.69
Southeast	76.28	66.59
South	86.1	72.78
Males		
Brazil	99.02	88.04
Northeast	76.57	107.13
North	70.39	74.51
Central-West	97.38	85.67
Southeast	112.70	94.7
South	137.31	110.12

In 2020, estimated incidence of cancer in terms of absolute numbers is about 46,060 in Rio Grande do Sul. In the same year, the cancer with the highest mortality rates in men in the state is prostate cancer, with a rate of 46.28 / 100,000, adjusted for world standard population. The next four types of cancer with the highest mortality rates in men are lung, colorectal, stomach, and oral cancers. Among women, the cancer with the highest mortality rate is breast cancer, with a death rate of 42.95 / 100,000, adjusted for world

standard population. The next four types of cancer with the highest mortality rates in women are lung, colorectal, cervical, and CNS neoplasias (49).

Risk factors

Obesity: In Brazil, the prevalence of obesity has increased by 60% among the population aged 25 to 34 years of age from 2006 to 2016. In this age range, about 17% of people qualified as obese in 2016. The National Health Survey found in 2013 that older age, less education, and male sex were associated with less physical activity and lower consumption of fruits and vegetables (50)

Smoking: Brazil has made significant strides in reducing tobacco consumption in its population since the inception of the National Tobacco Control Program in 1989, despit being the second greatest producer of tobacco in the world. Despite the gains made, men and lower socioeconomic populations have reduced their rates of consumption the least since then. In 2016, nearly 4 million more men than women smoke in Brazil. The nation plans to continue battling the tobacco epidemic with "ational and state level smoke-free air laws; packaging, marketing, and age restrictions; minimum pricing and taxation; cessation treatment; and behaviour change campaigns" (50).

Alcohol, Road Injuries, and Interpersonal Violence: Alcohol use continues to be one of the major contributions for road injuries, disproportionately affecting young males and pedestrians. Though safety laws involving zero tolerance for alcohol consumption while driving have passed, there continues to be self-reported consumption levels above the legal limit (50).

Alcohol also contributes to burdens related to interpersonal violence, which was one of the leading causes of DALYs in 2016. Brazil suffers from high levels of homicides due to firearms, conflicts that arise from drug trafficking, circulation of illegal firearms, and use of alcohol and drugs. Young men are disproportionately affected by these instances of violence (50).

Social Determinants of Health

Sex: Heavy alcohol consumption (defined in de Azevedo Barros' study as "consumption of four or more alcoholic drinks for women and five or more for men in a single occasion during the last 30 days" (51)) reached a prevalence of 24.3% among men and 7.9% among women aged 18-59 in 2016. While men have nearly a 3-fold higher prevalence of heavy drinking, and while both men and women have been found to have higher drinking rates in the last decade, women have seen an increased consumption rate compared to men. Men also consume fewer vegetables and fruits, according to the same study (51).

Race: The Black population has been found to have higher rates of hazardous alcohol consumption, in part attributed to racial segregation. At the same time, according to de Azevedo Barros et al., it appears that race alone accounts for only a slight difference in educational attainment between brown/Black and white individuals, though brown/Black communities have higher prevalences of sedentary lifestyles (27% higher) than do their white counterparts (51).

Lower Socioeconomic Background: Low socioeconomic backgrounds are associated with lower levels of education and a heavier dependence on the public health system for assistance. Sedentary lifestyles are more common among individuals with less education, as is consumption of fewer vegetables and fruits. People without private health insurance were also found to have a 49% higher prevalence of sedentary lifestyles compared to those dependent on SUS (51).

16.1.2. Financial Protection

In its 1988 constitution, Brazil denoted health to be a universal right. Subsequently, its government organized the publicly funded national health system. It would eventually be called the Unified Health System (SUS), created with the goal of achieving universal coverage for all Brazilians (45). Today, 100% of Brazilians are covered by public insurance, which covers a variety of services stated under section 16.3.4 "Service Delivery." Of note in the pharmaceutical realm, Brazil became one of the first middle-income countries to offer HIV/AIDS medication in 1996. Furthermore, the Popular Pharmacy of Brazil provides subsidies for specific medications and contraceptives (46).

Despite these significant milestones, Brazilians are considerably burdened by high out-of pocket (OOP) expenditures. The Commonwealth Fund estimates that OOP spending accounts for about 27% of total health expenditures. Furthermore, "in 2014, 5.3 percent of households experienced such high health expenditures that they had to forgo paying for non-health-related items" (46). While care in the public sector is provided free of charge, only a particular set of drugs are offered free of charge under SUS. Conversely, about 23% of the population purchases supplemental voluntary private insurance, 70% of whom receive it as an employment benefit. However, there are currently no limits to copays for services covered by private insurance, nor are there maximum OOP annual maximum costs. Furthermore, outpatient prescription drugs are not covered by private insurance (46).

Compared to several of its Latin American peers, in 2016, Brazil has increased its rate of health spending per capita on par with Peru (84). Health spending per capita and government health expenditures as a percentage of total spending in 2016 were at the highest (8.0%%) and lowest (33.3%), respectively, of its selected Latin American peers. According to the model outlined in the table below, out-of-pocket spending as a percentage of total health expenditures were also the highest among its peers at 43.9%, even higher than the estimate made by the Commonwealth Fund.

Appendix Table 7: Health spending in Selected Latin American Countries, 2016 (Source: Past, present, and future of global health financing: a review of development assistance, government, out-of-pocket, and other private spending on health for 195 countries, 1995-2050 (84)).

Country	Health spending per capita, 2016 (US$)	Annualized rate of change in health spending per capita, 1995–2016 (US$)	Health spending per GDP, 2016	Government health spending per total health spending, 2016	Out-of-pocket spending per total health spending, 2016
Chile	1244	4.55%	6.8%	58.5%	34.7%
Argentina	1071	0.68%	7.9%	76.1%	14.8%
Mexico	505	2.64%	4.2%	52.5%	40.0%
Brazil	1114	3.35%	8.0%	33.3%	43.9%
Colombia	358	0.81%	3.9%	65.1%	20.6%
Peru	337	3.59%	4.5%	62.7%	29.1%

16.1.3. User Satisfaction

An IPSOS study published in 2018 detailed opinions and attitudes from citizens of 28 different countries toward their healthcare systems, including Brazil's. Questions from the survey were targeted towards individuals from a variety of middle- to high-income nations, from Turkey, Serbia, South Africa, Peru, and Mexico to South Korea, Italy, Great Britain, Germany, and the United States (52).

Overall satisfaction with Brazil's health system ranked lower than many of its peers in this study. The table below details survey statements and percent of people in agreement, answered by individuals ages 16-64 in Brazil and peer countries.

Appendix Table 8: Percentage of Brazilians agreeing with survey statement regarding Brazil's Healthcare System. Comparisons made with other Latin American ICCI countries (Source: IPSOS) (52)

Survey Statements (% Agree)	Brazil	Argentina	Colombia	Chile
Waiting times to get an appointment with doctors are too long in my country	73%	70%	74%	77%
Many people in my country cannot afford good healthcare	74%	64%	78%	81%
The healthcare system in my country is overstretched	66%	60%	69%	70%
I am concerned that my personal data will be made available to third parties (government, private companies) without my consent	54%	52%	59%	62%
In my country, information about how to look after my health is readily available when I need it	25%	47%	35%	46%
In my country, information about healthcare services is readily available when I need it	22%	46%	27%	40%
I find it easy to get an appointment with doctors in my local area	24%	41%	31%	37%
I trust the healthcare system in my country to provide me with the best treatment	20%	47%	26%	34%
The healthcare system in my country provides the same standard of care to everyone	18%	34%	17%	19%

16.2. Health System Objectives

16.2.1. Equity

Brazil's health system has made significant progress since the end of the military government in the late 1980s. With health enshrined in the newest constitution as a human right, the government has managed to decrease gaps between the poorest and richest members of its society. Brazil's SUS has created a universal health system that aims to provide free treatment to all Brazilan citizens. The scope of services provided is comprehensive, providing coverage for primary care and high-cost medications (14).

Moreover, the Family Health Strategy of 1994, mentioned and elaborated on below under "Resource Management," has expanded primary care access for both urban and rural communities. According to Federico Guanais, "in 2009, 95.6 million people (52% of the population) were served by the family health programme. Out of this total, 73.9 million lived in urban areas and 21.7 million lived in rural areas, which represents a coverage of 47% for urban areas and 73% for rural areas" (56). Between 1998 and 2007, infant mortality was found to have decreased as a proportion to those covered by the Family Health Strategy. Improvements to children's health, access to services, and reduction of hospital admissions for chronic diseases in females have also been associated with the program (56).

However, out-of-pocket costs remain very high in Brazil, particularly in comparison to its peers. The lack of limits on copays and OOP maximums under private insurance plans make for situations in which a patient may easily run costs that exceed ability to pay. Additionally, access to services, particularly specialist care, remains out of reach or is slow to access for the poorer populations of Brazil, especially among those who are highly dependent on SUS for their medical needs. This inequity, disproportionately hurting the poor, will need addressing as the country continues to advance universal health coverage for its citizenry.

16.2.2. Efficiency

A study by the World Bank in 2013 examined the efficiency of the healthcare system in Brazil. It noted that few long-term studies examined efficiency, but that the evidence available suggested a significant level of inefficiencies plaguing the system. One of the notable causes of inefficiency is related to the use of medical technology. The report states that CT and MRI scanner density exceeds that of the lowest quartile of the OECD countries, and that the density is close to a group of five rich nations (Australia, Canada, France, the Netherlands, and the UK) that have regulated the use of new technology extensively. However, the majority of this technology is only available through the private sector. Furthermore, 70% of the technology is centered around areas with smaller populations (less than 30,000 inhabitants). Without a way to regulate the entrance of medical technology into the market, demand grows and so do costs. Another technology that appears overused involves that surrounding diagnostic testing, where investigations estimate that up to 60% of tests are unnecessary (57).

The World Bank has also noted that hospitals are not run in the most efficient manner possible. They attribute the problems to "inefficiency were small scale of operations, high use of human resources, and low use of installed capacity and technical resources" (57). SUS bed occupancy rates are too low, falling at 37% for acute care hospitals and 45% for all hospitals, compared to the international average at 70-75% (57). Moreover, resources within hospitals such as operating rooms are underutilized on average. However, disaggregated data shows that large referral hospitals are heavily used, with crowded rooms and long lines, while smaller referral hospitals are significantly underused. The report notes that Brazil's primary care system may also over-refer patients, resulting in unnecessary admissions that may be prevented by having stronger communication networks between facilities (57).

Current, payment mechanisms encourage a fee-for-service model that incentivizes potentially unnecessary and/or harmful treatments. Though inpatient care involves predetermined payments from the Ministry of Health to states and municipalities for specific diagnoses, the latter reimburse hospitals on a fee-for-service basis that may result in inefficient use of funds. Further, under a separate system of reimbursement for high-complexity procedures and high-cost treatments, the Ministry of Health reimburses municipalities or states according to the number of services provided, thus furthering a fee-for-service model for the most costly health services in the country (14)

16.2.3. Effectiveness

Brazil has seen significant improvements in several key health indicators since the creation of SUS. Life expectancy has increased about 9.8 years from 1985 to 2009, and infant mortality rates have decreased 71.3% in the same time frame, from 60.3 to 17.3 deaths per 1,000 live births. Child mortality (defined in the World Bank report as deaths of children under age 5 per 1,000 live births) has also significantly decreased, dropping 57.6% between 1990 and 2008. Infectious disease in children has also been better controlled, the country noting a drop in mortality from acute diarrhea in children less than 5 years of age from 12.3 to 3.5 deaths per 1,000 live births between 1990 and 2008. With these statistics in mind, it bears stating that between it and its Latin American peers, Brazil has made greater improvements to boost the health of its citizens. Life expectancy and infant mortality, measured in percentage changes between 1985 and 2009, have increased and decreased twofold, respectively, compared to its Latin American and Caribbean peers (57).

At the same time, other indicators suggest that the health system still has room for improving its effectiveness for Brazilians. Maternal mortality remains high, for example. The Millennium Development Goal for maternal mortality was 35 deaths per 100,000 in 2015, not met by Brazil with a rate of about 50 deaths per 100,000 around the same time. Furthermore, other infectious diseases continue to affect Brazilians, with Dengue and malaria incidences showing, on average, that further control is needed to prevent unnecessary morbidity and mortality. Mortality from traffic accidents remains a concern, and homicide continues to be a massive burden on society (57).

16.2.4. Responsiveness

Brazil has improved responsiveness since the fall of the military government, but still has problems to address within its federal system. Responsiveness has been examined within the primary care sector through a study by Guanais and Macinko. They preface their study by contextualizing primary care in Brazil, stating that decentralization had occurred in 1996 within the Family Health Program and Community Health Agents Program (where restricted services have been provided by community health workers). Like the World Bank report, they found massive decreases in neonatal mortality between 1998 and 2006. They also found that municipalities that pursued both decentralization of primary care facilities and expansion of primary care had actually reduced postneonatal mortality by about 25% compared to those that did neither, which bolsters the case for greater responsiveness in Brazil over time (58).

At the same time, decentralized management of SUS has been recognized as a barrier to achieving better responsiveness to the health needs of Brazilians. Fragmentation, redundancy, and gaps in health care provision continues to plague the system without a solid basis for coordinated care (14). One of the most recent attempts to deal with fragmentation involves Ministerial Ordinance Nº 4.279/10 and Decree Nº 7.508/11, together aiming to integrate healthcare and services. A study examined their effects in Minas Gerais, finding that they have led to "both a significant input of resources and innovative funding tools, which has contributed to increased implementation of the care network model in the various regions of the state" (59). Yet, the federal government's impositions that stipulate greater financing of medium and high complexity services continues to limit how local governments are able to properly allocate their resources and does not always result in prioritization of patient health needs. Under its federal system, Brazil will need to continue improving communication pathways that support its ability to respond adequately to local needs while also keeping the federal government aware of what is needed within each region (59).

16.3. Health system functions

16.3.1. Governance and Organisation

The Ministry of Health is the main manager of the SUS. It formulates, regulates, inspects, monitors, and evaluates the actions of SUS in combination with the National Health council. Its equivalents in the state and municipal governments are the State Departments of Health and the Municipal Health Departments. The former formulates health policies while supporting the municipalities alongside the state council. It also participates in the Bipartite Inter-Management Commission to approve and implement the state's health plan. The municipal health department organizes and executes health actions to, in turn, implement municipal health plans (47).

Regulatory Bodies of Brazil's Health System (60)

The National Private Healthcare Insurance and Plans Agency (ANS) was created in 2000 and it regulates private health plans in Brazil. It does so by regulating interactions among private insurers, service providers, and beneficiaries. The ANS is funded via federal taxes collected from private insurance companies.

Healthcare facilities are regulated by the Ministry of Health. They must be registered through the National Registry of Health Facilities (CNES).

The National Sanitary Surveillance Agency (ANVISA) is tied to the Ministry of Health and regulates pharmaceutical products and medical devices, specifically their production, marketing, and use. Alongside it is the Chamber of Medicine Market Regulation (CMED), regulating the market and prices of medications

16.3.2. Health Financing

Health is financed via a combination of public and private funds in Brazil. As of 2015, health spending in Brazil comprised 9.1% of the gross domestic product (GDP). Of that 9.1%, public spending accounted for 42.8%. Public insurance provided by the SUS are financed by a combination of tax revenues and social contributions from the three levels of government: federal, state, and municipal. By law, each of the three levels is required to contribute a set percentage of their incomes toward the public health system. The federal government must provide 15% of total revenues, the state 12%, and municipalities 15%. Within the last 30 years, federal funding has declined and contributions from municipal governments has increased (46).

Private insurance is either purchased directly by the consumer or is provided as an employee benefit. According to the Commonwealth Fund, about 0.5% of Brazil's GDP is spent as tax exemptions for private care, serving as a subsidy for those who pay for private insurance. In addition, a person can deduct expenses from health services, medicines, and medical supplies from taxable expenses (46).

As stated above under "financial protection," a significant portion of health financing comes from out-of-pocket funds. These funds pay primarily for outpatient prescription medications, which are not covered under private insurance and only partially covered by public insurance (46).

16.3.3. Resource Management

Primary care is organized around units called family health teams, following a model called the Family Health Strategy that was implemented in 1994. The teams consist of a doctor, nurse, nurse assistant, and a

maximum of 12 community health workers, all of whom can cover about 2,000-4,000 individuals across a defined area. Patients need referrals to access either outpatient specialties or for non-emergency inpatient admissions. Specialist care can be delivered by public or private facilities, though specialists in the public sector may also take private work. Capacity shortages in the public sector for specialist care has resulted in a growth of the private market to fill the needs of the population (46).

The federal government contributes to funding and delivering services at public hospitals, but contracting and reimbursement of services falls to either state or municipal governments around the country. In 2015, 71% of hospital beds were allocated to patients utilizing the SUS public health system. Among hospitals, 38% were public and 62% private, with the breakdown of public hospitals being as follows: 4% federal, 25% state-owned, and 70% municipal hospitals. The breakdown of private hospitals had 38% falling under non-profit and 63% falling under for-profit (46).

The federal government is also in charge of ensuring availability of "strategic medications" such as antiretrovirals, blood products, and other expensive drugs under the National Pharmaceutical Assistance Policy (53).

16.3.4. Service Delivery

All individuals in Brazil, including the undocumented, are able to use SUS benefits. Under SUS, several services are offered free of charge (14):

- preventive services, including immunizations
- primary health care
- outpatient specialty care
- hospital care
- maternity care
- mental health services
- pharmaceuticals
- physical therapy
- dental care
- optometry and other vision care
- durable medical equipment, including wheelchairs
- hearing aids
- home care
- organ transplant
- oncology services
- renal dialysis
- blood therapy

According to Santos et al., the supply of services for those under private health plans is wider than those who exclusively use SUS. This applies to the following services, which they classify as either involving treatment that is highly complex or uses high-cost equipment (53):

- Mammography
- Lithotripsy
- Ultrasound
- Computed Tomography (CT)

- Magnetic Resonance Imaging (MRI)
- Radiotherapy
- Nuclear medicine
- X-ray for hemodynamics

Underfunding of the public health system accounts for the gap in treatment availability for those benefitting from SUS only. Those who uses SUS are subject to long wait times to see a specialist (54).

According to da Silva et al., SUS covers most high-cost cancer treatments, at least in theory. However, they also noted that accessibility to radiotherapy is limited. The "Plan for the Expansion of Radiation Therapy in the SUS" in 2012 has attempted to expand availability of radiotherapy, but it has not kept up with the growing incidence of cancer and demand for services (55).

Additionally, it is estimated that a most pediatric oncology services provided in the country are given at facilities not accredited for this purpose, and that specific guidelines for treating pediatric cancers are largely absent in Brazil (55).

17. Appendix I: Stakeholder Meeting Report & Participants

From late-January to early-March 2021, the ICCI-LA held their stakeholder meetings virtually, rather than in-person attendance. Four separate stakeholder meetings were held, each with a particular cancer policy topic: Organization and Governance (January 27, 2021), Financing (February 11, 2021), Resource Management (February 25, 2021), and Service Delivery (March 4, 2021).

The workshops were held over Zoom teleconferences, allowing questions to be poised by moderators, and responded to by stakeholders who work in and around Brazil's health system. The first half of each stakeholder meeting sought to identify the main challenges of the country with regards to cancer, taking into account the particular context of the country. Stakeholders were also prompted to respond to issues currently facing Brazil's health system with regards to cancer due to the ongoing COVID-19 pandemic.

In second half of the workshops, participants were encouraged to propose potential solutions to the challenges that were previously identified. The four workshops helped to raise important discussions about the state of cancer in Brazil. Hopefully, it will lead to a better understanding of the problem and lead to the improvement of cancer outcomes. The participants to the workshops are included below.

17.1. Workshop 1: Organization and Governance

January 27, 2021, 11am-1:30pm, via ZOOM

Moderator:	Prof. Rifat Atun (with translation, if necessary, by members of the Local Committee)
# of Participants:	15-20 people
Duration:	2 – 2.5 hours
Format:	Interactive Discussion via Zoom; "raise hand" before speaking
Logistical Support:	INC Brazil and UICC
Notetakers:	Harvard research team and members of the Organizing Committee

Agenda

11:00-11:10:	**Welcome – Dr. Maira Caleffi**
	• A brief overview about the role of the local committee • Explanation about how to participate during Zoom discussion – "raise your hand" virtually through Zoom, say you name and institution before your comments • Support from UICC in managing the list of people who want to speak • ·Support from the Local Committee and the Harvard team to take notes • Everything will be discussed in Portuguese, apart from the comments made by Dr. Rifat Atun, which will be translated • Introduce Dr. Rifat AtunIntroduce Dr. Rifat Atun
11:10 - 11:15:	**Presentation of ICCI-LA – Prof. Rifat Atun**
	• Overview of the objectives of ICCI-LA • Why Brazil? • Objective of this workshop and other planned workshops • Participants are invited to participate in a future workshop to review the report that comes from these workshops
11:15 - 12:15:	**Group Discussion:** **Challenges related to the healthcare system in general and to cancer**
	Questions: (20 mins per question) 1. What are the principle challenges facing the Brazilian health system in relation to its organization and its governance capabilities in general, and in relation to the following topics? – Responsibility – Transparency – Ensuring decisions are made in an inclusive way – Planning, and

	– Coordination of the health system
	
	2. What are the principle challenges facing the Brazilian health system in relation to its organization and governance capacities **specifically in its management and control of cancer**, and in relation to the following topics?
	    – Responsibility
	    – Transparency
	    – Ensuring decisions are made in an inclusive way
	    – Planning, and
	    – Coordination of the health system
	
	3. What has been the impact of COVID-19 with relation to the organization and governance of Chile's health system in general; and specifically in regards to its response to cancer care and control?

12:15 – 1:15:	**Group Discussion: Proposed Solutions**

	Questions (15 mins per question)
	
	1. What are the three priorities to improve the organization and governance of the Brazilian health system in general, and in relation to the following topics?
	    – Responsibility
	    – Transparency
	    – Ensuring decisions are made in an inclusive way
	    – Planning, and
	    – Coordination of the health system
	
	2. What are the three priorities to improve the organization and governance of the Brazilian health system with regard to cancer control and cancer care, and in relation to the following topics?
	    – Responsibility
	    – Transparency
	    – Ensuring decisions are made in an inclusive way
	    – Planning, and
	    – Coordination of the health system
	
	3. What should be changed to improve the organization and governance of these priorities?
	
	4. How should the organization and governance of Brazil's health system be improved to more effectively respond to COVID-19 **in general** and how should it improve **specifically in relation to the cancer care and cancer control?**

1:15:	**Closing remarks and next steps – Prof. Rifat Atun**

17.2. Workshop 2: Financing

February 11, 2021, 12:30-3pm, via ZOOM

Moderator:	Prof. Rifat Atun (with translation, if necessary, by members of the Local Committee)
# of Participants:	15-20 people

Duration:	2 – 2.5 hours
Format:	Interactive Discussion via Zoom; "raise hand" before speaking
Logistical Support:	INC Brazil and UICC
Notetakers:	Harvard research team and members of the Organizing Committee

Agenda

12:30 – 12:40:	**Welcome – Dr. Maira Caleffi**
	- A brief overview about the role of the local committee - Explanation about how to participate during Zoom discussion – "raise your hand" virtually through Zoom, say you name and institution before your comments - Support from UICC in managing the list of people who want to speak ·Support from the Local Committee and the Harvard team to take notes - Everything will be discussed in Portuguese, apart from the comments made by Dr. Rifat Atun, which will be translated - Introduce Dr. Rifat Atun
12:40 – 12:45:	**Presentation of ICCI-LA – Prof. Rifat Atun**
	- Overview of the objectives of ICCI-LA - Why Brazil? - Objective of this workshop and other planned workshops - Participants are invited to participate in a future workshop to review the report that comes from these workshops
12:45 – 1:45:	**Group Discussion:** **Challenges related to the healthcare system in general and to cancer**

	Questions: (30 mins per question)
	1. In your experience and perspective, what do you consider the main challenges for Brazil's health system in terms of financing?
	2. In your experience and perspective, what do you consider the main challenges for Brazil's health system financing relating to:
	  – cancer control (prevention, early detection, screening)
	  – patient care (diagnostics, treatment, rehabilitation and palliative care)

1:45 – 2:45:	**Group Discussion: Proposed Solutions**
	Questions: (30 mins per question) 1. In your experience, what do you think should be the priorities and actions to take in order to improve the financing of the health system, with regards to cancer control? 2. How has the response to COVID-19 affected the health system's financing mechanisms, and how could we do more to improve the efficiency of the system for patients with cancer?
2:45:	**Closing remarks and next steps – Prof. Rifat Atun**

17.3. Workshop 3: Resource Management

February 25, 2021, 12:30-3pm, via ZOOM

Moderator:	Prof. Rifat Atun (with translation, if necessary, by members of the Local Committee)
# of Participants:	15-20 people
Duration:	2 – 2.5 hours
Format:	Interactive Discussion via Zoom; "raise hand" before speaking
Logistical Support:	INC Brazil and UICC
Notetakers:	Harvard research team and members of the Organizing Committee

Agenda

12:30 – 12:40:	**Welcome – Dr. Maira Caleffi**
	- A brief overview about the role of the local committee - Explanation about how to participate during Zoom discussion – "raise your hand" virtually through Zoom, say you name and institution before your comments - Support from UICC in managing the list of people who want to speak ·Support from the Local Committee and the Harvard team to take notes - Everything will be discussed in Portuguese, apart from the comments made by Dr. Rifat Atun, which will be translated - Introduce Dr. Rifat Atun
12:40 – 12:45	**Presentation of ICCI-LA – Prof. Rifat Atun**
	- Overview of the objectives of ICCI-LA - Why Brazil? - Objective of this workshop and other planned workshops - Participants are invited to participate in a future workshop to review the report that comes from these workshops
12:45 –1:45:	**Group Discussion:** **Challenges related to the healthcare system in general and to cancer**

	Questions: (30 mins per question)
	1. In your experience and perspective, what do you consider the main challenges for Brazil's health system in general in terms of resource management (human resources, technology, and information)? Consider your answers in terms of:
	   – Efficiency
	   – Equity
	   – Capacity

	2. In your experience and perspective, what do you consider the main challenges for Brazil's health system for cancer control in terms of resource management (human resources, technology, and information)? Consider your answers in terms of: – Efficiency – Equity – Capacity
1:45 – 2:45:	**Group Discussion: Proposed Solutions**
	Questions: (30 mins per question) 1. In your experience and perspective, what are some potential solutions for the challenges previously identified for Brazil's health system for **cancer control** in terms of **resource management** (human resources, technology, and information)? 2. How has resource management of Brazil's health system been affected by the COVID-19 pandemic, and how can the system become more efficient in the treatment and control of cancer?
2:45:	**Closing remarks and next steps – Prof. Rifat Atun**

17.4. Workshop 4: Service delivery

March 4, 2021, 12:30-3pm, via ZOOM

Moderator:	Prof. Rifat Atun (with translation, if necessary, by members of the Local Committee)
# of Participants:	15-20 people
Duration:	2 – 2.5 hours
Format:	Interactive Discussion via Zoom; "raise hand" before speaking
Logistical Support:	INC Brazil and UICC
Notetakers:	Harvard research team and members of the Organizing Committee

Agenda

12:30 – 12:40:	**Welcome – Dr. Maira Caleffi**
	- A brief overview about the role of the local committee - Explanation about how to participate during Zoom discussion – "raise your hand" virtually through Zoom, say you name and institution before your comments - Support from UICC in managing the list of people who want to speak ·Support from the Local Committee and the Harvard team to take notes - Everything will be discussed in Portuguese, apart from the comments made by Dr. Rifat Atun, which will be translated - Introduce Dr. Rifat Atun
12:40 – 12:45:	**Presentation of ICCI-LA – Prof. Rifat Atun**
	- Overview of the objectives of ICCI-LA - Why Brazil? - Objective of this workshop and other planned workshops - Participants are invited to participate in a future workshop to review the report that comes from these workshops
12:45 – 1:45:	**Group Discussion: Challenges**

	Questions: (20 mins per question)
	1. In your experience and perspective, what do you consider the main challenges for Brazil's health system **in general** in terms of **service delivery**? Consider your answers in terms of:
	   – Equity
	   – Effectiveness
	   – Efficiency
	   – Response capacity
	2. In your experience and perspective, what do you consider the main challenges for Brazil's health system for **cancer control** in terms of **service delivery**? Consider your answers in terms of:

	– Equity – Effectiveness – Efficiency – Response capacity 3. How has COVID-19 affected the **service delivery** mechanisms for Chile's health system for patients with cancer?
1:45 – 2:45:	**Group Discussion: Proposed Solutions**
	Questions: (20 mins per question) 1. What are two priorities to improve health services in the Brazilan health system? 2. In your experience and perspective, what are some potential solutions for the challenges previously identified for Brazil's health system for cancer control in terms of service delivery? 3. What innovations (for example: telemedicine) can be institutionalized in order to create a more sustainable model for cancer control and attention, based on the experiences of the COVID-19 pandemic?
2:45:	**Closing remarks and next steps – Prof. Rifat Atun**

18. Appendix I: Stakeholder Meeting Participants

Participant Names and Affiliations

1. Atun, Rifat — **Harvard University**
2. Rendler-Garcia, Melissa — **Union for International Cancer Control (UICC)**
3. Balsan, Gracielle — **FEMAMA**
4. Bayer, Franciane — **Deputada Estadual do Rio Grande do Sul**
5. Benvegnú, Luís Antônio — **Fundação Municipal de Saúde de Santa Rosa**
6. Borin, Gabriela — **Harvard University**
7. Caleffi, Maira — **Presidenta FEMAMA**
8. Carvalho, Aline — **Assessora Parlamentar da Deputada Estadual Franciane Bayer**
9. Esquici Godoy, Daiana — **ABAMI**
10. Farias, Elson — **Secretaria da Saúde – Rio Grande do Sul**
11. Harzheim, Erno — **Prof. Pós-Graduação em Epidemiologia da Faculdade de Medicina da UFRGS**
12. Hobold, Erica Ana — **FEMAMA**
13. Johnson, Gabriel — **FEMAMA**
14. Juver, Deborah — **Liga Feminina do Câncer**
15. Kauer, Patricia — **IMAMA**
16. Lopes, Gessie Anne — **Secretaria Estadual da Saúde- Rio Grande do Sul**
17. Lopes, Gilberto - **Sylvester Comprehensive Cancer Center at the University of Miami**
18. Marczyk, Michela — **Mastologista Hospital Moinhos de Vento**
19. Marques Gonçalves, Michelle — **Câmara dos Deputados - Distrito Federal**
20. Mattos, Marcos — **Rede Governança Brasil**
21. Medici, Andre — **Universal Health Monitor**
22. Mendales, Jake — **Harvard University**
23. Muller, Cristiane — **Tramandai**
24. Nunes, Samsara Nyaya — **Gestora executiva do IMAMA**
25. Polanczyk, Carisi — **UFRGS/IATS e Hosp Moinhos de Vento**
26. Sanchez, Jeremy — **Harvard University**
27. dos Santos Pedroso, Cristiani — **FEMAMA**
28. Shahini, Stephanie — **City Cancer Challenge**
29. Soares, Luciana — **Prefeitura Pelotas**
30. Souza Costa, Denise — **Prefeitura Municipal de Porto Alegre**
31. Teixeira Marques Gonçalves, Michelle — **Câmara dos Deputados – Federal**

32. Vargas Alves, Rafael Jose — **Santa Casa De Porto Alegre**

33. Wagner Gallo, Nelma Odete — **Liga Feminina de Combate ao Câncer no RS Rifat Atun Harvard University**

34. Bastos, Rafael — **FEMAMA**

35. Barcelos, Juliano — **Grupo Hospitalar Conceição**

36. Breyer, Tatiana — **Secretaria Municipal de Saúde de Porto Alegre**

37. Capra, Marcelo — **Grupo Hospitalar Conceição**

38. Cabral, Felipe — **Hospital Moinhos de Vento**

39. dos Anjos, Gabriel — **Hospital Ernesto Dornelles**

40. Galão, Adriani — **Hospital de Clínicas de Porto Alegre e UFRGS**

41. Pellin, Maira — **Hospital de Pronto Socorro de Porto Alegre - SMS**

42. Pinto, Maria Eugenia — **UFCSPA**

43. Pinto de Freitas, Bruno — **Secretaria da Casa Civil do Estado do RS**

44. Tarouco, Liane — **Universidade Federal do Rio Grande do Sul**

45. Werutsky, Gustavo — **LACOG**

46. Boff, Marcio Fernando — **Hospital Mãe de Deus**

47. Souza, Cristiane — **IMAMA**

48. Assis, Emilio — **Sociedade Brasileira de Patologia**

49. Fernandes, Marcia — **IMAMA**

50. Klock, Clovis — **Grupo Infolaudo-Medicina Diagnostica**

51. De Almeida, Wilson — **Hospital Moinhos De Vento**

52. Werutsky, Gustavo – **Latin American Cooperative Oncology Group (LACOG)**

ICCI-LA

Iniciativa Integrada para el Control de Cáncer en América Latina
Integrated Cancer Control Initiative in Latin America

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MIAMI

AMIGAS DA MAMA

FEMAMA
FEDERAÇÃO BRASILEIRA DE INSTITUIÇÕES
FILANTRÓPICAS DE APOIO À SAÚDE DA MAMA

LACOG
LATIN AMERICAN COOPERATIVE
ONCOLOGY GROUP

ONCOSITE
Centro de Pesquisa Clínica em Oncologia

SYLVESTER
COMPREHENSIVE CANCER CENTER
UNIVERSITY OF MIAMI HEALTH SYSTEM
GLOBAL ONCOLOGY AND
INTERNATIONAL PROGRAMS

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