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ORIGINALS

Analysis of Mortality Trends for Cerebrovascular Disease in Colombia from 2010 to 2021

Análisis de las tendencias de mortalidad por enfermedad cerebrovascular en Colombia de 2010 a 2021

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ABSTRACT

Introduction: globally, cerebrovascular disease is the second leading cause of death and the third leading cause of disability.
Objective: To discuss the narratives of Colombian health system stakeholders regarding care for people with cerebrovascular disease (CVD) in relation to the analysis of CVD mortality trends in Colombia between 2010 and 2021, by sex.
Methods: A mixed-method approach with an exploratory sequential design was used, combining qualitative data from focus groups with health system stakeholders and an ecological trend analysis study. CVD mortality data from the National Department of Statistics (DANE) were used, and Joinpoint regression was applied to assess changes.
Results: Stakeholders indicated that health outcomes and their analysis are essential for guiding care. Mortality, as a conclusive outcome, reflects the impact of the disease, and understanding it can contribute to its prevention. A sustained increase in CVD mortality was observed between 2010 and 2014, with higher rates among men. Between 2015 and 2021, a significant reduction was observed nationally and

among women. Throughout the period, deaths from CVD primarily affected people over 50 years of age, with a higher concentration among those over 80.
Conclusions: The contrast between the qualitative and quantitative findings suggests that the increase in mortality rates between 2020 and 2021 requires a deeper understanding of the factors that influence their variability. It also highlights the importance of legitimizing the experiences and needs of system stakeholders when formulating health care strategies.

Keywords: Mortality; Stroke; Mortality rate; Regression analysis; Outcome Assessment in Health Care, Colombia

RESUMEN
Introducción: a nivel mundial, la enfermedad cerebrovascular es la segunda causa de muerte y la tercera de discapacidad.
Objetivo: Discutir las narrativas de actores del sistema de salud colombiano sobre la atención a personas con Enfermedad Cerebrovascular, en relación con el análisis de tendencias de mortalidad por ella en Colombia entre 2010 y 2021, según sexo.
Métodos: enfoque mixto con diseño secuencial exploratorio, combinando datos cualitativos de grupos focales con actores del sistema de salud y un estudio ecológico de análisis de tendencias (cuantitativo). Se usaron datos de mortalidad por esta enfermedad del Departamento Nacional de Estadística, y se aplicó regresión *Joinpoint* para evaluar los cambios.
Resultados: Los actores señalaron que los desenlaces en salud y su análisis son fundamentales para orientar la atención. La mortalidad, como desenlace concluyente, refleja el impacto de la enfermedad y su comprensión puede contribuir a su prevención. Se observó un aumento sostenido en la mortalidad entre 2010 y 2014, con mayores tasas en hombres. Entre 2015 y 2021, se identificó una reducción significativa a nivel nacional y en mujeres. A lo largo del periodo, estas muertes afectaron principalmente a personas mayores de 50 años, con mayor concentración en mayores de 80.
Conclusiones: el repunte en las tasas de mortalidad entre 2020 y 2021 requiere profundizar en los factores que inciden en su variabilidad. Asimismo, se destaca la importancia de legitimar las experiencias y necesidades de los actores del sistema en la formulación de estrategias de atención en salud.

Palabras claves: Mortalidad; Accidente Cerebrovascular; Tasa de Mortalidad; Análisis de Regresión; Evaluación de Resultado en la Atención de Salud; Colombia.

INTRODUCTION

Cerebrovascular disease (CVD) or 'ictus' is a disorder caused by an ischemia or hemorrhage compromising one or more cerebral blood vessels. Speed of care is vital to improve clinical outcomes[1]. Cerebrovascular disease can be either symptomatic or asymptomatic. The most common symptoms include sudden loss of muscle strength on one side of the body, confusion, unexplained headache, difficulty speaking or understanding, and weakness or loss of consciousness[2].

Risk factors for CVD are classified as non-modifiable (family history of stroke and other demographic characteristics, such as educational level); semi-modifiable (atherosclerotic disease, diabetes mellitus, dyslipidemia, and hypertension); and modifiable (nutritional quality, body mass index, physical activity, alcohol consumption, and smoking)[1-3]. The highest risk factors for CVD include alcohol and tobacco consumption, obesity and sedentary lifestyles, high blood pressure, dyslipidemia, diabetes mellitus, and heart disease. The principal risks of ictus are being over 60 years of age[1], male sex, having a family history of ictus, and low educational level[3].

Globally, CVD is the second cause of death and the third of disability with an incidence of 200 cases for every 100,000 inhabitants per year. The mortality rate of cerebral ischemic stroke is 28% after 28 days; after one year, it increases to 41% and up to 60% in five years. This disease has diverse outcomes and mortality is one of them. This

outcome is a health problem, which must be intervened from Public Health and healthcare, turning it into a challenge for health systems around the world[4].

In Colombia, mortality due to CVD diminished from 40.62 per 100,000 inhabitants between 1985 and 1989 to 26.29 for every 100,000 inhabitants between 2010 and 2014; similar to high-income countries[5]. However, in 2019, CVD mortality was 32.15 for every 100,000 inhabitants and dropped in 2020 to 24.45 for every 100,000 inhabitants – likely due to the COVID-19 pandemic[6].

In other countries, like China, mortality due to CVD increased between 2013 and 2019, affecting mainly men, rural zones, and those over 85 years of age[7]. In contrast with Latin America and the Caribbean, between 1979 and 2015, mortality due to CVD had a downward trend, in both sexes, especially in South America and in high-income population[8].

The Ten-Year Public Health Plan seeks to reduce mortality due to CVD by 5% by 2031[9,10]. Nevertheless, research gaps still exist regarding its evolution from a gender perspective. Thus, the aim of this study was to discuss the narratives by some actors from the Colombian health system regarding health care to individuals with CVD, with respect to the analysis of trends in mortality rates due to CVD in Colombia from 2010 to 2021 by sex, contributing to the formulation of strategies for its prevention and management. The results of this article, will favor implementing strategies in health care for patients with stroke. Its results contribute to a case study currently underway, which seeks to establish a methodological and strategic health care route for individuals with CVD, focused on value creation[11], in a Health Service Provider Institution (IPS, for the term in Spanish) in Colombia.

MATERIALS AND METHODS

A mixed-approach study was conducted and its design was sequential exploratory[12], to answer the question: How do the perspectives of various Health System actors on the care of individuals with Cerebrovascular Disease (CVD) relate to the analysis of CVD mortality trends in Colombia, broken down by gender, from 2010 to 2021?

A sequential mix was carried out, where the first phase considered the results of the, already mentioned, case study focus groups about value-centered health care for individuals with CVD at an IPS in Colombia, and the second phase conducts the quantitative study (ecological), which analyzes mortality due to stroke in Colombia – by gender – from 2010 to 2021. This latter had greater preponderance over the qualitative study to characterize the meaning of one of the outcomes brought by CVD and which is referred to by some actors in the Colombian health system with its relationship with health care. Gender was considered a relevant factor, given that some publications in Colombia recommend focusing on women, with intervention strategies from health care to avoid CVD and its outcomes. Under the mixed approach, narratives by some actors from the health system in Colombia were discussed with respect to care of CVD and its outcomes, its comprehension, and significance

During the qualitative phase, four focus groups were conducted, each lasting an average of one hour. The sessions included participation from 31 individuals in diverse roles in the system, such as managers from various institutions and healthcare organizations,

patients and their families, clinical experts in CVD care and health care support and logistics staff. The focus groups were recorded, with the corresponding informed consent completed and signed by each participant. Analysis of qualitative data was guided by the techniques and procedures of grounded theory[13].

Thereafter, a mixed ecological study was carried out[14] to analyze the trend of mortality due to CVD in Colombia between 2010 and 2021 by sex. The information was obtained from the non-fetal death registry and coded by cause of death from the National Administrative Department of Statistics – DANE[15].

The variables analyzed were age, sex, and year of death due to CVD. The annual crude rates were calculated for Colombia and by sex, taking as denominator the population projections and back projections of the 2018 Census. The rates were adjusted with the direct method[16], using the standard population by the World Health Organization (WHO)[17], and expressed for every 100,000 inhabitants per year. Subsequently, standard errors were calculated using the following formula[18,19].

$$EE\_Tasa\_aj = \sqrt{\Sigma_{i=x}^{y}\left(\frac{Stdpop_i}{\Sigma_{j=z}^{y} stdpop_j}\right)^2 X \left(\frac{count_i}{population_j{}^2}\right)} \; X \; 100{,}000$$

Statistical analysis

The behavior of the mortality rate trends was assessed using the Joint-point regression model (segmented Poisson model). This model identifies in the trend in mortality rate due to CVD and by sex and permits calculating the annual percentage change (APC) and the Average Annual Percentage Change (AAPC) to summarize the trend for the period 2010-2021[20].

The regression model included the year of death due to CVD as independent variable and the adjusted mortality rate due to CVD as dependent variable. Statistical significance was estimated using Monte Carlo simulation[19] with a significance level of $p < 0.05$.

The data used are of public access and are from national databases. The analysis used freely accessible anonymized secondary sources published by official entities.

Ethical considerations

This study was derived from the doctoral thesis entitled "Value-based healthcare (VBC): a construction between the ideal and the real from the provision of health services in Colombia to people with stroke (ACV)", which was endorsed by the Ethics Committee of the CES University, Act 224 of 2023. The publicly available data were analyzed solely for academic purposes.

RESULTS

The findings from the qualitative data analysis regarding health care of CVD and its outcome as mortality were relevant. Some of the actors state that mortality must be

analyzed and understood, as the starting point to redefine intervention actions and refocus health care to contribute to its preventability. This is how a clinical expert in the management of this pathology expressed it: “Mortality is an outcome that must be understood, not just morbidity. Exploring those causes of death that perhaps could have been avoided by the pathology or the care and impact upon them” (O4GF4-40).

In this sense, mortality in Colombia needs to be analyzed and establish its causes to, thus, set up new strategies to care for this pathology, as stated by a manager from a health services provider institution (IPS, for the term in Spanish): “care focused on the user’s important needs, seeing that patient in comprehensive manner, in a total care form” (O4GF4-3).

Some individuals who have endured this disease and their families perceive that mortality, as outcome, may increase due to lack of knowledge, in the clinical and non-clinical setting, to identify this disease in timely manner, start its treatment, and avoid very disabling and fatal consequences. This is what a patient’s family referred to: “They looked at his heart attack, but they didn't address his cerebral infarction, that is, they didn't know he had a cerebral infarction” (O4GF1-18).

From this perspective, the patient becomes the driving force behind innovation, differentiation, and education processes. These efforts lead to interventions addressing modifiable and semi-modifiable causes within public health, with the patient at the center of these actions. Likewise, This was expressed by one of the leaders of the information systems in the sector: “the patient becomes an ally to have a better experience and education” (O4GF4-14).

Each of the actors must recognize the patient as a dignified person capable of communicating symmetrically and horizontally, and recognize that care strategies must be designed by all the actors to achieve better health outcomes. This recognition was expressed by a patient with CVD, regarding the nursing role, their care, and the call to co-design the health care strategy with help of patients[21]: “the nurse saw us as she passed through the hallway and approached me and said: tell me, how are you, how have you felt?” (EV1-6)

A manager from the Health Promotion Companies (EPS, for the term in Spanish) contributed from his perspective the following expression:

“value-based care is influenced by the outcome” (O4GF4-19), which indicates that mapping mortality and its causes is essential to transform health care and prevent CVD, from the actions of public health and new health care strategies

Finally, the results of the qualitative study were grouped into four subsidiary categories. The first states: “From volume to value; a joint construction of its meaning”; the second: “A network that gathers talents, skills, and knowledge to create value”; the third: “The culture of excellence is a decision of transformation, guided by purpose, strategy, efficiency, and retribution”; and the fourth: “Health outcomes are the voices of individuals with CVD, which give new significance to a new life upon the unexpected”.

From the interrelation of these categories three intermediate ones emerge, the first states that: “Creating value is recognizing the diverse voices, generating alliances, and motivating to obtain better health outcomes”; the second: “An organization that creates

value is sustainable and provides well-being in its internal and external environments"; the third expresses that: "Excellence in health care has as outcome an experience that leaves a mark and rewards achievements".

The study's final thesis is: "Improving health outcomes for individuals with CVD in an IPS in Colombia is a network-wide decision, which redefines and co-creates value-based health care within a culture of excellence, guided by the intersection between what is relevant and distinct".

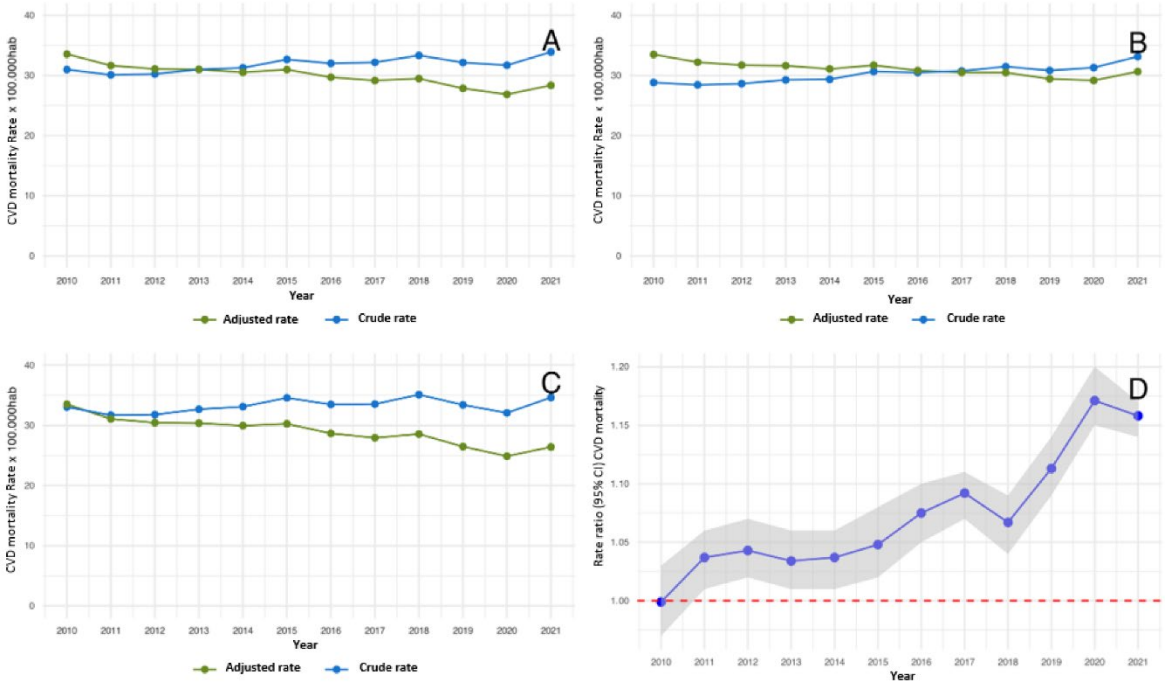
Currently, Colombia has centers of excellence to manage CVD[22], with this being an advance that has possibly contributed to diminishing CVD rates.

The mixed ecological study found that during the period from 2010 to 2021 179,788 deaths due to CVD were reported, with 53.4% in women and 46.6% in men. The CVD-adjusted mortality rate was reduced by 15.48%; higher in women (21.12%) than in men (8.48%) (Graphic 1).

Participation by men in mortality has increased in absolute and relative terms. For 2010 and 2011 there were no differences in the rates by sex; in 2012, the rate for men was 1.27 per 100,000 inhabitants – higher than for women who reached 4.24 per 100,000 inhabitants in 2021.

With respect to relative differences, the mortality rate for men was higher by 1% to 6% in 2011 (RD=1.04; 95%CI=1.01; 1.06), reaching a maximum in 2020 with an excess between 15% and 20% (RD=1.17; 95%CI =1.15; 1.20). By 2021, said difference remained, between 14% and 17% (RD= 1.16; 95%CI = 1.14; 1.17) (Table 1 and Graphic 1-D).

Graphic 1. A: CVD mortality rate for Colombia per 100,000 inhabitants, 2010-2021. B. CVD mortality rate for men per 100,000 inhabitants, 2010-2021. C. Mortality rate due to CVD for women per 100,000 inhabitants, 2010-2021. D. Adjusted rate ratio of mortality due to CVD in men/women (95%CI) 2010-2021.



Source: elaborated by the authors.

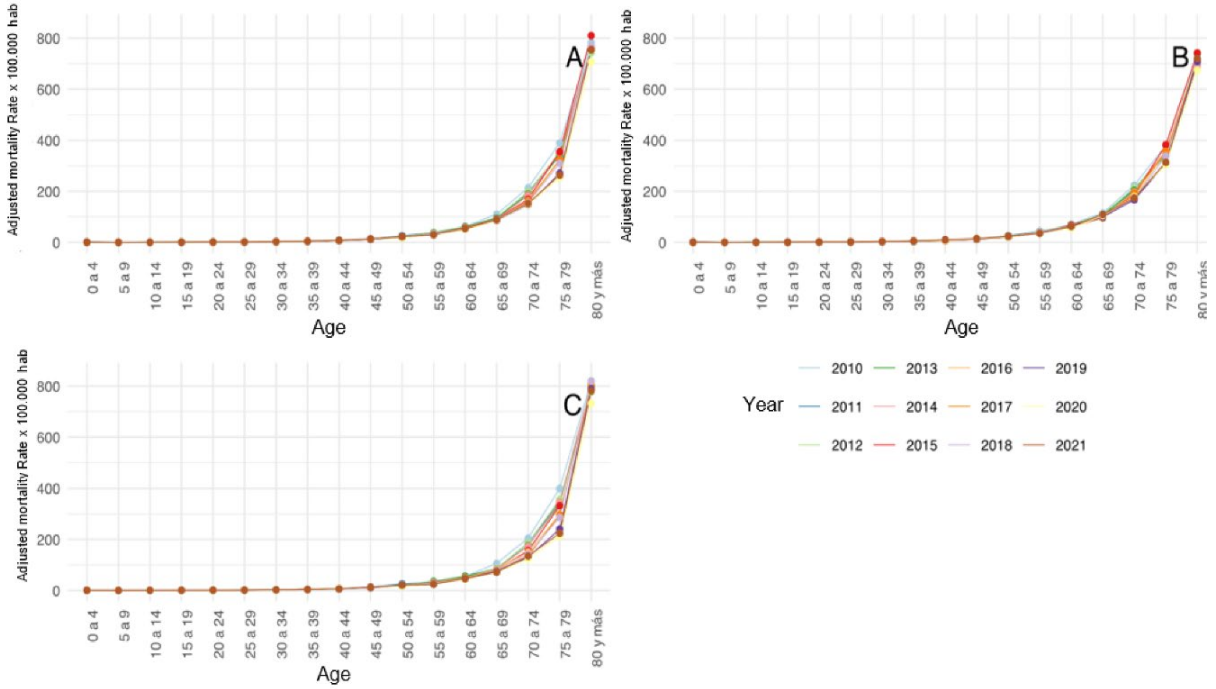
Between 2010 and 2012, the mortality rate in Colombia decreased by 3.43%, (APC=-3.34; 95%CI=-15.99%; 10.99%) and by 0.45% between 2012 and 2015 (APC= -0.45; 95%CI= 12.41; 13.14). Between 2015-2021, the reduction ranged between 3% and 0.5% (APC= 1.92; 95%CI=-3.35; -0.46). Compared to the average annual percentage change, in Colombia there was a reduction of 0.07%; however, it was not statistically significant.

In men, the reduction was 0.83% between 2010 and 2016, (APC=-0.83; 95%CI=-1.72%; 0.06%); 1.72% between 2016 and 2019 (APC=-1.72; 95%CI=--9.24%; 6.42%); and a slight increase of 1.13% between 2019 and 2021, although without statistical significance (APC=1.13; 95%CI=-6.62%; 9.51%). Regarding the AAPC, the mortality rate showed a reduction of 0.07%.

In women between 2010-2012, there was a 4.24% reduction, (APC=-4.24; 95%CI=-19.20%; 13.49%); 0.45% between 2012 and 2015 (APC=-0.45; 95%CI=-14.97%; 16.54%); and between 4.5% and 0.90% for the period from 2015 to 2021 (APC= -2.73; 95%CI=-4.53; -0.90). In AAPC, the mortality rate had a reduction of 2.39%, this variation was also not statistically significant.

The age-based analysis showed that mortality due to CVD increases with age. In Colombia, the rising trend begins between 45 and 49 years of age, duplicating for men between 75 and 80 years of age and over. In women, mortality in those over 80 years of age was three times higher than that of women between 75 and 79 years of age from 2019 to 2021 (Graphic 2).

Graphic 2: A. CVD-adjusted mortality rate for Colombia, 2010-2021 according to quinquennial ages; B. CVD-adjusted mortality rate for men, 2010-2021, according to quinquennial ages; C. CVD-adjusted mortality rate for women, 2010-2021 according to quinquennial ages



Source: elaborated by the authors.

DISCUSSION

According to the narratives by the actors, mortality is a negative outcome of CVD, which may be prevented in two major dimensions, people's lifestyles and refocusing of health care. They express that an individual's death due to CVD can be prevented in the acute phase of care and following hospital discharge, if provided in comprehensive, timely manner and under innovation and differentiation criteria. Education must be an ongoing strategy in public health to impact upon the lifestyles of the people, to improve their health condition and, thus, avoid and/or mitigate impacts from modifiable and semi-modifiable factors.

The qualitative results of this study align with the findings of other qualitative studies, which the literature has referred to decades ago until now, where the most representative for people with CVD and their caregivers are the outcomes and their impact. Also, the most-significant problem associated is quality care for individuals with stroke and education to prevent factors associated as cause of the disease[23,24].

The mixed ecological study component analyzed the CVD mortality trend in Colombia between 2010 and 2021 by sex, finding a more significant reduction in women than in men, and increasing between 2020 and 2021. Between 2015 and 2021, the reduction was significant in women and at national level. The mortality rate revealed growth as of 50 years of age, concentrating on those over 80 years of age.

In Colombia, the mortality rate due to cerebrovascular diseases diminished during the period observed[25]. According to the World Heart Federation (WHF), this is due to the reduction in recurrence rates and disease management[5], as well as new pharmacological treatments[26,27]. It is indicated that 64% of countries have implemented measures to control smoking, access to drugs, and created units specialized in public health[28].

In Colombia, strategies have been proposed to manage CVD, creating a care route and guidelines for its management[29,30]. Access to health services continues being a challenge, given that membership to the system does not guarantee effective care[31].

Between 2015 and 2021, CVD reduction was significant, coinciding with international data, where 51% of all deaths due to CVD occur in men and 49% in women[32]. Nevertheless, sufficient scientific evidence does not exist in Colombia to explain this difference, representing a gap in knowledge regarding the relationship between gender and mortality due to CVD. Women in Colombia continue to be a group of special significance and are differentiated from men due to the multiple factors that predispose them to a higher risk of CVD incidence and mortality from this cause as an outcome. Some of these factors include pregnancy and postpartum, use of oral contraceptives, coagulation factors, genetics, age, hormonal issues, immune and social aspects that ultimately contribute to an increased risk. Atrial fibrillation is also an important cause of this disease in women and it is exacerbated by the fact that they receive less anticoagulant treatment compared to men[33,34].

In the United States, reduction of mortality due to CVD has been attributed to improved health care and to prevention, although increased prevalence is noted[35]. Mexico and

Spain report decreased mortality, but without clear explanation of the factors contributing to this change[36,37].

Despite the reduction of mortality due to CVD, the number of deaths in Colombia and globally have increased by 60% in the last 30 years, which is linked to aging and population growth.[4,28] In Colombia, its occurrence is related with unhealthy diet, sedentary lifestyle, and poor access to related health services to control comorbidities[5,38].

For 2019, it was estimated that 17.9-million people died as a result of cardiovascular and/or cerebrovascular disease, representing 32% of the 17-million premature deaths (under 70 years of age); 38% were attributed to CVD[39].

The American College of Cardiology stresses that CVD is a multicausal disease, and that its prevention requires addressing the social determinants of health[40]. The Global Health Observatory (GHO) indicates that mortality due to CVD is greater in women than in men[41] which coincides with the results from this study.

Aging is a predictor of CVD, especially in those over 80 years of age. In several countries, the adjusted mortality rate due to CVD has decreased in this population, but progress must continue in its prevention and management. The literature suggests that an effective strategy should focus on promoting lifestyle changes, targeting high-risk populations, and emphasizing early detection, control, and management of the disease[42] Likewise, adopting integrated value-based care strategies[43] is configured as effective lines of work in addressing individuals with CVD.

Limitations: Given the scope of this type of study, only descriptive data can be provided. This limitation prevents establishing a relationship between observed trends and any associated clinical factors. No studies are available to explain the behavior of the trends found.

The implications of health care for CVD in Colombia, and according to the results, have seen the epidemiological behavior of mortality favored, according to its rates adjusted by gender, but – nevertheless – progress must be made on the incidence of this phenomenon through diverse health care strategies and models that impact upon the increasing number of mortality cases due to this medical condition.

It is necessary to advance in developing explanations on the behavior of the adjusted mortality rate due to CVD in Colombia. Likewise, it would be relevant to favor the implementation of emerging value- and person-centered health care models. Future studies of this type in other contexts and with equal or different pathology should broaden the contrast of qualitative data with quantitative data.

CONCLUSIONS

Although the reduction of mortality due to CVD in Colombia follows the global trend, the absolute number of deaths has increased, likely due to aging and population growth, as well as modifiable factors, such as sedentary lifestyles, obesity, and poor access to primary care. This reduction in Colombia may be associated with the advance and use of diverse health technologies to diagnose and treat time-dependent disease. Likewise,

improved timeliness of care, which favors its focus, diagnosis, and treatment, together with the availability of medications and the implementation of public health strategies, such as the cardio-neurovascular route. The active search to transform health care and the implementation of centers of excellence to care for this disease have contributed to diminishing the adjusted rate of mortality.
To diminish mortality and other adverse stroke outcomes, it is necessary to have participative strategies that include the needs and experiences of all the actors involved in patient value-based health care.

The study successfully achieved its objective. By contrasting the narratives of key actors with statistical data and their interrelations, it highlights the need to enhance health care and its quality. This improvement can be driven by strategies that amplify the patient's voice while aligning with the interests of other health system stakeholders. Such an approach fosters a value network, evident in the establishment of more centers of excellence for managing the pathology—both in Colombia and globally.

Nursing is a relevant actor with great scientific contribution to the study, design, and implementation of models that transform health care for individuals with CVD, given its role in care, how its skills improve the experience and – consequently – its contribution to improving health outcomes. Currently, nursing science has favored implementing value-centered care models.

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CONFLICTS OF INTEREST

The authors declare having no conflicts of interest.

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