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Breast cancer and health policies in Mexico

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Abstract

In Mexico, breast cancer is the most common type of cancer in women, accounting for almost 25% of all types of cancer. The average age at diagnosis is approximately 58.2 years. Despite national Mexican guidelines regarding monthly breast self-examination, annual clinical breast exams, and screening mammography for women aged 40-69, the early breast cancer diagnosis in Mexico faces challenges. Insufficient resources are allocated to healthcare due to limited screening coverage, resulting in barriers to access, and as a consequence, a high percentage of cases are being self-detected or diagnosed at late stages. In Mexico, a decline in the diagnosis and treatment of breast cancer has been observed. Key issues, besides insufficient resources, include several factors that hinder early detection, such as low mammography coverage and socio-cultural factors like fear and a lack of information, especially in rural and low-education populations. Otherwise, Mexican health policies vary significantly with each change in government and hinder continuity in breast cancer prevention policies. Besides, lack of access to social security, unemployment, being female, and low educational level negatively influence access to early diagnosis and treatment.

Keywords: Breast cancer; Social security; Quality of life; Health policies; Therapy; Mammography

1. Introduction

1.1. Breast cancer and health policies in Mexico

Health measures directly related to standard of living of people. Analyzing health systems enables comparisons between different population groups and the prediction of catastrophic scenarios related to short-term or long-term illnesses. By understanding the state of public health, governments design and implement public policies aimed at maximizing their economic and human resources, while minimizing the prevalence of diseases and reducing disease-related mortality [1].

Illness is much more than a statistical fact; in a broader sense, its negative impact on the reduction of people's capabilities and functioning must be considered [2]. Diseases are not random events that affect an individual or population, but also have their origin in structural socioeconomic conditions within an adopted institutional model [3].

The institutional framework determines the economic conditions and the conditions that enable or inhibit wealth generation; and they establish the mechanisms to ensure the exchange of goods and services in the market. These institutional frameworks can converge toward widespread well-being or deviate toward the accumulation of rents that benefit only a few. This action results in a decrease in the wealth of society [4].

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Through institutions, incentives can be fairly provided that strengthen individual capabilities, increase access to health services, reduce poverty, and enhance educational levels [5]. In an extractive institutional framework, individuals experience a deterioration in health parameters, which is reflected in a reduction in life expectancy [6].

While the objectives of state-sponsored institutions include maintaining order, they also aim to preserve the lives of their inhabitants, reduce mortality rates caused by disease, and make rational use of resources and distribute them equitably within the health system. While in a state of disorder, individuals fear for their lives and that of their families, in addition to the risk of losing their sources of livelihood and wealth. In this scenario of uncertainty, there are no incentives to produce or to abide by established laws [4].

Equitable access to health services is a fundamental act of justice in health. Justice must be seen through actions that allow people to achieve the highest levels of well-being, both individually and as a group [7].

1.2. Financing the public health system

The public health system in Mexico is financed through taxes, which are derived from business productivity, which in turn is influenced by the institutional arrangements adopted. The incentives adopted are derived from the institutional arrangement, which encourages the development of productive and entrepreneurial activities [4]. In Mexico, productivity is uneven. On the one hand, there are high-tech sectors in which productivity is higher compared to low-tech sectors, whose productivity is lower and tends to operate as an informal sector [8].

Healthcare system financing is also influenced by the priority objectives established by the current government, thus competing with other public goods such as infrastructure development, which connects different locations and markets. In some cases, these projects are viable and feasible; other times, they become white elephants, costing the treasury. In this sense, those in positions of authority, in pursuit of power and fame, embark on projects to satisfy their constituents without regard for their cost, diminishing individual rights and freedoms, such as the right to health [9].

A growing development process can generate an availability of goods and services without sufficient social value for people [10]. Some economic theorists propose that consumers make purchasing decisions based on their preferences and needs, but also taking market prices into account. Another problem is the consumption of products that are not only useless but even harmful to the consumer's health. The creation of consumer protection regulations can lead to overregulation, resulting in excessive costs for businesses [11].

With prior quality information, the state can make decisions to address diseases and their consequences, thus developing the best public policy to mitigate mortality from a disease, specifically breast cancer. On the other hand, in the absence of information, the choice of how to combat the disease is biased and insufficient, rendering public health policy ineffective and inefficient, as it fails to meet its objectives. Therefore, it needs to be reoriented [12].

Indicators such as premature mortality and breast cancer incidence rates allow for the establishment of public policy improvements aimed at enhancing the quality of life of people [13]. In Mexico, government intervention is crucial for providing early cancer detection services, thereby delivering a social benefit in terms of enhancing the quality of life for its inhabitants, while also mitigating negative externalities and amplifying positive ones for citizens [14].

However, in the health market breast cancer care is expensive and inaccessible to the general population, and the income of individuals income is decisive in their choice of service. In the exchange, health providers earn income from the services provided by hospitals, doctors, laboratories, and others, for the benefit of patients. Private agents offering health services and insurance have the market power to set rates, given the market segmentation of the target population [15].

The comparison of indicators by population group provides evidence of disease improvement or worsening, which eventually leads to debates about intervention priorities in public health policy [16]. The lack of government intervention in an epidemiological disease such as diabetes, and in this case, the increase in breast cancer, has adverse effects on the population, resulting in an inadequate assessment of the disease with high human, social, and economic costs. Evaluating the health status of a population helps decision-makers, researchers, and citizens understand the severity of the diseases to which they are exposed. Furthermore, mortality and incidence from breast cancer are indicators of other deprivations in the population [17].

Cancer: Its etiological factors. According to the literature, cancer is a group of diseases characterized by the uncontrolled growth and replication of a mass of cells, with and increased capacity to invade parts of the body other than its original

site [18]. Breast cancer is an abnormal and disordered growth of epithelial cells in the mammary ducts or lobules, which have the capacity to spread by invading neighboring tissues and metastasize to other organs of the body. As a malignant tumor, it results from alterations in the physical structure and function of genes [19]; although its development can occur even without risk factors that predispose to the disease [20].

In 2010, cancers and circulatory diseases accounted for 19% of Adjusted Life Years worldwide [16]. In this context, breast cancer is considered the leading cause of cancer-related death in women, with nearly 500,000 deaths each year, 70% of which occur in developing countries [21]. Specialists in the field recognize that breast cancer treatment is multimodal and requires a multidisciplinary team to be diagnosed early and initiate treatment to reverse mortality rates [22]. Since 2010, it has been recognized that late diagnosis associates with the lack of specialized services and inadequate diagnostic evaluation by healthcare institutions [23].

In 2002, there were 1,151,298 new cases of breast cancer and 410,712 deaths, and more than 4.4 million women were living with this type of cancer around the world [24]. By 2020, the number of this type of cancer rose to more than 2.2 million cases, and around 685,000 women died from this disease [25]. In Mexico, 11,656 cases were diagnosed in 2002, and 3,919 deaths occurred [26]. In 2021, according to the National Institute of Statistics, Geography, and Informatics (INEGI), 90,525 people died from malignant tumors. Of these, 7,973 deaths were due to breast cancer, 99.4% women, and 0.6% men [27].

Among the natural factors that potentiate the onset of the disease are: 1) natural aging; 2) being white; 3) hereditary genetic predisposition in other family members; 4) prior presence of atypical ductal hyperplasia, radial or stellate appearance, as well as lobullary carcinoma in situ by biopsy; 5) menstrual life over 40 years of age with menarche before age 12 and menopause after age 52; 6) being a known carrier of BRCA1 or BRCA2 genetic alterations also predisposes to uterine or other cancers, PTEN in Cowden syndrome, P 53 in Li-Fraumeni syndrome, STK11 in Peutz-Jeghers syndrome, CDH1 in hereditary diffuse gastric cancer syndrome [18, 28].

The above-mentioned factors may allow for its identification; however, a considerable number of women do not present symptoms of the disease. Therefore, physicians must promote mammography as an early diagnostic tool in the absence of clinical manifestations [29]. However, health actions and strategies aimed at reducing mortality are sometimes influenced by national policy objectives.

Other risks associated with the disease are those related to reproductive aspects, such as: 1) nulliparity; 2) first full-term pregnancy after 30 years of age; 3) hormone therapy during perimenopause or postmenopause for more than five years [18, 28]. Lifestyle factors also influence this, such as: 1) a diet rich in carbohydrates; 2) diets rich in animal fats and trans fatty acids; 3) obesity, especially after post menopause; 4) sedentary lifestyle; 5) alcohol consumption greater than 15 g/day; 6) smoking; and 7) circadian rhythm disturbances [28, 29].

Protective factors against the disease include: 1) a diet rich in fruits and vegetables, and low in fatty acids; 2) moderate physical exercise; 3) folic acid intake; 4) breastfeeding, along with an early age at first pregnancy; 5) maintaining an adequate body mass index; and 6) performing mastectomy or oophorectomy in women with a family history of high risk [28, 30, 31].

1.3. Health policies on breast cancer in Mexico

The Mexican healthcare system has undergone four reforms. The first occurred in 1943 with the creation of the Mexican Social Security Institute (IMSS) and the Ministry of Health and Social Assistance (SSA), which aimed to utilize medical science to address the problems of poverty and health. The second, in 1983, declared health a constitutional right. The third, in 2003, aimed to reduce health inequalities. In 2024, the proposed reform aimed to establish the integrity of healthcare services. However, to implement a reform for breast cancer, sufficient and necessary resources must be allocated, given the increasing prevalence of this disease.

The national breast cancer mortality rate for Mexican women 20 years of age and older is 17.9 deaths per 100,000 women, while for women 60 years of age and older, it is 42.8 deaths per 100,000 women [27]. The mortality rate is a key indicator of overall well-being in a country. In this context, policies for prevention and awareness of health risks, as well as timely treatment and control of the disease, become essential. The first precedent for breast cancer policies is found in birth control policies of the 1970s, which influenced the National Program for the Early Detection of Cervical and Breast Cancer [32].

The structural reform of the Mexican Health System in 2002, followed by the constitutional reform of the General Health Law, established the Health Protection System as a voluntary public insurance scheme to provide financial protection to individuals whose economic situation and type of employment did not afford access to social security. The high costs involved in breast cancer treatment and the catastrophic expenses incurred by households in 2007 were included in the treatment plan. Based on Article 77 bis 29 of the General Law, the Catastrophic Expense Protection Fund was established to provide treatment for the disease in highly specialized units and hospitals [33].

The 2001-2006 National Health Program generally sought to reduce the health gaps among the country's low-income population in its strategies, and within its line of action for breast cancer, it established treatment for malignant neoplasms [34]. While the 2007-2012 the goal of the Sectoral Health Program was for breast cancer was to triple coverage and detection of the disease through mammography among women aged 45 to 64, another line of action was to promote early care for both cervical and breast cancer [35].

The 2007-2012 Specific Action Program on Breast Cancer [36]. Sought to reduce the growth in mortality from the disease through detection, diagnosis, treatment, and control. In general, the goal was to influence outcomes by informing the population about the determinants that lead to the development of this type of cancer, with an emphasis on early detection, treatment, and timely screening for patients.

The program also focused on developing regulations for the construction, equipment, and human resources related to mammography. Also highlighted was the Care Model for the Detection, Diagnosis, and Referral of Breast Cancer, which used mobile mammography units to screen asymptomatic women between 50 and 69 years of age, as well as women with risk factors between 40 and 49 years of age.

The 2013-2018 Sectoral Health Program established a generic approach to health, focusing on disease prevention and protection from a gender perspective [37]. Regarding breast cancer, an indicator was established whose mortality rate seeks to ensure effective access to quality health services. Public health institutions aimed to detect and treat breast cancer promptly. The goal was also to reduce the number of deaths from the disease per 100,000 women.

Among the objectives of the program was ensuring effective access to quality health services and, as a strategy, targeting the central cancers: cervical, breast, and prostate cancers, as well as improving the detection and care processes for malignant neoplasms. In particular, in breast cancer, the focus was on prevention, detection, development, and dissemination of performance evaluations for screening programs [37]. A care model focused on the processes was also established.

1.4. Health budget in Mexico: health expenditures for breast cancer care

The allocation of resources among alternative purposes that generates productive dynamism in the economy leads to economic growth. However, regarding social spending, the public resources allocated to it continue along the same path, with the difference that these resources come from resources obtained through oversight or from those the government collects as a result of its services or productive activities exchanged with citizens. These public resources compete with each other to meet the various obligations that the public sector is responsible for.

Table 1 Public Sector Expenditure in Mexico 2018-2023. Figures in millions (X 1,000) of real Mexican currency, base year 2018 = 100)

Budget item/year	2018	2019	2020	2021	2022	2023
Federal Government[1]	2,297	2,317	2,419	2,786	3,042	3,261
Administrative branchs[1]	1,187	1,309	1,341	1,696	1,874	1,995
Health[1]	124	123	157	175	183	105
MSSI[2]	682	746	819	919	1,055	1,182
ISSSSW[2]	290	341	361	368	415	444

Source. Federal government report 2023-2024, [38].

Health: Health service for non-salaried workers; MSSI: Mexican Social Security Institute; ISSSSW: Institute for Social Security and Services for State Workers

Between 2018 and 2023, programmable spending increased to 42% across the various administrative branches, and it increased to 68%. In the health system, resources allocated to the health sector decreased by 14.7%, and in the case of the MSSI and the ISSSSW, spending increased by 73.3% and 53.5%, respectively. However, between 2020 and 2023, patients receiving various treatments from these three official entities face different situations regarding their needs and the health services provided, given their institutional affiliation with one of them, see Table 1.

During the period from 2018 to 2024, the most enormous programmable spending of the Mexican public sector has been allocated to the construction of refineries, leaving fewer resources available for health care for people who have cancer in its various forms. The number of deaths from this disease increased from 4,581 in 2007 to 7,969 in 2023, representing a 73.9% increase in deaths, see Figure 1.

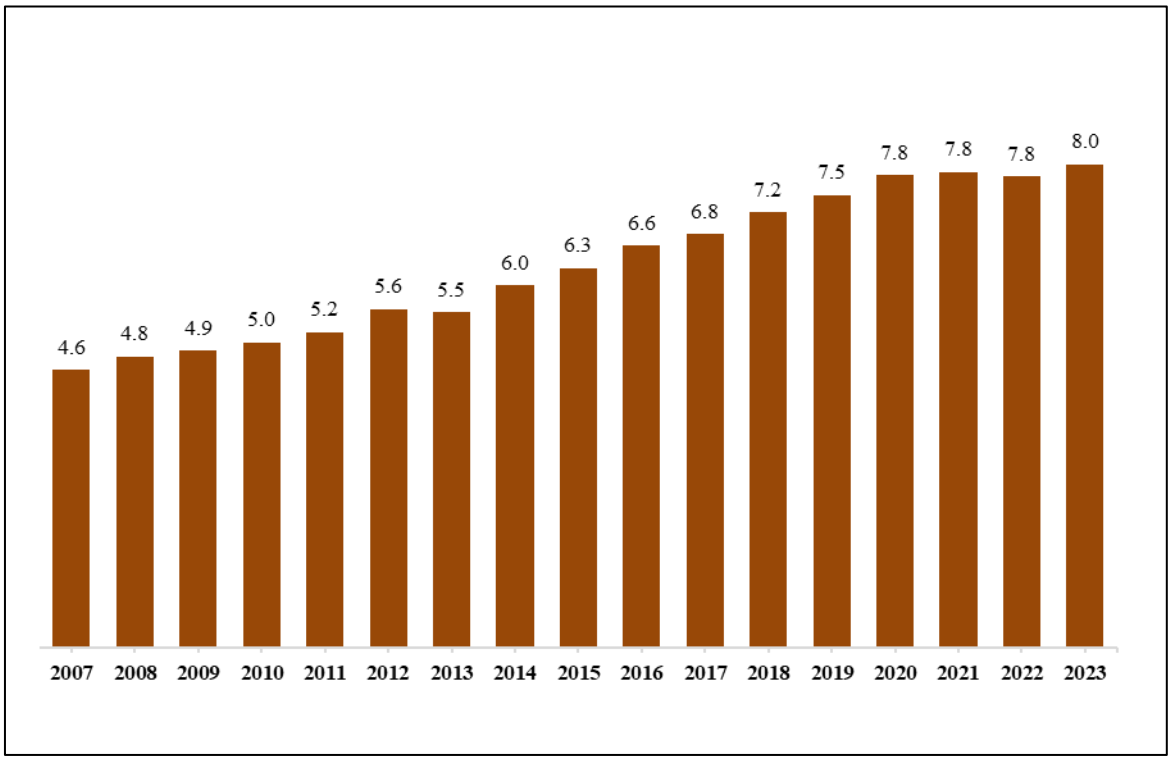

Figure 1 Number of deaths (in thousands) from breast cancer in México: 2007-2023. Source: Annual report of Mexican government [38]

During the same period, the number of mammograms increased from 556,103 in 2007 to 1,184,755 in 2023; a 113% increase in these examinations for the prevention and diagnosis of breast cancer. While the increase in these years was significant, the highest number of treatments took place between 2010 and 2018, with 2018 being the year with the highest number of mammograms, with 2,452,706 of these types of examinations performed in the office, see Figure 2.

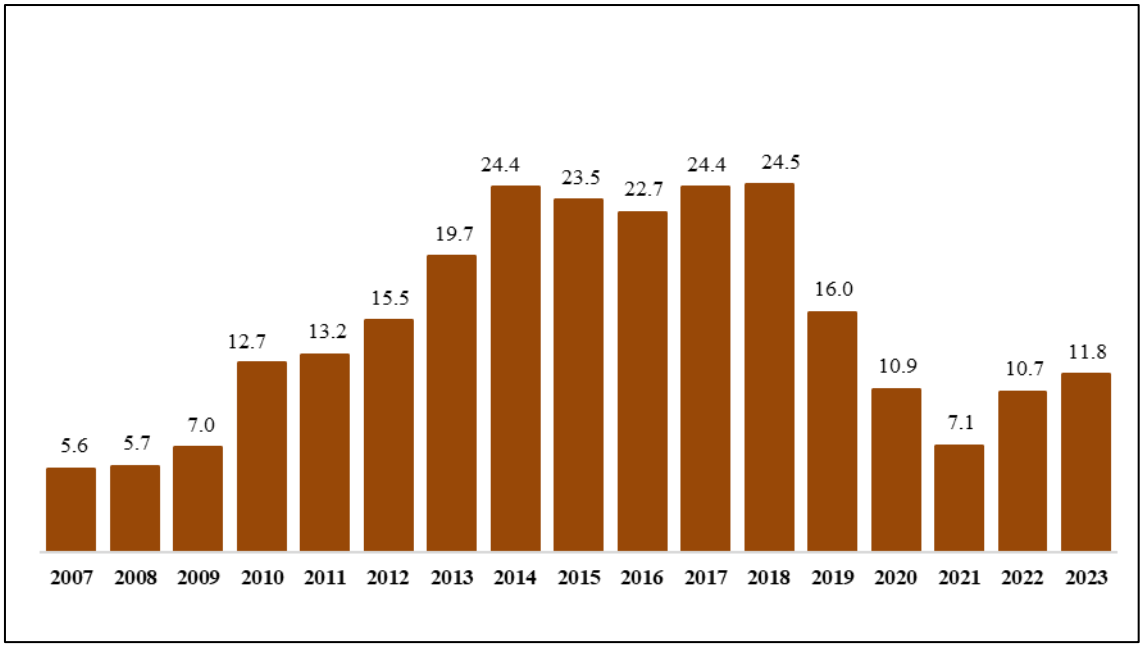

Figure 2 Number of mammograms (in millions performed by the Mexican National Health System: 2007–2023. Source: Government Report: 2023–2024 [38]

The mortality rate due to breast cancer between 2007 and 2020 increased steadily over these years, going from 16.2% in 2007 to 19.9% in 2023, Figure 4. While mammography screening coverage had an inverted "U" shape between 2007 and 2020, reaching its peak in 2015, this has a significant correlation with the number of mammograms performed by the health system globally in those years. Figure 3 illustrates the increasing mortality rate alongside decreasing coverage.

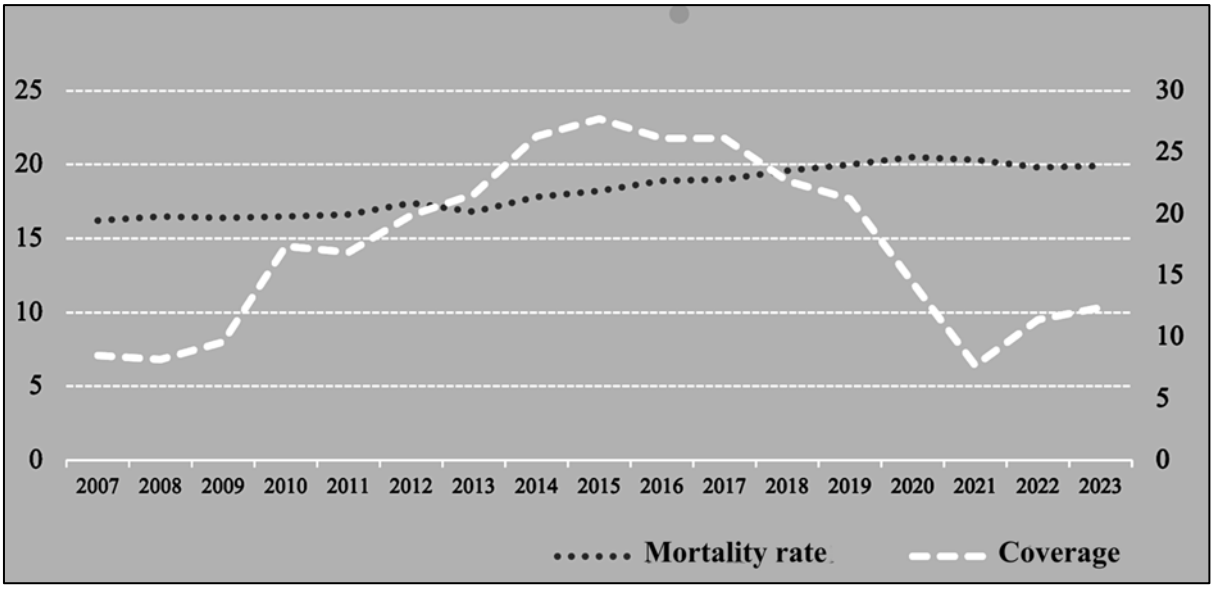

Figure 3 Breast cancer: coverage and mortality rate in Mexico: 2007-2024. Source: Government Report: 2023–2024, [38]

According to IMSS financial reports, 59,586 patients were treated in 2023, resulting in an expenditure of 3,121 billion Mexican pesos; compared to 2022, expenditures were lower, with a difference of 9,207 billion Mexican pesos. Despite this, the number of patients treated in 2022 was higher.

Table 2 Estimated population under treatment and expenditures for breast cancer care at the IMSS, 2018-2023 (millions of current Mexican money x 1,000)

	2018	2019	2020	2021	2022	2023
Treated patients	56.2	58.6	60.8	65.4	71.4	59.6
Outpatient health spending	2.1	2.1	2.1	2.5	2.8	1.6
Hospital spending	795	807	693	915	1,573	1,493
Total spending	2.9	2.9	2.8	3.4	4.4	3.1
Annual expenditure per patient	---	49.9	46.4	52.4	61.6	52.4

Source: [38, 39]

2. Methodology

According to INEGI, in 2023, the entities with the highest mortality rates in Mexican states were Sonora (27.5) and Chihuahua (25.2), while Campeche (9.9) and Guerrero (11.0) had the lowest rates [40]. To determine the factors that influence this disease, a panel-type Poisson model was constructed using the STATA 12 econometric package with microdata from the 32 federal states, available from INEGI, for the period from 2011 to 2023. The disease is classified as "C500" and "C509" according to the International Classification of Diseases (ICD) of the World Health Organization (WHO) [41]

The panel methodology enables the capture of the behavior of households, individuals, firms, or states over time through variables. The mathematical expression of the panel can be expressed as:

$$Y_{it} = \alpha + \beta x_{it} + \gamma z_{it} + c_i + u_{it} \quad \text{.....Ec. (1)}$$

where *i* expresses the individuals *i*:1,23...N followed over time, *t*: 1, 2.3... T.

While *Y* is the dependent variable which takes the value of one when the woman dies from cancer. The explanatory variables are represented by the K-dimensional vector (x_{it}), in this case, the level of education is taken, which are the degrees of education obtained; the activity of woman, that is, whether she has a job or not; entitlement, if the woman is affiliated with a public health institution, thus providing access to health; geographic region which is divided into north, center and south; place where the woman lives classified as urban or rural area; stages of life of the woman are subdivided into adolescence (11-19 years), youth (20-24 years), maturity (25-59 years), advanced (60 years and older) [42].

The intercept is α, β is the vector of parameters, γ is the M-dimensional column of parameters and c_i shows the individual effects, which in the case that each individual is observed in all periods, it is said that the panel has the characteristic of being balanced, otherwise it is unbalanced, finally the error term is represented by e_{it}, [43] then the equation to be estimated is:

$$Breast\ cancer_{\ mort} = \alpha + \beta\beta Public\ health\ service_{it}$$

$$+education_{it} + \ life\ cycle_{it} + Unemployment_{it} \ + \ Geographical\ area_{it} + \ Region_{it} \ + c_{it} + u_{it} \text{..... (2)}$$

3. Results

Of a total of 8,935,087 deaths in the period analyzed, 70,839 corresponded to breast cancer, with 99.32% in women and 0.68% in men. The result of the estimation of the random and fixed effects equation with a significance level of 1% ($p < 0.001$), 5% ($p < 0.05$), and 10% ($p < 0.1$) with a 95% confidence interval is shown in Table 3. In the probabilistic model, the adjusted R^2 is omitted because it is not applicable to non-continuous models.

Table 3 Estimation of the Poisson model for equation 2

		Fixed effects	**Random effects**
	Public health service access	-0.014*** (-0.00193)	-0.014*** (-0.00191)
Education	Non formal education	-0.005 (-0.00277)	-0.007* (-0.00284)
	Elementary school not completed	-0.004 (-0.00188)	-0.005* (-0.00221)
	Full elementary school	-0.001 (-0.00228)	-0.003 (-0.00257)
	Secondary school not completed	-0.003 (-0.00348)	-0.004 (-0.00371)
	Full secondary school	-0.001 (-0.00248)	-0.003 (-0.00256)
	High school not completed	0.000157 (-0.00333)	-0.000481 (-0.00361)
	Full high school	0.000655 (-0.00224)	-0.001 (-0.00253)
	Higher education	0.003 (-0.00198)	0.001 (-0.00228)

According to the random effects model, entitlement, educational attainment, no schooling, incomplete primary education, and later life (25–59 years) are significant at $p<0.05$. Advanced age (60 years and over), as well as the rural variable, and not working, are significant at 1%, 5%, and 10% levels. The northern zone variable is significant at $p<0.05$ and $p<0.01$. Meanwhile, in the fixed effects model: social security access, Advanced, Not working, and Rural are also significant.

Table 4 Estimation of the Poisson model for equation 2

Age	Teen years	-0.0594 (-0.0549)	-0.0594 (-0.0584)
	Youth	-0.011 (-0.0108)	-0.0107 (-0.0104)
	maturity	-0.00267** (-0.000968)	-0.00236* (-0.00107)
	Advanced age	-0.00975*** (-0.00144)	-0.00959*** (-0.00143)
Employment	none	0.0191*** (-0.00184)	0.0191*** (-0.00176)
Location	Rural	-0.00598*** (-0.00111)	-0.00594*** (-0.00107)
	North	-0.00284** (-0.00101)	-0.00280** (-0.00108)
	Center	0.000173 (-0.00112)	0.000206 (-0.00103)
Constant		---	-7.608*** (-0.00265)
lnalpha _cons		---	-20.79*** (-0.00107)
N		70,839	70,839

Note: The values presented are significant at * $p<0.05$, ** $p<0.01$, *** $p<0.001$, respectively, obtained through Stata12 [43].

According to the fixed-effects model, unemployed women have a 1.91 percent chance of developing breast cancer; the random-effects model found a similar value. While the variable for health insurance coverage was minus 1.41 percent, the random-effects model found it minus 1.36 percent. Health insurance coverage allows women to access health services, potentially allowing them to detect the disease at an early age.

The fixed effects model captures the prevalence of breast cancer in rural areas, which was less than 0.59% of the probability of cancer prevalence. In comparison, in the northern region, the probability was lower (-0.28%). These variables were also significant and close to these values for random effects. Regarding the woman's life cycle, the adolescence and youth stages were not significant in either model. While the maturity stage for fixed effects was less than 0.27% of the probability of prevalence, it was followed by advanced age at -0.98%. The values were similar for random effects, -0.24% and -0.96%, respectively.

In the random effects model, the highest prevalence rate was found in women with incomplete primary education, which was -0.52%, followed by women with no schooling (-0.67%) for $p < 0.05$; the other levels of schooling were not significant. The years of schooling a person obtains throughout their life enable them to acquire knowledge and information about their environment; it is expected that with greater education, people's choices will be more informed.

4. Discussion

Studies on breast cancer show that diagnosis is often made late, and that factors associated with the disease include geographic and environmental factors such as specific industries and contamination of aquifers and soils [44].

In this study, the models used show that non-working women have a higher prevalence of breast cancer. It is argued that homemakers depend on the income of other family members. If their income is insufficient, non-working women cannot access health services and early diagnosis. The same is true for single women.

The functioning of the health system depends on the revenue the government obtains through tax collection, which is used for various priority objectives established by the current administration. In 2018, breast cancer coverage decreased while the mortality rate increased. The lack of resources allocated to the health system led to late breast cancer detection, increasing the mortality rate.

According to the proposed model, having access to public health services reduces mortality. That is to say, women who are employed have access to early diagnosis and screening. Employment is related to the fact that public health institutions have, to a greater or lesser extent, appropriate technology for early breast cancer diagnosis.

Using the analysis model, it was found that factors that increase the prevalence of breast cancer due to timely reduction include lower education, lack of employment, and living in a rural area.

The results show that the prevalence is found in mature women (25-59 years old), implying that the disease presents at an early age. In this group, women are in their productive years, which are affected by the onset of the disease. However, the study is limited by not classifying the woman's status (whether she is married or single), which could influence the results obtained.

5. Conclusions

The quantitative data presented suggest that combining public health policies with breast cancer screening courses and medical resources such as mammography and screening can help detect and prevent the harmful consequences of this disease. The importance of having the appropriate equipment and technologies is emphasized, as is the training and proper use of sufficient human resources to enable early cancer detection and appropriate treatment.

In its official discourse, the Mexican government maintains that the well-being of the people must prevail over other socioeconomic factors. To fulfill this premise, it is necessary to reorient economic and health policies to achieve the goal of timely detection and treatment of people with cancer.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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