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Artículos científicos

El impacto de la de vacunación en las tasas de contagio, letalidad, defunción y comorbilidad de la covid-19

The Impact of Vaccination on the Rates of Contagion, Lethality, Death and Comorbidity of COVID-19

O impacto da vacinação nas taxas de contágio, letalidade, óbito e comorbidade da covid-19

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Resumen

En este artículo se analiza las tasas de crecimiento y de primera categoría de contagio, letalidad y mortalidad del covid-19 en México. El eje de esta investigación postula que a mayor número de vacunas aplicadas contra covid-19, tiene que darse una disminución sostenida en la transmisibilidad y defunciones por esta pandemia. Esta revisión se hizo desde tres momentos en el tiempo, lo que permite conocer un antes y un después de la aplicación de las vacunas en México. Se trabajó con la base Datos Abiertos de la Dirección General de Epidemiología mexicana. Para el cálculo de las tasas de primera categoría se requirió del Censo de Población y Vivienda de 2010 y 2020 y la Encuesta Intercensal 2015 del Instituto Nacional de Geografía y Estadística (Inegi). Para identificar el impacto de las comorbilidades, se hizo una regresión logística binomial que permitió estimar probabilidades de fallecimiento en cada uno de ellos. Entre los resultados se observa que, posterior a la fecha de inicio de inmunizaciones, las tasas de contagio, letalidad y mortalidad de covid-19 en el contexto mexicano presentaron una disminución significativa, lo que demuestra la efectividad de la inmunización. Otro dato importante es que la regresión logística binomial

demostró que las comorbilidades siguen generando una mayor propensión a fallecer en las personas que las padecen y se contagian de covid-19.

Palabras clave: covid-19, censos de población, grupos de edad, mortalidad.

Abstract

This article analyzes the growth and first category rates of contagion, lethality and mortality of COVID-19 in Mexico. The axis of this research postulates that the greater the number of vaccines applied against COVID-19, there must be a sustained decrease in transmissibility and deaths from this pandemic. This review was made from three moments in time, which allows knowing what happened before and after the application of the vaccines in Mexico. We worked with the Open Data base of the General Directorate of Mexican Epidemiology. To calculate the first category rates, the 2010 and 2020 Population and Housing Census and the 2015 Intercensal Survey of the Instituto Nacional de Geografía y Estadística (Inegi) were required. To identify the impact of comorbidities, a binomial logistic regression was performed, which allowed estimating probabilities of death in each of them. Among the results, it is observed that, after the start date of immunizations, the contagion, lethality and mortality rates of COVID-19 in the Mexican context presented a significant decrease, which demonstrates the effectiveness of immunization. Another important fact is that the binomial logistic regression showed that comorbidities continue to generate a greater propensity to die in people who suffer from them and become infected with COVID-19.

Keywords: COVID-19, population censuses, age groups, mortality.

Resumo

Este artigo analisa o crescimento e as taxas de primeira categoria de contágio, letalidade e mortalidade da covid-19 no México. O eixo desta pesquisa postula que quanto maior o número de vacinas aplicadas contra a covid-19, deve haver uma diminuição sustentada da transmissibilidade e das mortes por essa pandemia. Esta revisão foi feita a partir de três momentos no tempo, o que permite conhecer um antes e um depois da aplicação das vacinas no México. Trabalhamos com a base de dados abertos da Direção Geral de Epidemiologia Mexicana. Para o cálculo das taxas da primeira categoria foram necessários os Censos da População e Habitação 2010 e 2020 e o Inquérito Intercensitário 2015 do Instituto Nacional de Geografia e Estatística (Inegi). Para identificar o impacto das comorbidades, foi realizada

uma regressão logística binomial, que permitiu estimar as probabilidades de óbito em cada uma delas. Entre os resultados, observa-se que, após a data de início das imunizações, as taxas de contágio, letalidade e mortalidade da covid-19 no contexto mexicano apresentaram uma diminuição significativa, o que demonstra a eficácia da imunização. Outro fato importante é que a regressão logística binomial mostrou que as comorbidades continuam gerando maior propensão a morrer nas pessoas que sofrem com elas e se infectam com a covid-19.

Palavras-chave: covid-19, censos populacionais, faixas etárias, mortalidade.

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Introduction

The present investigation is based on the approach of Valenzuela (2020), who, resuming immunization studies in the world, states that in order to face the eradication and control of certain diseases susceptible to immunization, a high percentage of the population must be vaccinated, such and as it has been done historically. In the case of the 2019 coronavirus disease (covid-19) pandemic, in the year 2021, for example, the State of Israel[1] vaccinated 75% of people over 60 years of age and observed 60% decreases in hospitalizations almost immediately (De Quiroga, 2021). In this sense, the present investigation aims to identify the association between vaccination and variations in the first category rates of contagion, lethality and mortality of covid-19 in Mexico. This analysis was done at two important moments. The first of them, before the start of vaccination; the second, when vaccination had already started at the national level, although not significantly. The purpose is to estimate the weight of the vaccines as a whole against the spread of covid-19, as well as the effects of mortality and lethality in the population infected by the type 2 coronavirus that causes severe acute respiratory syndrome (SARS-CoV). -two). The growth rates of infected and deceased people who contracted covid-19 and who also suffered from some comorbidity were also analyzed. In this paper, the impact of each pharmaceutical or vaccine brand is not analyzed, on the contrary, it only reviews the global impact of immunizations in the Mexican context, as well as the change in the speed of contagion and mortality of said virus.

[1] The data can be corroborated on the page of https://ourworldindata.org/covid-vaccinations?country=ISR

Vaccines and their importance in the world

Vaccines have shown very high effectiveness in the global context. Without a doubt, it has been a way to eradicate diseases and bring benefits to the global population. Since the creation of the immunization programs of the World Health Organization (WHO), it has established itself as one of the most valued public health strategies, it has contributed to reducing mortality and, above all, to generating better life and health expectations. public. The initiative in question was launched in 1974. In 1977, the Pan American Health Organization (PAHO) implemented the Expanded Program on Immunization (PAI) in Latin American countries, with a vaccination scheme focused on six vaccine-preventable diseases: measles , rubella, diphtheria, whooping cough, mumps and polio virus. In Chile, for example, it was installed as a public good program with national coverage, free for the entire target population for each of the vaccines. In addition, continuing with the example, today it has political support, independent of changes in government and with exclusive national financing (Valenzuela, 2020). As Valenzuela (2020) himself refers, to ensure the success of immunization programs against diseases, it is essential to achieve high vaccination coverage (Table 1).

Table 1. Some epidemiological properties of childhood vaccine-preventable diseases, viral and bacterial infections, and critical vaccination coverage to block transmission

Agente infeccioso	Edad promedio (años) de infección, países desarrollados, previo a la vacunación	Índice de infecciosidad (RO)	Coberturas críticas de vacunación para bloquear la transmisión (%)
Sarampión	4 a 5 años	15-17	92-95
Tos ferina	4 a 5 años	15-17	92-95
Parotiditis	6 a 7 años	10-12	90-92
Rubéola	9 a 10 años	7-8	85-87
Difteria	11 a 14 años	5-6	80-85
Virus de la poliomielitis	12 a 15 años	5-6	80-85

Source: Valenzuela (2020)

In the case of measles, given the high rate of reproduction and infectivity, the WHO has stated that to achieve its elimination, coverage greater than 95% immunization is required (Valenzuela, 2020). Despite these advances and although 45 years have passed since the existence of immunization programs, in 2019 vaccine-preventable diseases were still among the 10 main threats to global health, according to the WHO (2019).

It is worth mentioning that covid-19 has presented a lower infectivity rate (R0 of 2.5), however, the vaccine should be mandatory for ethical reasons, since if an inhabitant becomes ill, it puts the health of the susceptible population at risk. surrounds you, starting with the family, neighbors and people closest to you. It should not be forgotten that we live in a community, therefore immunizations are designed for the common good of a population group. The WHO mentions that community protection, also known as herd immunity, requires reaching a minimum threshold of protection for the population through high vaccination coverage. A good example is the reemergence of measles; the results of mathematical modeling of the WHO have estimated that the collective protection threshold would be 92% to 95%, however, for eradication a coverage greater than or equal to 95% is necessary.

Under this same logic, covid-19 vaccination should be observed. At higher immunization rates, the impact on mortality and contagiousness should decrease significantly. Santiago de Quiroga (February 19, 2021) writes that, at the time of the publication of his editorial letter for the Gaceta Médica, there were already some real models of the impact of covid-19 immunization where large sectors were observed vaccinated with positive effects. . For example, the state of Israel, in the first week of February 2021, had administered to 75% of its population over 60 years of age two doses of the Pfizer/BioNTech RNAm vaccine (from Quiroga, February 19, 2021). 2021). The immediate result was a 60% reduction in hospital admissions. This shows that mass vaccination is an effective way to reduce the burden on health systems, which prevents medical care from collapsing, since it must not be forgotten that covid-19 is not the only disease that a society has.

Emergence of covid-19

The natural hosts of coronaviruses are mammals and even birds. This has led to characterize the infection in humans as zoonosis, that is, it has passed from animals to humans as a result of deforestation and environmental degradation. Coronaviruses were first described in 1966, associated with bat droppings, and not with cases of infection in humans.

Bratanich (2015) refers that the coronavirus is a genetic recombinant that combines a strain of bat in 80% to 85% associated with a strain of another animal species, such as an intermediate host, although there are some significant changes from zoonosis. with humans. This idea is also supported by Trilla (2020), who states that the 2019 coronavirus has a genetic sequence associated with other coronaviruses that circulate among bats. Zoonoses usually have a transmission capacity that oscillates between 1.4 and 2.5 and the consequences of infections are aggravated if people are older or suffer from chronic diseases, which increase the chances of death, scenarios that were not known until the moment of the covid-19 pandemic (Trilla, 2020).

For this reason, the WHO, in February 2018, made an international statement in which it published a list of priority diseases that should be studied in depth, given that they were presenting serious variants that put humanity in check (Reina , 2020). Among these diseases were severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS); both were observed with the potential to become pandemics. MERS syndrome had apparently been effectively controlled, although the latent possibility of its becoming a pandemic was discussed. For some scientists, the sanitary fences that were implemented worked adequately; for others, the spread of said disease ceased instantly, more due to natural causes than to human intervention (Mojica y Morales, 2020).

These diseases were being monitored by the WHO and were included in the new pathologies. Although they had been controlled, the potential risks that could affect society in the future were known (Reina, 2020). In 2019, the existence of two types of coronaviruses that had epidemically infected humans was already known. Severe acute respiratory syndrome coronavirus (SARS-CoV) emerged in 2002 in Guangdong province, China, spread throughout Southeast Asia, infecting approximately 8,000 people. This virus demonstrated a high fatality rate of 9.5%, since it caused, at that time, 774 deaths. It also presented a contagiousness index (R0) of 3.8, which favored its rapid expansion. However, although the contagion spread in different countries, its spread could be stopped relatively easily (Serrano et al., 2020).

In 2012, a coronavirus appeared in the Middle East that caused severe respiratory disorders. Known as the Middle East respiratory syndrome (MERS-CoV), a human respiratory disease, it presented a fatality rate between 30% and 40%. Research showed that it had a higher prevalence of deaths in the elderly and if associated with chronic diseases, it generated a greater probability of death in the hosts of this virus. However, its contagiousness rate was

very low and it was not transmitted efficiently from one individual to another, since it required very close contact (Bratanich, 2015).

In the month of November 2019, various infections occurred in the city of Wuhan, China, due to pneumonia of apparently unknown etiology that was communicated to the WHO in a timely manner. In the month of December of that year, said disease increased geometrically. In January 2020, the infected population was isolated and a new coronavirus could be detected in these patients, initially designated as 2019-nCoV6,7; In February, the WHO established the name of the disease as SARS-CoV-2.

The WHO declared covid-19 an international health emergency on January 30, 2020. Some governments minimized this warning, however, in a short time the overwhelming consequences of this virus were observed. Covid-19 became a pandemic that unexpectedly impacted the economy, population displacement and the way of life of the human being around the world.

Comorbidities and covid-19 are an association that generates complications. Comorbidity in humans is a chronic health condition that negatively impacts, generates a health disadvantage due to various external and internal factors of the patient and limits people to face other diseases. Comorbidity is understood as any disease or disadvantage in the health condition that a person lives. It is generally associated with impaired health. For Abizanda, Paterna, Martínez and López (2010), comorbidity is multimorbidity, defined as the concurrence of several diseases in a person without dominance or relationship between the two.

The term comorbidity was coined in 1970 by Feinstein when exploring the effect and the clinical and epidemiological interrelationships of the coexistence of multiple diseases in the same individual. He began to notice this phenomenon, as well as the increase in patients with complex clinical profiles due to the accumulation of chronic diseases as a consequence of the epidemiological transition. Subsequently, he proposed the term multimorbidity, which contains the classical and modern concepts of comorbidity. Today both terms continue to be used, even as synonyms (Fernández and Bustos, 2016).

The presence of multimorbidity or comorbidity associated with covid-19 increases the possibilities of complications and risk of death. Fernández, Puentes and García (2020), in an investigation on death from covid-19, found a close association between the older population that suffers from chronic pathologies such as high blood pressure, diabetes, obesity and heart problems. , among others, with the severity of the covid-19 infection, which brings an

increase in mortality. The explanation they offer is that comorbidities generate a greater propensity to develop severe clinical forms from covid-19 infection, which increases the chances of death (Fernández et al., 2020).

For Golpe et al. (2020), arterial hypertension is an excellent predictor of severity in people who are infected with covid-19. These authors found a close association between advanced age, diabetes, and hypertensive cardiomyopathy with the risk of hospital admission and mortality when the person contracts covid-19. (Golpe *et al.*, 2020).

Alcántara, Pacheco, Cadenas and Matsuki (2020), For their part, they classified patients infected with the 2019 coronavirus with cardiovascular risk factors, mainly males, elderly, suffering from arterial hypertension or diabetes, obesity, dyslipidemia, smoking, previous cardiovascular or cerebrovascular disease, as a population. vulnerable and high mortality. They found that a considerable proportion of covid-19 patients with these comorbidities may develop a vascular lesion that carries a higher risk of hospital mortality (Alcántara et al., 2020).

According to Mora (2020), there is a close relationship between arrhythmias and the severity of covid-19 infection. In her laboratory work, she found that the development of myocardial injury associated with covid-19 is frequent and causes the appearance of arrhythmias. In a series of cases that he analyzed, he found that the patients with the highest risk of death with covid-19 were those who presented malignant ventricular arrhythmias, which suggests that they are a marker of acute myocardial injury (Mora, 2020).

On the other hand, Valdes et al. (2020) discovered that in Spain pregnant women who contracted covid-19 had a higher risk of complications and death, which is why they proposed the use of a specific protocol. They suggest that pregnant women should be identified and treated in advance, checking if they have any comorbidity, in order to reduce the chances of death (Valdés et al., 2020).

While Garcia et al. (2020) found in an investigation carried out on hospitalized patients in some cities in the United States and the United Kingdom, that people with asthma or chronic obstructive pulmonary disease (COPD) are patients with a greater probability of complications if they are infected with covid-19, since They are comorbidities with significant risk factors, which makes it necessary to review their care at the time of being infected with covid-19. Emphasizing that these are respiratory diseases that are aggravated because covid-19 is a respiratory disease (García et al., 2020).

Hidalgo, Andreu, and Moreno (2020) searched for associations between covid-19 and kidney-type diseases and found that this relationship significantly increases their probability of poor prognosis. Their results demonstrated a conclusively higher mortality (Hidalgo *et al.*, 2020).

Likewise, Álvarez et al. (2020), in a study carried out in hospitals in Spain, found that the patient who has pneumonia and is infected with covid-19 has a high probability of dying, since both diseases are of the respiratory tract. Even this is just as serious if the patient develops pneumonia in the course of the covid-19 disease. In both cases, the prognosis is reserved for this type of patient, this is aggravated by the fact that pneumonia is considered a health problem in Spain, since its incidence generates 53,000 hospitalizations per year and an approximate cost of 115 million euros. Therefore, this comorbidity associated with the covid-19 syndrome generates a high probability of complication and death (Álvarez et al., 2020).

Gonzalez et al. (2020) also carried out scientific work in Spanish hospitals and found that the majority of critically ill patients were older and had more underlying conditions than patients not admitted to the intensive care unit (ICU), which led them to conclude that age and previous comorbidities are risk factors for increased mortality in the face of covid-19 infection. In addition, they add that admission to the ICU or the intubation process are invasive and more likely to be overcome by young people without comorbidities. For this reason, patients who are admitted to the ICU or who are intubated should preferably be channeled through the use of triage charts, the classic instrument of the medical service where differences in the level of urgency are established, and which obliges us to respond to the need to choose who enters these spaces, to optimize and guarantee resources and the spaces themselves, according to the probabilities of survival presented by each infected person (González et al., 2020).

For their part, Suárez et al. (2021) analyzed in-hospital mortality in Spain with patients infected with covid-19, but who were additionally immunosuppressed by various diseases. The authors observed 2,111 people with immunosuppression, 166 patients had received solid organ transplants, 1,081 had some type of malignancy, 332 had haematological malignancies, and 570 received systemic steroids, biologics, and immunosuppressants. The constant in all of them was that they were immunosuppressed and suffered from covid-19. When comparing this type of patients with others who were not immunosuppressed, the former presented a greater propensity to hospital death. There were groups with a high

mortality rate, such as cancer patients and transplant patients, so it was concluded that patients with hospitalized immunosuppressants infected with covid-19 have a higher probability of hospital complications and death compared to non-immunosuppressed patients. (Suárez *et al.*, 2021).

Finally, Cajamarca et al (2021) analyzed the impact of comorbidities and covid-19 infection and concluded that the diseases with the greatest complications that lead to the death of the patient are arterial hypertension, diabetes mellitus, cardiovascular and cerebrovascular disease.

Materials and method

The present investigation used as the main input the Open Data base referring to cases associated with covid-19 of the General Directorate of Epidemiology, dependent on the Ministry of Health in Mexico. There are three moments in time that were taken: the database of July 1, 2020, the database of May 20, 2021, and the database of December 31, 2021. These sources of information allowed knowing the growth rates of infections, lethality and mortality of covid-19 patients in the national context; but they also facilitated estimating the rate of intensity of the phenomenon. The calculation of these indicators requires knowing the population in Mexico by entity for the year 2020 and 2021, for this reason the Census of Population and Housing at the national level of the year 2020 (National Institute of Statistics and Geography [Inegi], 2020) was extrapolated. The open database of covid-19 cases in Mexico has 40 variables, including information on laboratory sample collection and what the result was; if an antigen sample was taken and the result of that antigen; This allows a final classification to be made to identify if the person was positive for covid-19.

The variables that were used in the present investigation were: the sex of the patient, the type of patient, if he was intubated, if he presented pneumonia, his age, if he was pregnant at the time of infection, if he is a speaker of an indigenous language, if he Self-identify as indigenous, if you have diabetes, if you suffer from chronic obstructive pulmonary disease (COPD), asthma, immunosuppression, if you have high blood pressure, if you suffer from any other comorbidity, if you have cardiovascular problems, if you are obese, if you have chronic kidney problems , if you smoke, if you have any other disease, if you are a migrant, or in the last case if you were admitted to the ICU. It is intended that these variables in accordance with the correlations shown make it possible to identify the probabilities of death associated with covid-19 (Pando y San Martín, 2004).

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About the periodicity of the study

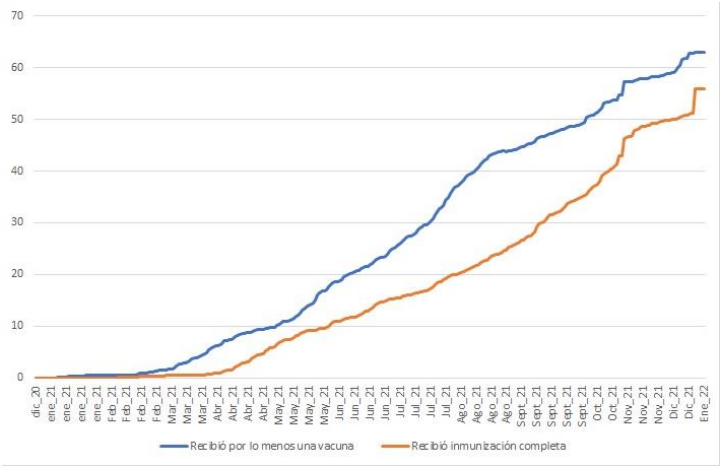
Three important dates were chosen. The first of these was on July 1, 2020, which is the calculation point for the growth rates of covid-19 contagion. If the information from April 12, 2020, when work officially began on a national basis, had been considered, the growth rates of the pandemic would be stratospheric, since it would start from a very small number of infected and deaths, therefore that the result of the present investigation would be biased.

On the other hand, vaccination in Mexico began on December 27, 2020, aimed at medical sector personnel nationwide. The second time point of this work is May 20, 2021; This benchmark was chosen because, by then, 8.83% of the population had already received two doses of vaccination, which allowed a part of the aging population to have greater protection against the pandemic. In total, the amount of 11,384,107 doses of vaccines had been applied until May 20, 2021. Although it was a low amount of vaccine application, it must not be forgotten that covid-19 produced high death rates in people over 40 years of age, and the risk increased with age; For this reason, the vaccination strategy, which began with the elderly, was very successful.

The third point in time was December 31, 2021, when the figure of 55.89% of the population with two immunizations was reached, as well as 62.88% of the Mexican population with at least one application of the covid-19 vaccine. (Figure 1). Currently, Mexico is considered to occupy the second position in doses administered in Latin America and the Caribbean.

These dates allow estimating from July 1, 2020 to December 31, 2020 as a period without effects of vaccines and with an exponential growth of infected and deceased by covid-19. For the period from July 1, 2020 to May 20, 2021, an incipient vaccination process is already observed, but still with strong contagion and death impacts. Finally, in the period from May 20 to December 31, 2021, a significant decrease in deaths, lethality and infections is observed.

Figure 1. Mexico: immunizations applied 2020-2022



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

Operationalization of variables

The dependent variable was constructed as a fictitious or dummy variable, where one (1) means that the patient died and zero (0) that he did not die. The explanatory or independent variables of the model will try to demonstrate to what magnitude they influence so that the possibility of death of patients who contract SARS-CoV-2 probabilistically increases. These independent variables are the following: sex, type of patient, whether hospitalized or outpatient, whether they were intubated, whether they presented pneumonia, the age of the patient, whether they were pregnant, whether they spoke an indigenous language, whether they self-register as indigenous, whether they suffer diabetes, COPD, asthma, if you have immunosuppression, arterial hypertension, if you suffer from any other comorbidity, if you have cardiovascular problems, if you are obese, if you suffer from chronic kidney disease, if you smoke, if you suffer from any other disease, if you were migrant, or if they required admission to the ICU. These variables were also constructed as dummies, that is, if they suffer from some type of comorbidity, the assigned value will be one; if they do not, it will be zero.

To carry out the analysis of the probabilities of death in patients with SARS-CoV-2 and who suffer from some type of comorbidity, the binary logistic regression model was used, which is one of the most widely used inferential statistical techniques in the production current scientific, in addition to being considered a very kind method (Montoya and Correa, 2017). This technique arose in the 1960s, it allows predicting the behavior of a phenomenon

from statistically finding that its behavior is not random, that is, that it follows an established pattern (Pando and San Martín, 2004).

The identification of the best logistic regression model that can be fitted is done using the likelihood ratio, which indicates, based on the sample data, how much more likely one model is compared to the other (Bocco and Herrero, 2009).

The binary logistic regression model is known for its usefulness in applied economics and for the analysis of qualitative variables through the use of discrete variables. Prior to modeling, it is necessary to structure a process to harmonize the variables with values that can be modeled using econometric techniques. (Damodar, 2010).

Additionally, relative risks were calculated [2] of covid-19 infection in Mexico in the general population, as well as the relative risk of dying in Mexico; this was contrasted with the relative risk of dying only for those infected with SARS-CoV-2. On the other hand, the odds ratio of covid-19 infection, death at the national level, as well as death by those infected with SARS-CoV-2 were calculated. Both the relative risks and the odds ratio were calculated for the total population, men and women according to age, as well as for men and women according to state. These calculations were made differentiating between before the vaccinations (May 20, 2021) and after the vaccinations (May 21, 2021). The results are observed in the annex.

Results

Growth rates are indispensable tools in population studies. They represent the speed, rhythm or change that a given event undergoes between two times (Leguina, 1982). A growth rate indicates the increase or decrease in personnel during a period. For this reason, within the present work, the geometric growth rate will be used, which supposes an accumulated growth of the population based on the initial population.

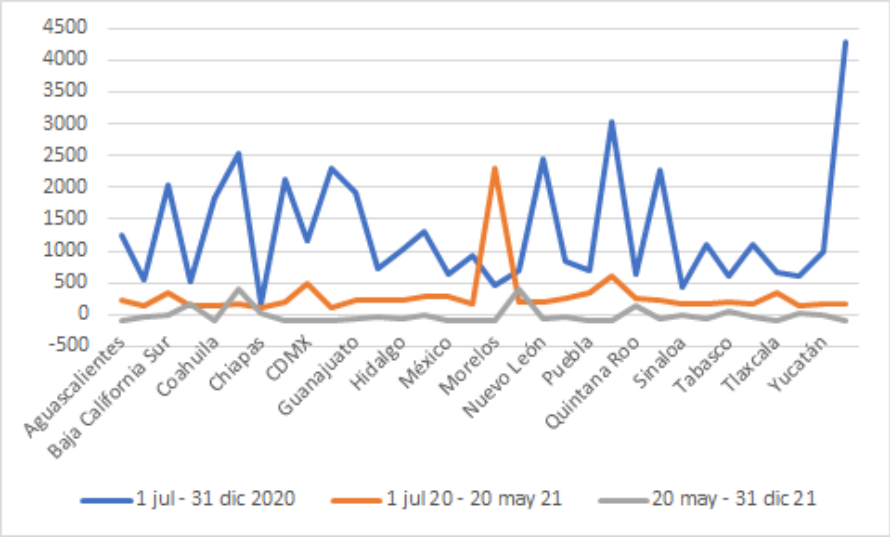
Calculating the growth rates of infections, three blocks were made: the first of them from July 1 to December 31, 2020, another moment was from July 1, 2020 to May 20, 2021 and a last moment that was calculated it was from May 20 to December 31, 2021 (figure 2 and table 1 of annexes).

[2] Según Dagnino (2014), se emplea en el análisis de trabajos prospectivos en los cuales dos grupos son seguidos para determinar la ocurrencia de algún evento. En cada grupo, el riesgo de ocurrencia de dicho evento se obtiene dividiendo el número de casos con el resultado de interés por el número total de casos. La razón entre estas proporciones en cada grupo es una medida del riesgo de un grupo comparado con el otro y se denomina *riesgo relativo* (RR).

In general terms, it is observed that, in the first period, from July 1 to December 31, the infection growth rates were very high, the five entities that led the contagion nationwide were Durango, with a rate of 2305.4%. , followed by Nuevo León (2453.2%), Colima (2542.9%), Querétaro (3018.4%) and Zacatecas (4271.4%). The entity with the lowest infection growth was Chiapas (159.4%), followed by Sinaloa (433.2%), Morelos (458%), Campeche (526.6%) and Baja California (550%).

During the period from July 1, 2020 to May 20, 2021, the growth rates of covid-19 infection decreased significantly, on average more than 1000%. It should be remembered that vaccination began at the end of December 2020, first with the medical sector, and it is estimated that by May close to 6 million Mexicans had already been immunized. However, for the period from May 20 to December 31, 2021, from the nationwide vaccination against covid-19, the infection growth rates are negative in 25 states, only seven are positive. . In states such as Colima and Nayarit, the rates are relatively high, but in the rest of the states they are negative, which shows that in said period the growth rate of infections has been declining steadily.

Figure 2. Mexico: growth rates of covid-19 contagion.



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

Regarding the behavior of the growth rate of mortality in the three periods of time in the national context, it differs from the contagion rate, since it presents a downward trend. In the mortality growth rate in the period from July 1 to December 31, 2020 (without vaccines), the growth in mortality was exponential, with a positive upward trend (Figure 3 and Table 2 of the annexes).

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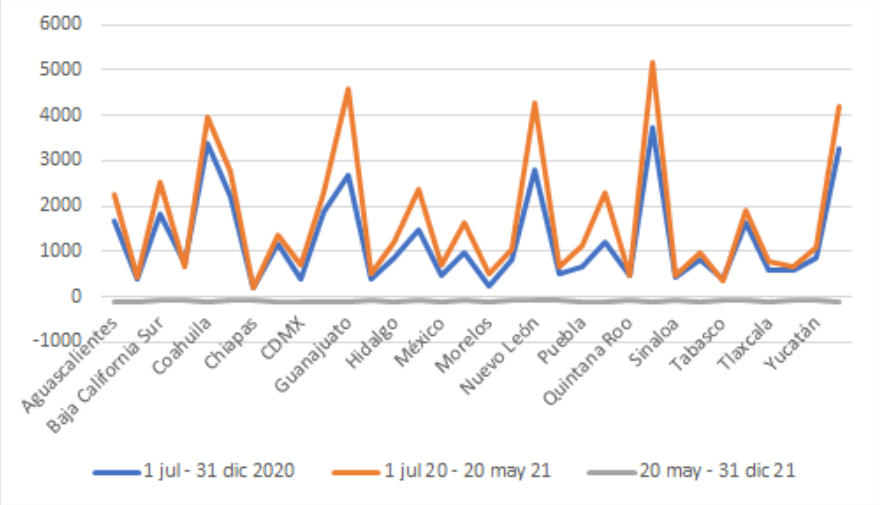
When reviewing the time period from July 1, 2020 to May 20, 2021, since only a small part of the population was vaccinated, the trend of inertia mortality increases significantly. For this reason, in 28 states of the Mexican Republic the mortality rates in this second period are higher and only in four states, Campeche, Chiapas, Quintana Roo and Tabasco, they were lower.

However, reviewing the first category contagion, lethality and mortality rates in the national context also suffer a significant increase. During the period from July 1 to May 20, 2021, the lowest infection rates occurred in the states of Chiapas, with 148.8 infections per 100,000 inhabitants, followed by Morelos (496.4) and Veracruz with 534.1 infected per 100 000 inhabitants (figure 4 and table 3 of annexes). The entities with the highest infection rates were Tabasco, with 1,837.70 infections per 100,000 inhabitants, followed by Baja California Sur (2,199.10) and CDMX (3,581.70).

Figure 3. Mexico: growth rates of covid-19 deaths



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

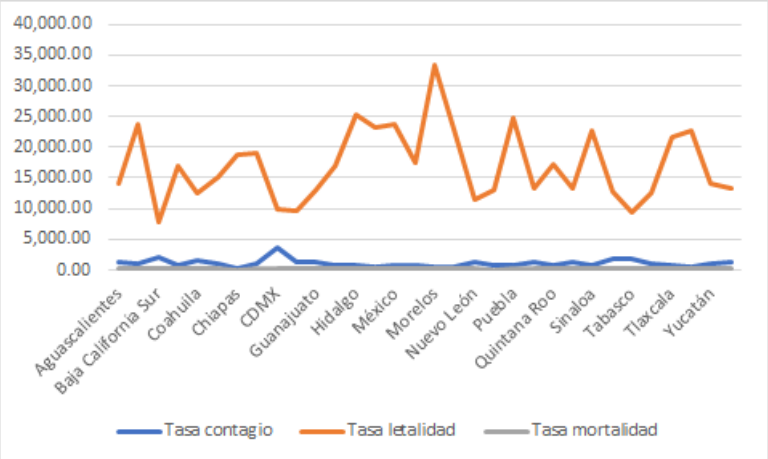
The fatality is the relationship between the deceased who were infected with covid-19 and all those infected with that disease, both indicators for a certain year and place. The lowest covid-19 fatality rates registered in the Mexican context were located in the entities of Baja California Sur, with 7,930.3 deaths per 100,000 infected, followed by Tabasco (9,315.7) and Durango (9,753.9). On the contrary, the highest fatality rates were located in the entities of Puebla (24,763.7), followed by Hidalgo and Morelos, with 25,275.2 and 33,377.5 deaths per 100,000 infected with covid-19, respectively (Figure 4 and Table 3). of the annex).

The crude mortality rate reflects the number of deaths over the total population for the national context. The lowest mortality rates were registered in the states of Chiapas, with 28.1 deaths per 100,000 inhabitants, followed by Oaxaca (88.7) and Michoacán (120.8); On the contrary, the entities that registered the highest mortality were Baja California (216.1), Sonora (222.9) and CDMX, with 358.6 deaths per 100,000 inhabitants.

This same information changed significantly in the period from May 20 to December 31, 2021, where more than 60% of the immunized Mexican population was reached (table 4 of the annex).

Regarding the rate of infections, it remained with a similar intensity. The entities with the lowest contagion rate were Chiapas (216.2), Michoacán (523.8) and Puebla (617.5); The entities with the highest infection rates were Tabasco, with 3,166.8 infections per 100,000 inhabitants, followed by Baja California Sur (3,659.8) and CDMX (3,687.9).

Figure 4. Mexico: contagion, lethality and mortality rates by state, from July 1, 2020 to May 20, 2021



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

However, the case fatality rate decreased significantly. On average for men and women, from 17,057 deaths per 100,000 infected, it dropped to 4,732.2 deaths. The lethality of men was reduced from 20,612 to 5,581 deaths per 100,000 infected. For their part, women decreased from 13,274 to 3,907 deaths per 100,000 infected (Table 4 of annexes and Figure 5).

The mortality rate was also significantly reduced, in men it went from 211 to 65 deaths per 100,000 inhabitants, in women mortality also decreased from 124.7 to 45.2.

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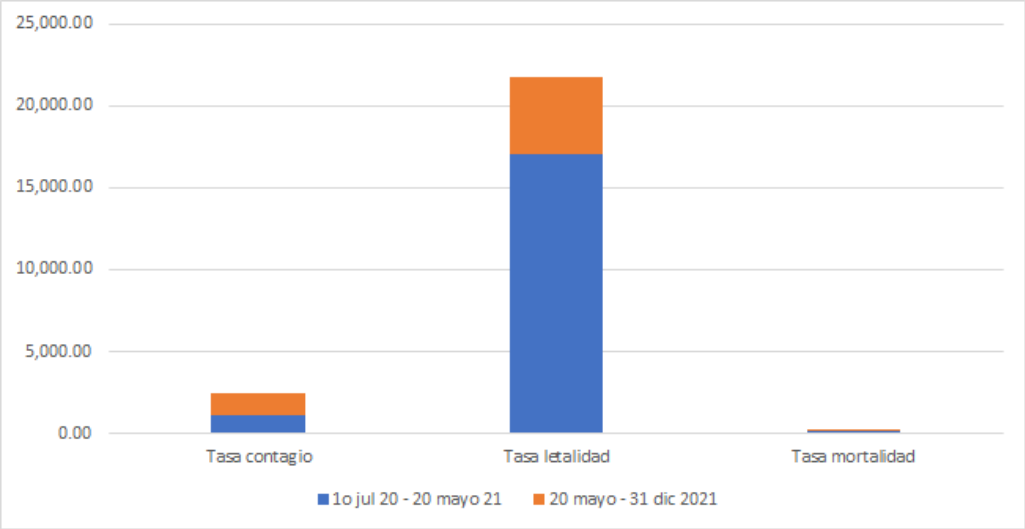
This reduction in mortality is clearly noticeable. In addition, between the age group of 31 to 45 years the difference in mortality is two digits, however, from the age of 46 the difference was three digits, which validates a relationship between the increase in age and the probability of dying from covid-19. It is also noted that in some cases, as age increased, the difference was up to four digits (tables 5 and 6 of the annex and figure 6).

There is a significant change that is also observed in these two periods being compared: the growth rates of the infected and the deceased described in Table 2 decreased significantly with vaccination. This information can also be broken down by state into tables 7 to 10 of the annex. The growth rate of those infected according to comorbidity, decreased significantly between the periods from July 1, 2020 to May 20, 2021, compared to the period from May 20 to December 31, 2021, all growth rates without exception , decreased significantly.

Figure 5. Mexico: contagion, lethality and mortality rates, comparison between two periods



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

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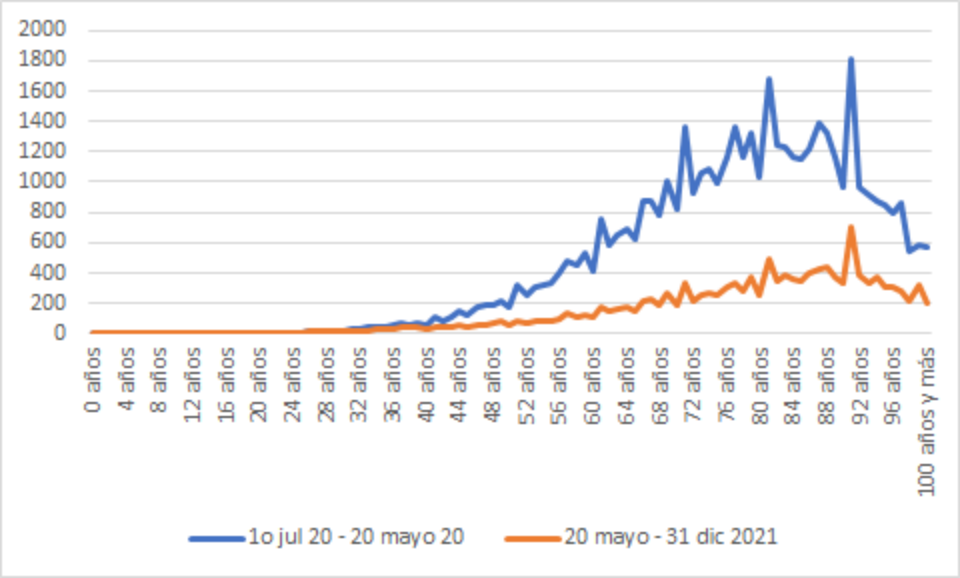
Figure 6. National: mortality rates in two different periods, 2020-2021



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

A similar behavior occurred in the case of mortality in people who suffered from comorbidities in both periods. In these groups of people who suffer from comorbidities, a high trend is also observed in mortality and its growth rate, to decrease drastically in the period from May 20 to December 31, 2021.

Table 2. Mexico: comorbidities and growth rate of each of them in two different periods

Comorbilidad o característica de condición social	Tasa crecimiento infectados		Tasa crecimiento defunciones	
	Del 1-jul-2020 al 20-may-2021	Del 20-may-2021 al 31-dic-2021	Del 1-jul-2020 al 20-may-2021	Del 20-may-2021 al 31-dic-2021
Intubado	1690.5	71.3	2642	74.5
Neumonía	1074.7	77.4	1562.8	75.0
Embarazo	1756.4	256.6	195.3	283.7
Hablante de lengua indígena	708.1	187.2	566.4	105.9
Autoinscribe indígena	SD*	169.7	SD*	113.9
Diabetes	1377.8	90.0	1637.6	69.6
EPOC	969.5	73.4	1172.0	65.0
Asma	1192.5	110.6	1584.9	68.8
Inmunosupresión	893.8	80.4	1041.7	80.4
Hipertensión	1458.2	89.8	1694.2	67.4
Otras enfermedades	1002.4	106.5	1232.6	74.6
Cardiovascular	1085.5	73.5	1637.8	66.8
Obesidad	1231.9	96.3	1280.0	71.2
Renal crónica	1091.7	80.9	1373.9	73.5
Tabaquismo	1376.1	119.8	1217.7	68.1
UCI	978.8	75.0	1255.6	74.5

* No data (SD)

Source: Own elaboration based on the Dirección General de Epidemiología (2022)

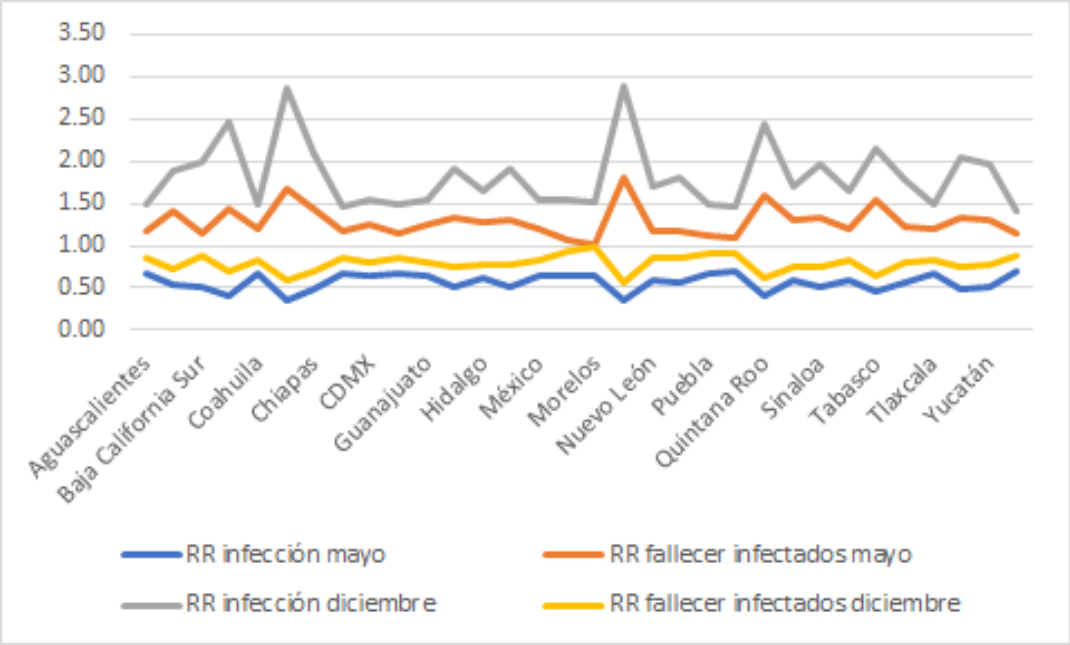
One explanation for this drop in mortality and in the covid-19 infection rate are the immunizations that began to be applied at the end of December 2020. During the year 2021, vaccination has gradually increased nationwide. national, keeping a close relationship between vaccination and the drop in growth rates between mortality and contagion, as noted in the tables included in the annex. In the same way, this relationship is also observed in the first category rates, as time progresses, the mortality, fatality and death rates tend to decrease,

which suggests that they are associated with the increase in immunizations in the national context.

A simple way to determine the radical changes from the application of the vaccines is the calculation of relative risks at the entity level. If the relative risks of dying before May 20, 2021 and subsequently from May 21 to December 31 are analyzed, it can be seen that in the first period the risk of infection in Mexico was lower than in December. In other words, with the passage of time and with the existence of a greater number of infected people, the risk of contagion increased despite the presence of the vaccines. However, the risk of dying after May 21 and until December 31 was lower than before that date, which validates that the vaccines fulfilled their expected function (figure 7).

This information is strengthened with the calculation of the odds ratio and retrospectively it is possible to assert that contagion is more likely to occur before May 20 than after that date. The same occurs with the propensity to die, before May 20 it is greater than after that date and until December 31, 2021 (figure 8).

Figure 7. Mexico: behavior of relative risks in two periods, before May 20 and after that date, in 2021, according to the federal entity

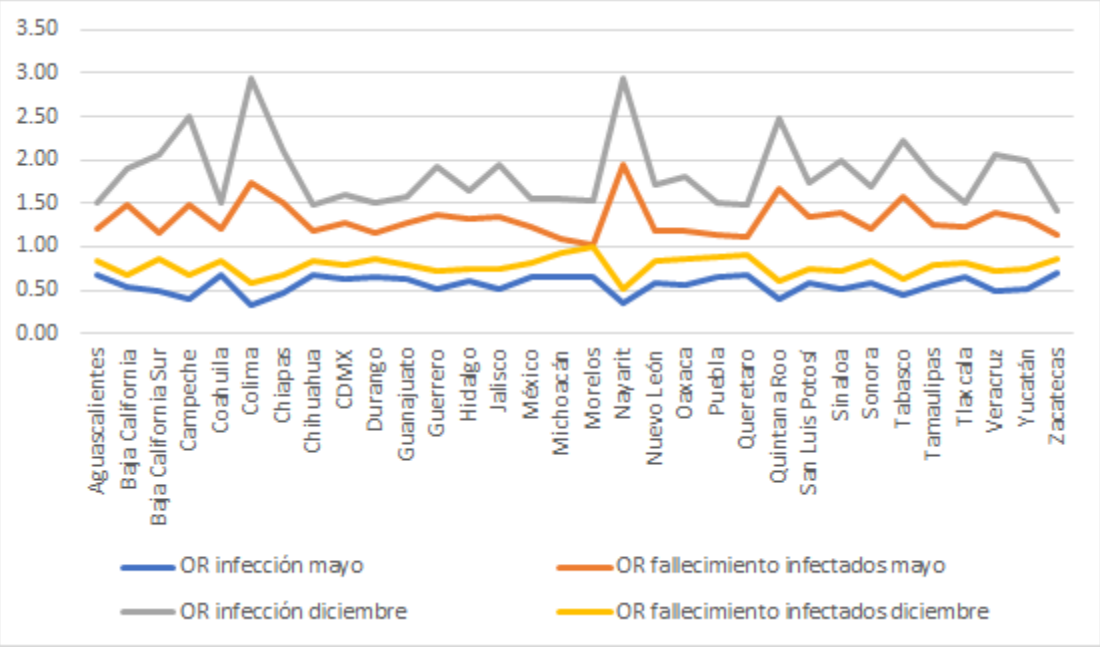


Source: Own elaboration based on the Dirección General de Epidemiología (2022)

Reviewing the relative risks and the odds ratio with respect to the changes observed from the application of the vaccines in the ages deployed at the national level, behaviors similar to those observed in the context of the entities are observed. It is observed that in the

first period, before May 20, 2021, the risk of infection in the different ages displayed was lower than in December. In other words, with the passage of time, and with the existence of a greater number of infected people, the risk of contagion increased despite the presence of vaccines, although there are differentiated behaviors from extreme ages. However, the risk of dying after May 21 and up to December 31 was lower than before that date, which validates that the vaccines fulfilled their expected function (figure 9).

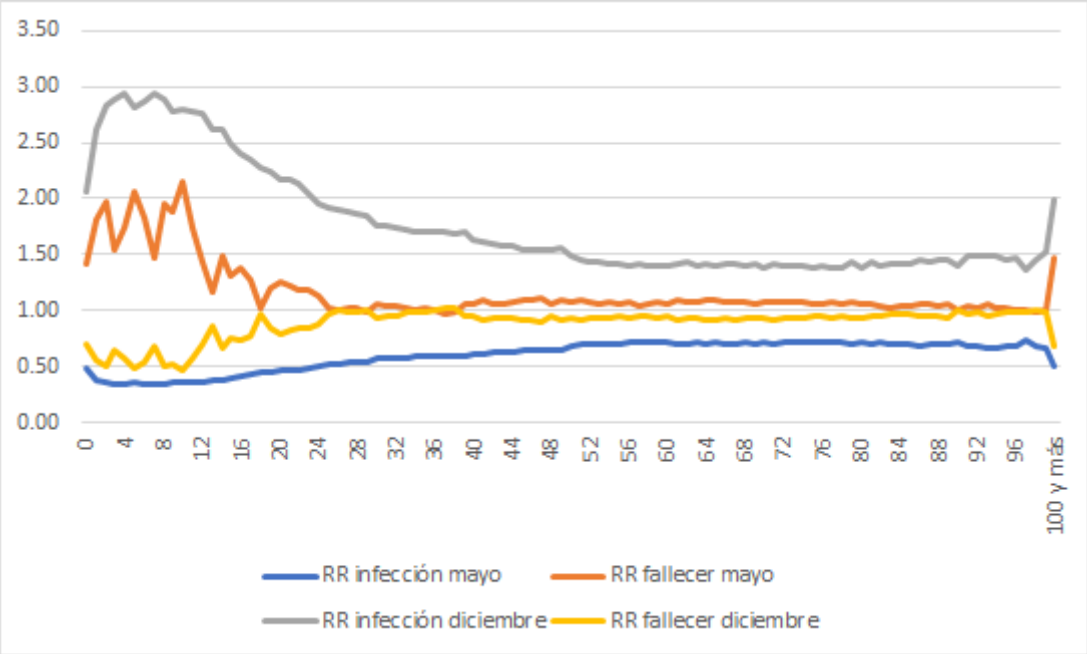
Figure 8. Mexico: behavior of the odds ratio in two periods, before May 20 and after that date, of the year 2021, according to the federal entity



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

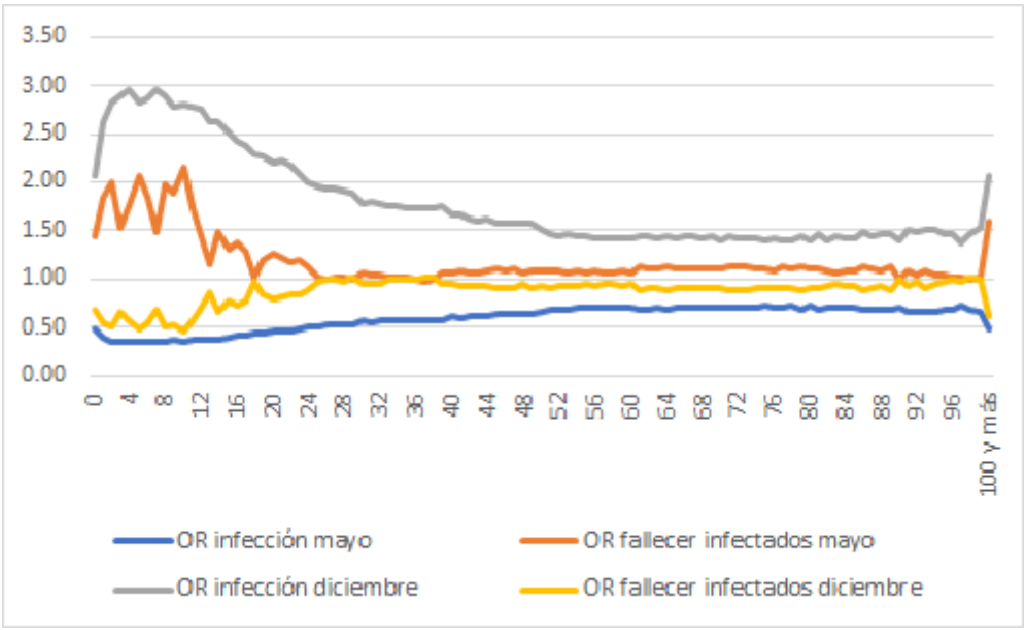
This information is strengthened by calculating the odds ratio and, retrospectively, it is possible to assert that contagion is more likely to occur before May 20 than after that date. The same occurs with the propensity to die, before May 20 it is greater than after that date and until December 31, 2021 (figure 10).

Figure 9. Mexico: behavior of relative risks in two periods, before May 20 and after that date, in the year 2021, according to age displayed



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

Figura 10. México: comportamiento de los *odds ratio* en dos periodos, antes de mayo 20 y posterior a esa fecha, del año 2021, según edad desplegada



Source: Own elaboration based on the Dirección General de Epidemiología (2022)

Discussion

In accordance with what has been stated by various authors, people who suffer from comorbidity and become infected with covid-19 are more likely to die. For this reason, a model was built with the 21 independent variables mentioned above, of which 19 were appropriate for the period from July 1, 2020 to May 20, 2021, while 18 variables could enter the model proposed for the period of May 20 to December 31, 2021.

For the data from the period from July 1, 2020 to May 20, 2021, a binomial logistic regression model was performed that presented a chi-square correspondence with a p value less than or equal to 0.05, the final model was adjusted accordingly. correct, this is observed in Table 3 with the following results:

a) The chi-squared statistic allows us to know if there is a relationship between variables: in order not to consider it random, the p value must be equal to or less than 0.05. The bus test is also strengthened, since it indicates that the model being built explains the event, in addition to the fact that the independent variables are responding to the dependent variable, which is death from covid-19 infection.

b) The indicator known as Nagelkerke's R-square and Cox and Snell's R-square show the part of the variance of the dependent variable that is being explained by the model; its reading is a percentage. Although both R squares are valid; there is a difference between them; Various authors suggest that an intermediate point between both indicators can be estimated. The higher the indicator, the higher the explanatory percentage of the model. For the present case, the Cox and Snell square indicates that the model is explained by these independent variables in 24.0%, while the Nagelkerke R square indicates that it is explained by 52.1%: the average would be 38.05%. In both cases, since we are in the ideographic sciences, the result is acceptable.

c) Binomial logistic regression is a predictive statistical test, it shows the number of cases that the model will be able to correctly predict. To do this, a regression equation must be used using the observed data. The prediction and interactions of the observed and predicted values help to explain the dependent variable by the independent variables; requires more than 50% correct classification for the model to fit and be valid. In this case, the percentage reached was 90.8 % of the data, which makes the model valid.

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d) Explanation of results through the exponential ß (exp(B)): this column is explanatory and shows the strength of the binomial logistic regression of the exercise that is carried out. In general, the result as you move away from one (1) will demonstrate a strong relationship, regardless of whether it is greater than or less than unity. In the event that the results of this column are less than the unit, you must work with its inverse, which is obtained by dividing the unit by the result obtained in exp(B). Another of the characteristics of the binomial logistic regression is that its results are equated to the relative risks and are understood as the product of the ratio between the probability of the analysis event occurring, that is, it indicates the influence of the independent variables. on the explained variable. The results are observed in table 3.

Table 3. Mexico: binomial logistic regression of comorbidities of covid-19 patients, period from July 1, 2020 to May 20, 2021

	B	E.T.	Wald	gl	Sig.	Exp(B)
sexo_2	0.428	0.006	4966.45	1	0.0	1.533
Intubado_2	2.803	0.014	39928.239	1	0.0	16.488
Neumonia_2	2.449	0.006	166174.328	1	0.0	11.58
Edad_1	0.869	0.015	3288.22	1	0.0	2.385
Edad_2	1.245	0.012	11257.486	1	0.0	3.473
Embarazo_2	-0.325	0.087	14.009	1	0.0	0.723
HLI_2	0.298	0.029	105.809	1	0.0	1.347
Diabetes_2	0.356	0.007	2674.011	1	0.0	1.428
Epoc_2	0.551	0.017	1014.328	1	0.0	1.734
ASMA_2	-0.222	0.022	99.607	1	0.0	0.801
INMUSUPR_2	0.28	0.023	145.864	1	0.0	1.324
Hipertension_2	0.453	0.007	4618.046	1	0.0	1.574
OTRA_COM_2	0.59	0.015	1469.648	1	0.0	1.804
Cardiovascular_2	0.226	0.016	202.458	1	0.0	1.254
Obesidad_2	0.119	0.008	246.949	1	0.0	1.126
RENAL_CRONICA_2	0.927	0.015	3715.965	1	0.0	2.528
Tabaquismo_2	-0.112	0.012	92.492	1	0.0	0.894
OTRO_CASO_2	-0.91	0.007	16997.994	1	0.0	0.403
UCI_2	-0.312	0.016	377.582	1	0.0	0.732
Constante	-5.105	0.011	198626.587	1	0.0	0.006

Variables entered in the step 1: sexo_2, Intubado_2, Neumonia_2, Edad_1, Edad_2, Embarazo_2, HLI_2, Diabetes_2, Epoc_2, ASMA_2, INMUSUPR_2, Hipertension_2, OTRA_COM_2, Cardiovascular_2, Obesidad_2, RENAL_CRONICA_2, Tabaquismo_2, OTRO_CASO_2, UCI_2.

Source: self made

Men were 1.53 times more likely to die than women. If the covid-19 patient was intubated, he was 16.48 times more likely to die. If the covid-19 patient developed pneumonia, he was 11.58 times more likely to die. If the patient had covid-19 and was pregnant, she was 1.3 times more likely to die.

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Although it is not a comorbidity, it is observed that speakers of an indigenous language were 1.3 times more likely to die if they suffered from covid-19, which strengthens the idea of a greater disadvantage or exclusion in society for indigenous populations.

If the covid-19 patient was 41 years old or older, he had a 2.38 times greater propensity to die, but if he was 46 years old or older, the propensity to die increased to 3.47.

If the covid-19 patient had diabetes mellitus, he was 1.42 times more likely to die. If the patient had COPD covid-19, their propensity to die increased to 1.73 times. If the person infected with covid-19 had any immunosuppression treatment, they were 1.32 times more likely to die.

If the covid-19 patient was hypertensive, they were 1.57 times more likely to die. If the covid-19 patient had chronic kidney-type comorbidity, their propensity to die increased to 2.52 times.

If the covid-19 patient suffered from cardiovascular problems, he had a 1.25 times higher probability of dying; If the person was overweight and got covid-19, their propensity to die was 1.12 times more, the same as if they were a smoker and got covid-19. If the covid-19 patient enters the ICU, their propensity to die was 1.36 times more. Lastly, if the covid-19 patient had a comorbidity other than those mentioned, she was 2.48 times more likely to die. These results suggest that the association of suffering from comorbidities with being infected with the covid-19 virus is validated, generating higher mortality rates.

On the other hand, for the binomial logistic regression model of the data obtained for the period from May 20 to December 31, 2021, where at the end of said period close to 60% of vaccinated Mexicans were reached, interesting results were obtained. and similar to those described above, which are shown in Table 4.

a) The chi-squared statistic presented a p value equal to or less than 0.05 in the bus test, which validates that the explanatory variables respond to the dependent variable, which was death from covid-19 infection for the period of time referred.

b) The Cox and Snell square shows that mortality from covid-19 is associated with comorbidities, and is explained with these independent variables in 14.4%, while the Nagelkerke R square explains them in 50.1%.

c) The prediction and interaction of the observed and predicted values help to explain the dependent variable by the independent variables, although it requires more than 50% of the correct classification for the model to fit and

be valid. In this case, 95.9 % of the data are considered within the model, which makes the model valid and robust.

d) The explanation of results through exp(B) shows the strength of the binomial logistic regression, as well as the influence of the independent variables on the variable to be explained in Table 4.

Table 4. Mexico: binomial logistic regression of comorbidities of covid-19 patients, period July 1, 2020 to May 20, 2021

	B	E.T.	Wald	gl	Sig.	Exp (B)
Sexo2	0.36	0.011	1131.064	1	0.0	1.434
Intubado_dummy	2.844	0.026	11751.264	1	0.0	17.188
Neumonía_dummy	2.936	0.011	73258.41	1	0.0	18.843
Edad_1	0.896	0.022	1647.719	1	0.0	2.449
Edad_2	1.047	0.019	3010.621	1	0.0	2.848
HLI_2	0.317	0.043	53.237	1	0.0	1.374
Diabetes_2	0.434	0.013	1115.446	1	0.0	1.544
Epoc_2	0.458	0.033	194.49	1	0.0	1.581
ASMA_2	-0.169	0.041	17.455	1	0.0	0.844
INMUSUPR_2	0.398	0.044	80.627	1	0.0	1.489
Hipertension_2	0.467	0.013	1358.119	1	0.0	1.596
OTRA_COM_2	0.713	0.029	615.095	1	0.0	2.039
Cardiovascular_2	0.27	0.031	75.46	1	0.0	1.31
Obesidad_2	0.321	0.014	505.335	1	0.0	1.378
Renal_cronica_2	0.983	0.028	1273.001	1	0.0	2.672
Tabaquismo_2	-0.107	0.022	23.622	1	0.0	0.898
Otro_caso_2	-0.665	0.013	2689.015	1	0.0	0.514
UCI_2	-0.056	0.028	4.028	1	0.045	0.945
Constante	-5.601	0.015	132231.858	1	0.0	0.004

Variables entered in the step 1: Sexo2, Intubado_dummy, Neumonía_dummy, Edad_1, Edad_2, HLI_2, Diabetes_2, Epoc_2, ASMA_2, INMUSUPR_2, Hipertension_2,

OTRA_COM_2, Cardiovascular_2, Obesidad_2, Renal_cronica_2, Tabaquismo_2, Otro_caso_2, UCI_2.

Source: self made

Men were 1.43 times more likely to die than women. If the covid-19 patient was intubated, he was 17.18 times more likely to die. If the covid-19 patient developed pneumonia, he was 18.84 times more likely to die.

If the covid-19 patient was 41 years old or older, they had a 2.44 times higher propensity to die, but if they were 46 years old or older, they increased to 2.84 times more likely to die.

If the patient, in addition to having covid-19, declared himself as an indigenous population, he had a 1.37 higher propensity to die. If the covid-19 patient had diabetes mellitus, he was 1.54 times more likely to die. If you had COPD, your propensity to die increased to 1.58 times. The covid-19 patient, if he also had asthma, was 1.89 times more likely to die.

If the person infected with covid-19 had some immunosuppression treatment, he was 1.48 times more likely to die. If the covid-19 patient was hypertensive, he was 1.59 times more likely to die. If the covid-19 patient had chronic renal-type comorbidity, their propensity to die increased to 2.67 their propensity to die.

If the covid-19 patient was obese, he was 1.37 times more likely to die. If he was addicted to tobacco and also caught covid-19, his propensity to die was 1.13 times higher. If the covid-19 patient presented any other disease different from what was referred to in this investigation, he had a propensity to die of 1.94 times more. If the patient was admitted to the ICU he had a 1.05 times higher propensity to die.

Lastly, if the covid-19 patient had a cardiovascular disease, he was 1.31 times more likely to die, but if he had another comorbidity not described in this study, he was 2.03 times more likely to die. In addition, if the covid-19 patient suffered from any chronic kidney disease, their propensity to die increased 2.67 times.

Conclusions

In the present investigation two important aspects have been demonstrated:

If progress is made in immunization against covid-19, infections, lethality and mortality due to this virus are reduced in a sustainable way. Although as of January 1, 2022, it has barely reached 62.88% of the population with at least one dose of vaccine and 55.92% of the population with two doses of immunization against covid-19, the decreases in mortality, transmission of the virus and lethality are observed significantly. The reasoning of Valenzuela (2020) that was proposed as a trigger in the present investigation has been verified, since as the immunizations carried out increase, the diseases tend to decrease, although for herd immunity in the national context around covid-19 the hardest part is yet to come.

Based on the vaccines that were applied since the last days of the year 2020 and that caused the figure of more than 60% of vaccinated Mexicans to be reached by the end of 2021, the growth rates of infections and deaths, as well as The first category contagion, fatality and mortality rates have decreased significantly in the period from May 20 to December 31, 2021, compared to the period from July 1, 2020 to May 20, 2021. This behavior also It can be seen in the growth rates of contagion and death in both periods.

The presence of multimorbidity or comorbidity associated with covid-19 increases the possibilities of complications and risk of death, which supports what was reported by Fernández et al. (2020), who found a close association between the older population that suffers from chronic pathologies, such as high blood pressure, diabetes, and heart problems. Another item that was validated was the one proposed by Golpe et al. (2020), who say that arterial hypertension is a predictor of severity in the course of the disease in people who are infected with covid-19. For Alcántara et al. (2020) patients infected with covid-19 with cardiovascular risk factors, mainly male, elderly AND suffering from arterial hypertension or diabetes, were identified as particularly vulnerable populations. This proposal was also validated in the Mexican national context.

For García et al (2020), patients with COPD have a greater probability of complications if they are infected with covid-19, a conclusion that was validated from the data used in this research.

For Hidalgo et al. (2020) there is an association between covid-19 and kidney-type diseases, their results convincingly demonstrated a higher mortality. The binomial logistic regression in both cases shows a trend similar to that proposed by the authors.

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Alvarez et al. (2020) found that the patient who has pneumonia and is infected with covid-19 has a high probability of having a poor prognosis. In the present investigation, a high propensity to die is also observed from the open covid-19 database for the Mexican context.

Suarez et al. (2021) found that immunosuppressed patients due to various diseases, when infected with the 2019 coronavirus, have higher probabilities of hospital complications and death compared to patients who are not immunosuppressed. In the results that have been worked on for the Mexican context, this association is also noted.

Finally, Cajamarca et al. (2021) concluded that the diseases with the greatest complications that lead to the death of the patient are arterial hypertension, diabetes mellitus, cardiovascular and cerebrovascular disease. Similarly, the binomial logistic regressions carried out in this research validate this result for the Mexican case in the two time periods that are analyzed.

The results described above are validated with the calculation of the relative risks and the odds ratio of infection and death for the total population at the national level, as well as death in the national context only for those infected with covid-19, according to age. deployed and sex, for the cut-off periods, before May 20 and after May 21, 2021. These results are very similar to those observed in the federal entities, which allows us to assert that the covid-19 vaccines complied its role in controlling the contagion, mortality and lethality of this virus.

Study limitations

This work has been developed from a quantitative edge and from a subjective perspective, so the results may vary from analyzing microsocial elements. In the same way, these results may vary due to the appearance of other variants of SARS-CoV-2 (the work of the period addressed had the so-called delta variant as the predominant variant). In fact, the omicron variant, which appeared more recently, seems to be less aggressive, but it would be necessary to analyze the data later to know its behavior in detail.

Strengths of the study

It is a quantitative work that demonstrates the accuracy of the theories used in the Mexican context from the implementation of immunization plans.

Study areas of weakness

The construction of life tables of the different entities was not carried out, as well as contrasting the behavior of deaths in the states of the country through standardization of mortality rates.

Future lines of research

The analysis of covid-19 is very broad. Undoubtedly, a topic for future research is demographic aging, a necessary topic for analysis in light of the increase in mortality as people age increases.

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Appendant

Table 1. Mexico: geometric growth rate of covid-19 infection at three different times, by sex and entity of residence, 2020-2021.

	1 julio al 31 diciembre 2020			1 julio 2020 a 20 mayo 2021			20 mayo 2021 a 31 dic 2021		
Entidad	Total	Hombres	Mujeres	Total	Hombres	Mujeres	Total	Hombres	Mujeres
Aguascalientes	1235.0	1310.2	1167.2	214.4	208.5	220.4	-84.8	-86.8	-82.8
Baja California	550.0	502.9	601.9	142.2	144.9	139.5	-31.0	-34.6	-27.4
Baja California Sur	2040.7	1785.0	2361.4	336.5	335.4	337.6	-8.7	0.2	-17.7
Campeche	526.6	478.0	606.9	126.6	113.4	139.7	172.7	87.1	258.3
Coahuila	1824.5	1695.9	1963.8	132.9	131.8	133.9	-84.8	-84.7	-84.8
Colima	2542.9	2127.8	3189.4	174.8	163.1	186.4	389.3	325.9	452.8
Chiapas	159.4	144.4	180.4	122.4	114.0	130.7	27.2	3.4	50.9
Chihuahua	2134.0	1903.0	2427.0	190.1	177.1	203.1	-88.2	-90.8	-85.5
CDMX	1160.0	1047.7	1287.8	482.3	467.5	497.0	-81.3	-82.2	-80.4
Durango	2305.4	2161.3	2446.9	120.1	118.2	122.0	-83.7	-84.5	-83.0
Guanajuato	1931.1	1777.0	2093.7	234.5	240.4	228.6	-79.1	-80.2	-78.0
Guerrero	732.5	631.9	871.6	221.0	212.0	229.9	-24.2	-34.8	-13.6
Hidalgo	1028.8	953.7	1126.1	229.0	226.2	231.8	-69.2	-73.2	-65.3

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Jalisco	1313.0	1207.3	1436.8	273.8	273.7	273.9	-19.9	-24.7	-15.1
México	636.5	602.4	678.1	293.5	294.3	292.8	-81.6	-82.3	-80.8
Michoacán	940.6	838.6	1068.1	160.8	161.7	159.9	-81.2	-81.5	-80.9
Morelos	458.0	421.5	507.6	2309.5	1899.7	2719.4	-84.6	-86.4	-82.8
Nayarit	686.7	648.0	731.8	201.7	194.1	209.3	408.7	323.3	494.1
Nuevo León	2453.2	2251.8	2698.3	184.4	183.1	185.6	-60.5	-59.0	-62.0
Oaxaca	847.0	814.8	886.6	269.8	257.0	282.6	-46.9	-52.3	-41.4
Puebla	682.2	657.1	713.4	350.4	350.5	350.3	-84.1	-85.8	-82.4
Querétaro	3018.4	2676.7	3453.6	602.0	573.5	630.5	-85.8	-86.3	-85.4
Quintana Roo	638.2	581.3	717.4	246.0	238.5	253.5	135.1	136.3	133.9
San Luis Potosí	2279.4	2120.0	2458.8	237.7	231.1	244.3	-61.2	-62.1	-60.3
Sinaloa	433.2	393.0	478.0	158.2	150.2	166.1	-13.6	-20.5	-6.7
Sonora	1113.1	999.3	1229.2	157.5	159.8	155.2	-67.7	-68.5	-66.9
Tabasco	610.3	553.1	677.6	191.9	179.5	204.3	42.8	40.2	45.3
Tamaulipas	1104.0	993.0	1257.6	179.5	160.3	198.6	-48.1	-53.7	-42.4
Tlaxcala	676.3	649.4	710.8	347.1	325.4	368.8	-84.0	-86.0	-82.1
Veracruz	620.1	567.8	696.5	144.9	133.6	156.2	13.6	-6.8	34.0
Yucatán	983.1	863.7	1155.6	161.1	155.0	167.2	-12.2	-11.5	-12.9
Zacatecas	4271.4	3725.1	4963.9	163.4	155.1	171.7	-90.3	-90.8	-89.9

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Total	1310.5	1190.1	1463.9	292.5	272.8	312.2	-11.5	-21.7	-1.3

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

Table 2. Mexico: geometric growth rate of deaths from covid-19 at three different moments, according to sex and entity of residence, 2020-2021

	1 julio al 31 diciembre 2020			1 julio 2020 a 20 mayo 2021			20 mayo 2021 a 31 dic 2021		
Entidad	Total	Hombres	Mujeres	Total	Hombres	Mujeres	Total	Hombres	Mujeres
Total	1240.8	1214.5	1305.7	1692.6	1597.9	1787.2	-89.8	-92.0	-87.7
Aguascalientes	1688.3	1871.6	1456.3	2257.7	2500.6	2014.7	-97.9	-98.1	-97.6
Baja California	378.7	373.7	386.5	419.3	412.9	425.7	-96.2	-96.2	-96.1
Baja California Sur	1813.0	1822.2	1800.0	2523.6	2688.9	2358.3	-63.1	-67.4	-58.8
Campeche	759.4	723.5	833.3	682.7	628.4	736.9	-56.6	-72.7	-40.6
Coahuila	3373.5	3546.6	3153.4	3961.3	4157.1	3765.6	-98.1	-98.5	-97.8
Colima	2221.2	1921.7	2910.0	2743.3	2194.3	3292.2	-59.4	-62.8	-55.9
Chiapas	212.7	218.3	201.1	205.6	205.2	206.0	-88.4	-93.0	-83.9
Chihuahua	1159.9	1137.5	1196.7	1364.0	1278.6	1449.3	-98.9	-99.3	-98.5
CDMX	410.0	390.5	450.9	688.3	608.0	768.7	-99.2	-99.3	-99.1

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Durango	1872.5	1812.9	1971.4	2287.5	2166.5	2408.5	-96.2	-97.9	-94.5
Guanajuato	2671.5	2477.6	3068.9	4596.6	3923.3	5269.9	-97.9	-98.6	-97.3
Guerrero	392.1	371.5	435.3	518.9	451.8	586.0	-90.3	-92.7	-88.0
Hidalgo	858.2	852.0	871.1	1205.5	1134.1	1276.9	-96.5	-97.8	-95.1
Jalisco	1470.4	1434.0	1538.6	2358.0	2211.1	2505.0	-89.0	-91.5	-86.5
México	469.8	450.1	512.0	701.9	630.2	773.6	-98.6	-98.9	-98.4
Michoacán	958.4	894.4	1089.7	1638.8	1436.0	1841.6	-91.1	-92.8	-89.4
Morelos	227.5	234.6	213.3	500.0	481.1	518.9	-96.8	-97.2	-96.3
Nayarit	814.5	845.3	764.6	1051.4	1093.8	1009.1	-72.6	-81.3	-63.8
Nuevo León	2789.0	2603.5	3138.3	4263.9	3749.9	4777.8	-91.8	-92.8	-90.8
Oaxaca	508.7	523.0	482.6	671.7	679.5	664.0	-88.2	-90.0	-86.3
Puebla	673.8	639.1	747.4	1134.9	1011.7	1258.2	-95.6	-96.6	-94.6
Querétaro	1217.3	1165.7	1327.1	2305.7	2040.4	2570.9	-96.7	-97.2	-96.2
Quintana Roo	479.4	472.2	493.5	457.8	441.9	473.8	-86.6	-89.3	-83.9
San Luis Potosí	3723.1	3911.1	3466.7	5166.6	5531.1	4802.0	-96.7	-97.2	-96.2
Sinaloa	439.0	396.9	509.9	477.4	418.8	535.9	-89.1	-90.5	-87.6
Sonora	833.8	832.3	835.9	973.9	971.0	976.7	-93.5	-94.2	-92.9
Tabasco	400.4	389.8	418.0	362.8	354.3	371.2	-91.1	-93.6	-88.7
Tamaulipas	1642.1	1546.5	1812.5	1895.7	1700.2	2091.3	-90.8	-92.1	-89.6

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Tlaxcala	571.1	547.2	622.2	783.7	672.0	895.5	-99.0	-99.2	-98.9
Veracruz	580.2	565.5	607.8	673.2	624.6	721.7	-83.0	-88.6	-77.3
Yucatán	848.5	800.7	942.9	1091.7	953.7	1229.7	-87.4	-89.1	-85.8
Zacatecas	3249.0	3092.3	3524.3	4199.2	3782.0	4616.4	-98.6	-98.6	-98.5
Total	1240.8	1214.5	1305.7	1692.6	1597.9	1787.2	-89.8	-92.0	-87.7

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

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Table 3. Mexico: first category rates of infections, lethality and mortality, according to sex and entity, for the period July 1, 2020 to May 20, 2021

	Tasa contagios por cada 100 000 habitantes			Tasa letalidad por cada 100 000 habitantes			Tasa de mortalidad por cada 100 000 habitantes		
Entidad	Total	Hombres	Mujeres	Total	Hombres	Mujeres	Total	Hombres	Mujeres
Aguascalientes	1182.6	1207.0	1159.3	14 179.5	17 145.6	11 227.5	167.7	206.9	130.2
Baja California	912.5	889.6	935.7	23 683.4	28 895.8	18 642.6	216.1	257.1	174.4
Baja California Sur	2199.1	2132.7	2267.8	7930.3	9834.7	6079.2	174.4	209.7	137.9
Campeche	779.1	919.7	642.8	16 834.3	18 710.0	14 234.1	131.1	172.1	91.5
Coahuila	1564.3	1533.5	1594.7	12 638.8	15 067.7	10 331.8	197.7	231.1	164.8
Colima	1080.0	1132.3	1029.1	15 012.0	17 988.8	11 827.7	162.1	203.7	121.7
Chiapas	148.8	170.6	128.1	18 872.9	22 826.3	13 855.4	28.1	38.9	17.7
Chihuahua	967.8	984.2	951.7	18 991.1	22 480.3	15 448.6	183.8	221.3	147.0
CDMX	3581.7	3655.8	3513.9	10 013.2	13 038.8	7127.6	358.6	476.7	250.5
Durango	1363.0	1288.4	1435.9	9753.9	12 598.3	7264.2	132.9	162.3	104.3
Guanajuato	1333.3	1306.3	1358.9	13 010.7	16 761.7	9600.9	173.5	219.0	130.5
Guerrero	732.6	790.2	679.4	17 044.0	20 844.5	12 961.2	124.9	164.7	88.1
Hidalgo	789.1	870.0	714.3	25 275.2	31 095.5	18 719.0	199.5	270.5	133.7

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Jalisco	620.4	634.1	607.2	23 262.3	29 109.7	17 372.5	144.3	184.6	105.5
México	857.4	929.6	789.4	23 646.5	29 010.5	17 685.3	202.8	269.7	139.6
Michoacán	695.9	724.8	668.6	17 353.8	21 440.1	13 169.6	120.8	155.4	88.0
Morelos	496.4	559.8	437.4	33 377.5	40 119.9	25 340.5	165.7	224.6	110.8
Nayarit	634.8	658.8	611.3	23 050.5	28 402.1	17 385.6	146.3	187.1	106.3
Nuevo León	1418.5	1439.4	1397.7	11 471.6	13 669.5	9209.9	162.7	196.8	128.7
Oaxaca	683.5	764.8	609.2	12 971.5	15 745.3	9783.7	88.7	120.4	59.6
Puebla	715.4	801.1	636.3	24 763.7	29 503.9	19 253.6	177.2	236.4	122.5
Querétaro	1356.3	1390.1	1324.1	13 234.7	16 822.9	9636.9	179.5	233.8	127.6
Quintana Roo	844.7	908.3	780.0	17 105.0	20 572.5	13 001.0	144.5	186.9	101.4
San Luis Potosí	1408.9	1435.7	1383.6	13 203.2	16 163.0	10 296.3	186.0	232.1	142.5
Sinaloa	882.0	881.8	882.3	22 808.3	27 016.8	18 706.2	201.2	238.2	165.0
Sonora	1750.5	1616.6	1884.4	12 731.1	15 900.6	10 014.0	222.9	257.0	188.7
Tabasco	1837.7	1889.1	1788.7	9315.7	11 433.7	7180.1	171.2	216.0	128.4
Tamaulipas	1113.9	1202.7	1027.9	12 481.3	14 083.0	10 665.7	139.0	169.4	109.6
Tlaxcala	825.6	927.3	730.2	21 753.2	25 231.3	17 611.2	179.6	234.0	128.6
Veracruz	534.1	618.4	456.1	22 648.9	25 527.6	19 044.4	121.0	157.9	86.9
Yucatán	1143.3	1236.2	1053.6	14 194.1	16 466.7	11 619.4	162.3	203.6	122.4
Zacatecas	1293.6	1301.6	1286.0	13 218.9	16 070.9	10 471.3	171.0	209.2	134.7

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Total	1117.1	1150.0	1086.4	17 057.2	20 611.8	13 274.0	166.8	210.8	124.7

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

Table 4. Mexico: first category rates of infections, lethality and mortality, by sex and entity, for the period May 20 to December 31, 2021

	Tasa de contagios por cada 100 000 habitantes			Tasa de letalidad por cada 100 000 habitantes			Tasa de mortalidad por cada 100 000 habitantes		
Entidad	Total	Hombres	Mujeres	Total	Hombres	Mujeres	Total	Hombres	Mujeres
Aguascalientes	871.2	837.5	903.4	4242.6	5281.6	3321.0	37.0	44.2	30.0
Baja California	1092.4	1048.0	1137.6	5496.3	6786.6	4287.1	60.0	71.1	48.8
Baja California Sur	3659.8	3683.9	3635.0	3131.7	3611.1	2630.1	114.6	133.0	95.6
Campeche	1503.8	1552.5	1456.7	5864.5	6637.0	5068.0	88.2	103.0	73.8
Coahuila	1033.5	1011.8	1055.0	3968.3	4407.2	3552.5	41.0	44.6	37.5
Colima	2903.0	2848.9	2955.5	3862.7	4824.5	2962.6	112.1	137.4	87.6
Chiapas	216.2	228.6	204.3	5148.6	6014.0	4226.5	11.1	13.7	8.6
Chihuahua	630.3	574.0	685.5	4853.6	5626.7	4218.5	30.6	32.3	28.9
CDMX	3687.9	3657.4	3715.9	1482.5	1899.9	1105.9	54.7	69.5	41.1
Durango	906.4	837.9	973.2	3835.9	4297.6	3447.9	34.8	36.0	33.6

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Guanajuato	1147.8	1107.6	1185.8	3202.2	3789.5	2682.4	36.8	42.0	31.8
Guerrero	1024.1	1036.5	1012.7	4762.4	5772.7	3809.5	48.8	59.8	38.6
Hidalgo	777.3	814.2	743.2	6528.6	7542.1	5502.5	50.7	61.4	40.9
Jalisco	935.2	933.5	936.8	6303.4	7522.4	5131.3	58.9	70.2	48.1
México	747.9	799.3	699.4	4985.0	5911.7	3986.2	37.3	47.3	27.9
Michoacán	523.8	542.9	505.7	8770.8	10271.4	7247.5	45.9	55.8	36.6
Morelos	805.6	815.8	796.0	5285.1	6804.0	3835.4	42.6	55.5	30.5
Nayarit	1791.3	1724.2	1857.1	4663.4	5600.1	3810.3	83.5	96.6	70.8
Nuevo León	1450.7	1490.3	1411.1	4,120.5	4,666.4	3,544.1	59.8	69.5	50.0
Oaxaca	875.9	931.3	825.1	4,306.7	5,259.8	3,322.2	37.7	49.0	27.4
Puebla	617.5	664.4	574.2	8,184.2	9,454.3	6,827.0	50.5	62.8	39.2
Querétaro	1317.5	1311.1	1323.7	3,498.8	4,385.5	2,658.9	46.1	57.5	35.2
Quintana Roo	1833.5	1961.6	1703.5	3,401.9	3,885.6	2,836.6	62.4	76.2	48.3
San Luis Potosí	1549.6	1553.0	1546.4	3,137.0	3,715.7	2,587.2	48.6	57.7	40.0
Sinaloa	1191.8	1140.5	1241.8	7,028.8	8,325.6	5,868.9	83.8	95.0	72.9
Sonora	1613.5	1481.4	1745.4	4,707.6	5,728.1	3,843.2	76.0	84.9	67.1
Tabasco	3166.8	3181.9	3152.4	2,032.5	2,336.4	1,740.0	64.4	74.3	54.9
Tamaulipas	1270.0	1283.5	1256.9	4,257.9	4,912.0	3,611.4	54.1	63.0	45.4
Tlaxcala	709.9	749.3	673.0	4,037.1	4,697.6	3,347.4	28.7	35.2	22.5

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Veracruz	778.7	831.3	730.2	7,425.3	8,151.9	6,662.3	57.8	67.8	48.6
Yucatán	1547.6	1664.2	1435.0	4,558.7	5,106.7	3,945.3	70.5	85.0	56.6
Zacatecas	756.0	736.8	774.2	4,346.4	5,378.4	3,411.7	32.9	39.6	26.4
Total	1341.8	1344.8	1339.1	4732.2	5581.4	3907.2	55.1	65.3	45.2

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

Table 5. Mexico: first category rates of infections, lethality and mortality, according to sex and age displayed, for the period July 1, 2020 to May 20, 2021

Edad desplegada	Tasa contagios por cada millón de habitantes			Tasa de letalidad por cada 100 000 habitantes			Tasa de mortalidad por cada 100 000 habitantes		
	Total	Hombres	Mujeres	Total	Hombres	Mujeres	Total	Hombres	Mujeres
0 años	1899.1	2012.9	1783.0	5521.3	5872.7	5116.9	10.5	11.8	9.1
1 año	1340.9	1413.1	1267.0	3539.1	3613.6	3454.1	4.7	5.1	4.4
2 años	980.8	1033.0	927.4	1407.0	1133.1	1718.6	1.4	1.2	1.6
3 años	904.7	938.4	870.7	894.7	1110.0	660.1	0.8	1.0	0.6
4 años	931.8	993.5	868.7	789.3	639.9	964.6	0.7	0.6	0.8
5 años	1047.0	1086.8	1005.9	481.4	581.4	370.0	0.5	0.6	0.4
6 años	1236.5	1293.6	1178.3	543.1	734.8	328.7	0.7	1.0	0.4
7 años	1322.0	1403.0	1239.0	423.7	525.6	305.3	0.6	0.7	0.4
8 años	1455.4	1484.9	1424.6	523.1	590.7	449.6	0.8	0.9	0.6

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9 años	1850.3	1866.9	1833.5	387.2	508.6	262.1	0.7	0.9	0.5
10 años	1827.7	1826.5	1829.0	476.6	467.1	486.6	0.9	0.9	0.9
11 años	2313.3	2301.7	2325.3	308.2	244.0	373.8	0.7	0.6	0.9
12 años	2537.4	2489.5	2587.1	401.4	523.6	279.2	1.0	1.3	0.7
13 años	3323.8	3284.5	3363.9	280.5	421.1	140.1	0.9	1.4	0.5
14 años	3783.0	3694.2	3873.4	245.9	274.7	218.0	0.9	1.0	0.8
15 años	4368.5	4261.5	4478.8	303.6	295.9	311.3	1.3	1.3	1.4
16 años	5267.0	5098.4	5439.6	374.6	354.5	393.8	2.0	1.8	2.1
17 años	5745.9	5411.3	6091.5	442.0	428.8	454.1	2.5	2.3	2.8
18 años	6786.7	6302.1	7288.8	274.5	270.2	278.3	1.9	1.7	2.0
19 años	10258.4	9981.9	10533.8	330.0	349.8	311.3	3.4	3.5	3.3
20 años	10985.7	10771.6	11197.9	421.9	512.2	335.7	4.6	5.5	3.8
21 años	15106.4	14651.0	15562.9	418.9	509.1	333.7	6.3	7.5	5.2
22 años	15190.4	14680.0	15700.9	430.1	553.2	315.1	6.5	8.1	4.9
23 años	18482.4	17659.6	19290.6	433.5	508.1	366.5	8.0	9.0	7.1
24 años	20508.0	19750.0	21237.7	498.1	607.7	400.1	10.2	12.0	8.5
25 años	20682.2	19931.8	21401.5	478.6	687.2	292.3	9.9	13.7	6.3
26 años	24567.8	24670.7	24471.3	629.4	754.0	511.7	15.5	18.6	12.5
27 años	25888.2	25895.0	25881.6	620.5	837.9	411.7	16.1	21.7	10.7
28 años	25135.6	25130.7	25140.2	742.0	942.6	548.6	18.7	23.7	13.8

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29 años	28114.3	28581.9	27677.3	826.0	1044.0	615.7	23.2	29.8	17.0
30 años	22321.9	22560.6	22096.2	1004.9	1321.2	699.6	22.4	29.8	15.5
31 años	33708.1	34956.1	32570.0	1068.5	1421.0	723.5	36.0	49.7	23.6
32 años	25381.1	26056.0	24754.0	1213.5	1574.7	860.3	30.8	41.0	21.3
33 años	28405.9	29232.1	27648.8	1302.9	1842.3	780.4	37.0	53.9	21.6
34 años	29026.4	29917.8	28197.8	1483.8	2049.0	926.6	43.1	61.3	26.1
35 años	24846.7	25584.2	24157.1	1722.5	2405.8	1045.8	42.8	61.6	25.3
36 años	27309.9	28238.3	26464.9	1840.0	2607.8	1094.4	50.3	73.6	29.0
37 años	31619.8	32808.4	30524.3	2008.2	2859.2	1165.1	63.5	93.8	35.6
38 años	25564.5	26241.8	24925.6	2341.1	3266.7	1422.0	59.8	85.7	35.4
39 años	29330.3	30447.6	28312.8	2607.2	3621.2	1614.0	76.5	110.3	45.7
40 años	21665.3	22444.0	20945.5	2902.8	4188.0	1629.5	62.9	94.0	34.1
41 años	34981.5	36451.4	33652.7	3293.7	4565.6	2048.3	115.2	166.4	68.9
42 años	23797.4	24587.5	23063.6	3711.1	5163.0	2273.9	88.3	126.9	52.4
43 años	28412.4	29568.8	27366.7	3990.1	5594.1	2422.9	113.4	165.4	66.3
44 años	32296.5	33625.0	31098.0	4531.8	6307.5	2799.5	146.4	212.1	87.1
45 años	24792.1	25367.6	24248.8	5110.9	7089.8	3156.4	126.7	179.9	76.5
46 años	32238.9	33549.6	31046.0	5458.7	7514.1	3437.4	176.0	252.1	106.7
47 años	31883.7	32531.7	31282.1	5950.9	8265.6	3715.9	189.7	268.9	116.2
48 años	30089.7	30863.9	29375.1	6223.8	8532.9	3984.0	187.3	263.4	117.0

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49 años	32226.5	32900.0	31611.4	6873.2	9295.7	4570.3	221.5	305.8	144.5
50 años	24243.9	24954.8	23593.6	7386.7	9957.7	4899.0	179.1	248.5	115.6
51 años	39539.1	41442.1	37837.9	8267.1	11119.5	5474.2	326.9	460.8	207.1
52 años	28445.5	29228.2	27731.1	9129.4	12104.5	6267.7	259.7	353.8	173.8
53 años	31350.7	32774.5	30074.6	9857.5	13421.0	6377.3	309.0	439.9	191.8
54 años	29742.6	31953.5	27823.9	10743.9	13889.4	7608.9	319.6	443.8	211.7
55 años	28943.4	30830.3	27258.5	11718.1	15059.8	8343.0	339.2	464.3	227.4
56 años	30132.6	31925.7	28493.5	13267.5	16825.5	9623.4	399.8	537.2	274.2
57 años	35172.4	37637.5	32994.6	13777.6	17155.9	10372.9	484.6	645.7	342.2
58 años	30134.9	32737.9	27824.6	14893.8	18140.2	11503.9	448.8	593.9	320.1
59 años	31826.8	35019.6	29000.0	16520.9	19877.0	12932.8	525.8	696.1	375.1
60 años	23250.4	25622.7	21149.8	18029.8	22141.6	13618.8	419.2	567.3	288.0
61 años	37584.0	41861.3	33878.6	20261.2	24237.9	16004.4	761.5	1014.6	542.2
62 años	26503.5	29024.2	24278.9	21830.9	25929.6	17506.8	578.6	752.6	425.0
63 años	27741.0	30586.8	25234.2	23440.7	27442.3	19168.3	650.3	839.4	483.7
64 años	27825.0	31398.0	24715.2	24667.8	28877.4	20013.5	686.4	906.7	494.6
65 años	23002.8	25659.8	20647.5	27002.0	31350.1	22211.6	621.1	804.4	458.6
66 años	31861.7	36282.4	28031.2	27266.8	31665.7	22333.1	868.8	1148.9	626.0
67 años	30427.3	33976.3	27224.5	28928.9	33368.4	23928.9	880.2	1133.7	651.5
68 años	25107.8	28867.4	21859.6	31046.6	35551.4	25906.7	779.5	1026.3	566.3

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69 años	31481.8	36450.9	27150.5	32012.5	36552.7	26699.4	1007.8	1332.4	724.9
70 años	24470.2	28639.7	20858.0	33825.3	38145.0	28686.8	827.7	1092.5	598.4
71 años	38254.3	44101.7	33087.0	35480.4	39978.0	30182.8	1357.3	1763.1	998.7
72 años	25448.7	29709.4	21660.2	36488.0	40803.9	31224.2	928.6	1212.3	676.3
73 años	28581.5	33019.1	24708.4	37187.0	41382.4	32293.6	1062.9	1366.4	797.9
74 años	28027.9	33111.9	23710.4	38513.2	42372.2	33936.4	1079.4	1403.0	804.6
75 años	25575.9	29433.9	22191.4	38635.8	42261.6	34416.9	988.1	1243.9	763.8
76 años	28917.9	33911.4	24585.9	40207.2	44804.3	34706.5	1162.7	1519.4	853.3
77 años	31769.8	37028.2	27144.1	42791.3	47032.4	37701.9	1359.5	1741.5	1023.4
78 años	27150.0	31383.5	23365.3	43051.8	47396.4	37835.0	1168.9	1487.5	884.0
79 años	30249.6	35504.6	25671.2	43654.3	48233.9	38136.0	1320.5	1712.5	979.0
80 años	23108.8	28003.4	19130.1	44661.8	50054.9	38244.5	1032.1	1401.7	731.6
81 años	37357.9	43957.6	31773.4	44975.1	50436.3	38581.7	1680.2	2217.1	1225.9
82 años	26638.4	32083.2	22234.0	46928.1	51418.7	41686.2	1250.1	1649.7	926.8
83 años	26490.1	32725.8	21617.5	46400.8	50452.1	41608.3	1229.2	1651.1	899.5
84 años	24833.4	30413.0	20524.3	46782.3	51730.2	41120.0	1161.8	1573.3	844.0
85 años	24669.4	30234.4	20375.3	46518.3	52180.6	40035.0	1147.6	1577.6	815.7
86 años	25083.4	31238.3	20422.2	48542.0	54473.1	41671.2	1217.6	1701.6	851.0
87 años	27346.1	34136.7	22281.1	50801.2	56246.7	44578.3	1389.2	1920.1	993.3
88 años	26855.5	32964.3	22291.2	49076.3	52921.6	44827.6	1318.0	1744.5	999.3

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89 años	23688.2	30015.8	19151.7	48916.3	56385.5	40523.5	1158.7	1692.5	776.1
90 años	21147.4	25859.2	17872.5	45407.7	50934.6	39849.6	960.3	1317.1	712.2
91 años	35897.7	44773.0	29910.4	50487.8	53883.5	47058.8	1812.4	2412.5	1407.5
92 años	20926.7	25884.8	17632.1	46453.9	50089.8	42907.2	972.1	1296.6	756.5
93 años	19445.0	23785.1	16580.9	47032.0	54225.4	40222.2	914.5	1289.8	666.9
94 años	18370.0	23931.6	14944.6	47441.2	54039.0	40934.1	871.5	1293.2	611.7
95 años	18698.2	24206.0	15241.7	45546.2	51515.2	39597.3	851.6	1247.0	603.5
96 años	16626.5	20724.2	13950.4	47727.3	55384.6	40298.5	793.5	1147.8	562.2
97 años	18154.9	24018.1	14574.5	47318.6	52830.2	41772.2	859.1	1268.9	608.8
98 años	15807.8	18557.1	14119.3	34782.6	37168.1	32857.1	549.8	689.7	463.9
99 años	15599.2	22000.8	11955.0	37790.7	45454.5	29761.9	589.5	1000.0	355.8
100 años y más	27555.4	36955.7	22279.2	20833.3	19753.1	21839.1	574.1	730.0	486.6

*La tasa de contagio está calculada por cada millón de habitantes, las tasas de letalidad y defunción se calcularon por cada 100 000 habitantes

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

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Table 6. Mexico: first category rates of infections, lethality and mortality, according to sex and age displayed, for the period May 20 to December 31, 2021

Edad desplegada	Tasa de contagios por cada millón de habitantes			Tasa de letalidad por cada 100 000 habitantes			Tasa de mortalidad por cada 100 000 habitantes		
	Total	Hombres	Mujeres	Total	Hombres	Mujeres	Total	Hombres	Mujeres
0 años									
1 año	2040.2	2214.0	1866.4	2228.8	2345.3	2112.3	4.6	5.2	3.9
2 años	2152.7	2256.1	2049.4	812.2	739.0	885.4	1.7	1.7	1.8
3 años	1784.6	1840.8	1728.3	278.9	212.0	345.8	0.5	0.4	0.6
4 años	1703.5	1732.8	1674.3	390.2	437.2	343.2	0.7	0.8	0.6
5 años	1801.5	1883.4	1719.6	274.1	385.7	162.4	0.5	0.7	0.3
6 años	1894.6	1926.3	1862.9	73.4	46.9	99.9	0.1	0.1	0.2
7 años	2301.4	2336.2	2266.5	146.5	122.1	170.9	0.3	0.3	0.4
8 años	2554.4	2632.6	2476.1	183.0	175.1	191.0	0.5	0.5	0.5
9 años	2725.8	2666.3	2785.2	131.5	164.5	98.6	0.4	0.4	0.3
10 años	3257.7	3203.1	3312.4	102.2	59.3	145.1	0.3	0.2	0.5
11 años	3241.4	3191.4	3291.4	40.4	26.7	54.1	0.1	0.1	0.2
12 años	4070.1	4156.0	3984.3	93.5	90.1	96.9	0.4	0.4	0.4
13 años	4406.8	4322.0	4491.5	180.9	201.0	160.8	0.8	0.9	0.7
14 años	5303.8	5299.3	5308.3	193.4	191.4	195.3	1.0	1.0	1.0

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15 años	6039.4	5917.7	6161.0	99.9	78.0	121.8	0.6	0.5	0.8
16 años	6459.9	6264.4	6655.5	156.1	172.5	139.6	1.0	1.1	0.9
17 años	7355.5	7023.0	7688.0	189.4	176.1	202.7	1.4	1.2	1.6
18 años	7741.2	7218.6	8263.7	249.5	197.8	301.2	2.0	1.4	2.5
19 años	8531.0	8174.1	8887.9	239.8	281.2	198.5	2.0	2.3	1.8
20 años	12653.4	12734.2	12572.6	220.3	219.3	221.3	2.8	2.8	2.8
21 años	12709.4	12976.0	12442.7	222.6	239.2	206.0	2.8	3.1	2.6
22 años	17507.9	17506.3	17509.6	237.0	242.6	231.4	4.1	4.2	4.1
23 años	16935.5	16960.3	16910.6	283.8	341.2	226.3	4.8	5.8	3.8
24 años	18965.9	19103.1	18828.7	270.6	330.3	210.9	5.1	6.3	4.0
25 años	19458.6	19831.3	19085.8	345.1	440.1	250.1	6.8	8.7	4.8
26 años	18682.7	19313.1	18052.2	413.8	471.2	356.3	7.8	9.1	6.4
27 años	21747.2	22564.8	20929.5	569.7	624.0	515.4	12.4	14.1	10.8
28 años	22487.2	23387.1	21587.4	551.4	663.9	438.8	12.5	15.5	9.5
29 años	21552.8	22250.1	20855.4	638.0	809.4	466.5	13.9	18.0	9.7
30 años	23509.9	24571.3	22448.6	789.4	967.0	611.9	18.7	23.8	13.7
31 años	16594.7	17159.5	16029.9	775.7	888.4	663.0	12.9	15.2	10.6
32 años	24940.9	25870.3	24011.5	851.2	1102.4	600.0	21.5	28.5	14.4
33 años	18419.7	19092.0	17747.4	986.0	1280.9	691.0	18.4	24.5	12.3
34 años	20201.7	20700.7	19702.6	1133.1	1458.4	807.8	23.1	30.2	15.9

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35 años	20218.8	20747.6	19690.0	1283.1	1696.5	869.8	26.2	35.2	17.1
36 años	17232.6	17461.7	17003.5	1464.8	1896.2	1033.3	25.3	33.1	17.6
37 años	18735.7	19019.9	18451.5	1666.2	2127.0	1205.3	31.3	40.5	22.2
38 años	21693.3	22215.7	21171.0	1923.0	2579.1	1267.0	42.1	57.3	26.8
39 años	17466.2	17487.2	17445.1	2230.0	3124.4	1335.6	39.0	54.6	23.3
40 años	20415.7	20781.7	20049.6	1970.2	2601.4	1339.0	40.5	54.1	26.8
41 años	13420.2	13451.3	13389.2	2246.1	2826.6	1665.5	30.2	38.0	22.3
42 años	21311.3	21194.8	21427.8	2261.5	3043.3	1479.6	48.1	64.5	31.7
43 años	13742.4	13548.5	13936.2	2703.1	3563.1	1843.0	37.0	48.3	25.7
44 años	16081.6	15852.1	16311.1	2827.6	3671.6	1983.7	45.3	58.2	32.4
45 años	18405.4	18061.8	18749.1	3067.5	4008.8	2126.2	56.1	72.4	39.9
46 años	13295.9	12921.9	13669.9	3246.8	4169.0	2324.6	42.8	53.9	31.8
47 años	17273.7	17148.1	17399.4	3606.7	4626.8	2586.6	62.2	79.3	45.0
48 años	17102.6	16762.9	17442.3	3666.0	4763.4	2568.6	62.3	79.8	44.8
49 años	15918.9	15810.2	16027.5	4418.4	5494.1	3342.8	70.2	86.9	53.6
50 años	17365.9	17107.0	17624.7	4599.1	5626.1	3572.2	79.6	96.2	63.0
51 años	11347.7	11187.1	11508.3	4716.2	6070.2	3362.1	53.3	67.9	38.7
52 años	17154.5	17189.3	17119.7	5022.8	6192.3	3853.2	86.2	106.4	66.0
53 años	11753.8	11617.7	11889.8	5624.8	7232.0	4017.7	65.9	84.0	47.8
54 años	13271.7	13232.3	13311.0	6367.5	7740.9	4994.2	84.5	102.4	66.5

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55 años	11922.5	12090.0	11755.1	6581.9	7984.8	5179.1	78.7	96.5	60.9
56 años	11619.7	11627.5	11612.0	7686.5	9299.5	6073.5	89.3	108.1	70.5
57 años	11710.8	11529.1	11892.5	7997.2	9385.5	6608.9	93.4	108.2	78.6
58 años	13842.0	14062.9	13621.1	9560.6	10853.8	8267.5	132.6	152.6	112.6
59 años	11596.0	11776.2	11415.8	9947.8	11575.1	8320.4	115.6	136.3	95.0
60 años	12057.3	12240.3	11874.3	10469.0	12187.2	8750.7	126.5	149.2	103.9
61 años	8850.6	8962.4	8738.7	12114.5	13772.8	10456.2	107.4	123.4	91.4
62 años	15429.1	15900.7	14957.4	11580.7	12911.4	10250.0	179.3	205.3	153.3
63 años	11009.8	11025.7	10994.0	13547.1	15515.6	11578.6	149.2	171.1	127.3
64 años	10728.7	11006.6	10450.8	14556.8	16743.1	12370.6	156.8	184.3	129.3
65 años	11466.0	11866.7	11065.3	14739.1	16999.4	12478.8	169.9	201.7	138.1
66 años	8911.5	9117.5	8705.6	16188.3	17943.6	14433.0	144.6	163.6	125.6
67 años	12748.8	13358.1	12139.6	17122.0	18961.3	15282.8	219.4	253.3	185.5
68 años	12355.4	13049.7	11661.1	18139.1	20675.5	15602.7	225.9	269.8	181.9
69 años	9453.8	10091.5	8816.0	19169.1	21951.2	16387.0	183.0	221.5	144.5
70 años	12480.7	13188.9	11772.5	20937.2	23984.5	17889.9	263.5	316.3	210.6
71 años	9104.2	9833.0	8375.4	20949.2	24180.7	17717.7	193.1	237.8	148.4
72 años	15173.1	16490.2	13856.0	21572.6	24197.8	18947.4	330.8	399.0	262.5
73 años	9671.4	10508.3	8834.5	22290.7	25503.8	19077.6	218.3	268.0	168.5
74 años	10881.3	12230.7	9531.9	23178.9	26787.6	19570.3	257.1	327.6	186.5

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75 años	10673.4	11932.3	9414.6	24599.9	28222.7	20977.0	267.1	336.8	197.5
76 años	9403.2	10516.1	8290.3	26024.6	29995.9	22053.4	249.1	315.4	182.8
77 años	11023.1	12213.7	9832.5	27424.5	30248.8	24600.2	305.7	369.4	241.9
78 años	11729.6	13186.0	10273.2	27686.6	31686.0	23687.1	330.6	417.8	243.3
79 años	9662.8	10689.1	8636.5	28929.9	31565.3	26294.6	282.2	337.4	227.1
80 años	12371.8	13816.9	10926.6	29382.8	34168.0	24597.7	370.4	472.1	268.8
81 años	8475.6	10014.8	6936.4	29408.2	33456.1	25360.2	255.5	335.1	175.9
82 años	15486.2	18255.5	12717.0	31291.6	33003.7	29579.6	489.3	602.5	376.2
83 años	9957.5	11494.4	8420.5	34097.7	38160.0	30035.3	345.8	438.6	252.9
84 años	10673.4	12551.5	8795.3	35859.4	38536.6	33182.2	387.8	483.7	291.8
85 años	9868.6	11650.7	8086.6	35179.3	40510.9	29847.7	356.7	472.0	241.4
86 años	9917.6	11820.8	8014.5	33904.2	41193.7	26614.7	350.1	486.9	213.3
87 años	11313.8	13563.4	9064.2	34393.0	37001.1	31784.8	395.0	501.9	288.1
88 años	11233.9	12830.5	9637.2	36852.5	44039.3	29665.7	425.5	565.0	285.9
89 años	11591.5	13877.4	9305.7	37358.4	41324.9	33391.9	442.1	573.5	310.7
90 años	10333.7	12560.8	8106.6	34961.7	40499.0	29424.3	373.6	508.7	238.5
91 años	8164.3	10029.5	6299.0	39291.6	45783.1	32800.0	332.9	459.2	206.6
92 años	17206.2	20593.4	13818.9	39930.6	46174.1	33687.0	708.2	950.9	465.5
93 años	9769.0	11478.5	8059.5	38847.0	41295.5	36398.5	383.7	474.0	293.4
94 años	9319.3	10385.1	8253.6	36182.3	37096.8	35267.9	338.2	385.3	291.1

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95 años	8861.2	10865.9	6856.5	40977.6	46625.8	35329.3	374.4	506.6	242.2
96 años	8291.4	9780.2	6802.5	36917.3	40000.0	33834.6	310.7	391.2	230.2
97 años	7644.4	9458.8	5830.0	39733.8	44943.8	34523.8	313.2	425.1	201.3
98 años	6632.0	8006.0	5257.9	39440.6	49056.6	29824.6	274.8	392.7	156.8
99 años	6727.7	8211.1	5244.3	31461.5	36000.0	26923.1	218.4	295.6	141.2
100 años y más	8362.1	9750.4	6973.8	35583.5	48717.9	22449.0	315.8	475.0	156.6
Total	11993.9	12680.0	11307.7	12603.9	14451.0	10756.9	139.1	177.2	100.9

*La tasa de contagio está calculada por cada millón de habitantes, las tasas de letalidad y defunción se calcularon por cada 100 000 habitantes

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

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Table 7. Mexico: geometric growth rate of those infected with covid-19 and suffering from comorbidities, according to comorbidity and federal entity, for the period from July 1, 2020 to May 20, 2021

	Intubado	Neumonía	Embarazo	Hablante lengua indígena	Autoinscribe	Diabetes	Epoc	Asma	Inmunosupresión	Hipertensión	Otras enfermedades	Cardiovascular	Obesidad	Renal crónica	Tabaquismo	UCI
Aguasc	3356.6	1343.3	933.7	298.4	S.D.	1543.3	1280.6	752.2	357.9	1550.2	763.0	647.1	1298.5	803.8	959.7	695.6
Baja C.	1460.8	352.0	505.3	413.1	S.D.	473.1	513.1	564.9	408.4	523.4	614.2	501.4	616.3	465.9	569.5	977.4
BCS	2460.2	1426.3	3937.9	917.6	S.D.	2846.5	1743.4	1987.8	939.3	2886.6	1395.8	2054.5	2204.1	2324.4	1826.2	2290.6
Camp	848.0	439.6	405.7	529.4	S.D.	440.9	421.1	466.4	291.9	480.8	283.8	360.6	416.0	425.3	483.2	321.4
Coah	5545.9	2723.4	2016.0	591.2	S.D.	2257.1	1301.1	1303.8	583.9	2250.5	1144.4	1939.1	1214.5	1330.5	1504.8	2107.1
Col	3357.7	1686.9	1751.3	1298.1	S.D.	2350.0	2823.7	1835.6	2418.5	2372.9	2571.6	3839.5	2092.8	2788.1	2353.2	1793.6
Chiaps	375.0	130.6	129.8	101.1	S.D.	150.4	116.1	113.0	110.0	146.2	157.8	143.9	113.0	200.1	171.5	86.0
Chih	1099.5	908.0	2657.9	1151.3	S.D.	1625.6	1334.5	1803.9	1442.7	1805.3	1168.2	1748.4	1465.0	1191.3	1765.2	587.8
CDMX	784.1	534.7	2000.9	937.1	S.D.	1131.2	729.5	1404.3	686.4	1215.0	666.9	812.1	872.6	690.6	1621.8	420.6
Dur	2399.8	1318.7	2029.8	568.2	S.D.	2031.8	1450.4	2129.5	2029.8	2242.9	1192.3	1036.2	1942.3	1211.5	2181.1	2262.3
Gto	1796.7	1879.4	3320.3	1175.4	S.D.	1969.1	1385.2	1732.3	1233.7	2096.1	1571.2	1293.0	2060.8	2048.7	2006.0	1401.6
Gro	558.9	464.5	925.5	1080.1	S.D.	641.8	437.4	767.0	696.0	663.6	437.1	544.0	641.2	556.5	790.9	451.2
Hgo	964.2	1169.9	1563.1	558.9	S.D.	1119.9	897.5	1011.9	1058.6	1194.1	938.4	845.9	973.1	958.8	1112.8	1409.6
Jalisco	2609.5	1361.7	2533.2	1090.1	S.D.	1607.2	1259.2	1528.0	1661.0	1786.9	1707.8	1704.2	1400.6	1658.4	1505.4	1616.1

Méx	776.2	490.9	870.2	441.5	S.D.	618.3	480.8	598.4	469.8	674.9	675.0	474.8	541.6	598.7	731.4	445.1
Mich	1592.3	1277.9	1984.9	740.4	S.D.	1115.2	957.4	866.9	754.5	1188.4	1234.6	998.9	814.9	1201.7	1264.0	1525.1
Mor.	449.5	502.9	963.6	296.7	S.D.	791.8	488.1	1602.1	842.8	865.8	434.1	674.9	915.2	639.3	1322.1	639.7
Nay.	1451.8	881.9	2752.5	477.6	S.D.	733.0	612.9	763.1	334.9	748.4	554.4	410.9	638.6	643.9	701.0	829.0
N.L.	1757.9	2428.6	3322.0	781.6	S.D.	2900.8	1963.7	2426.9	1544.0	2860.0	2430.5	2364.7	2612.9	2444.5	2339.3	824.7
Oax.	1027.3	624.7	890.1	606.3	S.D.	754.3	517.6	651.1	362.4	1155.2	969.0	484.1	973.3	587.7	790.2	618.4
Pueb	795.8	940.8	1027.6	681.4	S.D.	817.8	642.4	703.2	678.7	887.1	928.5	637.0	678.6	613.1	731.8	569.3
Quer	3026.8	1781.8	7599.4	2823.7	S.D.	3038.0	1342.3	2722.9	1303.3	3346.2	1795.1	1631.8	3376.3	1756.3	3925.1	965.6
Q Roo	1227.3	473.1	595.9	449.4	S.D.	563.3	454.7	472.2	613.5	570.8	428.1	546.6	612.6	381.4	630.5	362.0
S.L.P.	3057.4	3340.1	2084.8	822.5	S.D.	3222.8	1943.6	2227.2	1733.4	3014.7	1693.4	2280.5	3119.4	1960.9	3361.2	1068.3
Sin	848.7	359.1	490.2	266.8	S.D.	420.3	302.6	351.2	314.5	440.9	391.0	297.4	405.3	310.1	493.0	610.0
Son	1210.0	659.1	928.9	449.8	S.D.	872.9	489.5	668.8	696.3	933.1	671.4	653.0	779.5	780.3	826.4	418.1
Tab	646.7	311.8	406.8	166.4	S.D.	547.5	287.4	599.4	328.4	598.4	245.0	349.8	367.3	382.4	387.4	295.3
Tamps	3346.1	1319.1	1368.9	515.8	S.D.	1247.1	1058.1	1033.5	727.0	1393.6	902.9	995.7	1079.4	996.1	1108.7	1185.3
Tlax	686.9	555.1	947.1	442.2	S.D.	676.2	520.0	493.9	635.6	814.9	570.8	630.2	573.9	885.7	740.0	540.0
Ver	951.8	466.5	802.8	864.0	S.D.	531.8	443.2	448.1	401.6	546.9	571.7	426.2	494.7	466.8	559.0	461.2
Yuc	1418.9	728.8	616.7	608.4	S.D.	815.2	567.1	718.9	540.1	865.1	483.6	748.4	669.1	916.5	593.0	823.3
Zacs	2207.0	1507.9	3842.5	515.8	S.D.	4235.0	2258.3	3411.6	2402.1	4542.9	2486.0	2662.5	3458.0	2714.6	4681.0	2718.8
Total	1690.5	1074.7	1756.4	708.1	S.D.	1377.8	969.5	1192.5	893.8	1458.2	1002.4	1085.5	1231.9	1091.7	1376.1	978.8

*La tasa de contagio está calculada por cada millón de habitantes, las tasas de letalidad y defunción se calcularon por cada 100 000 habitantes

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

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Table 8. Mexico: geometric growth rate of those infected with Covid-19 and suffering from comorbidities, according to comorbidity and federal entity, for the period from May 20, 2021 to December 31, 2021

	Intubado	Neumonía	Embarazo	Hablante lengua indígena	Autoinscribe indígena	Diabetes	Epoc	Asma	Inmunosupresión	Hipertensión	Otras enfermedades	Cardiovascular	Obesidad	Renal crónica	Tabaquismo	UCI
Total	71.3	77.4	256.6	187.2	169.7	90.0	73.4	110.6	80.4	89.8	106.5	73.5	96.3	80.9	119.8	75.0
Aguasc	38.2	35.8	102.2	320.0	76.0	50.2	69.5	77.2	61.1	49.7	39.5	41.7	56.6	49.6	63.4	62.7
Baja C.	83.3	71.2	269.1	137.8	95.7	86.6	122.1	109.0	81.2	92.8	92.8	114.4	103.9	92.3	149.7	67.6
BCS	79.1	112.7	288.0	868.1	509.2	103.1	81.1	122.7	124.5	92.2	99.6	84.1	119.3	70.0	165.0	141.0
Camp	92.1	223.4	696.5	77.3	79.2	202.8	134.9	232.4	112.7	215.2	355.8	175.5	228.9	233.5	160.3	93.3
Coah	21.5	44.7	129.5	79.3	65.6	56.2	70.3	68.4	57.7	56.2	66.2	55.9	56.7	61.0	104.2	55.0
Col	100.8	118.5	392.8	234.3	320.0	210.3	109.8	342.1	200.9	217.3	225.0	178.1	283.0	164.1	355.3	80.9
Chiaps	137.0	79.7	376.8	91.3	98.9	105.2	83.2	115.0	103.5	112.0	155.3	83.1	116.6	120.7	150.7	46.2
Chih	44.3	45.1	166.8	470.7	423.9	63.2	81.0	81.2	60.6	64.3	73.7	56.1	70.2	63.3	92.0	45.1
CDMX	42.5	45.4	186.8	82.5	73.2	55.0	51.3	83.8	52.7	54.4	59.9	51.5	52.8	56.1	75.6	65.1
Dur	58.3	75.5	191.2	192.1	133.6	61.4	35.1	71.7	58.6	61.1	86.0	52.3	59.5	61.8	91.9	68.9
Gto	49.2	51.8	140.6	94.2	144.8	50.8	63.6	55.1	49.6	51.6	49.8	46.2	58.4	51.6	83.1	66.0

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Gro	58.2	88.3	275.5	206.8	215.3	107.8	66.9	135.8	88.1	103.8	68.3	85.0	103.7	80.5	138.2	78.2
Hgo	70.5	63.7	325.6	161.2	207.7	63.8	51.4	86.5	61.1	62.9	69.4	55.7	78.4	70.5	102.6	63.1
Jalisco	83.6	112.8	256.8	138.7	101.6	86.7	70.7	128.0	81.3	88.6	95.8	66.5	111.0	70.1	146.9	91.3
Méx	51.1	43.6	194.8	68.1	67.5	57.4	59.8	79.3	45.7	57.7	65.2	50.4	59.7	63.0	87.6	86.8
Mich	67.5	73.9	188.6	68.8	69.5	66.9	65.0	58.0	59.7	63.3	96.8	51.4	50.7	86.1	93.4	41.1
Mor.	63.2	77.2	239.4	59.8	104.7	65.2	45.7	69.1	64.8	64.1	80.3	61.1	55.5	67.8	64.0	83.8
Nay.	42.0	56.5	553.0	237.6	218.6	177.9	92.2	229.1	104.5	189.1	214.6	97.2	250.3	116.1	269.5	29.6
N.L.	85.2	46.7	153.7	115.4	113.4	71.1	70.2	91.6	65.2	70.0	89.2	48.9	75.5	52.8	95.4	55.9
Oax.	98.9	94.7	385.4	290.3	314.4	116.1	104.3	117.9	101.3	87.7	106.3	93.0	100.4	108.8	131.1	126.2
Pueb	59.0	61.1	214.0	121.0	111.1	55.0	52.0	65.1	57.5	52.9	129.3	46.2	63.5	64.7	75.8	44.3
Quer	50.9	38.1	120.9	137.0	127.8	43.8	35.9	46.9	44.6	41.0	68.1	39.6	57.4	41.1	60.3	44.6
Q Roo	73.7	101.2	219.9	159.3	188.0	108.4	95.8	116.6	123.9	112.4	148.3	91.0	111.8	94.7	130.2	60.6
S.L.P.	57.4	54.2	202.0	341.9	405.4	75.4	59.1	91.9	80.7	71.9	65.2	69.4	65.4	68.4	73.5	39.9
Sin	51.9	93.5	322.8	148.2	191.3	108.2	77.3	163.3	105.5	102.8	139.5	67.5	114.6	70.7	157.8	75.2
Son	59.3	82.9	175.8	131.4	136.4	81.3	83.0	99.9	75.6	86.5	122.7	61.4	92.2	65.7	168.4	88.2
Tab	241.8	98.0	325.6	249.8	320.1	146.1	102.0	150.1	104.6	149.9	125.2	104.9	115.1	99.7	109.0	181.1
Tamps	78.9	96.7	188.6	271.3	110.8	93.5	77.8	93.8	77.7	89.7	125.8	70.5	96.1	70.1	121.2	108.7
Tlax	38.5	42.9	191.3	67.7	59.8	48.0	47.1	64.8	56.5	49.9	47.0	46.5	47.8	61.7	57.5	51.7
Ver	67.6	101.7	394.9	154.7	161.8	110.3	86.2	126.1	98.9	108.3	99.9	80.4	97.1	99.2	111.4	46.0
Yuc	97.2	96.5	251.2	97.3	104.8	108.9	62.0	103.8	62.9	108.3	94.8	79.3	87.8	71.9	91.1	169.8

Zacs	39.0	47.9	91.1	115.1	80.2	44.8	43.3	62.2	48.0	45.2	53.5	45.5	40.7	41.9	56.2	41.6

*La tasa de contagio está calculada por cada millón de habitantes, las tasas de letalidad y defunción se calcularon por cada 100 000 habitantes

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

Table 9. Mexico: geometric growth rate of deaths from Covid-19, of patients suffering from comorbidities, according to comorbidity and federal entity, period from July 1, 2020 to May 20, 2021

	Intubado	Neumonía	Embarazo	Hablante lengua indígena	Autoinscribe	Diabetes	Epoc	Asma	Inmunosupresión	Hipertensión	Otras enfermedades	Cardiovascular	Obesidad	Renal crónica	Tabaquismo	UCI
Aguasc	6857.7	2329.3	0.0	0.0	S.D.	2470.7	2049.8	1349.1	481.2	2835.2	1418.2	1269.0	1359.7	1427.2	1470.6	1466.6
Baja C.	1829.6	439.4	118.8	280.8	S.D.	425.7	637.0	555.7	415.0	469.7	604.0	614.9	641.6	462.5	457.6	861.8
BCS	2839.5	2251.6	0.0	0.0	S.D.	2666.0	1036.2	829.6	849.1	2529.4	818.7	1685.7	1935.0	4428.1	1006.4	2547.6
Camp	1086.7	638.1	0.0	884.0	S.D.	630.4	593.6	298.4	392.2	621.1	392.2	378.6	491.9	462.6	1216.9	507.4
Coah	11872.2	3376.9	378.6	0.0	S.D.	3817.5	1850.3	4559.4	674.5	3703.8	2836.4	2473.0	2294.0	2516.8	2538.7	2079.2
Col	5639.8	3290.7	0.0	0.0	S.D.	3545.8	4911.7	6530.6	2516.8	2774.7	3408.0	14007.2	2428.0	2540.2	1308.3	5594.9
Chiaps	622.1	210.1	245.8	86.6	S.D.	190.3	218.1	181.5	264.5	194.9	245.8	378.6	188.8	234.0	254.0	259.2
Chih	1178.5	1096.1	245.8	976.7	S.D.	1453.1	1162.4	800.5	700.1	1462.6	1391.7	1243.8	933.2	1340.4	1328.9	798.3
CDMX	993.1	599.7	139.5	599.9	S.D.	639.6	527.0	527.1	366.9	690.3	781.0	605.8	523.1	547.4	537.7	417.7
Dur	3001.0	1362.6	0.0	423.9	S.D.	1860.0	1046.2	5804.8	3692.3	2310.1	984.1	894.5	2465.5	1165.6	1519.4	2360.3

Gto	3096.0	4511.0	0.0	1400.4	S.D.	4120.5	2847.4	4239.1	1802.1	4418.1	2296.2	2889.1	3197.2	4779.3	2724.6	1711.9
Gro	635.7	537.7	181.5	752.2	S.D.	510.6	342.4	450.8	717.9	524.6	463.9	441.7	475.0	626.2	484.2	462.8
Hgo	1036.2	1242.9	0.0	852.6	S.D.	1211.0	899.0	984.1	1179.8	1353.8	1065.4	1111.6	868.2	1030.6	1047.1	1042.3
Jalisco	3603.4	1605.4	245.8	1323.6	S.D.	2357.0	2037.9	1935.3	2041.7	2278.3	1974.5	2388.4	1785.0	2192.8	1710.5	1798.2
Méx	1007.1	603.0	1021.3	421.5	S.D.	657.8	584.6	599.4	562.4	744.9	920.2	493.5	478.9	776.9	495.4	452.1
Mich	1850.5	1440.0	1555.3	2029.8	S.D.	1641.8	1205.5	785.2	1419.6	1711.9	2056.5	1237.7	1208.0	1672.6	1605.1	1318.9
Mor.	406.5	455.4	0.0	68.0	S.D.	407.1	288.5	550.7	562.4	527.5	334.9	434.9	384.9	462.0	325.4	494.5
Nay.	2007.9	1175.9	0.0	0.0	S.D.	933.0	731.6	2516.8	229.6	994.8	355.4	412.5	829.6	674.5	1021.3	1104.9
N.L.	4515.6	4501.7	0.0	873.5	S.D.	3709.5	1909.9	2773.6	2903.0	3550.6	3478.8	3699.7	2560.7	2336.9	2216.1	2083.3
Oax.	1225.2	757.0	378.6	693.0	S.D.	603.9	432.2	800.5	421.1	775.5	778.2	562.4	479.7	603.8	562.4	663.5
Pueb	872.8	1321.0	219.9	942.3	S.D.	972.0	601.5	702.1	770.0	1122.1	928.7	779.5	810.6	839.7	658.1	613.1
Quer	3403.4	2294.0	0.0	0.0	S.D.	2180.0	947.1	3182.4	559.5	2295.0	1221.9	993.9	2122.6	1298.1	1329.0	1577.6
Q Roo	1684.6	520.2	515.8	298.9	S.D.	421.7	483.2	250.3	809.6	433.6	381.2	499.1	436.0	303.5	400.6	362.5
S.L.P.	4036.7	5752.9	0.0	1581.3	S.D.	4685.6	2720.5	3907.1	2544.2	4691.2	2571.6	4625.3	4412.2	1994.2	4407.7	1671.4
Sin	964.3	465.4	311.6	181.5	S.D.	489.0	279.6	374.9	358.2	491.5	375.7	377.4	425.5	404.5	477.0	694.3
Son	1574.3	998.2	0.0	699.5	S.D.	1067.9	902.1	619.0	867.4	1076.3	1099.0	974.4	843.1	1072.8	1146.3	523.8
Tab	916.6	361.0	311.6	86.1	S.D.	402.4	245.8	223.1	184.8	412.2	245.8	309.1	299.5	544.3	286.2	421.8
Tamps	8846.8	1689.4	0.0	378.6	S.D.	1906.3	1942.5	1053.3	757.1	2068.0	1565.1	1164.5	1445.1	1481.9	2058.1	1920.4
Tlax	1046.2	665.0	0.0	873.5	S.D.	757.1	617.9	571.7	1711.9	932.5	649.1	1599.9	457.2	1433.4	471.7	709.7
Ver	1321.6	605.8	378.6	736.2	S.D.	688.4	565.9	493.3	401.9	669.5	543.3	536.0	556.7	630.1	580.5	593.5

Yuc	1970.1	750.3	0.0	679.5	S.D.	1040.5	1034.9	834.8	680.4	1169.9	705.4	1048.0	865.5	1299.5	929.7	672.5
Zacs	2602.9	2162.4	0.0	0.0	S.D.	3939.7	1850.3	1431.2	1497.0	4381.0	2553.3	2280.9	2757.6	2382.8	2391.6	2392.0
Total	2642.0	1562.8	195.3	566.4	S.D.	1637.6	1172.0	1584.9	1041.7	1694.2	1232.6	1637.8	1280.0	1373.9	1217.7	1255.6

*La tasa de contagio está calculada por cada millón de habitantes, las tasas de letalidad y defunción se calcularon por cada 100 000 habitantes

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)

Table 10. Mexico: geometric growth rate of deaths from Covid-19, of patients with comorbidities, according to type of comorbidity and federal entity, period May 20, 2021 to December 31, 2021

	Intubado	Neumonía	Embarazo	Hablante Lengua Indígena	Auto inscribe Indígena	Diabetes	Epoc	Asma	Inmunosupresión	Hipertensión	Otras enfermedades	Cardiovascular	Obesidad	Renal crónica	Tabaquismo	UCI
Total	74.5	75.0	283.7	105.9	113.9	69.6	65.0	68.8	80.4	67.4	74.6	66.8	71.2	73.5	68.1	74.5
Aguasc	35.0	25.4	209.5	0.0	0.0	44.5	59.3	68.1	59.8	41.6	36.0	44.5	54.2	45.1	52.1	39.2
Baja C.	80.9	67.8	184.7	66.5	65.0	57.0	94.9	50.3	85.9	58.8	57.8	93.3	70.2	74.8	68.9	44.5
BCS	82.5	115.0	1278.4	149.0	174.3	83.2	76.8	87.8	84.2	80.6	84.5	78.9	125.1	46.7	93.7	105.0
Camp	99.6	188.6	0.0	87.7	68.1	157.2	106.4	202.1	86.0	159.8	221.9	165.8	170.0	201.2	108.9	111.4
Coah	20.4	47.6	275.0	0.0	31.3	46.0	52.8	34.6	46.8	46.0	54.2	47.1	42.9	60.3	54.4	49.8
Col	128.6	128.5	0.0	345.3	499.4	118.5	100.3	106.7	267.5	113.2	67.3	140.3	100.0	150.4	95.7	108.1

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Chiaps	120.2	71.7	209.5	10.1	27.6	76.2	80.4	47.0	84.2	81.8	171.9	103.6	89.8	115.5	78.9	21.7
Chih	43.0	37.9	394.7	156.1	158.7	46.6	67.6	49.3	78.7	44.8	35.6	41.8	46.4	54.0	62.5	36.7
CDMX	41.1	40.4	85.6	21.2	17.2	36.2	37.5	37.8	38.6	36.6	35.2	42.0	35.5	48.9	32.2	71.1
Dur	54.5	60.8	0.0	118.5	252.7	53.1	22.9	58.1	65.1	52.8	90.5	42.6	50.7	58.2	47.3	54.5
Gto	43.3	51.0	93.7	48.2	0.0	40.7	53.4	35.9	55.4	39.8	48.8	40.6	42.7	44.0	37.9	62.8
Gro	58.6	88.3	261.6	69.7	67.0	77.2	58.2	73.6	94.4	72.6	41.6	64.1	82.7	86.6	94.4	87.3
Hgo	78.7	53.5	394.7	77.6	95.1	44.7	40.0	54.0	47.2	42.1	42.4	43.2	48.8	53.7	39.0	69.0
Jalisco	91.0	115.5	345.3	114.1	93.7	77.9	70.5	89.4	76.6	74.1	65.8	63.7	75.7	69.5	78.4	114.1
Méx	54.9	48.6	63.7	30.0	25.7	49.9	50.3	49.9	40.4	48.5	45.5	48.7	44.5	59.4	49.6	102.1
Mich	68.9	78.6	93.7	121.0	89.4	80.0	78.5	64.8	109.3	72.5	67.8	78.7	65.3	98.7	75.3	46.0
Mor.	72.6	105.6	59.8	88.2	46.6	98.4	58.9	78.9	134.7	90.9	59.8	113.8	103.9	89.0	89.5	115.8
Nay.	48.1	56.6	209.5	89.1	86.2	98.4	60.3	59.8	62.7	98.9	65.1	54.8	94.7	90.1	74.4	37.2
N.L.	114.4	51.0	991.6	59.8	155.5	62.7	58.1	52.5	70.6	58.6	53.7	51.8	61.6	53.7	65.8	164.3
Oax.	94.2	91.3	583.0	181.4	167.6	108.0	138.3	136.7	95.2	88.2	71.7	69.2	99.9	93.7	91.0	139.6
Pueb	66.6	59.9	345.3	94.9	101.5	53.7	51.8	49.7	62.1	53.2	52.8	44.2	53.7	62.9	56.5	54.3
Quer	52.1	40.1	209.5	394.7	120.7	47.4	37.7	39.6	52.2	43.4	47.9	35.1	33.4	38.2	37.1	99.9
Q Roo	76.6	82.0	316.6	66.8	74.7	73.4	82.1	84.2	109.7	73.5	75.4	80.1	105.4	68.6	76.2	59.3
S.L.P.	58.4	50.0	174.3	175.7	174.0	45.5	46.3	48.8	41.7	46.3	61.3	44.1	41.0	51.1	45.5	41.6
Sin	52.0	94.6	409.2	34.6	98.3	80.6	62.9	92.9	121.7	71.2	64.9	65.9	75.8	67.6	98.6	82.4
Son	58.8	75.4	583.0	88.7	80.5	57.7	65.3	49.9	76.9	59.7	88.1	55.7	65.7	63.9	72.5	103.9

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Tab	257.4	81.8	78.9	77.7	80.9	77.1	47.0	48.5	85.0	74.1	238.0	61.6	57.6	81.8	60.6	224.0
Tamps	84.8	102.0	762.4	275.0	209.5	76.4	91.7	100.6	108.0	77.2	139.7	68.1	90.2	68.2	111.1	138.0
Tlax	41.5	42.0	43.9	59.8	30.3	37.5	43.1	18.7	54.9	35.8	19.4	36.3	33.7	59.4	37.1	52.6
Ver	71.5	109.7	420.2	106.3	145.1	100.7	72.7	103.8	85.1	94.7	86.0	84.3	80.3	98.9	75.0	55.2
Yuc	92.0	81.0	0.0	85.9	92.6	84.5	68.2	92.8	63.4	89.4	69.0	96.7	92.5	67.6	85.9	121.2
Zacs	41.8	57.5	0.0	93.7	316.6	37.5	44.3	34.0	29.5	37.9	27.1	38.6	43.1	30.0	34.2	54.1

*La tasa de contagio está calculada por cada millón de habitantes, las tasas de letalidad y defunción se calcularon por cada 100 000 habitantes

Fuente: Elaboración propia con base en la Dirección General de Epidemiología (2022)