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Relationship between universal health insurance benefits and prostate cancer mortality in Colombia

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Abstract

Purpose Prostate cancer is the most common cause for cancer mortality among men in Colombia. Law 100, in 1993, created a contributory regime (private insurance) and subsidized regime (public insurance) in which the subsidized regime had fewer benefits. However, Ruling T760 in July 2012 mandated that both systems must offer equal quality and access to healthcare. This study examines the impact of this change on prostate cancer mortality rates before and after 2012.

Methodology Prostate cancer mortality records from 2006 to 2020 were collected from Colombia's National Administrative Department of Statistics (DANE). Crude mortality was calculated by health insurance for different geographic areas and analyzed for changes between 2006 and 2012 and 2013–2020. Join-Point regressions were used to analyze trends by health insurance.

Results Crude mortality rates in the contributory regime had a non-statistically significant decrease from 2006 to 2012 (AAPC= -1.32%, $P=0.14$, 95% CI= -3.12, 0.52). In contrast, between 2013 and 2020 there was a non-statistically significant increase in crude mortality (AAPC 1.10%, $P=0.07$, 95% CI= -0.09, 2.31). Comparatively, crude mortality in the subsidized regime, from 2006 to 2012, increased with a statistically significant AAPC of 2.51% ($P<0.001$, 95% CI = 1.21, 3.83). From 2013 to 2020, mortality continued to increase with statistically significant AAPC of 5.52% ($P<0.001$, 95% CI = 4.77, 6.27). Compared to their crude mortality differences from 2006 to 2020, from 2013 to 2020, the departments of Atlántico, Córdoba, Sucre, Arauca, Cesar, and Cauca had the highest rates in prostate cancer mortality in the subsidized regime compared to the contributory regime.

Conclusion Ruling T760 did not positively impact prostate cancer mortality, particularly of men in the subsidized regime.

Keywords Prostate cancer, Colombia, Latin America, Insurance, Policy

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Background

In 2020, globally, prostate cancer ranked as the second leading cause of cancer-related deaths among men, following lung cancer [1]. Moreover, in 2020, researchers estimated that prostate cancer led to approximately 375,304 new male deaths worldwide, with Colombia contributing 14,460 new cases and 3,846 deaths [2, 3]. In Colombia, prostate cancer stands as the primary cause of cancer-related mortality in men [4]. This alarming trend in prostate cancer mortality is expected to escalate globally, driven by factors such as economic growth and an aging population [2, 3]. Furthermore, there exists a notable difference between high-income countries and low-and-middle-income countries (LMICs) concerning prostate cancer incidence and mortality rates [3, 5]. While LMICs generally exhibit lower incidence rates of prostate cancer, their mortality rates surpass those of high-income countries [3, 5]. These mortality rates, in LIMCs like Colombia or other Latin American nations, have been described in epidemiologic studies to be correlated to inequalities surrounding prostate cancer screening and treatment which can be closely associated with the type of health coverage and access to care [3]. Additional barriers hinder access to prostate cancer care, such as extended delays in obtaining service, a deficit of oncologists, absence of uniform care standards, and difficulties in accessing dependable and affordable transportation, especially in rural regions [6, 7].

In 1993, Law 100 was implemented to promote fair distribution of healthcare across Colombia [8]. This law introduced a healthcare managed competition model featuring two primary insurance schemes: the contributory regime and the subsidized regime [8]. The contributory regime caters to employed individuals who pay for their insurance, while the subsidized regime covers those unable to afford insurance through government subsidies [8]. However, universal coverage did not ensure equal access to care for all Colombians, despite the establishment of these insurance regimes, as numerous barriers to access care persisted and inequalities between Colombians in the contributory and subsidized regime were evident [9]. Consequently, in 2008, the Constitutional Court of Colombia issued Ruling T760, mandating the government to ensure equitable and effective universal healthcare rights to all Colombians by July 2012 [10]. The ruling aimed to provide all citizens, regardless of their insurance affiliation, with equal access to high-quality healthcare services [10]. The changes to the subsidized regime included expanding access to over 2,000 medicines, procedures, and health services that were previously unavailable [10]. This included access to specialized consultations of all kinds, diagnostic tests, and continuity in diagnosis and treatment [10]. Additionally, patients in the subsidized regime gained the ability to have first-time consultations with specialists without needing authorization from the Health Secretariats, and the paperwork for other types of care in municipal entities was eliminated [10].

In Colombia, both the ministry of health and the Colombian Urological Society recommend screening asymptomatic men over the age of 50 when going for medical appointments for other reasons [11]. Although there is a high knowledge of prostate cancer screening, only a third of men report getting screened [12]. In addition, in 2017, the Colombian Institute of Cancerology reported they could not find sufficient literature on the quality of treatment or the timeliness of prostate cancer diagnosis [13]. When examining cancer mortality in relation to health regime affiliation in Colombia, we found that for gastric cancer, members of the contributory regime had a 12.9% chance of five-year survival compared to 8.3% for those in the subsidized regime [14]. Similarly, for cervical cancer, women of the contributory regime had a 57.9% chance of five-year survival compared to 41.9% for those in the subsidized regime [15]. These mortality differences were linked to poor living conditions, lower educational levels, and administrative barriers to accessing health care [14, 15]. Based on these observations, we hypothesized that prostate cancer mortality will show significant differences based on insurance affiliation, despite Ruling T760 being in place.

According to Aday and Andersen [16] health policy is the starting point for consideration of access to health care. Elements of this model serve as our conceptual model and are useful to understand the relationship between policy, insurance and prostate cancer mortality. In Colombia policy dictates that health care access is a right and as such most of the Colombian population has access that is determined by law. Health policy also dictates the characteristics of health insurance and health delivery system, in terms of resources and organization. Therefore, in Colombia, health insurance status and type along with the characteristics of the population could determine cancer early detection and survival. The objective of this study was to assess whether Ruling T760 had a positive impact on prostate cancer mortality in Colombia's health regimes by comparing mortality data from 2006 to 2012 (before T760) and from 2013 to 2020 (after T760).

Methodology

Study Design and Data sources

This was a secondary data analysis of Colombian mortality data, that was collected and made publicly available by the National Administrative Department of Statistics (DANE) [17]. The data comes from death certificates which are filled out by physicians, collected by health care institutions, then sent to the Ministry of Health,

and subsequently to DANE for logging and quality control [17]. Each year, DANE's website reports an annual de-identified mortality dataset containing information on the primary cause of death, secondary cause of death, demographics, health regime affiliation, how the cause of death was determined, demographics including gender, age group, department where the deceased individual lived, marital status, race, and educational attainment [18].

Data Management

Fifteen "Vital Statistics" datasets were used, each containing between 48 and 69 variables. We first filtered the records by ICD-10 code C61- *malignant neoplasm of prostate*, and records with individual's permanent residence as Colombia. Twenty duplicate cases were then eliminated. Next, variables not relevant to the study were removed, such as those related to gestation or pregnancy status, deaths due to occupation, maternal educational attainment, the department where the individual died, occupation, cause of death, and birth-related information. Finally, the fifteen datasets were merged in SPSS, and the categories for each variable of interest were standardized across all datasets. The resulting dataset contained 55 variables. The main variables of interest were health insurance affiliation, educational attainment, marital status, primary cause of death, age group, department of residence, ethnicity, and rural/ urban residence.

Statistical analysis

First, we calculated the crude prostate cancer mortality rates for total male population in each regime, by year. Then, we calculated mortality rates by regime and year using the formula: *(total # of prostate cancer deaths in regime w in year x) / (total male population in regime w in year x) *100,000*. Since data for the number of Colombians in each regime was not categorized by sex, we estimated that 48% of men were in each regime in a given year by using census data from 2006 to 2020.

Additionally, we analyzed trends in prostate cancer mortality rate by insurance type and time-period using Joinpoint regression, through a statistical software provided by the National Cancer Institute. Joinpoint regression is a method used to evaluate shifts in time series data, such as changes in cancer mortality rates [19]. In our study, Joinpoint regression helped us identify changes in prostate cancer mortality from 2006 to 2020. The mechanism by which Joinpoint works is by allowing users to specify the minimum and maximum number of joinpoints [20]. Starting with the minimum (e.g., 0 representing a straight line), the program evaluates the statistical significance of additional joinpoints, enabling users to verify significant trend changes. The tests of significance use a Monte Carlo Permutation method [20]. Average annual percentage changes (AAPC) were used to determine by what percentage mortality increased or decreased from one time-period to the next. Statistical significance was determined by $p<0.05$.

We also calculated the differences in departmental rates between the two time-periods (2006–2012 and 2013–2020) based on health insurance type. The goal of this analysis was to assess the variation in mortality between these two periods in the subsidized and contributory regimes across Colombia's 32 departments. For both time periods, we used this formula: *(Prostate Cancer Crude Mortality from x time period in subsidized regime in y department) – (Prostate Cancer Crude Mortality from x time period in contributory regime in y department).*

The results were used to create two QGIS maps. Map 1 illustrates the prostate cancer crude mortality difference between the subsidized and contributory regime, from 2006 to 2012, in Colombia's departments. Map 2 shows the prostate cancer crude mortality difference between the subsidized and contributory regime, from 2013 to 2020, in Colombia's departments. In these maps, positive numbers (darker colors) indicate that in a specified time period, the subsidized regime had more prostate cancer-related deaths than the contributory regime. Conversely, the negative numbers (lighter colors) indicate that in a specified time period, the subsidized regime had fewer prostate cancer-related deaths than the contributory regime.

Overall, data analysis was done using SPSS v. 28.0.0 [21], Excel 2016 [22], Joinpoint v 5.0.2 [23], and QGIS v. 3.16.16 [24]. This study was declared as non-human subjects research by the CUNY Graduate School of Public Health and Health Policy Human Research Protection Program (HRPP) and Boston University School of Public Health. Additionally, it did not require us to submit a human subject determination in Colombia due to the nature of the study according to resolution 8430 of 1993 of Colombia.

Results

Sociodemographic characteristics

Table 1 presents the characteristics of all 41,298 prostate cancer mortality cases included in the study, categorized by health regime. The majority of men belonged to the contributory regime (47.4%), followed by the subsidized regime (43.3%), the uninsured (5.5%), and other (2.9%). All variables showed statistically significant differences between regimes. For example, a higher percentage of men in the subsidized regime lived in rural areas (17%) compared to 3.7% of men in the contributory regime. Additionally, 8.1% of subsidized men identified as Black or Afro-Colombian, compared to 5% of contributory-affiliated men. Lastly, 2.8% of men in the subsidized

Map 1 Prostate cancer death rates contrasted between subsidized and contributive healthcare, 2006–2012, in Colombian Departments. Due to limited space, all department names are not featured on the map. The positive numbers (darker colors) mean that from 2006 to 2012 the subsidized regime had more cervical cancer-related deaths than the contributive regime in x department. The negative numbers (lighter colors) mean that that from 2006 to 2012 the subsidized regime had fewer cervical cancer-related deaths than the contributive regime in x department

Map 2 Prostate cancer death rates contrasted between subsidized and contributive healthcare, 2013–2020, in Colombian Departments. Due to limited space, all department names are not featured on the map. The positive numbers (darker colors) mean that from 2013 to 2020 the subsidized regime had more cervical cancer-related deaths than the contributive regime in x department. The negative numbers (lighter colors) mean that that from 2013 to 2020 the subsidized regime had fewer cervical cancer-related deaths than the contributive regime in x department

regime completed secondary education compared to 10.8% of men in the contributory regime.

Mortality rates by health regime

Crude mortality in the contributory regime decreased from 13.21 deaths per 100,000 men in 2006, to 12.01 deaths per 100,000 men in 2012. This represented a non-statistically significant reduction in prostate cancer mortality with an average annual percentage change (AAPC) of -1.32% (P=0.14, 95% CI= -3.12, 0.52) (Graph 1). Then, from 2013 to 2020 there was a non-statistically significant increase from 13.30/100.000 to 13.90/100.000 (AAPC 1.10%, P=0.07, 95% CI= -0.09, 2.31).

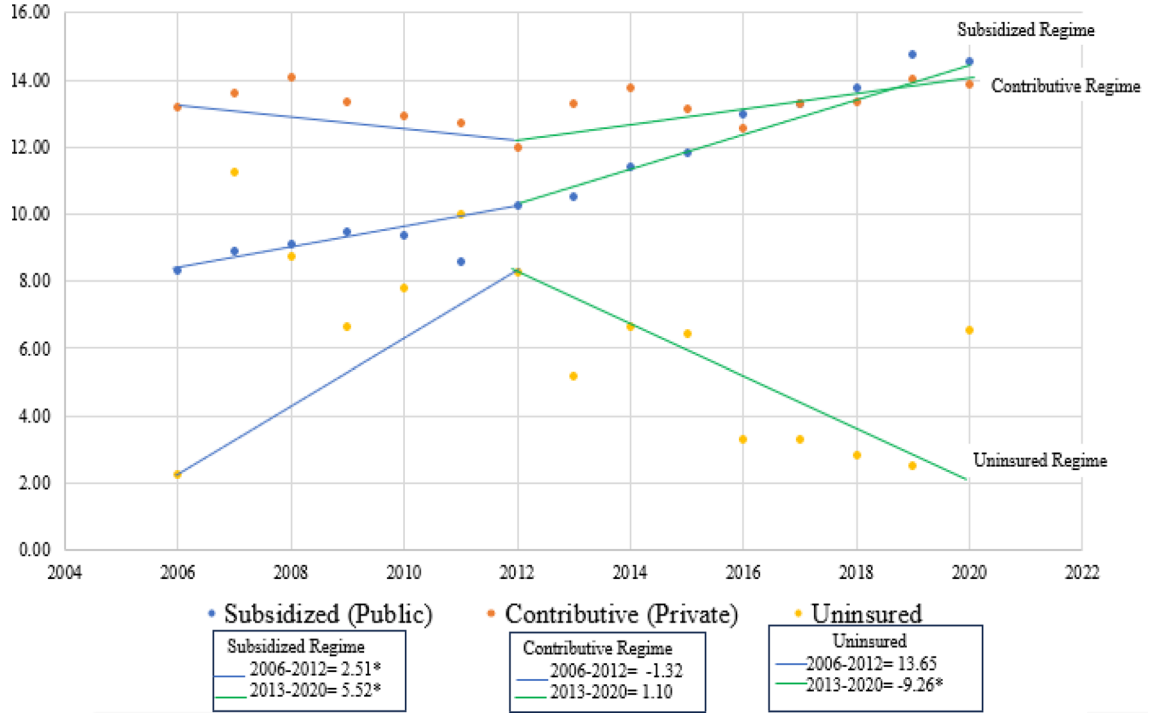
Comparatively, crude mortality in men in the subsidized regime was 8.33/100,000 in 2006 compared to 10.24/100,000 in 2012, with a statistically significant AAPC of 2.51% (P=<0.001, 95% CI=1.21, 3.83) (Graph 1). Also, from 2013 to 2020, there was a statistically significant increase from 10.54/100,000 to 14.54/100,000 with an AAPC of 5.52% (P=<0.001, 95% CI=4.77, 6.27).

The uninsured population had a non-statistically significant increase in mortality rates from 2006 to 2012

Table 1 Socio-demographic characteristics of 41,298 prostate cancer mortality cases in Colombia by insurance type

Variable	Total population *N* = 41,298	Contributive (private) *N* = 19,579	Subsidized (public) *N* = 17,873	Uninsured *N* = 2289	Other *N* = 1191	*p**
	N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	
Residential area	*N* = 40,787	*N* = 19,535	*N* = 17,798	*N* = 2275	*N* = 1179	**< 0.001**
Urban	34,433 (84.4)	18,335 (93.9)	13,021 (73.2)	2094 (92.0)	983 (83.4)	
City center	2379 (5.8)	469 (2.4)	1760 (9.9)	71 (3.1)	79 (6.7)	
Rural	3975 (9.7)	731 (3.7)	3017 (17.0)	110 (4.8)	117 (9.9)	
Ethnicity	*N* = 34,760	*N* = 16,677	*N* = 15,407	*N* = 1712	*N* = 964	**< 0.001**
Indigenous	340 (1.0)	36 (0.2)	285 (1.8)	4 (0.2)	15 (1.6)	
Rom	25 (0.1)	17 (0.1)	5 (0.0)	2 (0.1)	1 (0.1)	
Black or afro- Colombian	2269 (6.5)	829 (5.0)	1243 (8.1)	88 (5.1)	109 (11.3)	
Mixed	32,126 (92.4)	15,795 (94.7)	13,874 (90.0)	1618 (94.5)	839 (87.0)	
Marital status	*N* = 33,240	*N* = 16,306	*N* = 14,314	*N* = 1650	*N* = 970	**< 0.001**
Single	3746 (11.3)	1008 (6.2)	2439 (17.0)	74 (4.5)	225 (23.2)	
In a relationship	21,269 (64.0)	11,708 (71.8)	7859 (54.9)	1240 (75.2)	462 (47.6)	
Divorced, separated, or widowed	8225 (24.7)	3590 (22.0)	4016 (28.1)	336 (20.4)	283 (29.2)	
Education Level	*N* = 31,840	*N* = 15,316	*N* = 13,921	*N* = 1726	*N* = 877	**< 0.001**
Preschool or none	10,550 (33.1)	4114 (26.9)	5535 (39.8)	575 (33.3)	326 (37.2)	
Primary	18,356 (57.7)	9057 (59.1)	7975 (57.3)	833 (48.3)	491 (56.0)	
Secondary	2259 (7.1)	1613 (10.5)	388 (2.8)	210 (12.2)	48 (5.5)	
Undergraduate or higher	675 (2.1)	532 (3.5)	23 (0.2)	108 (6.3)	12 (1.4)	
Age group (in years)	*N* = 40,915	*N* = 19,573	*N* = 17,863	*N* = 2288	*N* = 1191	**< 0.002**
Less than one to 14	1 (0.0)	0 (0.0)	1 (0.0)	0 (0.0)	0 (0.0)	
From 15 to 44	125 (0.3)	57 (0.3)	50 (0.3)	8 (0.3)	10 (0.8)	
From 45 to 64	4236 (10.4)	1997 (10.2)	1899 (10.6)	198 (8.7)	142 (11.9)	
65 and older	36,553 (89.3)	17,519 (89.5)	15,913 (89.1)	2082 (91.0)	1039 (87.2)	

Note *The p-values provided describe the level of significance for the comparisons between each insurance type. Each variable had missing values



Graph 1 Colombian prostate cancer mortality comparing contributive, subsidized and uninsured regimes, 2006–2020. *Indicates that the AAPC is significantly different from zero at alpha = 0.05. ~ If the Average Annual Percentage Change (AAPC) is within one segment, the t-distribution is used. Otherwise, the normal (z) distribution is used

(AAPC=13.65%, P=0.44, 95% CI= -17.94, 57.42) (Crude rate: 2.26 /100,000 versus 8.30/100,000) (Graph 1). However, from 2013 to 2020, there was a statistically significant reduction in crude mortality with an AAPC of -9.26% (P<0.01, 95% CI= -14.99, -3.14) (Crude rate: 5.20/100,000 versus 6.53/100,000).

Mortality by department

Compared to the crude mortality differences of 2006 to 2020 (Map 1), from 2013 to 2020 (Map 2), the departments of Atlántico, Córdoba, Sucre, Arauca, Cesar, and Cauca had the highest increases in prostate cancer mortality in the subsidized regime compared to the contributory regime. Specifically, Atlántico had 4.03 more deaths/100,000 men, Córdoba had 3.71 more deaths/100,000 men, Sucre had 3.19 more deaths/100,000 men, Arauca had 2.96 more deaths/ 100,000 men, Cesar had 2.31 more deaths/100,000 men and Cauca 2.26 more deaths/100,000 men.

Discussion

The study revealed several key findings. Firstly, there was a non-statistically significant increase in crude prostate cancer mortality in the contributory regime after 2012. In contrast, the subsidized regime experienced a statistically significant increase in crude prostate cancer mortality during the same period. Interestingly, the uninsured population saw a statistically significant reduction in crude prostate cancer mortality after 2012. Furthermore, specific departments such as Atlántico, Cordoba, Sucre, Arauca, Cesar, and Cauca showed the highest increases in prostate cancer mortality under the subsidized regime compared to the contributory regime from 2013 to 2020.

The difference in post-2012 prostate cancer mortality between the contributory and subsidized regimes may be attributed to several factors. Ruling T760 did not change the health benefits of men in the contributory regime, rather it equated those of the subsidized regime [10]. Colombians in the contributory regime generally have a higher socioeconomic status (SES) than those in the subsidized regime [8, 25]. A higher SES provides patients with the financial means to opt for alternative private providers when their health insurance does not cover certain services or services are getting delay [25].

Residence can serve as a useful indicator of socioeconomic status [26] and also impacts access to care [25, 27]. Our results demonstrate that 17% of men affiliated with the subsidized regime reside in rural areas, compared to 3.7% of those in the contributory regime. Higher SES Colombians and those living in urban areas are more likely to have greater access to preventive and outpatient care, as most facilities are concentrated in urban areas [25, 27]. For instance, in the capital city of Bogota, there are approximately 11,068 new cancer cases expected each year, with 97 institutions offering care [28]. This equates to an average of 114 patients per institution [28]. In larger, more rural departments, these ratios range from 150 to 300 [28]. Due to increased access to a variety of health providers, men in the contributory regime are nearly nine times more likely to be screened for prostate cancer compared to men in the subsidized regime [29].

Educational attainment is another significant indicator of socioeconomic status (SES) [30]. It is often observed that Colombians in the contributory regime have higher educational attainment than those in the subsidized regime, which is consistent with our findings [29]. Research indicates an increased risk of cancer mortality among Colombian men with primary-level education (RR 1.35) compared to those with secondary-level education (RR 1.11) [30]. The reduced risk of prostate cancer mortality among higher-educated Colombian men may be attributed to greater healthcare utilization stemming from increased awareness regarding the importance of screening [29, 30]. Consequently, men in the contributory regime have higher odds of being screened (OR 8.81) than men in the subsidized regime (OR 3.7) [29].

Notably, socioeconomic status affects prostate cancer care not only in Colombia. In the United States, for example it has been found that after adjusting for PSA testing, age, race, and geographic region, men with some college and those in the highest quartile of SES were at reduced risk for prostate cancer [31]. Additionally, between 2004 and 2019, prostate cancer mortality significantly decreased in Guayas, Ecuador (-1.1%), compared to a 2.9% increase in Azuay [32]. Guayas is home to Ecuador's largest port, while Azuay is a rural province with a large indigenous population [32]. Like men in the contributory regime who are more likely to live in urban areas, men in Guayas have easier access to hospitals with specialist facilities for cancer detection and treatment [32]. These findings highlight the critical role of socioeconomic factors in influencing prostate cancer outcomes, both in Colombia and other countries.

Between 2013 and 2020, there was a significant increase in prostate cancer mortality rates among men in the subsidized regime. Our data aligns with the observation that Colombians in the subsidized regime often have lower income status, reside in rural areas, and have lower educational attainment [3, 29, 30]. Consequently, men affiliated with the subsidized regime may not have the same access to care or resources as those in the contributory regime [25, 33]. For example, there is a shortage of urologists in rural Colombia, with only 678 urologists in the country, primarily located in urban facilities [34]. Additionally, Colombia falls short of global transportation standards, with only 276 km of paved roads per 1 million residents, impacting rural Colombians the most [35]. This lack of transportation access impacts rural

Colombians the most [36]. On average, 6% of homes lack access to health facilities, rising to 16% in the Amazonian region and 19% in the Pacific region [36].

Our data also indicates that a higher proportion of men in the subsidized regime (8.1%) are Afro-Colombian compared to those in the contributory regime (5%). Additionally, the odds of being affiliated with the subsidized regime are 1.4 times higher for Afro-Colombians than for mixed Colombians [37]. Afro-Colombian communities face a higher risk of prostate cancer mortality, potentially due to disparities in healthcare insurance, socioeconomic factors, and education [2, 23]. The majority of rural populations consist of indigenous peoples (66.0%) and Afro-Colombians (30.4%), with most residing in the Atlantic and Orinoco-Amazon regions, known for their high levels of poverty and marginalization [37]. As a result, subsidized-affiliated Colombian men experience frequent interruptions in prostate cancer care due to health insurance contract expirations, medication unavailability, and service suspensions caused by government payment delays [27].

Similarly, individuals with lower socioeconomic status (SES) in rural areas of Latin America, the Caribbean, or the United States, especially those of African descent, may face trends in prostate cancer mortality related to treatment availability and access [32, 38, 39]. In rural Ecuador, factors such as lack of knowledge, delays in diagnosis, and uneven access to diagnostic tools contribute to 49% of men being diagnosed with advanced clinical stage IV prostate cancer [32]. Men of African descent in the Caribbean also face a higher risk of late-stage diagnosis due to limited access to urologists, diagnosis, and treatment facilities. Studies from Guadeloupe and Martinique report that 12% and 14% of men, respectively, were diagnosed with late-stage prostate cancer compared to 4% of White men [40]. Prostate cancer also disproportionately affects Black men in the United States, where financial constraints and geographical barriers impact health-seeking behaviors [41]. Since African Americans are more likely to be uninsured or underinsured, finances play a crucial role in health-seeking behaviors [41]. Additionally, the lack of accessibility to clinicians with similar cultural values affects willingness for screening or treatment [41]. Overall, lower SES and rural residence further complicate subsidized-affiliated Colombian men's and men of African descent from Latin America, the Caribbean, and the United States' ability to receive quality prostate cancer treatment or radiation therapy due to financial constraints and geographical barriers [32, 40, 41].

Between 2013 and 2020, there was a notable decline in prostate cancer mortality rates among those without insurance. This decline might be linked to a rise in the number of insured individuals in Colombia after 2012 [25, 42]. By 2017, approximately 95% of Colombians were covered by either subsidized or contributory insurance schemes (25,42). Consequently, only about 5% of the population remained uninsured, mirroring our findings [43]. Hence, with fewer uninsured individuals, it seems likely that the observed reduction in mortality rates is influenced by this trend. However, we do not have details of the characteristics of the uninsured population in terms of their socio-economic status and out of pocket capabilities to access care, we did not find similar results in the literature either. Therefore, we do not have enough information to explain this finding.

After 2012, the departments of Atlántico, Córdoba, Sucre, Arauca, Cesar, and Cauca had the highest increases in prostate cancer mortality in the subsidized regime compared to the contributory regime. Atlántico, Córdoba, Sucre, and Cesar are all part of the Caribbean region, which is known for its large Afro-Colombian population, susceptibility to underdevelopment, potentially limiting access to high-quality prostate cancer care [44]. Cauca, located in the Pacific region, appears to grow poorer over time and has less of Colombia's wealth concentrated in it [45]. Access to quality prostate cancer care is often linked to a man's socioeconomic status, and living in a poor region may result in financial limitations that impact access to quality care [25]. Arauca, part of the Orinoco region, faces challenges in providing cancer care due to communication difficulties and geographic isolation, as the majority of the population is indigenous [44, 46, 47]. These regional disparities underscore the importance of targeted interventions to improve access to quality prostate cancer care for vulnerable populations in Colombia.

Improving early diagnosis, particularly through PSA testing, is the top priority in low- and middle-income countries (LMICs) like Colombia [48]. This will reduce the proportion of men who present with advanced-stage cancer and raise the proportion of men with treatable disease [48]. Early detection is essential to avoid serious consequences including spinal cord compression and urine incontinence, especially in males of African origin with metastatic cancer [48]. Targeted screening appears promising based on early research. For example, in a community-led PSA screening in a high-risk Afro-Caribbean population in the Grand Bahamas, out of 1844 men screened, 315 had elevated PSA levels or abnormal digital rectal exams [49]. Consequently, 45 individuals had biopsies, of which 40 (2.2% prevalence), primarily high-risk males, had prostate cancer [49]. Comparably, a study conducted in São Paulo, Brazil, screening 9692 males, discovered aberrant findings in 588 of them, and 251 cases of prostate cancer (2.6% prevalence) were confirmed, comprising 75 cases at intermediate risk and 108 cases at high risk [50]. Compared to high-income

countries (HICs), where approximately 1% of those checked are diagnosed with prostate cancer, these detection rates are much higher [51–53]. In HICs, typically 10% of those examined are referred for additional testing [51–53].

Since pop-up clinics and mobile testing have shown to be successful and affordable when it comes to screening for other diseases, including HIV, in South Africa, they are also attractive innovative options [54]. These can be connected to educational outreach services and led by nurses [54]. The Man Van project demonstrates the potential of this approach for prostate cancer [55]. In high-risk neighborhoods in London, UK, this mobile health clinic provides physical examinations, which include PSA testing [55]. According to data from the pilot study, which included about 600 males, out of the 422 individuals who underwent testing, 14 (3%) had prostate cancer, 15–20% had hypertension and pre-diabetes, and 5% had overt diabetes [55]. Encouraging targeted screening for a range of health disorders, including prostate cancer, can be achieved by combining education with comprehensive health examinations. This approach can be highly effective and flexible for both high-income and low-income countries.

There are some limitations to this study. The data collected by DANE does not differentiate cases according to cell type, stage, or type of treatment. Only five cities, in Colombia, have cancer registries and access to data is limited. Lastly, we could not calculate age standardized mortality rates by healthcare regime because we did not have access to information of health care enrollment type by age groups or sex. Our study is unique in that it evaluates the effect of Ruling T760 on prostate cancer mortality in Colombia's regimes. Despite limitations, it provides a valuable framework for future research and policy aimed at improving the accessibility of quality prostate cancer care. Future studies could assess differences in early-stage and advanced-stage prostate cancer patient navigation with respect to accessing care and identify socioeconomic barriers to accessing cancer care. Future studies may also assess the socioeconomic status and out of pocket capabilities of uninsured Colombian men. Although lawmakers had the right idea, it did not have the expected result; Colombian men may have improved access to cancer care, though inequalities still exist.

Conclusion

Ruling T760 did not positively affect prostate cancer mortality after 2012, possibly due to administrative and socioeconomic hurdles. Both contributory and subsidized regimes experienced an increase in prostate cancer mortality between 2013 and 2020, with the subsidized regime showing the highest mortality rate. Furthermore, from 2013 to 2020, six out of 32 departments reported higher prostate cancer mortality rates under the subsidized system compared to the contributory regime. These results show that more needs to be done to address the increasing rates of prostate cancer mortality such as screening and improving access to healthcare services. Although urologists in Colombia do screening based on a patient's symptoms, a national screening program should be implemented to help mitigate the risks and reduce mortality rates as it has been shown to work in countries such as the US [2, 56]. Future research could focus on departments or municipalities with high mortality rates.

Abbreviations

LIMC	Low-and-middle-income-countries
DANE	National Administrative Department of Statistics
AAPC	Average annual percentage changes
SES	Socioeconomic status

Author contributions

EM and AL: Conceptualization, formal analysis, writing, map creation, reviewing and editing.ICGP: Conceptualization, formal analysis, writing, reviewing, and editing. DH: management of databases, reviewing and editing. AS and RC: reviewing and editing. All authors read and approved the final manuscript.

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Data availability

The dataset supporting the conclusions of this article are available on Colombia's National Administrative Department of Statistics (DANE) website, under the Salud (Health) section, https://microdatos.dane.gov.co/index.php/catalog/SAL-Microdatos.

Declarations

Ethics approval and consent to participate

This study used anonymous, secondary mortality microdata from 2006 to 2020 from DANE. CUNY Graduate School of Public Health and Health Policy, Boston University School of Public Health or University of Antioquia do not require an ethics board review for research that only uses anonymous, secondary data.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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