

JANUARY–JUNE  
2026

YEAR LIII

No. 122

ISSN 0303-1829

# NOTAS DE Población

## Pandemics in Mexico and its capital: a brief review

*Luis Javier Briseño Godoy, Eliud Silva, Alejandro Aguirre and Manuel Ordorica*

Date published: 29/04/2026

United Nations publication  
LC/PUB.2026/2-P  
Copyright © United Nations, 2026  
All rights reserved  
Printed at United Nations, Santiago  
S.2600006[E]

The United Nations and the countries it represents assume no responsibility for the content of links to external sites in this publication.

The views expressed in this publication are those of the authors and do not necessarily reflect the views of the Organization or the countries they represent.

This publication should be cited as: Briseño Godoy, L. J., Silva, E., Aguirre, A. and Ordorica, M. (2026). Pandemics in Mexico and its capital: a brief review. *Notas de Población* (122) (LC/PUB.2026/2-P). Economic Commission for Latin America and the Caribbean.

Applications for authorization to reproduce this work in whole or in part should be sent to the Economic Commission for Latin America and the Caribbean (ECLAC), Documents and Publications Division, publicaciones.cepal@un.org. Member States and their governmental institutions may reproduce this work without prior authorization, but are requested to mention the source and to inform ECLAC of such reproduction.



UNITED NATIONS

ECLAC

Economic Commission for Latin America and the Caribbean (ECLAC)  
Latin American and Caribbean Demographic Centre (CELADE)-Population Division of ECLAC

# Pandemics in Mexico and its capital: a brief review

Luis Javier Briseño Godoy<sup>1</sup>

Eliud Silva<sup>2</sup>

Alejandro Aguirre<sup>3</sup>

Manuel Ordorica<sup>4</sup>

Received: 07/05/2025

Accepted: 29/07/2025

## Abstract

Mexico has been struck by four pandemics with devastating impacts in terms of infections, mortality and demographic change: the smallpox and measles pandemics, the 1918 influenza pandemic and the coronavirus disease (COVID-19) pandemic. This study explores how these pandemics emerged, spread and affected population health, chiefly through the lenses of mortality and morbidity. A historical demographic perspective is adopted, focusing on Mexico City because of its demographic significance and availability of data. While the role of public health responses is acknowledged, the study emphasizes differential mortality effects, using information from both historical documentation and empirical evidence. Given the scarcity of reliable data for earlier pandemics, the analysis of these events is largely descriptive. A comparative approach highlights recurring patterns in the origin, progression and demographic impact of pandemics across Mexico and its capital. The study also incorporates disaggregated findings within Mexico City, offering insights into internal demographic disparities.

**Keywords:** pandemics, smallpox, measles, influenza, COVID-19, history, Mexico.

<sup>1</sup> Luis Javier Briseño Godoy holds a master's degree in Demography from the Centre for Demographic, Urban and Environmental Studies (CEDUA) at El Colegio de México, A. C. in Mexico. Email: luisj@colmex.mx.

<sup>2</sup> Eliud Silva (corresponding author) is a professor and researcher at Anahuac University in Mexico and an adjunct professor in Actuarial Science at the Acatlán Faculty of Higher Studies of the National Autonomous University of Mexico (UNAM). Email: jose.silva@anahuac.mx.

<sup>3</sup> Alejandro Aguirre is a professor and researcher at the Centre for Demographic, Urban and Environmental Studies (CEDUA) of El Colegio de México, A. C. in Mexico. Email: aguirre@colmex.mx.

<sup>4</sup> Manuel Ordorica is a professor and researcher at the Centre for Demographic, Urban and Environmental Studies (CEDUA) of El Colegio de México, A. C. in Mexico. Email: mordorica@colmex.mx.

## Resumen

México fue golpeado por cuatro pandemias —viruela y sarampión, gripe (1918) y enfermedad por coronavirus (COVID-19)—, con impactos devastadores en términos de infecciones, mortalidad y cambios demográficos. Este estudio analiza el surgimiento, propagación y afectación de la salud de la población (mortalidad y morbilidad). Se adopta una perspectiva histórico-demográfica centrada en la Ciudad de México por su relevancia demográfica y disponibilidad de datos. Se reconoce el papel de las respuestas de salud pública, pero se enfatizan los efectos diferenciales de la mortalidad, sobre la base de documentación histórica y datos empíricos. Dada la escasez de datos confiables para pandemias más antiguas, el análisis de estos acontecimientos es mayormente descriptivo. Un enfoque comparativo destaca patrones recurrentes de origen, progresión e impacto demográfico de las pandemias en México y su capital. También se ofrecen hallazgos desagregados de la Ciudad de México e información sobre disparidades demográficas internas.

**Palabras clave:** pandemia, viruela, sarampión, gripe, COVID-19, historia, México.

## Introduction

It is challenging to attempt to deal comprehensively with the population and territorial transformations of present-day Mexico and its capital, Mexico City, within the scope of a single research paper, particularly when it comes to the effects of epidemics on mortality rates. Since at least 1325, with the founding of Tenochtitlan, the region has undergone significant territorial modifications, initially driven by the need to reclaim land from surrounding bodies of water through techniques such as the construction of *chinampas*. This approach shifted during the New Spain colonial period, when lakes and rivers were increasingly drained and diverted to accommodate the development of major avenues and urban infrastructure.

Over seven centuries, the population has experienced phases of instability, growth, stagnation and decline, yet social inequalities, rooted in a system of social stratification, have persisted throughout. These inequalities were compounded by the mixing of indigenous, European, Asian and African populations. This stratification has not only endured but been reflected in physical spaces, with divergent social, economic, political and cultural conditions arising within the country and its capital and continuing to influence disparities in health and access to essential sanitation services to this day.

Since pre-Hispanic times, present-day Mexico City has been the epicentre of political and economic power, with territorial inequalities between the city's administrative divisions becoming increasingly entrenched. The concentration of essential services, such as hospitals, government institutions, universities, businesses, employment opportunities, communications networks, transportation and museums, has amplified these disparities. This paper aims to describe some of the circumstances in Mexico and its capital during different pandemics over time, namely the smallpox and measles, influenza (1918), and COVID-19 pandemics, using the current literature to conduct a comprehensive review of the phenomena observed.

Each historical period associated with the pandemics selected presents its own difficulties with data availability and the choice of methodological approach. It is a major challenge, in our view, to formulate a specific conceptual and methodological framework for health and mortality analysis that can fit such different contexts. This task merits a separate study that lies beyond the scope of the present paper. Nevertheless, we cite the main results of previous research where indicators for the COVID-19 pandemic have been used to conduct a more detailed demographic analysis at both national and subnational levels, with particular attention to Mexico City. We also introduce a new set of disaggregated results that highlight demographic differences within Mexico City. For earlier pandemics, owing to the lack of consistent and reliable data, our approach is descriptive and historical.

A key point in this paper concerns the definition of a pandemic and whether it differs from that of an epidemic. The World Health Organization (WHO, 2025) defines a pandemic as the worldwide spread of a new disease that affects a large number of people,

crosses international borders and causes significant health, social and economic disruption, while an epidemic is a sudden increase in the number of cases of a disease above what is normally expected in a specific population or area. When these definitions are applied, it becomes evident that the events discussed in this study qualify as pandemics in the context of Mexico.

What transforms a virus into a pandemic are the underlying societal conditions. Social inequality has been a persistent feature of all known human societies (Antonio-Villa et al., 2022). In Mexico City and other Latin American cities such as Lima, Guayaquil and São Paulo, these disparities are particularly pronounced and have contributed to elevated mortality levels, especially during pandemic periods (Molina del Villar, 2024). Inequalities manifest in the distribution of social groups, the organization of urban spaces and access to basic services. Differential access to clean water, healthcare services, nutritious food, adequate housing, stable employment, sufficient income and recreational spaces significantly impacts public health, increasing the risk of comorbidities (Molina del Villar, 2024).

Historically, a local factor that contributed to the context in which pandemics emerged was an ancient pre-Hispanic meso-American agricultural technique unique to the Valley of Mexico, and particularly what is now Mexico City, involving the use of *chinampas*, artificial islands built on the beds of shallow lakes that allowed for highly productive cultivation. Their relevance to this study lies in their historical impact on urban settlement patterns, population density and environmental conditions, which may have influenced public health outcomes during earlier epidemics. These agricultural systems were not the direct cause of pandemics such as smallpox or measles, since those pathogens were introduced by Europeans. However, it remains an open question whether the demographic and ecological configurations they supported could have indirectly contributed to the rapid dissemination of infectious diseases. In any case, the traditional use of *chinampas* began to decline significantly in the twentieth century, largely because of rapid urban expansion, large-scale drainage efforts that disrupted the lake system, and shifts in agricultural practices. Today, only remnants of *chinampa* agriculture survive in specific areas such as Xochimilco, on the southern edge of Mexico City (Moreno-Estrada et al., 2021).

We focus exclusively on the four pandemics referred to, acknowledging the limitation that the longer ago a pandemic occurred, the more challenging it becomes to find research papers or datasets dealing with it. We believe this type of study offers a different perspective on pandemics in developing countries over time. We have not found any similar papers focusing on a Latin American case study. We have chosen to omit other modern pandemics such as the obesity, diabetes and homicide pandemics. We consider that other demographic effects, such as migration and fertility, are also relevant, and these will be addressed in future research.

## A. The pandemics

### 1. Smallpox and measles

Modernity is often said to have begun with the opening up of the Atlantic following the arrival of Europeans in the Americas in 1492 (Dussel, 2007). In the aftermath of the Treaty of Tordesillas, Spanish and Portuguese representatives moved swiftly to consolidate control over their possessions. This contact between European colonizers and native populations triggered a demographic catastrophe, largely fuelled by the rapid spread of unfamiliar diseases (Martin, 2021). The treaty and subsequent agreements sought to establish peace by identifying clear spheres of influence for Spain and Portugal. However, the indigenous peoples of the Americas, Africa and Asia were unaware that they had effectively lost control of their lands (Duve, 2017).

In Japan, contact with Europeans did not result in the disastrous spread of disease, as the country had experienced its first smallpox outbreak as early as the eighth century, when an epidemic killed nearly a third of the population (Suzuki, 2011). Latin America, however, met with a different fate. The introduction of smallpox and measles, both emerging infections in the New World, began in the Caribbean and quickly spread to mainland Mexico, the heart of the Aztec Empire (Piret and Boivin, 2021; Molina del Villar, 2024). Smallpox arrived in Santo Domingo in 1518, reaching Mexico in 1520, and measles followed a similar path (Cordero del Campillo, 2001). The impact on indigenous populations was catastrophic, with diseases sweeping south to regions as distant as Tierra del Fuego (García Cáceres, 2003).

The exact extent to which war, famine, forced labour and disease contributed to the collapse of indigenous civilizations is debated. However, the combination of these factors is likely to have destabilized existing social, political and economic systems (Martin, 2021). The results included the extinction of groups such as the Taíno on Hispaniola and the collapse of the Inca and Mexica empires (Franco-Paredes, Lammoglia and Santos-Preciado, 2004). European forces, though few in number, leveraged superior technology, military strategy and the devastating effects of disease to conquer vast territories (Dussel, 2007). Crosby (1991), as cited by Martin (2021), argued that despite widespread violence and labour exploitation, it was not in the Spaniards' interests to kill all the natives, as they needed labour. One outcome was the beginning of the African slave trade in the Americas around 1518 (Martin, 2021; Molina del Villar, 2024).

Many historians note that Europeans, and particularly Spaniards and Portuguese, succeeded in conquering large territories with relatively few soldiers. Aside from the advantages of gunpowder and horses, the accidental introduction of diseases, which acted almost like a form of bacteriological warfare, played a decisive role in the rapid conquest of the Americas (Bustamante, 1982c). Between 1300 and 1600, the world underwent a "microbial unification", creating a global market in pathogens that had long circulated in Eurasia and the Atlantic

(Ladurie, 1989; Molina del Villar, 2024). Unlike indigenous populations, Europeans and Africans had developed immunities to smallpox and measles, having survived outbreaks early in their lives (McNeill, 1984; Molina del Villar, 2024).

Malaria and yellow fever, which probably originated in Africa, spread to the Americas via the trans-Atlantic slave trade, with slaves replacing the declining Amerindian workforce (McNeill, 1984). Hernán Cortés's conquest of the Aztec Empire, aided by a devastating smallpox epidemic, is a key example of the catastrophic effects of European diseases on indigenous civilizations (McNeill and McNeill, 2004). The geographical isolation of indigenous peoples, beginning when the first Americans migrated from Asia via the Bering Strait some 50,000 years ago, shielded them from the pathogens circulating in Europe, Africa and Asia for millennia and left them immunologically unprepared for the arrival of these new diseases (Livi Bacci, 2006, 2012; Crosby, 1991; Dussel, 2007). Europeans, by contrast, having once survived smallpox, developed lifelong immunity (Valdés, 2010). In addition to smallpox and measles, other diseases such as influenza, malaria and hepatitis were introduced to the Americas, contributing to demographic collapse (Martin, 2021). Misdiagnoses due to similarity of symptoms further complicated matters (Crosby, 1991; Bustamante, 1982c).

In Mexico, the arrival of smallpox in 1520, in the epidemic known in Nahuatl, the indigenous Aztec language, as *hueyzahtl*, wrought havoc on the population, who mistook it for other illnesses such as influenza and chickenpox (Franco-Paredes, Lammoglia and Santos-Preciado, 2004; Heyman, 2005). Casualties included Emperor Cuitláhuac, who succumbed to the disease in 1520 (Bustamante, 1982c). Measles, known as *tepitonzahuatl*, was even more contagious and equally devastating (Malvido, 1982). Over the following decades, repeated outbreaks of diseases such as measles and the plague contributed to a sustained decline in indigenous populations unprotected by immunity or knowledge of how to manage their spread. The epidemiological pattern of smallpox and measles in Mexico, coupled with wars and other disasters, resulted in the collapse of indigenous societies. In less than a century, on one estimate, the native population was reduced by half, from 19.8 million in 1500 to around 10.4 million by 1600 (Martin, 2021). Other estimates suggest a 90% decline by 1607, constituting a demographic catastrophe (Borah and Cook, 1962). Similarly, in Peru, the population plummeted by around 80% between 1524 and 1590 (Ladurie, 1989). This phenomenon was caused by several factors apart from epidemics, including population displacement, the abandonment of productive activities and the destruction of social structures (Molina del Villar, 2024). The long-term effects of smallpox in Mexico persisted into the twentieth century, with eradication only achieved in 1952 (Bustamante, 1982c).

Theories about disease causation evolved in later centuries, but in the early years of the Spanish conquest, many attributed the high mortality rates to divine punishment or miasmatic effects, with “vapours” from stagnant water being blamed for the spread of disease (Cooper, 1980; Iturriaga, 2020). Public health measures such as quarantine and variolation (an early form of smallpox immunization) were inconsistently applied, and public mistrust of treatments further hampered efforts to control epidemics (Iturriaga, 2020).

Variolation, a precursor to modern vaccination, involved intentionally infecting a person with smallpox to induce immunity. It was introduced in Mexico before the smallpox vaccine, which was taken to the country by Dr. Francisco Javier de Balmis in the early nineteenth century (Iturriaga, 2020). Over time, vaccination efforts helped reduce mortality from smallpox, although the spread of diseases remained a persistent challenge throughout the colonial period and beyond (Iturriaga, 2020).

## 2. Influenza

The 1918 influenza pandemic, often called the “Spanish flu” or “Spanish lady”, received this misleading name largely because of censorship during the First World War. Both the Allied Powers, a coalition that included France, the United Kingdom and later the United States, and the Central Powers, led by Germany, Austria-Hungary and the Ottoman Empire, suffered significant losses from the flu. However, military censorship prevented the press from reporting the outbreaks, since revealing this information could have benefited the enemy. In contrast, Spain, a neutral country, did not impose such restrictions, and Spanish newspapers openly reported on the devastating impact of the flu in May and June 1918, drawing global attention. As a result, many mistakenly believed that the pandemic had originated in Spain (Fujimura, 2003).

The virus responsible for the pandemic was identified as the influenza A (H1N1) virus, an avian influenza strain. Although its true origins remain uncertain, it is believed to have first spread from an agricultural area in Haskell, Kansas (United States), whereupon it quickly circulated because of the movement of troops during the latter stages of the First World War (Osterholm and Olshaker, 2020; Short, Kedzierska and van de Sandt, 2018). Within a year, the virus had reached all continents, its spread facilitated by trans-Atlantic trade routes and global troop movements (Márquez, 2013; Johnson and Mueller, 2002). Influenza A (H1N1) is a zoonotic virus that typically remains asymptomatic in wild waterfowl but can be transmitted to humans and other domestic animals (Centers for Disease Control and Prevention, 2022; Morens and Fauci, 2007).

During the First World War, military camps provided ideal conditions for the virus to spread. Overcrowded living quarters, close contact with livestock, frequent troop movements and pre-existing lung conditions caused by exposure to toxic gases created a fertile environment for the pandemic to flourish (Short, Kedzierska and van de Sandt, 2018). The pandemic progressed in three waves, with the second and third waves proving to be the deadliest (Morens and Fauci, 2007). The first wave, between March and May 1918, affected the United States, France, Spain and the United Kingdom before the virus spread to other parts of the world, reaching Asia, Africa and the Americas by early 1919 (Macip, 2020). Researchers estimate that the 1918 flu had an  $R_0$  of about 4, meaning each infected person transmitted the virus to four others (Macip, 2020).

Estimates suggest that the pandemic caused between 40 million and 100 million deaths worldwide, making it the deadliest pandemic in human history, with fatalities surpassing even those caused by the First World War (Johnson and Mueller, 2002; Morens and Fauci, 2007;

Del Río and Hernández-Ávila, 2009; Chowell et al., 2010; Davis, 2020; Khan et al., 2020). Unlike most influenza viruses, which are particularly lethal to infants and the elderly, the 1918 flu had an unusual pattern in that it disproportionately affected young adults between the ages of 20 and 40, and particularly those aged from 25 to 29 (Worobey et al., 2014). This anomaly has been attributed to a cohort effect, with older generations having some immunity due to prior exposure to the influenza A (H<sub>3</sub>N<sub>2</sub>) virus during the 1889–1890 pandemic (Acosta et al., 2019; Morens and Fauci, 2007).

The 1918 influenza virus also disproportionately affected strong, healthy individuals, including pregnant women, by causing an overreaction of the immune system known as a cytokine storm. This immune response led to severe damage to vital organs such as the lungs, kidneys and heart (Osterholm and Olshaker, 2020; Morens and Fauci, 2007). Co-infections with bacterial pathogens like streptococcus pneumoniae and staphylococcus aureus further complicated the disease, significantly increasing mortality rates (Del Río and Hernández-Ávila, 2009; Franco-Paredes et al., 2009; Short, Kedzierska and van de Sandt, 2018).

The pandemic underscored the importance of public health interventions. Despite the absence of vaccines and antibiotics at the time, measures such as social distancing, border closures and isolation of the sick helped slow the virus's spread (Morens and Taubenberger, 2018). The 1918 pandemic marked a significant shift in the way governments approached pandemics, moving from pure public health strategies to the incorporation of biomedical interventions such as vaccines and pharmaceuticals (Schwartz, 2018). However, as Greenberger (2018) points out, preparedness is always more effective than reactive measures, and pandemics often expose shortages of personnel and resources, as was seen during the 1918 pandemic. Measures taken to control the virus, such as quarantines, avoidance of social gatherings and mask wearing, were only moderately successful, especially in the absence of effective medical treatments (Short, Kedzierska and van de Sandt, 2018; Macip, 2020). The lack of antibiotics (penicillin was discovered only in 1928) made treating secondary bacterial infections nearly impossible (Jester et al., 2018; Macip, 2020).

Brought to the Americas by United States soldiers returning from the First World War, the 1918 influenza pandemic spread across Mexico against the tumultuous backdrop of the Mexican Revolution (1910–1921) (Cano, 2013). The country was significantly impacted by the pandemic, with reports indicating around 300,000 deaths in a population of 14.5 million by October 1918, at the height of the Revolution, with the northern states of Nuevo León, Tamaulipas and Coahuila being the worst affected (Márquez, 2013; Johnson and Mueller, 2002). Symptoms of the disease included high fever, headaches, cough, sore throat and respiratory distress, with severe cases resulting in cyanosis and death by pneumonia (Márquez, 2013). The first cases were detected in April 1918 in Mexico City, where initial containment efforts helped slow the spread of the virus (Cano, 2013), but by October 1918 it had spread further because of migration from the northern regions and the arrival of ships at ports on the Gulf of Mexico, affecting northern states before reaching other parts of the country via the railway network (Cano, 2013; Gómez-Dantés, 2020). By this time, 4,000 deaths had been recorded in the capital, which had a population of 800,000 to 1 million inhabitants (Cano, 2013, p. 278).

The contagiousness of the influenza A (H1N1) virus, which was easily transmitted through contact with mucous secretions, led the Mexican authorities to issue public health guidelines. These included advising people to avoid crowds, not share personal items unless they were sterilized, refrain from using public transportation for short trips and maintain hygiene by washing their hands and changing their clothes upon arriving home. The authorities also discouraged people from shaking hands or kissing, advised them to ventilate rooms and encouraged them to cover their mouths when coughing or sneezing (Ordorica-Mellado, 2021). Despite these recommendations, the sanitation measures implemented by the authorities failed to stop the virus's spread. The situation was exacerbated by political, economic and legislative disarray and a lack of doctors, medicines and general direction in health policies (Cano, 2013).

In the face of the health crisis, some sectors of society turned to religious practices, hoping for divine intervention to halt the contagion and deaths (Cano, 2013). As often happens in pandemics, the influenza virus was not the only health threat; Mexico was also dealing with typhus and cholera outbreaks (Márquez Morfín, 1994) and famine (Alexander, 2019; Iturriaga, 2020), exacerbated by poor harvests, a recurring problem since pre-Hispanic times (Bustamante, 1982a, 1982b).

Data on the total number of deaths during the pandemic are sparse, largely owing to the concomitant upheaval of the Mexican Revolution. However, estimates suggest that Mexico followed global mortality patterns, with a crude mortality rate of between 2% and 4%, the highest fatalities among young adults and three distinct waves in the spread of the flu (Chowell et al., 2010; Alexander, 2019), in spring 1918, autumn 1918 and winter 1920 (Chowell et al., 2010). Rural populations are likely to have been more severely impacted than urban centres (Alexander, 2019).

Despite the devastating effects of both the Revolution and the flu, the revolutionary movement resulted in significant reforms. These included the establishment of institutions designed to guarantee universal access to healthcare, as stipulated in article 4 of the 1917 constitution (Gómez de León and Partida, 2001; Fajardo Dolci, 2018; Gómez-Dantés, 2020). However, the implementation of these reforms created a health system in which access to healthcare services was largely determined by employment status, dividing the population between those entitled to public healthcare and those, including informal workers and the self-employed, who remained largely unprotected or reliant on private healthcare.

### 3. COVID-19

During the COVID-19 pandemic, pre-existing health conditions, particularly comorbidities, played a crucial role in exacerbating symptoms, increasing the likelihood of intensive care admission and raising mortality rates. “Pre-existing conditions include hypertension, cardiovascular disease, chronic kidney and liver diseases, cancer, obesity, and immunosuppressed states” (Treskova-Schwarzbach et al., 2021, p. 2). According to official figures, last updated on 25 June 2023, there were 44,235 deaths among residents of Mexico City, translating to

a crude mortality rate of 4.8 deaths per 1,000 inhabitants. Of these, 37% were women and 63% were men. The main associated comorbidities were hypertension (39%), diabetes (33%), obesity (19%) and smoking (9%).

As expected, the COVID-19 pandemic reached Mexican territory, and particularly Mexico City, through the country's global connections. The virus spread via infected individuals, whether symptomatic or asymptomatic, arriving from countries where community transmission was already under way. According to the reports available from the Epidemiological and Sanitary Intelligence Unit of Mexico City (UIES), an agency coming under the Ministry of Public Health of Mexico City, the first report of the SARS-CoV-2 outbreak dates back to 29 January 2020. This report, based on media monitoring, noted two suspected cases in the state of Mexico involving individuals who had travelled to Wuhan, China (Epidemiological and Sanitary Intelligence Unit of Mexico City [UIES], 2020a).

According to health authorities, “the first case of COVID-19 was detected on 28 February 2020 in a 35-year-old man who had travelled to Italy and was subsequently isolated at the National Institute of Respiratory Diseases (INER) in Mexico City” (León, 2020, p. 18). On 1 March, Mexico City authorities announced the first of three phases in the public health emergency (UIES, 2020b), with measures aimed at preventing, controlling and mitigating the disease (Ministry of the Interior of Mexico, 2023) in the absence of an effective vaccine or treatment. Phase 1 involved imported cases; phase 2 marked community transmission, prompting the National Healthy Distance Day (beginning on 23 March 2020); and phase 3, referred to as the “new normal”, started on 1 June 2020. This final phase introduced a colour-coded epidemiological traffic light system to indicate the risk of contagion in each of the country's states (Ministry of Health of Mexico, 2023).

The following health measures were recommended: “(1) Maintain physical distancing of 1.50, 1.80, 1.95 and 2.25 metres between individuals; (2) Follow basic hygiene practices, such as covering your mouth and nose when sneezing, and washing your hands frequently with soap and water; (3) Avoid kissing, handshakes and hugs; (4) Observe preventive isolation by only leaving your home if necessary; (5) Postpone large-scale public events until further notice; (6) Avoid spreading or paying attention to rumours or news from dubious sources” (León, 2020). Although these were internationally recognized recommendations, some sectors of society struggled to follow them owing to lack of access to clean water, inadequate living space for remote work or study, or insufficient income to sustain prolonged confinement (Ziccardi, 2020).

As one of the world's largest and most densely populated cities, as well as one of the most socioeconomically unequal, Mexico City unsurprisingly became the epicentre of COVID-19 infections and deaths, both directly and indirectly (Antonio-Villa et al., 2022). Some key demographic factors influencing this outcome included population density, household overcrowding and the proportion of the population over 64 years of age. Socioeconomic factors such as the percentage of workers earning less than twice the minimum wage, the proportion

of households without drainage and the percentage of homes lacking piped water further exacerbated vulnerabilities (Mendoza Ramírez and González Gutiérrez, 2021). In response to the crisis, agreements were entered into with both public and private healthcare providers to ensure access to medical care for those in need (Ministry of Health of Mexico, 2020).

Although several specialized, repurposed and temporary hospitals were established to treat COVID-19 patients (Álvarez Díaz, 2020), hospital saturation (Ministry of Health of Mexico, 2020b) and shortages of ventilators, specialized doctors, nurses, protective equipment and other resources occurred in Mexico City at various points during the pandemic. These factors may have directly or indirectly influenced mortality rates among both residents and non-residents. Furthermore, “there was a widespread anxiety to receive diagnostic confirmation and treatment, leading to saturation of healthcare facilities right across the country” (Ministry of Health of Mexico, 2023).

Mexico’s COVID-19 vaccination campaign began on 24 December 2020 and prioritized high-risk groups, starting with frontline healthcare workers and continuing with the elderly and then the general population, as determined by vaccine availability and individual risk factors (Ministry of Health of Mexico, 2020a). The vaccines approved for use included Abdala, AstraZeneca, CanSino, Covaxin, Janssen, Moderna, Sinovac, Sputnik V, Pfizer–BioNTech, Soberana 02 and Soberana PI (Ministry of Health of Mexico, 2020a). However, it is still difficult to determine whether the decline in mortality was due to immunization or other factors such as viral mutations leading to endemicity, an issue studied and described in an earlier context by McKeown (1989).

One of the most common government responses worldwide was mandatory or voluntary social distancing, a measure that significantly impacted daily life. In Mexico, the suspension of religious services, factory shutdowns and the closure of schools, cinemas, theatres and other public spaces was accompanied by the closing of international borders. To prevent the virus from “entering” their territories, many governments imposed restrictions on travel by air, sea and land, despite the global context of dynamic international flows of goods and people (Bartra, 2022). The World Health Organization never recommended full border closures, as this measure is of limited effectiveness in containing viral spread and can lead to severe social and economic consequences.

The main measures implemented, then, included screening travellers for infection, imposing travel restrictions, enforcing total border closures and requiring quarantine for incoming travellers (Grépin, Aston and Burns, 2023). The available evidence suggested that social distancing measures and border controls would only delay the global spread of the virus by a few days, which was probably what led health authorities to focus on declaring a pandemic rather than investing resources in largely ineffective containment measures. Nonetheless, significant time and effort were devoted to attempts to close national borders—an ultimately futile endeavour, as containing a virus of this nature “is like trying to stop the air” (Osterholm and Olshaker, 2020).

## **B. COVID-19: disruption of the trend and the transition to a new normal**

### **1. The limitations of historical data on earlier pandemics as compared to COVID-19**

Given the nature of pandemics, it was necessary for this research to adopt a multidisciplinary perspective that included public health, mortality and morbidity (Ordorica-Mellado, 2021). However, not all the pandemics discussed furnish the data required to support a proper analysis or allow for meaningful comparisons of their impact on the Mexican population. When smallpox arrived in New Spain, the territory now known as Mexico, they did so in a context marked by slavery, malnutrition and overcrowding. These conditions increased the lethality of the disease, especially among the indigenous population, which lacked immunity to such pathogens, the result being a drastic demographic decline (Crosby, 2003; McCaa, 1995). Molina del Villar et al. (2020) have examined these episodes and noted the absence of reliable records owing to the administrative shortcomings of the time.

In the twentieth century, some hundred years after Mexico began its struggle for independence in 1810 and achieved it in 1821, the 1918 influenza pandemic coincided with the Mexican Revolution, which had started in 1910. This severely affected the quality and availability of mortality data (Cano, 2013; Márquez, 2013). In 1920, in the wake of the Plan of Agua Prieta, political instability culminated in the assassination of President Venustiano Carranza, plunging the country into profound chaos (Alexander, 2019). The simultaneity of domestic armed conflict and the pandemic made the statistical tracking of causes of death and population impact even more difficult.

In contrast, the twenty-first century COVID-19 pandemic occurred in a context where systems for health monitoring and record-keeping were in place, making it possible to conduct a detailed demographic analysis, particularly in Mexico City, on the basis of empirical data (Antonio-Villa et al., 2022; Zazueta-Borboa et al., 2025). Accordingly, we shall now focus on this recent pandemic. In earlier cases, such systems did not exist, and only historical and documentary sources are available, limiting the potential for quantitative analysis. While we acknowledge the importance of public health decisions and their consequences, a detailed examination of the topic exceeds the scope of the present study and could be addressed in future research.

### **2. Evidence on the COVID-19 pandemic in Mexico and its capital**

Mexico City, as well as being Mexico's capital, is also officially recognized as one of the nation's 32 federal entities. From an administrative standpoint, it is subdivided into 16 regions, called *delegaciones*, which are roughly equivalent to counties or municipalities. Nearly all the

country's federal entities experienced reductions in life expectancy during the COVID-19 pandemic (García-Guerrero and Beltrán-Sánchez, 2021). The capital was among the most severely affected, despite having one of the lowest levels of deprivation in 2020 (National Population Council, 2021). Several factors may have contributed to this outcome, including the pre-existence of chronic conditions and a higher proportion of older adults. As noted by Quiroga (2021), countries with a higher level of economic development also tended to exhibit higher mortality rates during the pandemic.

Lima et al. (2021) quantified the national loss of life expectancy at 5.54 years, implying a return to levels last observed in 1987. This represented a considerable setback. For more detailed insights at the municipal level, Silva et al. (2024) developed a visualization showing how life expectancy evolved in both states and municipalities from 1990 to 2020 (Silva et al., n.d.). Regarding morbidity and long-term disabling conditions, there are currently no official statistics available, and the full extent of these consequences may only become clear with time.

Silva et al. (2022) analysed the unequal impact of the COVID-19 pandemic on life expectancy across age groups, identifying older adults as the worst-affected segment of the population. To examine these disparities, they estimated temporary life expectancy by sex for three broad age groups, both nationally and across Mexico's states. Their findings once again identified Mexico City as one of the most severely impacted regions. The use of temporary life expectancy estimation was particularly appropriate, as it aligned with their methodological approach, based on the controlled smoothing of segmented time series trends. Among their principal findings, they reported that for the 41 to 85 age group, temporary life expectancy between 2000 and 2020 declined by 3.5 years for men and 1.6 years for women at the national level. During the same period, the reductions in Mexico City were significantly greater: 7.1 years for men and 3.5 years for women, or nearly twice the national average.

A particularly important area of research explores the relationship between socioeconomic deprivation, chronic health conditions such as diabetes and obesity, and COVID-19 mortality. Lome-Hurtado and Soto-Pérez (2025) analysed official data at both the individual and municipal levels within the Mexico City Metropolitan Area. Their findings revealed a significant and positive association between socioeconomic disadvantage, comorbidities and higher COVID-19 mortality. On the strength of these results, the authors emphasize the need for ad hoc interventions prioritizing populations affected by socioeconomic deprivation and particular comorbidities.

Molina et al. (2021) conducted a comparative analysis using variables related to urban development, economic conditions and the number of reported COVID-19 cases in Mexico City. Their results showed a positive correlation between confirmed cases and three main factors: high population density, low per capita income and a high dwelling occupancy index. Zazueta-Borboa et al. (2025) analysed the contributions made by homicides, COVID-19 and deaths from causes deemed preventable with adequate healthcare to changes in life expectancy in Mexico. Their estimates show life expectancy declining by 7.1 years for men and 4.4 years for women between 2019 and 2020. In 2021, life expectancy remained stable for

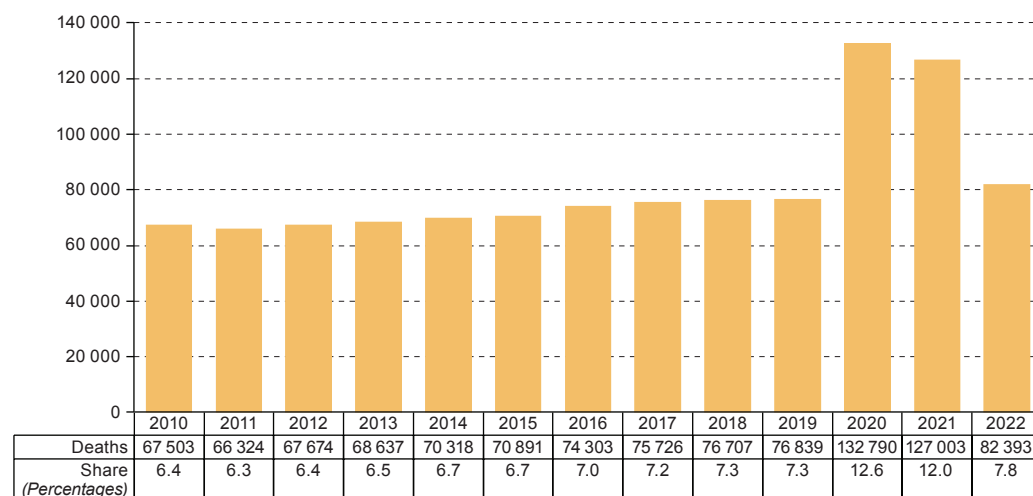
men but declined by an additional 0.44 years for women, largely owing to COVID-19 mortality. By 2022, recovery had begun, but patterns varied greatly across regions, with northern states showing the most significant improvements.

### 3. COVID-19 in Mexico City: statistical trends and demographic insights

Mortality statistics provided by the National Institute of Statistics and Geography (INEGI) for the period 2010–2022 were retrieved. The final dataset comprises only deaths which occurred in Mexico City and for which both the year of registration and the year of occurrence fall within the period 2010–2022. This time frame was selected in view of the availability of a robust dataset enabling historical comparisons to be made and supporting the quantification of specific pandemic-related effects on mortality. These effects on the number of deaths are considered deserving of thorough analysis from a demographic perspective.

From 2010 to 2019 (figure 1), the number of annual deaths exhibited a relatively stable yet gradually increasing trend. In 2010, a total of 67,503 deaths were recorded, rising steadily to 76,839 by 2019. This progressive increase, ranging from 1.3% to 2.5% annually, may be attributed to population ageing, improvements in death registration systems and the continued predominance of chronic non-communicable diseases, including diabetes and cardiovascular conditions, as leading causes of mortality in the region. Mexico City's share of the national total also increased slightly, from 6.4% in 2010 to 7.3% in 2019, reflecting both demographic shifts and ongoing urban concentration.

Figure 1  
**Mexico City: mortality levels and shares of national total, 2010–2022**  
(Numbers of deaths and percentages)



**Source:** Prepared by the authors, on the basis of data from the National Institute of Statistics and Geography.

The mortality pattern shifted dramatically in 2020. That year, the number of deaths surged to 132,790, an increase of over 72% from the previous year. The proportion of deaths in Mexico City relative to the national total reached a striking 12.6%, nearly double the levels of previous years. This rise is primarily attributed to the direct impact of COVID-19, which disproportionately affected the capital because of several factors, including high population density and urban mobility. In 2021, although the number of deaths declined slightly to 127,000, the figure remained elevated and represented 12.0% of the national total, reflecting the continued impact of the pandemic, with its successive waves of infection. This represents a phase of consolidation in the excess mortality that began in 2020.

By 2022, the number of deaths had declined significantly to 82,393, representing 7.8% of the national total. While this was a notable improvement on the previous two years, the level was still above the average observed during the period 2010–2019. The decline may reflect the combined effects of widespread vaccination, increased population immunity and institutional adaptation to the public health emergency. However, it could also include a displacement effect whereby deaths that might have occurred later were instead concentrated in 2020 or 2021.

From a demographic perspective, the excess mortality observed between 2020 and 2021 constitutes one of the most disruptive events in the recent history of Mexico City. Excess deaths included not only those directly attributed to COVID-19, but also those resulting from indirect causes such as interruptions or delays in the treatment of chronic illnesses, avoidance of medical care due to fear of contagion, hospital saturation that restricted access to emergency services, and psychosocial effects, including increased suicide rates and inadequately managed mental health conditions. All this reshaped the mortality structure, with the most severe impacts concentrated among older adults and individuals with comorbidities, as well as certain segments of the working-age population.

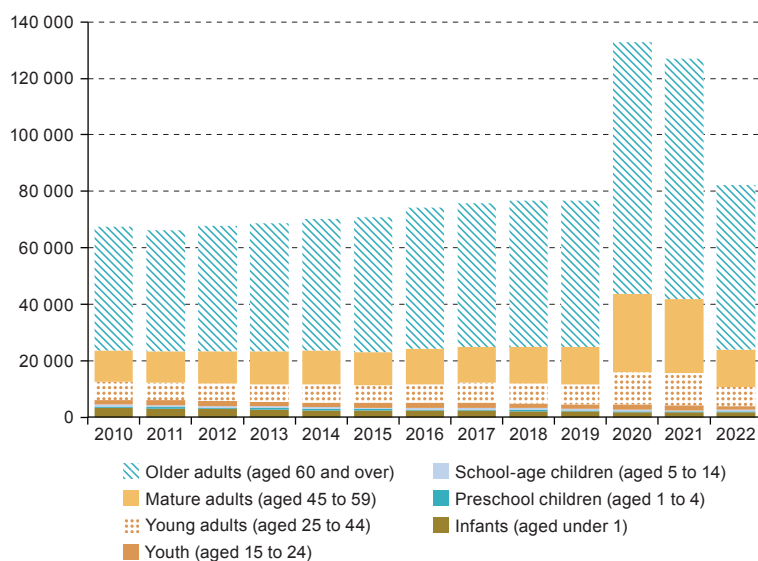
The year 2022 may be viewed as a phase of transition towards a new normal. Although the number of deaths remained above the pre-pandemic average, the difference was no longer as statistically pronounced as in 2020 and 2021. This pattern may be interpreted as an adjustment during which the structural determinants of health began to reassert their influence, even as the system continued to recover. Similarly, the variation in Mexico City's mortality rate relative to the national context suggests that the capital experienced a more severe health burden than other regions during the crisis.

Figure 1 presents total annual mortality in Mexico City from 2010 to 2022, illustrating the sharp rise in death rates associated with the COVID-19 pandemic. The stable trend observed until 2019 was suddenly disrupted in 2020, marking the onset of the most severe excess mortality recorded in decades. Although the data from 2022 suggest a potential stabilization, the cumulative impact has produced lasting effects on both the population structure and the public health system. This analysis underscores the importance of interpreting mortality figures not merely as statistical outputs, but as sensitive indicators of the social, health and demographic transformations experienced by a society confronted with an unprecedented global crisis.

Between 2010 and 2019, mortality in Mexico City exhibited a relatively stable pattern (figure 2). The total number of annual deaths ranged from approximately 65,000 to 78,000, and the age distribution of mortality remained consistent throughout the period. Older adults, defined as individuals aged 60 years and over, invariably accounted for the highest number of deaths, representing more than 60% of the annual total. This concentration of deaths at older ages aligns with the mortality profile of an urban population undergoing demographic ageing. Mature adults aged 45 to 59 ranked second by volume of mortality, although the numbers were significantly lower than for the 60 and over group. Young adults aged 25 to 44 maintained a stable share of total deaths, although their participation was markedly lower than that of older age groups. Mortality among individuals under the age of 25, including infants, children and youth, was low, with figures that were almost marginal in the overall structure. This pattern reflects sustained progress with public health, including advances in vaccination coverage and maternal and child healthcare over recent decades. The stability of both the number of deaths and the age structure during the years preceding the pandemic was consistent with what would be expected in a population at an advanced stage of the demographic transition, characterized by low fertility rates and a predominance of chronic causes of death, including cardiovascular disease, diabetes and cancer.

Figure 2

**Mexico City: age-specific mortality patterns before, during and after the COVID-19 pandemic**  
(Numbers of deaths)



**Source:** Prepared by the authors, on the basis of data from the National Institute of Statistics and Geography.

The years 2020 and 2021 marked a significant break from the historical mortality trend. The total number of deaths rose sharply, peaking in 2020 at more than 130,000, or almost double the average of previous years. This abrupt increase was primarily driven by a rise

in deaths among individuals aged 60 and over, a group that experienced disproportionate growth in mortality, confirming the heightened vulnerability of older adults to COVID-19. This vulnerability resulted not only from the direct effects of the virus but also from indirect factors such as social isolation, reduced access to medical care and the decompensation of chronic illnesses. Substantial increases were also observed among adults aged 45 to 59 and 25 to 44, who accounted for a greater share of excess mortality than in previous years. This pattern suggests that the pandemic affected not only the oldest segments of the population but also individuals in working and reproductive stages of their lives, generating significant collateral socioeconomic impacts.

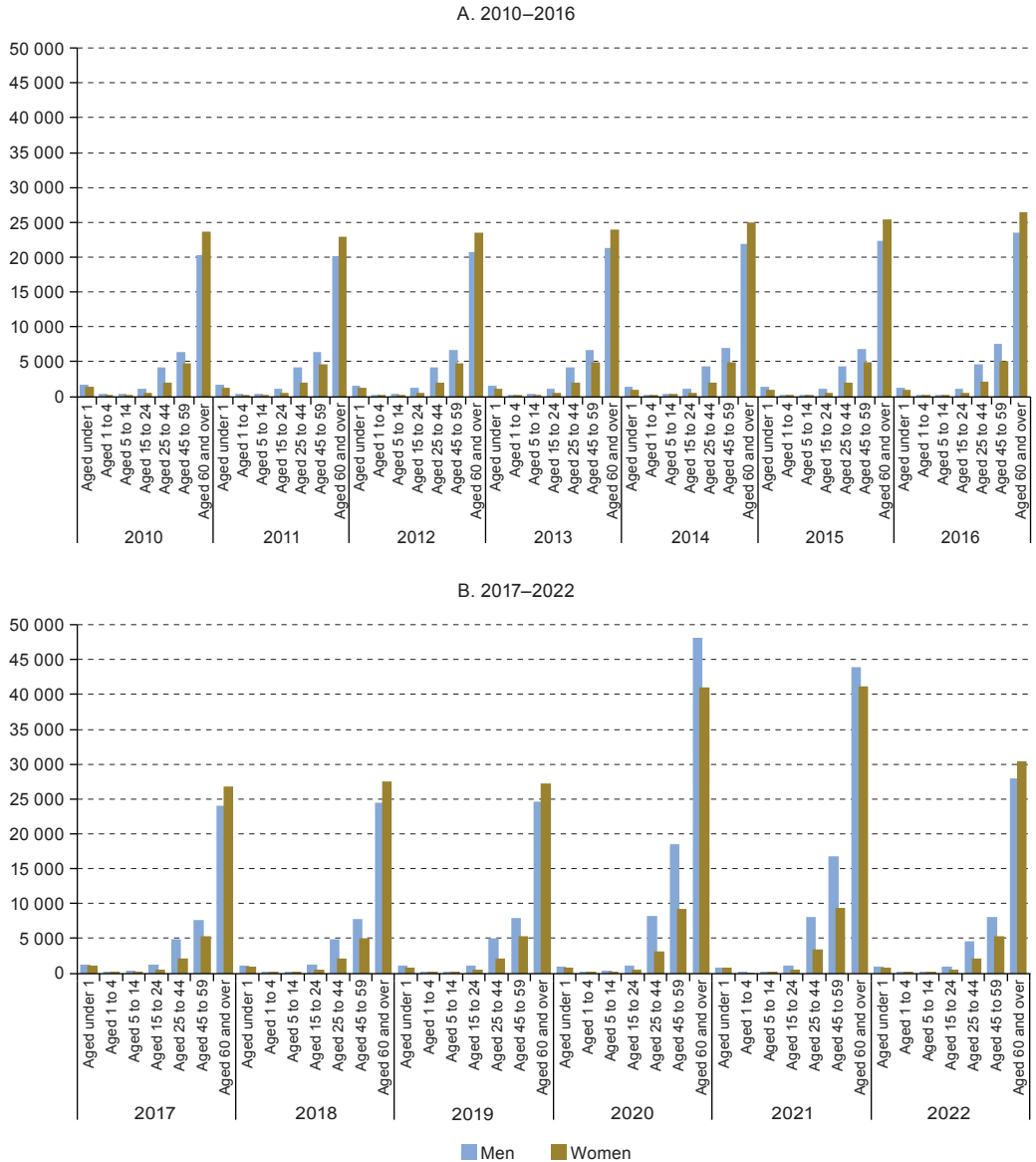
Although the absolute number of deaths among individuals under the age of 25 did not rise as sharply, it is noteworthy that mortality in this group ceased to decline, disrupting the previous downward trend. In some cases, reductions in infant and child mortality appear to have stalled or slightly reversed. Possible contributing factors include interruptions in health services, a decline in prenatal care visits, incomplete vaccination schedules and limited access to timely medical attention.

Figure 2 shows a decline in the total number of deaths in 2022 compared to the peaks observed during the pandemic, with the figure falling to approximately 85,000. However, deaths did not return to pre-pandemic levels, which may indicate lingering effects of COVID-19 or a more structural shift in the population's health status and patterns of disease. This partial recovery suggests that the consequences of the pandemic have extended beyond its immediate impact and may be reshaping long-term mortality dynamics. The chart serves as a visual testament to the demographic impact of COVID-19 in Mexico City. Besides excess mortality, it reveals a marked shift in the age distribution of deaths, signalling that the pandemic not only increased overall mortality but also disrupted historical patterns of morbidity and vulnerability. From a demographic perspective, these findings reinforce the importance of maintaining resilient health systems, particularly in densely populated urban environments such as Mexico City, where high mobility, structural inequality and pre-existing health conditions intensified the effects of an unprecedented public health crisis.

Figure 3 again provides age-disaggregated information, with a further breakdown by sex, and is divided for convenience into two panels, the top panel covering the period 2010–2016 and the bottom panel the period 2017–2022.

Mortality among children under 1 year of age shows a clear negative trend over the period, declining in absolute terms from just over 3,100 deaths in 2010 to around 1,700 by 2022. Deaths in the 1–4 age group also decreased steadily, falling from approximately 580 to 600 cases per year at the beginning of the decade to about 330 to 350 by the end of the period. Similarly, mortality among children aged 5–14 declined in absolute numbers, from values close to 700 deaths in 2010 to roughly 500 in 2022. Overall, these age groups exhibit a consistent reduction in mortality levels throughout the period, with absolute declines clearly visible before and after 2020.

Figure 3  
**Mexico City: age- and sex-specific mortality, 2010–2022**  
*(Numbers of deaths)*



**Source:** Prepared by the authors, on the basis of data from the National Institute of Statistics and Geography.

As expected, mortality increases markedly with age. Prior to 2020, deaths among individuals aged 15–24 remained low and fairly stable, fluctuating between around 1,400 and 1,800 per year, while mortality in the 25–44 age group ranged roughly between 6,000 and

7,500 deaths annually. The 45–59 age group consistently recorded higher levels, with deaths increasing gradually from about 11,000 to nearly 13,000 over the decade. Adults aged 60 and over accounted for the largest number of deaths, with the number rising steadily from approximately 43,000 in 2010 to just above 52,000 by 2019.

A clear structural break appears in 2020, with mortality increasing sharply across all adult age groups. Deaths among individuals aged 45–59 more than doubled to some 28,000, while deaths among those aged 60 and over peaked at about 90,000. Although mortality declined in 2021 and 2022, death counts in all adult groups remained well above pre-2020 levels. As mentioned, this surge is attributable not only to the direct impact of SARS-CoV-2 but also to indirect consequences, including the reallocation of hospital resources and delays in chronic disease management. Although mortality decreased slightly in 2021, it remained well above pre-pandemic levels.

The gender gap in mortality widened during the health crisis. Although men consistently registered higher numbers of deaths than women, the difference became more pronounced in 2020, particularly among middle-aged and older adults. This disparity is largely explained by men's greater occupational exposure to essential activities, lower utilization of preventive health services, and comorbidity patterns that increased the severity of COVID-19 outcomes in this population.

Analysis of mortality for Mexico City highlights the relative resilience of younger age groups during health crises, in contrast to the heightened vulnerability of older adults. The COVID-19 pandemic left a clear and lasting impact on mortality patterns, including changes in gender dynamics within certain age cohorts. Post-pandemic data from 2022 show a marked decline in mortality compared to the peak years of 2020 and 2021, with figures approaching but not yet returning to the lower levels observed in the early 2010s. This trend may reflect a process of recovery and adaptation, although it could also indicate a persistent elevation in mortality due to the long-term effects of the pandemic or other structural health determinants. To gain a more comprehensive understanding, it would be valuable to correlate these mortality trends with specific causes of death and relevant socioeconomic indicators.

## C. Conclusions

This review has traced some of the most significant pandemics in Mexico's history, showing how each left a deep demographic imprint, particularly in Mexico City. Although they occurred in different centuries and under very different circumstances, the smallpox and measles pandemics, the 1918 influenza pandemic and COVID-19 all have important things in common. Each began with the transmission of a pathogen from animals to humans. This mechanism of zoonotic spillover is not new, but it has become increasingly common as human activity has expanded into natural ecosystems and practices such as animal farming, the wildlife trade and the keeping of exotic pets have intensified.

Another thing these diseases share is the way they spread, which is through close human contact. Advances in transportation have brought the world closer together but have also made it easier for pandemics to spread rapidly and widely. In the case of COVID-19, mobility across urban networks and transport hubs played a key role in the fast and uneven spread of the virus, especially in densely populated areas like Mexico City.

Scientific knowledge has helped us understand these diseases and respond with tools like vaccines, yet science alone is not enough. Throughout history, fear, misinformation and distrust have shaped people's reactions to pandemics. Another constant is that some of the most basic public health measures, including handwashing, covering the mouth, isolating the sick and maintaining good nutrition, have stood the test of time and remain central in the fight against disease.

Pandemics disrupt everyday life, strain economies, reshape families and leave long-term marks on societies. Mexico City during the COVID-19 pandemic is a striking example. Despite its relatively robust infrastructure and low levels of deprivation, it experienced unexpectedly high mortality. This contradiction is a reminder that even well-resourced places are not immune to the risks created by inequality, high population density and structural care gaps.

## Bibliography

- Acosta, E., Hallman, S. A., Dillon, L. Y., Ouellette, N., Bourbeau, R., Herring, D. A., Inwood, K., Earn, D. J., Madrenas, J., Miller, M. S. and Gagnon, A. (2019). Determinants of influenza mortality trends: age-period-cohort analysis of influenza mortality in the United States, 1959–2016. *Demography*, 56(5). <https://doi.org/10.1007/s13524-019-00809-y>
- Alexander, R. M. (2019). The Spanish flu and the sanitary dictatorship: Mexico's response to the 1918 influenza pandemic. *The Americas*, 76(3). <https://doi.org/10.1017/tam.2019.34>
- Álvarez Díaz, J. A. (2020). Retos para el sistema de salud ante la pandemia de COVID-19. In C. Medel Palma, G. R. Jiménez Bustos, A. Rodríguez Nava and R. Martínez Rojas Rustrián (Coords.), *México ante el COVID-19: acciones y retos*. Chamber of Deputies and Metropolitan Autonomous University.
- Antonio-Villa, N. E., Fernandez-Chirino, L., Pisanty-Alatorre, J., Mancilla-Galindo, J., Kammar-García, A., Vargas-Vázquez, A., González-Díaz, A., Fermín-Martínez, C. A., Márquez-Salinas, A., Guerra, E. C., Bahena-López, J. P., Villanueva-Reza, M., Márquez-Sánchez, J., Jaramillo-Molina, M. E., Gutiérrez-Robledo, L. M. and Bello-Chavolla, O. Y. (2022). Comprehensive evaluation of the impact of sociodemographic inequalities on adverse outcomes and excess mortality during the coronavirus disease 2019 (COVID-19) pandemic in Mexico City. *Clinical Infectious Diseases*, 74(5). <https://doi.org/10.1093/cid/ciab577>
- Bartra, A. (2022). *Exceso de muerte: de la peste de Atenas a la COVID-19*. Fondo de Cultura Económica.
- Borah, W. and Cook, S. (1962). La despoblación del México central en el siglo XVI. *Historia Mexicana*, 12(1). <https://www.jstor.org/stable/25135147>
- Bustamante, M. (1982a). La influenza española en México: el caso de los estados fronterizos (1918-1919). In E. Florescano and E. Malvido (Comps.), *Ensayos sobre la historia de las epidemias en México*, 1. Mexican Social Security Institute.

- Bustamante, M. (1982b). Aspectos históricos y epidemiológicos del hambre en México. In E. Florescano and E. Malvido (Comps.), *Ensayos sobre la historia de las epidemias en México, 1*. Mexican Social Security Institute.
- Bustamante, M. (1982c). Notas sobre enfermedades prehispánicas en México: el sarampión. In E. Florescano and E. Malvido (Comps.), *Ensayos sobre la historia de las epidemias en México, 1*. Mexican Social Security Institute.
- Cano, B. (2013). Efectos demográficos de la pandemia de influenza en 1918-1920 a escala mundial. In A. Molina del Villar, L. Márquez Morfín and C. P. Pardo Hernández (Eds.), *El miedo a morir. Endemias, epidemias y pandemias en México: análisis de larga duración*. Centre for Research and Advanced Studies in Social Anthropology.
- Centers for Disease Control and Prevention. (2022). *Influenza aviar en aves*. <https://espanol.cdc.gov/flu/avianflu/avian-in-birds.htm>
- Chowell, G., Viboud, C., Simonsen, L., Miller, M. A. and Acuna-Soto, R. (2010). Mortality patterns associated with the 1918 influenza pandemic in Mexico: evidence for a spring herald wave and lack of preexisting immunity in older populations. *The Journal of Infectious Diseases*, 202(4). <https://doi.org/10.1086/654897>
- Cooper, D. B. (1980). *Las epidemias en la ciudad de México, 1761-1813*. Mexican Social Security Institute.
- Cordero del Campillo, M. (2001). Las grandes epidemias en la América colonial. *Archivos de Zootecnia*, 50(192). <http://hdl.handle.net/10612/2487>
- Crosby, A. W. (1991). *El intercambio transoceánico: consecuencias biológicas y culturales a partir de 1492*. National Autonomous University of Mexico.
- Crosby, A. W. (2003). *The Columbian Exchange: Biological and Cultural Consequences of 1492*. Praeger.
- Davis, M. (2020). *Llega el monstruo: COVID-19, gripe aviar y las plagas del capitalismo*. Capitán Swing.
- Del Río, C. and Hernández-Ávila, M. (2009). Lessons from previous influenza pandemics and from the Mexican response to the current influenza pandemic. *Archives of Medical Research*, 40(8). <https://doi.org/10.1016/j.arcmed.2009.12.005>
- Dussel, E. (2007). *Política de la liberación: historia mundial y crítica*. Editorial Trotta.
- Duve, T. (2017). El Tratado de Tordesillas: ¿Una “revolución espacial”? Cosmografía, prácticas jurídicas y la historia del derecho internacional público. *Revista de historia del derecho*. (54).
- Epidemiological and Sanitary Intelligence Unit of Mexico City. (2020a, 29 January). *Informe diario de emergencias en salud pública en la Ciudad de México*.
- Epidemiological and Sanitary Intelligence Unit of Mexico City. (2020b, 1 March). *Informe diario de emergencias en salud pública en la Ciudad de México*.
- Fajardo Dolci, G. (Coord.). (2018). *Ritmo y rumbo de la salud en México: conversaciones con los secretarios de salud 1982-2018*. Fondo de Cultura Económica.
- Franco-Paredes, C., Hernández-Ramos, I., Del Río, C., Alexander, K. T., Tapia-Conyer, R. and Santos-Preciado, J. I. (2009). H1N1 influenza pandemics: comparing the events of 2009 in Mexico with those of 1976 and 1918–1919. *Archives of Medical Research*, 40(8). <https://doi.org/10.1016/j.arcmed.2009.10.004>
- Franco-Paredes, C., Lammoglia, L. and Santos-Preciado, J. I. (2004). Perspectiva histórica de la viruela en México: aparición, eliminación y riesgo de reaparición por bioterrorismo. *Gaceta Médica de México*, 140(3).
- Fujimura, S. F. (2003). La muerte púrpura: la gran gripe de 1918. *Perspectivas de Salud*, 8(3). [https://www3.paho.org/Spanish/DD/PIN/Numero18\\_articulos5.htm](https://www3.paho.org/Spanish/DD/PIN/Numero18_articulos5.htm)
- García Cáceres, U. (2003). La implantación de la viruela en los Andes, la historia de un holocausto. *Revista Peruana de Medicina Experimental y Salud Pública*, 20(1). <https://doi.org/10.17843/rpmesp.2003.201.888>

- García-Guerrero, V. M. and Beltrán-Sánchez, H. (2021). Heterogeneity in excess mortality and its impact on loss of life expectancy due to COVID-19: evidence from Mexico. *Canadian Studies in Population*, 48. <https://doi.org/10.1007/s42650-021-00051-1>
- Gómez-Dantés, O. (2020). El trancazo, la pandemia de 1918 en México. *Salud Pública de México*, 62(5). <https://doi.org/10.21149/11613>
- Gómez de León, J. and Partida, V. (2001). Niveles, tendencias y diferenciales de la mortalidad. In J. Gómez de León Cruces and C. Rabell Romero (Coords.), *La población de México: tendencias y perspectivas sociodemográficas hacia el siglo XXI*. Fondo de Cultura Económica.
- Greenberger, M. (2018). Better prepare than react: reordering public health priorities 100 years after the Spanish flu epidemic. *American Journal of Public Health*, 108(11). <https://doi.org/10.2105/AJPH.2018.304682>
- Grépin, K. A., Aston, J. and Burns, J. (2023). Effectiveness of international border control measures during the COVID-19 pandemic: a narrative synthesis of published systematic reviews. *Philosophical Transactions of the Royal Society A*, 381(2257). <https://doi.org/10.1098/rsta.2023.0134>
- Heymann, D. (Ed.) (2005). *El control de las enfermedades transmisibles*. Pan-American Health Organization.
- Iturriaga, J. N. (2020). *Historia de las epidemias en México*. Grijalbo.
- Jester, B. J., Uyeki, T. M., Patel, A., Koonin, L. and Jernigan, D. B. (2018). 100 years of medical countermeasures and pandemic influenza preparedness. *American Journal of Public Health*, 108(11). <https://doi.org/10.2105/AJPH.2018.304586>
- Johnson, N. and Mueller, J. (2002). Updating the accounts: global mortality of the 1918-1920 “Spanish” influenza pandemic. *Bulletin of the History of Medicine*, 76(1). <https://doi.org/10.1353/bhm.2002.0022>
- Khan, U., Mehta, R., Arif, M. A. and Lakhani, O. J. (2020). Pandemics of the past: a narrative review. *The Journal of the Pakistan Medical Association*, 70(5).
- Ladurie, E. L. R. (1989). Un concepto: la unificación microbiana del mundo (siglos XIV al XVII). *Historias* (21).
- León, A. (2020). Redes de cooperación y solidaridad ante la contingencia por el COVID-19. In C. Medel Palma, G. R. Jiménez Bustos, A. Rodríguez Nava and R. Martínez Rojas Rustrián (Coords.), *México ante el COVID-19: acciones y retos*. Chamber of Deputies and Metropolitan Autonomous University.
- Lima, E. E. C., Vilela, E. A., Peralta, A., Rocha, M., Queiroz, B. L., Gonzaga, M. R., Piscoya-Díaz, M., Martínez-Folgar, K., García-Guerrero, V. M. and Freire, F. H. M. A. (2021). Investigating regional excess mortality during 2020 COVID-19 pandemic in selected Latin American countries. *Genus*, 77(1). <https://doi.org/10.1186/s41118-021-00139-1>
- Livi Bacci, M. (2006). *Los estragos de la conquista: quebranto y declive de los indios de América*. Crítica.
- Livi Bacci, M. (2012). *Historia mínima de la población mundial*. Ariel.
- Lome-Hurtado, A. and Soto-Pérez, M. (2025). Modelling the joint association of socio-economic disadvantage, diabetes, and obesity on COVID-19 mortality in Greater Mexico City. *Scientific Reports*, 15. <https://doi.org/10.1038/s41598-025-08615-w>
- Macip, S. (2020). *Las grandes epidemias modernas: la lucha de la humanidad contra los enemigos invisibles*. Ediciones Destino.
- Malvido, E. (1982). Efectos de las epidemias y las hambrunas en la población colonial de México (1520-1810). In E. Florescano and E. Malvido (Comps.), *Ensayos sobre la historia de las epidemias en México*, 1. Mexican Social Security Institute.
- Márquez, A. (2013). *La gripe española en México: impacto y respuestas sociales (1918–1920)* [Unpublished manuscript]. National Autonomous University of Mexico.

- Márquez, L. (2013). Efectos demográficos de la pandemia de influenza en 1918-1920 a escala mundial. In A. Molina del Villar, L. Márquez Morfín and C. P. Pardo Hernández (Eds.), *El miedo a morir. Endemias, epidemias y pandemias en México: análisis de larga duración*. Centre for Research and Advanced Studies in Social Anthropology.
- Márquez Morfín, L. (1994). *La desigualdad ante la muerte en la ciudad de México: el tifo y el cólera (1813 y 1833)*. Siglo XXI Editores.
- Martín, P. (2021). *La guerra eterna: grandes pandemias de la historia*. Galaxia Gutenberg.
- McCaa, R. (1995). Spanish and Nahuatl views on smallpox and demographic catastrophe in Mexico. *The Journal of Interdisciplinary History*, 25(3). <https://doi.org/10.2307/205693>
- McKeown, T. (1989). El camino hacia la salud: prioridades en la investigación. *Boletín de la Oficina Sanitaria Panamericana*, 107(3). <https://iris.paho.org/bitstream/handle/10665.2/17690/v107n3p264.pdf>
- McNeill, J. R. and McNeill, W. H. (2004). *Las redes humanas: una historia global del mundo*. Crítica.
- McNeill, W. H. (1984). *Plagas y pueblos*. Siglo XXI Editores.
- Mendoza Ramírez, L. Q. X. and González Gutiérrez, J. (2021). Tendencias y determinantes de los contagios y muertes asociadas al virus SARS-CoV-2 en la Zona Metropolitana de la Ciudad de México durante 2020. *Contraste Regional*, 9(18).
- Ministry of Health of Mexico. (2020a, 13 April). *Sector salud suscribe convenio con hospitales privados para hacer frente a la pandemia de COVID-19*. <https://www.gob.mx/salud/prensa/105-sector-salud-suscribe-convenio-con-hospitales-privados-para-hacer-frente-a-la-pandemia-de-covid-19>
- Ministry of Health of Mexico. (2020b). *Sistema de Información de la Red IRAG*. <https://www.gits.igg.unam.mx/red-irag-dashboard/reviewHome>
- Ministry of Health of Mexico. (2023). *Plan de gestión a largo plazo para el control de la COVID-19*. <https://coronavirus.gob.mx/wp-content/uploads/2023/06/2023.06.08-Plan-LP-COVID.pdf>
- Ministry of the Interior of Mexico. (2023, 29 May). Decreto por el que se declara terminada la acción extraordinaria en materia de salubridad general que tuvo por objeto prevenir, controlar y mitigar la enfermedad causada por el virus SARS-CoV-2 (COVID-19). *Diario Oficial de la Federación*.
- Molina del Villar, A. (2024). *Historia mínima de las epidemias en México*. El Colegio de México.
- Molina del Villar, A., Ramírez, C. and Canales, P. (2020). *Epidemias en la historia de México: impactos, respuestas sociales y políticas sanitarias* [Unpublished Manuscript]. Autonomous University of the State of Morelos.
- Molina-Torres, R., Nolasco-Jáuregui, O., Rodríguez-Torres, E. E., Itzá-Ortiz, B. A. and Quezada-Téllez, L. A. (2021). A comparative analysis of urban development, economic level, and COVID-19 cases in Mexico City. *Journal of Urban Management*, 10(3). <https://doi.org/10.1016/j.jum.2021.06.007>
- Moreno-Estrada, A., Gignoux, C. R., Fernández-López, J. C., Zakharia, F., Sikora, M., Contreras, A. V., Acuña-Alonzo, V., Sandoval, K., Eng, C., Romero-Hidalgo, S., Ortiz-Tello, P., Robles, V., Kenny, E. E., Nuño-Arana, I., Barquera-Lozano, R., Macín-Pérez, G., Granados-Arriola, J., Huntsman, S., Galanter, J. M., ... Bustamante, C. D. (2021). The genetics of Mexico recapitulates Native American substructure and affects biomedical traits. *Science*, 344(6189). <https://doi.org/10.1126/science.1251688>
- Morens, D. M. and Fauci, A. S. (2007). The 1918 influenza pandemic: insights for the 21st century. *The Journal of Infectious Diseases*, 195(7). <https://doi.org/10.1086/511989>
- Morens, D. M. and Taubenberger, J. K. (2018). The mother of all pandemics is 100 years old (and going strong)! *American Journal of Public Health*, 108(11). <https://doi.org/10.2105/AJPH.2018.304631>
- National Population Council. (2021, 4 October). *Índices de marginación 2020: Conoce los índices de marginación por entidad federativa, municipio, localidad y urbana, con base en el Censo de Población y Vivienda 2020*. <https://www.gob.mx/conapo/documentos/indices-de-marginacion-2020-284372>

- Ordorica-Mellado, M. (2021). Demografía y SARS-CoV-2. *Papeles de Población*, 27(107). <http://dx.doi.org/10.22185/24487147.2021.107.03>
- Osterholm, M. T. and Olshaker, M. (2020). *La amenaza más letal: nuestra guerra contra las pandemias y cómo evitar la próxima*. Planeta.
- Piret, J. and Boivin, G. (2021). Pandemics throughout history. *Frontiers in Microbiology*, 11. <https://doi.org/10.3389/fmicb.2020.631736>
- Quiroga, S. (2021, 19 May). La paradoja del exceso de mortalidad por COVID-19. *Gaceta Médica*. <https://gacetamedica.com/opinion/la-contra/la-paradoja-del-exceso-de-mortalidad-por-covid-19>
- Schwartz, J. L. (2018). The Spanish flu, epidemics, and the turn to biomedical responses. *American Journal of Public Health*, 108(11). <https://doi.org/10.2105/AJPH.2018.304581>
- Short, K. R., Kedzierska, K. and van de Sandt, C. E. (2018). Back to the future: lessons learned from the 1918 influenza pandemic. *Frontiers in Cellular and Infection Microbiology*, 8(343). <http://doi.org/10.3389/fcimb.2018.00343>
- Silva, E., Islas-Camargo, A. and Guerrero, V. M. (2022). Exceso de mortalidad preliminar medido a través de la esperanza de vida temporal en México tras la pandemia de Covid-19 en 2020. *Papeles de Población*, 28(113).
- Silva, E., Ortiz, B. and Carrasco, E. (n.d.). *Disaggregation of life expectancy in Mexico from state to municipal level from 1990 to 2020*. [https://rpubs.com/SilvaE\\_OrtizB\\_CarrascoE](https://rpubs.com/SilvaE_OrtizB_CarrascoE)
- Silva, E., Ortiz, B. and Carrasco, E. (2024). Desagregación de la esperanza de vida en México desde el nivel estatal hasta el municipal y sus respectivas visualizaciones, 1990-2020. *Notas de Población*. (117) (LC/PUB.2023/28-P). Economic Commission for Latin America and the Caribbean.
- Suzuki, A. (2011). Smallpox and the epidemiological heritage of modern Japan: towards a total history. *Medical History*, 55(3). <https://doi.org/10.1017/S0025727300005329>
- Treskova-Schwarzbach, M., Haas, L., Reda, S., Pilic, A., Borodova, A., Karimi, K., Koch, J., Nygren, T., Scholz, S., Schönfeld, V., Vygen-Bonnet, S. Wichmann, O. and Harder, T. (2021). Pre-existing health conditions and severe COVID-19 outcomes: an umbrella review approach and meta-analysis of global evidence. *BMC Medicine*, 19(212). <https://doi.org/10.1186/s12916-021-02058-6>
- Valdés, R. (2010). La viruela desde el punto de vista médico. In C. Cramaussel (Ed.), *El impacto demográfico de la viruela en México de la época colonial al siglo XX. La viruela antes de la introducción de la vacuna. Volumen 1*. El Colegio de Michoacán.
- World Health Organization. (2025, 27 June). *Pandemic prevention, preparedness and response agreement*. <https://www.who.int/news-room/questions-and-answers/item/pandemic-prevention-preparedness-and-response-agreement>
- Worobey, M., Han, G. Z. and Rambaut, A. (2014). Genesis and pathogenesis of the 1918 pandemic H1N1 influenza A virus. *Proceedings of the National Academy of Sciences*, 111(22). <https://doi.org/10.1073/pnas.1324197111>
- Zazueta-Borboa, J. D., Vázquez-Castillo, P., Gargiulo, M. and Aburto, J. M. (2025). The impact of violence and COVID-19 on Mexico's life-expectancy losses and recent bounce-back, 2015–22. *International Journal of Epidemiology*, 54(3). <https://doi.org/10.1093/ije/dyaf034>
- Ziccardi, A. (2020). Las grandes regiones urbanas y el distanciamiento social impuesto por el COVID-19. *Astrolabio Nueva Época*. (25). <https://dialnet.unirioja.es/servlet/articulo?codigo=7559944>