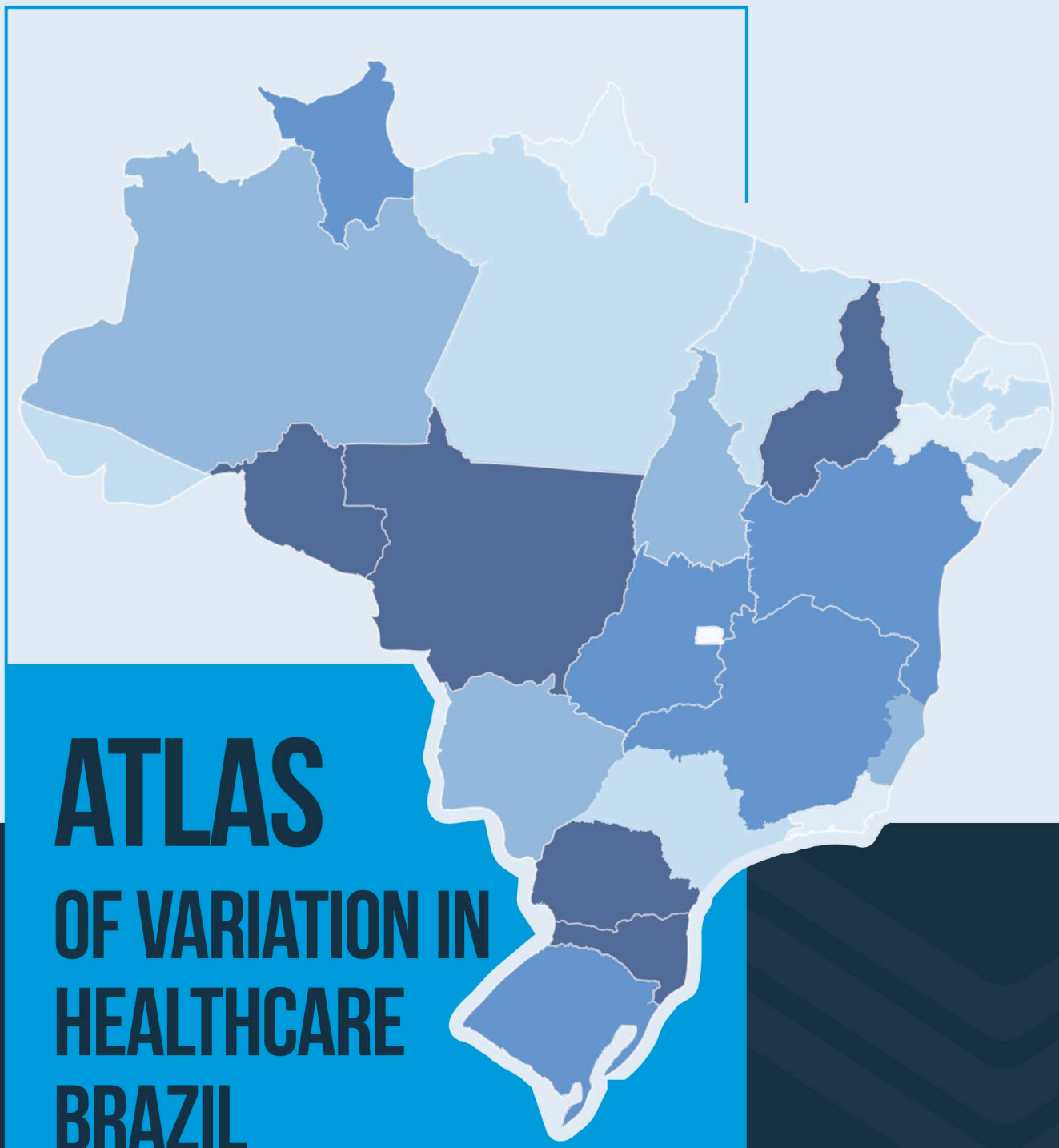

ATLAS
OF VARIATION IN HEALTHCARE BRAZIL

APRIL, 2022

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Atlas of Variation in Healthcare Brazil

April, 2022

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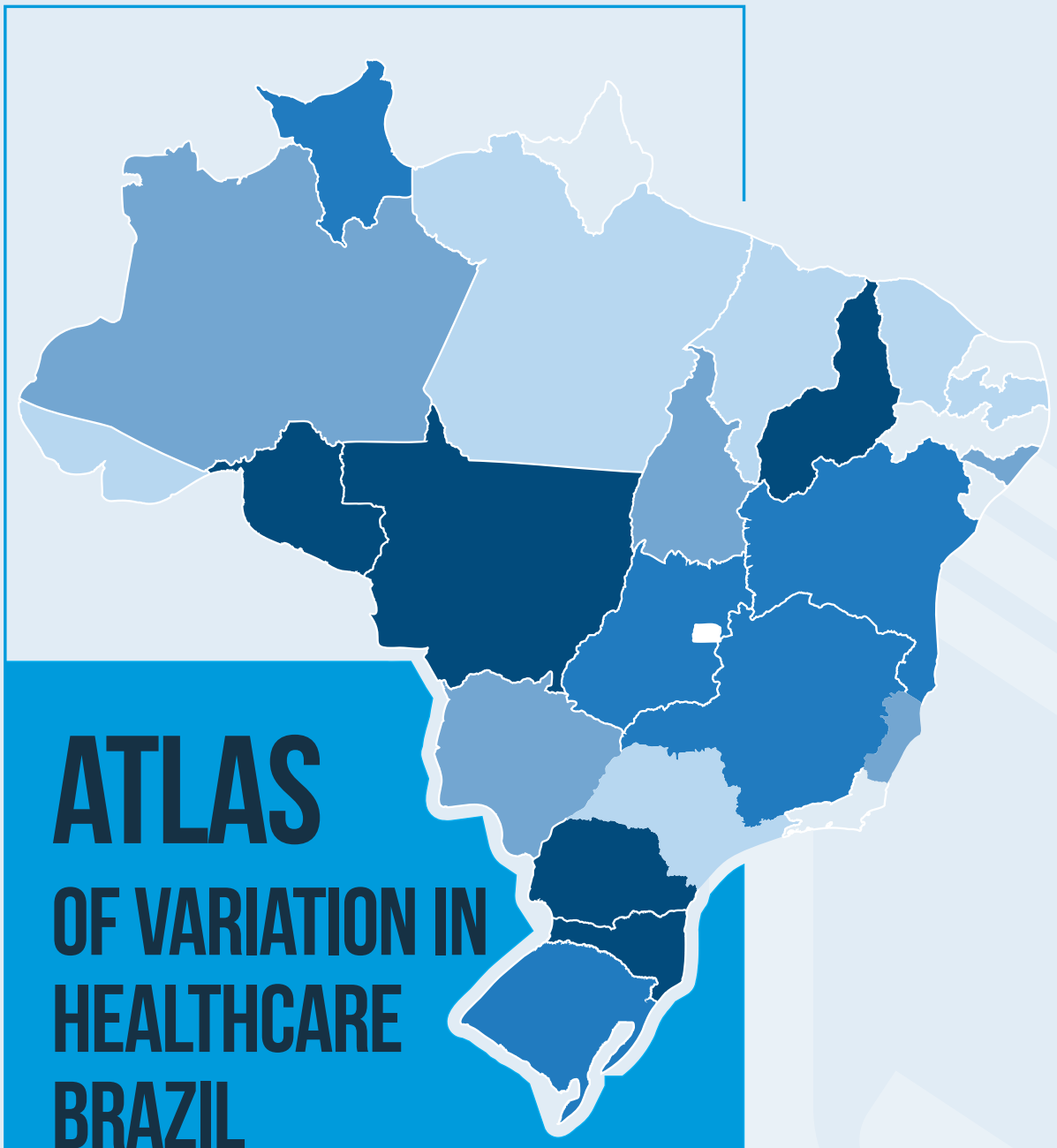

ATLAS
OF VARIATION IN HEALTHCARE BRAZIL

APRIL, 2022

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Preface

The Atlas of Variation in Healthcare: Brazil is a notable accomplishment for Brazil's healthcare system and the team that has ably led the project. The list of countries where Healthcare Atlases have accelerated the understanding and improvement of health care has grown from the U.S. Dartmouth Atlas in 1996 to Ontario Canada, England, France, Switzerland, Australia, South Korea, New Zealand, and Spain. Absent from this list is any middle-income country. Brazil's Atlas is the first.

What all these country's efforts have in common is the use of large existing databases to measure health care across places to reveal the marked and often irrational differences in health care delivery. For the clinician and health care administrator on the ground, each clinic or hospital – seems more similar than different. But at the scale of Atlas population-based measurement, each locale of healthcare appears more different than similar. Regional medical practice variation is found in every jurisdiction that has measured utilization, costs, and outcomes. And in no country have differences in population health status or preferences fully explained the variation. In every health care system, well-trained and well-intentioned clinicians unknowingly provide different quantities and quality of care across regions.

What does differ from country-to-country is the timing and pace of measuring variation, but all follow a similar developmental sequence, beginning with the type of rich descriptions found in the Brazil Atlas. The interpretation of some maps is relatively straightforward. For example, the variation in procedures for cancer screening (e.g., mammography and colonoscopy/flexible sigmoidoscopy) reveals significant underservice of medical interventions known to be effective. Interpreting the pattern of cardiovascular treatments and outcomes is somewhat more complicated, but also reveals important variation only partly explained by disease burden. How can this be concluded? The regional incidence of the various types of cardiovascular disease – acute myocardial infarction, strokes, congestive heart failure are highly correlated, as expected. And yet, the regional variation in each type of medical care - length of hospital stay and rates of angioplasty, and thrombolysis for strokes – have distinctive patterns of variation, very likely indicating unwarranted variation in medical practices related to differences in regional clinician and hospital procedure capacity.

Other maps in the Atlas are the foundational to the next stage of variation discovery, which is inquiry into its causes and consequences. Knowledge of cause is necessary to develop remedies. For some of interventions, the variation seen on Atlas maps is probably not explained by differences in patient needs and preferences, but the "right" rate is uncertain. It is for this reason that Atlas results are often extended by peer-reviewed research studies that investigate the causes and consequences of regional and hospital variation. While countries can learn from each other's research, some formal research is necessary within each country's unique population and health care construct.

Where to begin using Atlas information? Where the prospects for improving value are greatest. Most commonly, this means tackling regional inequities in the provision of care known to be effective and ineffective. How to get started? With "study groups" that include clinicians, managers, policy makers, and patients guided by Atlas-like analysis enriched with information from the front lines of health care delivery. These teams should be specific to a health condition or procedure and can be organized at local, regional, or national levels.

Using Atlas information to improve health care has a similarity to efforts for improving health: Sustained effort in measurement and improvement is necessary. We would never expect that measuring patterns of mortality only once would lower death rates; so too for health care. The Atlas of Variation in Healthcare Brazil is a pioneering accomplishment that sets the agenda for Latin America and for middle income countries – sustained population-based health care measurement, discovery of the causes of variation, and team led improvement.

David C. Goodman, MD MS
Professor of the Dartmouth Institute of Health Policy and Clinical Practice
Geisel School of Medicine at Dartmouth
The Wennberg International Collaborative

March 2022

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Introduction

The Need for a Revolution in Healthcare

By Sir Muir Gray and Marcia Makdisse

The Covid pandemic increased the need and demand for healthcare, and taught us, dramatically, that money is not always the most important resource. Services that had for years been desperate for more money suddenly had governments pouring money into healthcare only to meet other more difficult constraints such as lack of ventilators, oxygen or personal protective equipment and, even more important, human resources.

We know that well before the pandemic, the need and demand for health services had already been increasing steadily and relentlessly and will continue to increase for decades to come. This increase, however, should not be considered inevitable since both need and demand, which grow as a result of the four main factors presented in Figure 1, can be influenced.

Three of these factors (new diseases and epidemics, new technologies and population aging) can be influenced through actions such as:

- prevention of, and agility in the control of, the 21st century epidemics,
- the availability of more robust systems to ensure that only innovations that generate value be incorporated and,
- the prevention, and delay in the onset of frailty and dementia.

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The Challenge

'Needs and demands outstrip resources'

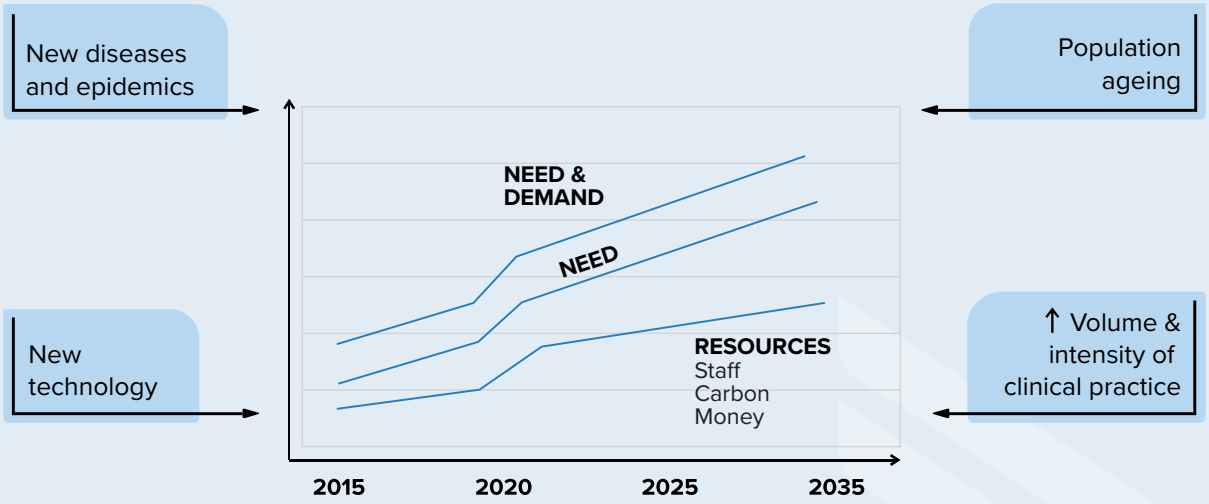

Figure 1. Challenges and drivers of need and demand for health resources.

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However, the greatest opportunity to control need and demand lies in the fourth factor: what has been termed the 'relentless increase in the volume and intensity of clinical practice'.

Wennberg's study of variations in rates of surgery led him to the concept of the 'surgical signature' in a surgeon's local population, which shows his or her interpretation of the evidence influences their threshold for intervention and therefore the rate of intervention and the use of resources[1]. Hence the most effective way of managing demand is by influencing those who supply health care, namely the medical profession.

Another classic study by Eddy in the USA showed that what he called the 'relentless increase in volume and intensity' was the main factor driving increases in the healthcare activity and costs (Figure 2)[2]. This conclusion continues to be valid some thirty years later.

In healthcare systems where decisions are made within a context of finite resources, changes in the volume and intensity of clinical practice will generate financial and service pressures that can drive the service in directions other than those identified as priorities.

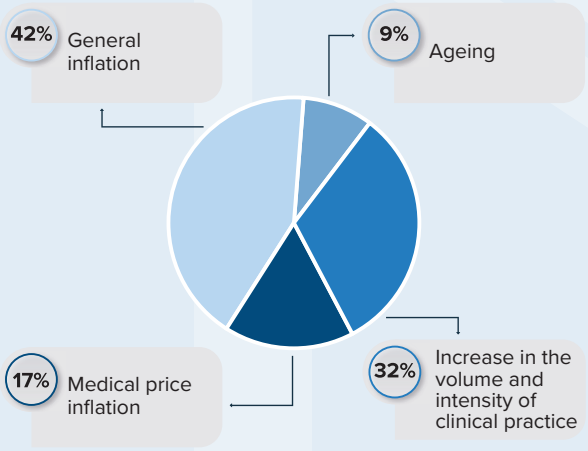

Figure 2. Causes of Cost Inflation.

Faced with the challenges of ensuring that universal health coverage will continue, more of the same will not be enough. There have been great achievements both scientific and managerial in the last fifty years but simply carrying on as we have been doing will not ensure that we can continue to provide comprehensive healthcare to all the citizens of Brazil. New challenges arising from the Covid-19 pandemic, such as staff absence as a result of positive testing, again indicating that the key healthcare constraint is staff time and not money. In addition, we need to respond to the challenges derived

from the United Nations Climate Change Conference (COP26), recently held in 2021, which concluded that a 'zero carbon health system' is not only desirable but necessary and drawing attention to the fact that this key resource, carbon, will play an increasingly important role in the decision-making process[3].

Finally, despite the fantastic achievements in technology and in the management of health services observed in the last 50 years, a new paradigm is needed. In other words, WE NEED A REVOLUTION IN HEALTHCARE!

...Paradigm shifts are revolutions

The First Revolution was the public health revolution starting in the 19th century. An example was the construction of the Cantareira System for the supply and drainage of water in the City of São Paulo, which began in the 1880s, by a private company and supported by the government.

The Second Healthcare Revolution, dominant for the last 50 years, has been the high-tech revolution, and it has seen amazing advances, from the artificial hip to the Covid Vaccine. It has been driven by big bureaucracies, in both the private and the public sector, developing the new technologies and, providing leadership and management through health services and big hospitals, for example with the introduction of evidence-based decision making and a focus on quality and safety. However, concerns emerged from this Revolution based mainly on the work of Jack Wennberg and colleagues at Dartmouth on unwarranted variation[4].

Both these Revolutions need to continue. They are necessary but not sufficient to meet the challenges set out above.

...A Third Revolution is needed - the Value Based Health Care Revolution.

In the Third Revolution, citizens have unparalleled access to knowledge, both accurate and inaccurate, through the Internet. A paradigm shift entails

- A **new way of thinking** with
  - A **new language** which
    - Creates a **new culture** which
      - Creates a **new social reality**, the result of the Revolution

The Value-based Healthcare Paradigm

For the next decade, perhaps for the rest of the 21st century, the dominant paradigm will be based on value.

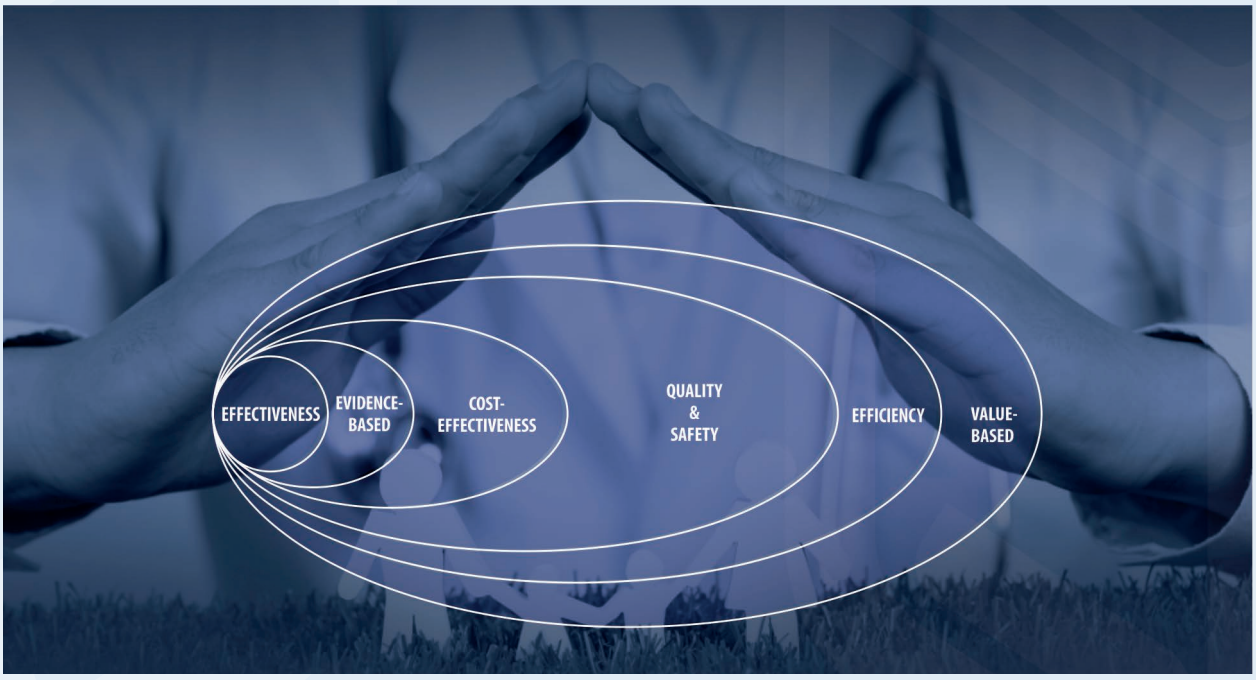

Figure 3. The Healthcare Paradigms.

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The new paradigm of value-based healthcare will encompass and adopt the previous paradigms and will not only challenge the assumption that increased investment in healthcare is always better, but also that increased investment in quality and safety also always increases value.

The definition of value from the European Union Expert Panel on Effective ways of Investment in Health (EXPH), and adopted at its plenary on June 26, 2019, emphasized four different dimensions[5]:

personal value *– appropriate care to achieve a patient's personal goals.*

technical value *– achievement of best possible outcomes with available resources (this is the meaning of the term 'value' used by most people in the United States but in countries committed to universal healthcare technical value, or efficiency, is only one type of value. Furthermore, in countries committed to universal healthcare the use of the available resources is related to all the people in need and not just to those people who have become patients, to all the people with hip pain, for example, and not just the people who have had a hip replacement).*

allocative value *– equitable resource distribution across all patient groups.*

social value *– contribution of healthcare to social participation and connectedness.*

Why Reporting Variation in Healthcare is Important?

> ***Unwarranted Variation***
>
> *'Variation that cannot be explained by discrepancy in need or patient preference.'*
>
> *John Wennberg, Creator of the Darmouth Atlas of Variation, 1996.*

Variation in healthcare is desirable when it reflects the accurate application of different levels of resources because of different levels of need, or because an explicit decision has been openly made relating the allocation of resources to meet the particular needs and priorities of that local population.

This type of variation is called warranted variation, warranted by the needs and choices of that population. However, much of the variation that is seen when comparing one population with a number of other populations is unwarranted and unwarranted variation reveals two other major problems.

- Overuse of resources, always associated with waste and sometimes with additional harm being caused and;
- Underuse of effective and cost-effective interventions, often complicated by inequity, namely low rates of intervention in the most deprived sections of the society, even though their need may actually be greater.

The issue of overuse and waste requires particular attention in an era in which most clinicians feel insufficient money has been invested and campaign for more. The changing relationship between expenditure, as measured by activity, and value was first described by Avedis Donabedian in his 1980 classic trilogy on quality in healthcare. He described how the benefits follow the 'Law of diminishing returns' rising quickly when an intervention is first introduced but then levelling off as the number of people treated increase and the people being treated are less severely affected and gain less benefit even though the intervention is deemed a success. The probability and magnitude of harm however is constant and harm at a population level increases in a linear fashion. Donabedian then subtracted harm from benefit and got a J shaped curve with the high point being the 'Point of Optimality'[6].

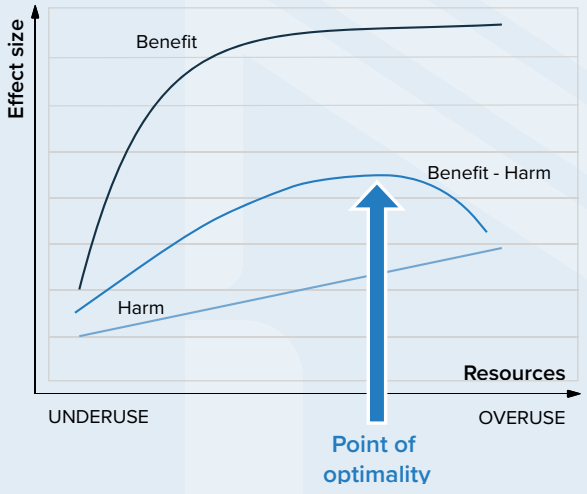

Figure 4. The Point of Optimality.

Of course, quality improvement can increase benefit and reduce harm, but all healthcare can do harm even when delivered at high quality.
Several factors can contribute to the occurrence of both warranted or unwarranted variation, so in the face of significant variations in practice, outcomes and/or costs, a more in-depth assessment of the underlying causes is needed to identify opportunities for improvement and optimization of value delivery (Figure 5).

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Variation in Healthcare

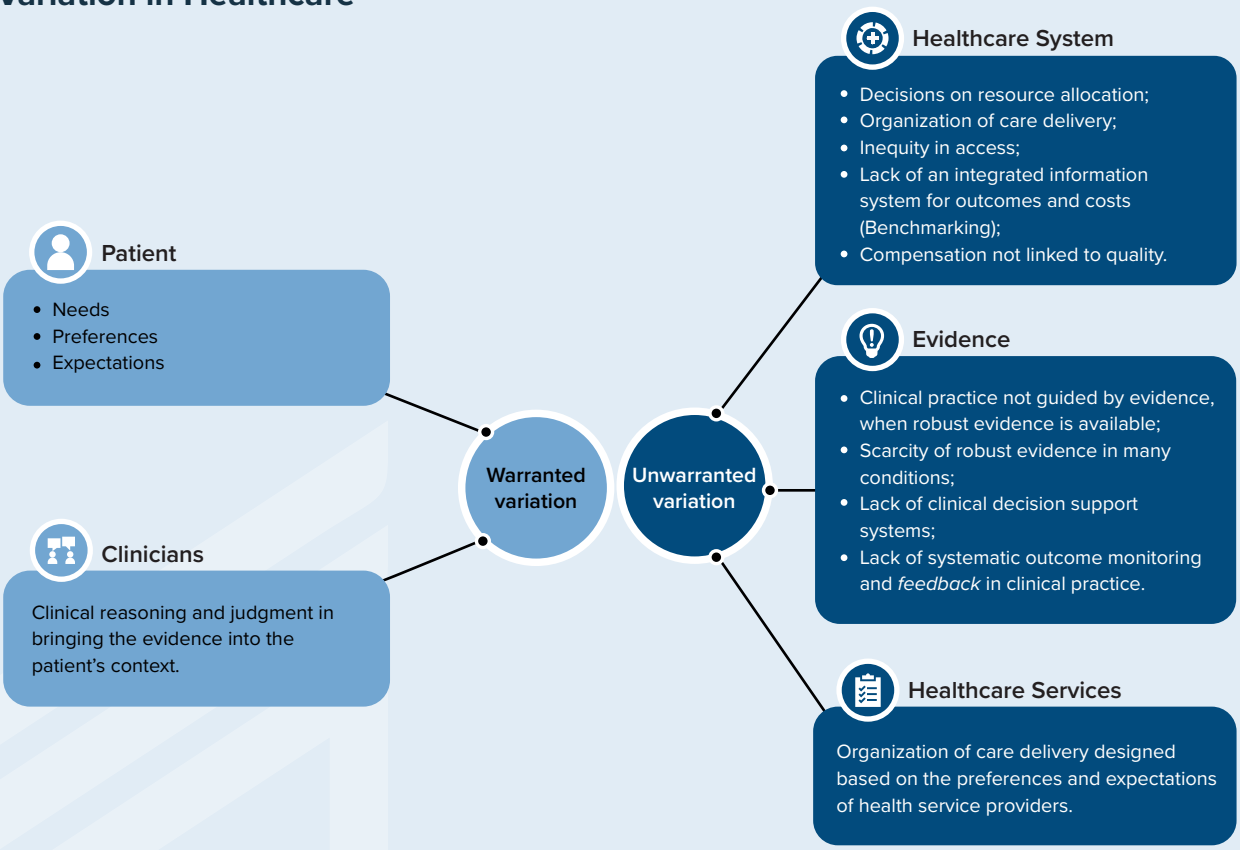

Figure 5. Variation in Healthcare delivery. Factors related to warranted and unwarranted variation.

Efforts to better understand unwarranted variation between health services have been going on for a long time. In a seminal study, published in 1938, J. Alison Glover demonstrated a greater than fourfold variation, in the incidence of tonsillectomy among school-age children living in different geographic regions in England. In his conclusion, Glover draws attention to the fact that the observed variation *'defies any explanation, save that of variations of medical opinion on the indications for surgery' and that 'one cannot avoid the conclusion that there is a tendency for the operation to be performed as a routine prophylactic ritual for no particular reason and no particular result'*[7].

Strongly influenced by Glover's studies[8], John Wennberg and Gittelsohn published a study in 1973 that analyzed information extracted from the Vermont Data System, one of six states in the New England region of the United States. The population was grouped into 13 geographic regions to capture differences in practice between physicians and physician groups. The results showed substantial variation among regions, and here again, tonsillectomy emerged as an astounding example of unwarranted variation, showing that a child living in certain regions had a 66% chance of having their tonsils removed before age 20, in contrast to areas with a 16 to 22% chance. The study emphasizes the importance of providing information on the health of populations as a prerequisite for decision-making and planning in the health area[9]. John Wennberg continued to invest in the study of variation and in 1996 he launched the first Dartmouth Atlas of Health Care, comparing data on capacity, resource utilization and health service outcomes[4].

Inspired by Wennberg's Atlases, the English National Health Service (NHS) published its first Atlas of Variation in Healthcare in 2010 with the aim of helping the health service to explore and understand the causes of unwarranted variation and to focus its efforts on reducing the use of low-value interventions and shifting these freed-up resources to high-value interventions[10].

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Since then, several countries have published Atlases of Variation in series and became members of The WIC (Wennberg International Collaborative) Network, founded by David Goodman of The Dartmouth Institute for Health Policy & Clinical Practice, and by Gwyn Bevan of London School of Economics and Political Science, in 2010, with the aim of accelerating research into the causes and consequences of unwarranted variation between geographic regions and healthcare providers[11].

Unwarranted variation, Overuse and Underuse

What Jack Wennberg and his team demonstrated was that at the end of these decades of progress three huge problems can be seen in every country, no matter how their care is organised or financed.
The first of these problems is huge and unwarranted variation in access, quality, cost, and outcome.
Analysis of the unwarranted variation publicised in the NHS Atlases of Variation, and the Atlases in many other countries inspired by Jack Wennberg, reveals the other two problems (Figure 6).

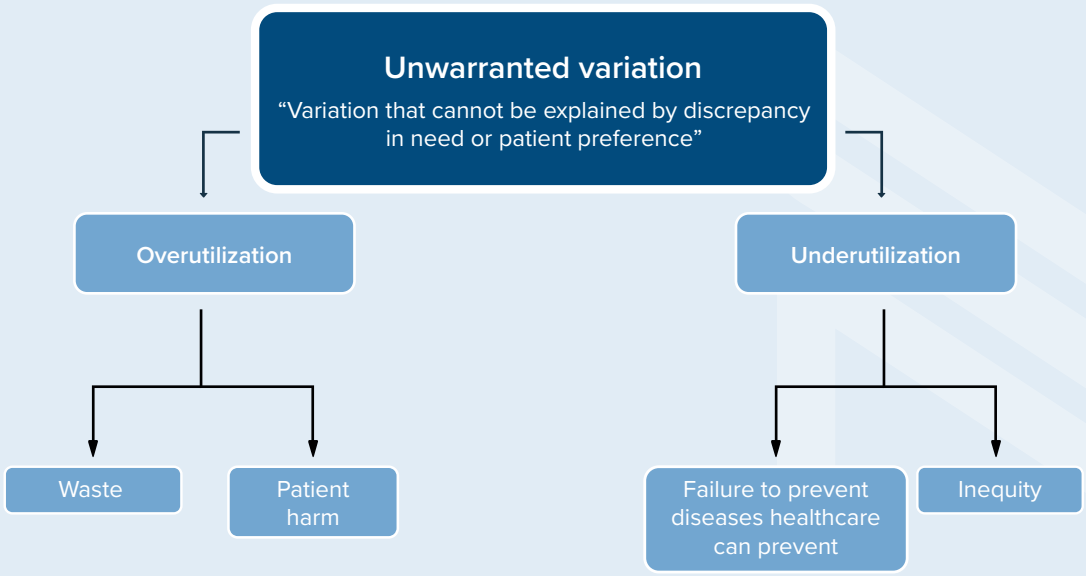

Figure 6. Unwarranted Variation and its consequences.

These problems will not be solved by the current paradigm and the set of activities that have dominated the thinking of leadership and management for the last decade, namely:

- Preventing disease, disability, dementia, and frailty, to reduce need;

  However, controlling the epidemics of the twenty-first century, which are caused by the social environment, will be much harder than it was to control the epidemics of the nineteenth century, controlled by modifying the physical environment.

- Improving outcome by providing only interventions with evidence of cost effectiveness;
- Improving outcome by increasing quality and safety of process;
- Increasing productivity by reducing cost.

These are all necessary and must continue but they are not sufficient to ensure the sustainability of universal healthcare.

A new paradigm is needed to tackle the challenges of unwarranted variation, overuse and underuse and a new paradigm is emerging:

Value-Based Healthcare with a Culture of Stewardship.

Viva the Healthcare Revolution!

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What is needed to create value-based healthcare with a culture of stewardship is a revolution, not only a cultural revolution in how people think but a revolution in how people make decisions, behave and act and the Revolution has five major activities:

- Define population sub-groups with a common need and allocate resources optimally;
- Design the system for each population sub-segment;
- Ensure each individual makes decisions to optimise personal value;
- Deliver value for the population and all the individuals in need equitably through networks;
- Create the culture of stewardship, with a governance process that promotes collective responsibility.

Define population sub-groups with a common need and allocate resources optimally

For decades healthcare, both tax-based and insurance-based, has been two- dimensional. One dimension is the traditional levels of care – primary, secondary, and tertiary or, to put it another way, generalist, specialist, and super specialist. At last, both self-care and informal care, the commonest types of care are now being added to these levels of care. The second dimension is the bureaucratic dimension with either population-based bureaucracies or institutions like hospitals all within a legal framework.

The different levels of care change but little with respect to one another but the bureaucracies change frequently in part because it is tempting to reorganise bureaucratic structure because it is relatively easy to do, although not so easy to cope with the consequences.

It is now being appreciated that these two dimensions, though necessary, are not sufficient and we are now moving to 3D healthcare with the third dimension being populations, or to be more precise systems focused on segments of the population defined by need; for example, people with respiratory disease, people with depression or people in the last year of life.

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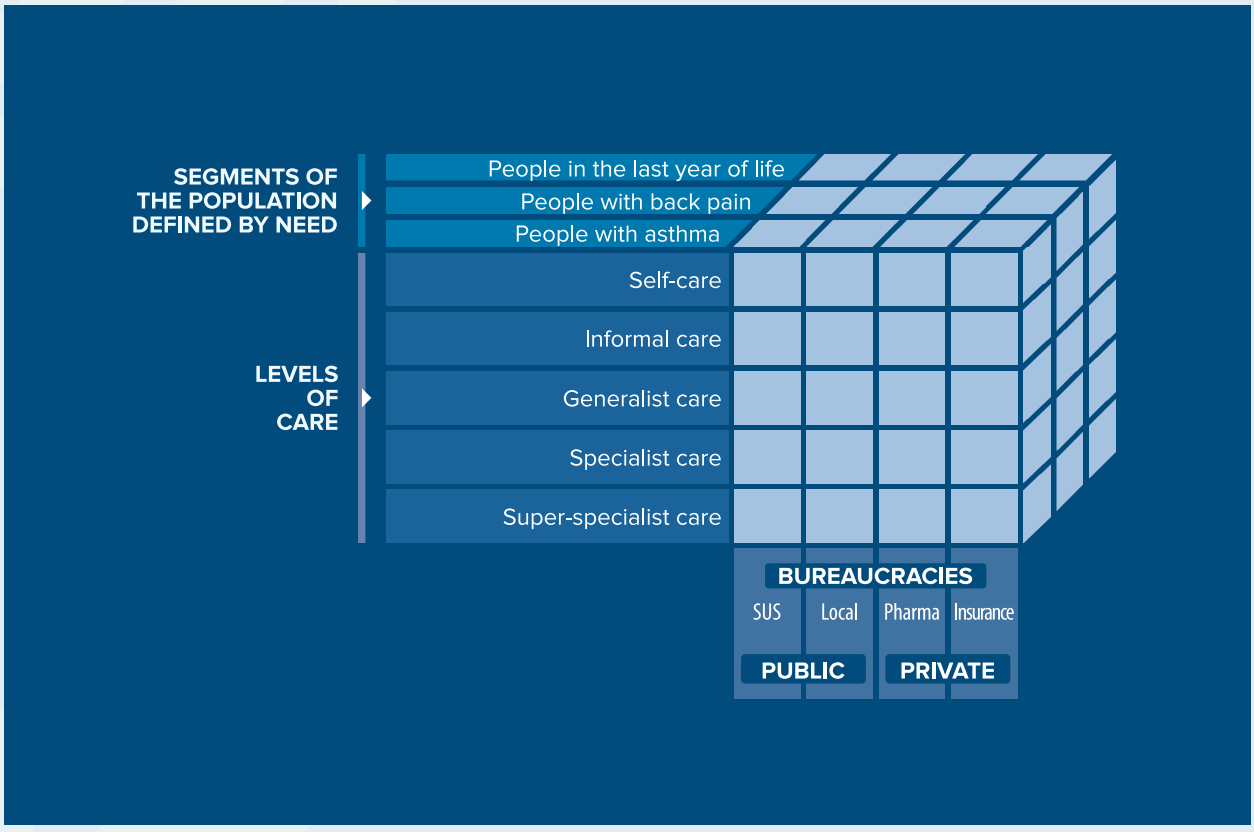

Figure 7. 3D Healthcare. (SUS= Brazil's public Unified Health System).

This third dimension facilitates the development of the new paradigm of value-based healthcare because it allows the development of budgets putting together all the resources focused on one particular subgroup of the population, programme budgeting or service line accounting, as it is called commercially. However equally, or more, important is the fact that by bringing together all the people interested in a segment of the population, including of course, the people who are affected – the people called 'patients' and 'caregivers' – it is much easier to develop the culture of stewardship.

This is about focusing on population healthcare, namely healthcare organised not with respect to buildings, specialties, or equipment but with respect to the segments of the population defined by a common need which may be a symptom such as breathlessness, a condition such as arthritis or a common characteristic such as frailty in old age. The taxonomy which best suits the challenge is called Bridges to Health[12].

The first step is to allocate the resources available equitably and optimally between the various segments of the population and then for each sub-segment within a segment to design the system of care for each sub-segment.

Design the system for each population sub-segment!

Systems are defined as a set of activities with a common set of objectives focused on outcomes that matter. This is not to deny the importance of hospitals and health centres but, for complex problems, systems are needed.

The four purposes for a system are:

- Improving population health and healthcare;
- Reducing inequity by tackling unequal outcomes and access;
- Enhancing both productivity and value for money; and
- Helping Brazil's public Unified Health System (SUS) to support broader social and economic development in the population they serve.

Ensure each individual makes decisions to optimise personal value

The need to focus on the value of the individual patient is increasingly receiving attention. Maureen Bisognano, the charismatic former Director of the Institute for Healthcare Improvement, advocated that we move from 'what's the matter medicine' to 'what matters to you medicine'.

Professor Al Mulley of Dartmouth University and his colleagues coined the term 'the silent misdiagnosis' to describe the common situation in which clinicians have accurately diagnosed a disease but have failed to identify the patient's preferences. They argue that not only do decisions need to be based on the best current evidence but also that decision-making needs to be sensitive to the preferences of individual patients. When seeking to explain the causes of unwarranted variation, Jack Wennberg highlighted that patients' preferences were often either not elicited or, if they were, their preferences would be ignored. Furthermore, evidence-based medicine, initially criticised as 'cookbook' medicine has from its earliest days emphasised the importance of personalisation.

> *"Evidence based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research. By individual clinical expertise we mean the proficiency and judgment that individual clinicians acquire through clinical experience and clinical practice. Increased expertise is reflected in many ways, but especially in more effective and efficient diagnosis and in the more thoughtful identification and compassionate use of individual patient's predicaments, rights, and preferences in making clinical decisions about their care."*
>
> *David L. Sackett et al, 1996.*[13]

Deliver value for the population and all the individuals in need equitably through networks

The 20th century was the century of the bureaucracy and the market, the 21st century is the century of the system and the network.

A network is a collection of links connecting the elements of a system[14]. The elements are called 'nodes' or 'vertices', the lines connecting them are called 'links' or 'edges'. Nodes are the points where connections take place..

Networks are a way of organizing complex systems. They capture the pattern of interactions between the elements which can have a big effect on the behavior of a system[15]. The Network concept has been applied to different areas comprising physical, biological and social sciences.[14-15]

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"A network is a set of interconnected nodes. A node is a point where the network intersects itself. A network has no centre, just nodes. Nodes may be of varying relevance to the network."

Manuel Castells, The Network Society: A Cross-cultural perspective, 2004[16]

The applicability of the Network concept in healthcare has been reviewed in the Networks Supporting Improvement Learning Report, published in 2004 by the Health Foundation[16]. The authors argue that the process of improvement in healthcare is highly social and define a Network as:

'A cooperative structure where interconnected groups or individuals coalesce around a shared purpose on the basis of trust and reciprocity'.

The authors also point out that 'networks are established or evolve spontaneously' and that they are 'distinct from hierarchies, which are controlled via commands, and from markets, where control is financial'[17].

Traditional health care delivery is in general set out as a hierarchy and the different levels of care, generalist, specialist and super specialist services are often depicted as hub and spoke organisations. But to deliver value and to create and sustain a culture of stewardship networks are needed, with every node in the network – whether it be a professorial unit, a primary care team or a patient care group – being of equal status although having a different function.

The development of networks requires not only to develop a culture of stewardship but also a collaborative culture.

Although there is no 'one size fits all formula' for designing effective networks, five core features of effective networks have been identified[17]:

- Common purpose;
- Cooperative structure;
- Critical mass;
- Collective intelligence;
- Community building.

Figure 8 shows an example of a Network topology including three types of networks:

- Primary care networks, a few primary care teams with support services;
- A Network of primary care networks that relate to a general hospital for hip replacement, stroke, acute myocardial infarction MI and type 2 diabetes type problems;
- A Network of hospital networks for problems such as end-stage renal failure requiring transplantation and cerebral tumors.

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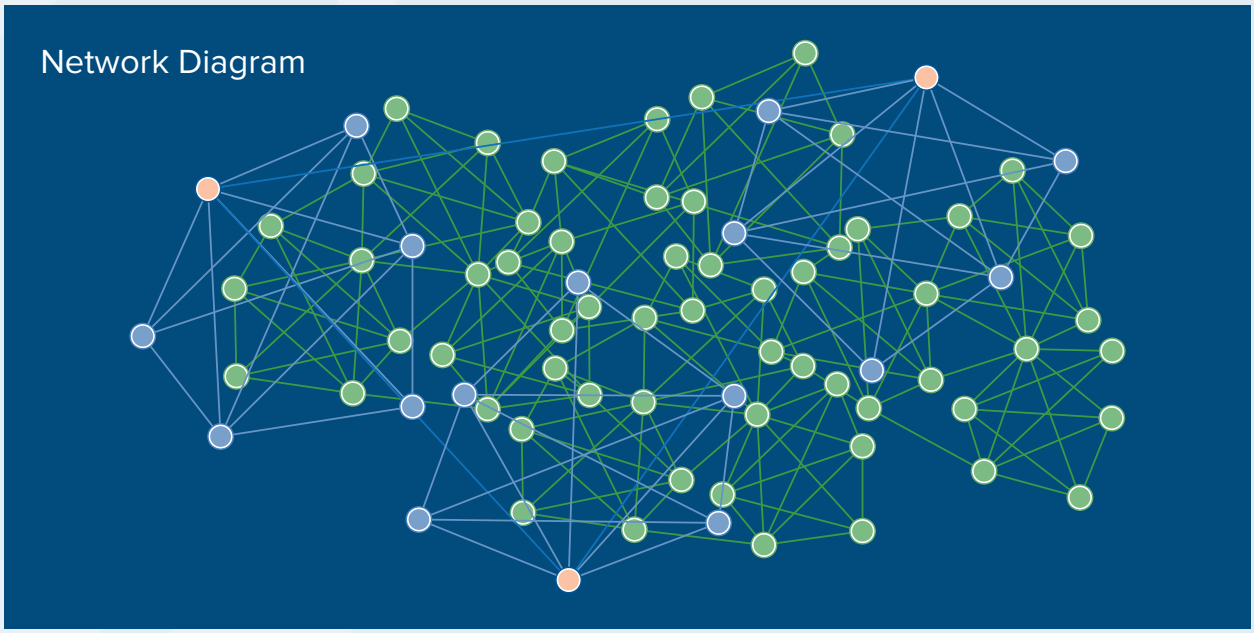

Figure 8. Network Diagram including 3 types of networks: 1. Primary care networks (green dots); 2. A Network of primary care networks that relate to general hospitals (blue dots) and, 3. A Network of hospitals networks specialized in specific medical conditions (orange dots).

Network topology is defined by Kurt as 'the structural network layout, that can be either physical or logical and arranged by a pattern of connected computers, devices, nodes, and other links of a network'.[18]

The precise relationship of one type of network to another will vary but they will all have the mission of delivering the objectives of the systems designed to optimise value for each segment of the population and they will know they can only do this, not by telling other people what to do or by competing with others, but by working together in a collaborative culture with a clear sense of the longer term culture of stewardship that is essential for the survival of the Unified Health System.

Good examples of disease-centered networks come from Europe. In Madrid, Spain, the heads of 4 hospitals, 43 primary care centers and the ambulance provider founded a cardiovascular network to address the needs of the population through eight condition-based projects and collectively reduce unwarranted variation, improve outcomes and patient experience, increase efficiency and focus on prevention. A significant improvement in early detection of undiagnosed atrial fibrillation in the population has been reported19. In England, UK, the London Cardiac and Stroke Network, founded in 2008, is a network with an official mandate to reconfigure stroke services and connect organizations and teams along the care pathwayo[17].

Create the Culture of Stewardship, with a governance process that promotes collective responsibility

A etimologia da palavra Stewardship vem da Bíblia.
The etymology of the word Stewardship comes from the Bible. The good steward looks after the land that he does not own, and he gives it back in better condition than he found it.

The contemporary use of the term Stewardship was first adopted in 1996 by Peter Block[20]:

"Stewardship is to hold something in trust for another."

The term came into use about the future of the planet. It refers to the fact that we are the stewards of the planet. We don't own it; we look after it for future generations. And according to Holmgren, the Stewardship concept demands that we constantly ask the question 'Will the resource be in better shape after my stewardship?'[21].

Elinor Ostrom, the joint winner of the Nobel Prize for Economics in 2009 with Oliver Williamson who convinced the world of economists and business that neither bureaucracies nor markets alone or together could meet complex challenges like healthcare, studied the management of scarce resources, such as fishing resources, water and grazing lands and came to the conclusion that "If those using the resources are allowed to manage those common pooled resources themselves, then sustainability is possible. They become stewards"[22].

The same concept is highly relevant to the stewardship of healthcare. If clinicians do not make good use of the resources, there may not be a health service of the type they value for the generations to come. A white paper published in 2014 by the Academy of Medical Royal Colleges recommends that 'doctors should embrace the values of resource stewardship in their clinical practice'. This document makes a call to action for clinicians[23]:

"As responsible stewards, doctors can provide a more effective use of constrained economic and environmental resources. A cultural shift is required which calls upon doctors and other clinicians to ask, not if a treatment or procedure is possible, but whether it provides real value to the patient and genuinely improves the quality of their life or their prospects for recovery. In other words, don't do something because it can be done, do it if it is necessary."

Maughan D, Ansell J,
Academy of Medical Royal Colleges, 2014.

In the Glossary of the Academia VBHC, the term Stewardship was kept in English, as there is no single word in Portuguese capable of fully expressing the meaning of stewardship.

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> ***Stewardship means care with diligence.***
>
> *"Stewardship in healthcare means caring diligently of the available health resources, understanding that they are finite and that each professional, whether on the clinical or administrative team, is responsible for ensuring the best use of these resources."*
>
> *Glossário da Academia VBHC*[24]

What is needed is an integrated system with the culture of stewardship

Presentation of the tasks in a linear fashion fails to represent the complexity of the work required to create the culture of stewardship, which is better represented as a picture:

Build a Culture of *Stewardship*

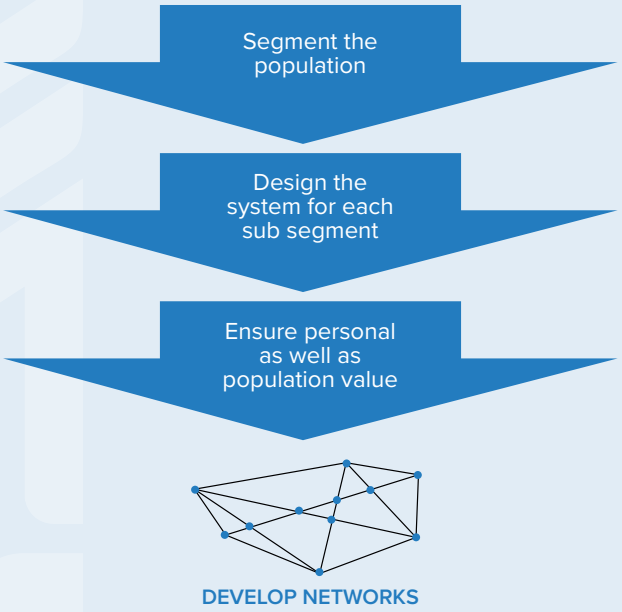

Figura 9. The Culture of *Stewardship*.

This also requires a new language be adopted, taught, absorbed and translated into action, a language containing concepts such as value, waste, stewardship, population healthcare, equity as distinct from equality, and networks.

It is important to understand that language is not simply a means of transacting information.

As the Philosophers such as Ludwig Wittgenstein and anthropologists have taught us

> *"The limits of my language mean the limits of my world."*
>
> *Ludwig Wittgenstein,*
> *Tractatus Logico-Philosophicus, 1922.*[25]

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"Human beings do not live in the objective world alone, nor alone in the world of social activity as ordinarily understood but are very much at the mercy of the particular language which has become the medium of expression for their society. It is quite an illusion to imagine that one adjusts to reality essentially without the use of language and that language is merely an incidental means of solving specific problems of communication or reflection…No two languages are ever sufficiently similar to be considered as representing the same social reality. The worlds in which different societies live are distinct worlds, not merely the same worlds with different labels attached."

Edward Sapir, The Status of Linguistics as a Science, 1929, p.209[26]

"Language is perhaps our greatest accomplishment as a species. Once a people have established a language, they have a series of agreements on how to label, characterize, and categorize the world around them."

Daniel Everett, Don't sleep, there are snakes. Life and Language in the Amazonian jungle. Values and Talking: The Partnership between Language and Culture, 2008.[27]

To achieve this transformation, we need a national programme with a new language translated into an agreed glossary, which is a collection of key terms of the language. We will also need a training programme for about 500 people per million population and a mechanism for developing systems for the 50 biggest segments of the population.

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About the Atlas of Variation in Healthcare Brazil

Brazil's Atlas of Variation in Healthcare is the first Latin American atlas as part of The Wennberg International Collaborative (WIC) Network and is also the first in a series of Atlases that will follow.

In this first Atlas our aim was to explore the degree of variation in the use of healthcare resources, outcomes and costs, existing among the different Brazilian geographic regions in the context of the Unified Health System (SUS), in order to contribute to the creation of discussion forums on the type of variation observed - whether it reflects the needs and characteristics of the population served or whether the variation is in fact unwarranted - and, from there, stimulate further investigation into the underlying causes and identify opportunities for improvement to reduce unwarranted variation, making the clinical practice more uniform, with more equitable access to high-value interventions, reduced access to low-value interventions, and consequently, contribute to improving outcomes and reducing the waste of available resources, making the Brazilian universal health system more sustainable.

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Atlas Development

Data Extraction

Data collection was performed using official data from different information systems linked to the DATASUS, the government's official data pooling service in the healthcare system.[1] The period of analysis was from January 2016 to December 2019; therefore, the anaylizis eliminated the impact of the COVID-19 pandemic on the variation in healthcare, establishing a reference period for future analyses.

All analyzes were performed using the place of residence of the person receiving healthcare as the reference. For example, if a resident of Roraima performs a surgery in the state of Amazonas, the frequency of surgery will increase in the state of Roraima. In this way, a more appropriate analysis of inequities in access to health services for residents of each location is possible.

Population living in States and Health regions

The resident population of each municipality and state was obtained through official population estimates carried out by the Brazilian Institute of Geography and Statistics (IBGE), in each year between 2016 and 2019.[2] To calculate the population of the Health Regions, the sum of the population of all the municipalities that comprised each Health Region was performed.

Mortality Information System (SIM)

It contains information from Death Certificates (DC) issued throughout the national territory, including information such as age, cause of death, place of death, among others. It includes data from all DCs, with no differentiation being made between SUS and private health insurance users.

Outpatient Information System (SIA)

This is the information system containing data related to outpatient procedures performed in the SUS, such as medication requests, exams, consultations, among others. The main data source used in the maps of use of outpatient resources were the Authorizations for Outpatient Procedures (APAC), documents used to request medication and other high-cost procedures.

Hospital Information System (SIH)

It includes hospital admissions in the SUS and it provides data related to diagnosis, procedure performed, length of stay and proportion of deaths.

Presentation of maps and charts

Data from each analysis is demonstrated in maps, tables and charts. Charts and maps are sorted in color, by shades of blue, where darker corresponds to a higher frequency or proportion, and lighter to a lower frequency or proportion. A simple method of division by the number of observations was performed for color classification, dividing the Federal Unit (FU) or Health Regions into five percentiles.

The analyzes were performed at two levels: FU and Health Regions. The FUs consist of the 26 states and the Federal District. The Health Regions total 450, and were established in Resolution No. 1, of September 29, 2011, where[3]:

> *The Health Region is considered to be the continuous geographic space constituted by a grouping of neighboring municipalities, delimited from cultural, economic and social identities and from communication networks and shared transport infrastructure, with the purpose of integrating the organization, planning and execution of health actions and services.*

The Health Regions aim to guarantee the population's "resolutive access, in a timely and quality manner",3 being, therefore, considered as the main unit of analysis of each map, better representing the patterns of access and quality of services, since there are substantial variations between different Health Regions in the same FU.

In each graph, the measure observed in each state was represented by the columns, while the measure observed in each health region was represented by the gray circles. The circle corresponding to the frequency observed in each Health Region was recorded on the bar of the FU where the Health Region is located in the X axis, allowing the visualization of the variation in each state.

Age Standardization

Standardization by age allows a direct comparison between Health Regions and FUs with different demographic profiles, avoiding variations in the frequency of services that are related to different needs of the population. For example, when observing a higher rate of use of medication for dementia in a region, this variation may be related to the higher proportion of elderly people. Through standardization, the rate of use of dementia medications can be adjusted, allowing direct comparison with a region that has a lower proportion of elderly people. In the present studies, all rates were standardized, and the frequency of resource use was calculated per 100,000 inhabitants.

Standardization was performed using the indirect method, which calculates the expected rate for each region based on that observed in Brazil, and divides it by the observed rate, obtaining the standardized rate.

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Health Insurance Coverage

In the maps that investigate the frequency of use of resources (rates), an additional analysis was carried out where the population at risk is considered as only residents who do not have private health insurance coverage and are therefore considered as exclusive SUS users.

This analysis aims to reduce the bias caused by the different coverage by health insurance among the locations in Brazil, since users of health insurance more often perform care outside the SUS. In this way, it is avoided to underestimate the use of resources in the SUS in places with high coverage by health plans.

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Table 1: Methodology used for the elaboration of the maps.

ID	Title	Measuring unit	ICD-10	Procedure codes in the SUS
1	Years of life lost due to cardiovascular disease	Number of years of life lost per 100,000 inhabitants per year	Chapter IX	
2	Hospitalizations for heart failure	Number of hospitalizations per 100,000 inhabitants per year		0303060212
3	Hospitalizations for acute myocardial infarction	Number of hospitalizations per 100,000 inhabitants per year		0303060190, 303060280, 0406030049
4	Length of hospital stay for acute myocardial infarction	Number of hospital admission days		0303060190, 303060280, 0406030049
5	Case-fatality rate for acute myocardial infarction	Proportion of deaths due to hospitalization		0303060190, 303060280, 0406030049
6	Primary coronary angioplasty for the treatment of acute myocardial infarction	Number of procedures per 100,000 inhabitants per year		0406030049
7	Hospitalizations for stroke	Number of hospitalizations per 100,000 inhabitants per year		0303040076, 0303040149, 0303040300
8	Thrombolysis for the treatment of stroke	Proportion of thrombolysis per hospitalization per hospitalization for stroke		0303040149, 0303040300
9	Case-fatality rate for Stroke	Proportion of deaths due to hospitalization		0303040076, 0303040149, 0303040300
10	Hospitalizations for diabetes	Number of hospitalizations per 100,000 inhabitants per year		0303030038
11	Bariatric surgery for obesity treatment	Number of procedures per 100,000 inhabitants per year	E66	0407010084, 0407010122, 0407010173, 0407010181, 0407010360, 0407010386
12	Prescription of medication for dementia	Number of prescriptions per 100,000 inhabitants/year		601220013, 601220021, 601220080, 601220099, 601220102, 604130015, 604130023, 604130031, 604130040, 604130058, 604130066, 604130074, 604130082, 604130090, 604130104, 604130120, 604130139
13	Cataract Surgeries	Number of procedures per 100,000 inhabitants per year		0405050097, 0405050100, 0405050119, 0405050372

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ID	Title	Measuring unit	ICD-10	Procedure codes in the SUS
14	Years of life lost due to early cancer deaths	Number of years of life lost per 100,000 population per year	Chapter II	
15	Number of mammograms in women aged 50 to 69 years	Number of exams per 100,000 inhabitants between 50 and 69 years old per year		0204030030, 0204030188
16	Proportion of women aged 50 to 69 years who underwent a mammogram	Proportion of mammograms in the 50-69 age group, among all mammograms performed		0204030030, 0204030188
17	Proportion of cancer deaths at home	Proportion of deaths by cancer happening at home	Chapter II	
18	Expenditure on chemotherapy drugs	Total amount used in the purchase of chemotherapy		Todos os procedimentos tabulados como "AQ - APAC de Quimioterapia"
19	Surgical treatment of femoral neck and hip fractures	Number of procedures per 100,000 inhabitants per year		0408040050, 408040084, 0408040092, 408050489, 0408050616, 0408050632
20	Spine Surgery: Herniated disc surgery or spinal fusion (arthrodesis)	Number of procedures per 100,000 inhabitants per year		0408030054, 408030062, 0408030070, 0408030089, 408030097, 0408030100, 0408030119, 0408030127, 0408030135, 0408030143, 0408030151, 0408030160, 0408030178, 0408030186, 0408030194, 0408030208, 408030216, 0408030224, 0408030232, 408030240, 0408030259, 408030267, 0408030275, 0408030283, 408030291, 0408030305, 0408030313, 0408030321, 0408030380, 408030399, 0408030402, 408030410, 0408030429, 0408030437, 408030445, 0408030453, 0408030461
21	Kidney Transplant	Number of procedures per 100,000 inhabitants per year		0505020092, 505020106
22	Colonoscopy or flexible sigmoidoscopy	Number of procedures per 100,000 inhabitants per year		0209010029, 0209010053
23	Inguinal hernia repair (herniorrhaphy)	Number of procedures per 100,000 inhabitants per year		0407040099, 407040102, 0407040137

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ID	Title	Measuring unit	ICD-10	Procedure codes in the SUS
24	Proportion of cesarean deliveries	Proportion of deliveries undergoing cesarean section		0310010039, 0310010047, 0310010055, 0411010026, 0411010034, 0411010042
25	Proportion of people aged 0–19 years who underwent tonsillectomy and/or adenoidectomy	Number of procedures per 100,000 inhabitants between 0 and 19 years old per year		
26	Hospitalizations for pneumonia or influenza	Number of hospitalizations per 100,000 inhabitants per year		0303140151
27	Length of hospital stay for pneumonia or influenza	Number of hospital admission days		0303140151
28	Hospitalizations for Asthma	Number of hospitalizations per 100,000 inhabitants per year	J45, J46	
29	Hospitalizations for emphysema and other chronic obstructive pulmonary diseases	Number of hospitalizations per 100,000 inhabitants per year	J43, J44	0303140046
30	Hospitalizations of people at high risk of suicide	Number of hospitalizations per 100,000 inhabitants per year		0303170131

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Main findingss

- This is the first Atlas to carry out a systematic investigation of variations in healthcare in Brazil.
- An investigation of healthcare variation is shown in 30 distinct maps, covering 11 health areas. The maps allow a comparison of patterns of access to services, outcomes and different practices of health professionals throughout Brazil.
- The maps suggest underuse, overuse and inequity of access to health resources in the SUS. As an example of overutilization, it is highlighted that, in some Health Regions, the proportion of cesarean deliveries was higher than 80%.
- In many States and Health Regions, the frequency of certain procedures was zero in the analyzed period. There were States where no resident was treated with thrombolysis for stroke, primary angioplasty for acute myocardial infarction or bariatric surgery to treat of obesity. The finding suggests that, in several locations, no inhabitant had access to these services in SUS.
- The analysis at the level of the Health Regions allowed to identify important findings that would not be visible by comparing only the States. The variation within each State was often greater than that observed between different States, emphasizing the importance of investigating variations in quality and access to services in the Health Regions of each State.
- The standardization of rates by age allowed a direct comparison between different locations, eliminating age group differences that could impact the use of health resources.
- In the period (2016-2019), the average coverage of private health insurance in Brazil was 24.1%, ranging from 5.6% to 40.9% between the Health Regions. To minimize this impact on healthcare variations, a correction was performed using as reference people who were SUS-only users. However, on most maps, there was an increase in variation after the correction by health plans coverage was performed. Although people with private health insurance can also use the SUS for healthcare, this finding suggests that SUS users in regions with high coverage by health plans use more SUS resources than inhabitants of regions with low coverage. This difference may have been caused by a greater supply of health services in these regions, a phenomenon referred to as supply-sensitive care.

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Limitations and transparency

- Academia VBHC accepted the challenge of creating the Atlas of Variation in Healthcare Brazil, creating momentum for a data-driven debate on SUS public data. All the effort translated into this work was carried out in good faith, with the aim of contributing to the creation of a data-driven continuous learning health system and encouraging discussion on the appropriate use of healthcare resources.
- The quality of available data can vary between places. However, Academia VBHC sought to use the best public sources available in the preparation of this material.
- As this is the first version of Atlas, we hope that the fruitful discussion among different healthcare stakeholders allowing for incremental improvements in the data source and analysis of each condition presented. Therefore, Academia VBHC's team is available for reviews and suggestions focused on improving the performed analysis.
- Incorrect coding of service provision and resources used can make it difficult to interpret the variations in healthcare. However, it is noteworthy that the procedure coding guides the transfer of resources to healthcare providers. Therefore, besides impairing the analysis of variations, inappropriate coding can lead to incorrect transfers of financial resources.
- The publicly available data have limitations for carrying out different interpretations, such as costs of complete cycles of care, outcomes and patient-reported experience, quality of services, appropriateness of care, among others.
- The present analysis focused only on data of the SUS, not including data from the supplementary health plans, with exception to maps 01, 14 and 17, which are based in death certificates, not differentiating public or private system users.
- The Academia VBHC invites the competent authorities, healthcare professionals, medical professional associations, patient advocacy groups, the civil society and people with medical conditions to discuss the findings of this Atlas, collaborating with future analyses.

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Summary tables

Table2: Summary of findings of each map, standardized by age.

ID	Title	Health area	Range of variation (UF)	Fold-variation (UF)	Range of variation (Health Regions)	Fold-variation (Health Regions)
1	Years of life lost due to cardiovascular disease	Cardiovascular and cerebrovascular diseases	644 - 1278	2,0	320 - 1677	5,2
2	Hospitalizations for heart failure	Cardiovascular and cerebrovascular diseases	42,5 - 186,3	4,4	26,2 - 568,7	21,7
3	Hospitalizations for acute myocardial infarction	Cardiovascular and cerebrovascular diseases	29,0 - 146,8	5,1	9,1 - 273,8	30,0
4	Length of hospital stay for acute myocardial infarction	Cardiovascular and cerebrovascular diseases	3,1 - 13,7	4,4	2,2 - 15,4	7,1
5	Case-fatality rate for acute myocardial infarction	Cardiovascular and cerebrovascular diseases	3,9% - 14,5%	3,7	1,1% - 33,7%	32,0
6	Primary coronary angioplasty for the treatment of acute myocardial infarction	Cardiovascular and cerebrovascular diseases	Zero - 12,9	N/D	Zero - 39,3	N/A
7	Hospitalizations for stroke	Cardiovascular and cerebrovascular diseases	43,4 - 141,9	3,3	34,0 - 195,4	5,7
8	Thrombolysis for the treatment of stroke	Cardiovascular and cerebrovascular diseases	Zero - 8,9%	N/D	Zero - 33,1%	N/A
9	Case-fatality rate for Stroke	Cardiovascular and cerebrovascular diseases	11,8% - 34,3%	2,9	5,0% - 39,0%	7,9
10	Hospitalizations for diabetes	Metabolic diseases	23,7 - 117,4	5,0	6,2 - 237,7	38,3
11	Bariatric surgery for obesity treatment	Metabolic diseases	Zero - 50,9	N/D	Zero - 108,7	N/A
12	Prescription of medication for dementia	Neurologic diseases	51,1 - 967,1	18,9	Zero - 2.717,8	N/A
13	Cataract Surgeries	Ophthalmic diseases	0,1 - 79,4	835,5	Zero - 341,9	N/A
14	Years of life lost due to early cancer deaths	Cancer	702 - 1.119	1,6	231 - 1.317	5,7
15	Number of mammograms in women aged 50 to 69 years	Cancer	278,0 - 9659,2	34,7	140,7 - 18.831,8	133,9

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ID	Title	Health area	Range of variation (UF)	Fold-variation (UF)	Range of variation (Health Regions)	Fold-variation (Health Regions)
16	Proportion of women aged 50 to 69 years who underwent a mammogram	Cancer	48,6% - 73,5%	1,5	35,1% - 96,2%	2,7
17	Proportion of cancer deaths at home	Cancer	7,3% - 34,5%	4,7	4,1% - 53,6%	13,1
18	Expenditure on chemotherapy drugs	Cancer	R$ 294.921 - R$ 1.227.190	4,2	R$ 54.919 - 2.146.526	39,1
19	Surgical treatment of femoral neck and hip fractures	Musculoskeletal diseases	4,1 - 44,5	10,8	3,1 - 74,9	23,8
20	Spine Surgery: Herniated disc surgery or spinal fusion (arthrodesis)	Musculoskeletal diseases	0,8 - 19,3	23,8	Zero - 43,8	N/A
21	Kidney Transplant	Kidney diseases	0,3 - 4,3	13,6	Zero - 6,1	N/A
22	Colonoscopy or flexible sigmoidoscopy	Digestive tract diseases	23,6 - 289,1	12,2	0,6 - 880,3	1481,2
23	Inguinal hernia repair (hernio-plasty)	Digestive tract diseases	21,2 - 91,1	4,3	21,2 - 138,1	6,5
24	Proportion of cesarean deliveries	Pregnancy and delivery	28,0% - 55,4%	2,0	19,5% - 84,0%	4,3
25	Proportion of people aged 0–19 years who underwent tonsillectomy and/or adenoidectomy	Breathing problems	2,6 - 130,8	49,7	Zero - 611,2	N/A
26	Hospitalizations for pneumonia or influenza	Breathing problems	128,8	3,7	81,9 - 1.201,5	14,7
27	Length of hospital stay for pneumonia or influenza	Breathing problems	4,6 - 8,6	1,9	3,0 - 9,7	3,3
28	Hospitalizations for Asthma	Breathing problems	8,5 - 99,3	11,6	1,9 - 488,0	257,5
29	Hospitalizations for emphyse-ma and other chronic obstruc-tive pulmonary diseases	Breathing problems	9,5 - 96,3	10,1	3,5 - 407,4	116,6
30	Hospitalizations of people at high risk of suicide	Mental disorders	0,1 - 63,2	883,8	Zero - 209,5	N/A

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Summary tables

Table3: Summary of findings of each map, corrected by health plan coverage.

ID	Title	Health area	Range of variation (UF)	Fold-variation (UF)	Range of variation (Health Regions)	Fold-variation (Health Regions)
2	Hospitalizations for heart failure	Cardiovascular and cerebrovascular diseases	48,9 - 238,5	4,9	25,9 - 565,7	21,9
3	Hospitalizations for acute myocardial infarction	Cardiovascular and cerebrovascular diseases	30,8 - 189,3	6,1	9,1 - 314,1	34,3
6	Primary coronary angioplasty for the treatment of acute myocardial infarction	Cardiovascular and cerebrovascular diseases	Zero - 15,8	N/D	Zero - 46,2	N/A
7	Hospitalizations for stroke	Cardiovascular and cerebrovascular diseases	68,3 - 152,1	2,2	39,9 - 240,1	6,0
10	Hospitalizations for diabetes	Metabolic diseases	31,9 - 125,1	3,9	10,3 - 273,6	26,7
11	Bariatric surgery for obesity treatment	Metabolic diseases	Zero - 68,2	N/D	Zero - 116,4	N/A
12	Prescription of medication for dementia	Metabolic diseases	51,1 - 1.570,3	18.9	Zero - 4.160,1	N/A
13	Cataract Surgeries	Ophthalmic diseases	0,1 - 101,2	907,0	Zero - 406,5	N/A
15	Number of mammograms in women aged 50 to 69 years	Cancer	319,9 - 13.796,1	43,1	144,1 - 21.708,7	150,7
18	Expenditure on chemotherapy drugs	Cancer	R$ 315.019 - R$ 1.550.087	4,9	R$ 54.966 - R$ 2.729,017	49,7
19	Surgical treatment of femoral neck and hip fractures	Musculoskeletal diseases	4,5 - 54,7	12,2	2,0 - 80,0	40,5
20	Spine Surgery: Herniated disc surgery or spinal fusion (arthrodesis)	Musculoskeletal diseases	0,9 - 25,5	27,1	Zero - 53,6	N/A
21	Kidney Transplant	Kidney diseases	0,3 - 5,7	17,2	Zero - 9,8	N/A

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ID	Title	Health area	Range of variation (UF)	Fold-variation (UF)	Range of variation (Health Regions)	Fold-variation (Health Regions)
22	Colonoscopy or flexible sigmoidoscopy	Digestive tract diseases	25,3 - 457,2	18,1	0,6 - 1.056,9	1.757,3
23	Inguinal hernia repair (hernioplasty)	Digestive tract diseases	31,4 - 100,1	3,2	22,2 - 178,9	8,1
24	Proportion of cesarean deliveries	Pregnancy and delivery				
25	Proportion of people aged 0–19 years who underwent tonsillectomy and/or adenoidectomy	Breathing problems	2,9 - 171,4	59,4	Zero - 729,9	N/A
26	Hospitalizations for pneumonia or influenza	Breathing problems	182,8 - 552,7	3,0	82,1 - 1.209,3	14.7
28	Hospitalizations for Asthma	Breathing problems	9,0 - 112,2	12,5	2,3 - 580,9	249,1
29	Hospitalizations for emphysema and other chronic obstructive pulmonary diseases	Breathing problems	10,9 - 115,6	10,6	5,2 - 416,9	80,6
30	Hospitalizations of people at high risk of suicide	Mental disorders	0,1 - 82,2	1.073,5	Zero - 265,5	N/A

No results were reported from maps investigating proportions, years of life lost, or length of stay, in which no correction was made for health insurance coverage.

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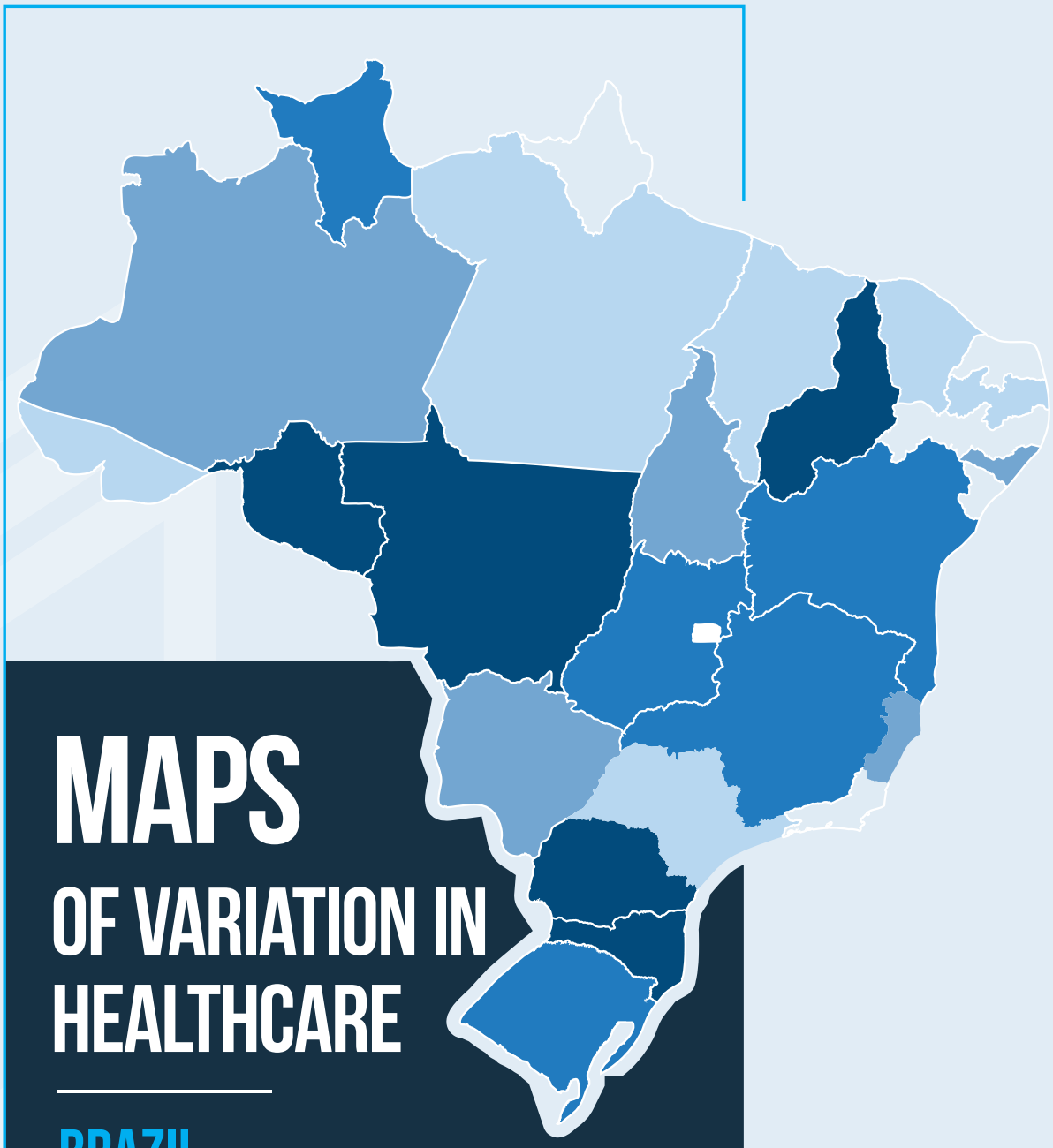
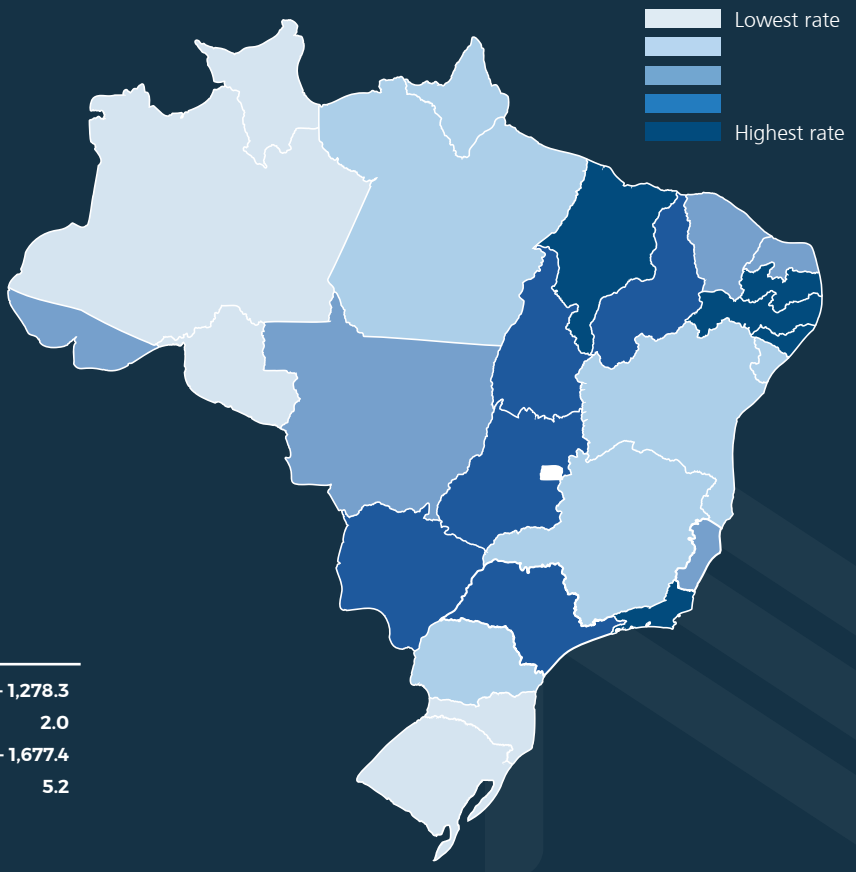


MAPS
OF VARIATION IN HEALTHCARE

BRAZIL

CARDIO-CEREBROVASCULAR DISEASES

Map 01: Years of life lost due to cardiovascular disease



Variation (UF)	643.9 - 1,278.3
Ratio (UF)	2.0
Variation (Health Region)	319.9 - 1,677.4
Ratio (Health Region)	5.2

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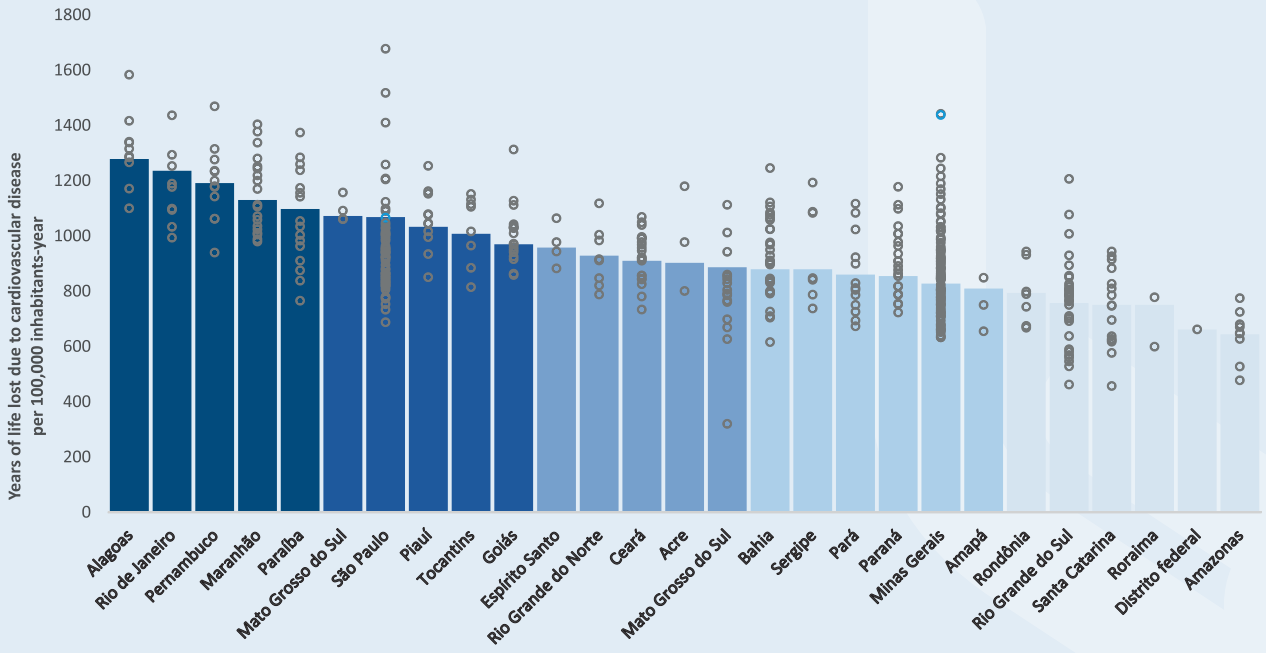

Context

Cardiovascular diseases were the leading cause of death in Brazil between 2016 and 2019, accounting for 27.3% of the total1 and were the biggest cause of years of life lost in the world in 2019, corresponding to 21.4% of the total.[2]

According to the Health Surveillance Secretariat, between 2000 and 2018, mortality from cardiovascular diseases increased by 12% in the North region and 17% in the Northeast region, while it reduced by 34% in the Southeast Region, 42% in the South Region and 29% in the Midwest Region.[3] The authors suggest that this difference may reflect a greater aging of the population in these regions, less access to health care and socioeconomic factors.

In cases of stroke and acute myocardial infarction (AMI), more than 90% of cases could be prevented by controlling modifiable risk factors.[4, 5] Among the risk factors, there is a lower incidence of stroke, AMI and other vascular conditions when there is better control of hypertension, physical activity, dyslipidemia, eating habits, smoking cessation, obesity and diabetes. While investment in prevention has the greatest potential for health value gain, changes take many years to be noticed and prevention will never be complete. Even with adequate policies, many people with established atherosclerotic disease will have events such as stroke and AMI, in addition to being highly dependent on the initiative of each individual.

The present analysis calculates the number of years lost due to early deaths from Chapter IX ICD-10 diseases, considering a life expectancy of 70 years. This chapter includes diseases such as AMI, stroke, pulmonary embolism, heart failure, and other cardiovascular conditions.

Magnitude of variation

- Among the Federative Units, the number of years of life lost due to early deaths from cardiovascular diseases varied from **643.9 to 1,278.3 per 100,000 inhabitants-year**, a **2.0-fold variation**;
- Among Health Regions, the variation was from **319.9 to 1,677.4**, a variation of **5.2 times**.

Possible reasons for the observed variation:

- Variations in lifestyle and prevalence of cardiovascular risk factors among regions, such as hypertension, obesity, smoking and physical inactivity;
- Variations in access, quality and demand for health services for the diagnosis and treatment of cardiovascular risk factors;
- Variations in access and quality of health services for the treatment of cardiovascular diseases such as stroke and AMI.

Opportunities to improve Value in Healthcare

- The greatest opportunity to gain value in
- cardiovascular disease is through prevention, a focus on controlling risk factors is needed;
- A population-based approach aimed at reducing deaths from cardiovascular diseases must be guided by improvements in health determinants, including environmental, economic and social determinants;
- The improvement in care for people with established cardiovascular disease includes a cultural change in health care, including population education on the recognition of stroke and AMI symptoms, training of pre-hospital emergency services, creation of referral centers with stroke units and coronary care units, and provision of reperfusion therapies.

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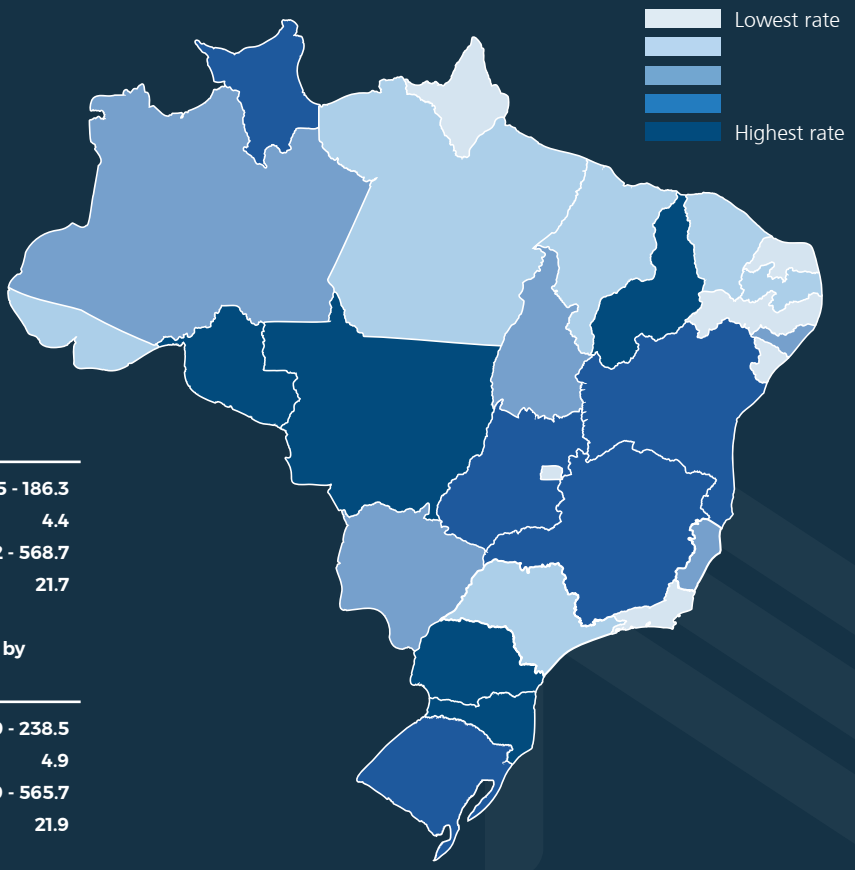
CARDIO-CEREBROVASCULAR DISEASES

Map 02: Hospitalizations for heart failure



01 - Standardization by age (map)

Variation (FU)	42.5 - 186.3
Ratio (FU)	4.4
Variation (Health Region)	26.2 - 568.7
Ratio (Health Region)	21.7

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	48.9 - 238.5
Ratio (FU)	4.9
Variation (Health Region)	25.9 - 565.7
Ratio (Health Region)	21.9

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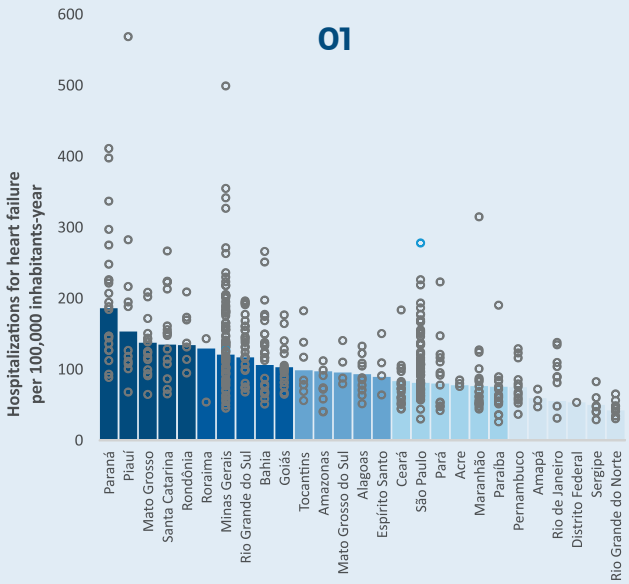

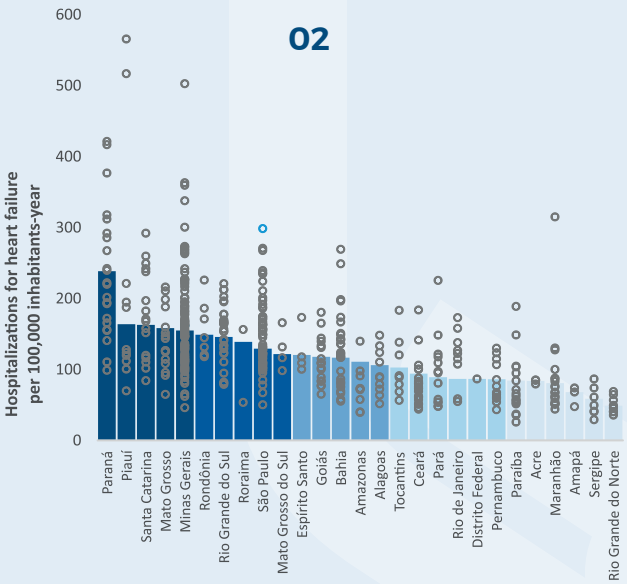

Context

Heart failure (HF) is a condition in which the heart is unable to pump enough blood to meet the body's needs.[1] The main causes of HF in Brazil vary by region. In the South, Southeast and Northeast regions, obstruction of the coronary arteries predominates, compromising the irrigation of the heart muscle, which can cause angina or myocardial infarction, and consequent impairment of cardiac function. In the North region, most cases of HF are caused by poorly controlled arterial hypertension and, in the Central-West region, cases of Chagas disease, an infectious disease caused by Trypanosoma cruzi, which, in its chronic phase, can affect the electrical system and the heart muscle[2].

In general, HF is a chronic, progressive condition that can be managed on an outpatient basis through a multidisciplinary approach, regular and ongoing use of effective medications, and patient education. Despite this, HF remains among the main causes of clinical hospitalization in Brazil, with this hospitalization rate being higher than the average for Latin American countries[3], although there has been a progressive reduction in recent years. However, such a reduction is associated with increased length of stay and high rates of readmission in the first 3 months after discharge, which increases costs.[4] As it is a potentially avoidable event, hospitalization for HF reflects inefficiency of care and generates waste of resources.

Magnitude of variation

- Among the Federative Units, the number of hospitalizations for the treatment of heart failure, standardized by age, ranged from **42.5 to 186.3 per 100,000 population-years**, a **4.4-fold variation**. Among the Health Regions, the number of hospitalizations varied from **26.2 to 568.7 per 100,000 inhabitants-year**, a **21.7-fold variation**;
- Among the Federative Units, the number of hospitalizations for the treatment of heart failure, standardized by age and adjusted for supplementary health plan coverage, ranged from **48.9 to 238.5 per 100,000 population-years**, a **4.9-fold variation**. Among the Health Regions, the number of hospitalizations varied from **25.9 to 565.7 per 100,000 inhabitants-year**, a **21.9-fold variation**.

Possible reasons for the observed variation:

- Differences in access to effective and coordinated care at the level of primary and secondary care and to medications across geographic regions;
- Variation in medical practice with demonstrated gaps in prescribing evidence-based therapies [2];
- Variations in etiology across geographic regions.

Opportunities to improve Value in Healthcare

- Strengthening primary care programs, such as the Family Health Program, with the creation of a heart failure care pathway that includes education and detection on risk factors for HF, early detection and treatment of HF, and monitoring and coordination of care for these patients;
- Sanitary actions are also essential to prevent contamination by *Trypanosoma cruzi*. It is essential to identify the social determinants of health and connect patients to available community resources;
- The multidisciplinary primary care team plays a fundamental role in controlling HF and, consequently, in reducing the risk of hospitalization through integrated and evidence-based action, education and patient engagement in self-care and identification of signs of decompensation. It is also essential to monitor performance through quality metrics;
- Given the impact in terms of outcomes and costs, the inclusion of metrics related to HF care in the pay-for-performance model of Previne Brasil, the SUS Primary Care financing program, can stimulate the improvement of quality6. In addition, the creation of incentives to stimulate the implementation of improvement cycles, based on the results of the metrics collected, is essential.

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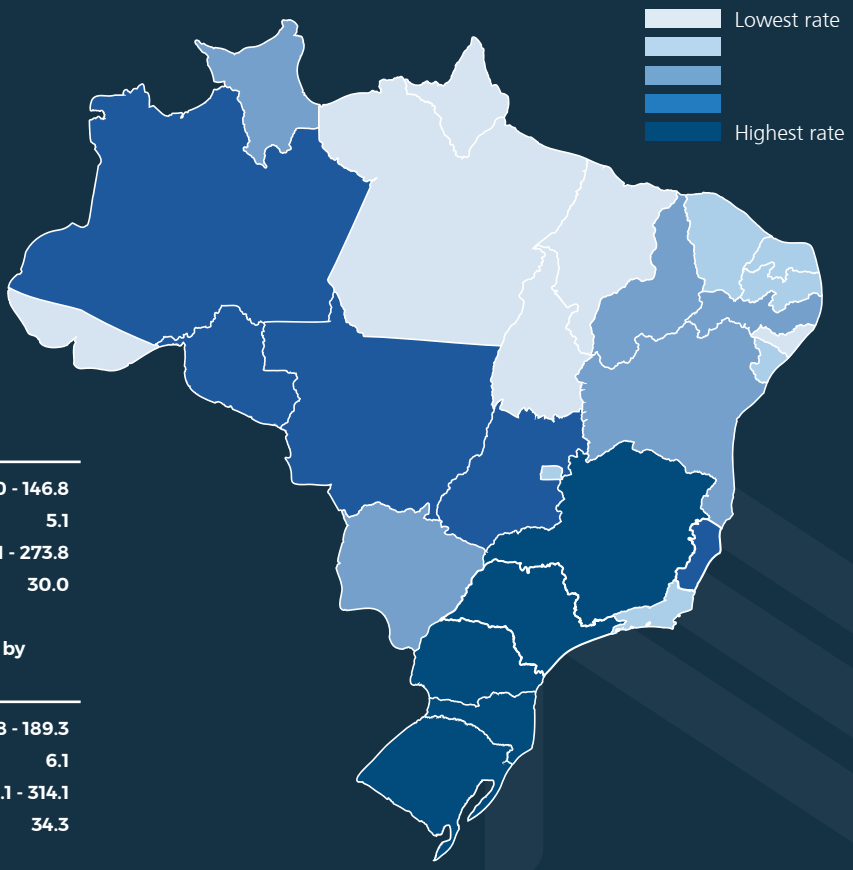
CARDIO-CEREBROVASCULAR DISEASES

Map 03: Hospitalizations for acute myocardial infarction



01 - Standardization by age (map)

Variation (FU)	29.0 - 146.8
Ratio (FU)	5.1
Variation (Health Region)	9.1 - 273.8
Ratio (Health Region)	30.0

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	30.8 - 189.3
Ratio (FU)	6.1
Variation (Health Region)	9.1 - 314.1
Ratio (Health Region)	34.3

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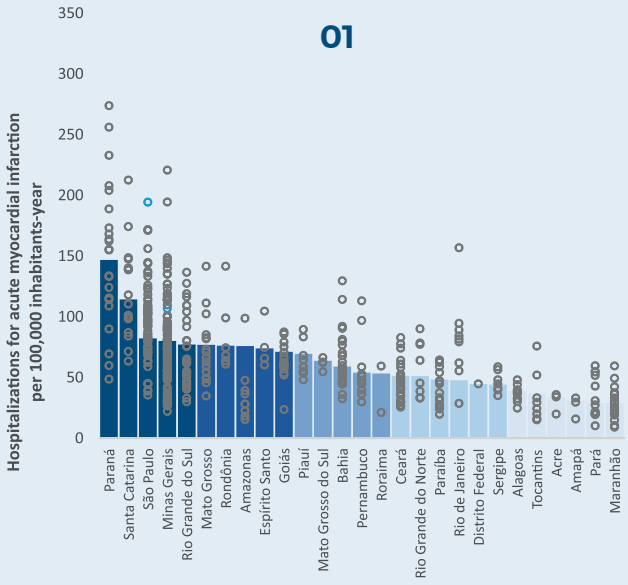

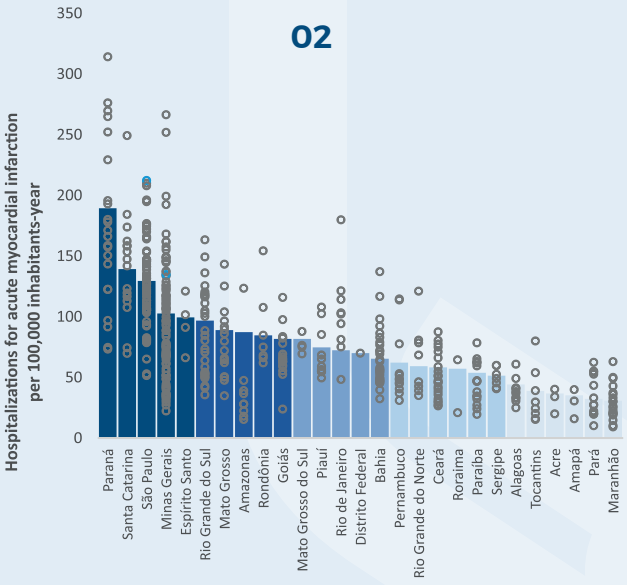

Context

Acute myocardial infarction (AMI), also known as 'heart attack', is the leading cause of death in the world and in Brazil[1]. It is caused by a sudden obstruction to the flow of blood within one of the coronary arteries, which are the vessels that nourish the heart muscle (myocardium), causing death of cells in the affected region, compromising heart function, arrhythmias and sudden death.

The risk factors for AMI are mostly modifiable by lifestyle changes and drugs of proven effectiveness. The main cause of coronary obstruction is atherosclerosis, in which the fat accumulated in the walls of the arteries forms plaques that can rupture and lead to the formation of clots that block the passage of blood causing the heart attack. Rarer causes include prolonged coronary spasm caused by drugs such as cocaine and amphetamine, intense emotional stress, smoking, cold exposure, and exercise.

A study carried out to assess the costs of heart disease in Brazil showed that, in 2015, AMI was the condition that had the greatest financial impact on the health system (US$ 4.7 billion), followed by heart failure (US$ 4.6 billion), hypertension (US$ 1.7 billion) and atrial fibrillation (US$ 812 million)[2].

Magnitude of variation

- Among the Federative Units, the number of hospitalizations for AMI treatment, standardized by age, ranged from **29.0 to 146.8 per 100,000 population-years**, a **5.1-fold variation**. Among the Health Regions, the number of hospitalizations ranged from **9.1 to 273.8 per 100,000 population-years,** a **30-fold variation**;
- Among the Federative Units, the number of hospitalizations for AMI treatment, standardized by age and adjusted for supplementary health plan coverage, ranged from **30.8 to 189.3 per 100,000 population-years**, a **6.1-fold variation**. Among the Health Regions, the number of hospitalizations varied from **9.1 to 314.1 per 100,000 inhabitants-year**, a **34.3-fold variation**.

Possible reasons for the observed variation:

- Differences between geographic regions, in relation to population characteristics, such as gender and adoption of healthier lifestyle habits, among others;
- Differences in access to preventive and coordinated care at the level of primary and secondary care and to medicines across geographic regions;
- Variation in medical practice with demonstrated gaps in prescribing evidence-based therapies.

Opportunities to improve Value in Healthcare

- The role of primary care is fundamental in identifying people at greater risk, in educating and prescribing measures to prevent and control risk factors such as high blood pressure, diabetes, cholesterol, obesity and smoking;
- It is essential to educate the population about the adoption of a healthier lifestyle and encourage the creation of community programs that favor access to healthy food, safe physical activity and prescription drugs;
- The creation of a national system for recording and systematically monitoring quality metrics and outcomes linked to the creation of incentives for good practice and the implementation of improvement cycles designed based on observed results, can help to create a more transparent and learning system. continuous, reducing variation in practice across geographic regions.

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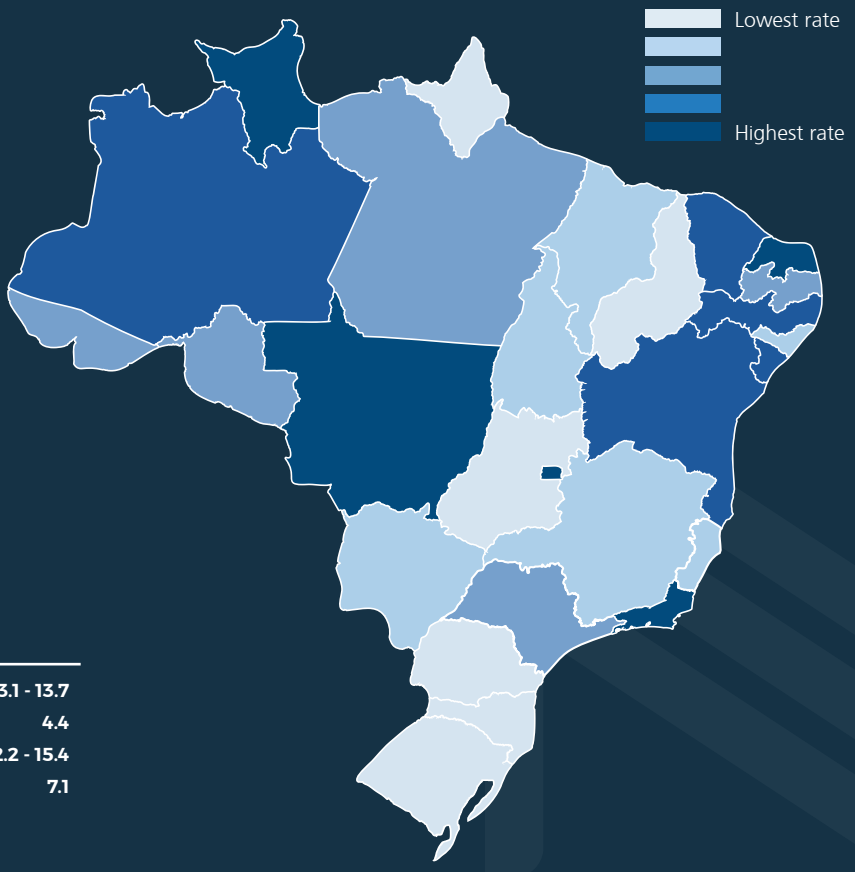
CARDIO-CEREBROVASCULAR DISEASES

Map 04: Length of hospital stay for acute myocardial infarction



Variation (UF)	3.1 - 13.7
Ratio (UF)	4.4
Variation (Health Region)	2.2 - 15.4
Ratio (Health Region)	7.1

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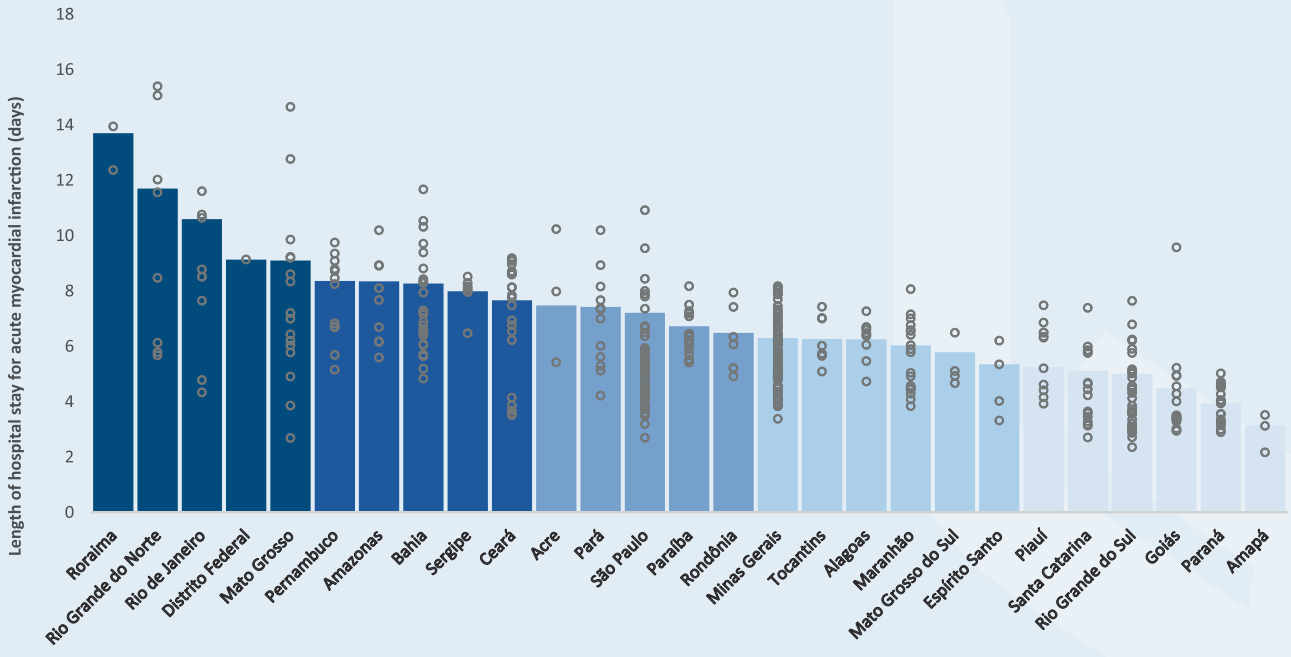

Context

The duration of hospitalization for AMI, also called 'length of hospital stay', is one of the metrics used to assess the clinical efficiency of health services, because in addition to the clinical complexity of each case, inefficiencies in the care process can increase the length of stay and lead to waste and increase in the cost of treatment. There is evidence that hospitalizations for AMI that occur on Fridays, in the afternoon or evening, and delays in accessing cardiac catheterization are related to a significant increase in the length of hospital stay[1].
A study carried out with data from DATASUS showed that, from 2010 to 2019, the length of stay of patients with AMI treated with primary angioplasty, that is, with artery clearance using a balloon catheter, was 36% shorter (5.3 days vs. 8.3 days)[2].

Magnitude of variation

- Among the Federative Units, the length of hospital stay for AMI ranged from **3.1% to 13.7 days**, a **4.4-fold variation**;
- Among the Health Regions, length of hospital stay varied from **2.2% to 15.4 days**, a **7.1-fold variation**.

Possible reasons for the observed variation:

- Variation in medical practice related to gaps in adherence to prescribing evidence-based therapies across geographic regions;
- Variation in timely access to the resources necessary for the effective resolution of the case, such as the Cath Lab service;
- Differences in relation to the risk profile of patients, including age, gender, co-morbidities, social determinants of health, among others.

Opportunities to improve Value in Healthcare

- To educate the population about the warning signs of AMI to reduce the time between the onset of symptoms and the search for medical care;
- Ensuring rapid and effective access to health services that provide reperfusion therapy in the acute phase of AMI, including pre-hospital care;
- Creating a care flow that allows hospitalized patients with AMI to have access to the necessary resources regardless of the day of the week or time of care;
- The creation of a national system for recording and systematically monitoring quality metrics and outcomes, linked to the creation of incentives for good practice and the implementation of improvement cycles designed based on observed results, which can help to create a more transparent and continuous learning system, reducing variation in practice across geographic regions.

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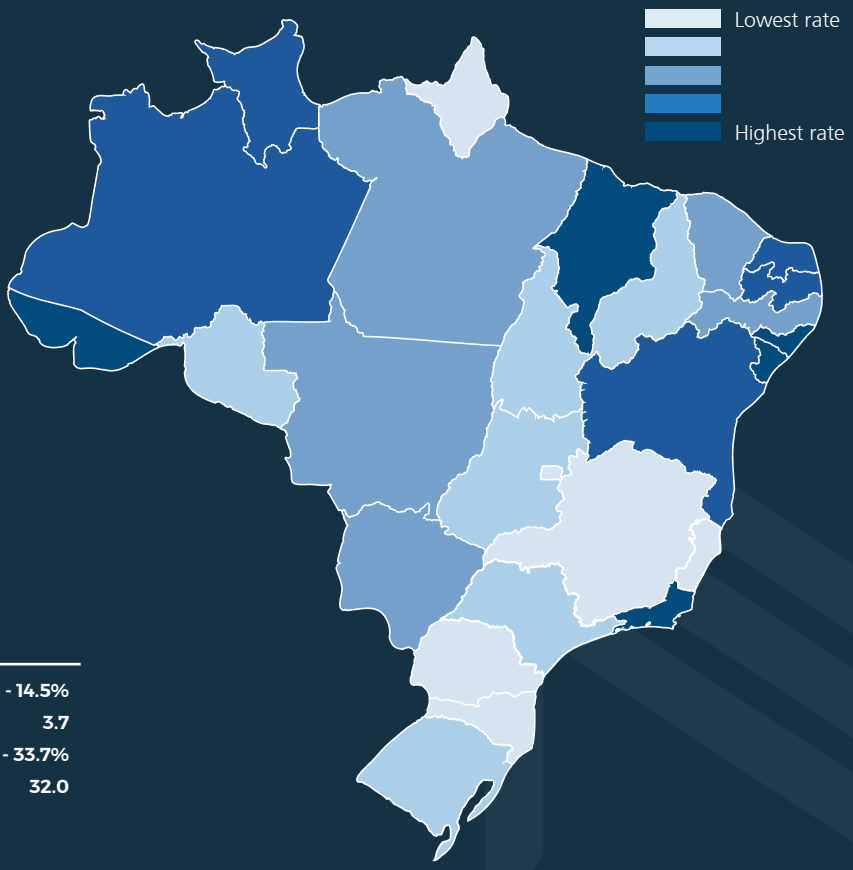
CARDIO-CEREBROVASCULAR DISEASES

Map 05: Case-fatality rate for acute myocardial infarction



Variation (UF)	**3.9% - 14.5%**
Ratio (UF)	**3.7**
Variation (Health Region)	**1.1% - 33.7%**
Ratio (Health Region)	**32.0**

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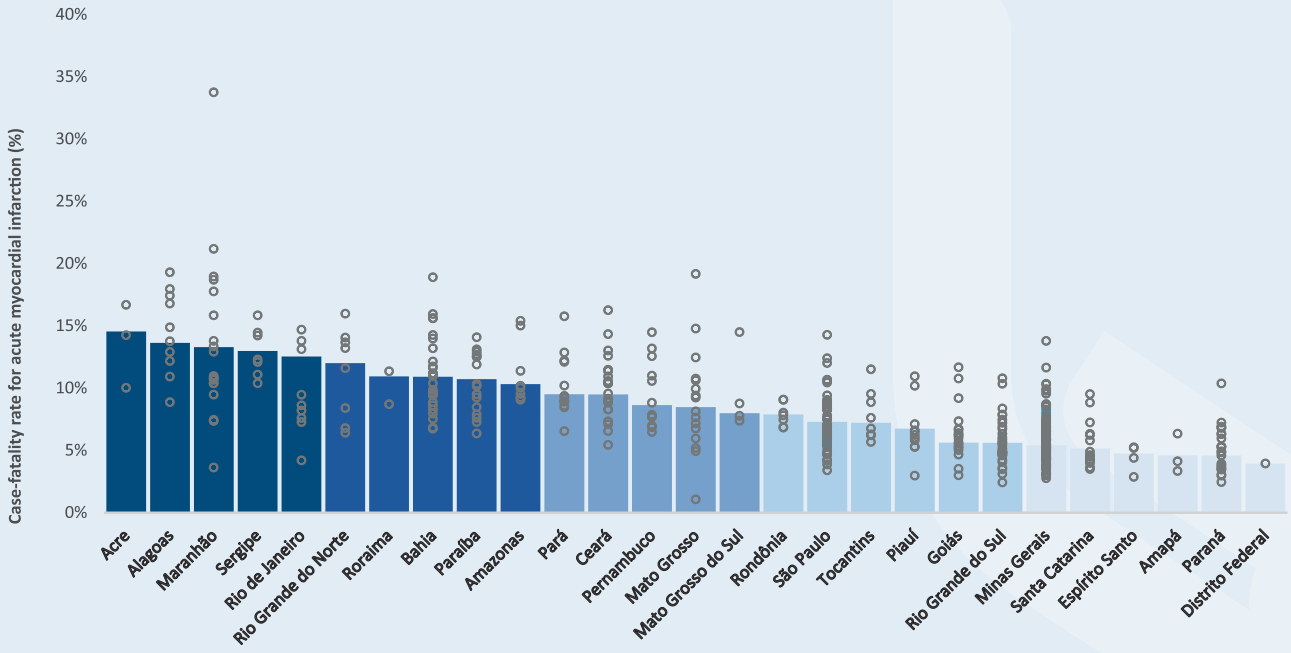

ACADEMIA VBHC

Context

Despite advances in the treatment of AMI that have taken place in recent decades, there are still large disparities in the access and quality of AMI treatment among Brazilian regions[1], that impact patients outcomes.
The AMI case-fatality rate is a measure that ultimately measures the outcome and quality of care provided. In Brazil, in people over 45 years of age, the average case-fatality rate is 13.3%, higher than the average in Latin America (10.6%) and OECD countries (6.9%)[2].

Magnitude of variation

- Among the Federative Units, AMI case-fatality rate ranged from **3.9% to 14.5%**, a **3.7-fold variation**;
- Among Health Regions, AMI case-fatality rate ranged from **1.1% to 33.7%**, a **32-fold variation**.

Possible reasons for the observed variation:

- Disparities in access to reperfusion therapy, including primary angioplasty and fibrinolysis, across geographic regions;
- Variation in medical practice with demonstrated gaps in adherence to prescribing evidence-based therapies across geographic regions (BRACE Registry)[1];
- Differences in the risk profile of patients, including age, gender, co-morbidities, social determinants of health, etc.

Opportunities to improve Value in Healthcare

- Risk factors for AMI are mostly modifiable by lifestyle changes and drugs of proven effectiveness. The role of primary care is fundamental in identifying people at greater risk, in educating and prescribing measures to control risk factors such as arterial hypertension, diabetes, cholesterol, obesity and smoking;
- To educate the population about the warning signs of AMI in order to reduce the time between the onset of symptoms and the search for medical care;
- To ensure rapid and effective access to health services that provide reperfusion therapy in the acute phase of AMI, including pre-hospital care;
- The creation of a national system for recording and systematically monitoring quality metrics and outcomes, linked to the creation of incentives for good practice and the implementation of improvement cycles designed based on observed results, can help to create a more transparent and learning system. continuous, reducing variation in practice across geographic regions.

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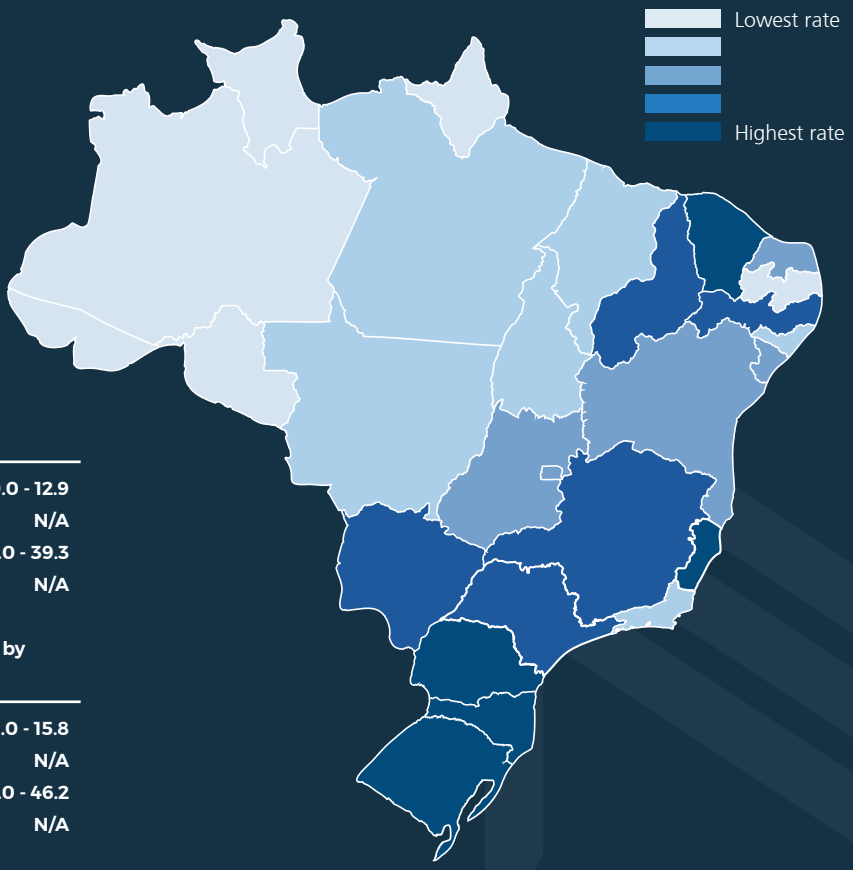
CARDIO-CEREBROVASCULAR DISEASES

Map 06: Primary coronary angioplasty for the treatment of acute myocardial infarction



01 - Standardization by age (map)

Variation (FU)	0.0 - 12.9
Ratio (FU)	N/A
Variation (Health Region)	0.0 - 39.3
Ratio (Health Region)	N/A

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	0.0 - 15.8
Ratio (FU)	N/A
Variation (Health Region)	0.0 - 46.2
Ratio (Health Region)	N/A

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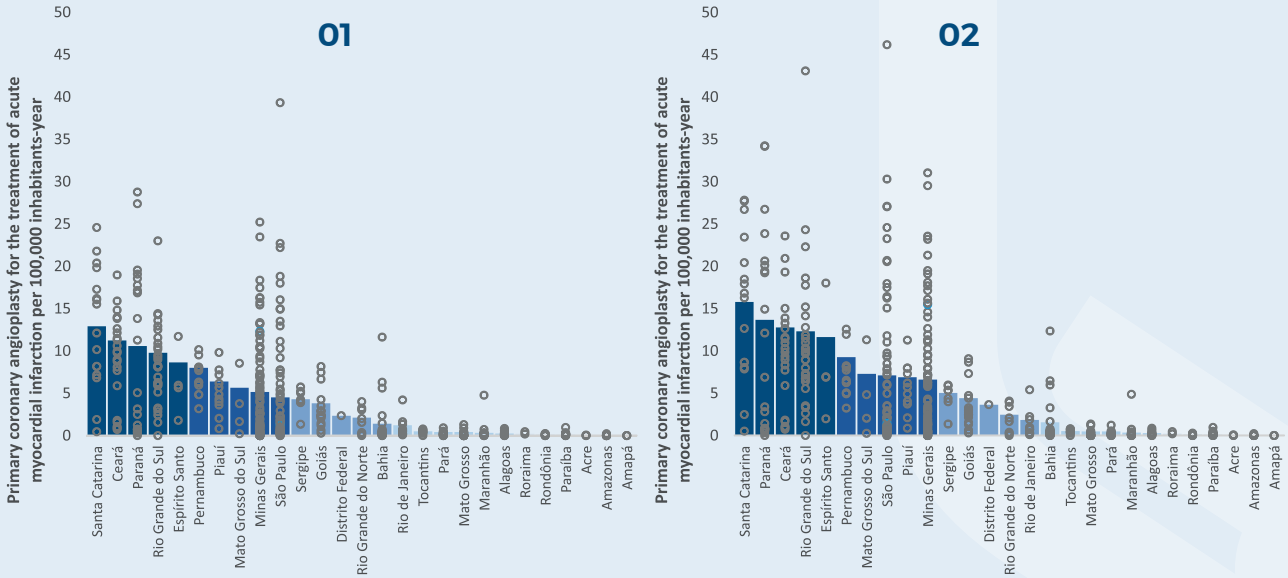

Context

Acute myocardial infarction (AMI) is caused by the obstruction of one of the coronary arteries. Time is muscle. This means that the faster the diagnosis and the clearing of the coronary artery, the less damage the heart will suffer.

When the occlusion is complete and the time from onset of symptoms is less than 12 hours, primary angioplasty is the treatment of choice. Angioplasty is performed in a catheterization laboratory and uses a balloon catheter, inserted into an artery in the arms or groin and guided into the coronary artery, where the balloon is inflated to unclog the coronary artery causing the AMI. When angioplasty is not available, the alternative is to inject a drug used to dissolve the clot, called a fibrinolytic, into a vein in the arm[1]. If the coronary occlusion is partial, primary angioplasty is not indicated and treatment is performed with drugs to stabilize the plaque and reduce oxygen consumption, with angioplasty being reserved for unstable cases[2].

Data from DATASUS showed a 40% increase in the absolute number of primary angioplasties between 2008 and 2018, from 7,648 (4.03 per 100,000 inhabitants) to 10,811 (5.19 per 100,000 inhabitants)[3]. Another study with data from DATASUS, from 2010 to 2019, showed a shorter hospital stay (-36%) and lower mortality (-53%) in patients treated with primary angioplasty[4].

Magnitude of variation

- Among the Federative Units, the number of primary angioplasties performed for the treatment of AMI, standardized by age, ranged from **0 to 12.9 per 100,000 inhabitants**. Among the Health Regions, the number of primary angioplasties ranged from **Zero to 39.3 per 100,000 inhabitants**. Due to the volume of primary angioplasty being zero in some locations, it was not possible to quantify the degree of variation;
- Among the Federative Units, the number of primary angioplasties performed for the treatment of AMI, standardized by age and adjusted for supplementary health plan coverage, ranged from **Zero to 15.8 per 100,000 inhabitants**. Among the Health Regions, this number ranged from **0 to 46.2 per 100,000 inhabitants**. Because the primary angioplasty volume is zero in some locations, it was not possible to quantify the degree of variation.

Possible reasons for the observed variation:

- Differences in the structure, organization and flow of emergency care for patients in the acute phase of myocardial infarction across geographic regions;
- Differences in the degree of awareness of patients about the warning signs of AMI that cause delay in care and loss of the 12-hour window for performing primary angioplasty;
- Differences in the clinical characteristics of patients, including the type of AMI presented.

Opportunities to improve Value in Healthcare

- Public education about the warning signs of AMI and the need to seek medical attention as soon as possible;
- Making available an integrated AMI care system including pre-hospital care, establishing reference centers for the treatment of the acute phase with evidence-based protocols and making available 24/7 cath laboratories;
- Given the impact in terms of outcomes and costs, continuous and transparent monitoring of process metrics, such as Door-Electrocardiogram Time, which measures the agility of diagnosis and Door-Balloon Time, which measures the agility to clear the artery, of outcomes and costs, and creating incentives to encourage the implementation of improvement cycles, based on the results of the metrics collected, is critical.

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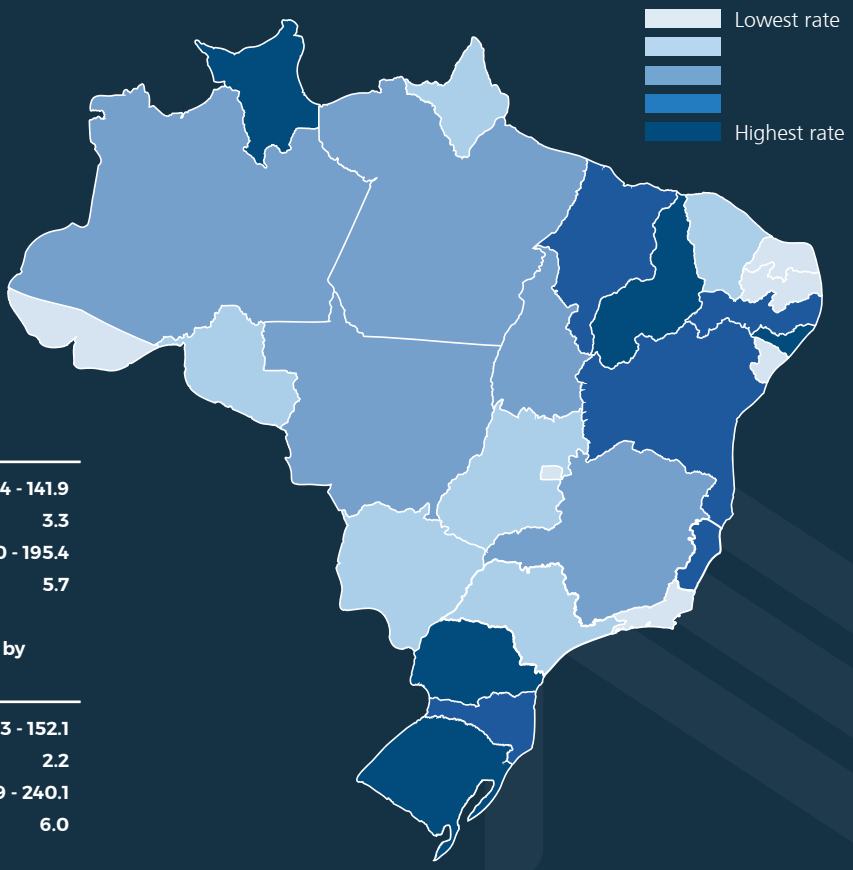
CARDIO-CEREBROVASCULAR DISEASES

Map 07: Hospitalizations for stroke



01 - Standardization by age (map)

Variation (FU)	43.4 - 141.9
Ratio (FU)	3.3
Variation (Health Region)	34.0 - 195.4
Ratio (Health Region)	5.7

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	68.3 - 152.1
Ratio (FU)	2.2
Variation (Health Region)	39.9 - 240.1
Ratio (Health Region)	6.0

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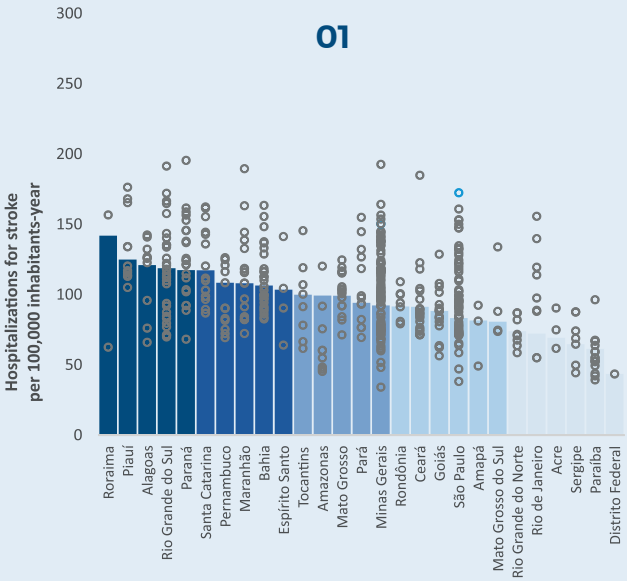

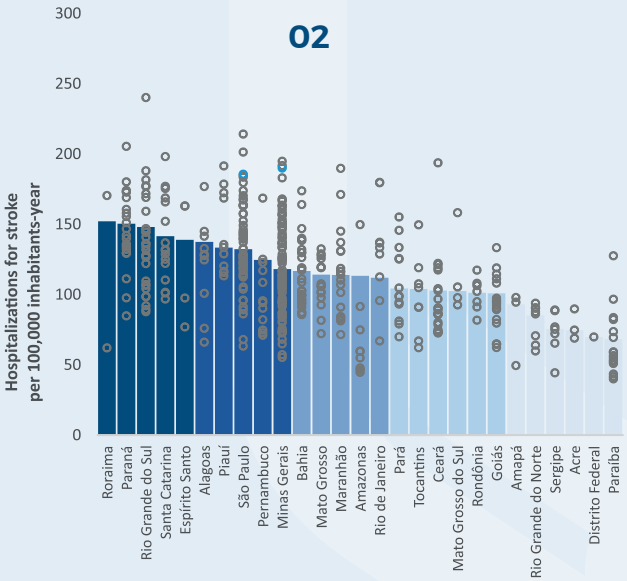

Context

Stroke is the second cause of death and disability in the world, affecting about 25% of people during their lifetime[1], leading to chronic disability in up to 50% of survivors.

The recent advances in care delivery organization for the evidence-based management of acute sroke[2] (such as admission in a Stroke Unit, intravenous thrombolysis with Alteplase, and mechanical thrombectomy for patients with large vessel occlusion), which have proven to improve survival and functionality after a stroke, unfortunately are still not fully incorporated in the majority of Brazilian hospitals.

Despite the availability of a National Policy for the Management of stroke, published in 2012[3,4], and of a Stroke Care pathway, published in 2020[5], access and availability of hospitals organized to provide effective Stroke care is still limited in Brazil, especially in the SUS. All patients with suspected stroke should be admitted quickly to the closest referral hospital, able to admit the patient in a stroke unit (SU), provide intravenous thrombolysis and mechanical thrombectomy, according to the subtype of the Stroke and individual eligibility criteria[3].

In addition to the acute-phase management, during hospital stay, the patient must be seen by an specialized multidisciplinary team that follows evidence-based protocols. An etiological investigation of stroke should be performed together with patient education, initiation of rehabilitation, prevention of clinical complications and definition of secondary prevention strategies secondary.

In Brazil, in 2020, a Stroke Care Pathway was published by the Ministry of Health, recommending that all suspected cases of stroke with onset of two symptoms less than or equal to 1 month, must be admitted to a hospital service[6]. However, stroke care is still challenged by inequities derived from insufficient education, access, quality, fragmentation of the patient journey and scarcity of data.

Magnitude of variation

- Among the Federal Units, hospitalizations for stroke treatment per 100,000 inhabitants/year varied from **43.4 to 141.9**, a **3.3-fold variation**;
- Among the Health Regions, hospitalizations for stroke treatment varied from **34.0 to 195.4**, a **5.7-fold variation**;
- Among the Federal Units, hospitalizations for stroke treatment per 100,000 inhabitants/year, adjusted for the coverage of the supplementary health plan, varied from **68.3 to 152.1**, a **2.2-fold variation**;
- Among health regions, hospitalizations for stroke treatment per 100,000 inhabitants/year, adjusted for supplemental health plan coverage, ranged from **39.9 to 240.1**, a **6-fold variation**.

Possible reasons for the observed variation:

- Variation in medical practice related to stroke management, related to lack of knowledge about the effectiveness of the implementation of evidence-based therapies across geographic regions;
- Variation in quality and access to the pre-hospital emergency care system;
- Variation of access to hospitals trained in stroke management[5] (Stroke Centers type I, II and III of the Ministry of Health);
- Differences in the incidence of stroke related to the risk profile of the population, including age, gender, co-morbidities, social determinants of health, among others.

Opportunities to improve Value in Healthcare

- Developing educational programs for the population on the symptoms and availability of stroke treatment, aiming to reduce the time between the onset of two symptoms and the search for medical care;
- Educating and training programs for health professionals on the best management of suspectbed stroke can improve consistency in management, through the dissemination of the line of care for stroke, importance of hospitalization for treatment, etiological definition, rehabilitation and secondary prophylaxis;
- Ensuring quick and effective access to hospitals capable of providing the best treatments for stroke;
- Ensure access to hospitalization in a Stroke Unit, as they represent the most effective model for the treatment of patients with acute cerebrovascular disease, significantly reducing the risk of death and disability;
- The creation of a national registry system and systematic monitoring of quality metrics, including patient outcomes, of stroke hospitalizations;
- Audit and certification of stroke centers authorized by the Ministry of Health, guaranteeing the implementation of best practices.

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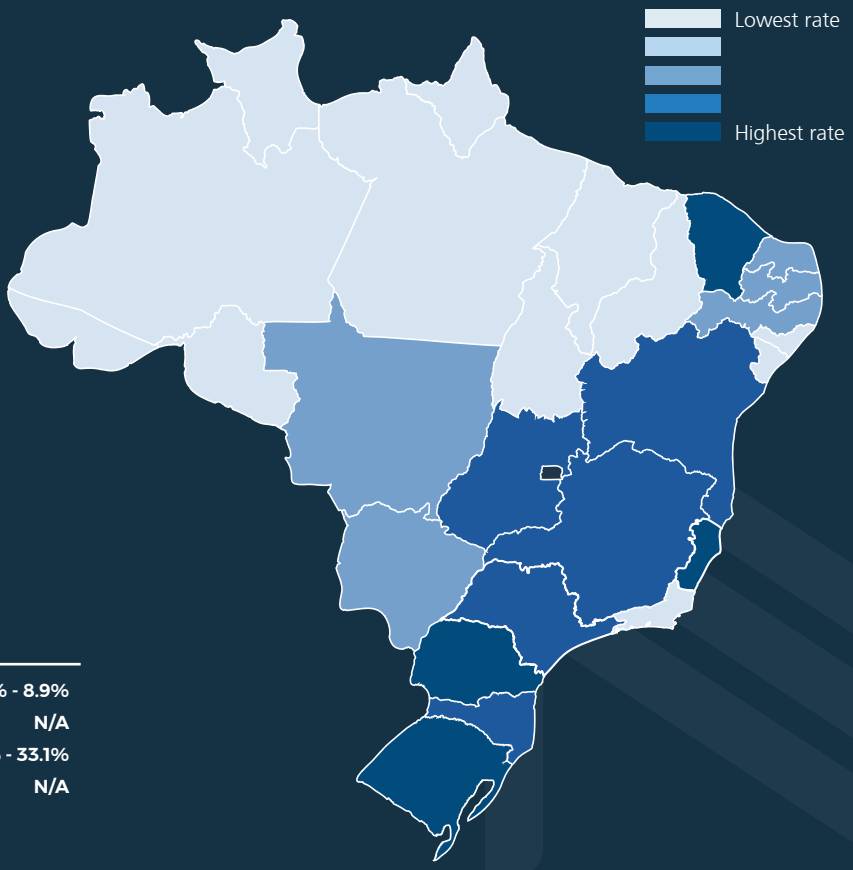
CARDIO-CEREBROVASCULAR DISEASES

Map 08: Thrombolysis for the treatment of stroke



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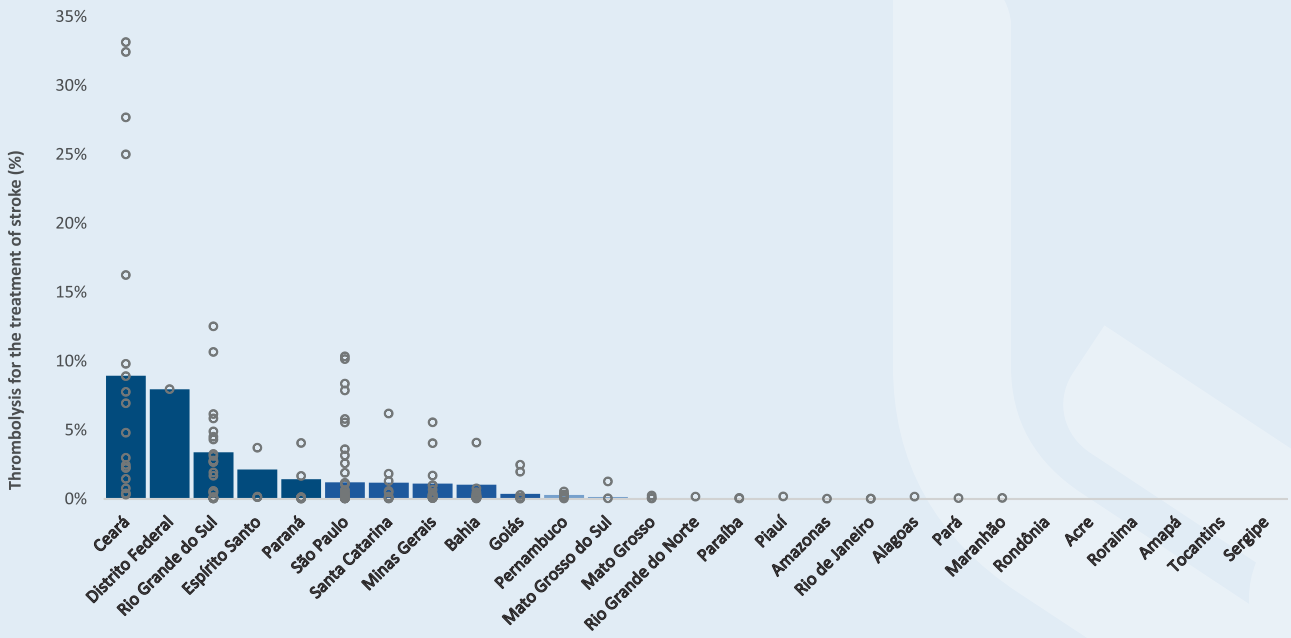
Variation (UF)	0.0% - 8.9%
Ratio (UF)	N/A
Variation (Health Region)	0.0% - 33.1%
Ratio (Health Region)	N/A



Context

Despite significant advances in stroke management in recent decades, cerebrovascular diseases remain the second leading cause of death and disability in the world, accounting for 143 million disability-adjusted life years (DALYs) annually[1].
About 80% of strokes are ischemic, and their emergency management involves hospital admission and acute-phase reperfusion therapies (intravenous thrombolysis with alteplase and mechanical thrombectomy). These therapies should be made available according to event characteristics and patient eligibility.
Intravenous thrombolysis with alteplase was the first cerebral reperfusion therapy with irrefutable scientific evidence of increased chances of better outcomes for patients with acute ischemic cerebrovascular disease[2, 3]. Therefore, alteplase must be administered within the narrow time window of 4.5 hours after the onset of stroke symptoms.
The implementation of thrombolysis requires the organization of the acute stroke care pathway, with population education, organization of the pre-hospital urgency and emergency network, access to referral hospitals for stroke and trained professionals.
In addition to the clinical benefits, the adoption of alteplase in the acute phase of ischemic stroke reduces costs to the health system, by avoiding disability and complications of immobility[4].
Some developed countries with public policies for the treatment of stroke have shown a gradual increase in the rates of administration of IV thrombolysis with alteplase. For example, in Germany about 15% of patients with acute ischemic stroke received treatment in 2016[5].
Since 2012, Brazil has had a public health policy[6] that encourages the adoption of acute-phase stroke therapy, with a differentiated compensation for stroke hospitalization and thrombolytic therapy. However, while some health regions demonstrate significant treatment rates (>33% of stroke patients receiving thrombolytic treatment), approximately 154 million people (87.6% of Health Regions) live in areas where thrombolysis is not performed or was performed in less than 1% of stroke cases.

Magnitude of variation

- Among the Federative Units, the proportion of patients with ischemic stroke who receive IV thrombolysis with alteplase ranged from **zero to 8.9%**. Due to the volume being zero in some locations, it was not possible to quantify the degree of variation;
- Across Health Regions, the proportion of ischemic stroke patients receiving IV thrombolysis with alteplase ranged from **zero to 33.1%**. Due to zero volumes in some locations, it was not possible to quantify the degree of variation.

Possible reasons for the observed variation:

- Population unawareness that acute stroke is a potentially treatable pathology;
- Variation in access to hospitals capable of managing stroke (Type I, II and III Stroke Centers of the Ministry of Health);
- Variation in access and quality of the SUS urgency and emergency network, coordinated by SAMU, for rapid hospital admission and initiation of therapy in the therapeutic window of ≤4.5 hours;
- Variation in availability of trained medical professionals for acute stroke management and implementation of alteplase therapy;
- Possible overuse influenced by the market, medical practice, training or reimbursement in some health regions.

Opportunities to improve Value in Healthcare

- Population education programs on stroke symptoms and availability of treatment can reduce the time between symptom onset and seeking medical care;
- It is necessary to organize the SUS urgency and emergency networks, directing patients with suspected stroke to the nearest Stroke Center;
- Educational programs for health professionals on the management of acute stroke;
- Telemedicine programs allowing remote access to the Stroke specialist;
- Creation of a National Stroke Registry System for rmonitoring processes and outcomes, allowing auditing on the appropriateness of thrombolytic therapy, and quality, safety and outcomes metrics.

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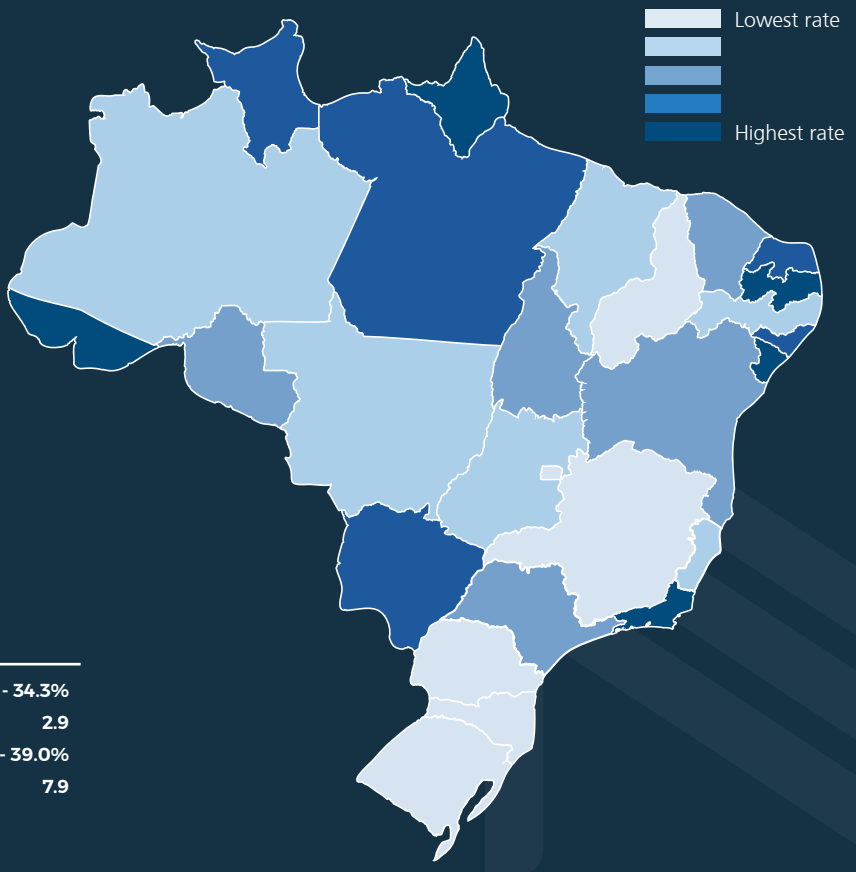
CARDIO-CEREBROVASCULAR DISEASES

Map 09: Case-fatality rate for Stroke



Variation (UF)	11.8% - 34.3%
Ratio (UF)	2.9
Variation (Health Region)	5.0% - 39.0%
Ratio (Health Region)	7.9

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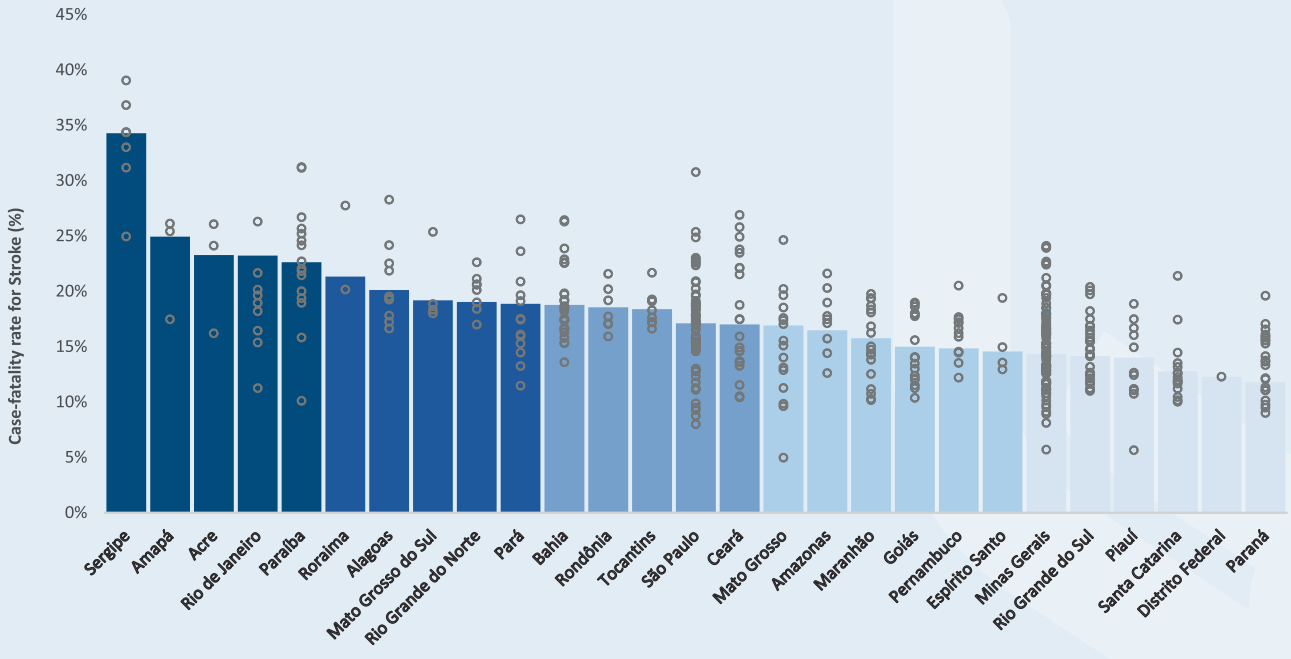

Context

Stroke is the second-leading cause of death with an annual 6,5 million fatal events worldwide. The bulk of the global stroke burden is found in developing countries and accounts for as much as 86% of all stroke deaths[1].
Stroke treatment has undergone many changes in recent decades, such as adopting stroke units, thrombolysis, and thrombectomy. These changes have been linked with a significant reduction in mortality and functional status improvement, with adequate treatment and rehabilitation.
Mortality after acute stroke varies significantly in individual patients, depending on stroke severity, stroke characteristics (location and size), the patient's comorbidities, age, and post-stroke clinical complications, mainly pneumonia, urinary tract infection, deep venous thrombosis, myocardial infarction, and congestive heart failure.
The quality of care received during hospitalization is a critical element in the prognosis of stroke patients for both survival and functional outcomes. Collaborative and standardized hospital care, carried out in services with stroke units, by a multidisciplinary team that uses evidence-based protocols promote significant impact on reducing stroke mortality[2].
In Brazil, since 2012, a National Stroke Policy, based on the organization of hospital services for evidence-based stroke management (stroke units, thrombolysis, physical therapy, and secondary prevention), has been promoted by the Ministry of Health in coordination with regional health authorities, medical societies, and healthcare professionals.
However, despite the availability of specific stroke policies in Brazil's public universal health system, significant variation exists in stroke case fatality rate.

Magnitude of Variation

- In-hospital case-fatality ranged from 11.8% to 34.3% (2.9-fold variation);
- Across health regions, case-fatality ranged from 5% to 39% (7.9-fold variation).

Possible reasons for the observed variation:

- Variation in medical practice related to stroke management, that may include a lack of knowledge about the significant effects of implementing evidence-based therapies;
- Variation in access to hospitals capable to provide effective stroke care (Type I, II and III Stroke Centers of the Ministry of Health Policy)[3];
- Variations in the availability of Stroke Units and a multiprofessional team approach for the treatment, rehabilitation and prevention of complications due to immobility;
- Differences in stroke incidence due to variations in the population risk profile, including age, gender, co-morbidities, social determinants of health, among others.

Opportunities to improve Value in Healthcare

- To implement the recommendations published by the Ministry of Health, promoting the extension of access to the Stroke National Policy, incorporating therapies based on evidence, such as reperfusion and stroke units as standard treatment;
- To expand coverage of the National Stroke Policy increasing the number of hospitals with stroke units;
- To stimulate the use of telemedicine, allowing the implementation of evidence-based care, even in rural areas where the population has challenges in accessing referral hospitals and specialized teams;
- To create a stroke national data registry to systematically monitor stroke quality data and outcomes metrics;
- Auditing and certification of stroke centers, authorized by the Ministry of Health, ensuring the implementation of the guidelines recommended by the Brazilian National Stroke Policy.

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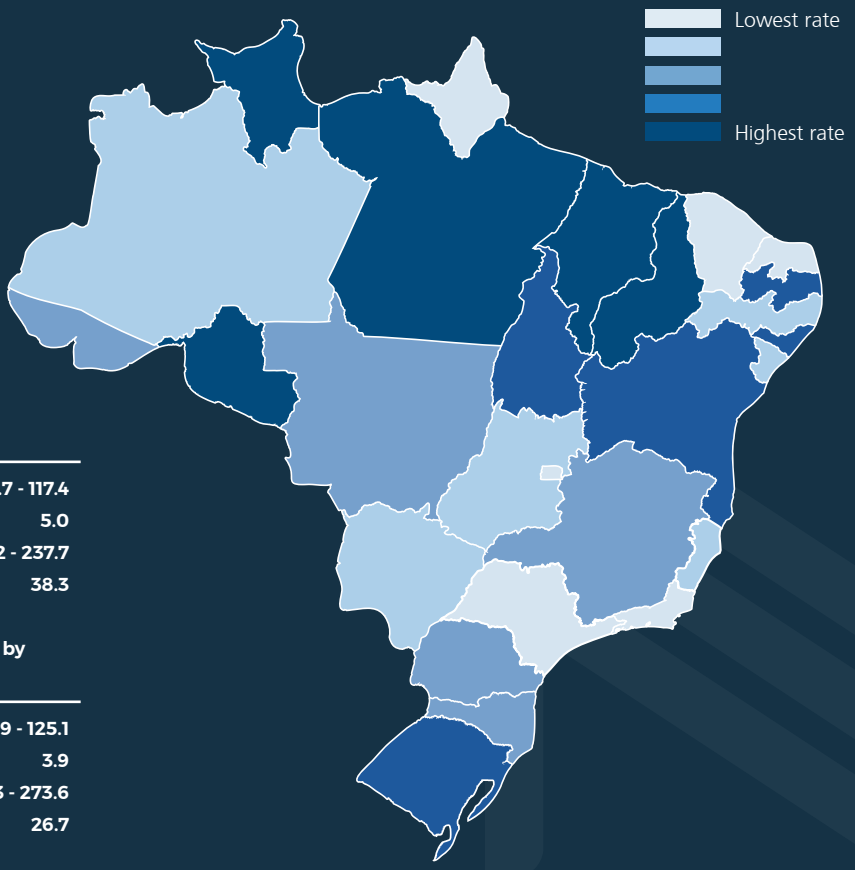
METABOLIC DISEASES

Map 10: Hospitalizations for diabetes



01 - Standardization by age (map)

Variation (FU)	23.7 - 117.4
Ratio (FU)	5.0
Variation (Health Region)	6.2 - 237.7
Ratio (Health Region)	38.3

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	31.9 - 125.1
Ratio (FU)	3.9
Variation (Health Region)	10.3 - 273.6
Ratio (Health Region)	26.7

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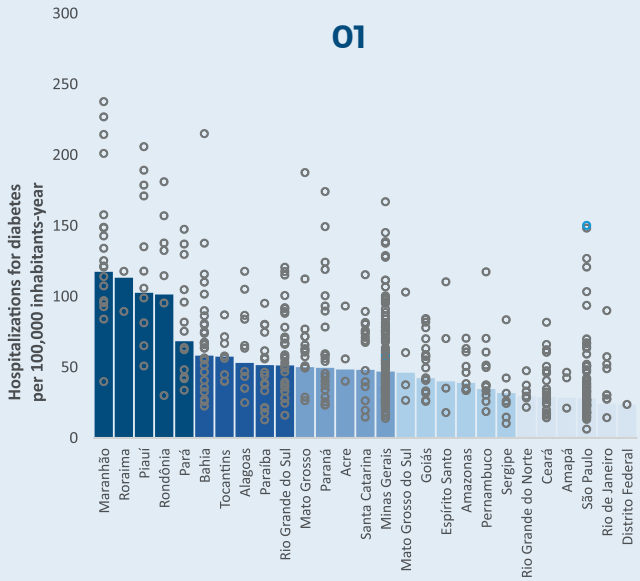

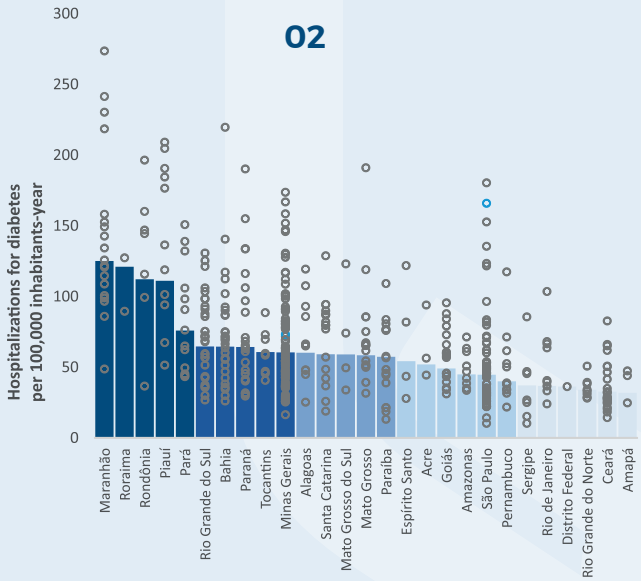

ACADEMIA VBHC

Context

Type 2 diabetes mellitus (T2DM) is a chronic metabolic condition, characterized by high and sustained levels of blood glucose, which can progress to serious complications, with high morbidity and mortality and a strong impact on the health system and society.

T2DM is a ambulatory care-sensitive condition (ACSC) and hospital admissions for hyperglycemia or hypoglycemia are generally preventable in patients who receive adequate clinical management. Studies show that effective outpatient glycemic control is associated with lower hospital admissions and readmission rates, as well as fewer emergency department visits[1,2].

For this, the person diagnosed with T2DM requires access to a comprehensive care plan, led by a multidisciplinary team, medications and continuity of care, systematically organized in search of glycemic control and prevention of complications[3].

Hospital admissions for diabetes is usually related to failure of outpatient management, with acute need for clinical stabilization, control of glycemic levels, treatment of chronic complications that require intensive care or other serious conditions unrelated to diabetes but that significantly affect its control or are complicated by diabetes.

Recommendations published in 2021 in The SUS T2DM Care Pathwayin 2021 recommend that patients with acute symptomatic hyperglycemia (random hyperglycemia ≥ 250 mg/dL, which can progress to more serious complications such as diabetic ketoacidosis and non-ketotic hyperglycemic hyperosmolar syndrome) should be referred to a Hospital Unit according to local regulation, to receive intensive medical intervention.

In the other clinical scenarios, outpatient treatment is recommended.

In this map, variations in the frequency of admissions for treatment of diabetes are analyzed, without subtype differentiation.

Magnitude of variation

- Among the Federative Units, the number of hospital admissions for the treatment of Diabetes Mellitus, standardized by age, ranged from **23.7 to 117.4 per 100,000 population-years**, a **5-fold variation**. Among the Health Regions, this number ranged from **6.2 to 237.7 per 100,000 inhabitants-year**, a **38.3-fold variation**;
- Among the Federative Units, the number of hospital admissions for the treatment of Diabetes Mellitus, standardized by age and adjusted for supplementary health plan coverage, ranged from 3**1.9 to 125.1 per 100,000 population-years**, a variation of **3.9 times**. Among the Health Regions, the number ranged from **10.3 to 273.6 per 100,000 inhabitants-year**, a **26.7-fold variation**.

Possible reasons for the observed variation:

- Disparity in access, quality of primary care and educational level of the population can vary across regions;
- There is evidence of an inverse correlation between access to primary care and hospital admission rates for T2DM, in part due to reduced access to trained outpatient teams and referral services[4];
- Regions with higher rates of hospital admissions for T2DM may harbor populations with lower socioeconomic and educational levels, making it difficult to adopt healthy lifestyle habits, control risk factors and adhere to drug therapy. Individuals with a lower income or a low level of education were more likely to have a hospitalization or emergency room visit for an acute complication of T2DM[5,6].

Opportunities to improve Value in Healthcare

- The broad adoption of public policies for the control of chronic diseases based on scientific evidence to standardize the clinical practice of multidisciplinary teams in the outpatient management of T2DM;
- Provide information systems to monitor clinical practice, glycemic control and complications of T2DM;
- Provide education for patients with Diabetes about the importance of glycemic control and options of non-pharmacological management (adoption of a healthy lifestyle);
- Ensure different population groups will have equitable access to health promotion interventions, as well as individual risk screening and effective long-term treatments.

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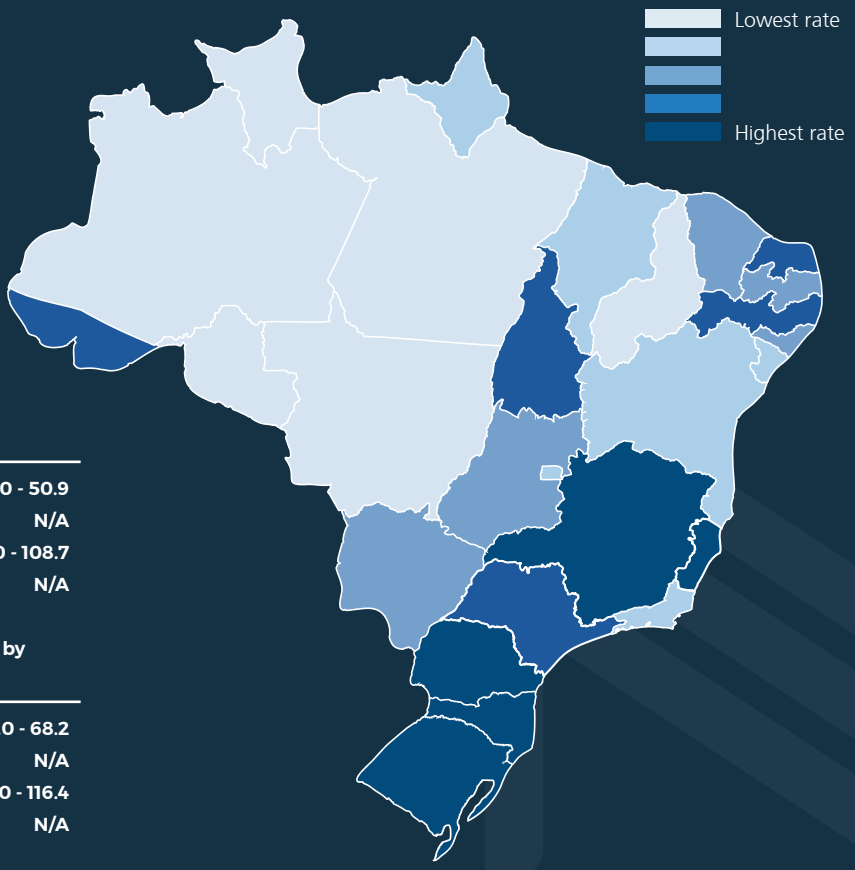
METABOLIC DISEASES

Map 11: Bariatric surgery for obesity treatment



01 - Standardization by age (map)

Variation (FU)	0.0 - 50.9
Ratio (FU)	N/A
Variation (Health Region)	0.0 - 108.7
Ratio (Health Region)	N/A

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	0.0 - 68.2
Ratio (FU)	N/A
Variation (Health Region)	0.0 - 116.4
Ratio (Health Region)	N/A

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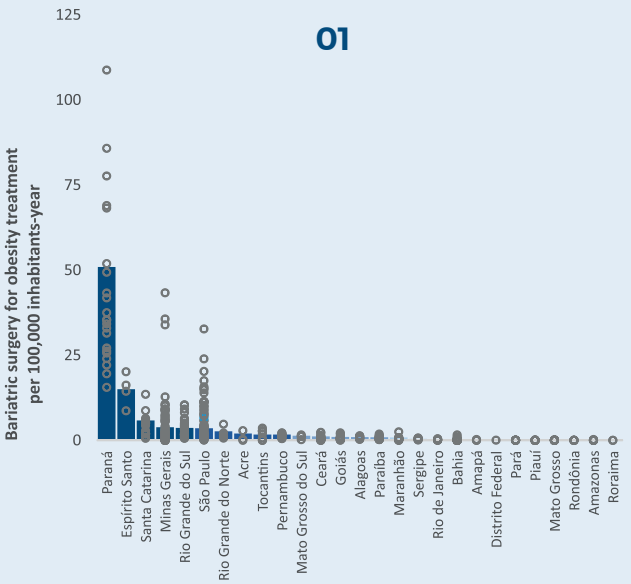

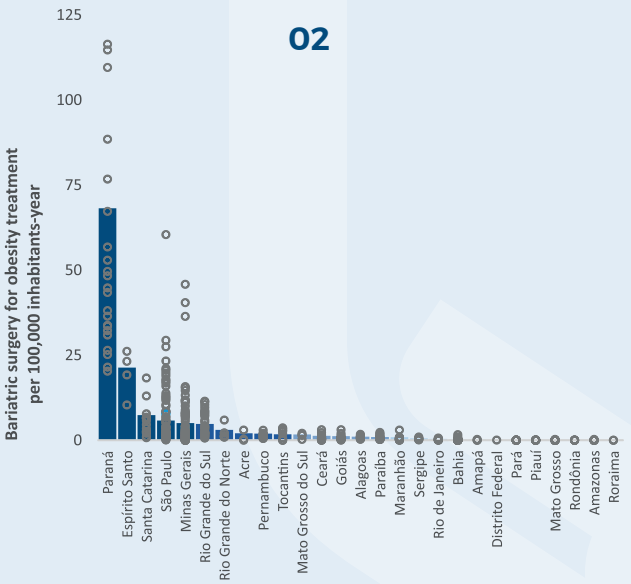

ACADEMIA VBHC

Context

Obesity is an important global health problem, with a progressive increase in its prevalence in developed and developing countries[1]. Data from the Brazilian Institute of Geography and Statistics (IBGE), published in 2019, indicate that 60.3% of the Brazilian population aged 18 years of age and over is overweight and the prevalence of obesity has increased continuously, with an acceleration of the growth rate in recent years[2].

Therapeutic management of obesity may include diet, physical exercise, behavioral therapies, pharmacological measures, and surgical interventions.

Important advances in the selection, safety and quality of care allowed bariatric surgery to be considered an effective treatment option for morbid obesity and its complications, with clinical benefits and reduced overall health costs[3]. Studies comparing different surgical techniques showed a reduction in comorbidities and an improvement in health-related quality of life for all types of procedures[4].

Despite its safety and efficacy, obesity surgery should be indicated for selected individuals and be part of a long-term care strategy, focusing on the control of risk factors, nutritional guidance and the adoption of healthy lifestyle habits.

The Brazilian Ministry of Health has defined Care pathway for the prevention and treatment of overweight and obesity as a priority. Bariatric surgery is part of the high-complexity care of individuals with obesity in the SUS[5].

Simply put, objective criteria define the indication for bariatric surgery: body mass index (BMI) > 40, regardless of the presence of comorbidities, or a BMI between 35 and 40 associated with comorbidities. The patient must be following a multidisciplinary team approach, be with a high BMI for at least 2 years, have undergone previous unsuccessful conventional treatments or weight relapse.

Despite the establishment of SUS guidelines for the use of bariatric surgery in the treatment of obesity, there seems to be an unwarranted variation in the rates of use of this intervention, with underutilization in some regions and high rates of surgical intervention in others.

Magnitude of variation

- Among the Federation Units, the rate of bariatric surgery per 100,000 inhabitants/year ranged from **zero to 50.9**. Among Health Regions, the rate of bariatric surgeries ranged from **zero to 108.7**;
- Among the Federation Units, the rate of bariatric surgery per 100,000 inhabitants/year, adjusted for supplemental health plan coverage, ranged from **zero to 68.2**. Among the health regions, the rate of bariatric surgeries ranged from **zero to 116.4**.

Possible reasons for the observed variation:

- Higher incidence of obesity and its comorbidities in different regions;
- The inequity of access to the Care Pathway for the prevention and treatment of obesity of the Health Care Network for People with Chronic Diseases;
- Lack of access to specialized hospital services with a multi-professional approach and experienced surgical teams;
- The concentration of trained health professionals and a more significant number of specialized centers in more developed regions;
- Overuse influenced by the market, medical practice, training, or reimbursement.

Opportunities to Improve Value in Healthcare

- Population education on health promotion and control of risk factors for obesity and its comorbidities;
- Encourage the implementation of reference centers for obesity in areas with less access;
- Collection and auditing of data on the relevance of the surgical indication, quality, safety, and long-term clinical outcome;
- Encourage long-term care continuity after bariatric surgery, focusing on controlling risk factors and adopting healthy lifestyle habits.

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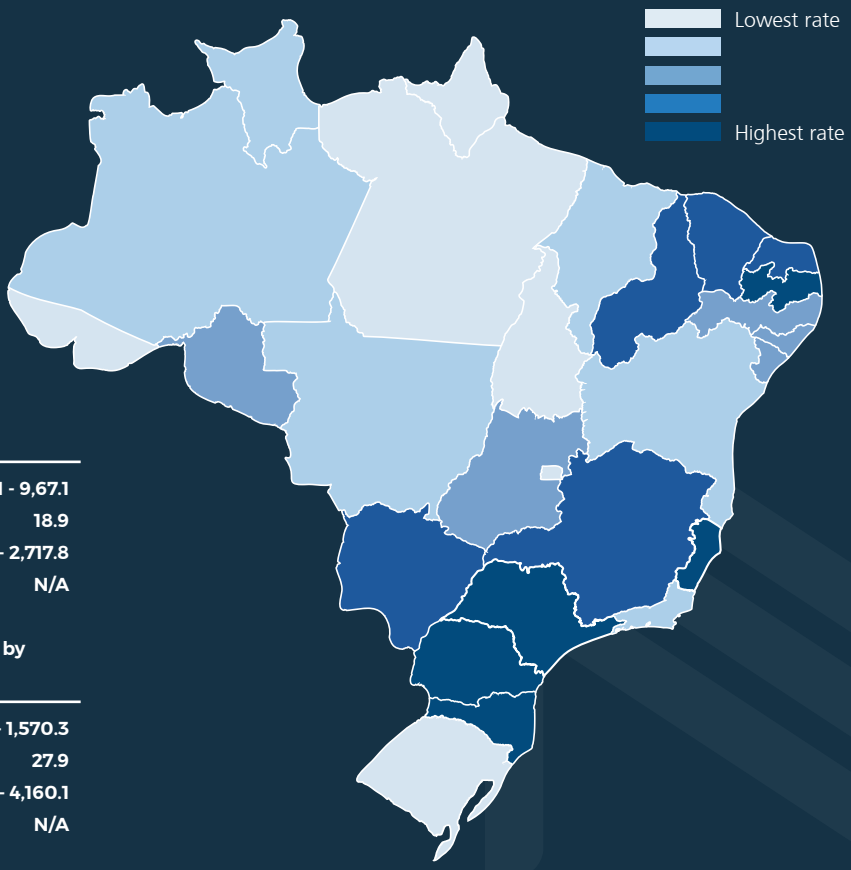
NEUROLOGICAL DISEASES

Map 12: Prescription of medication for dementia



01 - Standardization by age (map)

Variation (FU)	51.1 - 9,67.1
Ratio (FU)	18.9
Variation (Health Region)	0.0 - 2,717.8
Ratio (Health Region)	N/A

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	56,3 - 1,570.3
Ratio (FU)	27.9
Variation (Health Region)	0.0 - 4,160.1
Ratio (Health Region)	N/A

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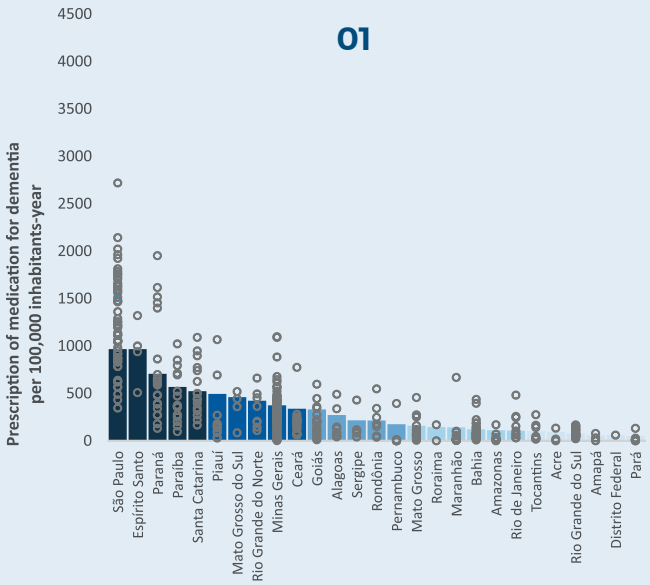

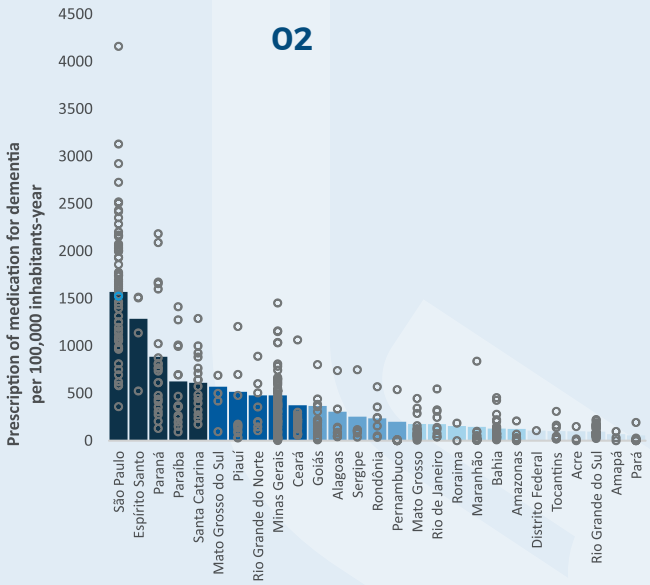

Context

Donepezil, galantamine and rivastigmine are drugs from the acetylcholinesterase inhibitor class used in the treatment of people with mild to moderate Alzheimer's disease[1].
Several scientific studies support the benefit of these medications in improving performance in activities of daily living and reducing cognitive decline. However, the absolute effect is small, so that, although statistically significant in improving certain functional metrics, the change may be insufficient to improve the quality of life of people with dementia or caregivers[2]. In contrast, non-pharmacological interventions have a greater absolute effect, with greater potential to improve the quality of life of people with dementia and caregivers[2,3]. These interventions include dyadic interventions (psychosocial activities involving the caregiver and the person with dementia), physical exercises, environmental adaptations, among others.
It is not possible to identify the ideal level of prescriptions of medication for dementia, therefore it is not clear whether the higher rates of prescriptions correspond to an overutilization of the resource, although this can occur, especially to the detriment of the use of non-pharmacological alternatives to care of people with dementia.

Magnitude of variation

- Among the Federative Units, the number of prescriptions, standardized by age, ranged from **51.1 to 9,67.1**, a **18.9-fold variation**. Among the Health Regions, the number of prescriptions varied from **zero to 2,717.8**, and it was not possible to quantify the degree of variation because some regions had a rate of zero;
- Among the Federative Units, the number of prescriptions, standardized by age and adjusted for the coverage of supplementary health plans, ranged from **56.3 to 1,570.3**, a **27.9-fold variation**. Among the Health Regions, the number of prescriptions ranged from **zero to 4,160.1**, and it is not possible to quantify the degree of variation because some regions have a rate of zero.

Possible reasons for the observed variation:

- Variation in medical practice related to different perceptions of the value of medications and other interventions for dementia;
- Variations in access to medical services for diagnosing dementia and recommending the most appropriate management strategies;
- Variations in the community's perception of dementia as a disease or natural aging process.

Opportunities to improve Value in Healthcare

- Development of integrated care networks and multiprofessional support for people with dementia and family members throughout their care cycle, including diagnosis, therapies to improve the quality of life, rehabilitation and palliative care;
- Monitoring outcomes that matter to patients and family members;
- Development of payment models that encourage practices to improve outcomes that matter to patients and families.

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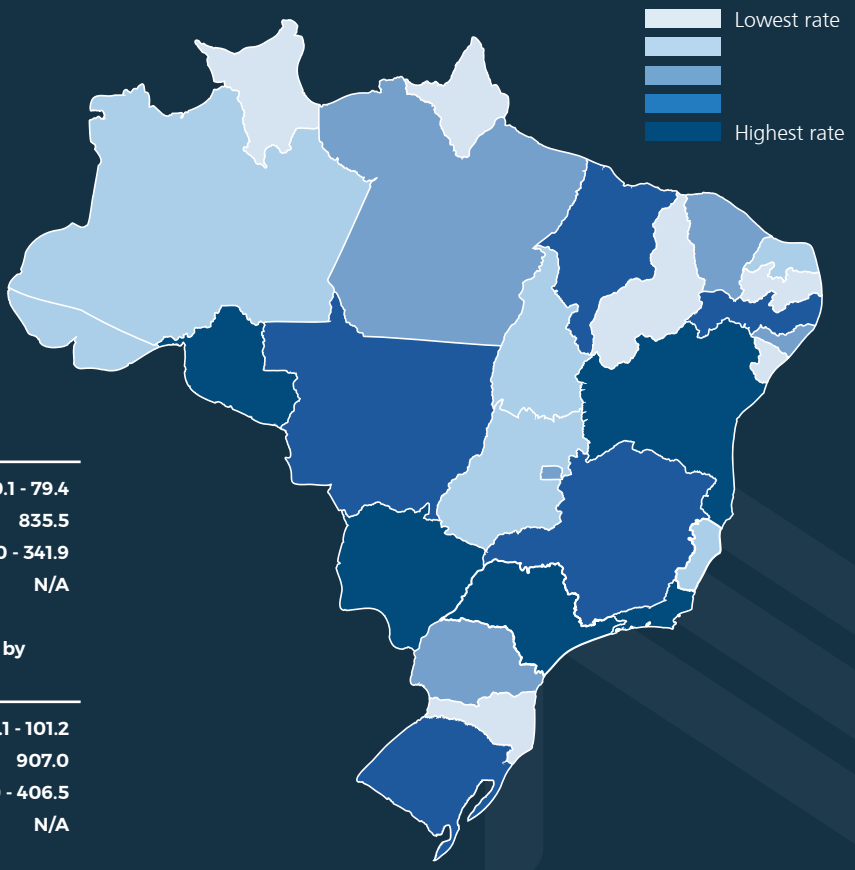
OPHTALMIC DISEASES

Map 13: Cataract Surgeries



01 - Standardization by age (map)

Variation (FU)	0.1 - 79.4
Ratio (FU)	835.5
Variation (Health Region)	0.0 - 341.9
Ratio (Health Region)	N/A

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	0.1 - 101.2
Ratio (FU)	907.0
Variation (Health Region)	0.0 - 406.5
Ratio (Health Region)	N/A

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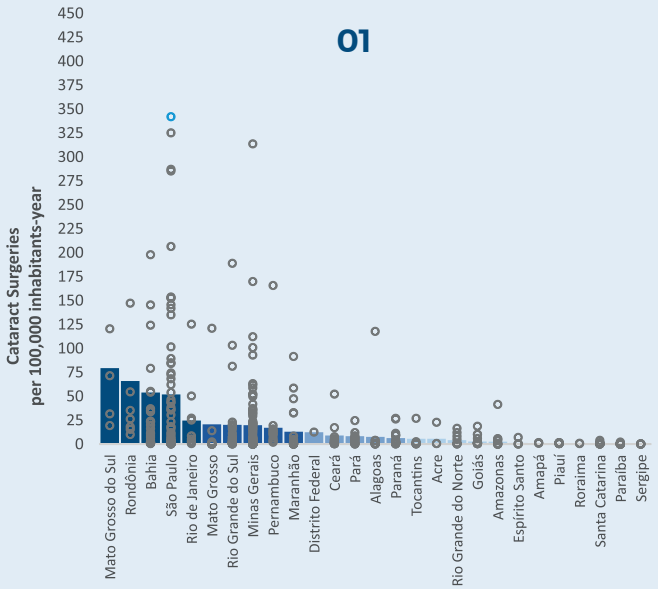

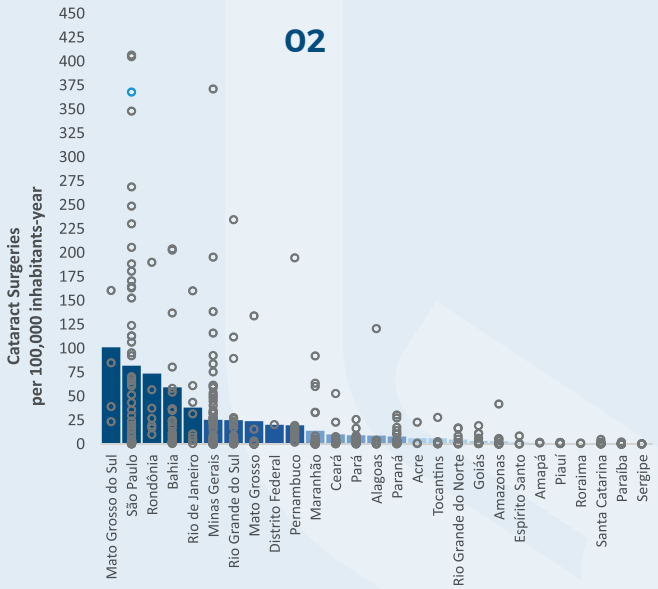

ACADEMIA VBHC

Context

Cataracts are among the leading causes of blindness in the world and result from the loss of transparency of the eye's natural lens, known as the crystalline. Senile cataract, caused by aging, is the most common form of cataract in adults, but other factors can contribute, such as diabetes and poorly controlled hypertension.
Cataract surgery with intraocular lens implant consists of replacing the lens with an artificial lens. According to a survey published by the Federal Council of Medicine in 2017, the waiting list for cataract surgery is the largest in the country, with more than 100,000 people waiting for the procedure[1], despite the existence of a national policy, called the National Policy for Attention to Ophthalmology (PNAO), established in 2008 by the Ministry of Health, with the aim of 'structuring a regionalized and hierarchical network of services, which establishes a line of comprehensive and integrated care in the management of ophthalmological diseases'[2].
The policy, however, only focuses on ensuring access to the procedure and does not mention strategies to optimize the value generated, such as ensuring 1) the relevance of care, so that only patients who actually have an indication for surgical correction have access to the procedure and 2) the measurement of outcomes, including complications and the achievement of functional improvement and quality of life for the operated.

Magnitude of variation

- Among the Federative Units, the number of hospitalizations for cataract surgery, standardized by age, ranged from **0.1 to 79.4 per 100,000 population-years**, a **835.5-fold variation**. Among Health Regions, this number ranged from **zero to 341.9 per 100,000 inhabitants-year**. It was not possible to calculate the variation due to the frequency being zero in some locations;
- Among the Federative Units, the number of hospitalizations for cataract surgery, standardized by age and adjusted for supplementary health plan coverage, ranged from **0.1 to 101.2 per 100,000 population-years**, a **907-fold variation**. Among the Health Regions, the number ranged from zero to **406.5 per 100,000 inhabitants-year**. It was not possible to calculate the variation due to the frequency being zero in some locations.

Possible reasons for the observed variation:

- Differences in access to surgery across geographic regions;
- Differences in clinical practice regarding the indication of surgery among physicians;
- Differences in the degree of visual impairment and in the patients' quality of life their perception of the benefits and risks of surgery.

Opportunities to improve Value in Healthcare

- Advance in the implementation of the PNAO with the inclusion of appropriateness of care criteria, a shared decision process and measurement of outcomes and costs in complete care cycles, aiming to ensure that cataract surgery is performed for the people most likely to benefit from it;
- Disseminate information to the population on the prevention and treatment of cataracts and provide a decision-making tool to encourage the active participation of patients in the shared decision-making process, including the benefits and risks of surgery;
- Provide information systems to monitor clinical practice in relation to the recommendations of the current good practice Guidelines, provide feedback, demand proof of improvement actions triggered by quality metrics and provide transparency to the data so that they can be used by patients and payers when choosing of the best performing providers.

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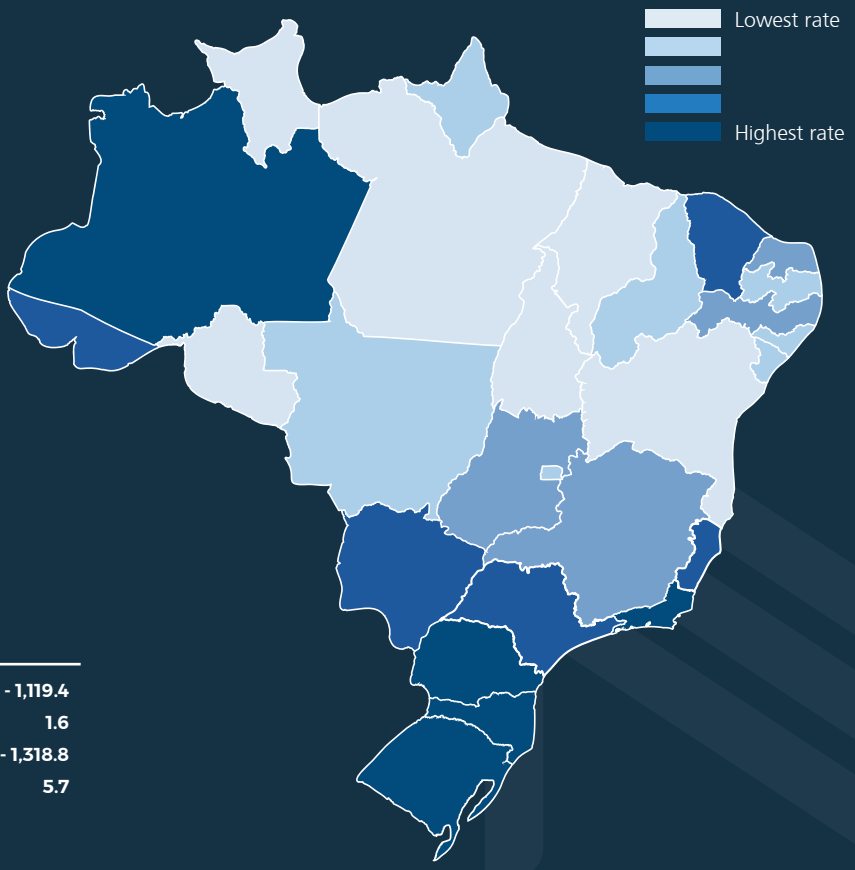
ONCOLOGICAL DISEASES

Map 14: Years of life lost due to early cancer deaths



Variation (UF)	702.4 - 1,119.4
Ratio (UF)	1.6
Variation (Health Region)	231.2 - 1,318.8
Ratio (Health Region)	5.7

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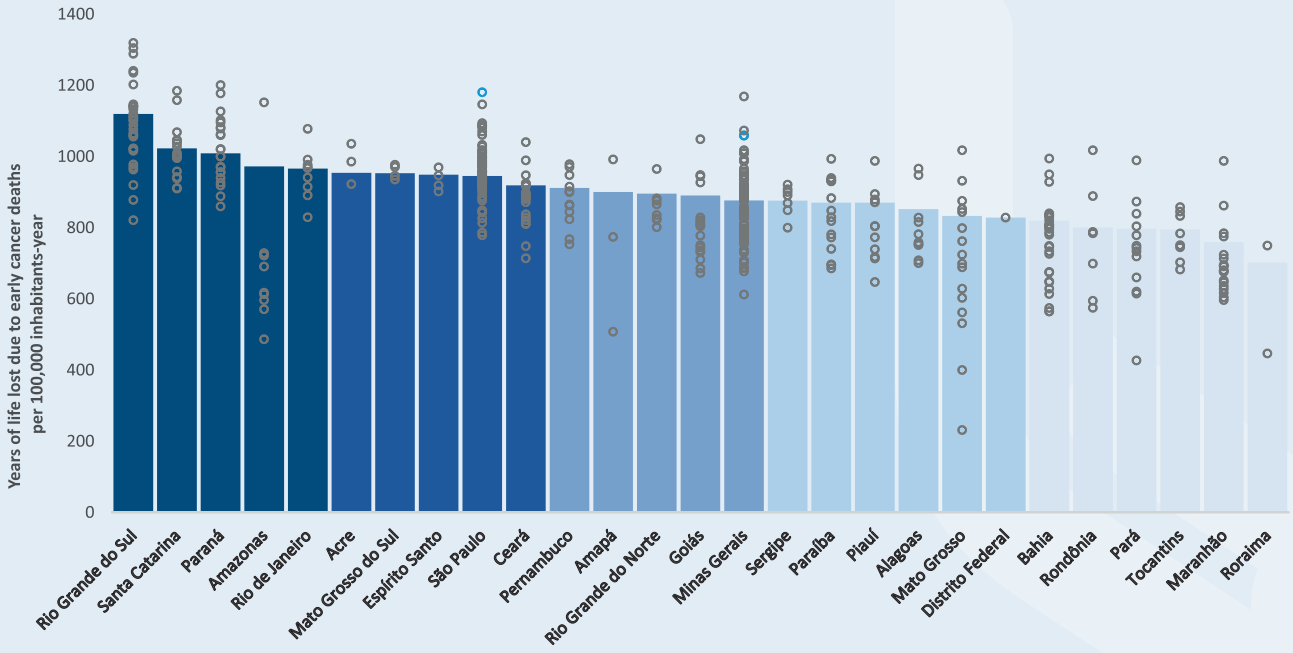

Context

Neoplasms were the second leading cause of death in Brazil between 2016 and 2019, accounting for 17.02% of the total.[1] The main causes of death, in number of deaths, are lung, colon and rectal, breast and prostate cancer.[2]
In 2019, cancer deaths accounted for 14.52% of years of life lost worldwide, a substantial increase from the 9.96% proportion observed in 1990.3 This proportional change was related to a reduction in mortality from communicable, neonatal and nutritional diseases, and not to an increase in mortality from neoplasms in general, which remained constant in the *Global Burden of Disease* study[3].
It is noteworthy that the major cause of cancer deaths in Brazil is due to neoplasms of the lung, bronchi and trachea, whose main risk factor is smoking. An increase in the prevalence of obesity may also have contributed to the increase in cancer mortality, since different types of neoplasms have their risk increased in overweight and obese people. In the United States, a 27% reduction in cancer mortality was observed between 1999 and 2019.[5] In the same period, cancer mortality in Brazil increased by 11.34%.[5]
According to the Health Surveillance Secretariat, between 2000 and 2018, mortality from malignant neoplasms increased by 44% in the North region, 67% in the Northeast region and 9% in the Midwest region, while it decreased by 8% in the Southeast region and 9% in the South region.[6]
The present analysis calculates the number of years lost due to early deaths from ICD-10 Chapter II diseases, considering a life expectancy of 70 years.

Magnitude of variation

- Among the Federative Units, the number of years of life lost due to neoplasms ranged from **702.4 to 1,119.4 per 100,000 inhabitants-year**, a variation of **1.6 times**;
- Among Health Regions, the variation was from **231.2 to 1,318.8**, a variation of **5.7 times**.

Possible reasons for the observed variation:

- Variations in lifestyle and risk factors for cancer, such as smoking, environmental and sun exposure, obesity, dietary patterns and genetics;
- Variations in access and quality of services for the treatment of neoplasms;
- Variations in access to and demand for early cancer diagnosis services, such as mammography and colposcopy;
- Variations in access to exams to confirm the diagnosis of neoplasms.

Opportunities to improve Value in Healthcare

- Reducing unwarranted variation in screening, diagnosis, and treatment of neoplasms;
- Promoting lifestyle changes to control risk factors for cancer, which is the strategy with the greatest potential to reduce the impact of the disease;
- Improve equity in access to cancer treatment, with a focus on expanding care for people living in locations further away from referral cancer centers.

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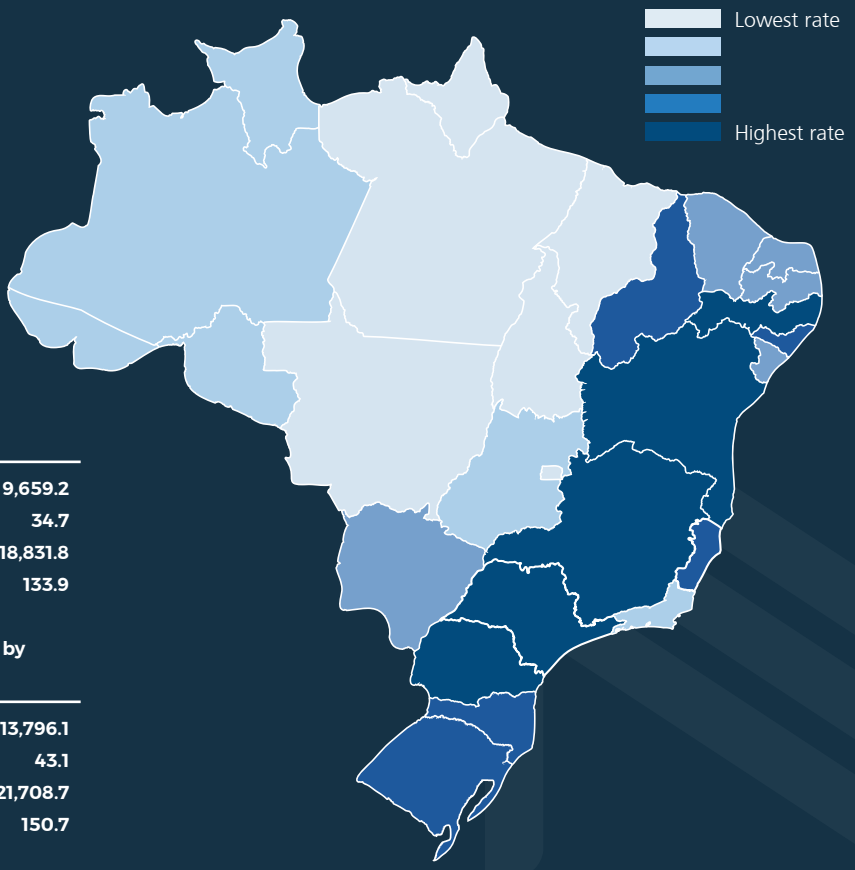
ONCOLOGICAL DISEASES

Map 15: Number of mammograms in women aged 50 to 69 years



01 - Standardization by age (map)

Variation (FU)	278,0 - 9,659.2
Ratio (FU)	34.7
Variation (Health Region)	140.7 - 18,831.8
Ratio (Health Region)	133.9

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	319.9 - 13,796.1
Ratio (FU)	43.1
Variation (Health Region)	144.1 - 21,708.7
Ratio (Health Region)	150.7

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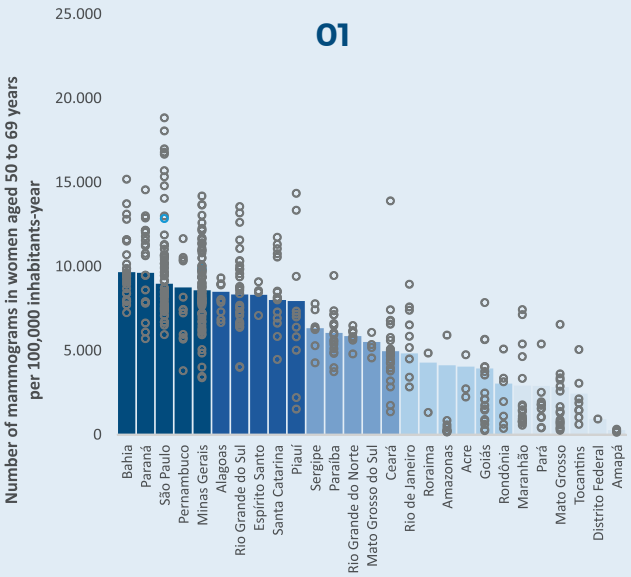

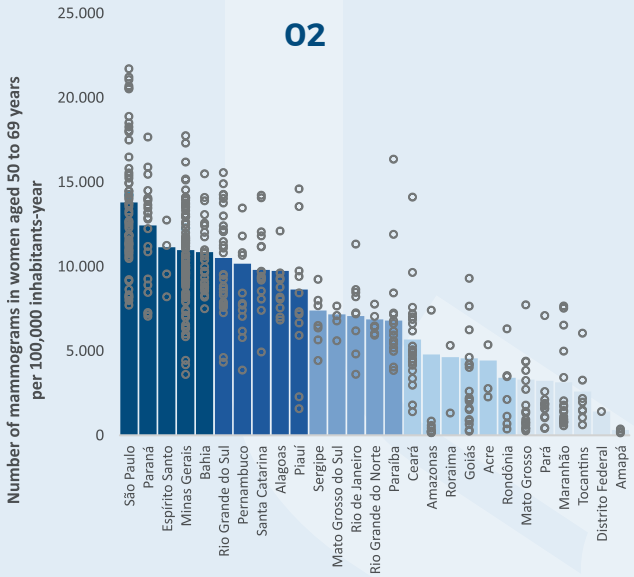

Contexto

The National Cancer Institute (INCA) estimates 317,023 potential years of life lost due to breast cancer in 2019, or 3.17 per 1000 women.[1] Late diagnosis of breast cancer is associated with a poor prognosis, while early diagnosis is related to a high probability of cure.

Periodic breast cancer screening is recommended, by various national and international societies, for women in specific age groups and with risk factors. It is estimated that screening can reduce in 20-35% the mortality of breast cancer.[2] However, there is controversy and scientific debate related to effectiveness, frequency, population group and screening methodology.

Guidelines for the early detection of breast cancer in Brazil recommend mammography as the main method of screening in women between 50 and 69 years, with biennial frequency.[3]

In this map we investigate the number of exams carried out in this age group, a way of investigating public access to the exam. Rates were significantly lower in the Amazon region, which may be related to inequities in access to mammograms.

Performing mammograms in all women with biennial attendance would result in a rate of 25,000 for every 100,000 population-years (considering that 50% are men), which is substantially above the frequency observed in all states and in most of the regions.

Magnitude of variation

- Among the Federative Units, the number of mammograms, standardized by age, ranged from **278.0 to 9,659.2** per 100,000 population-years, a **34.7-fold variation**. Among Health Regions, this number ranged from **140.7** to **18,831.8** per 100,000 inhabitants-year, a **133.9-fold variation**;
- Among the Federative Units, the number of mammograms, standardized by age and adjusted for supplementary health plan coverage, ranged from **319.9 to 13,796.1** per 100,000 population-years, a **43.1-fold variation**. Among the Health Regions, the number ranged from **144.1 to 21,708.7** per 100,000 inhabitants-year, a **150.7-fold variation**.

Possible reasons for the observed variation:

- Lack of access to mammography, or difficulty in transportation to perform the exam;
- The underutilization of the resource, observed in almost all health regions may be related to low community awareness on the need for early diagnosis;
- Different community perceptions about the benefit and discomfort tolerance of the exam;
- Different mammogram request practices among doctors.

Opportunities to improve Value in Healthcare

- Ensuring equitable access to mammograms across regions;
- Intensify health information and education to women in the age group eligible for the of the exam. Awareness campaigns can better inform the population about the benefits of mammography;
- Encouraging health professionals to follow the recommendations on ordering tests in the eligible population, especially in primary care settings.

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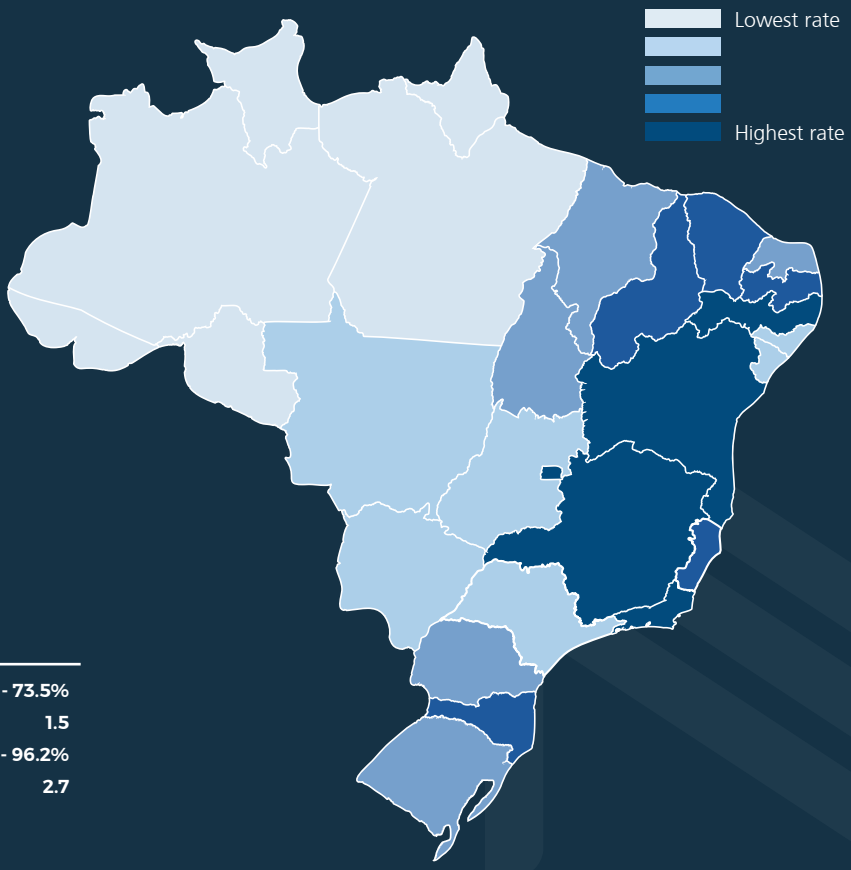
ONCOLOGICAL DISEASES

Map 16: Proportion of women aged 50 to 69 years who underwent a mammogram



Variation (UF)	48.6% - 73.5%
Ratio (UF)	1.5
Variation (Health Region)	35.1% - 96.2%
Ratio (Health Region)	2.7

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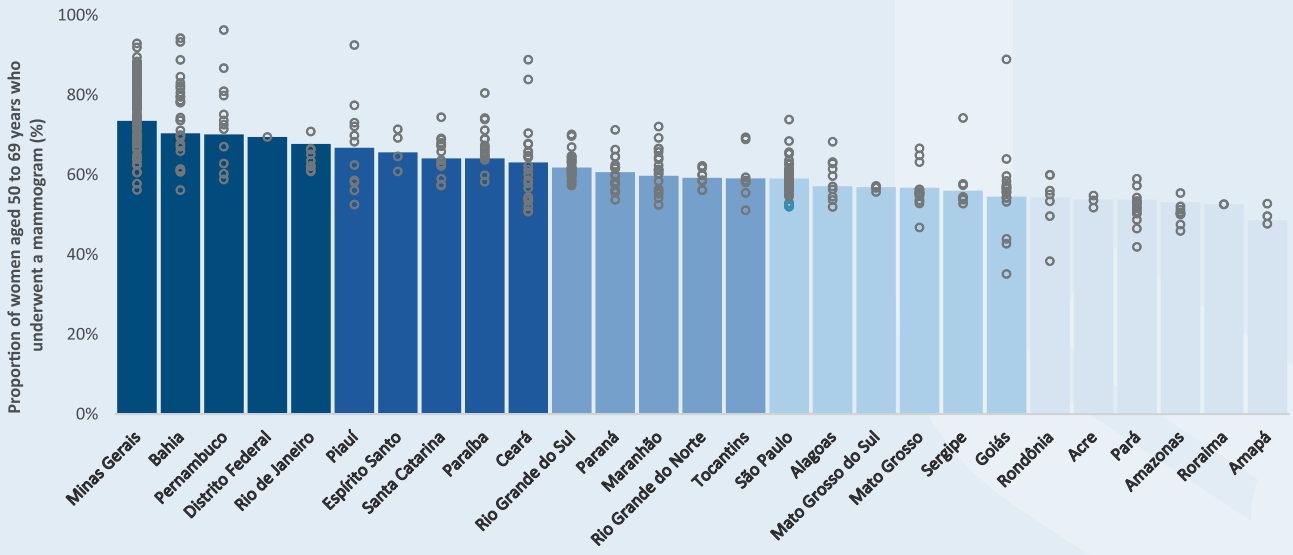

Context

The Ministry of Health Guidelines recommend performing mammography for breast cancer screening in women between 50 and 69 years old every 2 years.[1] Mammograms can also be indicated in other age specific groups, such as in genetic syndromes or in the presence of BRCA-1 or BRCA-2 gene mutation.

If performed more frequently, or with an earlier start, the Ministry of Health guidelines point out that the harm probably outweighs the benefits of screening.[1] Among the harms of overuse of mammography, overdiagnosis, overtreatment, and exposure to ionizing radiation stand out, which can induce breast cancer itself.

After performing 10 mammograms, the cumulative risk of a false positive test is between 20% and 60%,[2] being higher in younger women. False positive tests can lead to an unnecessary biopsy or surgical procedure, with negative psychological and physical effects, as well as resources wasting. There are few studies on the incidence of radiation-induced cancer, but the risk can be significant, outweighing even the benefits of mammography in younger age groups.[3]

The recommendation to perform mammograms between the ages of 50 and 69 is the most commonly found in guidelines from high-income countries, which generally recommend biennial frequency, while the English National Health Service recommends the examination every three years between 50 and 70 years.[4] It is important to highlight that there is a significant difference between the recommendation of the Ministry of Health and that of medical societies. While the Ministry of Health recommends performing between 50 and 69 years old every 2 years, medical societies recommend annually above 40 years in women with a life expectancy above 7 years.[5]

Magnitude of variation

- Among the Federative Units, the proportion of mammograms between 50 and 69 years old ranged from **48.6% to 73.5%**, a **1.5-fold variation**;
- Among Health Regions, the proportion ranged from **35.1% to 96.2%**, a **2.7-fold variation**.

Possible reasons for the observed variation:

- Variations in the medical practice in regard to screening in different age groups;
- Variations in recommendations between guidelines published by the Ministry of Health and by different medical societies.

Opportunities to improve Value in Healthcare

- Promoting scientific studies to investigate the most appropriate age and frequency for performing mammograms in women using the SUS;
- Promoting debates to enable greater agreement in the recommendation of different institutions on the recommended age for performing mammograms;
- Identifying the causes for requesting mammograms in women outside the age group recommended by the Ministry of Health.

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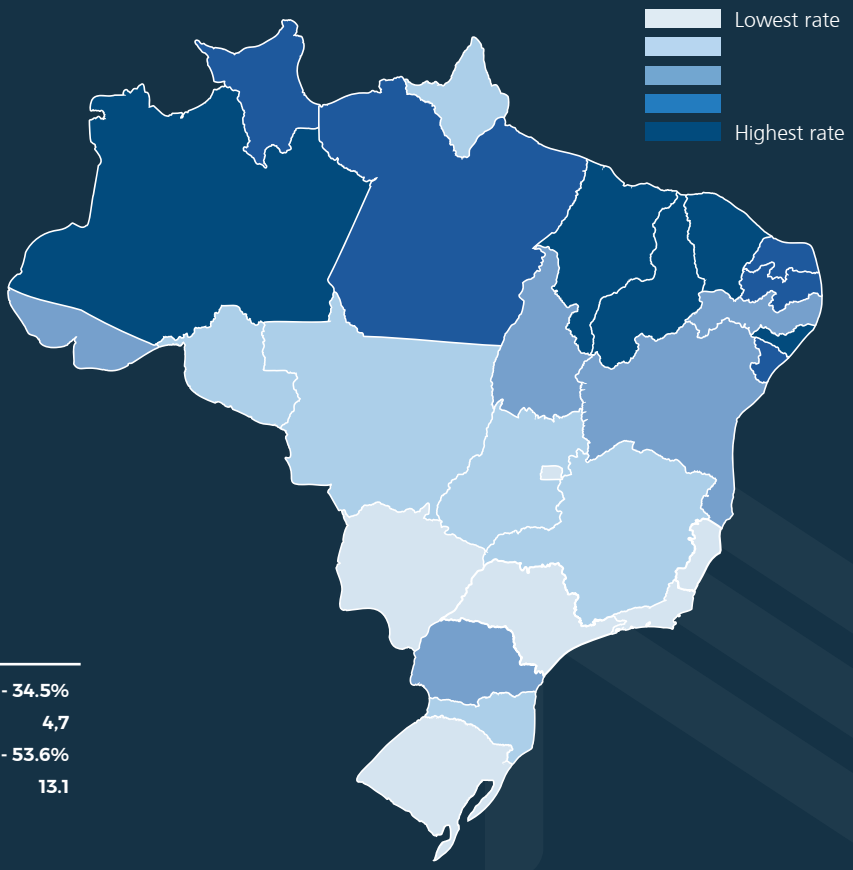
ONCOLOGICAL DISEASES

Map 17: Proportion of cancer deaths at home



Variation (UF)	**7.3% - 34.5%**
Ratio (UF)	**4,7**
Variation (Health Region)	**4.1% - 53.6%**
Ratio (Health Region)	**13.1**

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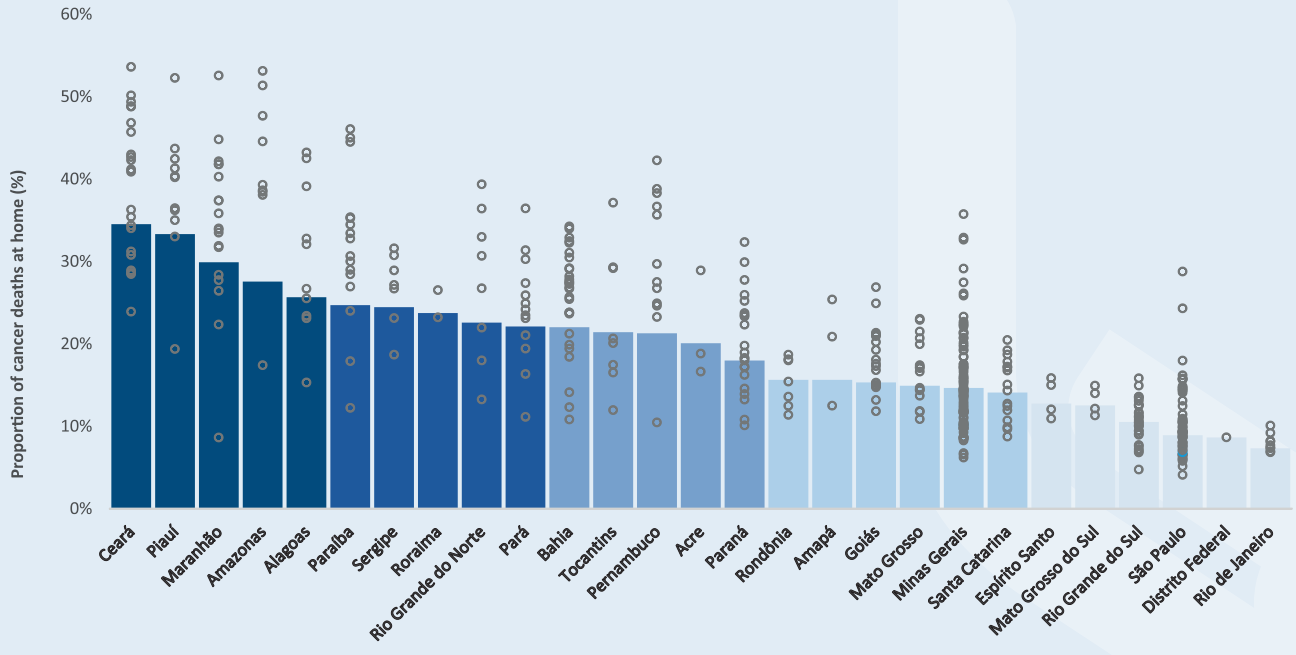

Context

The place of death can be a marker of the quality of health care received at the end of life. A study carried out in four European countries showed that the proportion of people who died at home ranged from 35% in Belgium to 50.6% in the Netherlands. On the other hand, the proportion of death at the site preferred by the patient ranged from 68% in Italy to 86% in Spain. These proportions were strongly associated with the availability of palliative care by health services[1].
In Brazil, a study that evaluated the distribution of places of death showed that, between 2002 and 2013, 66.7% of deaths occurred in hospitals, 21.4% at home and the remainder in other institutions. There was a difference between the Brazilian regions, with the highest rates of deaths at home in the Northeast (31.6%) and North (25.2%) regions and the highest rates of deaths in hospitals in the Southeast regions (72.1%), Midwest (68.4%) and South (60.0%)[2].
Despite the existence of a National Oncology Care Policy[3], approved in 2005, access to health services structured to provide palliative care is still limited in Brazil, especially in the SUS. In the 2015 Quality of Death Index Ranking, which included 80 countries, Brazil ranked 42nd. position in the global ranking, with only 0.3% of people who died having had access to palliative care[4].

Magnitude of variation

- Among the Federative Units, the proportion of cancer patients who died at home ranged from **7.3% to 34.5%**, a variation of **4.7 times**;
- Among Health Regions, the proportion ranged from **4.1% to 53.6%**, a variation of **13.1 times**.

Possible reasons for the observed variation:

- Differences in the degree of knowledge and sociocultural aspects regarding the importance of referring patients to palliative care services in a timely manner;
- Differences in the availability of palliative care services across regions;
- Differences in terms of patient access to palliative care services across regions.

Opportunities to improve Value in Healthcare

The great variation observed between regions in relation to the proportion of cancer patients who die at home needs to be better evaluated for a better understanding of their causes, since they may be related both to the overutilization of health services in some regions and to the underutilization by limited access to such resources in other.

- Investing in Palliative Care Programs that offer multiprofessional care aimed at supporting patients and caregivers, providing a shared decision model, relieving the burden of symptoms, and improving the quality of life and death of patients;
- Ensuring patients at advanced stages have access to timely palliative care programs;
- Invest in education of health professionals and the population about the importance of palliative care in order to bring about a change in culture with a focus on curative therapies for a new culture that recognizes the role of palliative care in alleviating suffering, the burden of disease and the quality of life of patients with advanced disease;
- Provide information systems to monitor clinical practice in relation to the recommendations of the current Good Practice Guidelines, provide feedback, demand proof of improvement actions triggered by quality metrics and provide transparency to the data so that they can be used by patients and payers when choosing of the best performing providers.

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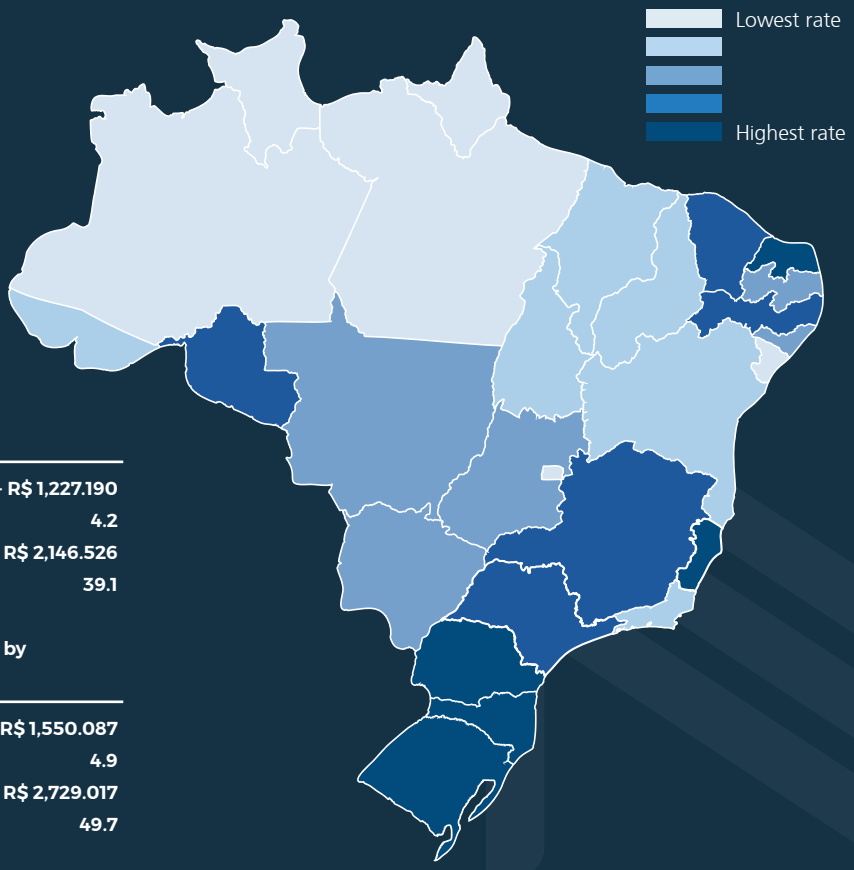
ONCOLOGICAL DISEASES

Map 18: Expenditure on chemotherapy drugs



01 - Standardization by age (map)

Variation (FU)	R$ 294,921 - R$ 1,227.190
Ratio (FU)	4.2
Variation (Health Region)	R$ 54,919 - R$ 2,146.526
Ratio (Health Region)	39.1

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	R$ 315,019 - R$ 1,550.087
Ratio (FU)	4.9
Variation (Health Region)	R$ 54,944 - R$ 2,729.017
Ratio (Health Region)	49.7

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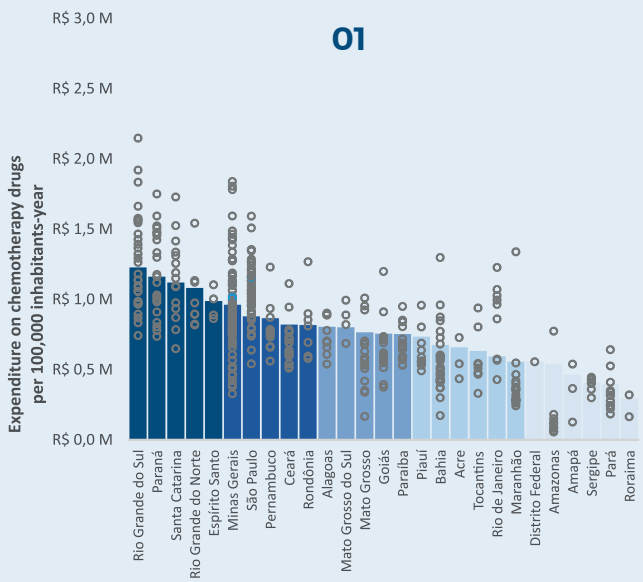

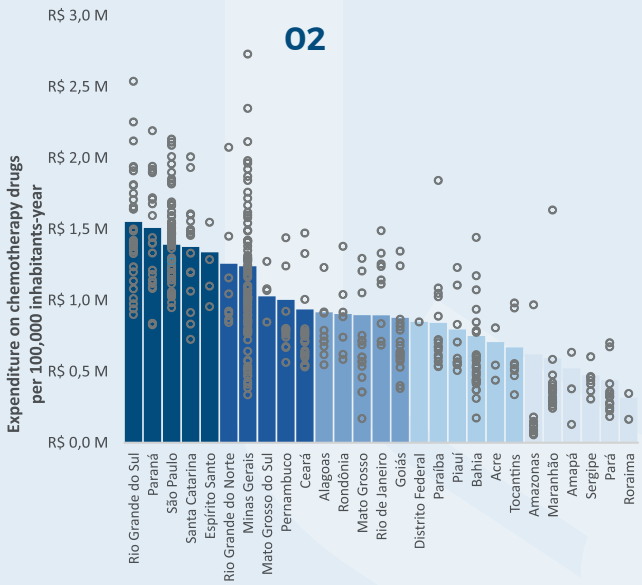

Context

At the beginning of the 20th century, the only curable type of cancer was the one with small dimensions, amenable to surgical removal. In the mid-twentieth century, substances that reduce cell proliferation, which would come to constitute the class of chemotherapeutics, were discovered. Medications were used as a treatment for inoperable neoplasms, to reduce cell growth after surgery (adjuvant treatment), or to reduce tumor size before surgery (neoadjuvant treatment). Chemotherapy was first shown to be effective in breast cancer, then used to treat colon, testicular, and other cancers.[1]

Chemotherapy in most cases is given intravenously, but also includes medications given orally, intramuscularly, subcutaneously, intrathecally, and topically. The goal of treatment may include a cure for the cancer, an increase in survival with the disease, or an increase in quality of life.

A study on outpatient expenses in the SUS identified that in 2020 oncology costs corresponded to about 25% of the total, where the component with the highest cost was palliative chemotherapy (with no cure objective).2 Between 2008 and 2020, the authors point to an increase of more than twice the budget for treatments in oncology.

The current data collection was carried out through chemotherapy prescriptions made through the Authorization of High Complexity Procedures (APAC), including chemotherapy drugs prescribed for any type of neoplasm. The methodology allows a comprehensive view of the costs of medications used in the treatment of cancer, although it does not include other therapeutic modalities, such as surgery and radiotherapy, and costs other than drugs.

Magnitude of variation

- Among the Federative Units, the cost of chemotherapy drugs ranged from **R$294,921 to R$1,227.190 per 100,000 inhabitants-year**, a **4.2-fold variation**. Among the Health Regions, the variation was from **R$54,919 to R$2,146.526**, a **39.1-fold variation**;
- Among the Federative Units, the cost of chemotherapy medication standardized by age and adjusted for health plan coverage ranged from **R$315,019 to R$1,550.087**, a **4.9-fold variation**. Among the Health Regions, the cost ranged from **R$54,966 to R$2,729.017**, a **49.7-fold variation**.

Possible reasons for the observed variation:

- Variation in cancer incidence and need for chemotherapy in different regions;
- Variations in access to screening, diagnosis and treatment of cancer;
- Variations in the incidence of different types of neoplasms due to lifestyle differences between regions;
- Variations in medical practice in the prescription of chemotherapy.

Opportunities to improve Value in Healthcare

- Review screening, diagnosis and treatment processes of neoplasms in regions with marked low use of chemotherapy, to avoid resource underuse;
- Discuss in detail with each person with cancer and family members the prognosis of the condition and expectations of benefits and harms of each treatment, to avoid chemotherapy overuse;
- Identify the expectations and the specific condition of each person with cancer, avoiding the use of scarce resources that would not benefit them, while identifying the real health needs, translating into outcomes that matter to patients.

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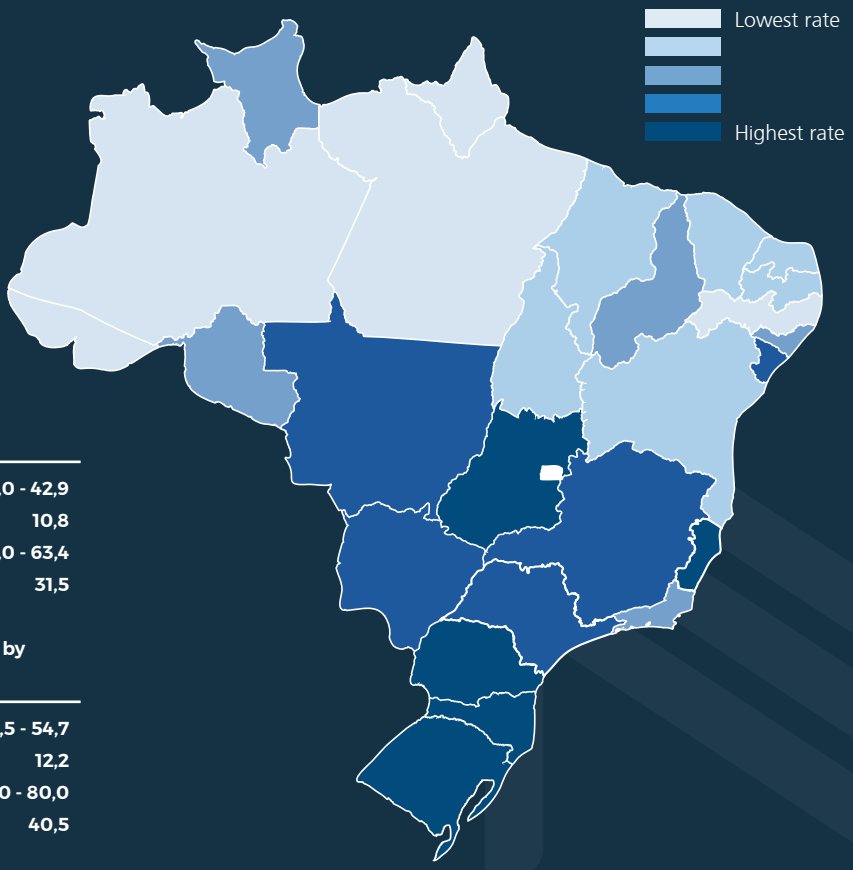
MUSCULOSKELETAL DISEASES

Map 19: Surgical treatment of femoral neck and hip fractures



01 - Standardization by age (map)

Variation (FU)	4,0 - 42,9
Ratio (FU)	10,8
Variation (Health Region)	2,0 - 63,4
Ratio (Health Region)	31,5

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	4,5 - 54,7
Ratio (FU)	12,2
Variation (Health Region)	2,0 - 80,0
Ratio (Health Region)	40,5

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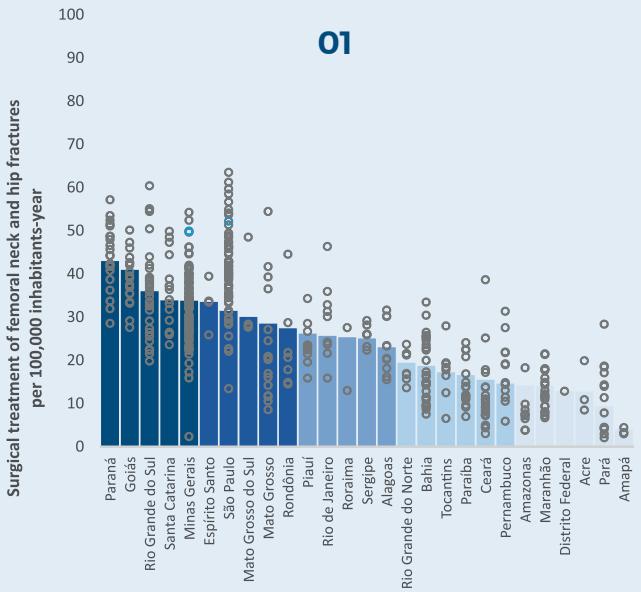

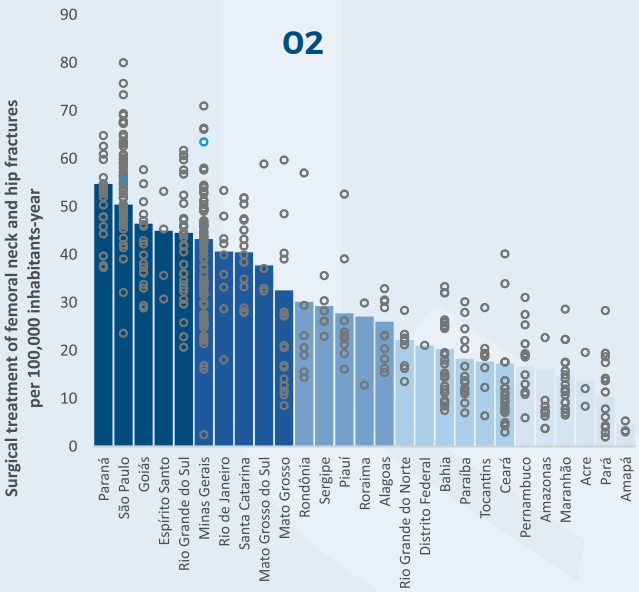

ACADEMIA VBHC

Contexto

Hip pathologies represent a significant health problem worldwide. It is estimated that the annual incidence of femoral neck and hip fractures is approximately 1.7 million cases. In addition to fractures, chronic musculoskeletal conditions, especially osteoarthritis, are also quite common in this topography. Furthermore, the incidence and prevalence of femoral neck and hip pathologies tend to increase as the elderly population grows[1], exerting a significant burden of pain and disability on the individual and the community, resulting in long-term physical impairment, reduced quality of life, decreased work capacity and increased healthcare costs.

The surgical management options for treating femoral neck and hip pathologies are closely linked to individual patient factors, the degree of joint involvement, pain, disability and fractures, the location and degree of displacement.

Analysis of geographic variations in surgical management of femoral neck and hip pathologies, based on DATASUS data on use and reimbursement data, allows

the debate on the care provided to the population in terms of access, underuse and overuse of surgical procedures. Information about the value created by the performed interventions, appropriateness of care and outcomes measurements, including complications, functional and quality of life improvement are not available.

Magnitude of variation

- Among the Federation Units, the surgical management for the treatment of the femoral neck and hip pathologies per 100,000 inhabitants/year ranged from **4.0 to 42.9**, a variation of **10.8 times**. Among Health Regions, surgical management for treating femoral neck and hip pathologies ranged from **2.0 to 63.4**, a variation of **31.5 times**;
- Among the Federative Units, the surgical management for the treatment of the femoral neck and hip pathologies per 100,000 inhabitants/year, adjusted for health plan coverage, ranged from **4.5 to 54.7**, a variation of **12.2 times**. Among the health regions, surgical management for the treatment of the femoral neck and hip pathologies adjusted for health plan coverage, ranged from **2.0 a 80.0**, a variation of **40.5 times**.

Possible reasons for the observed variation:

- The data suggest that people living in areas of economic deprivation were less likely to receive surgical management;
- Difference in access to specialized care;
- The concentration of the medical workforce and a greater number of specialized centers in the more developed regions;
- Individual patient preferences;
- Appropriateness of indications for surgical treatment.

Opportunities to improve Value in Healthcare

- Variations in the surgical management of femoral neck and hip diseases can serve as an indicator of inequity in access to health care in the population[2];
- Considering the trend of increasing population demand/need over time, it is essential to plan the allocation of resources to address the lack of access and meet the particular needs and priorities of local populations;
- Definition of quality, safety, and clinical outcome metrics related to the surgical management of femoral neck and hip pathologies;
- Optimization of the coding and data collection system in order to identify more accurately the different types of the femoral neck and hip medical conditions.

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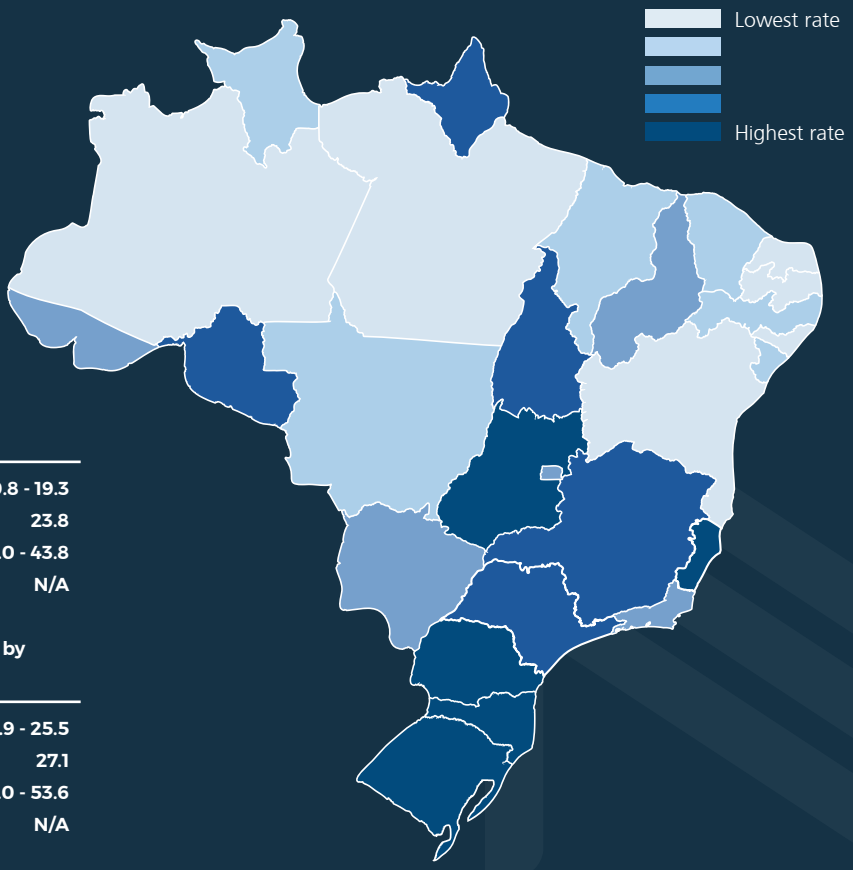
MUSCULOSKELETAL DISEASES

Map 20: Spine Surgery: Herniated disc surgery or spinal fusion (arthrodesis)



01 - Standardization by age (map)

Variation (FU)	0.8 - 19.3
Ratio (FU)	23.8
Variation (Health Region)	0.0 - 43.8
Ratio (Health Region)	N/A

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	0.9 - 25.5
Ratio (FU)	27.1
Variation (Health Region)	0.0 - 53.6
Ratio (Health Region)	N/A

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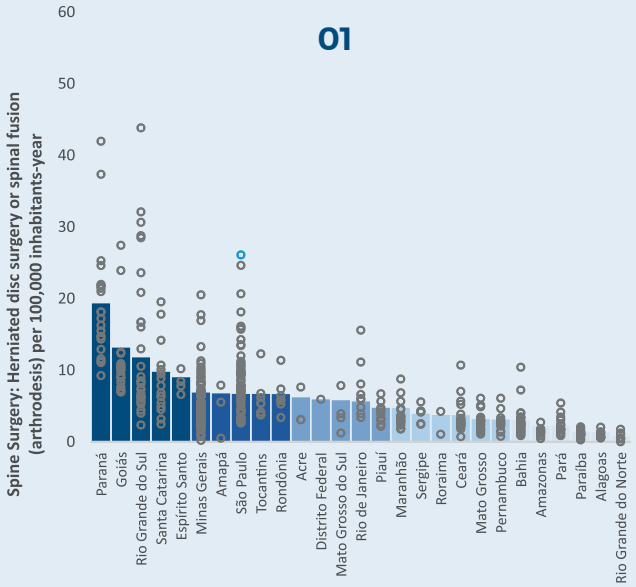

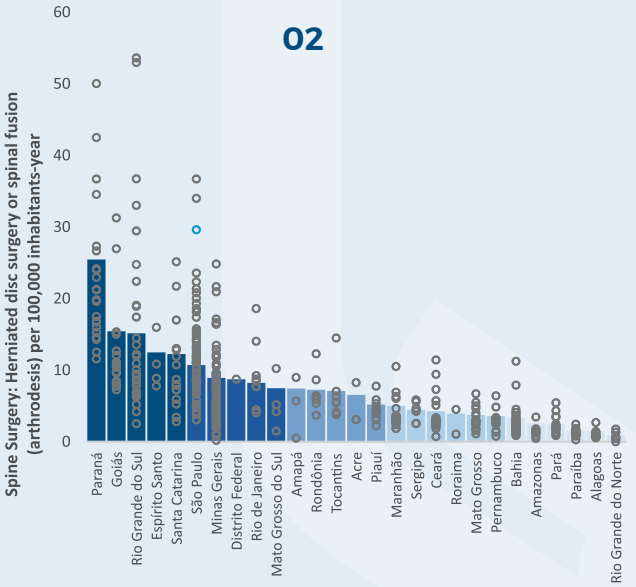

ACADEMIA VBHC

Context

Spinal pathologies represent a major health problem worldwide, exerting a significant burden of pain and disability on the individual and the community, resulting in long-term physical impairment, reduced quality of life, decreased work capacity, and increased healthcare costs.

In most spinal pathologies, the treatment indicated is not surgical and may involve drug therapies and a multi-professional approach. However, the demand for surgical interventions (discectomies and/or arthrodesis) is increasingly common[1].

Despite the dramatic increase in the quality of the scientific evidence base, with treatment design and results of surgical procedures for spinal diseases, most spinal conditions lack evidence-based consensus on the ideal intervention or metrics for outcome analysis.

In addition, concrete data on the epidemiology of spinal cord diseases, variations in access to specialized services, appropriateness surgery indication and outcomes measurement, including complications, functional and quality of life improvements are rarely found in the Brazilian population.

Magnitude of variation

- Among the Federative Units, the surgical management of disc herniation and spinal arthrodesis, standardized by age, ranged from **0.8 to 19.3** per 100,000 inhabitants-year, a **23.8-fold variation**. Among Health Regions, the surgical management of disc herniation and spinal arthrodesis ranged from **zero to 43.8** per 100,000 inhabitants-year. It was not possible to calculate the variation due to the frequency being zero in some locations;
- Among the Federative Units, the surgical management of disc herniation and spinal arthrodesis, standardized by age and adjusted for health plan coverage, ranged from **0.9 to 25.5** per 100,000 inhabitants-year, a **27.1-fold variation**. Among Health Regions, this rate ranged from **zero to 53.6**. It was not possible to calculate the variation due to the frequency being zero in some locations.

Possible reasons for the observed variation:

- Variation in the incidence of the spinal disease across regions;
- Inequities in access to specialized health care in some areas;
- Overuse influenced by the market, medical practice, training, or reimbursement;
- The concentration of the medical workforce and a more significant number of specialized centers in developed regions;

Opportunities to improve Value in Healthcare

- Improving access to multidisciplinary services, non-surgical and surgical treatments for chronic diseases of the spine;
- Definition of metrics fof appropriateness of surgical care, quality, safety, and clinical outcome, based on scientific evidence;
- Creation of incentives to encourage the implementation of reference centers in areas with less access;
- Creation of a national system of recording and systematic monitoring of quality metrics, safety, pertinence of the indication, functional outcomes, and quality of life for patients undergoing spinal surgeries, associated with a pay-for-performance model, encouraging implementation improvement cycles, based on the metrics monitored.

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References

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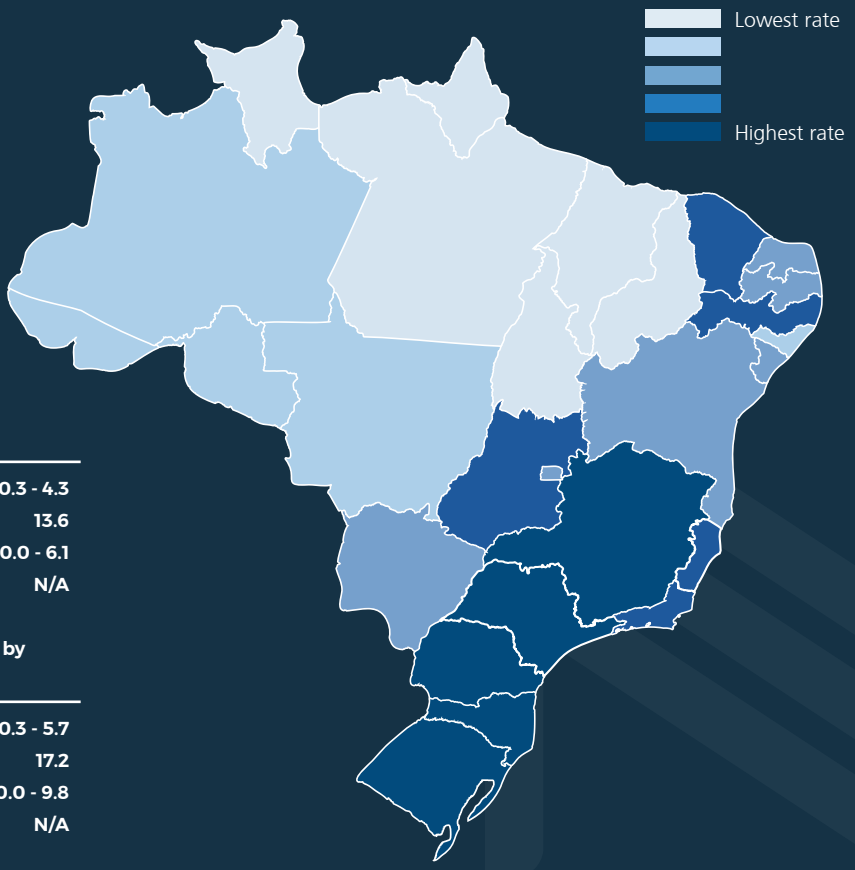
KIDNEY DISEASES

Map 21: Kidney Transplant



01 - Standardization by age (map)

Variation (FU)	0.3 - 4.3
Ratio (FU)	13.6
Variation (Health Region)	0.0 - 6.1
Ratio (Health Region)	N/A

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	0.3 - 5.7
Ratio (FU)	17.2
Variation (Health Region)	0.0 - 9.8
Ratio (Health Region)	N/A

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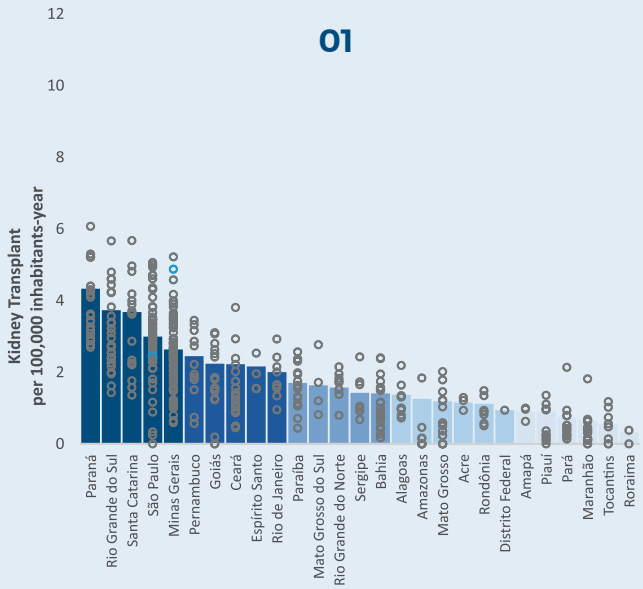

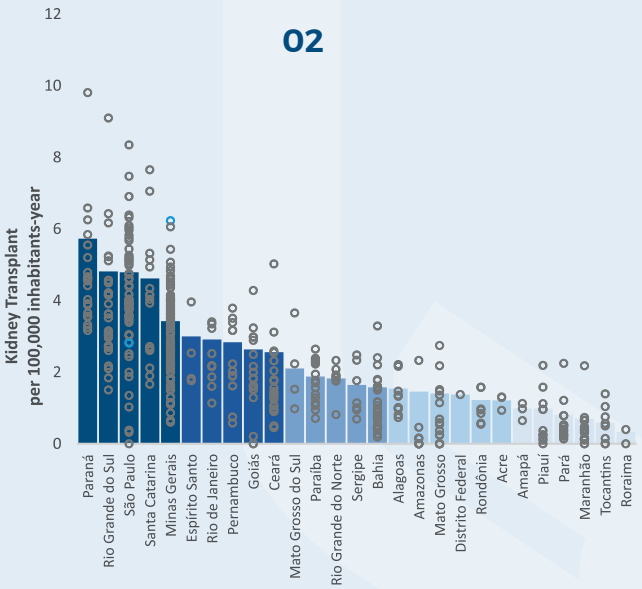

ACADEMIA VBHC

Contexto

In 2017, the international prevalence of kidney disease chronic disease was 9.1%, reaching about 700 million people all over the world.1 Due to population aging, the prevalence has increased by 29.1% since 1990.[1]
In people with end-stage renal disease, there is a need for renal replacement therapy, which may be performed through hemodialysis, peritoneal dialysis and kidney transplantation. The SUS is currently responsible for financing the treatment of about 90% of renal replacement therapies in Brazil.[2]
In 2018 there were an estimated 133,464 people in dialysis in Brazil. Of these, 92.3% were on hemodialysis and 7.7% on peritoneal dialysis, and 22.1% were on a waiting list for a kidney transplant.[3]
In Brazil, there is a National Policy for the Care of People Living with Kidney Disease (Ordinance No. 1168, of June 15 2004), which gives the right to access and equity in regard to kidney transplantation.[4] However, the map shows a marked variation in the rate of kidney transplantation across different locations in Brazil.

Magnitude of variation

- Among the Federative Units, the rate of kidney transplants, standardized by age, ranged from **0.3 to 4.3 per 100,000 inhabitants-year**, a **13.6-fold variation**. Among Health Regions, the rate of kidney transplants ranged from **zero to 6.1 per 100,000 inhabitants-year**. It was not possible to calculate the variation due to the frequency being zero in some locations;
- Among the Federative Units, the rate of kidney transplants, standardized by age and adjusted by for health plan coverage, ranged from **0.3 to 5.7 per 100,000 inhabitants-year**, a **17.2-fold variation**. Among the health regions, the rate of kidney transplants, ranged from **zero to 9.8 per 100,000 inhabitants-year**. It was not possible to calculate the variation due to the frequency being zero in some locations.

Possible reasons for the observed variation:

- Variation in access to health strategies for the control of risk factors for chronic kidney disease;
- Difficulty in identifying the worsening of kidney disease and seeking timely care for the best treatment;
- Difference in access to centers trained for the management of chronic kidney disease;
- Variations in the number of kidney transplant services across regions;
- Variations in the capacity of the national system of transplants in meeting the demand for organs in different regions of Brazi;
- Cultural and individual differences in donation and acceptance of organ transplantation.

Opportunities to improve Value in Healthcare

- Education of the population and health professionals on the control of risk factors for chronic kidney disease;
- Optimization of the distribution of centers specialized in the treatment of chronic kidney disease and transplantation in regions with less access;
- Strengthening of the National Transplant Policy in different regions of Brazil.

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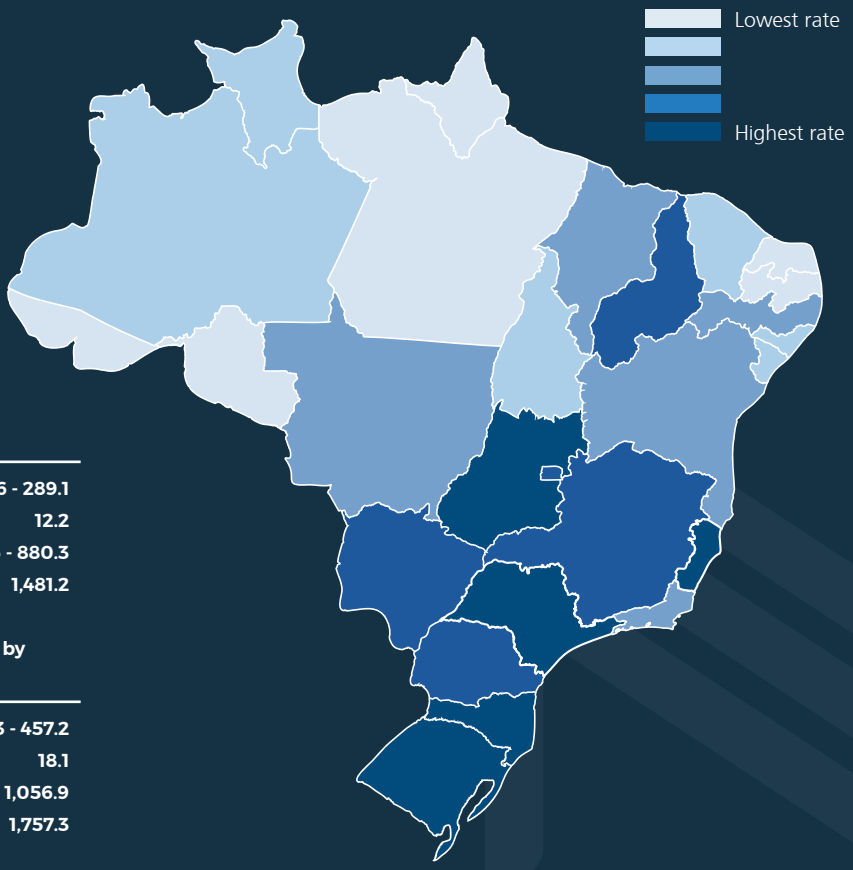
GASTROINTESTINAL DISEASES

Map 22: Colonoscopy or flexible sigmoidoscopy



01 - Standardization by age (map)

Variation (FU)	23.6 - 289.1
Ratio (FU)	12.2
Variation (Health Region)	0.6 - 880.3
Ratio (Health Region)	1,481.2

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	25.3 - 457.2
Ratio (FU)	18.1
Variation (Health Region)	0.6 - 1,056.9
Ratio (Health Region)	1,757.3

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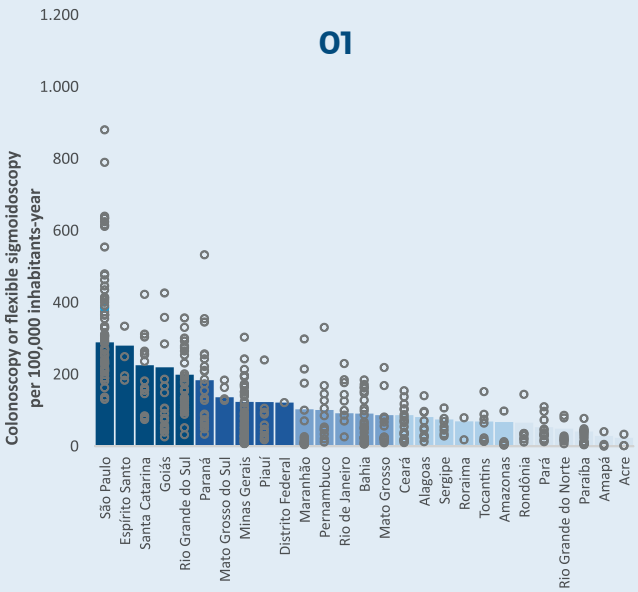

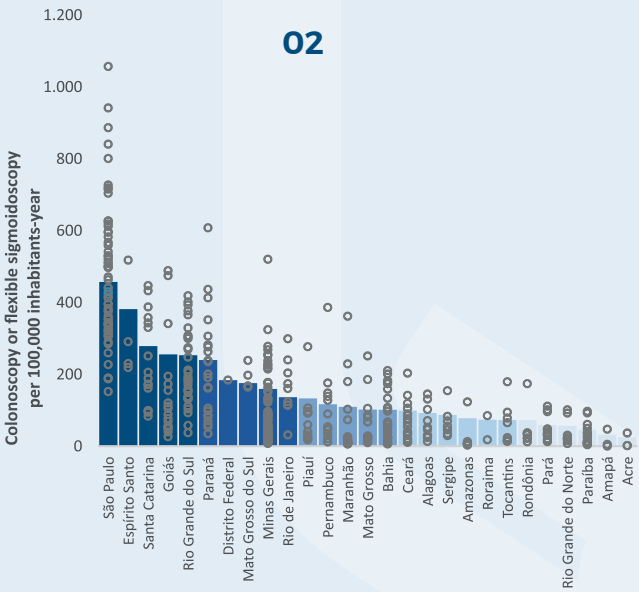

Contexto

Colon and rectal cancer, also called colorectal cancer, affects the intestine and is one of the most frequent tumors in Brazil. Data published by the National Cancer Institute (INCA), by the Ministry of Health, show that its incidence differs according to gender and region of the country. Excluding non-melanoma skin tumors, among men, colorectal cancer is the second most frequent type in the Southeast and Midwest regions, third most frequent in the South region and fourth most frequent in the North and Northeast regions. Among women, it ranks second in the Southeast and South Regions and third in the Midwest, Northeast and North Regions.[1]
When detected early, colorectal cancer has a good potential for a cure. Colonoscopy can be used for both detection and removal of precancerous lesions, enabling a more comprehensive evaluation of the bowel than sigmoidoscopy. However, there is no consensus on the ideal screening method and on the cost-effectiveness of population screening. The Primary Care Notebooks, published by the Ministry of Health in 2010, recommend screening adults aged between 50 and 75 years, through fecal occult blood testing, colonoscopy or sigmoidoscopy.[2] The American Cancer Society recommends starting screening at age 45 for people considered at medium risk and even before age 45 for high-risk people[3].

Magnitude of variation

- Among the Federative Units, the number of colonoscopies and rectosigmoidoscopy, standardized by age, ranged from **23.6 to 289.1 per 100,000 population-years**, a **12.2-fold variation**. Among the Health Regions, this number ranged from **0.6 to 880.3 per 100,000 inhabitants-year**, a **1,481.2-fold variation**;
- Among the Federative Units, the number of colonoscopies and sigmoidoscopy, standardized by age and adjusted for supplementary health insurance coverage, ranged from **25.3 to 457.2 per 100,000 population-years**, a **18.1-fold variation**. Among the Health Regions, the number ranged from **0.6 to 1,056.9 per 100,000 inhabitants-year**, a **1,757.3-variation**.

Possible reasons for the observed variation:

- Differences in clinical practice regarding the request for colonoscopy or sigmoidoscopy among physicians;
- Differences in access to exams;
- Differences in patients' adherence to the exams due to different levels of perception of the population about the benefit and tolerance to the discomfort of the exam.

Opportunities to improve Value in Healthcare

- Given the prevalence of colorectal cancer in Brazil, the availability of a national guideline for screening for colorectal cancer, based on scientific evidence, could contribute to standardizing clinical practice;
- Ensuring access to diagnostic tests for high-risk patients or in suspected cases and establishing a continuity flow for timely treatment;
- Based on the Guidelines, make information available to the population about the importance and different forms of screening in people at increased risk of colorectal cancer and about the warning signs for suspecting it;
- Provide information systems to monitor clinical practice in relation to the recommendations of the current Good Practice Guidelines, provide feedback, demand proof of improvement actions triggered by quality metrics and provide transparency to the data so that they can be used by patients and payers when choosing of the best performing providers.

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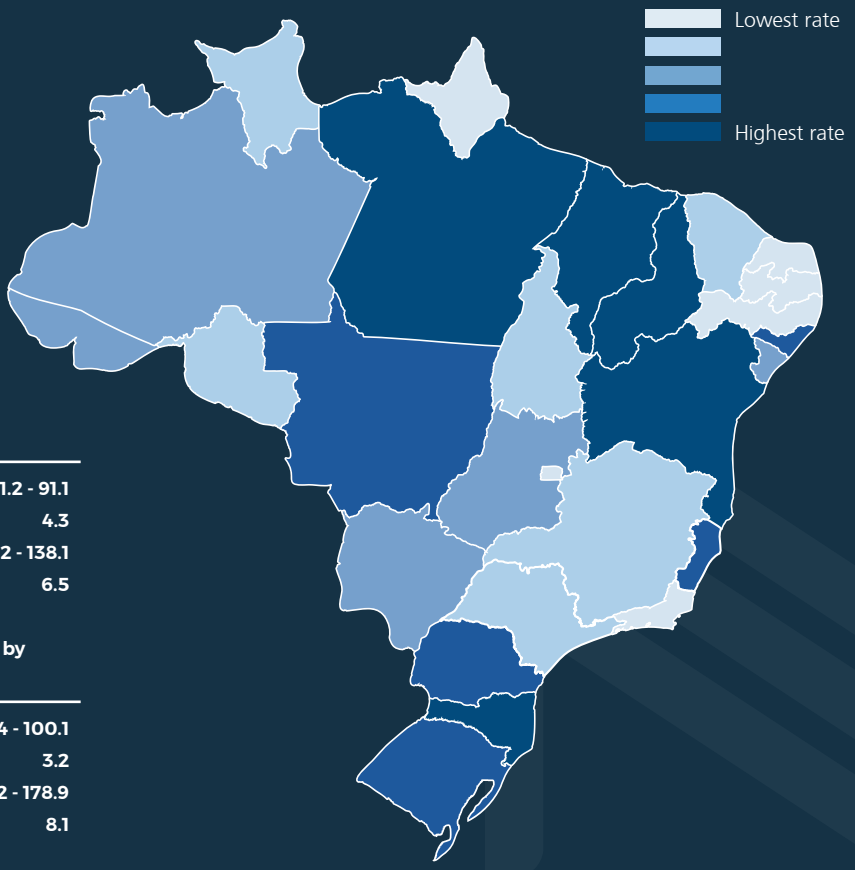
GASTROINTESTINAL DISEASES

Map 23: Inguinal hernia repair (hernioplasty)



01 - Standardization by age (map)

Variation (FU)	21.2 - 91.1
Ratio (FU)	4.3
Variation (Health Region)	21.2 - 138.1
Ratio (Health Region)	6.5

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	31.4 - 100.1
Ratio (FU)	3.2
Variation (Health Region)	22.2 - 178.9
Ratio (Health Region)	8.1

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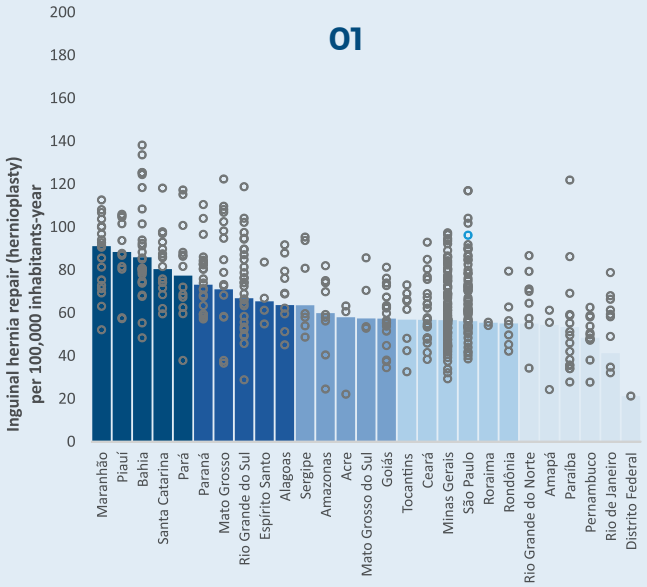

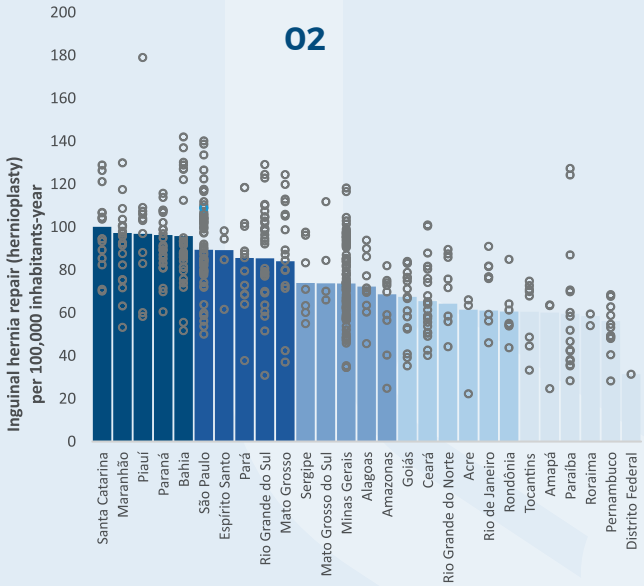

Context

Worldwide, more than 20 million people are submitted to inguinal hernia surgery[1]. Among abdominal hernias, the inguinal hernia is the most prevalent, representing about 75% of cases, being extremely frequent in tgeneral surgery services and occurs predominantly in adult males[2].
Surgery is the only definitive treatment option even in patients with minimal symptoms, indicated early to avoid complications such as imprisonment or strangulation, situations that increase the risk of morbidity[1,3].
Surgical treatment brings with it the possibility of complications such as chronic pain and recurrence and impacting quality of life and costs of the care cycle.

Magnitude of variation

- Among Federative Units, the number of Inguinal hernia repairs, standardized by age, ranged from **21.2 to 91.1 per 100,000 inhabitants-year**, a **4.3-fold variation**. Among the Health Regions, this number ranged from **21.2 a 138.1 per 100,000 inhabitants-year**, a **6.5-fold variation**;
- Among Federative Units, the number of Inguinal hernia repairs, standardized by age and adjusted for supplementary health insurance coverage, ranged from **31.4 to 100.1 per 100,000 inhabitants-year**, a **3.2-fold variation**. Among the Health Regions, this number ranged from **22,2 a 178.9 per 100,000 inhabitants-year**, a **8.1-fold variation**.

Possible reasons for the observed variation:

- Differences in the provision of treatment across regions;
- Characteristics of the population and socioeconomic conditions;
- Difficulties in diagnostics and search for treatment in the population;

Opportunities to improve Value in Healthcare

Increase the access to early treatment of inguinal hernia to avoid complications,
optimizing outcomes and costs.

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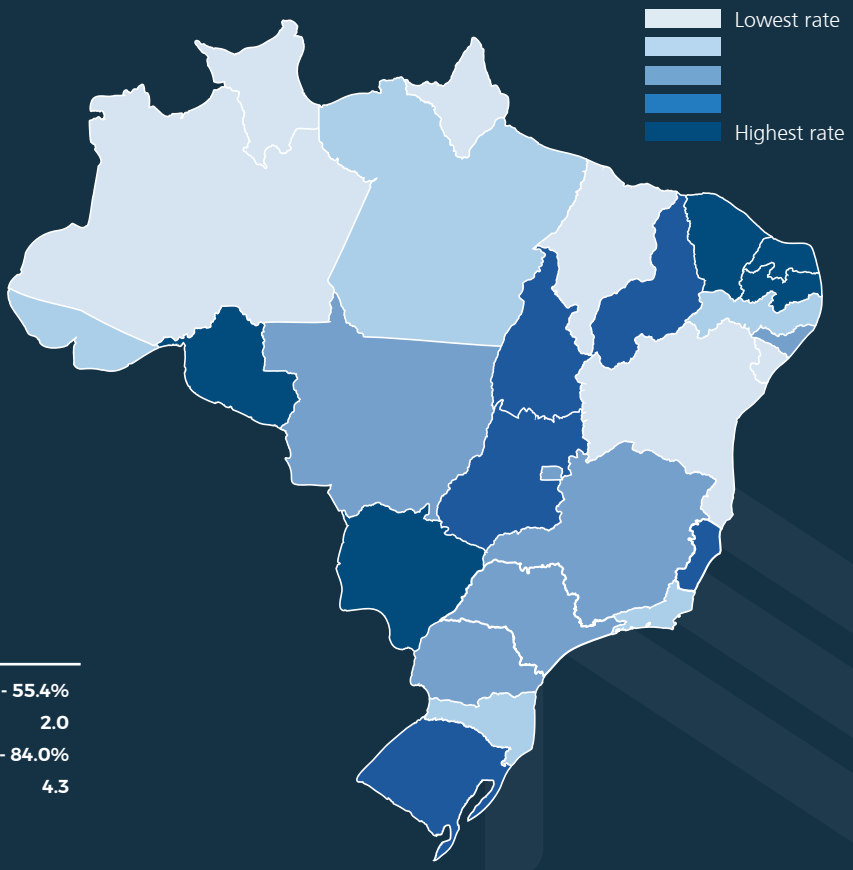
PREGNANCY, LABOR & DELIVERY

Map 24: Proportion of cesarean deliveries



Variation (UF)	**28.0% - 55.4%**
Ratio (UF)	**2.0**
Variation (Health Region)	**19.5% - 84.0%**
Ratio (Health Region)	**4.3**

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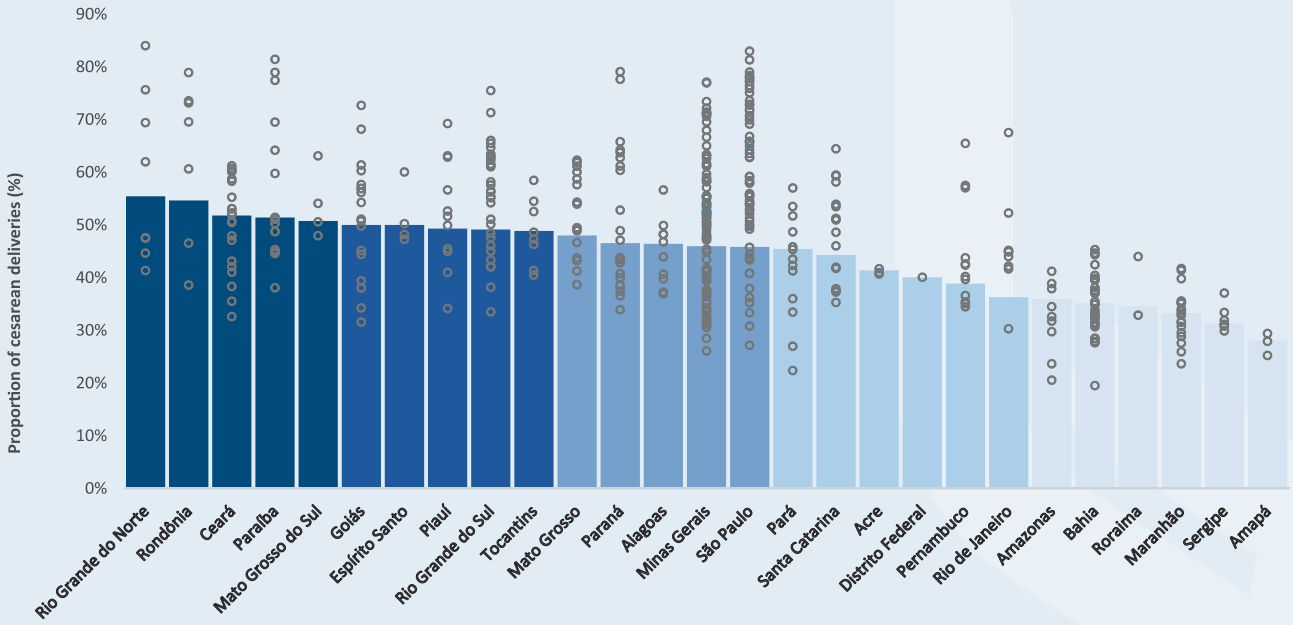

ACADEMIA VBHC

Context

Data published by the World Health Organization (WHO) point to a global growth in the proportion of cesarean deliveries, which increased from 7% in 1990 to the current levels of 21%, with estimates that this number will reach 28.5% in 2030[1]. Furthermore, the study shows wide variation across regions, with the lowest levels observed in Sub-Saharan Africa (5%) suggestive of underutilization, and the highest observed in Latin America and the Caribbean (42.8%), suggestive of overutilization of the procedure. According to the WHO, the international medical community considers the proportion of cesarean sections between 10 and 15% to be adequate[2].

Brazil ranks second in the ranking of countries that most perform cesarean sections in the world (55.7%), behind only the Dominican Republic (58.1%)[1].

Cesarean section, when indicated based on criteria of appropriateness of care, is an effective procedure to reduce maternal and perinatal morbidity and mortality. However, when misused, it can damage the health of the mother and baby and unnecessarily raise costs[3].

Recommendation No. 11 of the National Health Council, published on May 7, 2021, given the high rate of cesarean sections in Brazil, which reached 85% in private health services, provides guidelines to the Ministry of Health and the National Supplementary Health Agency (ANS) so that actions to monitor the quality of obstetric services are triggered, strengthening of maternal mortality committees and data transparency, including the source of funding for health services and professionals who perform deliveries and the review of the Certification Program for Good Practices in Health Care for Private Health Care Plan Operators to ensure the adoption of practices recommended in the 'National Guidelines for Assistance to Normal Childbirth' and the 'Guidelines for Care of Pregnant Women: Cesarean Section' by the Ministry of Health, in all obstetric and neonatal care services in the supplementary sector[4-6].

Magnitude of variation

- Among the Federative Units, the proportion of cesarean deliveries ranged from **28.0% to 55.4%**, a **2-fold variation**;
- Among Health Regions, the proportion ranged from **19.5% to 84.0%**, a **4.3-fold variation**.

Possible reasons for the observed variation:

- Differences across geographic regions regarding women's clinical and obstetric characteristics;
- Variations in the model of care offered and in the perception of health professionals;
- Variations in women's preferences, perceptions and cultural patterns;
- Different policies and financing models available.

Opportunities to improve Value in Healthcare

- Making evidence-based information available on forms of childbirth, including their risks and benefits, in order to engage women and strengthen their role in shared decision-making;
- Monitoring the adherence of health services and professionals to the recommendations of the current Good Practice Guidelines, providing feedback, demanding evidence of improvement actions triggered by quality metrics and providing transparency to the data so that it can be used by patients and payers when choosing providers with better performance;
- Offering payment models that encourage good practice and pay based on the best outcomes obtained.

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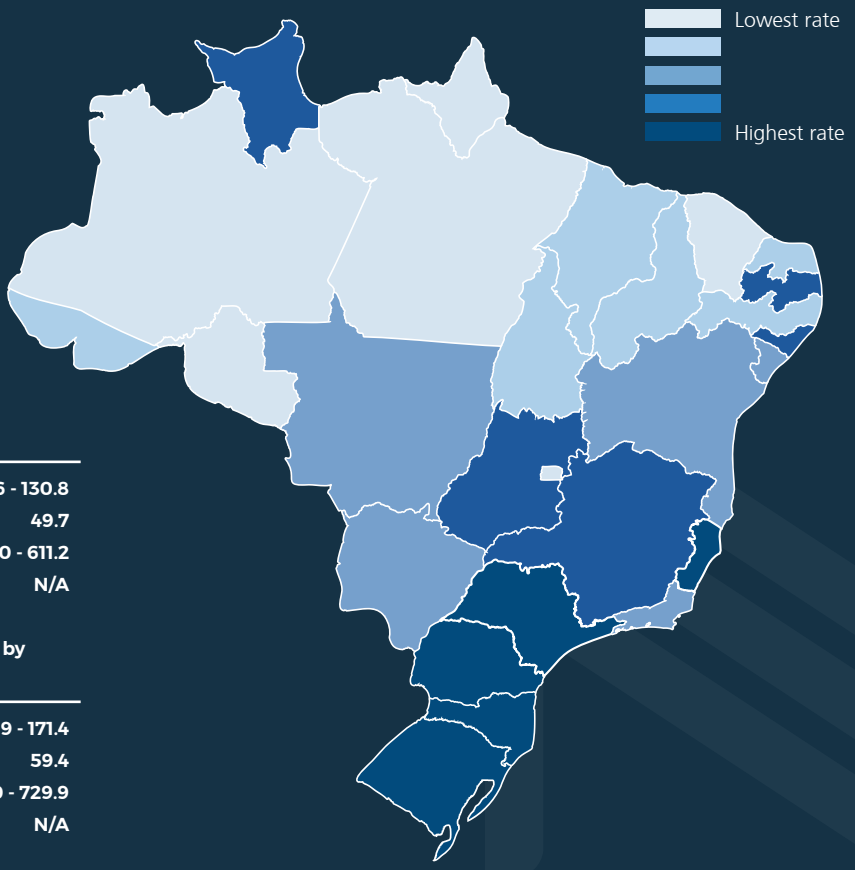
RESPIRATORY DISEASES

Map 25: Proportion of people aged 0–19 years who underwent tonsillectomy and/or adenoidectomy



01 - Standardization by age (map)

Variation (FU)	2.6 - 130.8
Ratio (FU)	49.7
Variation (Health Region)	0.0 - 611.2
Ratio (Health Region)	N/A

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	2.9 - 171.4
Ratio (FU)	59.4
Variation (Health Region)	0.0 - 729.9
Ratio (Health Region)	N/A

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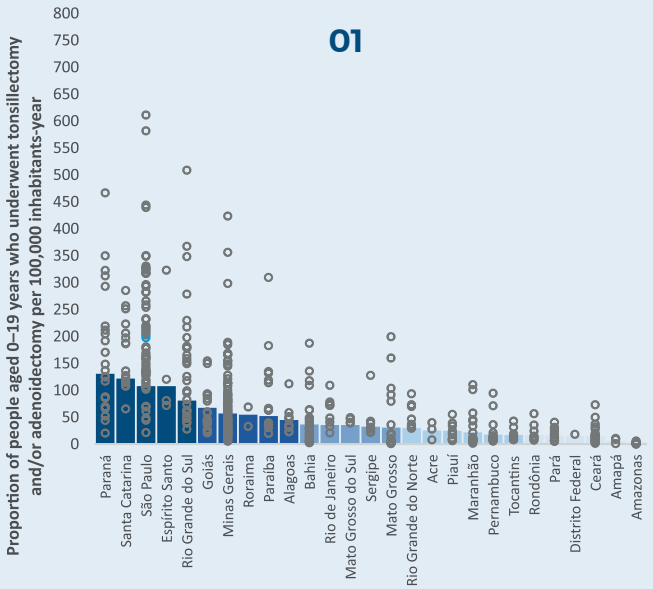

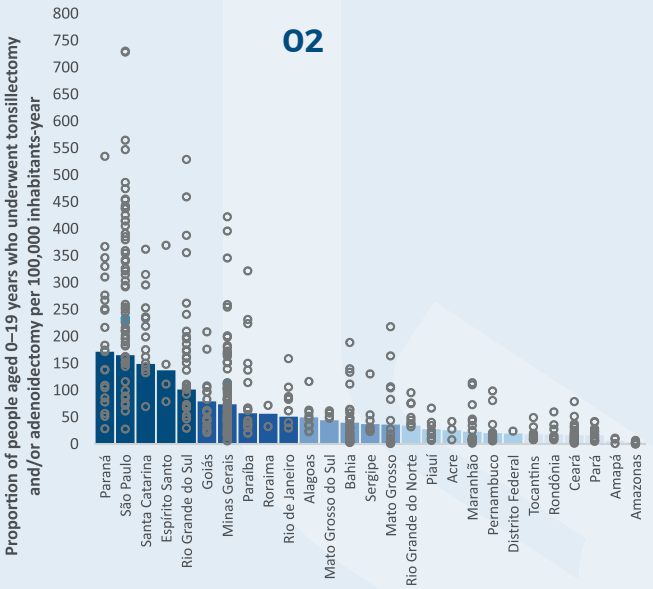

ACADEMIA VBHC

Context

Tonsillectomy and adenoidectomy are surgeries to remove the tonsils and adenoids, currently known as palatine tonsils and pharyngeal tonsils, respectively. They are located in the pharynx, back of the mouth and nose, and are formed by lymphoid tissue, being part of the immune defense mechanism against infectious agents and respiratory allergy.

These surgeries are among the most frequent performed in children around the world, despite the scarcity of scientific evidence and guidelines about the benefits and risks for children, who mostly have mild to moderate cases of repeated infection in the throat and obstructive sleep apnea[1,2].

In addition, there is a wide and unjustified geographic variation in the performance of these procedures, raising the question that other factors, unrelated to the clinical profile of the operated children, are influencing medical practice in the indication of these procedures[3,6].

Magnitude of variation

- Among the Federative Units, the number of admissions for tonsillectomy or adenoidectomy, standardized by age, ranged from **2.6 to 130.8 per 100,000 population-years**, a **49.7-fold variation**. Among the Health Regions, this number ranged from **zero to 611.2 per 100,000 inhabitants-year**. It was not possible to calculate the variation due to the frequency being zero in some locations;
- Among the Federative Units, the number of tonsillectomy or adenoidectomy, standardized by age and adjusted for supplementary health insurance coverage, ranged from **2.9 to 171.4 per 100,000 population-years**, a **59.4-fold variation**. Among the Health Regions, the number ranged from **zero to 729.9 per 100,000 inhabitants-year**. It was not possible to calculate the variation due to the frequency being zero in some locations.

Possible reasons for the observed variation:

- Differences in clinical practice regarding the indication of tonsillectomy and adenoidectomy among physicians;
- Lack of robust evidence to guide the creation of protocols that define pertinence criteria for carrying out the procedures;
- Differences in the levels of perception of the population about the risk and benefit of the procedures.

Opportunities to improve Value in Healthcare

- Given the wide variety of practices, the availability of a Tonsillectomy and Adenoidectomy Indication Guideline, based on scientific evidence, could contribute to standardizing clinical practice;
- Based on the Guidelines, make public information available to parents about treatment options, as well as their risks and benefits, so that they can actively participate in the decision-making process;
- Provide information systems to monitor clinical practice in relation to the recommendations of the current Good Practice Guidelines, provide feedback, demand proof of improvement actions triggered by quality metrics and provide transparency to the data so that they can be used by patients and payers when choosing of the best performing providers.

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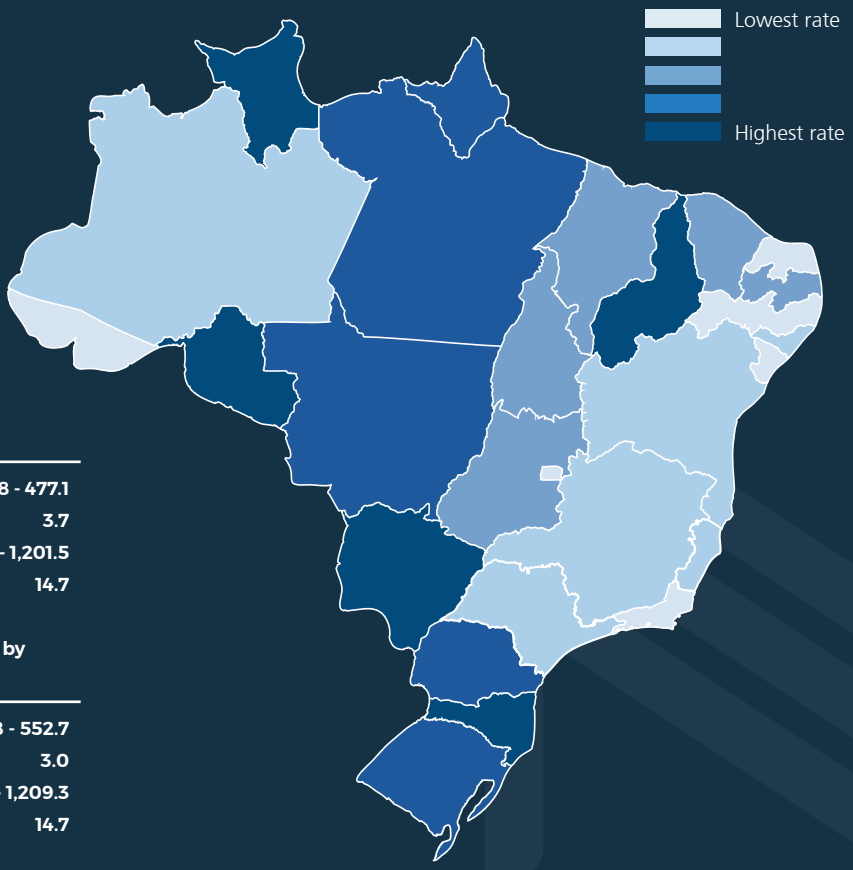
RESPIRATORY DISEASES

Map 26: Hospitalizations for pneumonia or influenza



01 - Standardization by age (map)

Variation (FU)	128.8 - 477.1
Ratio (FU)	3.7
Variation (Health Region)	81.9 - 1,201.5
Ratio (Health Region)	14.7

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	182.8 - 552.7
Ratio (FU)	3.0
Variation (Health Region)	82.1 - 1,209.3
Ratio (Health Region)	14.7

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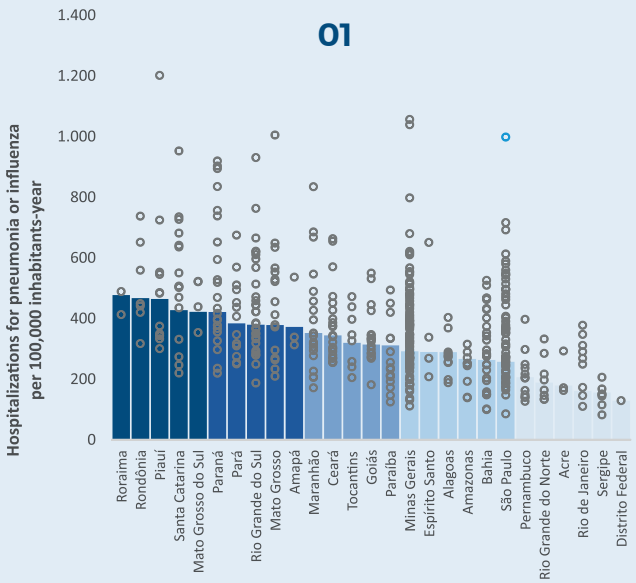

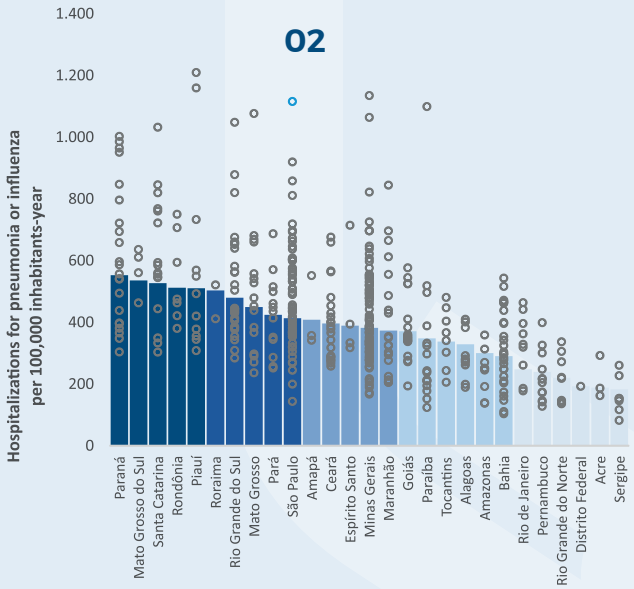

Context

Influenza is an acute infectious respiratory disease, caused by viruses, classically divided into three immunological types: Myxovirus influenza A, B and C, with only types A and B having clinical relevance in humans[1]. On the other hand, Pneumonia is an acute inflammatory disease that affects the lungs and can be caused by bacteria, viruses, fungi or by inhalation of toxic products[2].
Despite recent advances in reducing mortality from childhood pneumonia, this progress has not been observed in all age groups. In particular, pneumococcal pneumonia is the most significant cause of morbidity and mortality from pneumonia in the adult population[2,3].
Hospital admissions for pneumonia is not recommended in all cases, the decision being highly dependent on the clinical judgment of the attending physician, although there are tools available to assist in the decision process, such as the CURB-65 tool.

Magnitude of variation

- Among the Federative Units, the number of admissions for pneumonia or influenza, standardized by age, ranged from **128.8 to 477.1 per 100,000 population-years**, a **3.7-fold variation**. Among the Health Regions, this number ranged from **81.9 to 1,201.5 per 100,000 inhabitants-year**, a **14.7-fold variation**;
- Among the Federative Units, the number of hospitalizations for pneumonia or influenza, standardized by age and adjusted for supplementary health plan coverage, ranged from **182.8 to 552.7 per 100,000 population-years**, a **3.0-fold variation**. Among the Health Regions, the number ranged from **82.1 to 1,209.3 per 100,000 inhabitants-year**, a **14.7-fold variation**.

Possible reasons for the observed variation:

- Social, cultural, economic and climatic characteristics of each region;
- Differences in access and availability of vaccines between states (supply and demand for Influenza and Pneumococcal Vaccines) for children and the elderly;
- Differences in the prevalence of comorbidities and frailty among the elderly across regions;
- Differences in medical practice.

Opportunities to improve Value in Healthcare

- Reinforce preventive actions regarding respiratory tract care for groups at risk, such as children and the elderly. These practices have become more common during the COVID-19 pandemic, such as hand hygiene, avoiding contact with people with suspected infection, using masks, and preferring more airy environments;
- Strengthen awareness campaigns and population education about the importance of vaccination;
- Ensuring access and supply of Influenza and Pneumococcal vaccines to the target population, accordingly with the SUS vaccination policy;
- Promoting guidance to education professionals (daycare centers) and nursing homes regarding care and preventive;
- Promoting actions in primary care to create awareness on the care team about the importance of tracking and immunization of the population with chronic conditions.

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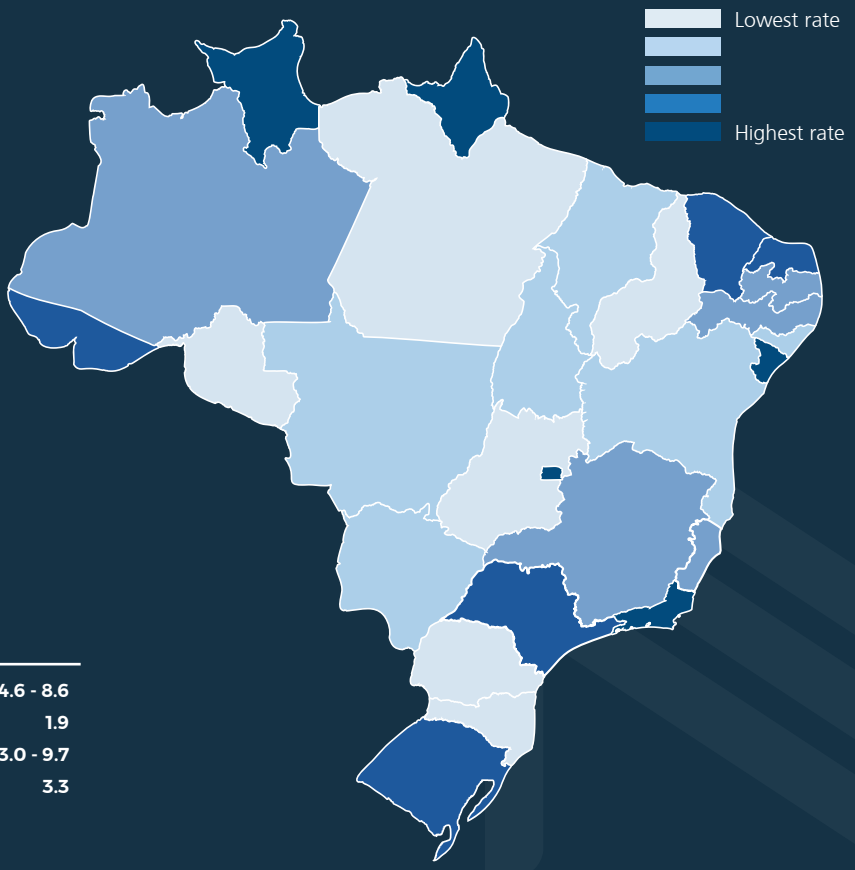
RESPIRATORY DISEASES

Map 27: Length of Hospital Stay for pneumonia or influenza



Variation (UF)	**4.6 - 8.6**
Ratio (UF)	**1.9**
Variation (Health Region)	**3.0 - 9.7**
Ratio (Health Region)	**3.3**

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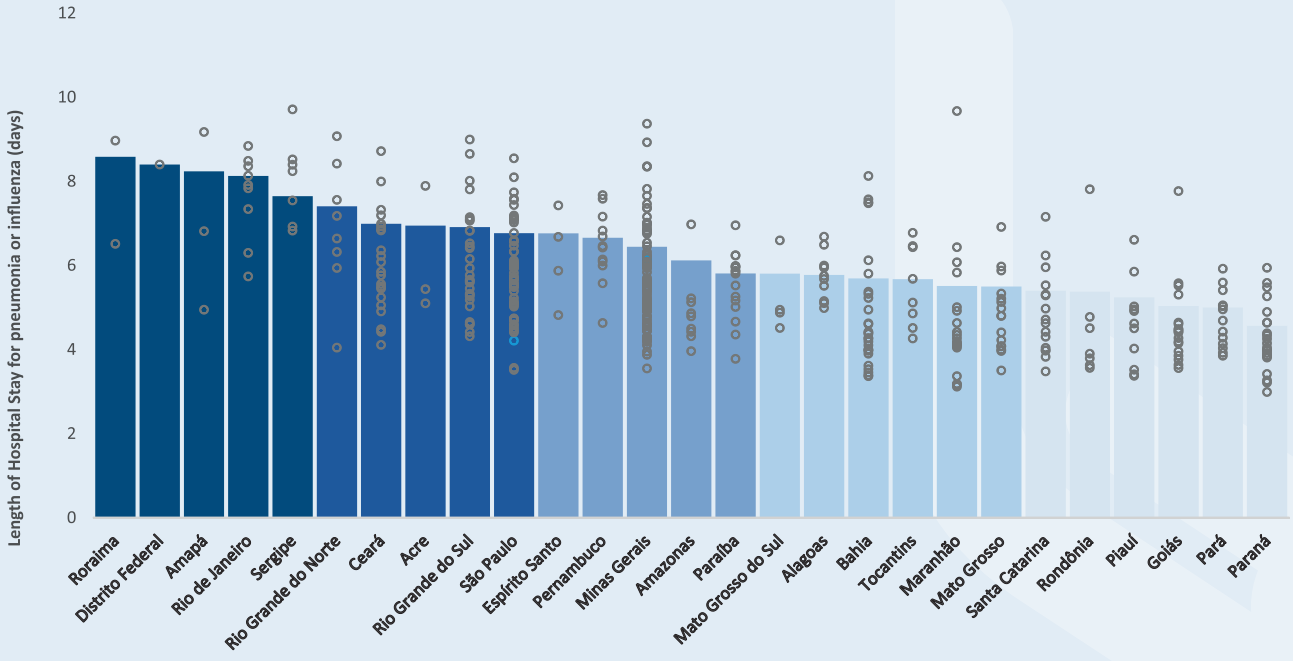

ACADEMIA VBHC

Context

As pointed out in the previous map, admissions for respiratory diseases have several possible etiologies, and not all cases require hospitalization for treatment. When indicated, hospital stays vary significantly, and may be influenced by the severity of illness and the need to use resources available in the hospital setting.

According to the Centers of Disease Control and Prevention (CDC), the average length of hospital stay for pneumonia in the United States in 2014 was 4.97 days. Among patients with pneumonia, 25.8% required hospitalization in an inpatient care unit, with length of stay of 7.2 days, while those without hospitalization in an ICU had an average length of stay of 4.2 days.[1]

Among the factors that lead to a longer hospital stay, the severity of illness, the occurrence of complications and the need for intravenous antibiotic therapy are highlighted. Factors such as the availability of caregiver support or outpatient care services for post-discharge follow-up may also be relevant.

Magnitude of variation

- Among the Federative Units, the duration of hospitalizations for pneumonia or influenza, standardized by days, ranged from **4.6 to 8.6 days**, a **1.9-fold variation**;
- Among Health Regions, this number ranged from **3.0 to 9.7 days**, a **3.3-fold variation**.

Possible reasons for the observed variation:

- Differences in the clinical profile of patients across regions;
- Differences in access and availability of medications (orally or intravenously) in health services across regions;
- Variations in medical practice across regions;
- Availability of services for outpatient care after discharge.

Opportunities to improve Value in Healthcare

- Promoting adherence to guidelines in regard to early diagnosis and appropriate treatment of influenza or pneumonia leading to a complete recovery;
- Ensuring access to and provision of treatment according to individual needs and population characteristics, respecting the age and needs of each individual;
- Promoting actions in health services to make the care team aware of the importance of diagnosis, treatment and prevention of complications during hospitalization to reduce length of stay and allow a safe and early return home;
- Provide de-hospitalization services that facilitate the transition between hospital and post-discharge care, in order to reduce the length of stay and the risk of hospital readmissions.

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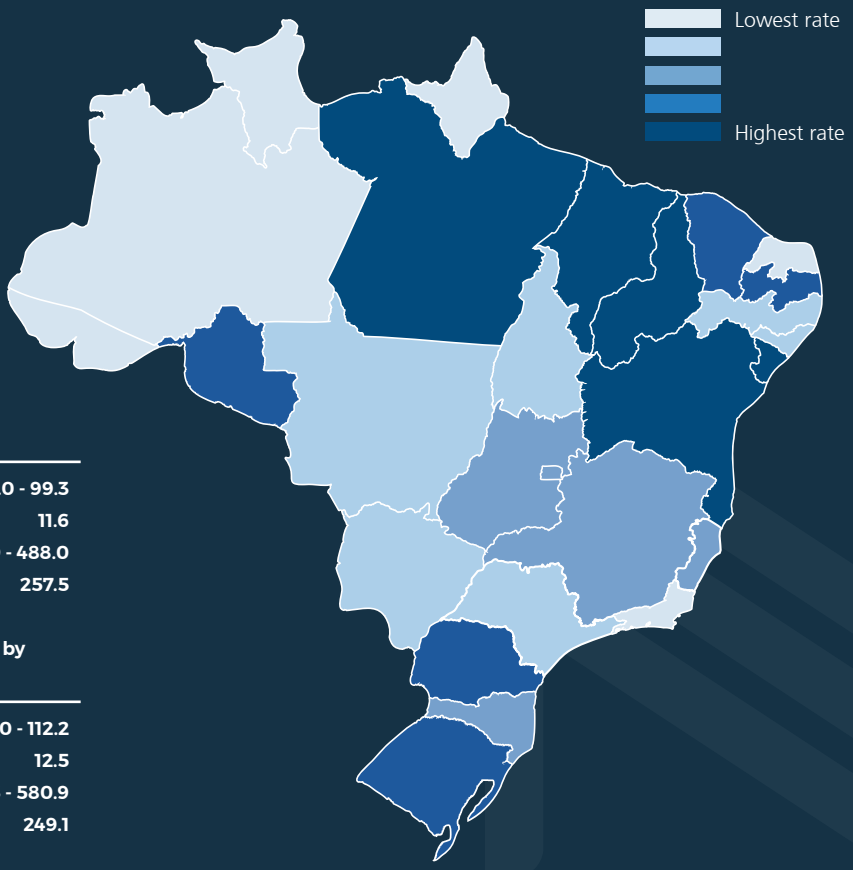
RESPIRATORY DISEASES

Map 28: Hospitalizations for Asthma



01 - Standardization by age (map)

Variation (FU)	85.0 - 99.3
Ratio (FU)	11.6
Variation (Health Region)	1.9 - 488.0
Ratio (Health Region)	257.5

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	9.0 - 112.2
Ratio (FU)	12.5
Variation (Health Region)	2.3 - 580.9
Ratio (Health Region)	249.1

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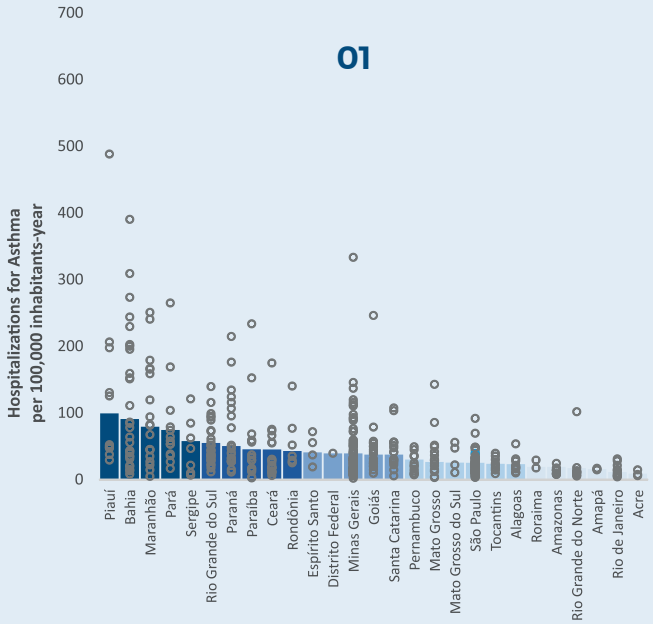

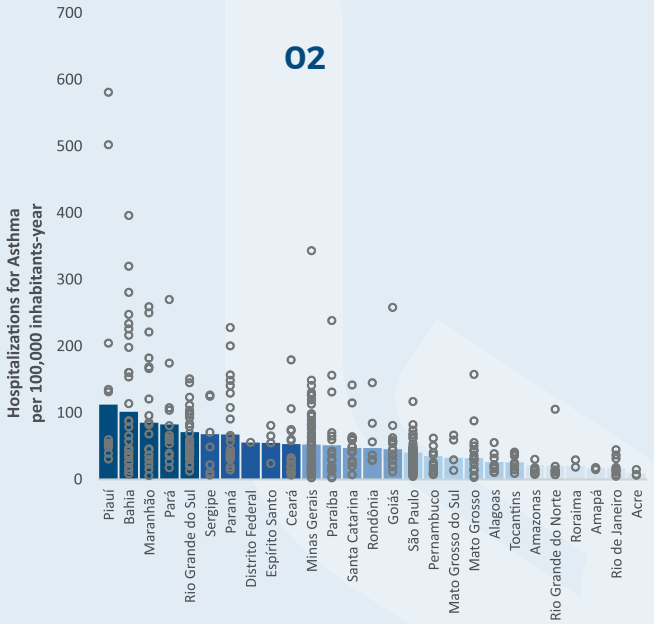

Contexto

Asthma is a common non-communicable chronic disease among children and that also has a high prevalence among adults, being a major global health problem with high rates of morbidity,[1] and high social and economic costs to the health system. The disease can affect people of all ethnicities and ages, and may be related to increased exposure to allergens and ollutants[2].
There has been an advance in the knowledge of the pathophysiology of asthma, that allowed an improvement in available therapies that aim at improving quality of life[2,3], including symptom control, preventing exacerbations, and consequent reduction in hospital admissions.
This map investigates the frequency of hospital admissions for the treatment of decompensated asthma, that usually occur when outpatient management fails.

Magnitude of variation

- Among the Federative Units, the number of admissions for asthma, standardized by age, ranged from **85.0 to 99,3 per 100,000 population-years**, a **11.6-fold variation**. Among the Health Regions, this number ranged from **1.9 to 448.0 per 100,000 inhabitants-year**, a **257.5-fold variation**;
- Among the Federative Units, the number of admissions for asthma, standardized by age and adjusted for supplementary health plan coverage, ranged from **9.0 to 112.2 per 100,000 population-years**, a **12.5-fold variation**. Among the Health Regions, the number ranged from **2.3 to 580.9 per 100,000 inhabitants-year**, a **249.1-fold variation**.

Possible reasons for the observed variation:

- Inequities in access to effective outpatient care at the primary care level for the symptomatic control of asthma;
- Differences related to the characteristics of the population, level of education and socioeconomic conditions;
- Differences in the support and guidance for family members for prevention and at home care strategies;
- Climate differences and greater exposure to pollution.

Opportunities to improve Value in Healthcare

- Ensuring access to effective in primary care with a focus on individual needs and characteristics, contributing to better patients and their families adherence;
- Educational and preventive interventions should be offered in addition to medications;
- Stimulating an active participation of schools in the context of crisis prevention, promoting actions of health education and, enabling better quality of life while at school;
- Development of care networks for people with asthma promoting education, Environmental and behavioral changes and effective treatments.

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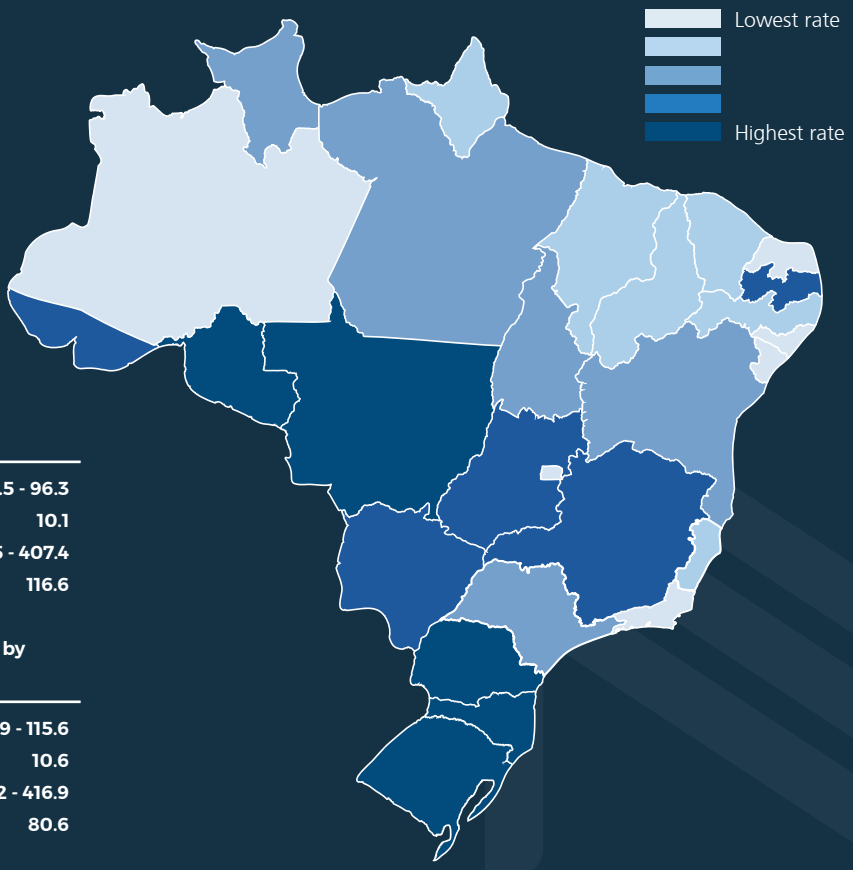
RESPIRATORY DISEASES

Map 29: Hospitalizations for emphysema and other chronic obstructive pulmonary diseases



01 - Standardization by age (map)

Variation (FU)	9.5 - 96.3
Ratio (FU)	10.1
Variation (Health Region)	3.5 - 407.4
Ratio (Health Region)	116.6

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	10.9 - 115.6
Ratio (FU)	10.6
Variation (Health Region)	5.2 - 416.9
Ratio (Health Region)	80.6

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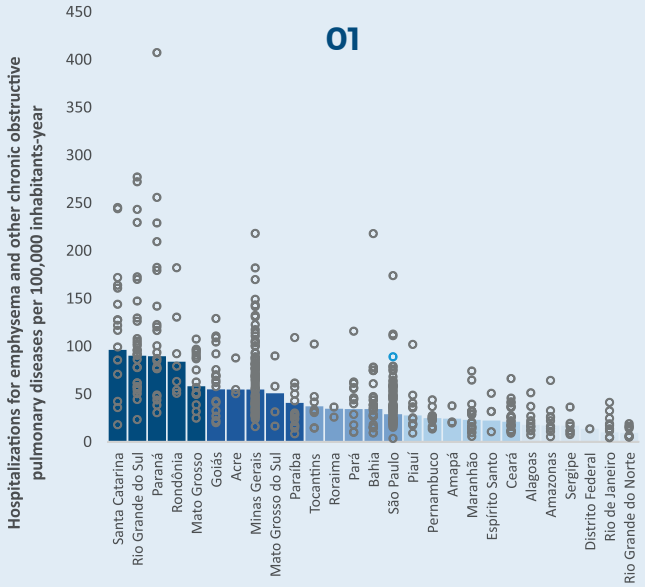

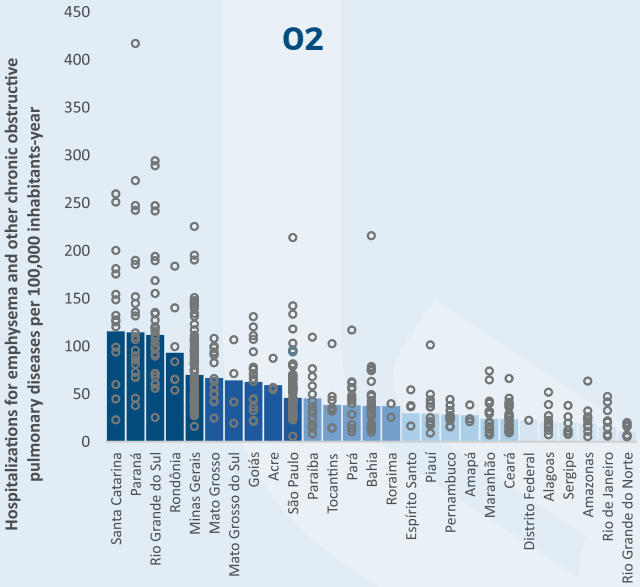

ACADEMIA VBHC

Context

Caring for people with obstructive pulmonary chronic disease (COPD) requires a multidisciplinary approach, As this is a common and preventable condition, characterized by persistent respiratory symptoms and airflow limitation due to abnormalities of the airways and/or alveoli[1].

COPD is a condition sensitive to programs of health promotion and prevention, especially those that focus on encouraging smoking cessation, its main risk factor. Despite advances in diagnosis, COPD is a underdiagnosed and undertreated disease in developing countries, which can lead to serious health consequences, due to increased morbidity and mortality and causing an economic impact on the health system.

A follow-up study in people with COPD showed that its prevalence in Brazil was 17% between adults over 40 years of age and the region with the highest prevalence was the Midwest (25%), followed by the Southeast Region (23%)[2,3].

The management and follow-up carried out in the primary care setting positively impacts symptoms control, quality of life, mortality[4], and reduces hospital admissions [3,4].

Magnitude of variation

- Among the Federative Units, the number of admissions for emphysema and other COPD, standardized by age, ranged from **9.5 to 96,3 per 100,000 population-years**, a **10.1-fold variation**. Among the Health Regions, this number ranged from **3.5 to 407.4 per 100,000 inhabitants-year**, a **116.6-fold variation**;
- Among the Federative Units, the number of admissions for emphysema and other COPD, standardized by age and adjusted for supplementary health plan coverage, ranged from **10.9 to 115.6 per 100,000 population-years**, a **10.6-fold variation**. Among the Health Regions, the number ranged from **5.2 to 416.9 per 100,000 inhabitants-year**, a **80.6-fold variation**.

Possible reasons for the observed variation:

- Inequity of access to effective programs of promotion, prevention and treatment of COPD;
- Socio-economic and cultural differences across regions;
- Differences in the clinical profile of patients across regions.

Opportunities to improve Value in Healthcare

- Plan strategies to achieve equity in the access to effective outpatient management for all COPD patients, according to individual needs and population characteristics;
- Implementation of comprehensive networks of integrated care throughout the care cycle, from health promotion, cessation of smoking, to the treatment of COPD.

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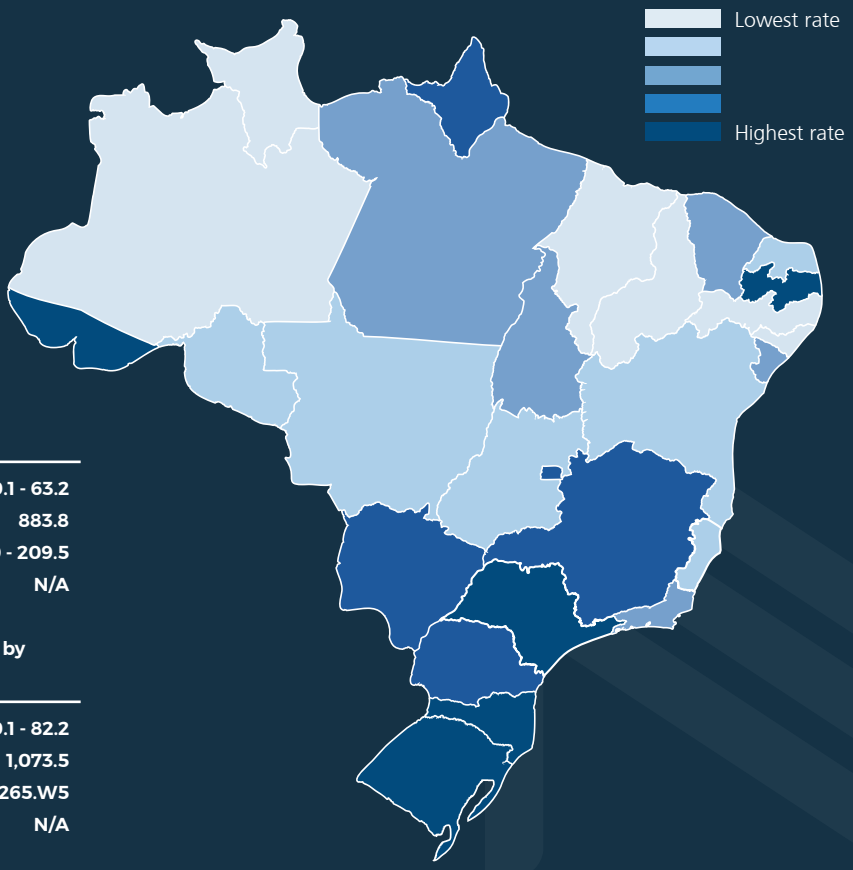
MENTAL DISORDERS

Map 30: Hospitalizations of people at high risk of suicide



01 - Standardization by age (map)

Variation (FU)	0.1 - 63.2
Ratio (FU)	883.8
Variation (Health Region)	0.0 - 209.5
Ratio (Health Region)	N/A

02 - Standardization by age, adjusted by private health plan coverage

Variation (FU)	0.1 - 82.2
Ratio (FU)	1,073.5
Variation (Health Region)	0.0 - 265.W5
Ratio (Health Region)	N/A

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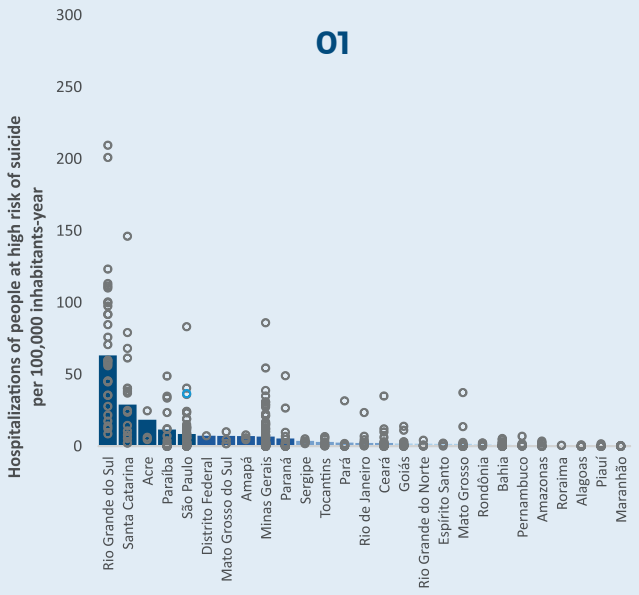

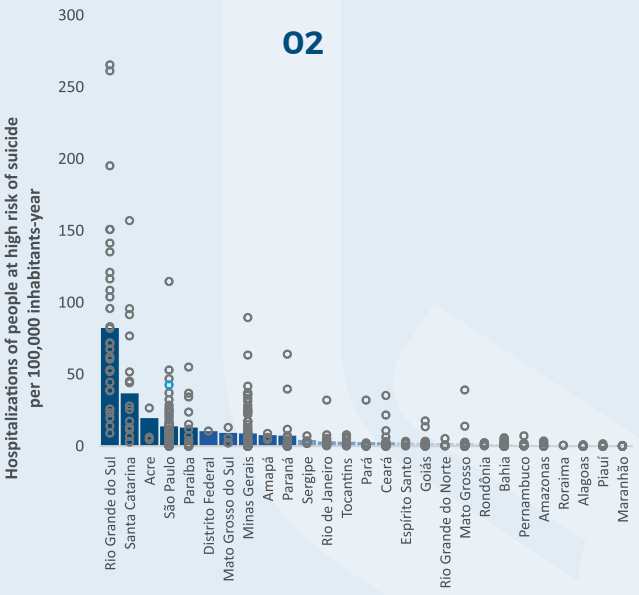

ACADEMIA VBHC

Contexto

Global estimates indicate that around 700,000 people commit suicide every year[1]. Over the last decade, an increase in suicide and depression has been reported in children, adolescents, and adults. The number of hospital admissions of people at high risk of suicide seems to have also increased[2,3].

Suicidal ideation and suicide attempts are associated with a high risk of re-attempts and subsequent death. For example, up to 27% of children and adolescents aged 10 to 18 years with a first suicide attempt will try again[2]. Among adults, during the first year of the suicide attempt, up to 2% of patients will die by suicide[4].

Most patients with attempted suicide are admitted to hospital emergencies and require hospitalization, as outpatient management of people at high risk of suicide is generally not safe[5].

Hospitalization allows for the management of possible injuries related to the suicide attempt, psychiatric evaluation and stabilization, the performance of toxicological tests and multidisciplinary assessment to assess the risk of suicide. In a safe environment, support can be provided to the patient and family, planning long-term care with evidence-based interventions[1].

The present maps shows an analysis of hospital admission for mental disease in situations of high risk of suicide.

Magnitude of variation

- Among the Federative Units, the number of admissions for treatment of people at high risk of suicide, standardized by age, ranged from **0.1 to 63.2** per 100,000 population-years, a **883.8-fold variation**;
- Among the Health Regions, this number ranged from **zero to 209.5** per 100,000 inhabitants-year. It was not possible to calculate the variation due to the frequency being zero in some locations;
- Among the Federative Units, the number of admissions for treatment of people at high risk of suicide, standardized by age and adjusted for supplementary health plan coverage, ranged from **0.1 to 82.2** per 100,000 population-years, a **1,073.5-fold variation**;
- Among the Health Regions, the number ranged from **zero to 265.5** per 100,000 inhabitants-year. It was not possible to calculate the variation due to the frequency being zero in some locations.

Possible reasons for the observed variation:

- Higher incidence of depression and risk factors for suicide in different regions;
- The inequity of access to outpatient mental health care specialized services, that could promote psychosocial care, detection and early management of risk factors for suicide;
- Lack of access to hospital services capable of providing emergency care for mental health disorders with a high risk of suicide;
- Lack of knowledge of health providers about the importance of hospitalization for clinical treatment in situations of high risk of suicide;
- The concentration of trained health professionals and specialized centers in more developed regions;
- Personal, family, and social prejudice, stigmatizing and minimizing the real risk of suicide in vulnerable patients.

Opportunities to improve Value in Healthcare

- Educação populacional sobre os sintomas e sinais de alerta para detecção precoce do risco suicídio;
- Educação e capacitação dos profissionais da saúde em setores de emergência para o manejo protocolar e baseado em evidência;
- Definição da linha de cuidado do paciente com risco elevado de suicídio, incluindo-se internação hospitalar, diagnóstico multiprofissional, instituição das intervenções terapêuticas e seguimento ambulatorial de longo prazo;
- Estimular a implementação de redes de referência para manejo ambulatorial e hospitalar dos transtornos da saúde mental.

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