

Marcela Virginia Santana Juárez

Mexico Distribution of COVID-19 in Mexico and obesity comorbidities

Abstract

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, began in China in December 2019. The World Health Organization (WHO) declared it a pandemic on March 11, 2020. In Mexico, the first cases were registered in February 2020. On December 31st, 2021, three epidemic waves or peaks were registered, when some cases and deaths had a differentiated space-time behavior in the national territory, in which comorbidities, as one of the socio-spatial conditioning factors, also had an influence. The objective of this work is to analyze morbidity and mortality due to SARS-CoV-2, caused by the COVID-19 disease, with obesity comorbidities: high blood pressure, diabetes, obesity, and cardiovascular disease, accumulated from the years 2020 and 2021. Methodology. For this research, a literature review was carried out on the role of comorbidities in deaths from COVID-19. The universe of study is Mexico. The spatial disaggregation scale is at the level of the federal entity or state-owned, with 32 spots. The sources of information are the Daily Technical Communications of the COVID-19 from the Government of Mexico; the Ministry of Health; the General Directorate of Epidemiology (DGE); information from the National Institute of Statistics and Geography (INEG), as well as information from the *Geosalud México* site. The analysis methods are the implementation of a geographic database, at the state-owned level, from which tables, maps and the generation of indicators (absolute values, percentages and ratio) were prepared, as well as thematic cartography using GIS software.

Keywords: COVID-19, comorbidities, spatial distribution.

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Introduction

Epidemics and pandemics are ancient phenomena that have always accompanied humanity. The COVID-19 pandemic started in late 2019, in Asia. The first outbreak of this disease began in the industrial city of Wuhan, Hubei province, China,

on December 10th, 2019, on the banks of the Yangtze River, a disease that the World Health Organization (WHO) declared a pandemic on March 11th, 2020.

The spatial distribution was presented in a differentiated way in the world territory, in the regions and in the countries, due to various epidemiological, socio-economic, political, and cultural factors, among others.

By December 2021, worldwide, 287,910,417 cases and 5,434,990 total deaths were registered. The countries with the highest values were: the United States (53,506,483 cases and 816,686 deaths), Brazil (22,277,239 cases and 618,984 deaths), Argentina (5,606,745 cases and 117,146 deaths), Colombia (5,147,039 cases and 129,901 deaths), and Mexico (3,969,686 cases and 299,285 deaths), among others (Johns Hopkins University, 2021).

58.2% of the world population received at least one dose of the anti-COVID-19 vaccine. 9.15 billion doses were administered worldwide and 32.09 million each day. However, only 8.5% of people in low-income countries received at least one dose (Our world in data, 2021), so access to vaccines was uneven.

In Mexico, the first cases were registered in February 2020, according to the Mexican Daily Technical Report COVID-19, published by the Ministry of Health of the Government of Mexico. By December 31st, 2021, a total of 3,979,723 cases (by residence entity) and 299,428 accumulated deaths (by medical unit entity) were reported. These situations influenced several conditioning factors, one of them being the comorbidities of obesity: hypertension, diabetes mellitus, and cardiovascular diseases, among others, which have their origin in the unhealthy lifestyles of the population. The percentage of vaccination was 63% (Our world in data, December 2021).

In the national territory, the distribution of accumulated cases and deaths show great contrasts among the 31 states and Mexico City, according to both the various socio-spatial conditions and the comorbidities of obesity.

It is important to know what the population gets sick of and dies from, where, why and to what extent, with the purpose of generating geographical knowledge that may improve levels of health and well-being, in accordance with the United Nations agenda on sustainable development goals, specifically "Health for all at all ages." Generating cartography of the territories with the most vulnerable populations is essential to provide inputs aimed at decision-making, in the proposal of strategies, policies, as well as intersectoral activities, because health is a transversal axis that has to do with people, with families, and with various sectors, such as health, food, environment, economy, transportation, education, among others.

This work aims to analyze the morbidity and mortality from SARS-CoV-2, caused by the COVID-19 disease, and the role of obesity comorbidities: high blood pressure, diabetes, obesity and cardiovascular disease, accumulated by December 31st, 2021. This research is developed through six sections: introduction, theoretical aspects, methodological aspects, results, final considerations, and references.

Theoretical support

One of the oldest backgrounds that addressed the importance of health and the environment was that developed by Hippocrates of Cos (460 BC) in his work "About

the waters, the airs and the places.” In this work, he established the characteristics that the geographical situations of Asia and Europe could exert on the disease.

The first published work of medical geography was developed by Leonhard Ludwig Finke in 1792, *Versuch einer allgemeinen medicinisch-praktischen Geographie*. Under the paradigm of determinism, he performs an analysis of the topography of diseases (Barcellos C., Buzai G. and Santana P. 2018).

Another contribution was given by Dr. John Snow, father of Epidemiology, who drew up a map of the Soho neighborhood, which is a small central sector of the City of London, during the epidemic in 1854. On the map, the dots are the cases of cholera and the crosses represent the water wells where the sick drank. Snow confirmed the hypothesis that cholera was transmitted through water and suggested closing the Broad Street well, which appeared to be the focus of the cases. With this procedure, the cases ended, so this verification served to bring down the cholera epidemics in Europe.

The rise of Medical Geography was mainly during the 19th century and the first years of the 20th century, characterized by a set of medical topographies or paleographies, carried out mostly by doctors of the time. The classical approach prioritized disease over health and went from a Hippocratic model, represented by the miasma theory, its spatial expression and medical topographies, to another typical of positivist medicine, represented by the microbial theory (Pickenhayn, 2014).

In 1933, Max Sorré published the *Annales de Géographie los Complexes patogénés et Géographie Médicale*. In 1955 he described the general principles of Medical Geography and related them to the distribution of pathogenic complexes. He highlighted an approach that consisted of showing the distribution of diseases (geography of diseases) and another regional approach, since each region is characterized by an association of endemics or epidemics, linked to geographic characteristics (Ramírez, n.d.).

Since the 1970s, an integrated analysis of the geography of health has evolved, mainly with an approach that addresses more attention to the social conditions that influence the health of populations (Tisnes, 2014).

Health Geography is a branch of Geography focused on the analysis of the health situation of the population. It has two main sub-branches for carrying out its studies: Medical Geography, for the analysis of the spatial distribution and diffusion of diseases, as well as Geography of Health Services, for the analysis of care systems (Buzai and Santana, 2020).

The current topics that are developed are vulnerability in health, poverty and health, environmental quality and health, climate and health, territory and health, health facilities and services, as well as urban and rural areas and health, where the relationship between health and the environment is addressed in a clustered manner, with various local, regional and global conditioning factors like: geographic, environmental, social, economic, cultural, political, among others.

A theoretical contribution, raised by Buzai and Santana, is related to the Socio-spatial Conditioning Factors of Health (SCFH), which are defined as conditions that influence the health situation, but do not determine it, since there is always a margin of uncertainty that arises from individual characteristics and from man's responses to health problems (Buzai and Santana, 2018). These authors state that the “spatial dimension with which it broadens the context of health could theoretically

encompass all the potential contextual conditioning factors, with a multiscale approach, from the local to the global. Beyond Biology and lifestyle, all contextual conditioning will be socio-spatial at a specific time" (Buzai and Santana, 2018).

These socio-spatial conditions have had a differential role in the expansion of the COVID-19 pandemic. Comorbidities are one of those conditions that have had a differential influence on cases and deaths from COVID-19, but do not determine them.

Comorbidities

According to the World Health Organization, comorbidity is the simultaneous occurrence of two or more diseases in the same person (WHO in Ávila, 2007).

Comorbidity can be measured in three ways: through the frequency of association between two entities or health problems, by counting the number of diseases present in an individual in a simple mathematical way or through comorbidity scales, which combine the number and severity of current diseases (Blanco et al. 2017).

According to Santana (2009a and 2009b), the causes associated with the change in mortality, morbidity and demographic patterns are associated with non-communicable diseases, that is, chronic diseases such as: cancer, heart diseases, vascular accidents, and mental disorders), among others (Santana, et al., 2014). In recent years, eating disorders and mental illnesses have been added to this trend.

Obesity is a chronic, complex and multifactorial metabolic disease, associated with a chronic inflammatory state, in which an abnormal or excessive accumulation of fat prevails and can be detrimental to health (WHO, 2020).

Obesity plays an essential role in the development of other diseases such as: type 2 diabetes mellitus (DM2), dyslipidemia, high blood pressure (HBP) and cardiovascular diseases (Carretero et al., 2020). The above then becomes comorbidity, which is defined as the simultaneous occurrence of two or more diseases in the same person (WHO in Ávila, 2007).

These situations can aggravate the situation and risk for a person who presents symptoms of COVID-19, since the person who suffers from obesity comorbidities is more likely and vulnerable to death (Santana J. 2021).

In Mexico, lifestyles are having an increasing impact on the morbidity and mortality of the population, which is reflected in the increase in obesity and chronic-degenerative diseases, such as diabetes mellitus, cancer, heart disease, as well as cardiovascular and liver diseases, among others. This situation can occur at the same time or one after the other, which means that this interaction can worsen the evolution of both (Santana, G. 2020).

Methodological support

The universe of study is the country of Mexico; the scale of analysis is by federal entity or states. It includes 32 states, including Mexico City, with a total population

of 126,014,024 people, according to data from the Population and Housing Census of the National Institute of Statistics and Geography (INEGI 2021).

The analysis methods are the implementation of geographic databases at the state level, from which tables and graphs were prepared and thematic cartography was generated through the use of GIS software, which allowed the generation of indicators of cases and deaths by COVID -19 and comorbidities like obesity, diabetes, hypertension, and cardiovascular sicknesses (absolute values, percentages, and ratio of the number of deaths among non-deceaseds per 100 inhabitants).

The sources of information are the Daily Technical Communications of the COVID-19 from the Government of Mexico, published by the Ministry of Health; information from the National Institute of Statistics and Geography (INEGI, 2021), as well as information from the *Geosalud México* site.

Variables and indicators

For the development of COVID-19 and comorbidities, two subtopics were addressed:

- The first subtopic presents an overview of the main comorbidities in the morbidity and mortality of COVID-19: number of people with comorbidities, number and percentage of deceased, number and percentage of non-deceased, as well as the indicator of the ratio of the number of deceased divided by the non-deceased per 100 inhabitants. Information metadata belongs to the place of residence.
- The second subtopic focuses on the distribution of the comorbidities selected in this research: high blood pressure, diabetes, obesity, and cardiovascular disease, together and accumulated during the 2020–2021 period, at the federal entity level. With indicators similar to the previous topic, it also includes the number of people with comorbidities, the number and percentage of deceased, the number and percentage of non-deceased and the ratio of the number of deceased divided by the non-deceased per 100 inhabitants.
- The generation of the thematic cartography of the second topic consisted in the elaboration of maps of absolute values and the indicator of the ratio for comorbidities. In the case of absolute values of the total number of people who had comorbidities, they were classified into four ranges: the very high range includes the absolute values corresponding to Mexico City and the State of Mexico (for presenting atypical data), while the rest of the data were classifications in three ranges, in equal intervals. The ratio indicator was classified into three ranges by equal intervals: high, medium and low.

Results

In Mexico, according to INEGI (2021), during the January-June 2021 period, deaths from COVID-19 were the leading cause of death, nationwide, with 145,159. It was followed by heart diseases with 113,899 deaths and diabetes mellitus with 74,418 deaths (INEGI 2022).

According to the Our World in Data site (2021), the proportion of people vaccinated against COVID-19, by December 30th, 2021, was 63%, whereas the one with a complete vaccination program was 56% and with a partial one, 7%. In this month, the increase in cases continued, but with low deaths; however, it is important to know the role of comorbidities in deaths from COVID-19, especially in the most affected territories.

Spatial distribution of positive cases and deaths accumulated by COVID-19 (2020 -2021), at the federal entity level

Considering the spatial distribution of positive cases accumulated by COVID-19 (2020 -2021), at the federal entity level, Mexico City is in the highest range in the center of the country (1,003,554 cases); in the high range is the State of Mexico (384,119 cases), Guanajuato in the center (203,986 cases) and Nuevo León in the northeast (210,212 cases). The mid-range includes nine states located in the central west, at the north of the slope of the Gulf of Mexico, as well as in the center, such as Jalisco (166,441), Puebla (126,738), Veracruz (124,876) and Sonora (123,441).

It should be highlighted that these ranges of accumulated cases contain the most important metropolitan areas, in terms of population size. In the low and very low ranges, there are 10 and 9 entities, respectively, located mainly in the south-east and north-west of Mexico, as well as some in central Mexico (Table 1 and Figure 1).

In the national territory, the accumulated deaths show great contrasts among the 31 states and Mexico City. In the very high range is Mexico City (it is the one that houses the largest metropolitan area in Mexico), with 52,811 accumulated deaths, as well as the State of Mexico with 33,095, in the center of the country.

The high range comprises five entities: Nuevo León (13,836), in the north; Jalisco (17,632) and Guanajuato (13,321) in the central west; Puebla (15,753) in the center; and Veracruz (14,799) on the slope of the Gulf of Mexico. The main metropolitan areas show high and very high ranges, according to population size.

In the middle range, there are 9 states located mainly on the northern border, such as Baja California (10,911), Sonora (9,248) and Sinaloa (9,043), as well as in the center such as Michoacán (8,054), and Hidalgo (7,779).

In the low and very low ranges, there are 8 entities, respectively, located in the northwest, south, and southeast of Mexico, such as Durango (3,093) and Chiapas (2,134) (Table 1 and Figure 1).

Table 1. México COVID-19. Positive cases and accumulated deaths per federal entity, as of December 31st, 2021

Entity	Positive cases*	Positive deaths**
Aguascalientes	39263	3117
Baja California	91570	10911
Baja California South	61831	2407

Campeche	24356	2068
Coahuila	102029	7818
Colima	33409	2229
Chiapas	23654	2134
Chihuahua	80715	8749
México city	1003554	52811
Durango	51038	3093
Guanajuato	203986	13321
Guerrero	77561	6123
Hidalgo	63429	7779
Jalisco	166441	17632
State of México	384119	33095
Michoacán	73983	8054
Morelos	50752	4914
Nayarit	34693	3016
Nuevo León	210212	13836
Oaxaca	84043	5422
Puebla	126738	15753
Querétaro	100453	5881
Quintana Roo	62066	4025
San Luis Potosí	108549	6803
Sinaloa	75641	9043
Sonora	123441	9248
Tabasco	144521	5921
Tamaulipas	104513	7360
Tlaxcala	29672	2813
Veracruz	124876	14799
Yucatán	75513	5868
Zacatecas	43102	3385
National total	3979723	299428

Notes:

*Cases per residence entity

**Deaths per medical unit entity

Source: own design based on data from INEGI and the Government of Mexico. Ministry of Health (2021) Open data. General Directorate of Epidemiology [on line] https://www.gob.mx/cms/uploads/attachment/file/689960/Comunicado_Tecnico_Diario_COVID-19_2021.12.31.pdf

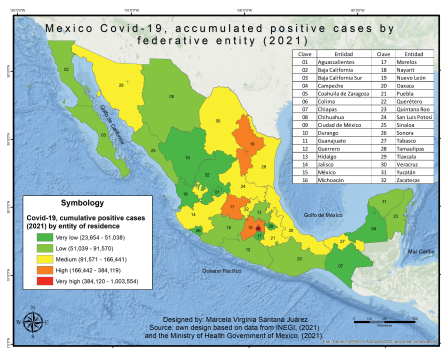


Figure 1A. México Covid-19: A. accumulated cases, (as of December 31st. 2021)

Source: own design based on data from INEGI and the Government of Mexico. Ministry of Health (2021). Open data. General Directorate of Epidemiology [on line] https://www.gob.mx/cms/uploads/attachment/file/689960/Comunicado_Tecnico_Diario_COVID-19_2021.12.31.pdf

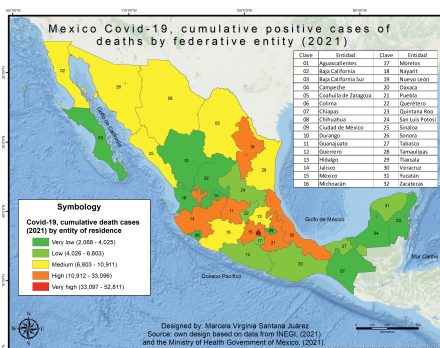


Figure 1B. México Covid-19: B. accumulated deaths (as of December 31st. 2021)

Source: own design based on data from INEGI and the Government of Mexico. Ministry of Health (2021). Open data. General Directorate of Epidemiology [on line] https://www.gob.mx/cms/uploads/attachment/file/689960/Comunicado_Tecnico_Diario_COVID-19_2021.12.31.pdf

COVID-19 and comorbidities

Main comorbidities

In Mexico, during the COVID-19 pandemic, in the years 2020 and 2021, the main accumulated comorbidities registered in patients with COVID-19 were blood pressure, with 1,396,190 people, which represents 27% of the total comorbidities, of which 88% did not die and 12% did die. 14 out of 100 people, who had this comorbidity and had COVID-19, died (Table 2).

There were 1,185,202 people with obesity, which represented 23% of all comorbidities, of which 93.5% did not die and 6.5% did die. 7 out of 100 people (7%), who had this comorbidity and had COVID-19, died. Diabetes represented 19.9% of the total comorbidities, of which 86.3% did not die and 13.7% did die. 16 out of 100 people, who had this comorbidity and had COVID-19, died.

Smoking represented 16.6% of the total comorbidities, of which 96.5% did not die and 3.5 did die. 4 out of 100 people, who had this comorbidity and had COVID-19, died.

Asthma presented 5.1% of the total comorbidities, of which 97.5% did not die and 2.5% did die. Regarding the indicator, of the ratio 3 out of 100 people, who had this comorbidity and had COVID-19, died, being the lowest of the main comorbidities in México.

Cardiovascular disease represented 2.6% of the total comorbidities, of which 84.2% did not die and 15.8% did die. 19 out of 100 people, who had this comorbidity and had COVID-19, died.

Chronic renal comorbidity represented 2.5% of all comorbidities, of which 76.9% did not die and 23.1% did die. 30 out of 100 people, who had this comorbidity

and had COVID-19, died. This situation indicates that, despite having a low value, with respect to the total of the main comorbidities, it is the highest in deaths and in the ratio, which means that it has an important role in deaths due to COVID-19.

Chronic obstructive pulmonary disease (COPD) represented 1.8% of the total of the main comorbidities, of which 80.2% did not die and 19.8% did die. 25 out of 100 people, who had this comorbidity and had COVID-19, died. This situation indicates that, despite having a low value, with respect to the total of the main comorbidities, it is one of the highest in deaths and in the ratio, which means that it has an important role in deaths due to COVID-19.

Immunosuppression indicated 1.5% of the total comorbidities, of which 86.9% did not die and 13.1% did die. 15 out of 100 people, who had this comorbidity and had COVID-19, died.

Therefore, the comorbidities registered in patients who fell ill with COVID-19 affected deaths differently, with the comorbidities of chronic kidney disease, COPD and cardiovascular disease, having the highest percentages of deaths. Those that had a lower incidence were diabetes, immunosuppression, and blood pressure, while obesity, smoking, and asthma had low percentages (table 2).

Table 2. Mexico, COVID-19, main comorbidities: deceased and non-deceased, 2020- 2021

Comorbidity	Total	%	Non-deceased	%	Deceased	%	Ratio
Blood pressure	1396190	27	1228281	88.0	167909	12.0	13.7
Obesity	1185202	23	1108364	93.5	76838	6.5	6.9
Diabetes	1029723	19.9	888766	86.3	140957	13.7	15.9
Smoking	857665	16.6	827626	96.5	30039	3.5	3.6
Asthma	261218	5.1	254576	97.5	6642	2.5	2.6
Cardiovascular disease	133312	2.6	112295	84.2	21017	15.8	18.7
Chronic kidney disease	128907	2.5	99148	76.9	29759	23.1	30.0
COPD	91582	1.8	73417	80.2	18165	19.8	24.7
Immunosuppression	78764	1.5	68479	86.9	10285	13.1	15.0
México	5162563	100	4660952	90.3	501611	9.7	10.8

*ratio of the number of deceased divided by the number of non-deceased per 100 inhabitants. (2020–2021)

Metadata: per residence entity.

Source: own design based on data from the Government of Mexico. General Directorate of Epidemiology. Open data. <https://www.gob.mx/salud/documentos/datos-abiertos-152127>

Comorbidity of blood pressure, diabetes, obesity and cardiovascular disease (2020 – 2021)

In Mexico, as of December 31st, 2021, 13,719 people were registered who had comorbidities of high blood pressure, diabetes, obesity and cardiovascular disease, of which 10,610 did not die (77.3%) and 3,109 did die (22.7%). 29 out of 100

people, who had these comorbidities and had COVID-19, died, which is a significant indicator to be taken into consideration for proposals that reduce such comorbidities (Table 3 and Figure 2).

The spatial behavior of these comorbidities is differentiated in each of the entities. In the very high range are Mexico City and the State of Mexico, in the center of the country, where people with these comorbidities were significantly concentrated, with 2,447 and 1,133 respectively, of which 13.9% and 23.7% died, in each of these states. 16 and 31 out of 100 people, who had co-morbidities and had COVID, correspondingly died in these places.

Although the largest number of people with these comorbidities occurred in Mexico City, less people died there compared to the ones in the State of Mexico; fewer people with comorbidities were found in Mexico City, but more people died. This situation indicates that, where there was the largest number of people who had higher values of comorbidities of blood pressure, diabetes, obesity and/or cardiovascular disease, the highest values of deaths did not precisely occurred, since other conditioning factors, such as access to medical services, were present.

In the high range (613 – 996) there were four states: Jalisco, Nuevo León, Baja California and Guanajuato, located in the north and center west. In this range, Baja California registered the highest number of deaths, with 30.4% of the state total of people with these comorbidities. 43.8 out of every 100 people, who had these comorbidities and had COVID-19, died, so this federal entity recorded its own behavior. The remaining entities registered percentages between 23% and 26% of deaths. Between 30 and 35 out of every 100 people, who had these comorbidities and had COVID-19, died, which is a significant figure since practically about a third of the population with these comorbidities, presenting COVID-19, died.

In the middle range (from 307 to 612 people who had high blood pressure, diabetes, obesity and cardiovascular disease), there are 9 states: in the north and northwest are the states of Coahuila de Zaragoza and Sinaloa. In the first case, of the total number of people with these comorbidities, 18.1% died. 22 out of 100 people, who had these comorbidities and who had COVID-19, died. In the second case, of the total number of people with these comorbidities, 34% died. 51 out of 100 people, who had these comorbidities and had COVID-19, died. The rest of the entities are distributed mainly in the north and central east of Mexico, as well as the state of Michoacán, in the center.

In the low range (from 78 – to 306) there are 17 states. Nayarit, located to the northwest, recorded the highest values. Of the total number of people with these comorbidities, 30% died. 43 out of 100 people, who had these comorbidities and had COVID-19, died. The entities with the lowest values were Morelos (in the center of Mexico) and Chiapas (in the south), which registered 216 and 100 people who had blood pressure, diabetes, obesity and cardiovascular diseases, respectively, of which 12% died. 14 out of 100 people, who had these comorbidities and had COVID-19, died. The rest of the states are distributed mainly in the south and southeast, with some states in the center and others in the northwest of Mexico.

Table 3. México. COVID-19: people who suffered blood pressure, diabetes, obesity and cardiovascular diseases (2020–2021)

Entity	Non-deceased	Deceased	Total	Non-deceased (%)	Deceased (%)	Ratio of deceased divided by non-deceased per 100 inhabitants
Aguascalientes	158	37	195	81	19	23.4
Baja California	585	256	841	70	30	43.8
Baja California Sur	194	33	227	85	15	17.0
Campeche	71	21	92	77	23	29.6
Coahuila de Zaragoza	335	74	409	82	18	22.1
Colima	78	31	109	72	28	39.7
Chiapas	88	12	100	88	12	13.6
Chihuahua	325	112	437	74	26	34.5
México city	2107	340	2447	86	14	16.1
Durango	136	27	163	83	17	19.9
Guanajuato	495	151	646	77	23	30.5
Guerrero	135	43	178	76	24	31.9
Hidalgo	157	46	203	77	23	29.3
Jalisco	735	261	996	74	26	35.5
State of México	865	268	1133	76	24	31.0
Michoacán de Ocampo	310	111	421	74	26	35.8
Morelos	190	26	216	88	12	13.7
Nayarit	91	39	130	70	30	42.9
Nuevo León	689	216	905	76	24	31.3
Oaxaca	124	39	163	76	24	31.5
Puebla	233	106	339	69	31	45.5
Querétaro	159	41	200	80	21	25.8
Quintana Roo	92	34	126	73	27	37.0
San Luis Potosí	294	73	367	80	20	24.8
Sinaloa	328	169	497	66	34	51.5
Sonora	406	168	574	71	29	41.4
Tabasco	241	54	295	82	18	22.4
Tamaulipas	388	118	506	77	23	30.4
Tlaxcala	63	15	78	81	19	23.8

Veracruz de Ignacio de la Llave	246	108	354	69	31	43.9
Yucatán	112	37	149	75	25	33.0
Zacatecas	180	43	223	81	19	23.9
México	10610	3109	13719	77	23	29.3

*ratio of the deceased divided by the number of non-deceased per 100 inhabitants (2020–2021)

Metadatos: * Per residence entity

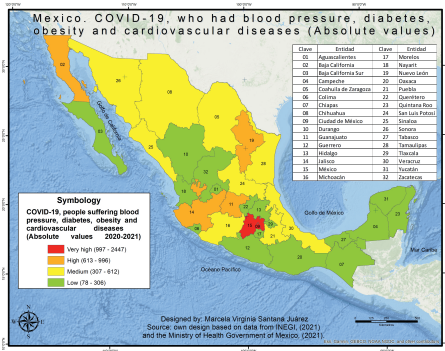


Figure 2A. Mexico. COVID-19, people suffering blood pressure, diabetes, obesity and cardiovascular diseases (2020–2021): A. Absolute values.

Source: own design based on data from INEGI and the Government of Mexico. Ministry of Health (2021). Open data. General Directorate of Epidemiology [on line] https://www.gob.mx/cms/uploads/attachment/file/689960/Comunicado_Tecnico_Diario_COVID-19_2021.12.31.pdf

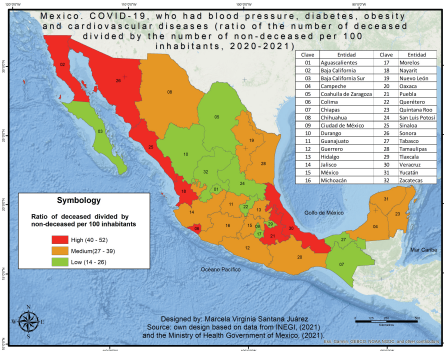


Figure 2B. Mexico. COVID-19, people suffering blood pressure, diabetes, obesity and cardiovascular diseases (2020–2021): B. Ratio of the number of deceased divided by the number of non-deceased per 100 inhabitants.

Source: own design based on data from INEGI and the Government of Mexico. Ministry of Health (2021). Open data. General Directorate of Epidemiology [on line] https://www.gob.mx/cms/uploads/attachment/file/689960/Comunicado_Tecnico_Diario_COVID-19_2021.12.31.pdf

Final considerations

Two years after the COVID-19 pandemic in Mexico, obesity comorbidities had an important differentiated influence by type of comorbidity and at spatial level, in both cases and deaths from COVID-19.

In Mexico, in terms of absolute values, of the main comorbidities suffered by patients who fell ill with COVID-19, during the 2020–2021 period, blood pressure represented the comorbidity with the highest values, with 27% of the total of them, followed by obesity, with 23%, and diabetes, with 19.9%, so these were the most common. In lower percentages, the remaining ones were smoking, with 16.6%, asthma, with 5.1%, and cardiovascular diseases, with 2.6%, among others.

In terms of the ratio of the number of deceased divided by the number of non-deceased, the main comorbidities suffered by patients who fell ill with COVID-19,

during the 2020–2021 period, were chronic kidney disease, chronic obstructive pulmonary disease, and cardiovascular disease, with ratios of 30, 25, and 19 out of 100 people, respectively, who had comorbidity and had COVID-19, died. Those that had a moderate or medium influence on deaths from COVID-19 were diabetes, immunosuppression, and high blood pressure, while obesity, smoking, and asthma had low values. Therefore, each comorbidity had a different impact on deaths from COVID-19.

Some researches indicate that, in Mexico, the presence of chronic degenerative diseases is a risk factor for morbidity and mortality from COVID-19, the most common being blood pressure, diabetes, obesity, and cardiovascular diseases (Estefanía et al., 2021).

In Mexico, during 2020 and 2021, the effects of obesity comorbidities, addressed in this research, were: high blood pressure, obesity, diabetes and cardiovascular disease, which has been significant and differentiated in morbidity and mortality from COVID-19. Some researches also indicate that each comorbidity had a different influence on people who fell ill with COVID-19 (Santana J. 2021); however, when these were presented together, the impact on deaths was more significant. Also, in Mexico, 13,719 people who had comorbidities of blood pressure, diabetes, obesity and cardiovascular disease were registered, of which 10,610 did not die (77.3%), but 3,109 (22.7%) did. 29 out of 100 people, who had all these comorbidities and had COVID-19, died, which is a significant indicator in deaths from COVID-19.

The spatial behavior of people with comorbidities of high blood pressure, obesity, diabetes and cardiovascular disease, who fell ill with COVID-19, was heterogeneous in the territory of Mexico, which constituted one of the determining factors that have influenced morbidity and mortality from COVID-19. 19, differently.

Chronic kidney disease, cardiovascular disease, blood pressure and diabetes mellitus are among the comorbidities that imply the greatest risk, for a severe clinical presentation in patients with COVID-19, followed in importance by immunodeficiencies, smoking, chronic respiratory diseases and chronic liver diseases (Plasencia-Urizarri et al., 2020).

In relation to the total number of people who suffered from all these comorbidities, in absolute terms, the very high ones were located in the center of Mexico (Mexico City and State of Mexico); the high ones, in the central west and north of Mexico, while those with mean values were in the center and north of Mexico. The low ones were mainly in the south and southeast of Mexico, as well as in the center and northwest, for which they were registered mainly in entities with a predominantly urban population.

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has presented a global health crisis that has caused many illnesses and deaths, mainly in the population with blood pressure and metabolic abnormalities (Hernández et al, 2021).

Regarding the ratio of the deceased among the non-deceased, the states with the highest values are in the central east (Puebla and Veracruz), as well as in the northwest (Baja California, Sonora, Sinaloa, Nayarit and Colima and southwest of Mexico). While the low values were recorded in entities in the north and south east of Mexico.

During the 2020–2021 period, both in morbidity and mortality from COVID-19, comorbidities in Mexico had a differential influence as a socio-spatial conditioning factor, not as a determinant, a situation that explains why people with obesity did not die when suffering from the disease by COVID-19; those people who suffered from cardiovascular diseases did die, as well as when they suffered from all the comorbidities at the same time and died from COVID-19, to name a few realities.

Given this situation, it is important to suggest policies and strategies aimed at reducing the comorbidities of obesity and chronic diseases, such as heart diseases, diabetes mellitus, malignant tumors, liver diseases, cerebrovascular diseases, among others, to increase the resilience of the population to phenomena such as pandemics.

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Biographical note on the author: Ph.D in Geography Marcela Virginia Santana Juárez, Professor & Researcher in the Faculty of Geography, UAEM. México. Ph.D in Geography (Pass with merit) at UNAM. Master Degree in Urban and Regional Planning at UAEM. B.Sc. in Geography at UAEM. Expert in automated cartography. She was given the Benito Juárez Medal of Merit, awarded by the Mexican Society of Geography and Statistics, June 2013. She received the Jerzy Kondracki Medal awarded by the Faculty of Geography and Regional Studies of the University of Warsaw on March 22, 2022. She belongs to the National System of Researchers, Level I. Her research line is Geography, Management and Sustainable Management of the Territory, Geography of Health, Urban Geography and geographical thought. She has participated in projects at UNAM, for instance: “Atlas of health in Mexico. Bicentennial of Independence, Centennial of the Revolution.” CONACYT funded research project: Geographical health and risk observatory in Mexico, and others projects.