

MILLIMAN REPORT

# The effect of comorbidities on COVID-19 fatality rates

Based on an analysis of COVID-19  
infected population in Mexico

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## Introduction

Several months into the pandemic, COVID-19 continues to be an issue of concern in the life and health insurance industry. Although the extraordinary initial uncertainty has been reduced, daily contracting, rate setting, valuation and projections are still impacted by the evolution of the pandemic. This is particularly relevant in countries or regions where the infection rate is either increasing, stabilized at high levels, or vulnerable to a second wave. Additionally, there is a risk that, despite an eventual vaccination, the virus will not be eradicated and becomes endemic.

At Milliman, we are assessing information that allows us to better understand the lethality of COVID-19. Many studies have uncovered risk factors that increase fatality. However, many of these studies focus on clinical aspects of COVID-19 that are not directly applicable to actuarial analyses, or provide data with insufficient granularity to quantify the risk associated with comorbidities in the insured population.

The government of Mexico, through its Ministry of Health, has made public statistics of the registered COVID-19 infected cases, including the comorbidities exhibited by the individuals at the time of reporting the possible infection by COVID-19. Milliman used these data to analyse the increase in the mortality rate produced by COVID-19 by gender, age, and the presence of comorbidities. The data underlying this report was a subset of data released by the Ministry of Health on July 27, 2020 and includes all registered and testing-confirmed COVID-19 infected cases with a date of symptoms onset prior to June 28, 2020 and deaths registered through July 27, 2020 for the same group of cases. We refer to this data throughout this report as “the Database.”

The comorbidities reported in this public information are, in order of prevalence:

- Hypertension
- Obesity
- Diabetes
- Smoking
- Other pathologies
- Asthma
- Cardiovascular disease
- Chronic kidney failure
- COPD (chronic obstructive pulmonary disease)
- Immunosuppression

Given the size of the sample and its granularity, this analysis makes it possible to establish a relationship between the risk of death among individuals with a confirmed COVID-19 infection and their comorbidities, by age and gender. The conclusions of this paper are largely consistent with other studies<sup>1</sup>.

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<sup>1</sup> See section “Comparison with other studies”

## Executive summary

### SCOPE AND SIGNIFICANCE OF COMORBIDITIES IN THE FATALITY RATE OF COVID-19 INDIVIDUALS

- According to the Database, 68.7% of deaths related to COVID-19 had a relevant associated comorbidity. Among those 20 to 70 years of age (roughly the age range of active workers) this percentage was very similar, at 66.9%
- The consideration of comorbidities is relevant for the adoption of any underwriting policy or potential quantification of risk.

### CASE FATALITY RATE OF COVID-19 AMONG INDIVIDUALS WITHOUT COMORBID CONDITIONS

- The population that did not exhibit comorbidities had, according to the Database, a much lower Case Fatality Rate (CFR) due to COVID-19. The lowest CFR for any cohort studied was 0.4% (females aged 20 to 29 with no comorbidities) and it was less than half the CFR of females aged 20 to 29 with or without comorbidities (0.9%).
- The population under 15 years old presented a significantly higher CFR than those aged 15 to 19 and 20 to 29, particularly among males.
- CFR, as expected, significantly increased with age, with the exception noted above.
- The CFR of the male population was higher than that of the female population among all age cohorts with a sufficient statistical sample. These results are consistent with several other studies.<sup>2</sup>
- For life insurers, the data suggests that if insured lives do not present the comorbidities, the effect of COVID-19 on mortality will be limited.

### RELEVANT COMORBIDITIES

- Seven out of nine comorbidities captured in this database had an impact on CFR. The impact level is shown below:
 

<ul style="list-style-type: none"> <li>– <b>High impact:</b></li> <li>– Chronic kidney failure</li> <li>– Diabetes</li> <li>– COPD</li> <li>– Immunosuppression</li> </ul>	<ul style="list-style-type: none"> <li>– <b>Medium impact:</b></li> <li>– Obesity</li> <li>– Hypertension</li> <li>– Cardiovascular disease</li> </ul>
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- Although excluded in the Database, other studies suggest that at least the following other comorbidities may also have an effect on the lethality of COVID-19:<sup>2</sup>
  - Neurological / neurodevelopmental diseases / intellectual disability
  - Tuberculosis
  - Liver diseases
  - Other kidney diseases
  - Hemiplegia or paraplegia
  - Peptic ulcer disease
  - Dementia
- Note that the groups of comorbidities reported in the Database represent broad classifications of diseases in different stages, which, when considered individually, could have very different impacts on CFR. As an example, the Database does not distinguish between type I and type II diabetes.
- We were unable to specify cancer as a comorbidity independent of immunosuppression. The Database included an indication for immunosuppression, although this condition may be related to a wide variety of causes. On the other hand, other studies<sup>2</sup> we reviewed included cancer as a comorbidity but without an indication for immunosuppression.
- Smoking as a stand-alone risk factor did not exhibit an increase in the CFR. However, we observed an increase in the CFR of diabetic and hypertensive individuals who were also smokers. We do not consider this observation to be conclusive.
- Similarly, asthma did not exhibit an increase in the CFR unless it was combined with other comorbidities.

<sup>2</sup> See section "Comparison with other studies"

**ASSESSMENT OF THE ADDITIONAL MORTALITY RISK ASSOCIATED WITH COMORBIDITIES**

- Because several of the comorbidities studied were more prevalent in advanced ages, there is a correlation between fatality and age that must be adjusted when assessing the increased risk of comorbidities. This analysis is included in the chapter corresponding to each comorbidity.
- The additional CFR for all of the comorbidities analysed was relatively stable across age bands and gender cohorts when measured as excess CFR in absolute values (that is, as a difference in CFR) but not when measured in relative terms (that is, as a percentage of the CFR of the population without comorbidities). For example, diabetes increased the CFR by 800% for males aged 20 to 29 and by 11% for ages 70 to 79 when analysing it in relative values. If we review those same cohorts but using absolute values instead, the excess CFR ranged by 4.7% and 9.7% in those same age ranges when measured as a difference in CFR for COVID-19 individuals with and without diabetes.
- Although, as mentioned above, the excess CFR due to comorbidities was relatively stable across cohorts, it showed significant differences for some age bands that should be considered in the use of this information. The age curve was not homogeneous and differed depending on the comorbidity. Details can be found in the respective chapters.
- The impact of comorbidities also varied by gender. For some comorbidities, the impact in CFR was higher among men (e.g. immunosuppression), but for others, the impact was higher among women (e.g. COPD).
- The relative increase in CFR (measured as the CFR of individuals with comorbid conditions relative to the CFR of individuals without comorbidities) decreased sharply at ages over 70 for many of the conditions analysed. Following the example above, the CFR in the group with diabetes and no other comorbidities for males between 70 to 80 was only 11% higher than the CFR in the group without comorbidities. This is because the excess CFR, which was relatively stable, is compared to CFR of population without comorbidities that increased sharply with age for COVID-19 individuals.
- The data suggested that the impact of certain combinations of comorbidities was significant. Also, some combinations of comorbidities were more significant than others. Therefore, when assessing the relative risk of the registered COVID-19 infected cases, it is important to consider the impact of the various combinations of comorbidities.
- One example of the aforementioned impact involving combinations of comorbidities is that when diabetes was present, the impact of other comorbidities such as hypertension and / or obesity increased the CFR

Relevant information for these combined analyses is presented in each chapter.

## Limitations

Some limitations that apply to this study have also been identified in different international studies. Among them:

- Limitations in the ability to register all cases of COVID-19 due to:
  - Extraordinarily high number of asymptomatic cases of COVID-19.
  - High number of cases with mild symptoms that may be erroneously attributed to other diseases, and therefore not reported.
  - Limitations on the availability of testing.
  - Limitations in the procedures for collecting and validating data across a large geographic area.
- Limitations on the possibility of registering all deaths derived from COVID-19 due to, among other reasons:
  - Limitations in the identification of COVID-19 as the main cause of death.
  - Limitations in procedures for collecting and validating data in an extended geographic region.
  - Recording of COVID-19 as a secondary cause of death on death certificates.

Note that studies carried out in different countries suggest that the number of deaths recorded in Mexico during the pandemic was unusually high in relation to the expected number of deaths in the general population, based on seasonal historical experience, and that the difference exceeded reported deaths related to COVID-19. These other analyses also suggest there may be a significant under-counting of deaths related to COVID-19 in the Database.

It should be noted that the groups of comorbidities reported in the Database represent broad classifications of diseases in different stages, which, when considered individually, could have very different impacts on CFR.

As robust as the data was, when viewing results by combinations of variables such as age, gender and different combinations of comorbidities, results were not always credible.

Statistics presented here, or any other inference made on the same information, are intended to serve as a starting point for the analysis of CFR of COVID-19. We recommend readers make adjustments, where thought to be appropriate, when using this data or the conclusions of our report. In particular, any adjustments to these figures should take into account the availability and volume of testing as well as positivity rates in each geography.

### LIMITATIONS RELATED TO THE MEASUREMENT OF CFR

Calculated CFR in Mexico is among the highest in the world. Mexico has low testing rates and, according to some sources, testing practices exclude a high portion of individuals without life-threatening symptoms. These low testing rates likely contributed to the high CFR observed in Mexico and reflected in this analysis of the Database.

The results from this study should be interpreted in light of the high CFR in Mexico, which is likely influenced by the individuals who are tested and therefore part of the Database, as compared to the CFR and testing practices in other populations.

### LIMITATIONS RELATED TO THE DATA SOURCE

Milliman has not modified or adjusted the information contained in the Database. The accuracy and quality of the conclusions made in this report depend on the accuracy and quality of the data underlying the analysis.

We understand that the information indicating the presence of a comorbidity or condition in the Database is self-reported at the time of the testing for COVID-19. Self-reported data is vulnerable to over- and under-reporting of the true prevalence of comorbidities. Appendix I presents a comparison of published prevalence rates for the comorbid conditions in this study and the self-reported prevalence rates in the Database. To the extent that comorbidities are under- or over-reported differentially among severe versus less severe patients, our results would be skewed, limiting the applicability of our findings to other populations.



## Methodological considerations

### METHODOLOGY

This report includes descriptive statistics on interactions between comorbidities, age and gender of the registered COVID-19 infected cases on the CFR.

### DEFINITION OF THE STATISTICAL SAMPLE

In order to estimate CFR, we removed the effect of recently reported cases that were ongoing and that may result in death in the future. To this end, we had only considered registered COVID-19 infected cases whose date of first symptoms occurred through June 27, and deaths registered through July 27, 2020 for the same group of cases. This subset of data formed the basis of this report, and we refer to it as “the Database.” Based on a study carried out on cases reported as of July 8, 2020, we estimated that deaths occurring within 30 days from the date of symptoms amounted to 94% of the expected ultimate CFR.

### AGE GROUPING

The study shows results by age band with individuals grouped in 10-year age intervals. As an exception, ages under 20 years were grouped as follows: 0-14 and 15-19 years of age. This was done for the purpose of segregating lethality in ages 0-14, which were analysed separately in previous medical studies. Ages over 80 were grouped into a single age band.

### METHODOLOGY FOR CALCULATING THE EXCESS CFR DERIVED BY THE DIFFERENT COMORBIDITIES

The “Case Fatality Rate (CFR)” has been defined as follows:

*Case fatality rate (CFR)*

$$= \frac{\text{Number of deaths registered up to July 27 2020 for registered COVID – 19 infected cases whose date of first symptoms occurred up to June 27 2020}}{\text{Number of registered COVID – 19 infected cases whose date of first symptoms occurred up to June 27 2020}}$$

The CFR was calculated for each comorbidity or set of comorbidities by taking the deaths and registered COVID-19 infected cases in the Database.

In order to estimate the excess CFR for each age group and gender, the CFR of the population with each comorbidity was compared to the CFR of the group without any comorbidity (among the comorbidities reported in the Database).

This relationship is shown in two ways, for the sample corresponding to each segment:

$$\text{Relative variation} = \frac{\text{CFR of the population with the studied comorbidity}}{\text{CFR of the population without comorbidities}} - 1$$

$$\text{Absolute variation} = \text{CFR of the population with the studied comorbidity} - \text{CFR of the population without comorbidities}$$

In order to calculate the average excess CFR for the entire population, we adjusted the data for differences in the distribution of individuals by age and gender in the populations with and without comorbidities (among the comorbidities reported in the Database). This was done according to the following formulas:

$$ME_{ijs} = r_{\bar{c}js} * Cases_{ijs}$$

$$ME_i = \sum_{\forall j \wedge \forall s} ME_{ijs}$$

$$re_i = \frac{ME_i}{Cases_i}$$

$$r_i = \frac{M_i}{Cases_i}$$

Total absolute and relative variation

$$VAT_i = r_i - r_{\bar{c}}$$

$$VRT_i = \frac{r_i}{r_{\bar{c}}} - 1$$

Absolute variation (or difference) attributable to age and gender adjustment

$$VAAD_i = re_i - r_{\bar{c}}$$

Average absolute and relative variation attributable to the comorbidity

$$VAC_i = r_i - re_i = VAT_i - VAAD_i$$

$$VRC_i = \frac{r_i}{re_i} - 1 = \frac{r_i}{r_i - VAC_i} - 1$$

Where

- $ME_{ijs}$ : Number of deaths expected from COVID-19 for the population with comorbidity i, age range j and gender s calculated from the application of the CFR of the population without comorbidities to the population with comorbidity i corresponding to the same age range and gender.
- $r_{\bar{c}js}$ : CFR of the population without comorbidities of age range j and gender s.
- $Cases_{ijs}$ : number of registered COVID-19 infected cases with comorbidity i, age range j and gender s.
- $ME_i$ : Number of total expected deaths from COVID-19 in the population with comorbidity i if the CFR of the population without comorbidities is recorded.
- $re_i$ : Average expected CFR of COVID-19 in the population with comorbidity i in case of registering the CFR of the population without comorbidities.
- $M_i$ : Number of deaths from COVID-19 observed in the population with comorbidity i.
- $r_i$ : COVID-19 CFR observed in the population with comorbidity i.
- $Cases_i$ : Number of registered COVID-19 infected cases and comorbidity i.
- $r_{\bar{c}}$ : Average CFR of the population without comorbidities.
- $VAT_i$ : Absolute variation in CFR between the population with comorbidity i and the population without comorbidities.
- $VRT_i$ : Relative variation in CFR between the population with comorbidity i and the population without comorbidities.
- $VAAD_i$ : Absolute variation in CFR attributable to age and gender adjustment due to difference in age structure and gender of the population without comorbidities and the population with comorbidity i.
- $VAC_i$ : Absolute variation in CFR attributable to comorbidity i.
- $VRC_i$ : Relative variation in CFR attributable to comorbidity i.

## COMORBIDITY GROUPINGS

In the Database, each comorbidity was recorded separately for each case. This allowed us to assess the effect of each comorbidity when presented alone or in combination with others. Many of the comorbidities in this study were correlated. When presenting CFR of each comorbidity, we did not adjust for these correlations. Similarly, when presenting CFR for combinations of comorbidities, we did not explicitly adjust for other comorbid conditions.

In order to present the multiple combinations, we stratified the analysis as follows:

- The analysis of each comorbidity is included in the section "Detailed analysis of the effect of comorbidity on the CFR for each comorbidity" and the conclusions are shown separately for two different groups, as follows:
  - "Only (the studied comorbidity)", that is, the statistics related to the population subgroup with one comorbidity alone (and no other from the reported conditions in the Database).
  - "At least (the studied comorbidity)", that is, the statistics related to the population group with corresponding comorbidities, whether or not in combination with another comorbidity. Thus, this second group includes individuals in the group above, plus those with one or more additional comorbidities.
- The section "Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities" shows the excess CFR experienced by individuals with exclusively two comorbidities. Likewise, the average absolute and relative variations are presented.
- In the section "Detailed analysis of the effect of three or more comorbidities in the CFR", the excess CFR experienced by individuals with three or more comorbidities is shown. Only those combinations of comorbidities that presented a reasonable sample size and/or showed consistency of results are presented here. In order to establish the excess CFR for each sub-segment (each group of two of the three comorbidities), the CFR has been successively adjusted to the new age and gender composition.

## APPLICABILITY TO OTHER POPULATIONS

We emphasize that the Ministry of Health data showed a high CFR over the registered COVID-19 infected cases. As is the case in all comparisons of cases infected with COVID-19, there may be, among others, effects of differences in the level of case detection or demographics. In particular, Mexico reported a high test positivity rate at the time of this writing, which some attribute to testing policies that exclude a large portion of patients that do not present lethal symptoms. Since the base CFR for registered COVID-19 infected cases in the Mexican Database was higher than that reported in other populations, the excess CFR may be higher as well. Therefore, we recommend adjusting these results as necessary before applying the relative variations or absolute variations for each comorbidity presented in this study. These adjustments require an understanding of the data collection methodology and how cases are detected and registered in a given setting.

## DATABASE

As noted in the Mexican government website<sup>3</sup>, the information included in this Database, reflects data obtained from the epidemiological study of suspected cases of viral respiratory disease at the time identified in the medical centers of the Ministry of Health. The Database contained preliminary data subject to additional validation by the Ministry of Health through the General Center of Epidemiology. This study only considered those confirmed cases of COVID-19, as registered in the Database, whether treated in an ambulatory setting or hospitalized.

The main fields of the Database are listed below:

- Case ID
- Gender
- Type of Patient (ambulatory or hospitalized)
- Admission Date
- First Symptom Date
- Death date
- Age
- Pneumonia (y/n)
- Pregnant (y/n)
- Diabetes (y/n)
- COPD (y/n)
- Asthma (y/n)
- Immunosuppressed (y/n)
- Hypertension (y/n)
- Cardiovascular (y/n)
- Obesity (y/n)
- Chronic Kidney Failure (y/n)
- Smoking (y/n)
- Other (y/n)
- Test Result (positive, not positive, pending)
- Intensive Care Unit (y/n)

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<sup>3</sup> <https://datos.gob.mx/busca/dataset/informacion-referente-a-casos-covid-19-en-mexico>

## Aggregated results

### SIZE OF THE STATISTICAL SAMPLE

As of the date of the study (July 27, 2020), there had been 395,479 registered COVID-19 infected cases and 44,021 deaths since the start of the pandemic registered in the database. As stated in the section “methodological considerations”, for the purposes of the study we have considered only those registered COVID-19 infected cases whose first symptom date occurred prior to June 28, 2020, but considered the deaths registered until July 27, 2020. The data set, thus selected, has been the basis of the statistics for this report, and we will refer to it as the “Database”.

The Database contained 271,763 registered COVID-19 infected cases since the beginning of the pandemic, of which 127,440 had associated comorbidities. 36,851 deaths from COVID-19 had been registered, of which 26,589 were associated with cases with associated comorbidities. Thus, 46.9% of the population registered comorbidities and this population generated 72.2% of the deaths.

### COMPARISON OF THE SAMPLE WITH THE MEXICAN TOTAL POPULATION

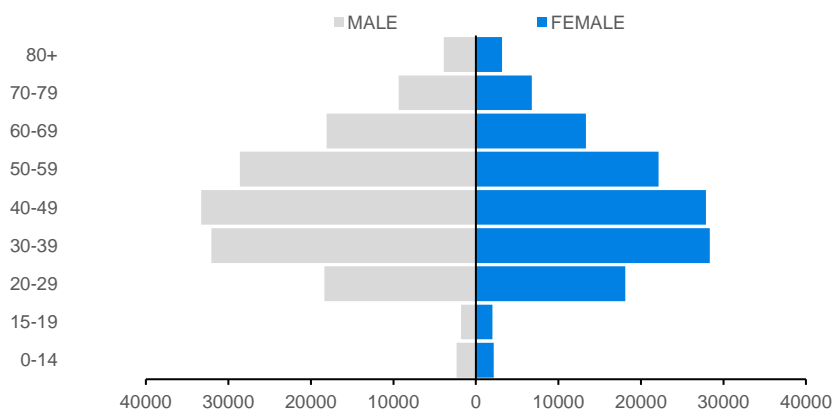
Mexico has a population of 127,191,826 inhabitants (according to data projected at the beginning of 2020<sup>4</sup>).

The basic data for age and gender of the registered COVID-19 infected population compared to the total Mexican population are shown below:

**FIGURE 1: BASIC DATA FOR AGE AND GENDER OF THE REGISTERED COVID-19 INFECTED POPULATION COMPARED TO THE GENERAL POPULATION**

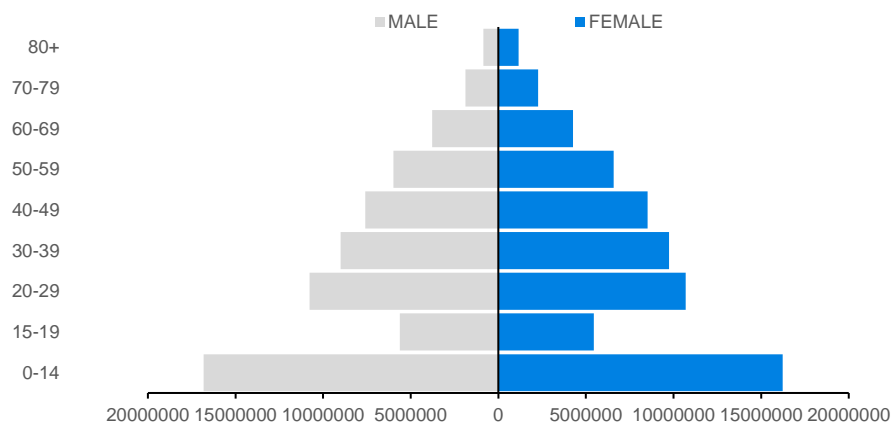
	MALE		FEMALE	
	COVID-19 POPULATION	GENERAL POPULATION	COVID-19 POPULATION	GENERAL POPULATION
<b>% population</b>	54.4%	49.0%	45.6%	51.0%
<b>Average age</b>	46.3	30.5	44.8	32.0

**FIGURE 2: MEXICO COVID-19 POPULATION PYRAMID**



<sup>4</sup> <https://datos.gob.mx/busca/dataset/proyecciones-de-la-poblacion-de-mexico-y-de-las-entidades-federativas-2016-2050>

**FIGURE 3: MEXICO POPULATION PYRAMID**



This information is included just as background of the analyzed population composition.

**CFR BY AGE AND GENDER**

The total registered COVID-19 infected cases and total CFR, by age and gender, are shown below.

**FIGURE 4: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	4,512	2.2%	2,360	2.3%	2,152	2.0%
15-19	3,778	0.9%	1,793	0.8%	1,985	1.0%
20-29	36,484	1.2%	18,370	1.5%	18,114	0.9%
30-39	60,394	3.0%	32,052	4.0%	28,342	1.8%
40-49	61,199	8.1%	33,302	10.4%	27,897	5.3%
50-59	50,752	17.4%	28,595	21.2%	22,157	12.5%
60-69	31,450	31.8%	18,103	35.6%	13,347	26.8%
70-79	16,138	44.4%	9,350	47.6%	6,788	39.9%
80+	7,056	50.1%	3,894	53.8%	3,162	45.6%
Total	271,763	13.6%	147,819	16.3%	123,944	10.3%

As expected, CFR sharply increases with age (with the exception of ages 0 to 14) and is higher for males than for females. As described elsewhere in this report, CFR in the Database is high compared to other geographies.

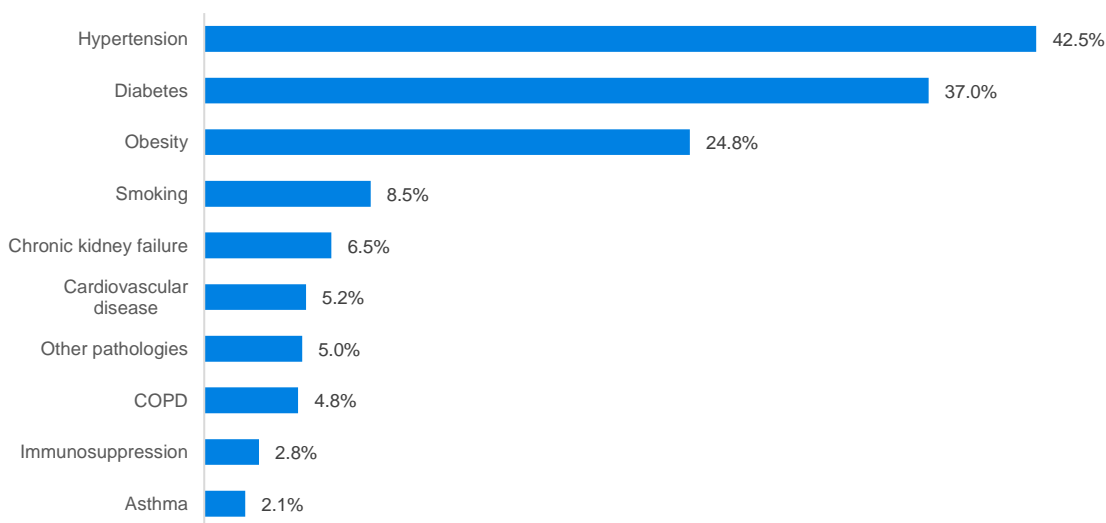
### DEATHS BY COMORBIDITY

The percentage of deaths in Mexico for each comorbidity is shown below. For comparison purposes, the same percentage is added for other jurisdictions investigated. Given that there can be more than one comorbidity for each reported death, the sum of the percentages can be greater than 100%. Note also that each of the other jurisdictions did not necessarily keep track of every comorbidity that Mexico studied and there are other variations in how the data are collected and reported in each jurisdiction.

**FIGURE 5: PERCENTAGE OF DEATHS BY COMORBIDITY**

Comorbidity	México <sup>5</sup>	New York <sup>6</sup>	Italy <sup>7</sup>	Ireland <sup>8</sup>	China <sup>9</sup>
Hypertension	42.5%	55.4%	68.1%		39.7%
Diabetes	37.0%	37.3%	30.5%	14.6%	19.7%
Obesity	24.8%		10.8%		
Smoking	8.5%				
Chronic kidney failure	6.5%	11.0%	20.5%		
Cardiovascular disease	5.2%				22.7%
Other pathologies	5.0%				
COPD	4.8%	8.3%	16.5%	17.1%	7.9%
Immunosuppression	2.8%		3.8%		
Asthma	2.1%				

**FIGURE 6: PERCENTAGE OF DEATHS WITH COMORBIDITIES OVER TOTAL DEATHS IN MEXICO**



It is noted that the sum is greater than 100% since each case may present more than one comorbidity.

As can be seen in the Figure above, while hypertension and diabetes prevalence on COVID-19 related deaths were in the same orders of magnitude of other geographies, chronic kidney failure and COPD exhibited a relatively low prevalence.

<sup>5</sup> México: own elaboration

<sup>6</sup> New York: <https://www.the-hospitalist.org/hospitalist/article/220457/coronavirus-updates/comorbidities-rule-new-yorks-covid-19-deaths>

<sup>7</sup> Italy: [https://www.epicentro.iss.it/en/coronavirus/bollettino/Report-COVID-2019\\_14\\_May\\_2020.pdf](https://www.epicentro.iss.it/en/coronavirus/bollettino/Report-COVID-2019_14_May_2020.pdf)

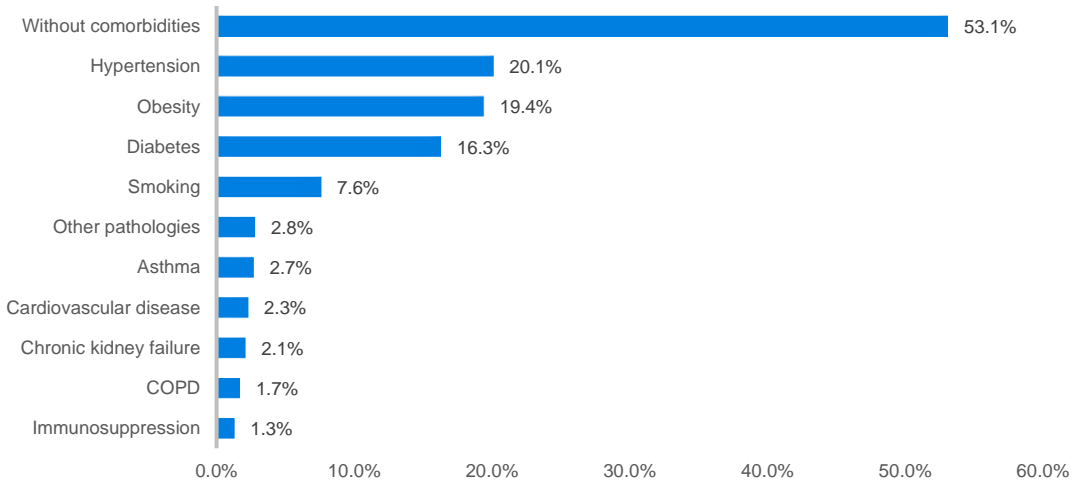
<sup>8</sup> Ireland: <https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/surveillance/underlyingconditionsreports/Underlying%20conditions%20summary.pdf>

<sup>9</sup> China: <http://weekly.chinacdc.cn/en/article/id/e53946e2-c6c4-41e9-9a9b-fea8db1a8f51>

**PREVALENCE OF COMORBIDITIES IN THE REGISTERED COVID-19 INFECTED POPULATION**

Reported prevalence of comorbidities is shown below.

**FIGURE 7: REPORTED PREVALENCE OF COMORBIDITIES**



This table shows that the prevalence of comorbidities in registered COVID-19 infected population represented a very significant proportion (almost 50%), being hypertension, obesity and diabetes the most prevalent ones.

**CFR BY NUMBER OF COMORBIDITIES**

CFR for the population with COVID-19 according to the number of comorbidities registered for each case is shown below.

**FIGURE 8: CFR WITH AND WITHOUT COMORBIDITIES**

COMORBIDITY	CASES	DEATHS	CFR
Without comorbidities	144,323	10,262	7.1%
With comorbidities	127,440	26,589	20.9%
<b>Total</b>	<b>271,763</b>	<b>36,851</b>	<b>13.6%</b>

**FIGURE 9: CFR ACCORDING TO THE NUMBER OF COMORBIDITIES**

NUMBER OF COMORBIDITIES	CASES	DEATHS	CFR
0	144,323	10,262	7.1%
1	73,014	11,097	15.2%
2	35,706	8,975	25.1%
3	13,839	4,552	32.9%
4	3,673	1,431	39.0%
5+	1,208	534	44.2%
<b>Total</b>	<b>271,763</b>	<b>36,851</b>	<b>13.6%</b>

This Figure shows that the CFR is very dependent on the presence of comorbidities, and also that accumulation of comorbidities also increases sharply the CFR.

## CFR OF THE POPULATION WITHOUT COMORBIDITIES

In order to establish the excess CFR of the registered COVID-19 infected cases with different types of comorbidities, we compare them in the following sections with the CFR of the registered COVID-19 infected population without comorbidities by age and gender. The latter is detailed below.

**FIGURE 10: CFR OF THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	3,836	1.4%	1,982	1.8%	1,854	1.0%
15-19	3,060	0.5%	1,450	0.4%	1,610	0.5%
20-29	26,719	0.6%	13,047	0.9%	13,672	0.4%
30-39	39,826	1.7%	20,651	2.5%	19,175	0.9%
40-49	33,190	4.9%	17,891	6.9%	15,299	2.6%
50-59	21,483	12.3%	12,420	16.2%	9,063	6.8%
60-69	10,112	25.8%	6,221	29.6%	3,891	19.5%
70-79	4,171	38.8%	2,691	42.7%	1,480	31.8%
80+	1,926	44.8%	1,168	49.9%	758	36.8%
Total	144,323	7.1%	77,521	9.7%	66,802	4.2%

CFR for the population without comorbidities is significantly lower than the average. The CFR by age and gender shown in Figure 10 are used as to compare the excess CFR of the comorbid population compared to the population without comorbidities.

## EXCESS CFR OF THE REGISTERED COVID-19 INFECTED POPULATION WITH COMORBIDITIES

A summary of the average results of the comorbidity analysis is shown below.

**FIGURE 11: EXCESS CFR OF THE REGISTERED COVID-19 INFECTED POPULATION WITH COMORBIDITIES**

COMORBIDITY	AVERAGE EXCESS CFR ATTRIBUTABLE TO EACH COMORBIDITY (ABSOLUTE VARIATION)	
	Only the comorbidity	At least the comorbidity
Diabetes	8.5%	12.4%
Hypertension	3.3%	9.6%
Obesity	3.9%	7.2%
Smoking	-0.4%	3.9%
Asthma	-0.4%	2.6%
Cardiovascular disease	2.1%	9.2%
Chronic kidney failure	9.8%	23.6%
COPD	8.0%	12.6%
Immunosuppression	7.8%	14.5%
Other pathologies	6.2%	11.7%

We can see in Figure 11 that:

- Chronic kidney failure, diabetes, COPD and immunosuppression have been the comorbidities with highest impact on CFR both when analysed alone or in combination with other comorbidities.
- Obesity, hypertension and cardiovascular disease appear have a lower but still significant impact on CFR when compared to the previous group.
- Smoking and asthma showed effect when combined with other comorbidities but almost no effect in the segment that only exhibited those conditions.

The detail by age and gender, the excess measured in relative variations and the combination of comorbidities are analysed in particular in each section.



## Detailed analysis of the effect of comorbidity on the CFR for each comorbidity

For purposes of this section, we will refer with "population" to the registered COVID-19 infected population.

Likewise, when calculating the excess CFR of the studied population compared to the population without comorbidities, we considered the CFR by age and gender shown on Figure 10.

### DIABETES

#### Population that has had only Diabetes (and no other comorbidity)

FIGURE 12: CFR BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	16	0.0%	9	0.0%	7	0.0%
15-19	27	0.0%	11	0.0%	16	0.0%
20-29	271	7.0%	128	7.8%	143	6.3%
30-39	1,169	9.1%	624	10.3%	545	7.7%
40-49	3,034	14.5%	1,789	16.5%	1,245	11.6%
50-59	3,950	22.4%	2,401	25.9%	1,549	16.8%
60-69	2,728	33.2%	1,674	36.5%	1,054	27.9%
70-79	1,089	44.6%	665	47.4%	424	40.3%
80+	350	50.3%	185	51.9%	165	48.5%
<b>Total</b>	<b>12,634</b>	<b>23.9%</b>	<b>7,486</b>	<b>26.9%</b>	<b>5,148</b>	<b>19.4%</b>

FIGURE 13: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14						
15-19						
20-29	1028.5%	6.4%	794.1%	6.9%	1554.8%	5.9%
30-39	436.6%	7.4%	318.6%	7.8%	784.9%	6.8%
40-49	193.4%	9.5%	139.1%	9.6%	339.1%	8.9%
50-59	82.7%	10.1%	60.1%	9.7%	146.7%	10.0%
60-69	28.8%	7.4%	23.1%	6.9%	42.8%	8.4%
70-79	15.0%	5.8%	11.0%	4.7%	26.7%	8.5%
80+	12.4%	5.5%	4.0%	2.0%	31.7%	11.7%
<b>Total</b>	<b>235.6%</b>	<b>16.8%</b>	<b>178.7%</b>	<b>17.2%</b>	<b>367.6%</b>	<b>15.3%</b>

FIGURE 14: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	23.9%	26.9%	19.4%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	16.8%	17.2%	15.3%
Difference attributable to age and gender adjustment [4]	8.3%	9.1%	6.4%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	8.5%	8.2%	8.8%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5])-1	54.9%	43.7%	83.5%

[4] For more detail go to Methodological considerations section

## Population that has had at least Diabetes (Diabetes only or diabetes and other comorbidities)

FIGURE 15: CFR BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	35	11.4%	21	9.5%	14	14.3%
15-19	49	2.0%	21	0.0%	28	3.6%
20-29	607	8.2%	289	9.0%	318	7.5%
30-39	2,876	12.6%	1,561	14.2%	1,315	10.6%
40-49	8,417	17.5%	4,725	19.8%	3,692	14.5%
50-59	12,819	26.3%	7,152	29.5%	5,667	22.2%
60-69	11,281	38.0%	6,237	41.5%	5,044	33.7%
70-79	6,229	47.8%	3,381	51.3%	2,848	43.6%
80+	2,111	52.6%	1,038	54.5%	1,073	50.8%
<b>Total</b>	<b>44,424</b>	<b>30.7%</b>	<b>24,425</b>	<b>33.5%</b>	<b>19,999</b>	<b>27.3%</b>

FIGURE 16: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	697.1%	10.0%	424.3%	7.7%	1294.0%	13.3%
15-19	346.1%	1.6%			618.8%	3.1%
20-29	1225.8%	7.6%	929.6%	8.1%	1884.3%	7.2%
30-39	642.8%	10.9%	480.4%	11.8%	1113.7%	9.7%
40-49	254.6%	12.6%	186.9%	12.9%	452.2%	11.9%
50-59	114.3%	14.0%	81.8%	13.3%	225.0%	15.4%
60-69	47.7%	12.3%	40.1%	11.9%	72.8%	14.2%
70-79	23.1%	9.0%	20.2%	8.6%	37.1%	11.8%
80+	17.6%	7.9%	9.2%	4.6%	38.0%	14.0%
<b>Total</b>	<b>331.6%</b>	<b>23.6%</b>	<b>247.0%</b>	<b>23.8%</b>	<b>555.4%</b>	<b>23.1%</b>

FIGURE 17: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

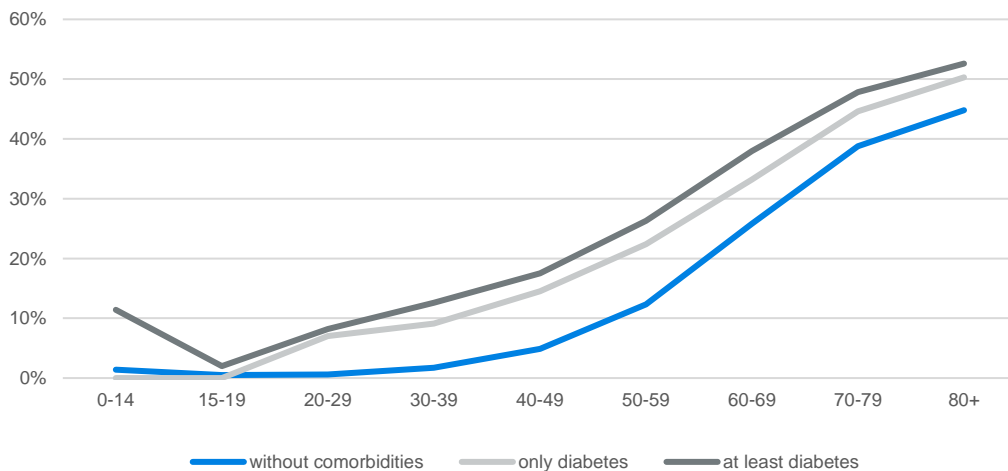
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity [1]	30.7%	33.5%	27.3%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	23.6%	23.8%	23.1%
Difference attributable to age and gender adjustment [4]	11.2%	12.2%	9.8%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	12.4%	11.7%	13.3%
Average relative variation attributable to the comorbidity [6] = ([1] - [5]) - 1	67.9%	53.3%	95.8%

[4] For more detail go to Methodological considerations section

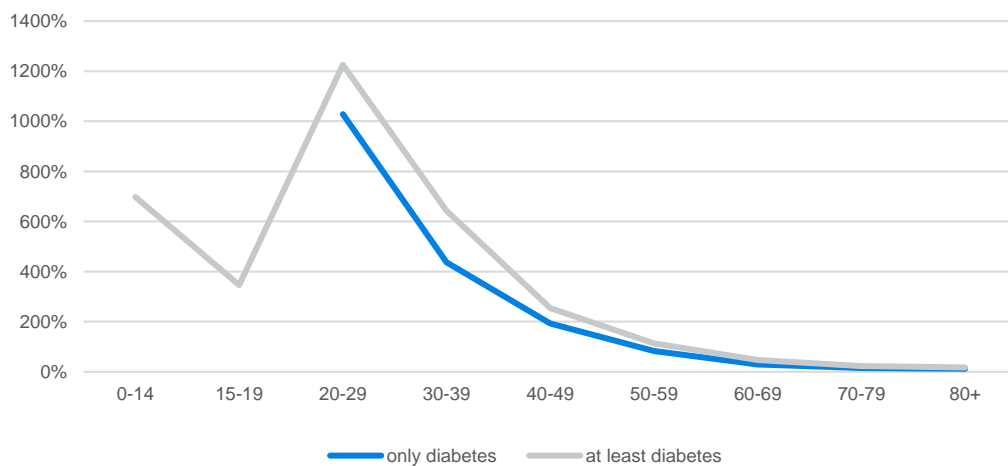
### Comparative charts

The results previously presented for both genders as a whole are shown below.

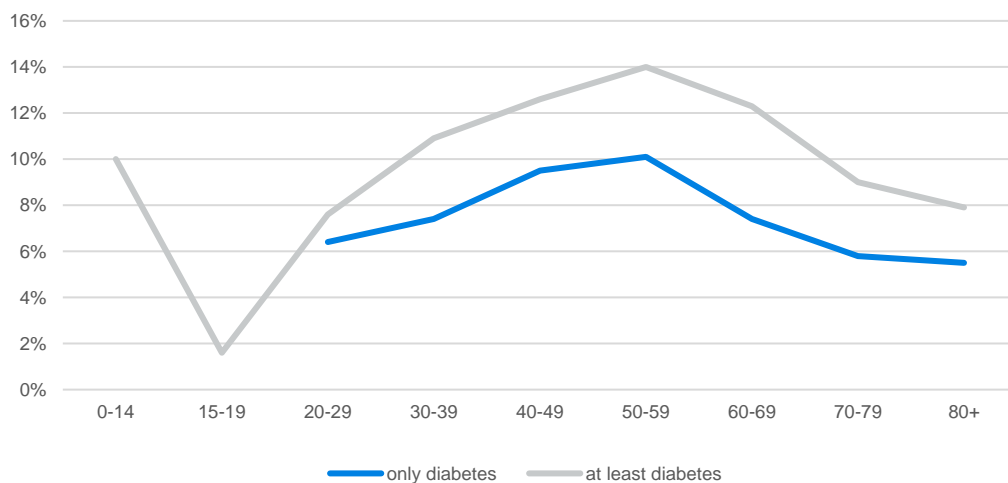
**FIGURE 18: COMPARISON OF THE CFR OF THE POPULATION WITH DIABETES VERSUS THE POPULATION WITHOUT COMORBIDITIES**



**FIGURE 19: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 20: EXCESS CFR - ABSOLUTE VARIATION**



## Association with other comorbidities

The percentage of the population with diabetes that has presented at least another comorbidity is shown below.

**FIGURE 21: PERCENTAGE OF THE POPULATION WITH DIABETES THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have diabetes and that additionally present other comorbidities								
		COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
28%	72%	4.2%	2.8%	2.7%	53.5%	5.7%	28.5%	7.0%	8.6%	3.8%

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

## HYPERTENSION

### Population that has had only hypertension (and no other comorbidity)

**FIGURE 22: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	12	8.3%	6	0.0%	6	16.7%
15-19	10	0.0%	7	0.0%	3	0.0%
20-29	384	3.4%	227	2.2%	157	5.1%
30-39	1,380	4.1%	835	5.1%	545	2.4%
40-49	3,307	8.2%	1,817	9.8%	1,490	6.2%
50-59	4,413	14.7%	2,401	18.5%	2,012	10.2%
60-69	3,456	27.5%	1,938	31.8%	1,518	22.0%
70-79	2,288	42.0%	1,223	46.8%	1,065	36.5%
80+	1,235	50.7%	628	55.6%	607	45.6%
<b>Total</b>	<b>16,485</b>	<b>21.4%</b>	<b>9,082</b>	<b>24.3%</b>	<b>7,403</b>	<b>17.8%</b>

**FIGURE 23: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	481.2%	6.9%			1526.3%	15.6%
15-19						
20-29	444.9%	2.8%	152.1%	1.3%	1239.7%	4.7%
30-39	140.1%	2.4%	110.2%	2.7%	173.9%	1.5%
40-49	66.1%	3.3%	42.0%	2.9%	136.9%	3.6%
50-59	20.2%	2.5%	14.1%	2.3%	49.9%	3.4%
60-69	6.9%	1.8%	7.4%	2.2%	12.6%	2.5%
70-79	8.2%	3.2%	9.6%	4.1%	14.8%	4.7%
80+	13.3%	5.9%	11.3%	5.7%	24.0%	8.8%
<b>Total</b>	<b>201.1%</b>	<b>14.3%</b>	<b>151.8%</b>	<b>14.7%</b>	<b>329.1%</b>	<b>13.7%</b>

**FIGURE 24: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	21.4%	24.3%	17.8%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	14.3%	14.7%	13.7%
Difference attributable to age and gender adjustment [4]	11.0%	11.8%	9.9%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	3.3%	2.9%	3.8%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5]))-1	18.1%	13.4%	26.9%

[4] For more detail go to Methodological considerations section

### Population that has had at least Hypertension (Hypertension only or hypertension and other comorbidities)

**FIGURE 25: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	34	11.8%	17	17.6%	17	5.9%
15-19	35	2.9%	21	0.0%	14	7.1%
20-29	1,016	8.7%	599	7.7%	417	10.1%
30-39	3,724	8.5%	2,225	9.3%	1,499	7.5%
40-49	9,763	14.5%	5,306	16.9%	4,457	11.6%
50-59	14,714	23.0%	7,845	26.5%	6,869	18.9%
60-69	13,159	34.9%	6,971	38.6%	6,188	30.7%
70-79	8,463	46.2%	4,486	49.7%	3,977	42.2%
80+	3,750	52.0%	1,880	55.6%	1,870	48.4%
Total	54,658	28.6%	29,350	31.3%	25,308	25.5%

**FIGURE 26: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	720.5%	10.3%	871.6%	15.8%	474.0%	4.9%
15-19	524.5%	2.4%			1337.5%	6.6%
20-29	1294.1%	8.0%	778.9%	6.8%	2548.1%	9.7%
30-39	405.3%	6.8%	277.9%	6.8%	757.9%	6.6%
40-49	193.9%	9.6%	145.6%	10.0%	339.5%	8.9%
50-59	87.4%	10.7%	63.6%	10.3%	176.7%	12.1%
60-69	35.5%	9.1%	30.4%	9.0%	57.0%	11.1%
70-79	19.0%	7.4%	16.4%	7.0%	32.7%	10.4%
80+	16.2%	7.3%	11.4%	5.7%	31.6%	11.6%
Total	302.8%	21.5%	224.7%	21.7%	513.1%	21.3%

**FIGURE 27: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

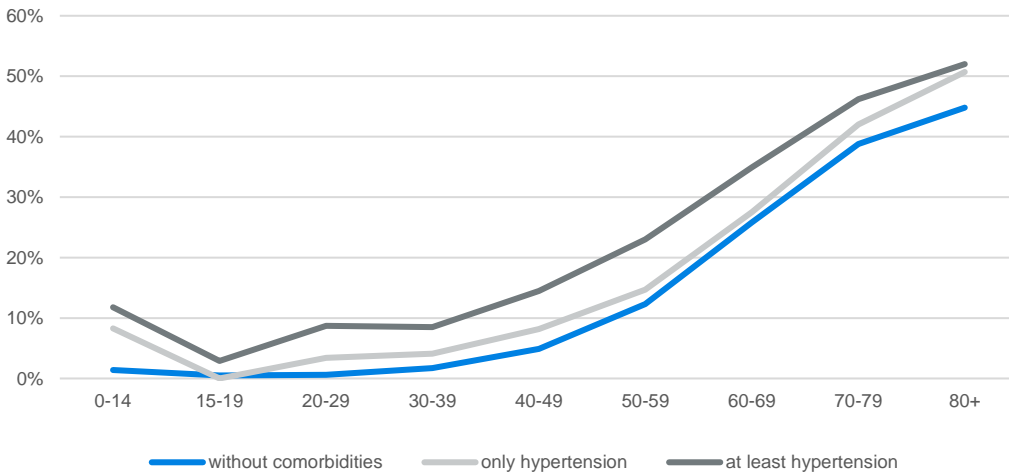
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	28.6%	31.3%	25.5%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	21.5%	21.7%	21.3%
Difference attributable to age and gender adjustment [4]	11.9%	12.9%	10.7%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	9.6%	8.8%	10.6%
Average relative variation attributable to the comorbidity [6]=([1]/[1]-[5])-1	50.8%	39.1%	71.4%

[4] For more detail go to Methodological considerations section

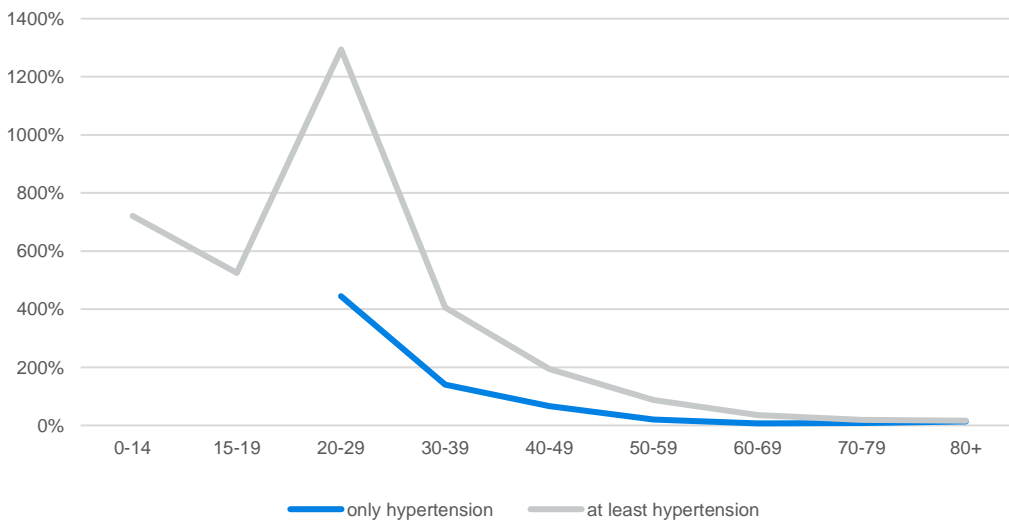
**Comparative charts**

The results previously presented for both genders as a whole are shown below.

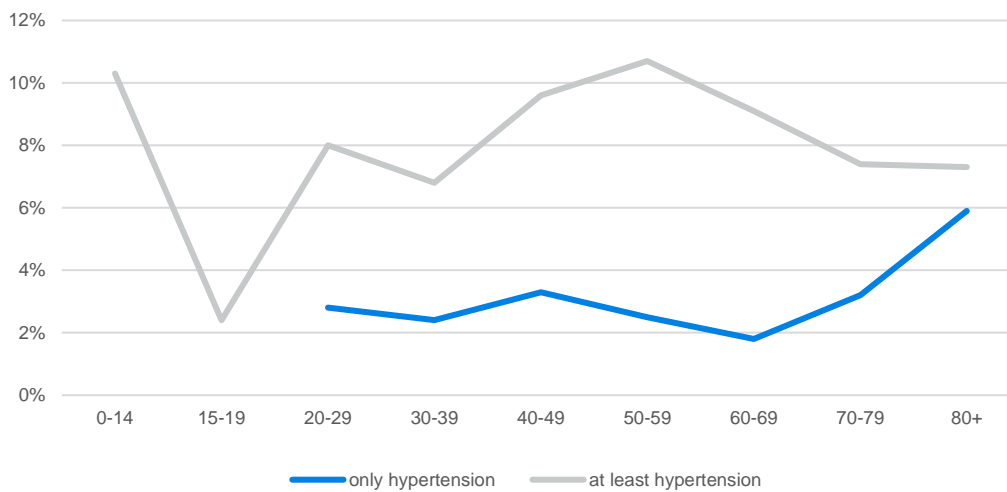
**FIGURE 28: COMPARISON OF THE CFR OF THE POPULATION WITH HYPERTENSION VERSUS THE POPULATION WITHOUT COMORBIDITIES**



**FIGURE 29: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 30: EXCESS CFR - ABSOLUTE VARIATION**



**Association with other comorbidities**

The percentage of the population with hypertension that has presented at least another comorbidity is shown below.

**FIGURE 31: PERCENTAGE OF THE POPULATION WITH HYPERTENSION THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have hypertension and that additionally present other comorbidities									
		Diabetes	COPD	Asthma	Immunosuppression	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies	
30%	70%	43.5%	4.4%	3.2%	2.3%	6.9%	31.2%	6.9%	8.1%	4.2%	

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

**OBESITY**

**Population that has had only Obesity (and no other comorbidity)**

**FIGURE 32: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	125	2.4%	79	0.0%	46	6.5%
15-19	244	2.9%	101	4.0%	143	2.1%
20-29	3,360	1.9%	1,596	2.0%	1,764	1.8%
30-39	7,094	4.9%	3,649	6.9%	3,445	2.9%
40-49	6,985	9.4%	3,717	13.0%	3,268	5.4%
50-59	4,360	16.4%	2,320	21.4%	2,040	10.6%
60-69	1,589	31.6%	831	38.3%	758	24.3%
70-79	445	43.4%	254	47.6%	191	37.7%
80+	136	52.2%	69	62.3%	67	41.8%
<b>Total</b>	<b>24,338</b>	<b>10.5%</b>	<b>12,616</b>	<b>13.9%</b>	<b>11,722</b>	<b>6.9%</b>

**FIGURE 33: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	67.4%	1.0%			536.4%	5.5%
15-19	527.0%	2.4%	857.1%	3.5%	322.2%	1.6%
20-29	201.8%	1.3%	129.5%	1.1%	362.1%	1.4%
30-39	191.1%	3.2%	179.6%	4.4%	230.0%	2.0%
40-49	91.6%	4.5%	89.2%	6.2%	103.3%	2.7%
50-59	33.7%	4.1%	32.2%	5.2%	55.7%	3.8%
60-69	22.7%	5.8%	29.1%	8.6%	24.3%	4.7%
70-79	11.7%	4.6%	11.7%	5.0%	18.5%	5.9%
80+	16.6%	7.4%	24.9%	12.4%	13.5%	5.0%
<b>Total</b>	<b>48.0%</b>	<b>3.4%</b>	<b>43.7%</b>	<b>4.2%</b>	<b>66.6%</b>	<b>2.8%</b>

**FIGURE 34: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	10.5%	13.9%	6.9%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	3.4%	4.2%	2.8%
Difference attributable to age and gender adjustment [4]	-0.4%	-0.7%	0.1%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	3.9%	4.9%	2.7%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5]))-1	57.8%	55.3%	63.4%

[4] For more detail go to Methodological considerations section

### Population that has had at least Obesity (Obesity only or obesity and other comorbidities)

**FIGURE 35: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	167	4.2%	102	2.0%	65	7.7%
15-19	313	2.2%	138	2.9%	175	1.7%
20-29	4,821	2.5%	2,435	2.9%	2,386	2.1%
30-39	11,187	5.9%	6,053	7.7%	5,134	3.8%
40-49	13,870	11.6%	7,451	15.0%	6,419	7.7%
50-59	11,846	20.9%	6,152	25.1%	5,694	16.5%
60-69	6,730	35.9%	3,260	40.4%	3,470	31.6%
70-79	2,894	49.0%	1,362	52.1%	1,532	46.3%
80+	841	50.9%	368	56.5%	473	46.5%
<b>Total</b>	<b>52,669</b>	<b>17.4%</b>	<b>27,321</b>	<b>19.9%</b>	<b>25,348</b>	<b>14.6%</b>



FIGURE 36: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	192.3%	2.8%	8.0%	0.1%	650.6%	6.7%
15-19	388.8%	1.8%	600.5%	2.5%	245.0%	1.2%
20-29	307.3%	1.9%	233.7%	2.0%	462.0%	1.8%
30-39	250.2%	4.2%	216.2%	5.3%	331.6%	2.9%
40-49	135.1%	6.7%	117.2%	8.1%	191.0%	5.0%
50-59	70.9%	8.7%	54.7%	8.9%	140.9%	9.6%
60-69	39.2%	10.1%	36.2%	10.7%	61.9%	12.1%
70-79	26.3%	10.2%	22.2%	9.5%	45.4%	14.5%
80+	13.7%	6.1%	13.2%	6.6%	26.4%	9.7%
Total	144.2%	10.3%	106.2%	10.3%	251.7%	10.5%

FIGURE 37: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

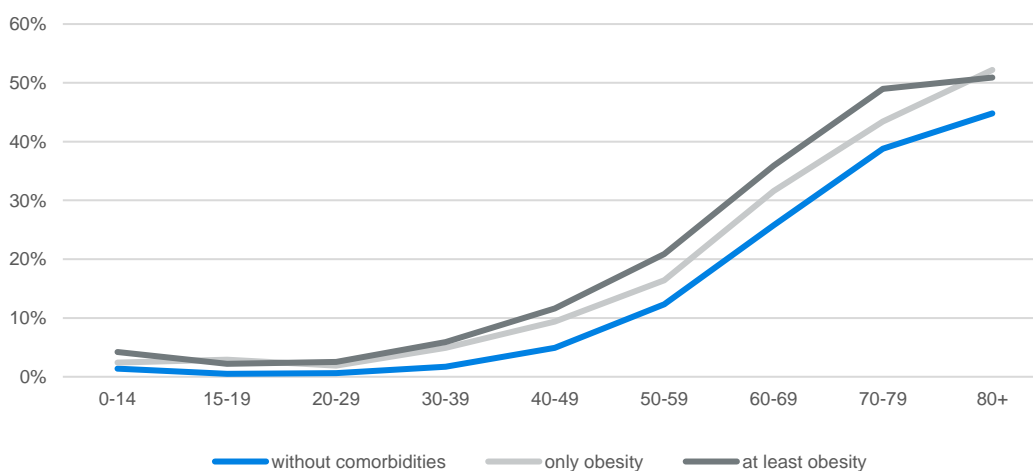
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity [1]	17.4%	19.9%	14.6%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	10.3%	10.3%	10.5%
Difference attributable to age and gender adjustment [4]	3.1%	2.8%	3.5%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	7.2%	7.4%	6.9%
Average relative variation attributable to the comorbidity [6] = ([1]/([1]-[5]))-1	70.4%	59.3%	89.8%

[4] For more detail go to Methodological considerations section

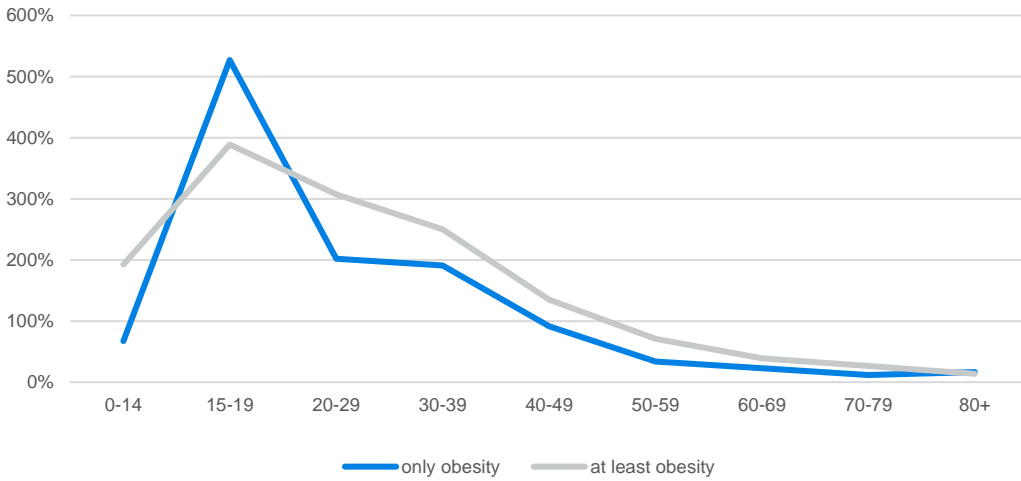
### Comparative charts

The results previously presented for both genders as a whole are shown below.

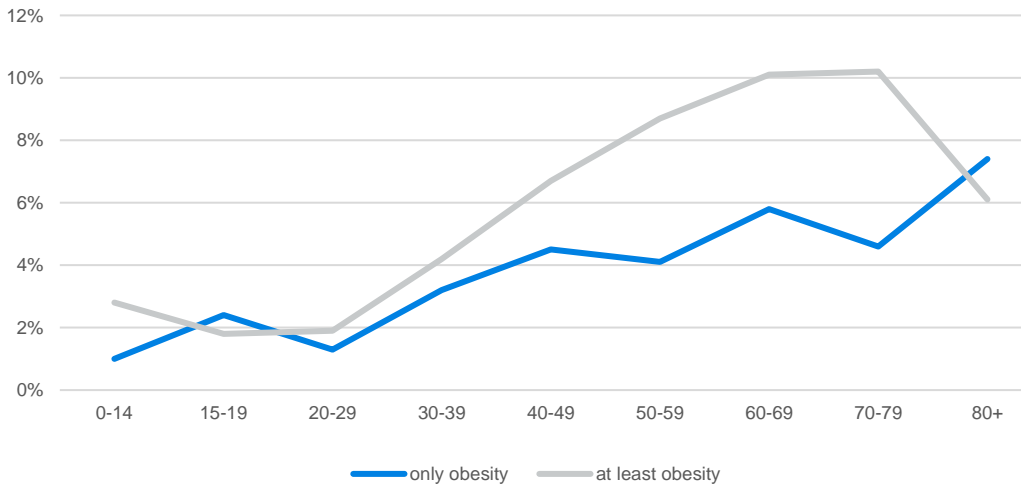
FIGURE 38: COMPARISON OF THE CFR OF THE POPULATION WITH OBESITY VERSUS THE POPULATION WITHOUT COMORBIDITIES



**FIGURE 39: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 40: EXCESS CFR - ABSOLUTE VARIATION**



**Association with other comorbidities**

The percentage of the population with obesity that has presented at least another comorbidity is shown below.

**FIGURE 41: PERCENTAGE OF THE POPULATION WITH OBESITY THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have obesity and that additionally present other comorbidities								
		Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Chronic kidney failure	Smoking	Other pathologies
46%	54%	24.1%	2.6%	4.2%	1.7%	32.4%	3.9%	2.4%	11.4%	3.5%

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

## SMOKING

## Population that has had only Smoking (and no other comorbidity)

FIGURE 42: CFR BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	9	0.0%	5	0.0%	4	0.0%
15-19	87	0.0%	54	0.0%	33	0.0%
20-29	2,282	0.4%	1,598	0.6%	684	0.1%
30-39	3,089	1.3%	2,107	1.7%	982	0.4%
40-49	2,020	4.5%	1,434	5.5%	586	2.0%
50-59	1,193	12.8%	886	15.7%	307	4.6%
60-69	619	29.9%	517	32.3%	102	17.6%
70-79	276	47.5%	240	47.1%	36	50.0%
80+	114	46.5%	103	47.6%	11	36.4%
<b>Total</b>	<b>9,689</b>	<b>6.8%</b>	<b>6,944</b>	<b>8.5%</b>	<b>2,745</b>	<b>2.6%</b>

FIGURE 43: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14						
15-19						
20-29	-29.5%	-0.2%	-35.5%	-0.3%	-61.6%	-0.2%
30-39	-23.4%	-0.4%	-30.3%	-0.7%	-53.2%	-0.5%
40-49	-8.7%	-0.4%	-20.1%	-1.4%	-22.3%	-0.6%
50-59	4.7%	0.6%	-3.2%	-0.5%	-33.2%	-2.3%
60-69	16.1%	4.1%	9.0%	2.7%	-9.7%	-1.9%
70-79	22.3%	8.6%	10.4%	4.4%	57.1%	18.2%
80+	3.9%	1.7%	-4.7%	-2.3%	-1.2%	-0.4%
<b>Total</b>	<b>-3.8%</b>	<b>-0.3%</b>	<b>-11.7%</b>	<b>-1.1%</b>	<b>-37.8%</b>	<b>-1.6%</b>

FIGURE 44: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity [1]	6.8%	8.5%	2.6%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	-0.3%	-1.1%	-1.6%
Difference attributable to age and gender adjustment [4]	0.1%	-0.8%	-1.1%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	-0.4%	-0.3%	-0.4%
Average relative variation attributable to the comorbidity [6] = ([1]/[1]-[5])-1	-5.1%	-3.8%	-14.7%

[4] For more detail go to Methodological considerations section

## Population that has had at least Smoking (Smoking only or smoking and other comorbidities)

FIGURE 45: CFR BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	19	0.0%	11	0.0%	8	0.0%
15-19	113	0.0%	65	0.0%	48	0.0%
20-29	3,222	1.1%	2,202	1.2%	1,020	0.7%
30-39	5,134	3.0%	3,485	3.7%	1,649	1.4%
40-49	4,360	8.9%	3,059	10.6%	1,301	4.8%
50-59	3,379	20.3%	2,470	23.6%	909	11.2%
60-69	2,330	36.6%	1,802	39.6%	528	26.3%
70-79	1,399	50.1%	1,143	51.3%	256	44.9%
80+	579	53.4%	467	54.6%	112	48.2%
<b>Total</b>	<b>20,535</b>	<b>15.2%</b>	<b>14,704</b>	<b>17.8%</b>	<b>5,831</b>	<b>8.6%</b>

FIGURE 46: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14						
15-19						
20-29	69.8%	0.4%	40.3%	0.4%	80.4%	0.3%
30-39	75.2%	1.3%	51.1%	1.3%	60.1%	0.5%
40-49	80.0%	3.9%	54.0%	3.7%	80.9%	2.1%
50-59	65.5%	8.0%	45.6%	7.4%	64.3%	4.4%
60-69	42.2%	10.9%	33.7%	10.0%	34.8%	6.8%
70-79	29.1%	11.3%	20.2%	8.6%	41.2%	13.1%
80+	19.2%	8.6%	9.4%	4.7%	31.0%	11.4%
<b>Total</b>	<b>113.7%</b>	<b>8.1%</b>	<b>84.5%</b>	<b>8.2%</b>	<b>107.0%</b>	<b>4.5%</b>

FIGURE 47: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

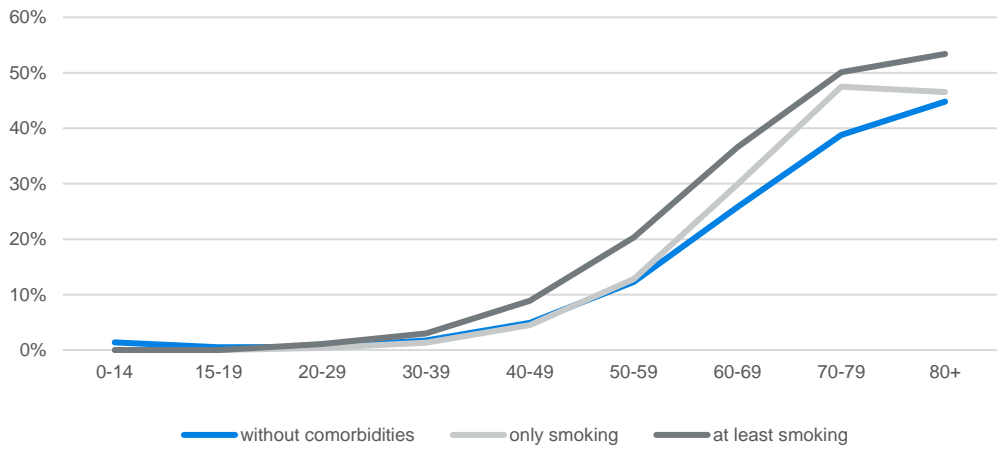
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity [1]	15.2%	17.8%	8.6%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	8.1%	8.2%	4.5%
Difference attributable to age and gender adjustment [4]	4.1%	3.8%	1.7%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	3.9%	4.4%	2.8%
Average relative variation attributable to the comorbidity [6] = ([1]/([1]-[5]))-1	35.0%	32.9%	47.3%

[4] For more detail go to Methodological considerations section

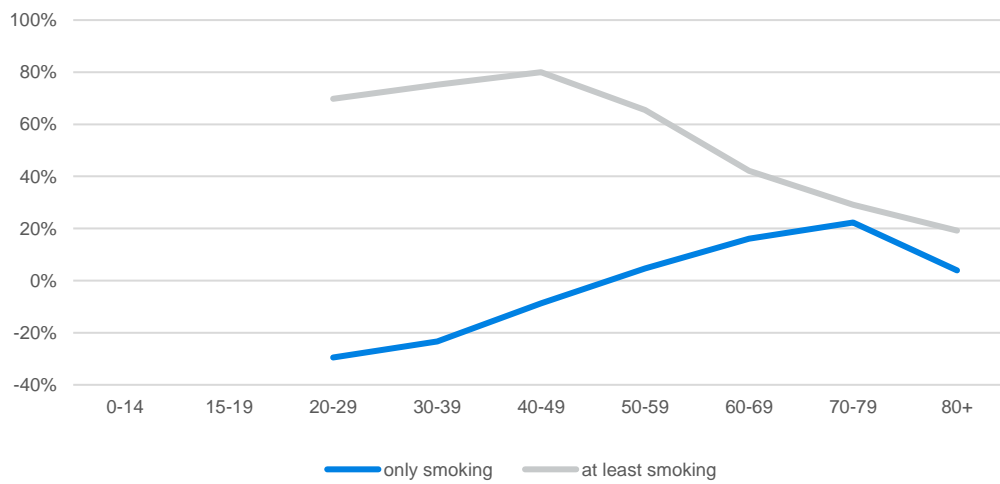
### Comparative charts

The results previously presented for both genders as a whole are shown below.

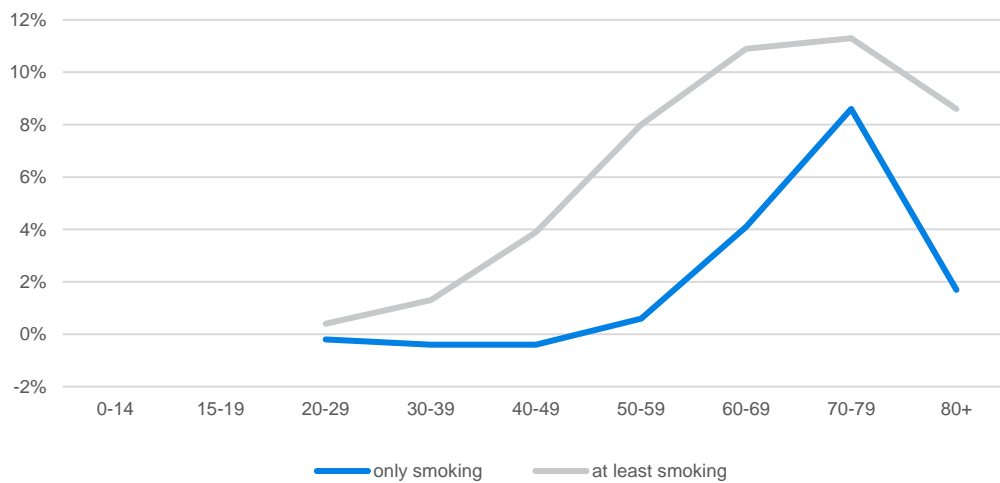
**FIGURE 48: COMPARISON OF THE CFR OF THE POPULATION WITH SMOKING VERSUS THE POPULATION WITHOUT COMORBIDITIES**



**FIGURE 49: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 50: EXCESS CFR - ABSOLUTE VARIATION**



## Association with other comorbidities

The percentage of the population with smoking that has presented at least another comorbidity is shown below.

**FIGURE 51: PERCENTAGE OF THE POPULATION WITH SMOKING THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have smoking and that additionally present other comorbidities								
		Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Other pathologies
47%	53%	18.5%	4.6%	2.9%	1.8%	21.4%	3.7%	29.3%	2.9%	3.6%

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

## ASTHMA

### Population that has had only Asthma (and no other comorbidity)

**FIGURE 52: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	116	0.9%	71	0.0%	45	2.2%
15-19	134	0.0%	65	0.0%	69	0.0%
20-29	735	1.0%	310	1.3%	425	0.7%
30-39	1,026	1.2%	401	2.2%	625	0.5%
40-49	778	4.2%	281	6.8%	497	2.8%
50-59	385	7.8%	147	8.2%	238	7.6%
60-69	141	23.4%	68	33.8%	73	13.7%
70-79	59	33.9%	24	37.5%	35	31.4%
80+	14	35.7%	5	20.0%	9	44.4%
<b>Total</b>	<b>3,388</b>	<b>4.2%</b>	<b>1,372</b>	<b>5.6%</b>	<b>2,016</b>	<b>3.2%</b>

**FIGURE 53: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	-39.9%	-0.6%			116.8%	1.2%
15-19						
20-29	53.3%	0.3%	47.7%	0.4%	85.6%	0.3%
30-39	-30.8%	-0.5%	-8.4%	-0.2%	-44.9%	-0.4%
40-49	-14.0%	-0.7%	-2.0%	-0.1%	6.9%	0.2%
50-59	-36.4%	-4.5%	-49.6%	-8.0%	10.7%	0.7%
60-69	-9.1%	-2.3%	14.1%	4.2%	-29.9%	-5.8%
70-79	-12.7%	-4.9%	-12.1%	-5.2%	-1.2%	-0.4%
80+	-20.2%	-9.0%	-59.9%	-29.9%	20.7%	7.6%
<b>Total</b>	<b>-41.5%</b>	<b>-2.9%</b>	<b>-41.9%</b>	<b>-4.0%</b>	<b>-23.7%</b>	<b>-1.0%</b>

**FIGURE 54: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	4.2%	5.6%	3.2%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	-2.9%	-4.0%	-1.0%
Difference attributable to age and gender adjustment [4]	-2.5%	-3.1%	-0.9%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	-0.4%	-1.0%	-0.1%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5]))-1	-9.7%	-14.6%	-2.9%

[4] For more detail go to Methodological considerations section

### Population that has had at least Asthma (Asthma only or asthma and other comorbidities)

**FIGURE 55: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	142	0.7%	89	0.0%	53	1.9%
15-19	162	0.0%	81	0.0%	81	0.0%
20-29	1,156	1.5%	514	2.1%	642	0.9%
30-39	1,751	3.1%	715	4.6%	1,036	2.0%
40-49	1,796	7.2%	638	10.0%	1,158	5.7%
50-59	1,258	15.3%	444	18.0%	814	13.8%
60-69	673	27.9%	259	35.1%	414	23.4%
70-79	303	40.9%	124	43.5%	179	39.1%
80+	127	39.4%	62	50.0%	65	29.2%
Total	7,368	10.3%	2,926	12.4%	4,442	8.8%

**FIGURE 56: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	-50.9%	-0.7%			84.1%	0.9%
15-19						
20-29	136.7%	0.8%	144.9%	1.3%	145.7%	0.6%
30-39	82.5%	1.4%	88.4%	2.2%	132.7%	1.2%
40-49	46.8%	2.3%	45.4%	3.1%	116.4%	3.1%
50-59	24.6%	3.0%	11.2%	1.8%	101.5%	6.9%
60-69	8.5%	2.2%	18.5%	5.5%	20.0%	3.9%
70-79	5.4%	2.1%	2.1%	0.9%	22.9%	7.3%
80+	-12.0%	-5.4%	0.2%	0.1%	-20.6%	-7.6%
Total	44.3%	3.2%	28.9%	2.8%	112.2%	4.7%

**FIGURE 57: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

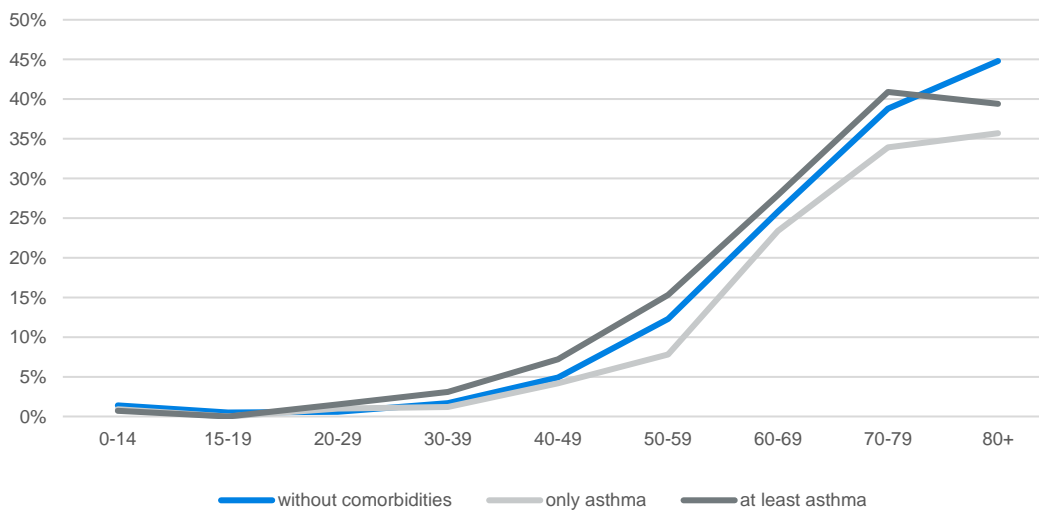
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	10.3%	12.4%	8.8%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	3.2%	2.8%	4.7%
Difference attributable to age and gender adjustment [4]	0.5%	0.6%	1.7%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	2.6%	2.2%	3.0%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5])-1)	34.8%	21.1%	50.6%

[4] For more detail go to Methodological considerations section

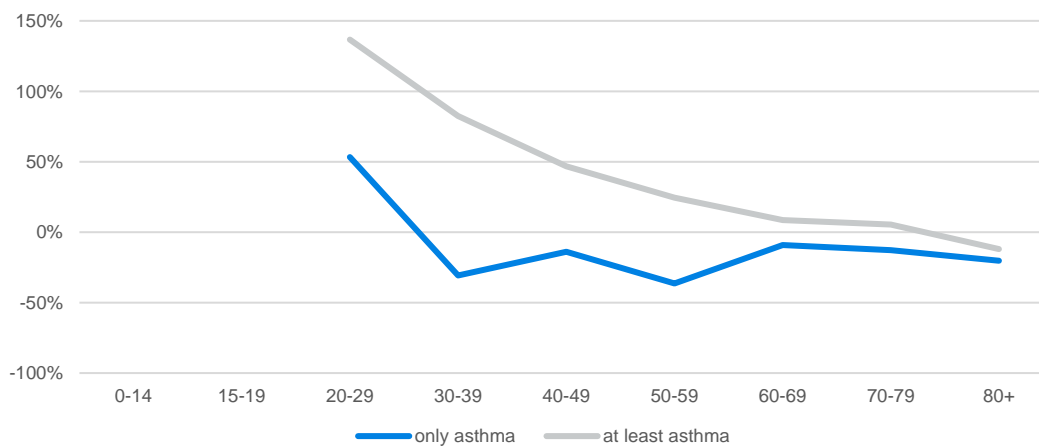
### Comparative charts

The results previously presented for both genders as a whole are shown below.

**FIGURE 58: COMPARISON OF THE CFR OF THE POPULATION WITH ASTHMA VERSUS THE POPULATION WITHOUT COMORBIDITIES**

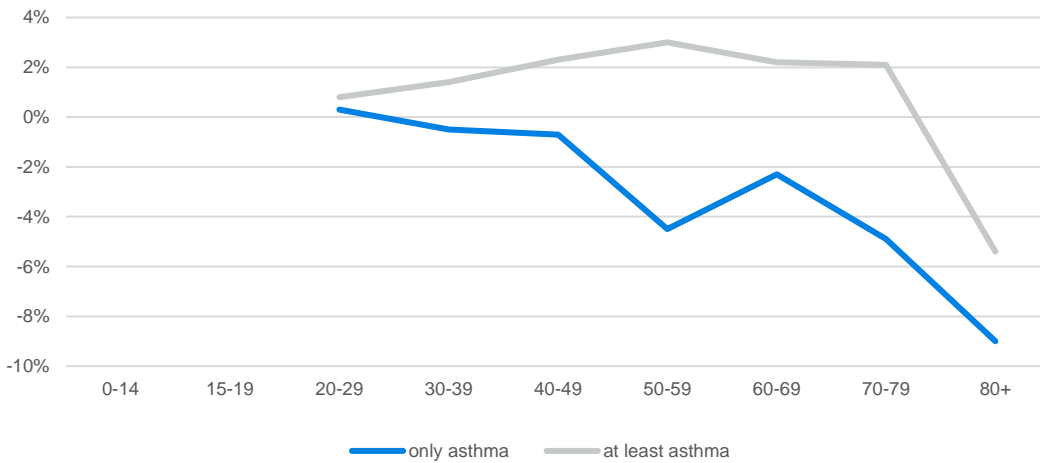


**FIGURE 59: EXCESS CFR - RELATIVE VARIATION**





**FIGURE 60: EXCESS CFR - ABSOLUTE VARIATION**



**Association with other comorbidities**

The percentage of the population with asthma that has presented at least another comorbidity is shown below.

**FIGURE 61: PERCENTAGE OF THE POPULATION WITH ASTHMA THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have asthma and that additionally present other comorbidities									
		Diabetes	COPD	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies	
46%	54%	17.1%	4.7%	2.9%	23.8%	4.0%	30.2%	2.4%	8.0%	4.3%	

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

**CARDIOVASCULAR DISEASE**

**Population that has had only Cardiovascular disease (and no other comorbidity)**

**FIGURE 62: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	37	5.4%	20	5.0%	17	5.9%
15-19	14	0.0%	8	0.0%	6	0.0%
20-29	107	3.7%	50	4.0%	57	3.5%
30-39	153	2.6%	75	5.3%	78	0.0%
40-49	202	5.0%	106	7.5%	96	2.1%
50-59	169	14.8%	101	15.8%	68	13.2%
60-69	153	28.8%	93	31.2%	60	25.0%
70-79	117	36.8%	83	37.3%	34	35.3%
80+	78	59.0%	59	57.6%	19	63.2%
Total	1,030	17.3%	595	21.0%	435	12.2%

**FIGURE 63: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	277.0%	4.0%	175.3%	3.2%	474.0%	4.9%
15-19						
20-29	501.7%	3.1%	357.8%	3.1%	822.5%	3.1%
30-39	54.7%	0.9%	117.7%	2.9%		
40-49	0.4%	0.0%	9.4%	0.6%	-20.9%	-0.6%
50-59	20.7%	2.5%	-2.3%	-0.4%	93.8%	6.4%
60-69	11.7%	3.0%	5.2%	1.5%	28.0%	5.5%
70-79	-5.3%	-2.1%	-12.5%	-5.3%	10.9%	3.5%
80+	31.8%	14.2%	15.5%	7.7%	71.6%	26.4%
<b>Total</b>	<b>143.0%</b>	<b>10.2%</b>	<b>117.6%</b>	<b>11.4%</b>	<b>193.0%</b>	<b>8.0%</b>

**FIGURE 64: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	17.3%	21.0%	12.2%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	10.2%	11.4%	8.0%
Difference attributable to age and gender adjustment [4]	8.1%	10.3%	4.5%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	2.1%	1.0%	3.5%
Average relative variation attributable to the comorbidity [6]=([1]/[1]-[5])-1	13.7%	5.2%	40.2%

[4] For more detail go to Methodological considerations section

### Population that has had at least Cardiovascular disease (Cardiovascular disease only or cardiovascular disease and other comorbidities)

**FIGURE 65: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	63	6.3%	32	3.1%	31	9.7%
15-19	30	3.3%	15	6.7%	15	0.0%
20-29	232	6.5%	119	5.9%	113	7.1%
30-39	447	8.7%	238	10.9%	209	6.2%
40-49	796	13.7%	437	16.0%	359	10.9%
50-59	1,231	23.6%	712	26.3%	519	20.0%
60-69	1,388	37.6%	830	39.8%	558	34.4%
70-79	1,257	45.3%	744	48.4%	513	40.9%
80+	735	51.2%	402	55.2%	333	46.2%
<b>Total</b>	<b>6,179</b>	<b>31.2%</b>	<b>3,529</b>	<b>34.1%</b>	<b>2,650</b>	<b>27.3%</b>

**FIGURE 66: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	342.8%	4.9%	72.0%	1.3%	844.3%	8.7%
15-19	628.6%	2.9%	1511.1%	6.3%		
20-29	940.7%	5.8%	573.2%	5.0%	1761.4%	6.7%
30-39	416.3%	7.0%	345.8%	8.5%	614.2%	5.3%
40-49	177.6%	8.8%	132.2%	9.1%	312.4%	8.2%
50-59	92.9%	11.4%	62.0%	10.1%	193.4%	13.2%
60-69	46.0%	11.9%	34.1%	10.1%	76.2%	14.9%
70-79	16.8%	6.5%	13.4%	5.7%	28.6%	9.1%
80+	14.3%	6.4%	10.6%	5.3%	25.6%	9.4%
<b>Total</b>	<b>338.6%</b>	<b>24.1%</b>	<b>253.4%</b>	<b>24.5%</b>	<b>556.1%</b>	<b>23.1%</b>

**FIGURE 67: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

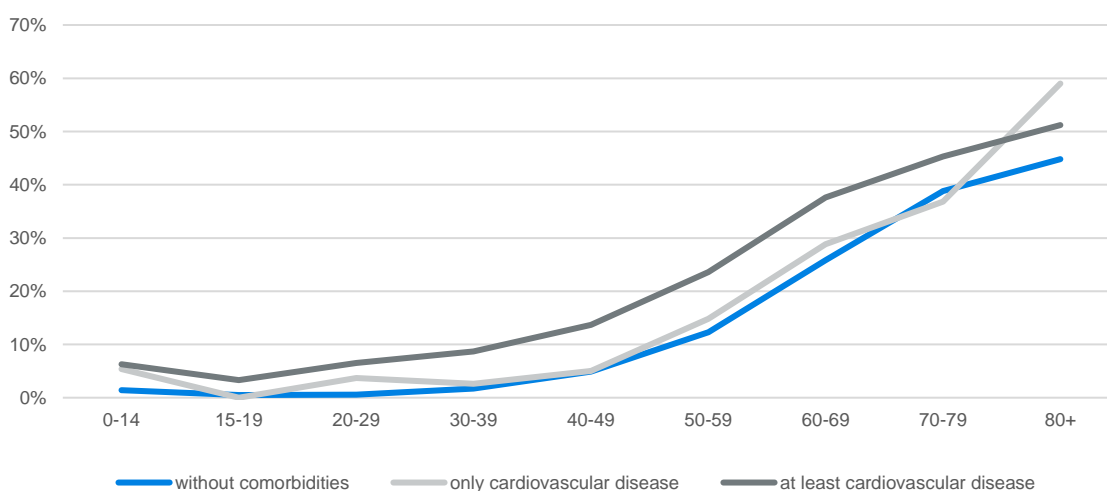
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	31.2%	34.1%	27.3%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	24.1%	24.5%	23.1%
Difference attributable to age and gender adjustment [4]	14.9%	16.3%	12.5%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	9.2%	8.1%	10.6%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5])-1)	41.7%	31.3%	63.4%

[4] For more detail go to Methodological considerations section

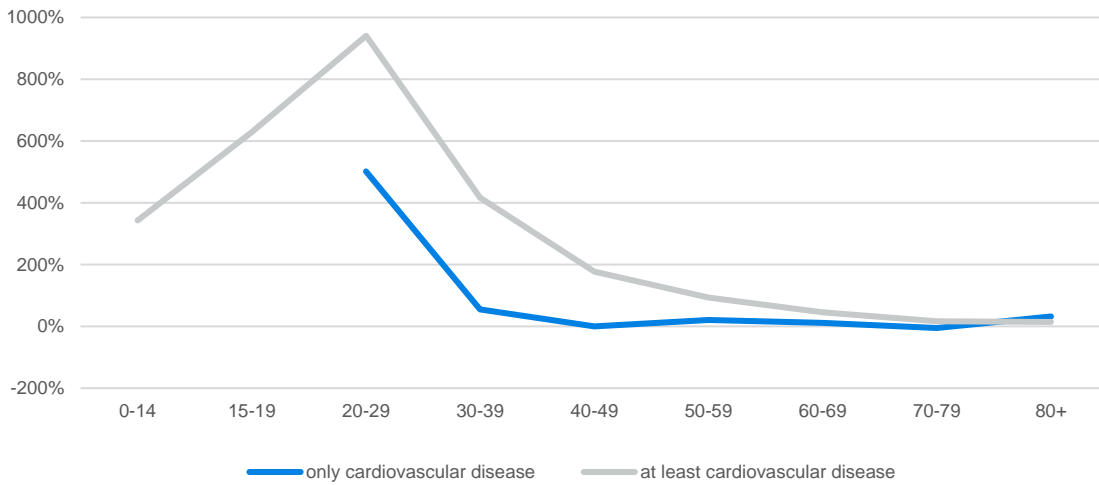
**Comparative charts**

The results previously presented for both genders as a whole are shown below.

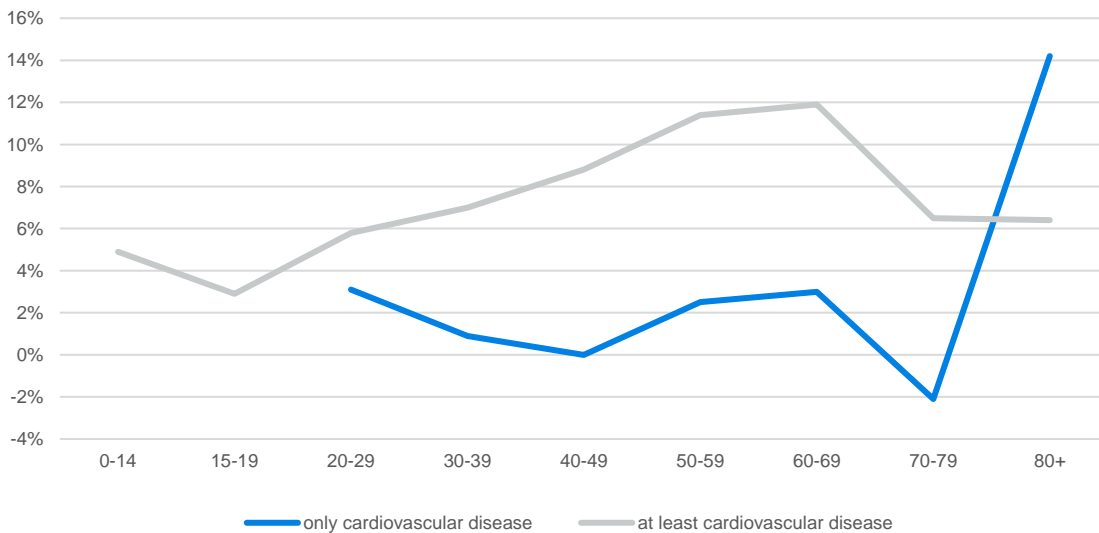
**FIGURE 68: COMPARISON OF THE CFR OF THE POPULATION WITH CARDIOVASCULAR DISEASE VERSUS THE POPULATION WITHOUT COMORBIDITIES**



**FIGURE 69: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 70: EXCESS CFR - ABSOLUTE VARIATION**



**Association with other comorbidities**

The percentage of the population with cardiovascular disease that has presented at least another comorbidity is shown below.

**FIGURE 71: PERCENTAGE OF THE POPULATION WITH CARDIOVASCULAR DISEASE THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

		Percentage of cases that have cardiovascular disease and that additionally present other comorbidities								
WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Obesity	Chronic kidney failure	Smoking	Other pathologies
17%	83%	40.7%	9.6%	4.8%	5.8%	60.8%	32.9%	11.0%	12.4%	9.7%

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

## CHRONIC KIDNEY FAILURE

## Population that has had only Chronic kidney failure (and no other comorbidity)

FIGURE 72: CFR BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	10	0.0%	5	0.0%	5	0.0%
15-19	14	0.0%	3	0.0%	11	0.0%
20-29	108	6.5%	60	8.3%	48	4.2%
30-39	206	12.1%	113	17.7%	93	5.4%
40-49	176	18.8%	100	23.0%	76	13.2%
50-59	137	25.5%	88	30.7%	49	16.3%
60-69	86	33.7%	53	30.2%	33	39.4%
70-79	55	43.6%	33	48.5%	22	36.4%
80+	26	50.0%	17	41.2%	9	66.7%
<b>Total</b>	<b>818</b>	<b>20.3%</b>	<b>472</b>	<b>24.2%</b>	<b>346</b>	<b>15.0%</b>

FIGURE 73: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14						
15-19						
20-29	943.2%	5.9%	853.7%	7.5%	995.5%	3.8%
30-39	618.2%	10.4%	622.3%	15.2%	517.3%	4.5%
40-49	280.2%	13.8%	233.5%	16.1%	399.5%	10.5%
50-59	108.5%	13.3%	89.3%	14.5%	139.0%	9.5%
60-69	30.9%	8.0%	1.8%	0.5%	101.7%	19.9%
70-79	12.4%	4.8%	13.7%	5.8%	14.3%	4.5%
80+	11.7%	5.2%	-17.5%	-8.7%	81.1%	29.9%
<b>Total</b>	<b>185.4%</b>	<b>13.2%</b>	<b>150.2%</b>	<b>14.5%</b>	<b>261.4%</b>	<b>10.9%</b>

FIGURE 74: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	20.3%	24.2%	15.0%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	13.2%	14.5%	10.9%
Difference attributable to age and gender adjustment [4]	3.4%	3.7%	2.5%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	9.8%	10.8%	8.3%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5]))-1	92.9%	81.4%	124.1%

[4] For more detail go to Methodological considerations section

## Population that has had at least Chronic kidney failure (chronic kidney failure only or chronic kidney failure and other comorbidities)

FIGURE 75: CFR BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	22	9.1%	10	10.0%	12	8.3%
15-19	31	9.7%	14	7.1%	17	11.8%
20-29	322	17.1%	175	18.3%	147	15.6%
30-39	645	20.8%	380	21.6%	265	19.6%
40-49	861	32.5%	510	34.1%	351	30.2%
50-59	1,320	44.2%	771	47.9%	549	39.2%
60-69	1,338	50.3%	779	53.4%	559	46.0%
70-79	840	53.8%	465	55.7%	375	51.5%
80+	338	57.4%	199	57.8%	139	56.8%
<b>Total</b>	<b>5,717</b>	<b>41.6%</b>	<b>3,303</b>	<b>43.9%</b>	<b>2,414</b>	<b>38.4%</b>

FIGURE 76: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	534.0%	7.7%	450.6%	8.2%	713.2%	7.3%
15-19	2015.2%	9.2%	1626.2%	6.7%	2267.6%	11.3%
20-29	2649.3%	16.5%	1992.8%	17.4%	4013.8%	15.3%
30-39	1129.4%	19.1%	780.7%	19.1%	2153.1%	18.8%
40-49	559.3%	27.6%	394.7%	27.2%	1046.5%	27.6%
50-59	261.1%	32.0%	195.3%	31.7%	473.4%	32.3%
60-69	95.3%	24.5%	80.2%	23.8%	135.4%	26.4%
70-79	38.6%	15.0%	30.6%	13.0%	61.7%	19.6%
80+	28.2%	12.6%	15.8%	7.9%	54.4%	20.0%
<b>Total</b>	<b>484.7%</b>	<b>34.5%</b>	<b>354.4%</b>	<b>34.2%</b>	<b>824.4%</b>	<b>34.3%</b>

FIGURE 77: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

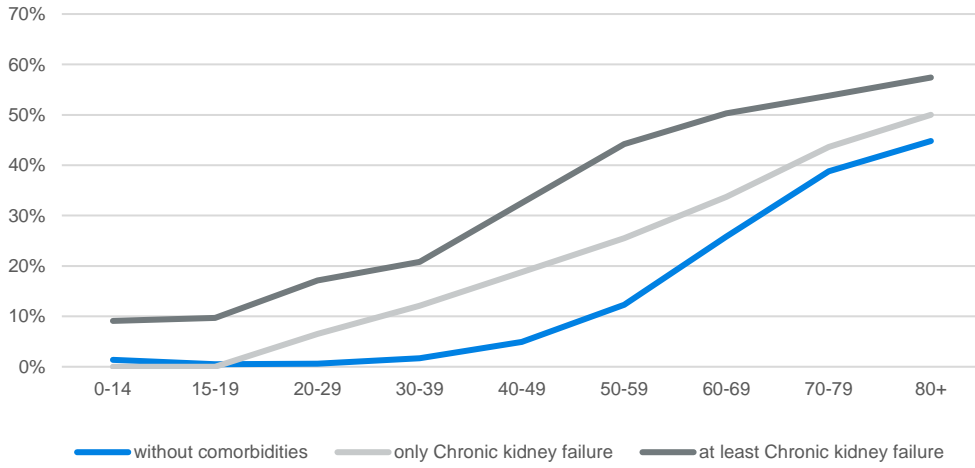
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	41.6%	43.9%	38.4%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	34.5%	34.2%	34.3%
Difference attributable to age and gender adjustment [4]	10.9%	11.5%	9.5%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	23.6%	22.7%	24.8%
Average relative variation attributable to the comorbidity [6]=([1]/[1]-[5])-1	130.9%	107.1%	181.6%

[4] For more detail go to Methodological considerations section

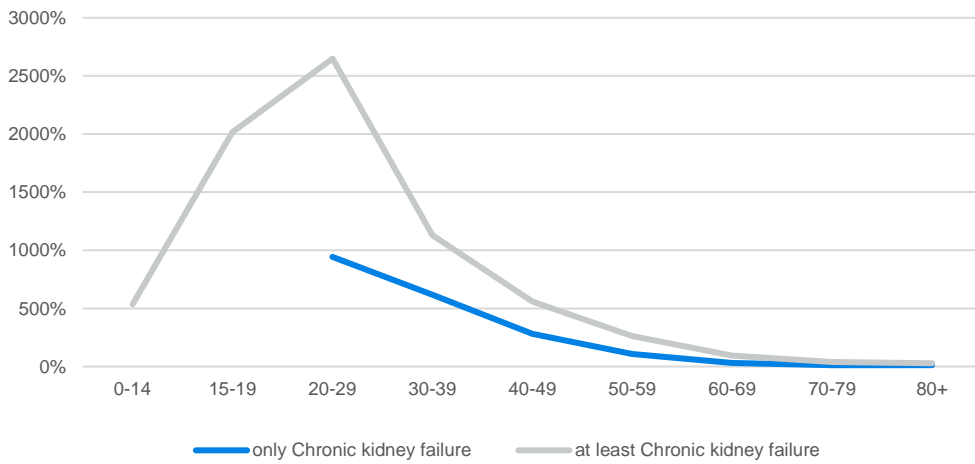
### Comparative charts

The results previously presented for both genders as a whole are shown below.

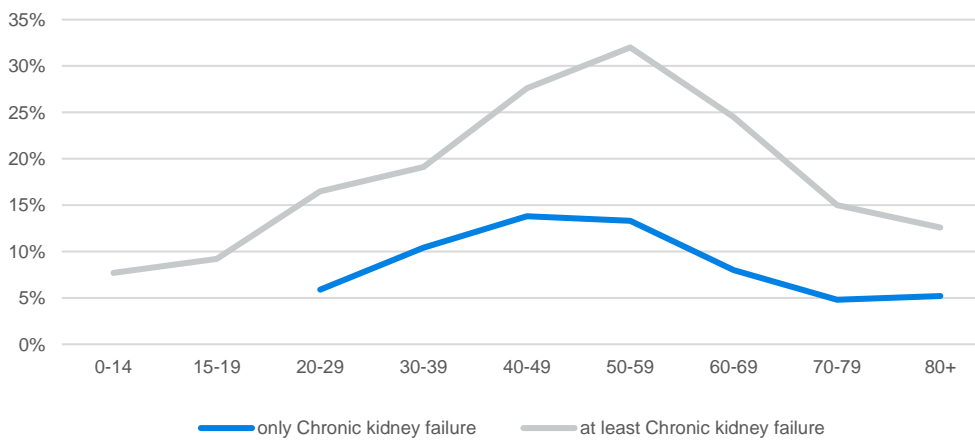
**FIGURE 78: COMPARISON OF THE CFR OF THE POPULATION WITH CHRONIC KIDNEY FAILURE VERSUS THE POPULATION WITHOUT COMORBIDITIES**



**FIGURE 79: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 80: EXCESS CFR - ABSOLUTE VARIATION**



**Association with other comorbidities**

The percentage of the population with chronic kidney failure that has presented at least another comorbidity is shown below.

**FIGURE 81: PERCENTAGE OF THE POPULATION WITH CHRONIC KIDNEY FAILURE THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have chronic kidney failure and that additionally present other comorbidities								
		Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Smoking	Other pathologies
14%	86%	54.8%	6.5%	3.1%	9.5%	66.4%	11.9%	21.8%	10.3%	8.1%

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

**COPD**

**Population that has had only COPD (and no other comorbidity)**

**FIGURE 82: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	5	0.0%	4	0.0%	1	0.0%
15-19	1	0.0%	1	0.0%	0	
20-29	19	5.3%	11	9.1%	8	0.0%
30-39	50	4.0%	25	0.0%	25	8.0%
40-49	97	14.4%	54	18.5%	43	9.3%
50-59	156	28.2%	95	30.5%	61	24.6%
60-69	172	33.7%	97	37.1%	75	29.3%
70-79	156	41.7%	97	38.1%	59	47.5%
80+	128	50.0%	67	47.8%	61	52.5%
<b>Total</b>	<b>784</b>	<b>31.6%</b>	<b>451</b>	<b>32.2%</b>	<b>333</b>	<b>30.9%</b>

**FIGURE 83: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14						
15-19						
20-29	747.1%	4.6%	940.4%	8.2%		
30-39	136.7%	2.3%			818.6%	7.1%
40-49	192.6%	9.5%	168.5%	11.6%	253.1%	6.7%
50-59	130.2%	16.0%	88.3%	14.3%	260.0%	17.8%
60-69	30.9%	8.0%	25.2%	7.5%	50.2%	9.8%
70-79	7.3%	2.9%	-10.6%	-4.5%	49.1%	15.6%
80+	11.7%	5.2%	-4.3%	-2.2%	42.5%	15.7%
<b>Total</b>	<b>344.9%</b>	<b>24.5%</b>	<b>233.0%</b>	<b>22.5%</b>	<b>643.8%</b>	<b>26.8%</b>



**FIGURE 84: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	31.6%	32.2%	30.9%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	24.5%	22.5%	26.8%
Difference attributable to age and gender adjustment [4]	16.5%	17.7%	14.3%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	8.0%	4.8%	12.5%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5]))-1	34.1%	17.4%	67.7%

[4] For more detail go to Methodological considerations section

### Population that has had at least COPD (COPD only or COPD and other comorbidities)

**FIGURE 85: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	8	0.0%	5	0.0%	3	0.0%
15-19	2	0.0%	2	0.0%	0	
20-29	73	9.6%	39	7.7%	34	11.8%
30-39	170	11.8%	98	13.3%	72	9.7%
40-49	426	18.3%	230	23.5%	196	12.2%
50-59	843	29.9%	455	32.3%	388	27.1%
60-69	1,144	39.3%	602	44.0%	542	34.1%
70-79	1,139	48.9%	589	49.1%	550	48.7%
80+	773	50.2%	413	52.5%	360	47.5%
<b>Total</b>	<b>4,578</b>	<b>38.3%</b>	<b>2,433</b>	<b>40.6%</b>	<b>2,145</b>	<b>35.6%</b>

**FIGURE 86: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14						
15-19						
20-29	1443.4%	9.0%	780.4%	6.8%	2993.2%	11.4%
30-39	596.2%	10.1%	441.4%	10.8%	1016.3%	8.9%
40-49	271.2%	13.4%	240.4%	16.6%	364.9%	9.6%
50-59	144.0%	17.6%	99.3%	16.1%	296.2%	20.2%
60-69	52.8%	13.6%	48.5%	14.4%	74.8%	14.6%
70-79	26.0%	10.1%	15.0%	6.4%	53.1%	16.9%
80+	12.2%	5.4%	5.3%	2.6%	29.1%	10.7%
<b>Total</b>	<b>438.2%</b>	<b>31.2%</b>	<b>320.6%</b>	<b>31.0%</b>	<b>756.5%</b>	<b>31.5%</b>

**FIGURE 87: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

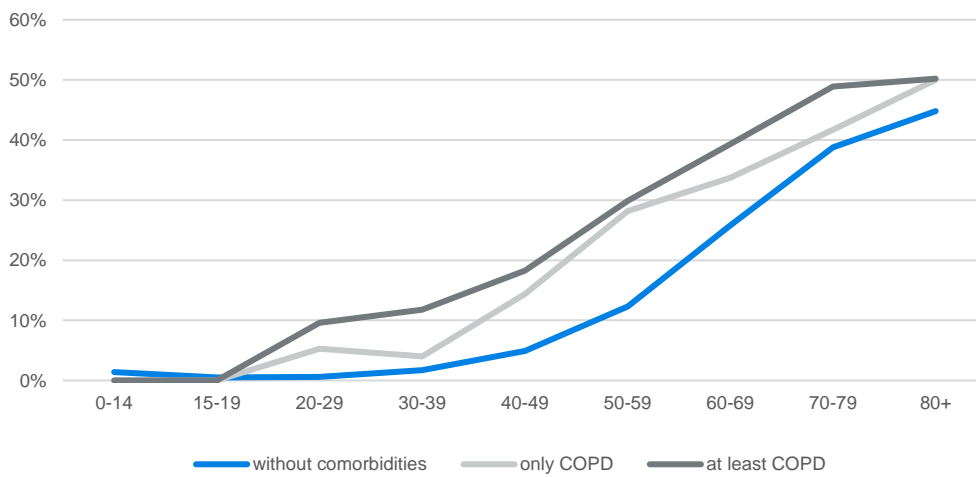
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	38.3%	40.6%	35.6%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	31.2%	31.0%	31.5%
Difference attributable to age and gender adjustment [4]	18.5%	20.3%	16.6%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	12.6%	10.7%	14.8%
Average relative variation attributable to the comorbidity [6]=([1]/[1]-[5])-1	49.2%	35.7%	71.4%

[4] For more detail go to Methodological considerations section

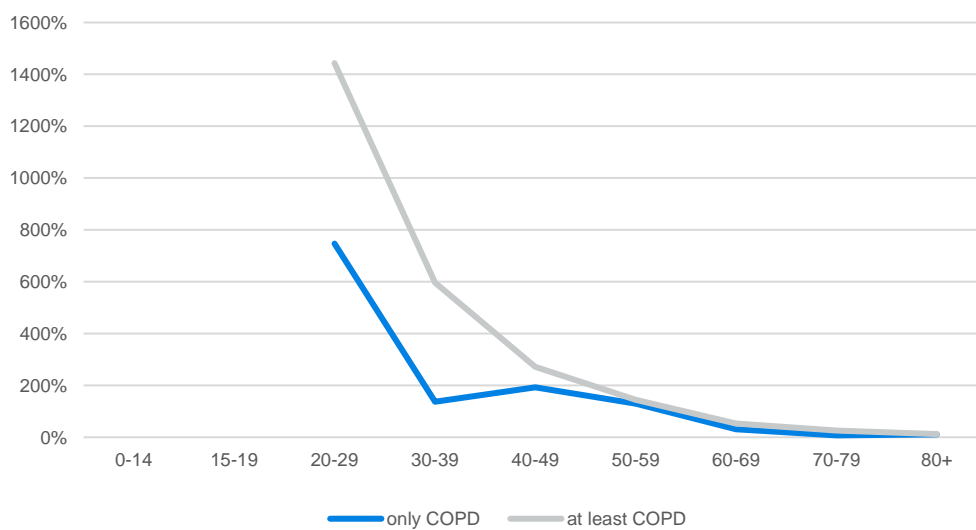
**Comparative charts**

The results previously presented for both genders as a whole are shown below.

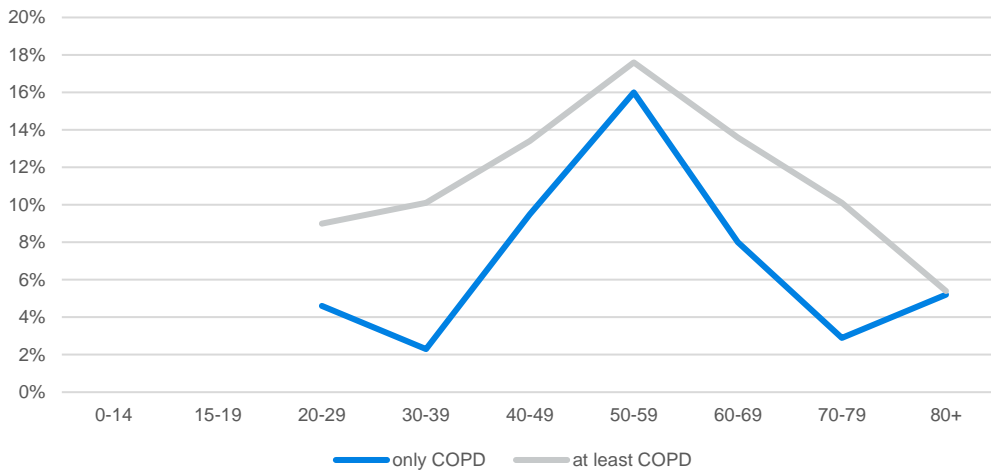
**FIGURE 88: COMPARISON OF THE CFR OF THE POPULATION WITH COPD VERSUS THE POPULATION WITHOUT COMORBIDITIES**



**FIGURE 89: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 90: EXCESS CFR - ABSOLUTE VARIATION**



**Association with other comorbidities**

The percentage of the population with COPD that has presented at least another comorbidity is shown below.

**FIGURE 91: PERCENTAGE OF THE POPULATION WITH COPD THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have COPD and that additionally present other comorbidities								
		Diabetes	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
17%	83%	40.8%	7.6%	6.4%	52.3%	13.0%	29.7%	8.1%	20.6%	6.8%

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

**IMMUNOSUPPRESSION**

**Population that has had only Immunosuppression (and no other comorbidity)**

**FIGURE 92: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	85	3.5%	36	2.8%	49	4.1%
15-19	29	10.3%	13	7.7%	16	12.5%
20-29	106	11.3%	52	13.5%	54	9.3%
30-39	157	6.4%	85	8.2%	72	4.2%
40-49	199	15.1%	90	16.7%	109	13.8%
50-59	197	21.3%	88	29.5%	109	14.7%
60-69	101	28.7%	50	42.0%	51	15.7%
70-79	62	46.8%	27	55.6%	35	40.0%
80+	28	46.4%	18	50.0%	10	40.0%
<b>Total</b>	<b>964</b>	<b>17.7%</b>	<b>459</b>	<b>22.2%</b>	<b>505</b>	<b>13.7%</b>

**FIGURE 93: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	146.2%	2.1%	52.9%	1.0%	298.3%	3.1%
15-19	2161.1%	9.9%	1759.0%	7.3%	2415.6%	12.0%
20-29	1722.2%	10.7%	1440.6%	12.6%	2334.5%	8.9%
30-39	276.9%	4.7%	236.1%	5.8%	378.4%	3.3%
40-49	205.7%	10.1%	141.6%	9.8%	422.4%	11.1%
50-59	74.0%	9.1%	82.3%	13.3%	114.9%	7.8%
60-69	11.5%	3.0%	41.7%	12.4%	-19.7%	-3.8%
70-79	20.5%	8.0%	30.2%	12.9%	25.7%	8.2%
80+	3.7%	1.7%	0.2%	0.1%	8.7%	3.2%
<b>Total</b>	<b>149.5%</b>	<b>10.6%</b>	<b>130.2%</b>	<b>12.6%</b>	<b>228.6%</b>	<b>9.5%</b>

**FIGURE 94: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity [1]	17.7%	22.2%	13.7%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	10.6%	12.6%	9.5%
Difference attributable to age and gender adjustment [4]	2.8%	3.2%	3.1%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	7.8%	9.4%	6.4%
Average relative variation attributable to the comorbidity [6] = ([1]/([1]-[5]))-1	79.0%	72.8%	89.0%

[4] For more detail go to Methodological considerations section

### Population that has had at least Immunosuppression (Immunosuppression only or immunosuppression and other comorbidities)

**FIGURE 95: CFR BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	140	6.4%	69	4.3%	71	8.5%
15-19	60	15.0%	29	13.8%	31	16.1%
20-29	254	13.8%	129	13.2%	125	14.4%
30-39	480	13.5%	247	17.4%	233	9.4%
40-49	686	19.5%	331	23.3%	355	16.1%
50-59	763	29.9%	353	37.1%	410	23.7%
60-69	672	39.0%	325	44.3%	347	34.0%
70-79	379	50.9%	190	58.9%	189	42.9%
80+	152	56.6%	88	59.1%	64	53.1%
<b>Total</b>	<b>3,586</b>	<b>28.5%</b>	<b>1,761</b>	<b>33.1%</b>	<b>1,825</b>	<b>24.0%</b>

**FIGURE 96: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER**

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	348.4%	5.0%	139.4%	2.5%	724.6%	7.4%
15-19	3178.6%	14.5%	3233.3%	13.4%	3146.0%	15.6%
20-29	2117.9%	13.2%	1408.2%	12.3%	3686.1%	14.0%
30-39	701.4%	11.9%	610.5%	15.0%	984.1%	8.6%
40-49	296.0%	14.6%	237.3%	16.4%	509.5%	13.4%
50-59	143.9%	17.6%	129.0%	20.9%	246.4%	16.8%
60-69	51.4%	13.2%	49.5%	14.7%	74.1%	14.5%
70-79	31.2%	12.1%	38.2%	16.3%	34.7%	11.0%
80+	26.4%	11.8%	18.4%	9.2%	44.3%	16.3%
Total	300.4%	21.4%	242.9%	23.5%	477.1%	19.8%

**FIGURE 97: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY**

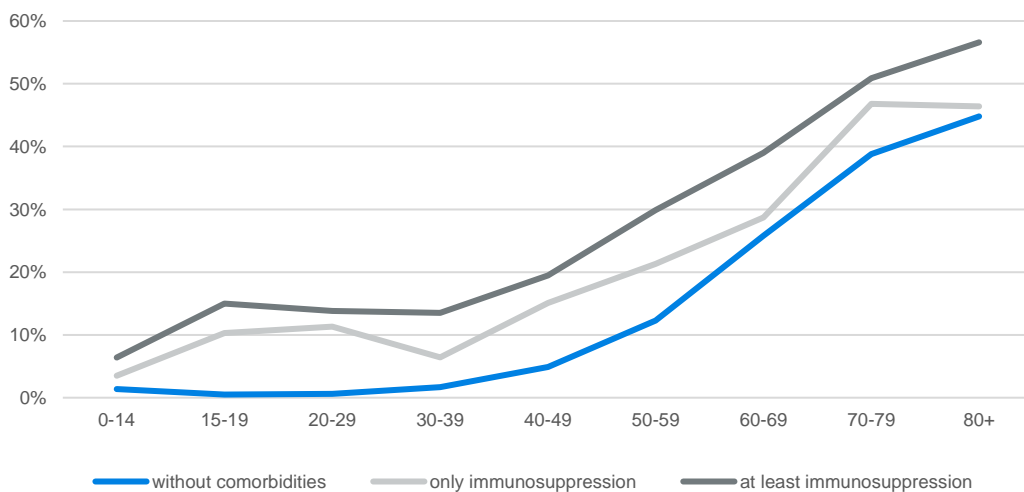
	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity[1]	28.5%	33.1%	24.0%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	21.4%	23.5%	19.8%
Difference attributable to age and gender adjustment [4]	6.9%	7.9%	6.4%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	14.5%	15.5%	13.5%
Average relative variation attributable to the comorbidity [6]=([1]/([1]-[5])-1)	103.3%	88.1%	127.9%

[4] For more detail go to Methodological considerations section

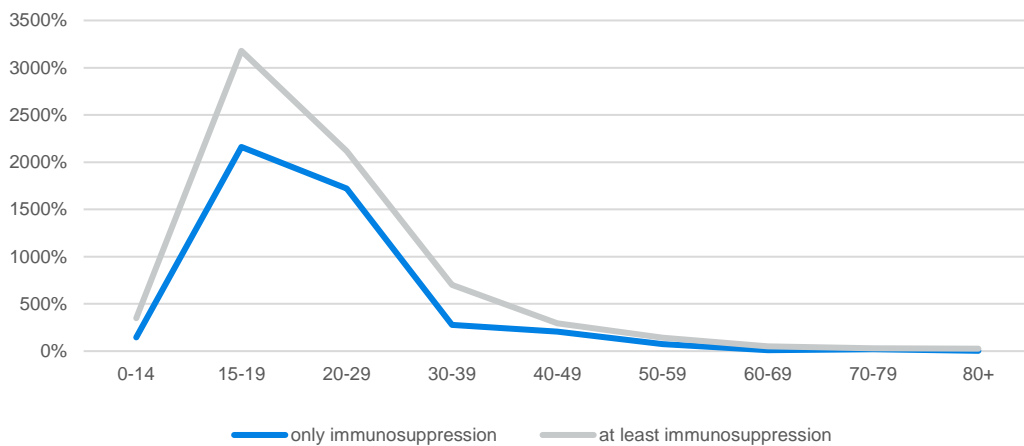
**Comparative charts**

The results previously presented for both genders as a whole are shown below.

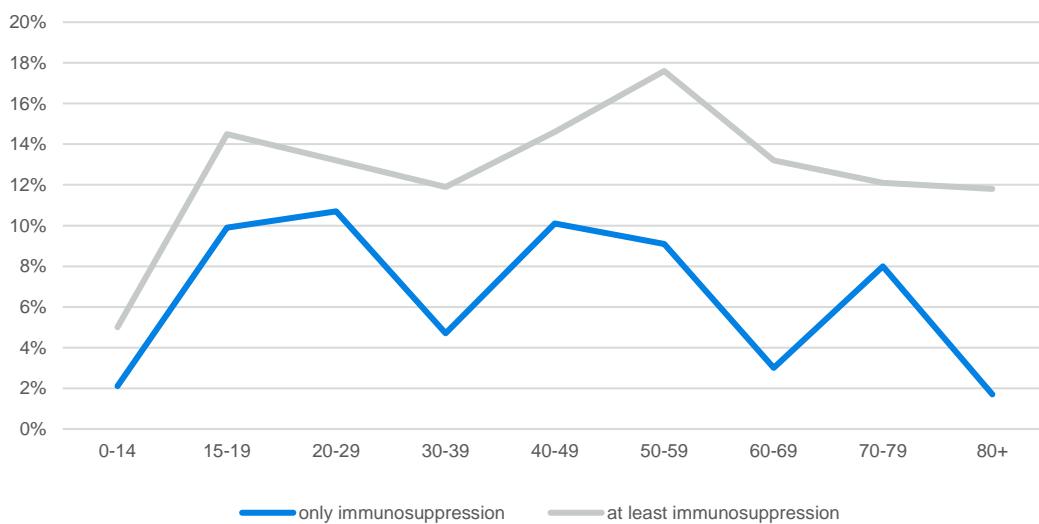
**FIGURE 98: COMPARISON OF THE CFR OF THE POPULATION WITH IMMUNOSUPPRESSION VERSUS THE POPULATION WITHOUT COMORBIDITIES**



**FIGURE 99: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 100: EXCESS CFR - ABSOLUTE VARIATION**



**Association with other comorbidities**

The percentage of the population with immunosuppression that has presented at least another comorbidity is shown below.

**FIGURE 101: PERCENTAGE OF THE POPULATION WITH IMMUNOSUPPRESSION THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have immunosuppression and that additionally present other comorbidities								
		Diabetes	COPD	Asthma	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
27%	73%	33.7%	8.2%	6.0%	34.5%	10.0%	25.5%	15.2%	10.4%	18.8%

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

## OTHER PATHOLOGIES

## Population that has had only other pathologies (and no other comorbidity)

FIGURE 102: CFR BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	132	15.9%	69	17.4%	63	14.3%
15-19	39	7.7%	22	4.5%	17	11.8%
20-29	356	4.8%	135	8.1%	221	2.7%
30-39	718	2.8%	277	5.8%	441	0.9%
40-49	696	8.8%	278	11.9%	418	6.7%
50-59	474	17.7%	188	25.5%	286	12.6%
60-69	260	34.6%	154	44.2%	106	20.8%
70-79	133	57.9%	75	64.0%	58	50.0%
80+	76	67.1%	49	75.5%	27	51.9%
<b>Total</b>	<b>2,884</b>	<b>14.7%</b>	<b>1,247</b>	<b>22.0%</b>	<b>1,637</b>	<b>9.2%</b>

FIGURE 103: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	1009.6%	14.5%	857.5%	15.6%	1294.0%	13.3%
15-19	1581.3%	7.2%	998.5%	4.1%	2267.6%	11.3%
20-29	668.6%	4.2%	832.5%	7.3%	613.8%	2.3%
30-39	64.8%	1.1%	135.7%	3.3%	4.1%	0.0%
40-49	77.7%	3.8%	72.1%	5.0%	154.3%	4.1%
50-59	44.6%	5.5%	57.5%	9.3%	84.3%	5.8%
60-69	34.4%	8.9%	49.0%	14.5%	6.3%	1.2%
70-79	49.2%	19.1%	50.0%	21.3%	57.1%	18.2%
80+	49.9%	22.3%	51.3%	25.6%	40.9%	15.0%
<b>Total</b>	<b>106.8%</b>	<b>7.6%</b>	<b>127.6%</b>	<b>12.3%</b>	<b>120.3%</b>	<b>5.0%</b>

FIGURE 104: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity [1]	14.7%	22.0%	9.2%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	7.6%	12.3%	5.0%
Difference attributable to age and gender adjustment [4]	1.4%	3.3%	1.0%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	6.2%	9.1%	4.0%
Average relative variation attributable to the comorbidity [6] = ([1]/[1]-[5])-1	72.3%	70.1%	76.4%

[4] For more detail go to Methodological considerations section

## Population that has had at least Other pathologies (Other pathologies only or other pathologies and other comorbidities)

FIGURE 105: CFR BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	CASES	CFR	CASES	CFR	CASES	CFR
0-14	203	12.8%	111	11.7%	92	14.1%
15-19	77	11.7%	39	7.7%	38	15.8%
20-29	585	6.7%	242	9.5%	343	4.7%
30-39	1,329	6.1%	546	9.5%	783	3.7%
40-49	1,592	13.4%	656	17.5%	936	10.5%
50-59	1,444	27.0%	653	33.5%	791	21.6%
60-69	1,140	39.9%	589	45.2%	551	34.3%
70-79	695	55.7%	389	61.7%	306	48.0%
80+	420	61.9%	229	67.2%	191	55.5%
<b>Total</b>	<b>7,485</b>	<b>24.8%</b>	<b>3,454</b>	<b>31.4%</b>	<b>4,031</b>	<b>19.2%</b>

FIGURE 106: EXCESS CFR OF THIS POPULATION COMPARED TO THE POPULATION WITHOUT COMORBIDITIES BY AGE AND GENDER

AGE	TOTAL		MALE		FEMALE	
	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION	RELATIVE VARIATION	ABSOLUTE VARIATION
0-14	793.3%	11.4%	544.8%	9.9%	1278.8%	13.1%
15-19	2454.7%	11.2%	1759.0%	7.3%	3077.6%	15.3%
20-29	973.1%	6.0%	987.7%	8.6%	1126.5%	4.3%
30-39	260.7%	4.4%	288.7%	7.1%	325.3%	2.8%
40-49	171.3%	8.4%	154.2%	10.6%	297.5%	7.8%
50-59	120.4%	14.8%	106.9%	17.3%	216.5%	14.8%
60-69	55.0%	14.2%	52.4%	15.5%	75.6%	14.8%
70-79	43.5%	16.9%	44.6%	19.0%	51.0%	16.2%
80+	38.3%	17.1%	34.7%	17.3%	50.8%	18.7%
<b>Total</b>	<b>249.5%</b>	<b>17.7%</b>	<b>225.4%</b>	<b>21.8%</b>	<b>362.3%</b>	<b>15.1%</b>

FIGURE 107: DISCRIMINATION OF THE AVERAGE EXCESS CFR BY EFFECT OF DIFFERENT COMPOSITION OF THE POPULATION BY AGE AND GENDER OF THE EFFECT OF THE COMORBIDITY

	TOTAL	MALE	FEMALE
CFR of the population with the comorbidity [1]	24.8%	31.4%	19.2%
CFR of the population without comorbidities [2]	7.1%	9.7%	4.2%
Difference [3] = [1] - [2]	17.7%	21.8%	15.1%
Difference attributable to age and gender adjustment [4]	6.1%	8.4%	4.9%
Average absolute variation attributable to the comorbidity [5] = [3] - [4]	11.7%	13.4%	10.2%
Average relative variation attributable to the comorbidity [6] = ([1] - [5]) - 1	88.5%	74.0%	113.4%

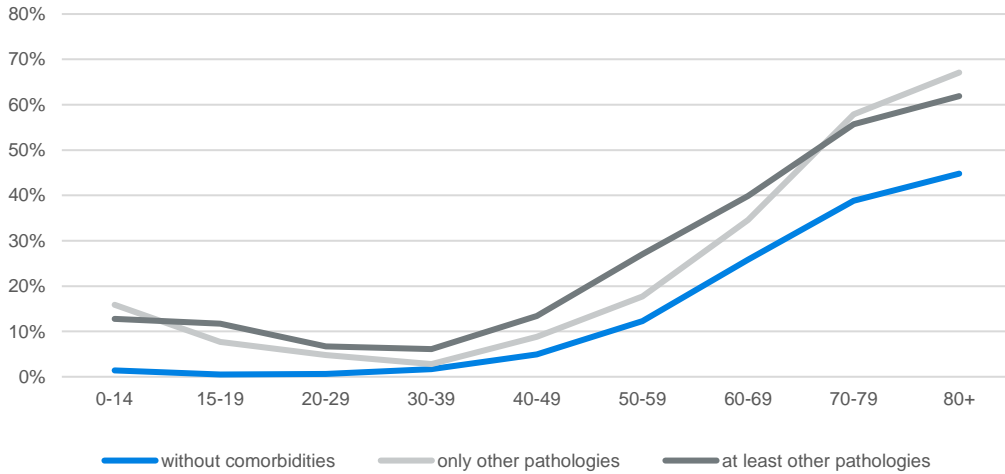
[4] For more detail go to Methodological considerations section



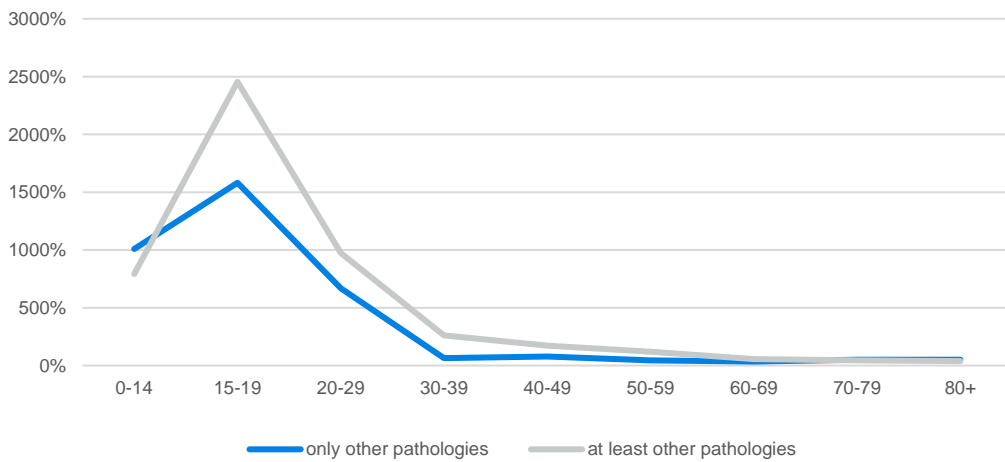
**Comparative charts**

The results previously presented for both genders as a whole are shown below.

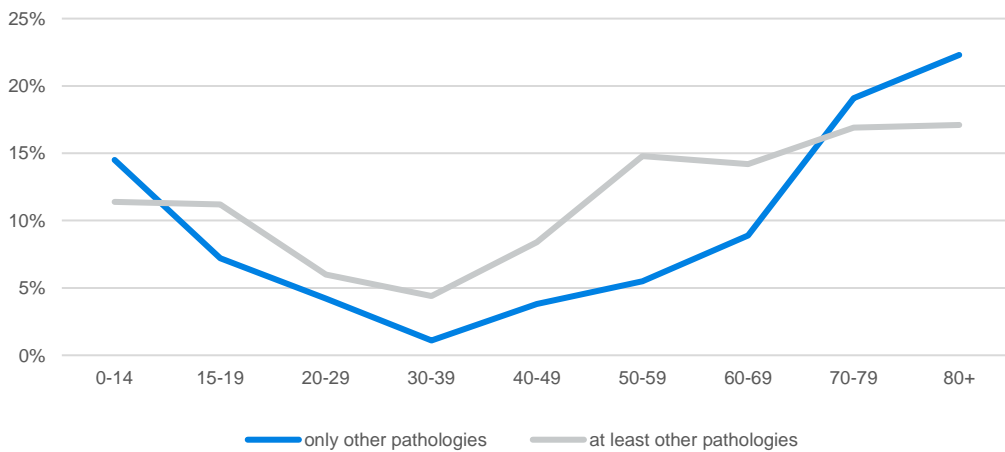
**FIGURE 108: COMPARISON OF THE CFR OF THE POPULATION WITH OTHER PATHOLOGIES VERSUS THE POPULATION WITHOUT COMORBIDITIES**



**FIGURE 109: EXCESS CFR - RELATIVE VARIATION**



**FIGURE 110: EXCESS CFR - ABSOLUTE VARIATION**



**Association with other comorbidities**

The percentage of the population with other pathologies that has presented at least another comorbidity is shown below.

**FIGURE 111: PERCENTAGE OF THE POPULATION WITH OTHER PATHOLOGIES THAT HAVE PRESENTED AT LEAST OTHER COMORBIDITY**

WITHOUT OTHER COMORBIDITIES	WITH OTHER COMORBIDITIES	Percentage of cases that have other pathologies and that additionally present other comorbidities								
		Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking
39%	61%	22.3%	4.2%	4.3%	9.0%	30.8%	8.0%	24.3%	6.2%	9.8%

The percentages of cases with more than one comorbidity were calculated over all cases with comorbidity (with more comorbidities or not). It is noted that a case may present more than two comorbidities.

The analysis of the corresponding CFR can be found in the section “Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities”.

## Detailed analysis of the effect of comorbidity on the CFR for each pair of comorbidities

In order to allow for the identification of the difference between the lethality variations with only one comorbidity or with several comorbidities, we show below the effect of the paired comorbidities.

The results shown here are for those registered COVID-19 infected population that have only exhibited each pair of comorbidities exclusively. That is, they did not have a third associated comorbidity. Because of the number of combinations of comorbidities, results by age and gender are not included.

All the tables presented in this section can be interpreted by analyzing either by rows or by columns, since the values of the pairs of comorbidities are the same at the respective intersections.

### SIZE OF EACH SEGMENT

The number of registered COVID-19 infected cases in each population is shown below:

**FIGURE 112: NUMBER OF REGISTERED COVID-19 INFECTED CASES IN EACH POPULATION OF PAIR OF COMORBIDITIES**

	Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
Diabetes	12,634	284	271	216	11,027	256	3,709	319	964	296
COPD	284	784	54	23	515	37	196	20	174	30
Asthma	271	54	3,388	29	414	33	985	21	230	94
Immunosuppression	216	23	29	964	173	24	177	64	71	221
Hypertension	11,027	515	414	173	16,485	766	6,838	667	1,060	546
Cardiovascular disease	256	37	33	24	766	1,030	265	42	97	102
Obesity	3,709	196	985	177	6,838	265	24,338	127	3,320	601
Chronic kidney failure	319	20	21	64	667	42	127	818	62	41
Smoking	964	174	230	71	1,060	97	3,320	62	9,689	245
Other pathologies	296	30	94	221	546	102	601	41	245	2,884

This information is provided as a reference of the results credibility shown in Figures 115, 116 and 117.

### PROPORTION OF EACH SEGMENT

For each pair of comorbidities shown in the table, the percentage is calculated as the number of cases having only these two comorbidities, over the number of cases having these two comorbidities and any additional comorbidities. The number of cases in the numerator comes from Figure 112.

**FIGURE 113: PROPORTION OF REGISTERED COVID-19 INFECTED CASES THAT HAD EXCLUSIVELY THE COMBINATION OF COMORBIDITIES IN RELATION TO THOSE THAT HAD AT LEAST THAT COMBINATION OF COMORBIDITIES**

	Diabetes	COPD	Asthma	Immuno-suppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
Diabetes	28.4%	15.2%	21.6%	17.9%	46.4%	10.2%	29.3%	10.2%	25.3%	17.8%
COPD	15.2%	17.1%	15.6%	7.8%	21.5%	6.2%	14.4%	5.4%	18.4%	9.6%
Asthma	21.6%	15.6%	46.0%	13.6%	23.7%	11.1%	44.3%	11.7%	39.2%	29.4%
Immunosuppression	17.9%	7.8%	13.6%	26.9%	14.0%	6.7%	19.4%	11.8%	19.0%	32.8%
Hypertension	46.4%	21.5%	23.7%	14.0%	30.2%	20.4%	40.1%	17.6%	24.1%	23.7%
Cardiovascular disease	10.2%	6.2%	11.1%	6.7%	20.4%	16.7%	13.1%	6.2%	12.6%	17.1%
Obesity	29.3%	14.4%	44.3%	19.4%	40.1%	13.1%	46.2%	10.2%	55.2%	33.0%
Chronic kidney failure	10.2%	5.4%	11.7%	11.8%	17.6%	6.2%	10.2%	14.3%	10.5%	8.8%
Smoking	25.3%	18.4%	39.2%	19.0%	24.1%	12.6%	55.2%	10.5%	47.2%	33.3%
Other pathologies	17.8%	9.6%	29.4%	32.8%	23.7%	17.1%	33.0%	8.8%	33.3%	38.5%

This information is provided as a reference to better understand the results shown in Figures 115, 116 and 117.

### AVERAGE AGE OF EACH SEGMENT

Next, the average ages of the population that have exhibited each pair of comorbidities are shown.

**FIGURE 114: AVERAGE AGE OF EACH POPULATION OF PAIR OF COMORBIDITIES**

	Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
Diabetes	54.2	65.4	50.9	56.2	61.4	61.5	50.8	58.1	54.5	55.7
COPD	65.4	62.4	57.5	65.1	68.7	68.7	57.6	58.6	64.8	68.7
Asthma	50.9	57.5	37.4	45.2	52.4	45.5	39.5	41	35.5	40.3
Immunosuppression	56.2	65.1	45.2	43.7	58.6	50.8	46.7	39.4	47.2	42.1
Hypertension	61.4	68.7	52.4	58.6	57.3	66.4	52.4	52.6	57.1	60.5
Cardiovascular disease	61.5	68.7	45.5	50.8	66.4	50.2	48.4	45.7	49.6	48.1
Obesity	50.8	57.6	39.5	46.7	52.4	48.4	42.2	45.9	40.6	44.2
Chronic kidney failure	58.1	58.6	41	39.4	52.6	45.7	45.9	45.7	47.5	45.4
Smoking	54.5	64.8	35.5	47.2	57.1	49.6	40.6	47.5	40.2	45.6
Other pathologies	55.7	68.7	40.3	42.1	60.5	48.1	44.2	45.4	45.6	43.3

This information is provided as a reference for interpretation of the results shown in Figures 115, 116 and 117.

### CFR OF EACH SEGMENT

The average CFR of each segment are shown in the table below.

**FIGURE 115: AVERAGE CFR OF EACH POPULATION OF PAIR OF COMORBIDITIES**

	Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
Diabetes	23.9%	37.3%	16.6%	33.3%	33.5%	29.7%	22.3%	49.2%	26.7%	32.4%
COPD	37.3%	31.6%	22.2%	26.1%	38.3%	37.8%	24.0%	40.0%	38.5%	36.7%
Asthma	16.6%	22.2%	4.2%	17.2%	15.5%	9.1%	6.7%	14.3%	4.3%	9.6%
Immunosuppression	33.3%	26.1%	17.2%	17.7%	28.3%	16.7%	18.1%	31.3%	21.1%	24.9%
Hypertension	33.5%	38.3%	15.5%	28.3%	21.4%	31.2%	20.4%	38.1%	24.2%	33.3%
Cardiovascular disease	29.7%	37.8%	9.1%	16.7%	31.2%	17.3%	21.5%	23.8%	15.5%	23.5%
Obesity	22.3%	24.0%	6.7%	18.1%	20.4%	21.5%	10.5%	19.7%	9.9%	15.8%
Chronic kidney failure	49.2%	40.0%	14.3%	31.3%	38.1%	23.8%	19.7%	20.3%	22.6%	34.1%
Smoking	26.7%	38.5%	4.3%	21.1%	24.2%	15.5%	9.9%	22.6%	6.8%	18.0%
Other pathologies	32.4%	36.7%	9.6%	24.9%	33.3%	23.5%	15.8%	34.1%	18.0%	14.7%

These results show the impact of each pair of comorbidities on the average CFR. However, we can see that several combinations did not include enough data and have limits for reasonable interpretations with descriptive statistics.

### RELATIVE VARIATION IN THE CFR OF EACH SEGMENT

The average relative variation attributable to each pair of comorbidities after adjustment for differences in the distribution of individuals by age and gender, as defined in the “Methodological considerations” section, is shown below.

**FIGURE 116: CFR RELATIVE VARIATION FOR EACH PAIR OF COMORBIDITIES**

	Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
Diabetes	54.9%	45.4%	46.1%	93.7%	54.4%	28.6%	92.3%	146.4%	55.0%	99.5%
COPD	45.4%	34.1%	10.7%	-0.4%	34.5%	19.6%	32.4%	101.7%	30.9%	22.1%
Asthma	46.1%	10.7%	-9.7%	111.0%	26.2%	-0.6%	44.3%	79.6%	5.4%	79.1%
Immunosuppression	93.7%	-0.4%	111.0%	79.0%	45.6%	58.3%	88.2%	364.4%	60.8%	137.8%
Hypertension	54.4%	34.5%	26.2%	45.6%	18.1%	13.5%	55.5%	139.5%	20.4%	56.4%
Cardiovascular disease	28.6%	19.6%	-0.6%	58.3%	13.5%	13.7%	74.2%	120.2%	9.4%	59.0%
Obesity	92.3%	32.4%	44.3%	88.2%	55.5%	74.2%	57.8%	108.5%	53.8%	110.9%
Chronic kidney failure	146.4%	101.7%	79.6%	364.4%	139.5%	120.2%	108.5%	92.9%	73.1%	185.9%
Smoking	55.0%	30.9%	5.4%	60.8%	20.4%	9.4%	53.8%	73.1%	-5.1%	58.2%
Other pathologies	99.5%	22.1%	79.1%	137.8%	56.4%	59.0%	110.9%	185.9%	58.2%	72.3%

These results show the impact of each pair of comorbidities on the relative variation of the CFR. However, we can see that several combinations did not include enough data and have limits for reasonable interpretations with descriptive statistics.

**ABSOLUTE VARIATION IN THE CFR OF EACH SEGMENT**

The average absolute variation attributable to each pair of comorbidities after adjustment for differences in the distribution of individuals by age and gender, as defined in the “Methodological considerations” section, is shown below.

**FIGURE 117: CFR ABSOLUTE VARIATION FOR EACH PAIR OF COMORBIDITIES**

	Diabetes	COPD	Asthma	Immunosuppression	Hypertension	Cardiovascular disease	Obesity	Chronic kidney failure	Smoking	Other pathologies
Diabetes	8.5%	11.7%	5.2%	16.1%	11.8%	6.6%	10.7%	29.2%	9.5%	16.2%
COPD	11.7%	8.0%	2.1%	-0.1%	9.8%	6.2%	5.9%	20.2%	9.1%	6.6%
Asthma	5.2%	2.1%	-0.4%	9.1%	3.2%	-0.1%	2.1%	6.3%	0.2%	4.2%
Immunosuppression	16.1%	-0.1%	9.1%	7.8%	8.9%	6.1%	8.5%	24.5%	8.0%	14.4%
Hypertension	11.8%	9.8%	3.2%	8.9%	3.3%	3.7%	7.3%	22.2%	4.1%	12.0%
Cardiovascular disease	6.6%	6.2%	-0.1%	6.1%	3.7%	2.1%	9.2%	13.0%	1.3%	8.7%
Obesity	10.7%	5.9%	2.1%	8.5%	7.3%	9.2%	3.9%	10.2%	3.5%	8.3%
Chronic kidney failure	29.2%	20.2%	6.3%	24.5%	22.2%	13.0%	10.2%	9.8%	9.5%	22.2%
Smoking	9.5%	9.1%	0.2%	8.0%	4.1%	1.3%	3.5%	9.5%	-0.4%	6.6%
Other pathologies	16.2%	6.6%	4.2%	14.4%	12.0%	8.7%	8.3%	22.2%	6.6%	6.2%

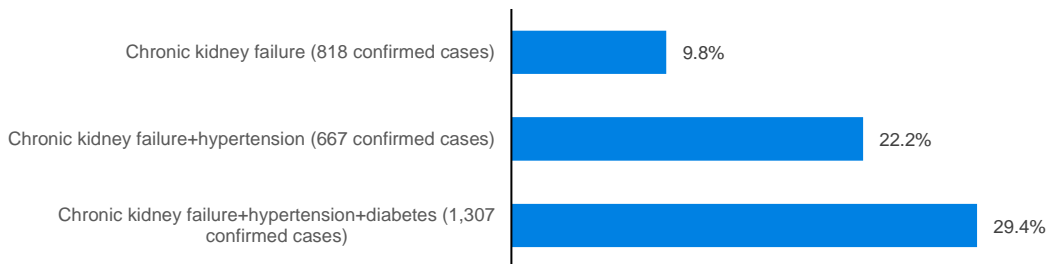
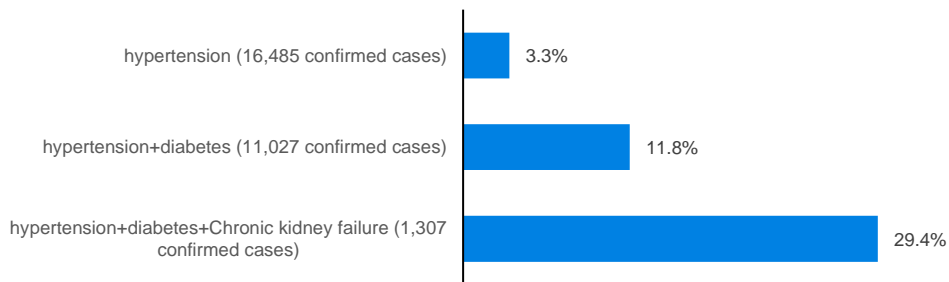
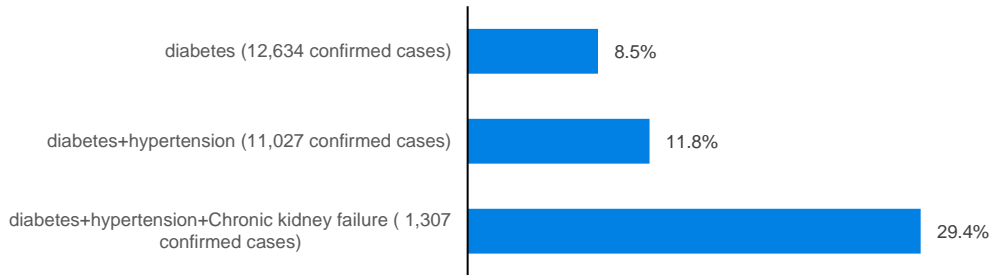
These results show the impact of each pair of comorbidities on the absolute variation of the CFR. However, we can see that several combinations did not present enough data and have limits for reasonable interpretations with descriptive statistics.

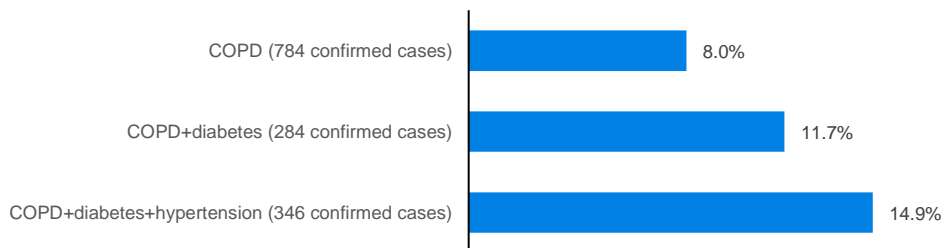
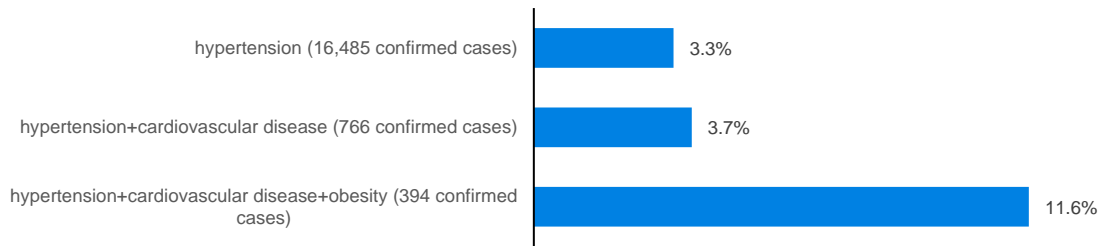
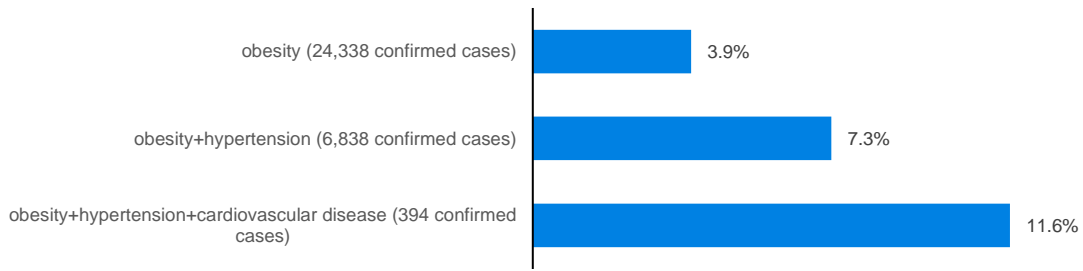
## Detailed analysis of the effect of comorbidity on the CFR for groups with three or more comorbidities

To examine the difference in CFR between cases with only one comorbidity and those with several comorbidities, we show the effect of comorbidities in selected cumulative groups. The charts below show the excess CFR of different combinations of comorbidities (those that presented only the combination of selected comorbidities).

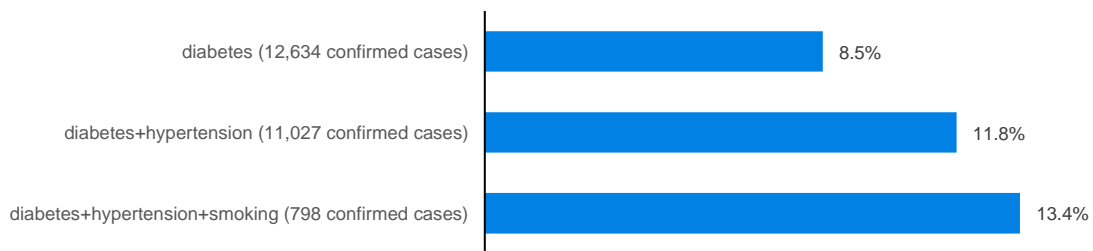
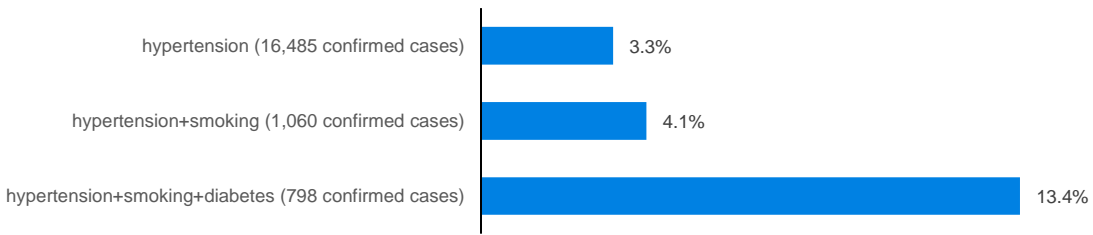
The methodology and its limitations have been described in the section on methodological considerations.

**FIGURE 118: EXCESS CFR OF DIFFERENT COMBINATIONS OF COMORBIDITIES**









These examples show the cumulative effect of comorbidities on some selected cases found in the data.

## Comparison with other studies

To expand on the understanding of the impact of comorbidities on COVID-19 CFR, we have made a comparison with other studies in varied geographies on this topic. It should be noted in the comparisons that the goals, methodology, source of data and timing of the studies may differ. In particular some studies provided modeled results while others just include descriptive values. Also, the comparison may be impacted by the method of reporting of comorbidities. In particular, self-reported data may contain inaccuracies in the reporting of comorbidities, and differences in testing practices in different locations may alter CFR measurements.

### GENERAL CONCLUSIONS

The general conclusions are:

- Comorbidities that appeared as relevant in the Mexican experience were also relevant in studies corresponding to other geographies.
- The level of relative impact of comorbidities among themselves showed geographic variations.
- The studies analysed incorporated other possible comorbidities with an impact on the CFR of COVID-19. These comorbidities include:
  - Neurological / neurodevelopmental diseases / intellectual disability
  - Tuberculosis
  - Liver diseases
  - Other kidney diseases
  - Hemiplegia or paraplegia
  - Peptic ulcer disease
  - Dementia

Detailed comparisons are shown in the Figures below.

### COMPARATIVE DETAILED ANALYSIS AND SPECIFIC CONCLUSIONS

The studies analyzed are the following:

1. Vital Surveillances: The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020  
Source: <http://weekly.chinacdc.cn/en/article/id/e53946e2-c6c4-41e9-9a9b-fea8db1a8f51>
2. COVID-19 in South Carolina: Pre-Existing Conditions (Confirmed and Probable)  
Source: [https://www.scdhec.gov/sites/default/files/media/document/COVID19\\_Comorbidities\\_6.30.20.pdf](https://www.scdhec.gov/sites/default/files/media/document/COVID19_Comorbidities_6.30.20.pdf)
3. Clinical characteristics and predictors of outcomes of hospitalised patients with COVID-19 in a London NHS Trust: a retrospective cohort study  
Source: <https://www.imperial.ac.uk/media/imperial-college/medicine/mrc-gida/2020-04-29-COVID19-Report-17.pdf>
4. Western Cape: COVID-19 and HIV / Tuberculosis  
Source: [https://storage.googleapis.com/stateless-bhekisisa-website/wordpress-uploads/2020/06/94d3ea42-covid\\_update\\_bhekisisa\\_wc\\_3.pdf](https://storage.googleapis.com/stateless-bhekisisa-website/wordpress-uploads/2020/06/94d3ea42-covid_update_bhekisisa_wc_3.pdf)
5. Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta-analysis  
Source: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7177098/>
6. “Comorbidities associated with mortality in 31,461 adults with COVID-19 in the United States: A federated electronic medical record analysis”  
Source: <https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1003321>

### Comparison with “Vital Surveillances: The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020”

This publication reported descriptive statistics for China as of February 11, 2020 that can be compared with those of our report as follows:

**FIGURE 119: COMPARISON WITH CHINESE EXPERIENCE**

Variable	Mexico	Study
Number of cases studied	271,763	44,672
Information cut-off date	July 27 2020	February 11 2020
Number of deaths	36,851	1,023
Comorbidities common to both studies -		
Average CFR by comorbidity:		
Diabetes	30.69%	7.26%
Hypertension	28.64%	6.00%
Cardiovascular disease	31.19%	10.54%
Without comorbidities	7.11%	0.86%

In all cases, a higher fatality was observed in Mexico, which may be due to geographical differences, testing practices and, in the case of Mexico, deaths that occurred one month after the information cut-off date were considered.

Notwithstanding this, given that we are interested in the relative effect of comorbidity with respect to the population without comorbidities, we compared both. The formula used to calculate this was:

$$\text{Relative increase in the lethality} = \frac{\text{CFR of the comorbidity}}{\text{CFR without comorbidities}} - 1$$

**FIGURE 120: RELATIVE INCREASE IN THE LETHALITY OF EACH COMORBIDITY VERSUS THE LETHALITY OF THE POPULATION WITHOUT COMORBIDITIES, MEXICO VS. CHINA**

Comorbidity	Mexico	Study
Diabetes	331.6%	748.0%
Hypertension	302.8%	601.0%
Cardiovascular disease	338.6%	1131.0%

In this comparison, it appears that:

- The order of the disease groups by average CFR coincided in both studies for the common comorbidities.
- Cardiovascular diseases in Chinese experience suggested a more significant impact in relation to diabetes and hypertension than the Mexican experience
- The high effect of these comorbidities was in any case common to both experiences.

The relative differences may be due to differences by age, geographies and other variables. It should be noted that these data do not incorporate potential age and gender differences as they were not identified in the Chinese experience report.

As additional information, it should be noted that the cited publication included cancer with a CFR of 5.6%.

### Comparison with “COVID-19 in South Carolina: Pre-Existing Conditions (Confirmed and Probable)”

The State of South Carolina has published descriptive statistics on the comorbidities associated with COVID-19 deaths, without distinguishing by age and gender.

The comparison of the results of common comorbidities indicates the following:

**FIGURE 121: COMPARISON WITH EXPERIENCE FROM SOUTH CAROLINA (U.S.A.)**

Variable	Mexico	Study
Number of cases studied	271,763	36,399
Information cut-off date	July 27 2020	June 29 2020
Number of deaths	36,851	739
<b>Average CFR by comorbidity:</b>		
Chronic kidney failure (1)	41.6%	20.5%
COPD (2)	38.3%	12.8%
Cardiovascular disease	31.2%	10.9%
Diabetes	30.7%	9.4%
Immunosuppression	28.5%	9.0%
Smoking (3)	15.2%	4.1%
Asthma	10.3%	3.8%
All (with or without comorbidities)	13.6%	2.0%

(1) The South Carolina experience indicated "Chronic kidney failure, end-stage kidney disease - dialysis"

(2) South Carolina experience indicated "COPD, bronchitis and emphysema"

(3) In the case of South Carolina, included current and former smokers

We must remember that the magnitude level of the CFR, in addition to being affected by geographic differences and testing levels, was partially affected by the fact that the South Carolina cases presumably did not include deaths during the month after the cut-off date, such as they did in statistics from Mexico. Likewise, the South Carolina statistics included suspected unconfirmed cases of COVID-19 increasing the denominator and therefore comparatively reducing the CFR. Also, the number of cases in South Carolina was more limited than those in Mexico.

In this comparison it appears that:

- The order of the disease groups by average fatality rate coincided in both experiences for common comorbidities.
- In the South Carolina experience, chronic kidney failure had a much greater relative effect with respect to other diseases than in the Mexican experience.
- Relative to the average CFR for South Carolina, asthma and smoking had a higher CFR, potentially suggesting that these comorbidities had an impact on lethality. However, this may be due to the inclusion of other comorbidities (e.g., smoking cases may include those with COPD which would increase the CFR).
- As additional information, the South Carolina experience included the following significant case fatality comorbidities:
  - Neurological / neurodevelopmental diseases / intellectual disability
  - Other kidney diseases
  - Chronic liver diseases

### Comparison with “Clinical characteristics and predictors of outcomes of hospitalised patients with COVID-19 in a London NHS Trust: a retrospective cohort study” from Imperial College.

This report, like ours, indicated an important significance of diabetes, hypertension, COPD, chronic kidney disease and certain cardiovascular diseases.

As differential elements we distinguish that:

- The relative comparison of the effect of different comorbidities was in some cases different from the ones we found in our study. We take into account that this comparison is relative given the differences in the methodology, the type of sample (hospitalized patients) and the statistical indicators between both studies.
- The report indicated cirrhosis and dementia as relevant comorbidities.
- The specific analysis of several cardiovascular diseases can potentially provide greater detail on this group.
- The Imperial College report estimated the “Odds Ratio” of asthma at 0.62, with a 95% confidence interval between 0.26 and 1.48- and a p-value of 0.28 (not significant). Within the limitations mentioned in the previous point, we believe that this analysis endorses the fact that asthma may not entail an increased risk of fatality when no other comorbidities were exhibited.

### Comparison with “Western Cape: COVID-19 and HIV / Tuberculosis”

The Department of Health in Cape Town, South Africa, has presented an analysis including a modeling of the fatality of COVID-19 in South Africa.

In order to make the results comparable, we have estimated the relationship in the lethality of each comorbidity with respect to the lethality of the group without comorbidities. We did this by making a demographic adjustment by age and gender to approximate the “Adjusted Hazard Ratio”. A Hazard Ratio of 1 would be representative of the overall population without comorbidities, as has been reported in the Cape Town publication.

The comparison of common comorbidities is as follows:

**FIGURE 122: COMPARISON WITH EXPERIENCE FROM SOUTH AFRICA**

Variable	Mexico	Study
Information cut-off date	July 27 2020	Not known
Form of expression of the results	Relation between lethality of the group with each comorbidity and lethality of the group without comorbidities (With demographic adjustment)	Adjusted Hazard Ratio
Diabetes (1)	1.68	3.64 to 13.02
Hypertension	1.51	1.46
Chronic kidney failure disease (2)	2.31	2.02

(1) The analysis from South Africa differentiated groups according to the level of diabetes control.

(2) In the case of Mexico it was Chronic kidney failure and in South Africa Chronic Kidney Disease

From the analysis emerges:

- The values for lethality of diabetes in the South African analysis were much higher than those of Mexico.
- Values for hypertension were on similar orders of magnitude.
- Given the difference in definitions for chronic kidney failure and disease the range of the values was reasonable.

As differential elements, the analysis from South Africa included specific tests for HIV and tuberculosis as comorbidities, these being the basis of initial concern for the analysis.

### Comparison with “Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta-analysis”

This study did not only include deaths but both "critical and mortal cases". Therefore, the number of positive cases was higher and could induce bias due to differences in proportionality between critical cases and mortal cases. On the contrary, this study presumably did not include deaths after the cut-off date.

**FIGURE 123: COMPARISON WITH OTHER CHINESE EXPERIENCE**

	Mexico	Study
Number of cases studied	271,763	2,579
Information cut-off date	July 27 2020	March 20 2020
Number of events	36,851	460
Average CFR by comorbidity:		
Diabetes	30.7%	40.8%
Hypertension	28.6%	29.7%
Cardiovascular disease	31.2%	55.6%

In this comparison it appears that:

- The order of the disease groups by average fatality rate matched in both experiences for common comorbidities.
- Cardiovascular diseases and diabetes appeared in proportion as having a much more significant impact in relation to hypertension than the Mexican experience. It should be noted that these data did not incorporate potential age and gender differences as they were not identified in this Chinese experience report.

As additional elements we highlight that this report also included cancer with a positive case rate of 33.3% (critical and mortal).

### Comparison with “Comorbidities associated with mortality in 31,461 adults with COVID-19 in the United States: A federated electronic medical record analysis”

This report, like ours, indicated an important significance of certain cardiovascular diseases, chronic pulmonary disease, diabetes mellitus, and renal disease on the CFR of COVID-19 individuals. The report indicated other relevant comorbidities, which were not available in the Mexican database:

- Liver diseases, even mild.
- Hemiplegia or paraplegia
- Peptic ulcer disease
- Dementia

However, the comparison of these study results were limited due to different disease classifications. Also, the US average CFR was much lower than the CFR reported in Mexico.

The specific analysis of several cardiovascular diseases, liver diseases by severity and tumors can potentially help in a more detailed analysis of these groups.

## Final comments

The COVID-19 pandemic is new and extraordinarily dynamic. Understanding this phenomenon and its consequences requires the participation of different sectors, contributing their respective viewpoints and approaches.

At Milliman we are conducting various studies on this phenomenon. It is our intention to contribute to a better understanding of the impact, such as this report, in order to provide a vision that can be used by different disciplines and different sectors of society.

## Appendix I

### PREVALENCE OF COMORBIDITIES IN THE REGISTERED COVID-19 INFECTED POPULATION

We have compared the prevalence of each comorbidity in the population with COVID-19 according to the Database to the prevalence rate of disease of the general population in Mexico, which was obtained from different sources identified below.

**FIGURE 124: COMORBIDITY PREVALENCE IN MEXICO**

COMORBIDITY	COVID-19 DATABASE	GENERAL POPULATION
Hypertension	20.1%	24.4% <sup>10</sup>
Obesity	19.4%	32.4% <sup>10</sup>
Diabetes	16.3%	10.4% <sup>11</sup>
Smoking	7.6%	10.0% <sup>12</sup>
Asthma	2.7%	7.0% <sup>13</sup>
Cardiovascular disease	2.3%	
Chronic kidney failure	2.1%	12.2% <sup>14</sup>
COPD	1.7%	10.0% <sup>15</sup>
Immunosuppression	1.3%	
Other pathologies	2.8%	
Without comorbidities	53.1%	

We note that, with the exception of diabetes, the comorbidity rates found in the general population are higher than those found in the COVID-19 patient database. This may be the result, among other reasons, of:

- Underreporting of comorbidities within the population at the time of COVID-19 testing
- Different criteria to consider the classification of a case in the comorbidity group
- Different methodologies or parameters for measurement

<sup>10</sup> Organisation for Economic Co-operation and Development: <https://www.oecd.org/mexico/Cardiovascular-Disease-and-Diabetes-Policies-for-Better-Health-and-Quality-of-Care-Mexico-In-Spanish.pdf>.

Encuesta Nacional de Salud y Nutrición indicates 18.4% for hypertension: [https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut\\_2018\\_presentacion\\_resultados.pdf](https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut_2018_presentacion_resultados.pdf)

<sup>11</sup> World Health organization: [https://www.who.int/diabetes/country-profiles/mex\\_en.pdf?ua=1](https://www.who.int/diabetes/country-profiles/mex_en.pdf?ua=1). Instituto Nacional de Salud Pública indicates 10.3% in population aged 20 years old and up: [https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut\\_2018\\_presentacion\\_resultados.pdf](https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut_2018_presentacion_resultados.pdf)

<sup>12</sup> Encuesta Nacional de Salud y Nutrición- [https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut\\_2018\\_presentacion\\_resultados.pdf](https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut_2018_presentacion_resultados.pdf)

<sup>13</sup> Mexican Government-Ministry of health: <https://www.gob.mx/salud/prensa/siete-por-ciento-de-la-poblacion-en-mexico-padece-asma>

<sup>14</sup> Instituto Nacional de Salud Pública: <https://www.insp.mx/avisos/5296-enfermedad-renal-cronica-mexico.html>

<sup>15</sup> Mexican government-Ministry of health: <https://www.gob.mx/salud/prensa/10-por-ciento-de-la-poblacion-mexicana-padece-epoc>

## Appendix II

### ABOUT THE DATABASE

The Database in this study was compiled by the Ministry of Health and made available to the public via downloadable files by the government of Mexico.

In order to facilitate the understanding of the information included in this Database, we reproduced below the description provided by the Ministry of Health:

#### **General description of the database contents:**

*“This database includes Information from the Epidemiological Surveillance System for Viral Respiratory Diseases, which includes data from the 475 viral respiratory disease monitoring units (USMER) distributed throughout the country including the entire health system (IMSS, ISSSTE, SEDENA, SEMAR, ETC).*

*Note: This is preliminary data subject to validation by the Ministry of Health through the Office of Epidemiology. The information contained corresponds only to the data obtained from the epidemiological study of a suspected case of viral respiratory disease at the time it is identified in the medical units of the Health Sector.*

*According to the clinical diagnosis at the time of admission, it is classified as an outpatient or hospitalized case. The database does not include the evolution during their stay in the medical units, with the exception of the recording of the discharge by the hospital from the epidemiological surveillance units or health jurisdictions in case of deceased patients.”*

### DESCRIPTION OF FIELDS IN THE DATABASE

The website <https://datos.gob.mx/busca/dataset/informacion-referente-a-casos-covid-19-en-mexico> offers the following description of the fields included in the database:

FIELD NAME IN THE DATABASE	DESCRIPTION (SPANISH)	DESCRIPTION (ENGLISH)
FECHA_ACTUALIZACION	La base de datos se alimenta diariamente, esta variable permite identificar la fecha de la última actualización.	The database is updated daily. This variable identifies the date of the last update.
ID_REGISTRO	Número identificador del caso	Case identifier number
ORIGEN	La vigilancia centinela se realiza a través del sistema de unidades de salud monitoras de enfermedades respiratorias (USMER). Las USMER incluyen unidades médicas del primer, segundo o tercer nivel de atención y también participan como USMER las unidades de tercer nivel que por sus características contribuyen a ampliar el panorama de información epidemiológica, entre ellas las que cuenten con especialidad de neumología, infectología o pediatría. (Categorías en Catálogo Anexo).	Surveillance is carried out through the viral respiratory disease monitoring units (USMER). The USMER includes first, second or third care level medical units. Third level of care units which, because its characteristics, contribute to expand the epidemiological information, including specialties in pulmonology, infectology and pediatrics. (Categories included in the attached Catalog).
SECTOR	Identifica el tipo de institución del Sistema Nacional de Salud que brindó la atención.	Identifies the type of institution of the National Health System that provided the care.
ENTIDAD_UM	Identifica la entidad donde se ubica la unidad médica que brindó la atención.	Identifies the State where the medical unit that provided the care is located.
SEXO	Identifica al sexo del paciente.	Identifies the patient's gender
ENTIDAD_NAC	Identifica la entidad de nacimiento del paciente.	Identifies the patient's place of birth
ENTIDAD_RES	Identifica la entidad de residencia del paciente.	Identifies the patient's State of residence
MUNICIPIO_RES	Identifica el municipio de residencia del paciente.	Identifies the patient's City of residence
TIPO_PACIENTE	Identifica el tipo de atención que recibió el paciente en la unidad. Se denomina como ambulatorio si regresó a su casa o se denomina como hospitalizado si fue ingresado a hospitalización.	Identifies the type of care the patient received in the unit. It is classified as outpatient if they went back home or inpatient if they were admitted in a hospital.
FECHA_INGRESO	Identifica la fecha de ingreso del paciente a la unidad de atención.	Identifies the admission date of the patient to the care unit.
FECHA_SINTOMAS	Identifica la fecha en que inició la sintomatología del paciente.	Identifies the date on which the patient's symptoms began
FECHA_DEF	Identifica la fecha en que el paciente falleció.	Identifies the date when the patient died (if applicable).
INTUBADO	Identifica si el paciente requirió de intubación.	Identifies if the patient required intubation
NEUMONIA	Identifica si al paciente se le diagnosticó con neumonía.	Identifies if the patient was diagnosed with pneumonia



FIELD NAME IN THE DATABASE	DESCRIPTION (SPANISH)	DESCRIPTION (ENGLISH)
<b>EDAD</b>	Identifica la edad del paciente.	Identifies the patient's age
<b>NACIONALIDAD</b>	Identifica si el paciente es mexicano o extranjero.	Identifies if the patient is Mexican or foreign
<b>EMBARAZO</b>	Identifica si la paciente está embarazada.	Identifies if the patient is pregnant
<b>HABLA_LENGUA_INDIG</b>	Identifica si el paciente habla lengua indígena.	Identifies if the patient speaks an indigenous language.
<b>DIABETES</b>	Identifica si el paciente tiene un diagnóstico de diabetes.	Identifies if the patient has a diagnosis of diabetes.
<b>EPOC</b>	Identifica si el paciente tiene un diagnóstico de EPOC.	Identifies if the patient has a diagnosis of COPD.
<b>ASMA</b>	Identifica si el paciente tiene un diagnóstico de asma.	Identifies if the patient has a diagnosis of asthma
<b>INMUSUPR</b>	Identifica si el paciente presenta inmunosupresión.	Identifies if the patient is immunosuppressed
<b>HIPERTENSION</b>	Identifica si el paciente tiene un diagnóstico de hipertensión.	Identifies if the patient has a diagnosis of hypertension.
<b>OTRAS_COM</b>	Identifica si el paciente tiene diagnóstico de otras enfermedades.	Identifies if the patient has a diagnosis of other diseases.
<b>CARDIOVASCULAR</b>	Identifica si el paciente tiene un diagnóstico de enfermedades cardiovasculares.	Identifies if the patient has a diagnosis of cardiovascular disease.
<b>OBESIDAD</b>	Identifica si el paciente tiene diagnóstico de obesidad.	Identifies if the patient has a diagnosis of obesity.
<b>RENAL_CRONICA</b>	Identifica si el paciente tiene diagnóstico de insuficiencia renal crónica.	Identifies if the patient has a diagnosis of chronic kidney failure.
<b>TABAQUISMO</b>	Identifica si el paciente tiene hábito de tabaquismo.	Identifies if the patient has a smoking habit.
<b>OTRO_CASO</b>	Identifica si el paciente tuvo contacto con algún otro caso diagnosticado con SARS CoV-2	Identify if the patient had contact with any other case diagnosed with SARS CoV-2
<b>RESULTADO</b>	Identifica el resultado del análisis de la muestra reportado por el laboratorio de la Red Nacional de Laboratorios de Vigilancia Epidemiológica (INDRE, LESP y LAVE). (Catálogo de resultados diagnósticos anexo).	Identifies the test result provided by National Network of Epidemiological Surveillance Laboratories (INDRE, LESP and LAVE). (Catalog of diagnostic results attached).
<b>MIGRANTE</b>	Identifica si el paciente es una persona migrante.	Identifies if the patient is a migrant person
<b>PAIS_NACIONALIDAD</b>	Identifica la nacionalidad del paciente.	Identifies the nationality of the patient.
<b>PAIS_ORIGEN</b>	Identifica el país del que partió el paciente rumbo a México.	Identifies the country from which the patient departed for Mexico.
<b>UCI</b>	Identifica si el paciente requirió ingresar a una Unidad de Cuidados Intensivos.	Identifies if the patient required admission to an Intensive Care Unit.

## Glossary of Terms

- **Registered COVID-19 infected cases (CASES):** individuals whose diagnosis for COVID-19 has been positive in the Database.
- **Database:** includes all registered COVID-19 infected cases whose date of first symptoms occurred through June 27, and deaths registered through July 27, 2020 for the same group of cases. The information included in this Database, reflected data obtained from the epidemiological study of suspected cases of viral respiratory disease at the time identified in the medical centers of the Ministry of Health. The Database contained preliminary data subject to additional validation by the Ministry of Health through the General Center of Epidemiology. This study only considered those confirmed cases of COVID-19, as registered in the Database, whether treated in an ambulatory setting or hospitalized.
- **Deaths:** Individuals whose diagnosis for COVID-19 has been positive and have a reported death in the Database.
- **CFR – Case Fatality Rate:** number of known deaths at the cut-off date divided by the number of registered COVID-19 infected cases in the Database at the cut-off date.
- **General population:** total population of Mexico (according to data projected at the beginning of 2020).
- **Population with COVID-19:** total of registered COVID-19 infected cases in the Database.

This glossary refers to terms used in this study. May not apply to the other studies mentioned for comparison purposes.

At Milliman we are dedicated to analyzing the effect of COVID-19 from multiple approaches. Please contact us if you are interested in learning more about this pandemic or how it may impact you or your business.

It will be a real pleasure for us to receive any suggestions for future surveys or studies, or comments on the studies already carried out.

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