

## Are my Values Different from Yours? The Value of Coronary Artery Disease Invasive Care in Brazil

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Coronary Artery Disease (CAD) has been consistently associated with the leading cause of death and disability in most western industrialized countries since the mid-1950s. Although it still has a major impact on the health of society in these countries, CAD rates have considerably decreased in recent decades.<sup>1</sup>

There are significant differences in the prevalence of CAD, as different world regions face varying stages of this epidemic. An epidemiological transition model for cardiovascular disease describes a series of stages starting from a population profile with low life expectancy and cardiovascular diseases mainly due to infectious diseases and malnutrition, which is a pattern commonly observed in developing countries. As the economic and public health development improves the population's nutrition and decreases infectious disease rates, life expectancy increases, and the pattern and rates of cardiovascular disease are changed. In the last phase, commonly seen in high-income countries, life expectancy increases, and degenerative cardiovascular diseases at advanced age predominate. Variable rates of incidence, prevalence, and mortality reflect the different levels of risk factors, other concurrent causes of death, and the availability of resources to fight cardiovascular disease.<sup>2</sup>

Despite large variations in the number of revascularization procedures in different countries, the number of interventions does not seem to be related to the incidence of CAD.<sup>3</sup>

The increase in the number of interventional procedures for myocardial revascularization (angioplasty

and surgery) in the last 20 years performed by the Unified Health System (SUS) in Brazil follows this second CAD epidemic wave in developing countries and may help to rethink the model of care that we will need to build in the next decades for our society.

The more expressive growth in the number of angioplasties in relation to surgeries in SUS is also paralleled by different countries worldwide in the same period. The use of angioplasty has increased rapidly over the past 20 years in most of the Organization for Economic Cooperation and Development (OECD) countries, surpassing myocardial revascularization surgery as the preferred method for revascularization in the mid-1990s.<sup>3</sup> On average, in OECD countries, angioplasty now accounts for 78% of all revascularization procedures and exceeds 85% in France, Spain, and Israel.<sup>3</sup> In Brazil, 66% of myocardial revascularization procedures performed by SUS in 2015 were carried out by transcatheter approach.

Dissimilarly, following the last stage of this epidemic, US hospitals observed a significant reduction in the number of myocardial revascularization surgeries and a non-significant reduction (stabilization) in the number of angioplasties performed in the first decade of the 21<sup>st</sup> century, during which time more hospitals performed both procedures, reducing the average volume of each institution, which can have a negative impact on the quality, safety and costs associated with these interventions.<sup>4</sup>

These observations have led several legislators and managers to rethink the cardiovascular care model through the construction of consolidated health systems and through the creation of disease-specific centers of excellence, which offer integrated care, per time cycle, focused on the demands of the individual, as a way of generating value for care in the United States.

### Keywords

Coronary Artery Disease; Cardiovascular Diseases/epidemiology; Minimally Invasive Procedures Angioplasty; Balloon, Coronary

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Coronary angioplasty is an expensive intervention, but it is much less costly than coronary artery bypass grafting, as it is less invasive. On average, the estimated price of an angioplasty for the 24 OECD countries was approximately US \$7,400.00 in 2010, compared to US\$ 17,400 for conventional surgery.<sup>5</sup> These are much higher values than the ones that were reimbursed, on average, by SUS per HAA for each of these interventions in 2015 in Brazil. Consequently, for patients who would otherwise receive a surgical (arterial and/or venous) graft, the introduction of angioplasty not only reduced the morbimortality of the interventional procedure, but also reduced costs. Currently, up to 18% of elective coronary angioplasty procedures in the United States is performed without the need for hospital admission, aiming to further reduce the costs associated with the care of CAD patients.<sup>4</sup>

Inflation-adjusted aggregated hospitalization costs for five of the six most expensive procedures in the United States have increased since 1999.

In 2007, the United States spent US\$ 697 billion on in-hospital patient care, where the more complex procedures are performed and the more complex technologies used, accounting for 37% of health care costs in that year. Three of the six procedures that contributed the most to hospital costs in the United States are associated with cardiovascular diseases and include coronary angioplasty, myocardial revascularization surgery and pacemaker implantation, ventricular resynchronization therapy and defibrillator implantation. The number of hospital discharges after coronary angioplasty has steadily increased since 1999 to 828,000, and inflation-adjusted hospital costs have increased 108% – to US\$ 13.3 billion. In contrast, hospitalizations due to myocardial revascularization surgeries decreased 24%, to 245,000. However, the aggregate costs for conventional surgery declined only 3 percent, to US\$ 8.1 billion.<sup>5</sup>

Although more expensive and the fact that it is associated with higher morbidity and mortality rates, some patients benefit from myocardial revascularization surgery, such as those with a more complex anatomy, with left ventricular dysfunction and diabetic patients. The selection of the best candidates for the best intervention should always be considered and discussed by teams of specialized professionals, who have complementary technical skills for the care of patients with CAD.

Patient selection for one or another invasive strategy, based only on available scientific evidence and disregarding local institutional results, as well as patient values and preferences, can impose a great burden on society, especially in a poorly consolidated model of institutions that are performing an increasingly lower volume of tertiary-complexity procedures.<sup>4</sup>

Regional and national averages can mask important variations in the assistance outcomes of different institutions. Therefore, an important aspect to consider is the adequacy of scientific study results to the local scenario of each hospital due to the great variability of the indicators, mainly those related to myocardial revascularization surgery. In this analysis, performed in Brazil in 2015, the mortality rate after myocardial revascularization surgery non-adjusted by SUS varied from 5.3% in the Southeast Region to 8.3% in the North of the country, that is, a difference of 65%, while mortality after angioplasty varied from 1.9% to 3.1% in the Southeast and North Regions, respectively. Despite the lower mortality rate (non-adjustably compared to surgical mortality rates), regional differences also exceed 60% for percutaneous interventions.

Many see quality health care as a comprehensive umbrella, under which lies patient safety. For instance, the Institute of Medicine (IOM) considers patient safety “indistinguishable from the delivery of quality health care.”<sup>6</sup>

Working groups, such as the IOM, have tried to define the quality of health care in terms of standards. Initially, the institute defined quality as “The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.”<sup>7</sup>

This led to a definition of quality, which seemed to be a list of indicators that are expressions of the standards. Most of these standards have been and generally continue to comprise the five domains (death, disease, disability, discomfort, and dissatisfaction) rather than more positive components of quality.<sup>8</sup>

Periprocedural mortality, although still widely used as a quality and safety standard, especially because it is a simple and accurate measure, but also because of the impact its measurement generates, cannot express other domains related to the quality of care. High mortality rates in relation to an established standard deserve attention, as they definitely express a low care VALUE. However, low mortality rates are not necessarily

associated with high-VALUE care. The institutional capacity to care for post-intervention complications and morbidities (avoidable or not) can minimize the impact of their occurrence on periprocedural mortality rates, generating wastage and a negative impact on the patient's experience.

The most recent work of IOM to identify quality care components for the 21<sup>st</sup> century focuses on the conceptual components of quality, rather than on measured indicators: quality care is safe, effective, patient-centered, timely, efficient, and equitable. Thus, safety is the foundation upon which all other aspects of quality care are built.<sup>9</sup>

In addition to the conceptual evolution on patient quality and safety, in recent years there has been a growing concern regarding cost control in the health area. Several aspects justify this concern: the increasing public spending in the area, problems related to the financing of these expenses, the great need and the still little dissemination of adequate cost calculation or measurement methods, the importance of cost management and monitoring, its control, and its use as a tool for decision-making, analysis and choice of programs and establishment of policies for the area.

Cost, price, and value are not synonymous. Value is a difficult term to be defined, as it has several meanings, depending on its context.

In philosophy, values are the set of characteristics of a particular person or organization, which determine how the person or organization behaves and interacts with other individuals and with the environment. Emphasis is placed on ethics as a vital value.

For economics, economic value is the non-monetary, but estimated value of particular goods or services, that is, the degree of importance of these goods or services for society. The financial value can be understood as how many monetary units – for instance, how many dollars – one would be willing to pay to have access to these goods or services.

Life has no price (since what is priced can be replaced by something else, an equivalent). This aphorism has justified the behavior of health professionals, institutions and industries for the development and incorporation (into care practice) of drugs, devices and processes that, in general, add costs to the health system. This development cycle and its costs, however, are not necessarily directly related to concrete

and proportionate benefits (quality of life and life expectancy) for individuals and may have a negative impact on society in general. The association between health systems' costs and health care outcomes is of interest to managers, considering the steady increases in health care spending for most industrialized countries. For instance, the United States stands out because they spend much more on health than any other country, but the life expectancy of the American population is not longer, it is actually shorter than in other countries that spend much less. In the most extreme case, we see that Americans spend more than five times what Chileans do, even though Chileans actually live longer than Americans.<sup>10</sup>

Nevertheless, the establishment of causal relationships is complex because, first, health care costs comprise just one of many quantitative and qualitative factors that contribute to health outcomes, and second, health status measurement is an imperfect process.

The meaning of VALUE in the health area, in addition to not being well understood yet, is difficult to practice. Conceptually, care VALUE can be determined as the association between care outcomes (including patient experience) and the economic costs related to the individual's care over an entire time cycle (not just for specific interventions). Therefore, providing quality care, without wastage, is one of the challenges of any health system in the current global scenario.<sup>11</sup>

Myocardial revascularization surgery, coronary angioplasty, or clinical treatment are care strategies that need to be customized for the individual with CAD, relying on the best current scientific evidence and the results of the institution's assistance, considering the patient's values and preferences. The fee-for-service and the misalignment of values among patients, health professionals, hospital institutions, and paying sources are at the center of discussions on the sustainability of the health system. Only with clear and transparent values, in an environment of trust, can new leaderships support, with courage and resilience, a value-based health system organized in high-reliability institutions, in which high-performance teams and shared decision-making have great VALUE.

To understand, however, why the monetary values of medical and institutional fee refunds in Brazil over the last 20 years have remained on average well below inflation, especially in the group of percutaneous revascularizations – that is another story!

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