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Immediate effect of the COVID-19 pandemic on governance: The case of México

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Abstract

COVID-19 outbreak exposed the governance and governability limitations of world health care systems, and México was no exception. With data from the Mexican Ministry of Health, two Gompertz models were estimated with a time horizon of the first three months of the pandemic. Factors such as chronic diseases, age groups, and sex were related. The probability of dying increased with age >51 years and in men. Comorbidities increased the probability of death: Diabetes at 70.1%, renal failure at 50.8%, and obesity at 42.7%. Compared to other countries, México was unable during the initial stage of the Covid-19 outbreak to establish a coherent policy appropriate to the epidemiological emergency.

Keywords: COVID-19; Governance; Comorbidities; Gompertz model; Policy; Technology

1. Introduction

The severe acute respiratory syndrome virus (SARS-CoV-2) is a variant of the coronaviruses that affect humans; This virus can produce from a common cold to other more serious ones with high infection rates and a lethality higher than influenza. The COVID-19 pandemic caused a rupture in society and the economy and put the governance and governability of health systems under scrutiny. As a result, health prevention and containment policies in the American continent are highly questionable since they have caused a high human, social and economic cost, as well as a significant number of deaths that could be prevented, with the consequences reflected in the affected social circles [1]. As of July 31, 2020, 17,604,767 infected people and 675,506 deaths from COVID-19 had been registered. In México, on the same date, 426,537 infections and 46,688 deaths were confirmed with a fatality rate of 10.99%, which turned out to be one of the highest in the world [2].

Whether due to epidemics or pandemics, this condition of social disease risk transcends directly to individual health. This situation is also perceived in cases where other social scourges occur, such as war or natural disasters [3]. Moreover, the relationship between the conflict and its implications for the economy, such as trade blockades or food rationing, also directly and indirectly, impact the population welfare, eliciting a weakening of the individual immune system. Therefore, the increased occurrence of infectious diseases impacts the political and economic frameworks, giving rise to social instability and uncertainty [4,5].

In economics, the effect of a pandemic is remarkable: it interrupts the circular flow of companies and families and stops the exchange of goods and services. At a broader level, it impacts tax collection, investment, and foreign trade in such a way that it inhibits economic activity and paralyzes the input-output relationships of the community, the country, and

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world trade [6]. Over time, these situations generate a simultaneous collapse in the labor, products, and financial markets, which produces a substantial increase in risk aversion [7], and reduces the creation of wealth, potentializing the outbreak of social conflicts.

The current COVID-19 pandemic is challenging the health systems in the countries of the American continent, and especially that of the Latin American countries since these are fragmented health systems with limited resources. For this reason, the indicators in health and health resources of these two groups of countries are different given the organizational scheme that prevails in their health systems, since some use public financing (Canada and Uruguay), while the other group they have fragmented systems and a low share of health spending (México, Brazil, and United States of America).

As seen, the level of health financing in the United States of America (USA) is much higher than that of other countries, in contrast to the low financing of the Mexican system. Otherwise, Canada has the highest *life expectancy at birth* (LEB), the maternal mortality index is remarkably lower than the other selected countries, and *the maternal mortality ratio* (MMR) of the USA is twice that of Canada. In general, the Canadian health system is much better than that of the other selected countries of the American continent. Uruguay undoubtedly has a high EVN and offers adequate care to pregnant women since its MMR is as low as 17 deaths per 100,000 births, contrary to México, which registers an MMR of 33, and Brazil with 60 [8]. Therefore, we can affirm that the social and health policy of Uruguay is effective, as shown by its health indicators, see Table 1.

Table 1 Indicators and resources of the health services in Latin America (selected countries)

Country	**Health expenditure (% GDP) 1**	**Life expectancy at birth (years)2**	**Maternal Mortality Ratio per 100,000 births 3**	**Number of doctors per thousand inhabitants 4**	**Number of computed tomography (CT) scanners per million population 5**	**Magnetic resonance imaging (MRI) units per million opulation6**
USA	16.9	79	19	2.6	45	40
Canada	10.8	82	6	2.6	15	10
México	5.4	75	36	2.4	5.8	2.6
Brazil	9.5	76	59	2.2	15.4	6.8
Uruguay	9.2	78	17	5.1	12.9	2.9

1. Data as of 2018; 2. Data as of 2019; 3. National estimates for the period 2014-2019; 4. Average 2013-2018; 5. Brazil, México and Uruguay in 2016. Canada and the USA in 2019 6. Brazil, México, and Uruguay in 2016. Canada and the USA in 2019. Source: [8-10].

Regarding the provision of health services, human health resources and technological support for diagnosing and treating diseases are fundamental factors that support their quality and timeliness. For example, table 1 shows that Uruguay, Canada, and the USA have more physicians, while Brazil and México operate their services with a lower number. On the other hand, it can be asserted that a low number of technology units limits the proper functioning of health services. For example, the technological gap concerning CT and MRI units between the USA and the other selected countries is remarkable, but in the Mexican case, the availability of these technology units is scarce.

The rulers are always willing for the effects of the pandemic in their societies to be rapidly transient, as they are aware that these diseases have the potential to cause political, and socio-economic instability. In addition, these pandemics can hinder their projects and political visions. In this sense, the rulers have the economic possibility of increasing economic activity and minimizing the effects of the pandemic on the population [11]. Therefore, the rulers must choose and implement strategies based on clear policies and prompt application to contain the health problem. Therefore, although pandemics are not everyday situations, they are not an unknown phenomenon either. Therefore, the rulers have two strategies to deal with an epidemic while a therapeutic solution is found, such as developing a vaccine [12]:

- Mitigation, which seeks to reduce the spread of contagion and the demand for medical care. Also aimed to protect those people more likely contracting the disease, and
- Suppression, which seeks to reverse the growth of the infection rate with few new cases, facilitating an arrest in transmission, an indefinite dead end in transmission.

In addition, these strategies are implemented with non-pharmaceutical interventions (NFI), which consist of:

- Screening of people identified with the virus;
- Isolation of infected people;
- Implementation of quarantines for the general population;
- Closure of schools and universities at the local or national level;
- Closure of work centers that are not essential for social functioning;
- Cancellation of socially popular places [12,13].

Governance is a process in which the forms of organization allow achieving the objectives of the established policy, but within an expanded framework, with the incorporation of different social actors to promote a new way of managing public life. For its part, governance is limited to the governmental sphere, the management of administrative programs, and their resources to achieve their objectives [14].

With the growing number of deaths and the scarcity of resources to face the COVID-19 outbreak, those responsible for health must find an optimal solution that maintains social stability but with rules that do not reduce their freedom. Similarly, institutions must ensure that economic conditions contribute to the achievement of adequate health for people and guarantee the performance of their operations [15]. In addition, the literature on equity in health shows that developing countries must face the inequity produced by their health policies. In its population, there are significant differences related to age groups, education, gender, communicable and non-communicable diseases, and socio-behavioral phenomena [16].

It is recognized that the social determinants of health influence the policies and processes, mainly the economic ones such as salary and employment, as well as other social aspects. On the other hand, many of these factors escape health policies; therefore, public policy must strengthen and integrate different policies and the main actors, with governability and governance interacting. All these factors let to face the COVID-19 pandemic for the time being and improve the health situation of the population permanently.

This work aims to analyze through studying the initial period of the COVID-19 outbreak in México from the perspective of a theoretical framework and discuss the relevant aspects of governance. This analysis will make it possible to assess the institutional performance in limiting the COVID-19 outbreak and the efficacy of the measures to protect the population. Primarily this work will address aspects related to age, sex, and comorbidities.

2. Material and methods

Different indicators have been taken to measure the magnitude of the COVID-19 pandemic, such as the number of cases and deceased related to COVID-19 infections and especially the mortality rate. The World Health Organization (WHO) considers that, by not being able to determine who is infected by COVID-19 due to lack of serological tests, the containment and mitigation policies for this disease of governments are erroneous, for which it recommends carrying out the as many tests as possible [17]. However, given the methodological differences in how both infections and the number of deaths have been recorded between countries, the case fatality ratio must be considered an indicator subject to reservations since it makes comparisons difficult.

The sentinel model implemented by the Mexican Ministry of Health was intended to monitor the path of the coronavirus pandemic in the country, detecting the most severe cases, which are those that go to the hospital, which are diagnosed and notified to the surveillance network. [18, 19]. In addition, the Ministry of Health decided not to use massive tests for COVID-19, as was done in many countries. This policy was contrary to that recommended by WHO to monitor the evolution of the COVID-19 outbreak [17, 20, 21].

The transmission of COVID-19 has given rise to different epidemiological models to determine the maximum point and its mitigation, as well as to understand the causes and forms of spread that make it a pandemic so that prevention and control actions can be implemented [22]. For COVID-19, the SIR model has been used, which captures the number of infectious I(t), people who can be infected S(t), and those removed R(t), and some modifications have been implemented [23]; the model works with constant populations and without any mutation of the analyzed virus.

The Gompertz model is used in this study using the Mexican Ministry of Public Health database, which consists of 29,001 positive cases for SAR-COVID-19, seven thousand 317 non-positives, and two thousand 133 with pending results, all data registered until May 31, 2020. This model is an asymmetric function, and it captures the growth of COVID-19 over time (t) until it reaches a maximum point in terms of the carrying capacity of the system, considering the initial cases of the disease. Besides, it has the advantage of explaining the trend of mortality and cases infected by this disease in people

suffering from a chronic degenerative disease. Thus, people who died from COVID-19 equal 1 (death=1) contribute to the hazard function, and people with death=0 contribute to their survival function through t_i. Thus, the value of $\lambda_i>0$ indicates that the danger increases over time; whether $\lambda_i<0$ the function decreases over time. Expressed as:

$$L_i = (\lambda_i exp(t\gamma_i)^{d_i} * \frac{exp\left[-\frac{\lambda_i}{\gamma}[\exp(\gamma t_i)-1\right]}{exp\left[-\frac{\lambda_i}{\gamma}[\exp(\gamma t_i)-1\right]} \quad \ldots\ldots (1)$$

Thus, the parameterized Gompertz allows capturing chronic diseases against COVID as a proportional or logarithmic risk model relative to the form of danger expressed as [24,25]:

$$h(t_i|x_i;\beta) = h_0(t)\exp(x_i\beta) \quad \ldots\ldots (2)$$

Where the hazard baseline is given by $h_0(t) = \exp(\gamma t_i) y \exp(x_i\beta) = \lambda_i$ is the baseline hazard scale multiplied by the same amount at each instant. If $\gamma > 0$, the hazard function increases with time; otherwise, if $0<\gamma$, the hazard function decreases with time.

The dependent variable is death, recorded as deaths from COVID-19; and the independent variables are:

- Age registered as the age reached by those who died due to COVID-19 and is grouped in 10-year intervals;
- Sex allows determining if it is a man or a woman through values of one and zero, respectively;
- Chronic degenerative diseases such as kidney failure, diabetes, hypertension, cardiovascular disease, asthma, smoking; are all registered qualitatively in a dichotomous way.

3. Results

Table 2 shows the results of the relationship between mortality and chronic diseases, age group, and sex using the Gompertz model at 1%, 5%, and 10%, respectively. The diabetes variable was significant in each degree of significance. Thus, the person contracting COVID-19 and if they have diabetes, the risk of dying is 59.5% in model 1 and 70.1% in model 2. In the case of suffering from insufficiency chronic kidney disease, in model 1, 47.2% of the risk of dying having the symptom of coronavirus is obtained, while in model 2, it is 50.8%, that is, 3.6 points more than the first. People suffering from obesity had the same trend, while the cardiovascular variable, asthma, and the age range from 0-10 to 11-20 were not significant in Model 2.

Table 2 Econometric results of the Gompertz Model for México, May 31, 2020

Variables	**Model 1**	**Model 2**
Diabetes	0.595***	0.701***
	(-0.0189)	(-0.0192)
Smoking	-0.0944***	-0.0483
	(-0.0283)	(-0.0283)
Obesity	0.417***	0.427***
	(-0.0199)	(-0.0201)
Chronic Renal	0.472***	0.508***
	(-0.0316)	(-0.032)
Cardiovascular	0.0848*	
	(-0.0343)	
Asthma	0.00897***	
	(-0.000942)	
Male	0.576***	0.571***

	(-0.0179)	(-0.0179)
0-10	-2.363***	
	(-0.087)	
11-20	-3.165***	
	(-0.116)	
21-30	-3.400***	-2.221***
	(-0.0653)	(-0.0627)
31-40	-2.660***	-1.487***
	(-0.0462)	(-0.0426)
41-50	-1.697***	-0.539***
	(-0.0379)	(-0.0339)
51-60	-0.965***	0.174***
	(-0.0353)	(-0.0315)
61-70	-0.412***	0.706***
	(-0.0352)	(-0.0319)
71-80	-0.145***	0.965***
	(-0.0371)	(-0.0342)
81-90	-0.181*	
	(-0.0756)	
Constant	-14.34***	-15.50***
	(-0.0366)	(-0.0313)
Gamma	0.00000220***	0.00000217***
Constant	-1.15E-07	-1.15E-07
Observations	274,997	275,004

Note: The error coefficients obtained are shown in parentheses to the degree of significance at *p<0.05 (5%), **p<0.01 (10%), ***p<0.001 (1%). Estimated in Stata 13.

Source: Own elaboration based on open data regarding COVID-19 cases in México (Ministry of Health, 2021)

In the case of grouping by age, model 1 shows negative significance. In model 2, the signs are positive, maintaining a higher risk of death for ages 71-80, 61-70, 41-50, 51-60, ranging from 96.5%, 70.6%, 53.9% and 17.4%, respectively. For men indicates that the risk of dying is 57.1% compared to women. Likewise, the gamma parameter is positive, indicating that the risk function of dying from the disease increases over time. The econometric estimation generally indicates that the risk of morbidity due to a chronic degenerative disease associated with COVID-19 is found among older people and males.

4. Discussion

As shown in this study, the management of the pandemic has given different results in each country due to the differences in their health policies, given there is information to face this health problem [14, 26]. In this way, the governance problems of each country are highlighted. Nonetheless, it is evident that the sample of Latin American countries that have best managed their health resources and presented lower case fatality rates at that time is Uruguay, supported by its best strategy and use of NFI [12, 17, 22].

In this study, we showed that the Mexican case had the worst results of the selected sample of countries on the continent. The opacity of the data presented by the local health authorities stands out. Besides, these poor results were also

correlated with a lack of control of asymptomatic infected people, the reluctance of the health authority to carry out tests extensively, and limiting itself to using the sentinel model for the registration of the spread of the infection. Besides, the NFI measures were scarce, with reluctance to close daily and productive activities more rigorously in regions with the highest infection rates. Thus, we observed a vicious circle with a more significant number of cases and deceased, which causes unnecessary private and social costs to the population [19].

Like other studies, the Gompertz model for the case of México showed that people who suffer from a chronic degenerative disease such as diabetes have a greater probability of dying when suffering from COVID-19, in addition to the fact that diabetes is also classified as one of the leading causes of death in México and the world [27]. Likewise, it is confirmed that the risk of dying in the population with age >70 years is very high (0.965), the same for Italy and France. Likewise, in an econometric study with 115 patients at the beginning of the pandemic in China where the NRL (neutrophil/lymphocyte ratio) changed from patients under 50 years of age with NRL ≥ 3.13 with a probability of death of 10% to patients with greater than or equal to 50 years of age with the same NRL with a probability of death of 70% [28]. In the case of the social determinants of the disease impact, enunciative evidence was indicated for comorbidities, causes of death, mortality by sex, states, level of wealth, education, work activity, and type of health institution where the death occurs. [27]. Likewise, in an estimative way, this study found that referent to sex, men died 57.1% more than women, explained by the better immune response in women related to a more significant number of B lymphocytes, as well as a better inflammatory reaction in case of viral diseases [29].

One of the limitations of this study is the collection of data, given that the pandemic evolves quickly. Therefore, the econometric model is subject to this initial condition [21, 23]. However, it is essential to highlight the importance of governance to better understand the pandemic, given that the efficient and effective form of organization is viable to achieve the objectives of public health policies coupled with better governance [5].

Macroeconomic models of the disease indicate that in the absence of specific medical treatment, policies that combine testing and monitoring of infected people with quarantine drastically reduce the human cost of this type of disease [11], which coincides with the recommendations coming from other health and political institutions with their researchers, such as the WHO, the UNAM, the National Institute of Public Health, the Institute of Global Health Sciences at the University of California, and the Senate of the Republic [17, 19 - 22], because they point out the lack of better control of the pandemic caused by the lack of widespread testing among the population, which leads to a failure and lack of health control and statistical evolution of infections [20, 22]. In addition, there is a severe shortage in terms of human infrastructure and health equipment in the country to face an emergency of this magnitude.

With the strategy and surveillance system implemented by the Mexican health sector, only partial solutions and information were provided. The governance generated by the health authorities possibly prolonged the most acute stage of the pandemic, with an increase in infection rate and deceased. [6, 30]. Nowadays, the fundamental interventions required to have an integrated response are well established. The basic components are to lower cases minimize community transmission, reduce critical cases through primary covid clinics, provide community and home-based care, and contain hotspots [31].

5. Conclusion

Countries with different forms of governability and governance faced the pandemic successfully, using their political norms and agreements to organize their societies to accomplish public health actions. As a result, these countries could afford a better health approach to managing viral infection and its complications. With coordinated social constructs that avoid exclusions and inequalities, we can face the challenge that COVID-19 implies so that in the medium term, they can provide better health to their citizens and the economy so that both thrive.

In México, health authorities initially attributed excess mortality to comorbidities associated with the fatal outcome in subjects with COVID-19 infection. Also, the health structure deficiency, in addition to political and economic considerations, made the initial response to the COVID-19 outbreak difficult.

Despite the historical background of previous pandemics, COVID-19 caught countries off guard. Countries with poor health systems had to face the challenge of establishing a comprehensive and inclusive policy in a short time. In cases of pandemics, health systems must quickly achieve an efficient case detection and registration system.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors certify that there is no actual or potential conflict of interest in relation to this article.

Statement of informed consent

The present research work does not contain any experimental studies performed in animals or human subjects by any of the author. The research follows proper ethical procedure.

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