Excess mortality during the COVID-19 pandemic in Spain by non-COVID-19 causes of death

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[INDEX]

[ABBREVIATIONS]

ABBREVIATION	DESCRIPTION
COPD	Chronic Obstructive Pulmonary Disease
GAM	Generalized additive model
ICD-10	International Classification of Diseases, 10th edition
ICU	Intensive care unit
INE	National Institute of Statistics (Instituto Nacional de Estadística)
ISCIII	Carlos III Health Institute (Instituto de Salud Carlos III)
MoMo	Monitoring of daily all-cause mortality (Monitorización de la mortalidad diaria por todas las causas)
PCR	Polymerase chain reaction
RAE-CMBD	Specialized Healthcare Activity Registry – Minimum Basic Data Set (Registro de Actividad de Atención Sanitaria Especializada - Conjunto Mínimo Básico de Datos)
SD	Standard deviation
SNHS	Spanish National Healthcare System
URT	Upper respiratory tract

00

[EXECUTIVE SUMMARY]

The COVID-19 pandemic in Spain generated excess mortality due to identified and unidentified COVID-19 in 2020, accounting for 82.51% of the excess mortality in the second wave of the pandemic. However, an important part of the excess mortality recorded could be due to the indirect impact of the pandemic, manifested as excess mortality from non-COVID-19 causes.

OBJECTIVES

Principal	Specific
To estimate excess mortality during the COVID-19 pandemic in Spain by non-COVID-19 causes of death.	**1.** To analyze the variation in mortality in 2020 vs. 2015-2019 period, by non-COVID-19 causes of death. **2.** To analyze the variation (excess/defect) of hospital discharges due to exitus in 2020 and 2021 vs. 2015-2019 period, according to hospital service and main diagnosis. **3.** To analyze the variation of mortality in 2020 vs. 2015-2019 period, by specific causes.
Exploratory	
To assess the impact of healthcare system overload on mortality variation in 2020 vs. 2015-2019 period, by non-COVID-19 causes of death.	

METHODOLOGY

To achieve the objectives of the study, the official databases that recorded mortality data during the COVID-19 pandemic in Spain were analyzed:

1) To contextualize excess all-cause mortality during the COVID-19 pandemic, the Carlos III Health Institute's (ISCIII) monitoring of daily all-cause mortality (MoMo) system was consulted;

2) To estimate excess mortality from non-COVID-19 causes of death during the COVID-19 pandemic, the death statistics by cause of death reported by the National Institute of Statistics (INE) were consulted; and

3) To complete the analysis of the indirect impact of the COVID-19 pandemic on excess mortality, we consulted hospital discharges due to exitus from the Specialized Healthcare Activity Registry – Minimum Basic Data Set (RAE-CMBD) of the Spanish National Healthcare System (SNHS).

In general, the analysis of the databases consisted of estimating the variation of the monthly and annual mortality rate in 2020 with respect to the period from 2015 to 2019 according to non-COVID-19 cause of death and place of death. In addition, we estimated the variation of in-hospital exitus discharge rate in 2020 and 2021 with respect to the period from 2015 to 2019, according to non-COVID-19 cause of death and hospital service. The analysis focuses on three blocks of diseases in which the COVID-19 pandemic had a greater impact: diseases of the respiratory system, neoplasms, and diseases of the circulatory system.

INDEX

In addition, the present study had an Advisory Committee, comprised by healthcare professionals linked to different hospital services which were especially involved in healthcare during the COVID-19 pandemic in Spain, to guide the analysis and interpretation of the data from their knowledge and experience. The social and healthcare context of the COVID-19 pandemic was further contemplated.

RESULTS

In 2020, there was a 17% increase in mortality compared to the previous 5 years, reaching 80% in April, with COVID-19 being the main cause of death. Likewise, at the in-hospital level, there was a 29% increase in discharges due to exitus, despite the provision of additional hospitals and ICU beds.

Respiratory system diseases

The analysis focused on diseases of the respiratory system, excluding COVID-19, recorded an increase in the mortality rate in March 2020 with respect to the previous 5 years, which disappeared in the following months. This was possibly due to the low diagnostic capacity of COVID-19 at the beginning of the pandemic, erroneously attributing the cause of death to a classic disease of the respiratory system.

In addition, at the in-hospital level, 2020 recorded an increase in mortality due to diseases such as pneumonia, chronic obstructive pulmonary disease (COPD), or bronchitis. However, in 2021 and despite the lower number of discharges due to exitus compared to 2015-2019, the in-hospital mortality rate increased, possibly due to the fact that hospitalization was restricted to more severe patients. On the other hand, COVID-19 may have precipitated death from other causes, especially in chronic pathologies and vulnerable population. Of the patients who died in March 2020, some also had identified or suspected COVID-19. In April 2020, this proportion increased significantly, coinciding with the increase in the proportion of patients dying in nursing homes.

Neoplasms

The analysis focused on neoplasms showed an increase in the mortality rate in March 2020 compared to the previous 5 years. As was the case for respiratory system diseases, this may have been due to the low diagnostic capacity of the COVID-19 at that time. However, in July 2020, coinciding with the end of the state of alarm and the relaxation of the use of the mask, there was again an increase in the mortality rate not attributable to COVID-19, since at that time the diagnostic capacity had increased fivefold.

In contrast, at the in-hospital level, the years 2020 and 2021 recorded a reduction in mortality compared to the 2015-2019 period. It is possible that these patients died more in the out-of-hospital setting as was observed in malignant neoplasms of the trachea, bronchi or lung, or that they saw their medical appointments cancelled or were afraid to go to the hospital at a time of high COVID-19 incidence. In fact, the reduction was smaller in 2021, which may be indicative of a recovery in the care of these patients.

Diseases of the circulatory system

As for diseases of the circulatory system, there was an increase in the mortality rate in March 2020 compared to March in the previous 5 years. As with respiratory system diseases and neoplasms, this could be due to the low diagnostic capacity of COVID-19 at that time, so that some of these patients could have died from COVID-19, but also from thromboembolism derived from COVID-19, which was underdiagnosed due

INDEX

to their unknown correlation at that time. However, from July 2020, coinciding with the end of the state of alarm and the relaxation of the use of the mask, there was again an excess mortality not attributable to COVID-19, since at that time the diagnostic capacity had increased fivefold.

At the in-hospital level, despite a reduction in the number of discharges due to exitus in 2020 and 2021 compared to 2015-2019 for heart failure, the in-hospital mortality rate increased, possibly due to more severely ill patients being admitted. There was also a reduction in the proportion of in-hospital deaths during the first wave of the COVID-19 pandemic due to heart failure, in addition to cerebrovascular disease, angina pectoris, and acute myocardial infarction, in parallel with a significant increase in out-of-hospital mortality, especially in nursing homes and at home. This was possibly associated with patients being afraid to go to the hospital.

CONCLUSIONS

Unlike most of the studies found in the scientific literature, this study analyzes both the direct and indirect impact of the COVID-19 pandemic at the national level, both in-hospital (broken down by services) and out-of-hospital (broken down by place of death), on multiple causes of mortality.

The results of this study describe common patterns associated with the indirect impact of the COVID-19 pandemic. First, the reduction in hospital deaths in parallel to the increase in the hospital mortality rate with respect to the pre-pandemic period, especially in cases of heart failure, could be indicative of the fact that only the most severe patients were admitted during the pandemic. Secondly, the reduction in the proportion of deaths in the hospital setting during the pandemic paralleled the increase in the out-of-hospital setting, especially in cases of chronic lower tract disease, malignant neoplasms of the trachea, bronchi or lung, and heart failure, among others. This could indicate that patients were afraid to go to the hospital, especially during peak incidence and hospital overcrowding, and died at home or in nursing homes.

The volume, complexity and limitations of the data analyzed, together with the multifactorial nature of the impact of the COVID-19 pandemic on mortality, preclude establishing a cause-effect relationship or confirming the exploratory objective of the possible impact of healthcare system overload on mortality from non-COVID-19 causes of death.

01

[INTRODUCTION AND CONTEXT]

The Spanish system for monitoring daily all-cause mortality (MoMo) recorded an unprecedented excess of mortality in 2020 coinciding with the onset of the COVID-19 pandemic and, in parallel, with the cumulative incidence of people with COVID-19[1]. The total impact of the COVID-19 pandemic on mortality extends beyond records of identified COVID-19 mortality and also encompasses excess mortality from unidentified COVID-19 and non-COVID-19 causes[2]. Thus, the excess all-cause mortality reflects both the direct (due to identified or unidentified COVID-19) and indirect (e.g., due to healthcare system overload) impact of such a pandemic[1–3]. The proportion of excess mortality directly attributable to COVID-19 was 66.46% during the first wave of the pandemica and 82.51% during the second waveb , according to data from the MoMo system[1]. These proportions are similar to those reported in other studies for the year 2020 (66.54% - 71.52%)[4,5]. Therefore, a non-negligible part of the excess mortality in that period could be attributed to the indirect impact of the pandemic.

In this regard, a recent study analyzed the impact of the first wave of the COVID-19 pandemic on the number of hospitalizations of non-COVID-19 patients in a hospital in Seville and the associated in-hospital/out-of-hospital mortality[2]. This study observed a 26.8% decrease in the number of annual hospitalizations during the first wave of the pandemic compared to the period 2017-2019, accompanied by a change in the profile of hospitalized patients (older, more severe patients, admitted for emergency and with longer hospital stays) and an increase in in-hospital (25.6%) and out-of-hospital (9.8%) mortality[2]. Specifically, there was a significant increase in in-hospital mortality rates associated with permanent pacemaker implantation, followed by epilepsy, other nervous system disorders, hip prosthesis implantation, stroke and precerebral occlusion with infarction, and heart failure[2].

Although the severity of non-COVID-19 patients admitted to hospitals during the first wave of the pandemic increased from previous years, these patients did not contribute to a change in intensive care unit (ICU) overcrowding, according to the study authors[2]. However, despite the increase in ICU bed capacity, especially during the first wave of the pandemic, there was a significant increase in ICU bed occupancy by COVID-19 patients and a decrease by non-COVID-19 patients, which may have contributed to the increase in ICU overcrowding[6]. This may have contributed to the increase in mortality observed in the latter[2].

In contrast, this same study reflects declines in mortality rates from non-COVID-19 causes such as acute myocardial infarction, which also reflects the indirect impact of the COVID-19 pandemic. It is possible that these reductions are associated with mortality prevented by the social restrictions imposed during the COVID-19 pandemic[2,7], but in some cases it could be because these deaths occurred in the out-of-hospital setting. In this regard, in a study of cardiorespiratory arrest care, there was a significant reduction in the number of cases treated in the out-of-hospital setting and an increase in out-of-hospital mortality during the onset of the COVID-19 pandemic compared to the same period in previous years.[8]. This reduction in the number of cases treated, together with an excess of in situ mortality, could be associated with factors such as the overload of healthcare resources or the fear of seeking help during the pandemic, among others[8].

a The first wave refers to the period from March 10 to June 21, 2020.
b The second wave refers to the period from June 22 to December 6, 2020.

Most studies on the indirect impact of the COVID-19 pandemic in Spain, understood as excess mortality from non-COVID-19 causes, have focused on specific diseases (e.g., cancer) or cardiovascular and cerebrovascular events. In general, these studies recorded excess mortality during the COVID-19 pandemic compared to a pre-pandemic period in patients with cardiovascular events such as symptomatic severe aortic stenosis, cardiorespiratory arrest, or acute myocardial infarction[9,10,8,11], in patients with stroke[12–14], or with sexually transmitted or intra-abdominal infections, among others[15,16].

The study of the impact of the COVID-19 pandemic on mortality from non-COVID-19 causes cannot be separated from the health, political and social context. Although most published studies focus on the direct impact of the COVID-19 pandemic, in order to understand the overall impact of the pandemic, an exhaustive study of the indirect impact, considering the main causes of non-COVID-19 death individually and as a whole, will be essential to understand the extent of the impact of the pandemic in Spain.

02

[OBJECTIVES]

MAIN OBJECTIVE

To estimate excess mortality during the COVID-19 pandemic in Spain by non-COVID-19 causes of death.

SPECIFIC OBJECTIVES

- To analyze the variation in mortality in 2020 vs. 2015-2019 period, by non-COVID-19 causes of death.
- To analyze the variation (excess/defect) of hospital discharges due to exitus in 2020 and 2021 vs. 2015-2019 period, according to hospital service and main diagnosis.
- To analyze the variation of mortality in 2020 vs. 2015-2019 period, by specific causes.

EXPLORATORY OBJECTIVE

To assess the impact of healthcare system overload on mortality variation in 2020 vs. 2015-2019 period, by non-COVID-19 causes of death.

03

[METHODOLOGY]

3.1. SOURCES OF INFORMATION

In order to achieve the objectives of this study, the following sources were consulted:

3.1.1. Scientific literature

A search of the scientific literature on excess mortality during the COVID-19 pandemic in Spain was carried out using the PubMed® search engine.

3.1.2. Databases

The official databases that recorded mortality data during the COVID-19 pandemic in Spain, developed by the following organizations, were analyzed:

- **Carlos III Institute of Health.** To contextualize the excess all-cause mortality during the COVID-19 pandemic, the ISCIII MoMo system was consulted[17].
- **National Institute of Statistics.** To estimate excess mortality from non-COVID-19 causes of death during the COVID-19 pandemic, the death statistics by cause of death of the National Statistics Institute (INE) were consulted[18].
- **National Healthcare System:** In order to perform a complete analysis of the indirect impact of the COVID-19 pandemic on excess mortality, we consulted hospital discharges due to exitus from the SNHS RAE-CMBD[19].

3.1.3. Advisory Committee

To guide the analysis of excess mortality from non-COVID-19 causes of death during the COVID-19 pandemic and to ease the interpretation of the results, an Advisory Committee comprising healthcare professionals linked to different hospital services involved in healthcare during the COVID-19 pandemic was convened. »»» Table 1 shows the composition of the Advisory Committee that participated in this project.

»»» Table 1. Members of the Advisory Committee

Expert	Affiliation
Dr. Ricard Ferrer Roca	Intensive Care Medicine Service. Vall d'Hebron Hospital. Barcelona.
Dr. Juan María González del Castillo	Emergency Department. San Carlos Clinical Hospital. Madrid.
Dra. Rosario Menéndez Villanueva	Pneumology Service. La Fe Hospital. Valencia.
Dra. M.ª del Carmen Sanclemente	Medical Director. Son Espases Hospital. Balearic Islands.
Dr. Roger Paredes Deiros	Infectious Diseases Service. Germans Trias i Pujol Hospital. Badalona.

3.2. PHASES OF THE ANALYSIS

3.2.1. Analysis of overall excess mortality

To contextualize excess **all-cause** mortality during the COVID-19 pandemic, peak excess mortality was estimated[a] throughout 2020 as follows:

For each month (Calculation A):

$$\Delta_{REL} = \frac{\text{observed mortality}_{2020} - \text{expected mortality}_{2020}}{\text{observed mortality}_{2020}} \cdot 100$$

*where observed mortality2020 is the observed monthly mortality in the year 2020 and the expected mortality2020 is the expected monthly mortality for the year 2020 estimated by the **ISCIII MoMo System** using a Generalized Additive Model (GAM) with the number of daily deaths observed in the 10 years prior to 2020 as the dependent variable[17].*

To estimate excess mortality **by specific causes** during the year 2020, the **INE death statistics** were analyzed according to the reduced cause of death list[b][18] (»»» **Annex 1**) as follows:

a) From the number of deaths registered by cause of death, year, and month, from January 2016 to December 2020, mortality rates were calculated by cause of death, year, and month, based on the number of inhabitants as of January 1 of each year[c].

For each cause of death, year, and month (Calculation B):

$$\text{Mortality rate}_{20nn} = \frac{\text{number of deaths}_{20nn}}{\text{number of inhabitants as of January 1, 20nn}} \cdot 100{,}000 \text{ inhabitants}$$

*where **nn** corresponds to the last two digits of the year*

a The peaks of excess mortality correspond to the months of April, August, and November 2020.
b The degree of accuracy or reliability of the quantitative or qualitative information derived from the authors' own elaboration is the sole responsibility of the authors.
c The population as of January 1 of each year was assumed for the calculation of the mortality rate in all months of that same year.

b) Next, we estimated the absolute and relative variation of mortality rates obtained in *Calculation B*, by cause of death and month, in 2020 with respect to the same rates corresponding to the same pre-pandemic period from 2015 to 2019, the period usually used to estimate expected mortality[4,20,7,21].

For each cause of death, year of comparison, and month (Calculation C):

$$\Delta_{\text{ABS }20nn-2020} = \text{mortality rate}_{2020} - \text{mortality rate}_{20nn}$$

$$\Delta_{\text{REL }20nn-2020} = \frac{\text{mortality rate}_{2020} - \text{mortality rate}_{20nn}}{\text{tmortality rate}_{20nn}} \cdot 100$$

*where **nn** corresponds to the last two digits of the comparison year (2015 to 2019)*

c) Finally, the mean and standard deviation of the absolute and relative variation of mortality rates obtained in *Calculation C*, by cause of death and month in 2020 were estimated with respect to the same corresponding rates in the pre-pandemic period from 2015 to 2019.

For each cause of death and month (Calculation D):

$$\Delta_{\text{ABS mean}} = \frac{\sum \Delta_{\text{ABS }20nn-2020}}{\text{years compared}}$$

$$\Delta_{\text{REL mean}} = \frac{\sum \Delta_{\text{REL }20nn-2020}}{\text{years compared}}$$

*where **nn** corresponds to the last two digits of the comparison year (2015 to 2019)*

In addition, from the mortality rates obtained in *Calculation B*, by cause of death, year, and month from January 2016 to December 2020, the sum of the mortality rates in the months of 2020 in which there was a peak of excess relative mortality according to the analysis of the MoMo System data for each cause of death and year was calculated. Next, the mean and standard deviation of the absolute and relative variation of the sum of mortality rates by cause of death in 2020 relative to the sum of mortality rates by cause of death in the prepandemic period, 2015 to 2019, were estimated (*Calculation C* and *Calculation D*).

3.2.2. Analysis of excess in-hospital mortality

In order to perform a complete analysis of the indirect impact of the COVID-19 pandemic on excess mortality, we explored the variation in in-hospital mortality due to non-COVID-19 causes of death in 2020 and 2021 with respect to the 2015-2019 period. For this purpose, hospital discharges due to exitus were analyzed according to main diagnosis[d] (»»» Annex 2) and hospital service[e] (»»» Annex 3), registered in the SNHS RAE-CMBD[f][19], as follows:

a) Based on the annual number of discharges due to exitus recorded from 2015 to 2021, the absolute variation of discharges due to exitus in 2020 and 2021 was calculated with respect to the average annual number of discharges due to exitus from 2015 to 2019, according to principal diagnosis and hospital service.

d Condition that, after the study, is established as the cause of the contact with the hospital center.
e Last service in which the patient was admitted.
f The registry data are annual (without a monthly breakdown), therefore, the year-on-year comparisons contain a temporality and seasonality bias.

For each main diagnosis and hospital service (Calculation E):

$$\Delta_{\text{ABS 2020 vs. 2015–2019}} = \text{exitus discharges}_{2020} - \frac{\sum \text{anual exitus discharges}_{2015-2019}}{\text{number of years}_{2015-2019}}$$

$$\Delta_{\text{ABS 2021 vs. 2015–2019}} = \text{exitus discharges}_{2021} - \frac{\sum \text{anual exitus discharges}_{2015-2019}}{\text{number of years}_{2015-2019}}$$

b) In addition, based on the annual number of hospital admissions and discharges due to exitus recorded from 2015 to 2021, the annual rate of discharges due to exitus (number of discharges due to exitus with respect to the number of hospital admissions) was calculated for each year, according to main diagnosis and hospital service.

For each main diagnosis and hospital service (Calculation F):

$$\text{exitus discharge rate}_{20nn} = \frac{\text{exitus discharge}_{20nn}}{\text{hospital admissions}_{20nn}}$$

*in which **nn** corresponds to the last two digits of the year*

c) Finally, we estimated the relative change in the exitus discharge rate in 2020 and 2021 with respect to the average annual exitus discharge rate from 2015 to 2019, by main diagnosis and hospital service.

For each main diagnosis and hospital service (Calculation G):

$$\Delta_{\text{REL 2020 vs. 2015–2019}} = \text{exitus discharge rate}_{2020} - \frac{\sum \text{annual exitus discharge rate}_{2015-2019}}{\text{number of years}_{2015-2019}} \cdot 100$$

$$\Delta_{\text{REL 2021 vs. 2015–2019}} = \text{exitus discharge rate}_{2021} - \frac{\sum \text{annual exitus discharge rate}_{2015-2019}}{\text{number of years}_{2015-2019}} \cdot 100$$

3.2.3. Discussion and validation of the data with the Advisory Committee

In a first stage, to ease the interpretation of the results of this analysis by the members of the Advisory Committee, a Microsoft Excel tool was designed with the data related to in-hospital mortality. They were asked to individually explore this tool with an ad hoc questionnaire for guidance. This tool allowed them, interactively, to select a main diagnosis and see how discharges due to exitus in 2020 and 2021 had varied with respect to the 2015-2019 period depending on the hospital service or, conversely, to select a hospital service and see how discharges due to exitus in 2020 and 2021 had varied with respect to the 2015-2019 period depending on the main diagnosis.

Subsequently, relevant findings were shared in a joint online meeting with all the members of this committee, where they discussed and interpreted the data, based on their experience and knowledge, in order to reach a consensus on the main causes of excess mortality as an indirect consequence of the COVID-19 pandemic.

3.2.4. Analysis of excess mortality due to specific causes

After compiling the contributions of the Advisory Committee members, those non-COVID-19 causes of death selected by the Advisory Committee were analyzed in detail using the *Statistical Package for the Social Sciences* - SPSS® program (IBM Corp. Released 2022. IBM SPSS *Statistics for Windows,* Version 29.0. Armonk, NY: IBM Corp.) For these causes, the following analyses were performed based on the INE death statistics according to cause of death[18]:

Identification of COVID-19 as an additional cause of death in 2020

In addition to the basic cause of death, the INE death statistics by cause of death include other diseases or complications in the chain of events leading to death (immediate, intermediate, and fundamental causes) as well as other diseases that, without directly producing the death, have contributed to it (e.g., comorbidities). Thus, for each non-COVID-19 cause of death selected by the Advisory Committee, the proportion of 2020 annual and monthly deaths that had COVID-19 identified or suspected as an additional cause of death was estimated. The ICD-10 detailed list of causes of death[g][22] was used for this purpose.

Analysis of additional non-COVID-19 causes of death in 2020

In the same way as in the previous analysis, the proportion of annual deaths that had another non-COVID-19 disease as an additional cause of death in 2020 was estimated. The ICD-10 detailed list of causes of death[h][22] was used for this purpose.

Mortality analysis by place of death

For each non-COVID-19 cause of death selected by the Advisory Committee, the proportion of deaths per year (between the years 2015 and 2020) and per month (in the year 2020) was estimated according to the place of death (home, hospital, nursing home, or workplace or other). The ICD-10 short list of causes of death[i][18] (»»» Annex 1) was used for this purpose.

g The degree of accuracy or reliability of the quantitative or qualitative information derived from the authors' own elaboration is the sole responsibility of the authors.

h The degree of accuracy or reliability of the quantitative or qualitative information derived from the authors' own elaboration is the sole responsibility of the authors.

i The degree of accuracy or reliability of the quantitative or qualitative information derived from the authors' own elaboration is the sole responsibility of the authors.

04

[RESULTS]

4.1. SOCIAL AND HEALTHCARE CONTEXT OF THE COVID-19 PANDEMIC

The social and healthcare context f the COVID-19 pandemic should be considered in the interpretation of the results of this study. Different factors that evolved in parallel to mortality are described below: freedom of movement restrictions, the use of facemasks, the COVID-19 diagnostic capacity, the COVID-19 spread, and the level of pharmacological adherence in that period.

4.1.1. Freedom of movement restrictions

One of the first measures taken to deal with the COVID-19 pandemic after the declaration of the first state of alarm on March 14, 2020, was the restriction of the freedom of movement[23]. In the study by Surís et al. (2022) a sub-analysis of excess mortality according to different periods of confinement was carried out[24] which, together with the declaration of the second state of alarm on October 25, 2020, establish the following consecutive phases to be considered[25] (»»» Figure 1):

1) Pre-confinement: from January 1 to March 14, 2020;

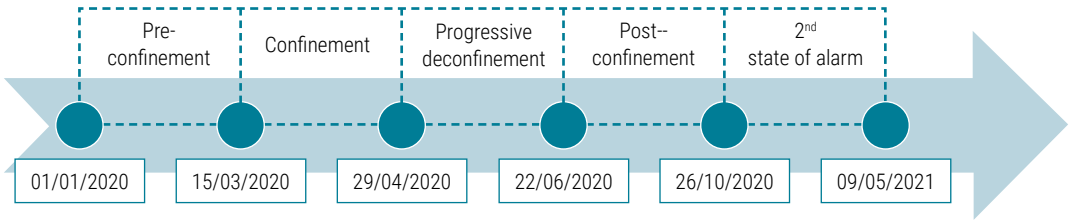
2) Confinement: from March 15 (declaration of the first state of alarm) to April 28 (approval of the de-escalation plan) 2020;

3) De-escalation: from April 29 to June 21, 2020 (end of the state of alarm);

4) Post-confinement: June 22 to October 25, 2020 (declaration of the second state of alarm); and

5) Second state of alarm: from October 26, 2020 to May 9, 2021.

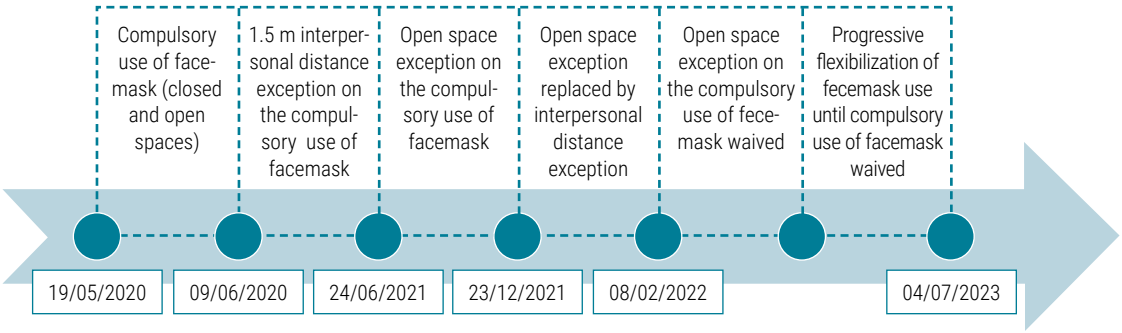
»»» **Figure 1. Phases of freedom of movement restrictions due to the COVID-19 pandemic**



4.1.2. Use of facemasks

On May 19, 2020, the use of facemasks became mandatory for all people ≥6 years of age outdoors, as well as in indoor public spaces or spaces open to the public, with some exceptions[26,27]. On June 9, 2020 this obligation was removed provided a minimum interpersonal distance of 1.5 meters[28]. However, it was not until June 24, 2021 that the mandatory outdoor use of facemasks was eliminated[29]. However, in December 23, 2021, the outdoor use of facemasks (without exceptions for interpersonal distance) was reintroduced[30]. It is not until February 8, 2022 that the mandatory outdoor use of facemasks was eliminated[31]. From then on, these measures gradually became more flexible until the elimination of the mandatory use of facemasks on July 4, 2023[32,33] (»»» Figure 2).

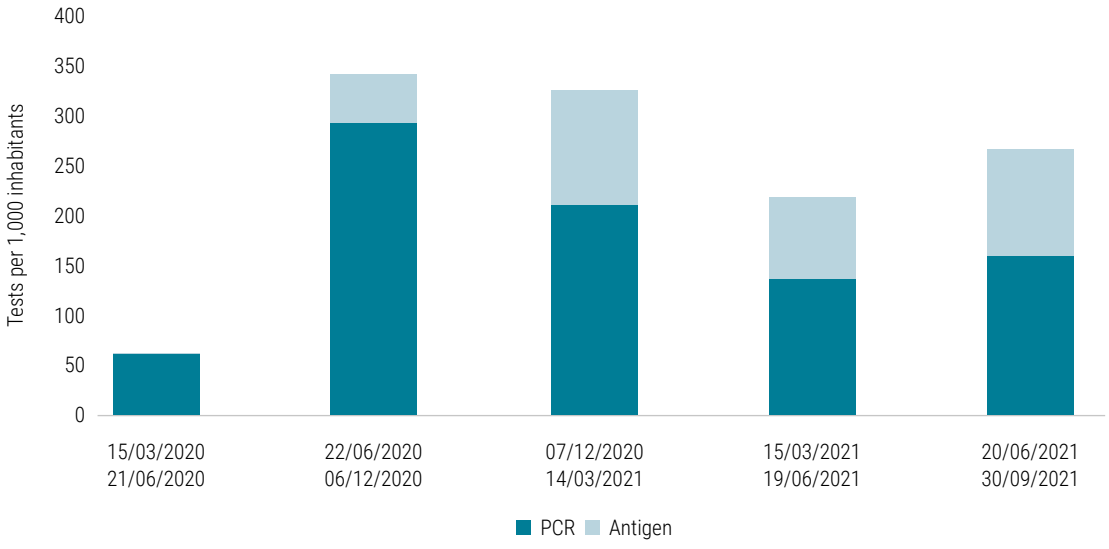
»»» Figure 2. Phases of facemask use due to the COVID-19 pandemic



4.1.3. COVID-19 diagnostic capacity

The effectiveness of the measures taken to contain COVID-19 depends on the diagnostic capacity. Thus, in the second half of the year 2020, the number of diagnostic tests per 1,000 inhabitants had increased fivefold[6] (»»» Figure 3).

»»» Figure 3. Diagnostic capacity according to test type



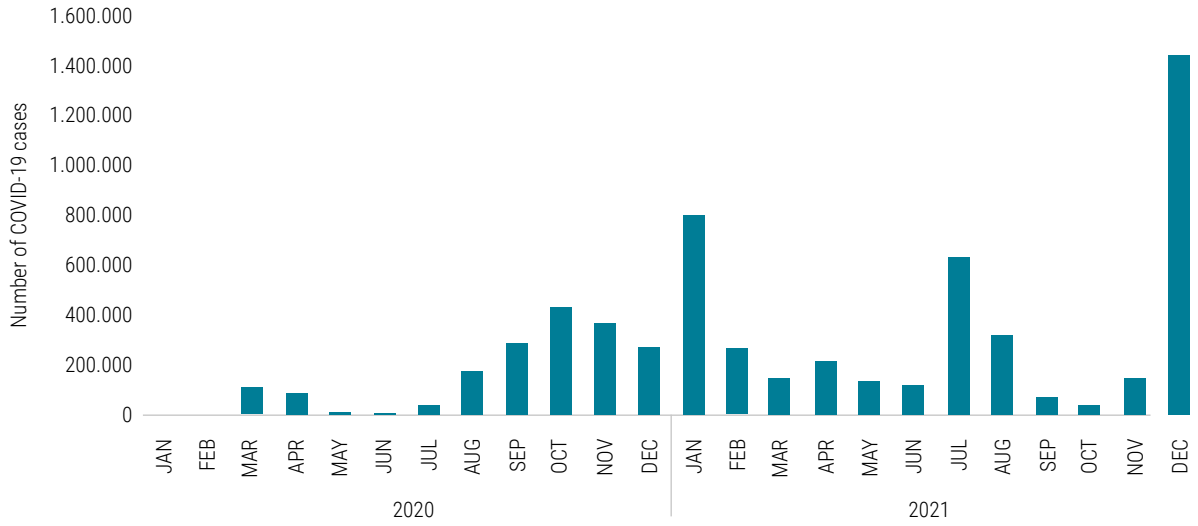
Source: Developed by the authors based on data published in the Annual Report of the Spanish National Healthcare System 2020-2021[6].

INDEX

4.1.4. COVID-19 spread

Restrictions on the people's freedom of movement and the use of facemasks were decisive in controlling virus spread. Taking COVID-19 diagnostic capacity into account, the number of COVID-19 cases, notified and confirmed with a positive diagnostic test of active infection, or notified before May 11 requiring hospitalization, admission to an ICU or death with a clinical diagnosis of COVID-19, is described below (»»» Figure 4).

»»» Figure 4. Number of COVID-19 cases in 2020 and 2021 by month



Source: Developed by the authors based on data published by the National Epidemiology Center[34].

4.1.5. Pharmacological adherence in non-COVID-19 diseases

In patients with chronic diseases, pharmacological adherence was altered by factors such as fear of COVID-19, difficulty in contacting health services or the reduced availability of medicines, among others[35,36]. In these patients, therapeutic continuity is of vital importance for effective disease management[35].

In Spain, several studies have identified a reduction in therapeutic adherence during the COVID-19 pandemic, specifically in patients with hypertension and/or statin therapy[37,38]. The following is a description of the evolution of drug dispensing in community pharmacies during the COVID-19 pandemic for the pathologies selected as of greatest interest in this report.

The analysis of the number of people with medication dispensed in community pharmacies[39] with indication for atherosclerosis, cerebrovascular disease, hypertensive disease, COPD, heart failure, and pneumonia during the COVID-19 pandemic and post-pandemic, compared to previous years (2017-2019), shows a break in the trend. While in previous years dispensed medication increased with respect to the immediately preceding year, in 2020 a change is observed, showing a negative or positive year-to-year variation but much lower than that of the previous year. In 2021 there is a modest recovery in the number of people on medication. For a detailed report of the pharmacological adherence analysis you may consult the »»» Annex 4.

INDEX

On the one hand, there is a significant decrease (of at least 30%) in the expected number of people on medication with regard to:

- Anti-infectives for systemic use: therapeutic subgroups J07 vaccinesa and J01 antibacterials for systemic use[b]
- Respiratory system: R05 cough and cold preparationsc and R03 medicines for the obstruction of the respiratory tract[d]
- Sensory organs: S01 ophthalmology[e]

On the other hand, the volume of people on medication maintaining positive year-on-year growth in 2020, albeit much more moderate than in previous years, relate to:

- Cardiovascular system: therapeutic subgroups C02 antihypertensives[f], C10 lipid modifiersg, C07 beta-blockers[h], C08 calcium channel blockers[i], C09 antihypertensives with renin-angiotensin system actionj and C03 diuretics[k]
- Anti-infectives for systemic use: J01 antibacterials for systemic use[l]
- Sensory organs: S01 ophthalmology[m]
- Food tract and metabolism: A05 biliary and hepatic therapyn and A10 antidiabetics[o]
- N06 psychoanaleptics: N06 psychoanaleptics[p]
- Genitourinary system and sex hormones: G04 Urological drugs[q]

This change in therapeutic adherence, measured as people withdrawing their medication in community pharmacies, could have had some impact on the excess mortality detected during the COVID-19 pandemic and post-pandemic. There is evidence that therapeutic adherence improves the prognosis of cardiovascular pathologies, specifically in terms of mortality reduction[40–42].

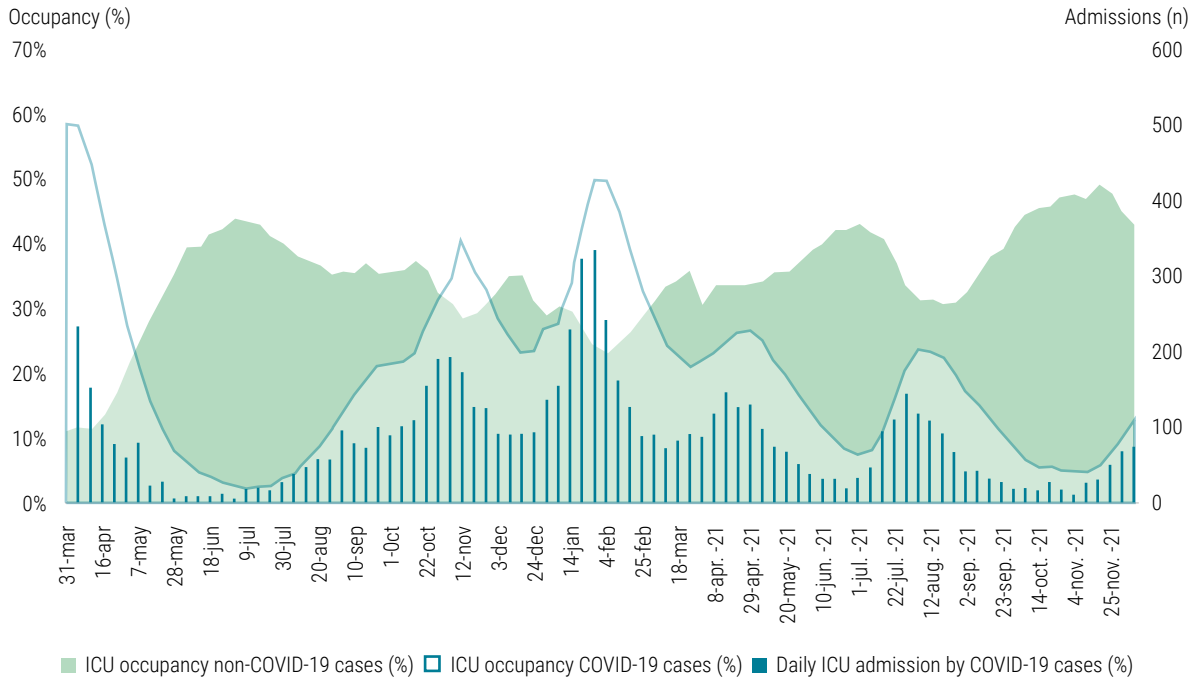
a J07A - bacterial vaccines (-64%) and J07B - viral vaccines (-38%).
b J01F - macrolides and lincosamides (anti-infectives for systemic use) (-32%) and J01C - beta-lactam antibacterials, penicillins (-30%).
c R05C - expectorants, excluding association with antitussives (-40%), R05D - antitussives, excluding associations with expectorants (-40%) and R05X - other combined cold preparations (-39%).
d R03C - adrenergics for systemic use (antiasthmatics) (-53%) and R03D - others for airway obstruction, systemic use (-32%).
e S01A - anti-infectives (ophthalmic) (-31%).
f C02D - antihypertensives smooth muscle arteriolar action (14%).
g C10B - lipid modifiers in association (11%).
h C07A - beta-blockers alone (1%) and C07F - beta-blockers and other antihypertensives (2%).
i C08C - selective calcium channel blockers with vascular effect (1%).
j C09D - angiotensin II antagonists in association (1%).
k C03A - low-ceiling diuretics, thiazides (1%), C03C - high-ceiling diuretics (2%) and C03D - potassium-sparing diuretics (4%).
l J01R - antibacterial associations (anti-infectives for systemic use) (12%).
m S01H - local anesthetics (ophthalmic) (4%).
n A05A - biliary therapy (3%).
o A10A - insulins and analogues (2%) and A10B - oral antidiabetics, excl. insulins (2%).
p N06A - antidepressants (1%) and N06D - drugs for dementia (2%).
q G04C - drugs for benign prostatic hypertrophy (1%).

INDEX

4.1.6. Occupancy rate of ICU beds with respirators

In response to the need for critical care in COVID-19 patients, the number of ICU beds was increased, reaching a peak of 13,801 in the first wave of the pandemic. This represented a 180% increase in the number of ICU beds per 100,000 inhabitants[6]. The saturation of these beds evolved in parallel to the indicators of infection and hospitalization, with a reduction in the occupancy of ICU beds by non-COVID-19 patients and an increase in occupancy by COVID-19 patients[6] (»»» Figure 5).

»»» Figure 5. ICU activity and occupancy of ventilator-equipped beds. Spain, March 2020 - September 2021



Source: Developed by the authors based on data published in the Annual Report of the National Health System 2020-2021[6].

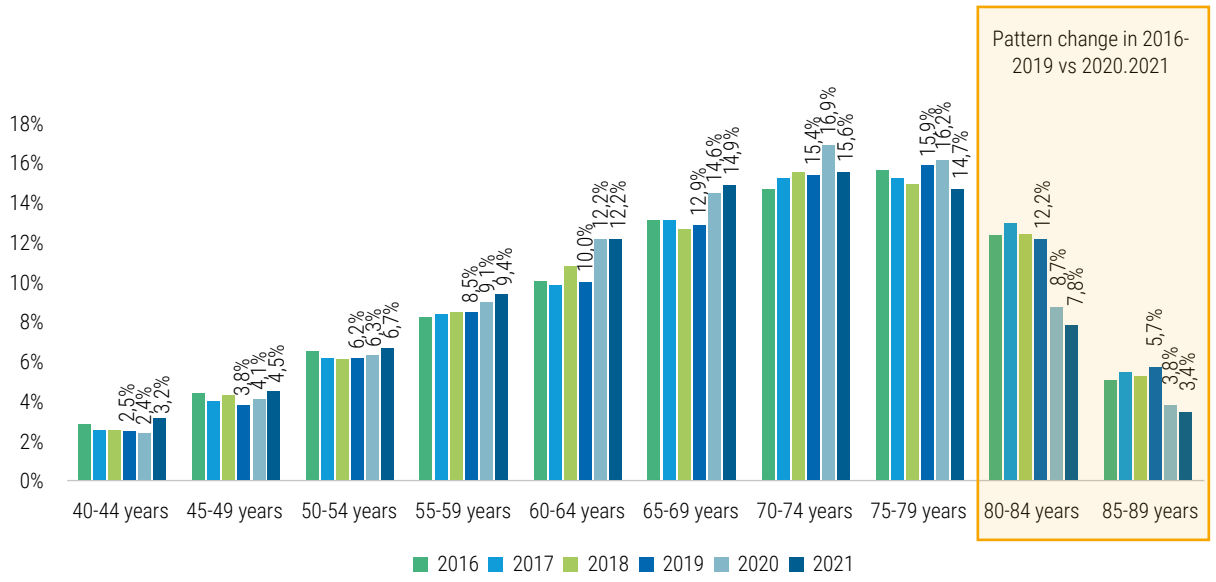
Given this situation and in order to reduce the burden on existing healthcare resources, the first consensus of ethical recommendations for difficult ICU decision-making in pandemic crisis situations was published in 2020[43] . According to this consensus, it was recommended that ICU admission should be prioritized based on the characteristics and overall situation of each individual. In the case of the elderly, their biological age should be taken into account (e.g., considering frailty). Thus, unstable or critically ill patients with little chance of recovery were assigned a lower level of priority. In addition, the indication for invasive mechanical ventilation in patients older than 80 years was excluded in patients with comorbidities and limited in those without comorbidities.

To ensure compliance with the ethical principles of fairness and the common good, it was recommended that triage for ICU access be based on objective criteria[44]. In this sense, clinical criteria could be used to determine which patients have a better prognosis and which are expected to have a shorter length of stay in the ICU. However, in Spain, some non-objective criteria such as chronological age were considered.

According to data from the Ministry of Health, of the total number of patients admitted to the Intensive Care Medicine Department, the weight of patients aged 80 years and older decreased significantly in 2020 and 2021 compared to the period from 2016 to 2019, increasing in younger patients (»»» Figure 6).

INDEX

»»» **Figure 6. Distribution of admissions to Intensive Care Medicine according to age and by years in the period 2016-2021**



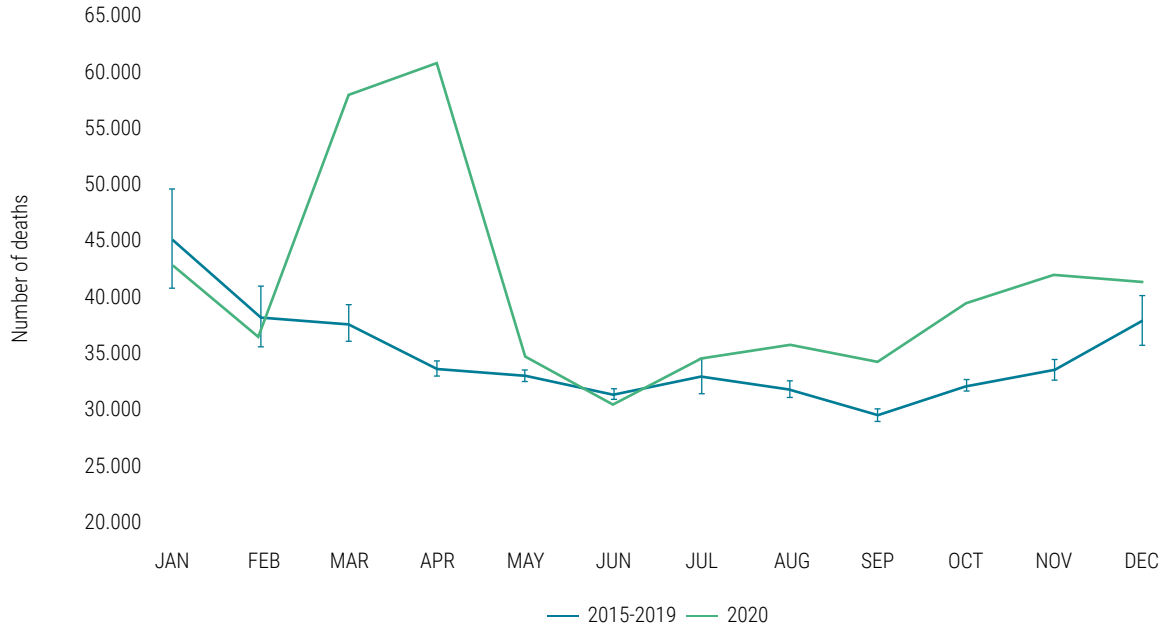
4.2. ANALYSIS OF THE OVERALL EXCESS MORTALITY RATE

In 2020, there was an excess of absolute all-cause mortality of 68,173 deaths over the estimated mortality (+15.91%), according to the ISCIII MoMo System. During that year, three peaks of excess mortality were recorded, corresponding to the months of April, August, and November. In April, there were 25,453 excess deaths (+72.26%), 3,671 in August (+11.30%), and 6,859 in November (+19.05%).

Moreover, the excess of absolute all-cause mortality according to the analysis of the INE death statistics provides similar results, with an excess of 72,951 deaths in 2020 with respect to the average of the previous 5 years (+17.34%). In this case, two peaks of excess mortality were recorded[r], corresponding to April with an excess of 27,073 deaths (+79.74%) and November with an excess of 8,404 deaths (+24.82%) (»»» Figure 7 and »»» Figure 8).

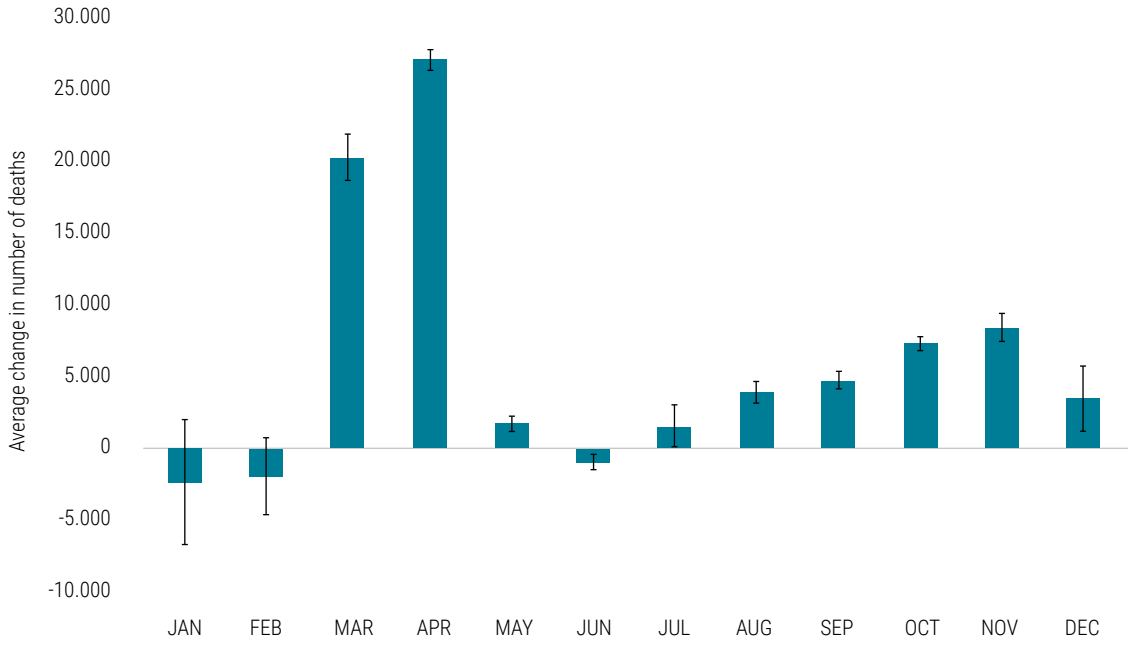
r For the purposes of this report, the calculation of excess mortality considering the peaks of excess mortality from all causes in 2020 is based on those peaks estimated from the ISCIII's MoMo System data[17].

»»» Figure 7. Number of all-cause deaths in 2020, and 2015-2019 average, by month



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

»»» Figure 8. Average change in the number of all-cause deaths in 2020 compared to 2015-2019 by month

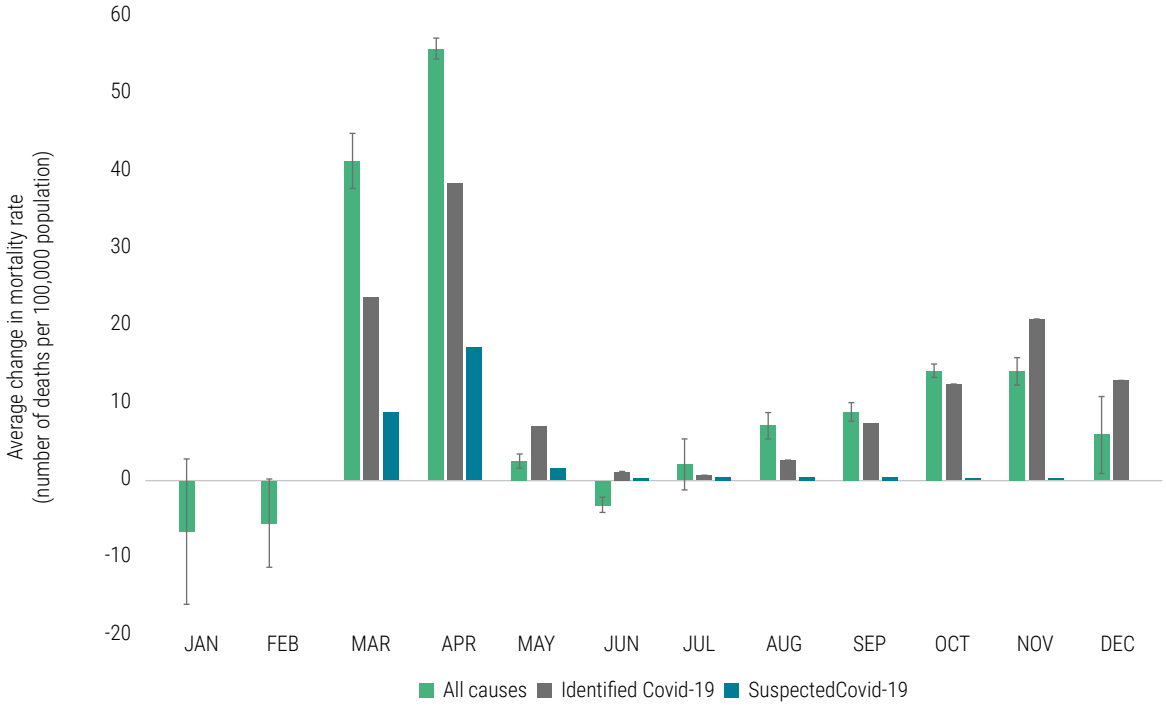


Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

According to the analysis of the INE death statistics by cause of death, the increase in COVID-19 mortality especially contributed to the excess mortality recorded (»»» Figure 9).

INDEX

»»» Figure 9. Average change in all-cause, COVID-19 identified, and COVID-19 suspected mortality rates in 2020 compared to 2015-2019, by month



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

In 2020, there was an excess **ALL-CAUSE mortality** with respect to the previous 5 years (+17%), especially in April (+80%) and November (+25%), with COVID-19 being the leading cause of death.

Regarding the variation in mortality from non-COVID-19 causes, the analysis focuses on three disease blocks where the COVID-19 pandemic had the greatest impact:

1) Diseases of the respiratory system.

2) Neoplasms.

3) Diseases of the circulatory system.

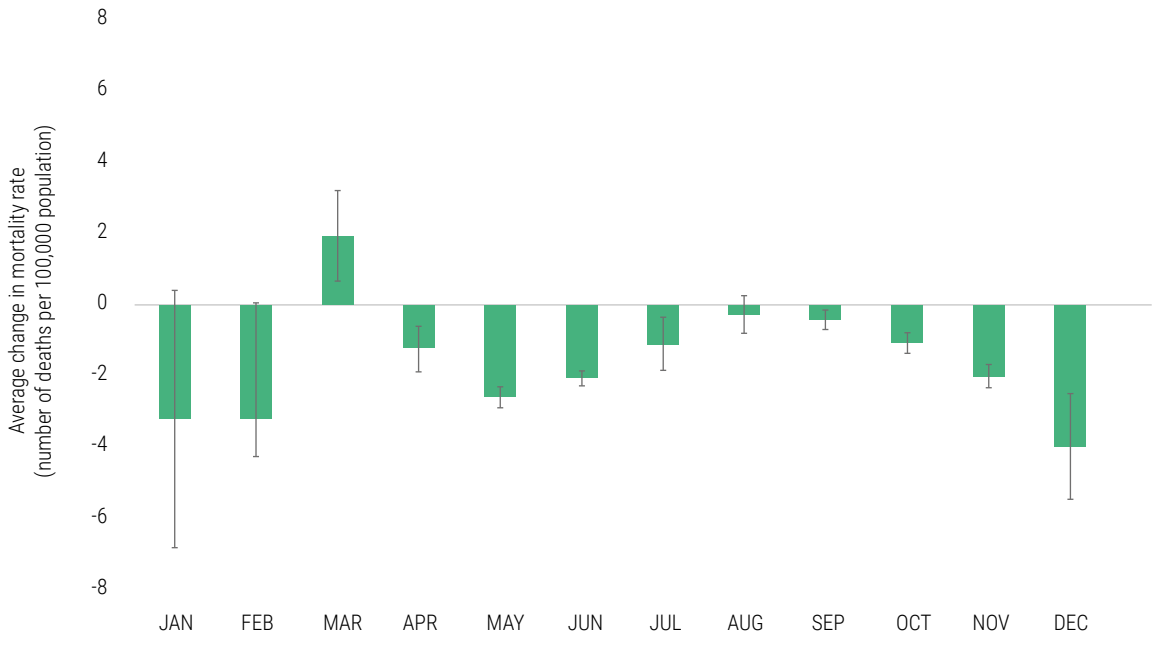
4.2.1. Excess mortality due to diseases of the respiratory system

For a detailed analysis of excess mortality due to diseases of the respiratory system, see section 1 of »»» Annex 5.

In general, throughout 2020, mortality rates were reduced with respect to the 2015-2019 period due to diseases of the respiratory system (excluding COVID-19), except in the month of March, which showed an average increase of 1.94 (SD: 1.25) deaths per 100,000 inhabitants (»»» Figure 10). Likewise, focusing on excess mortality peaks in 2020, an average reduction in the mortality rate for respiratory system diseases of 3.56 (SD: 1.5) deaths per 100,000 inhabitants was observed.

INDEX

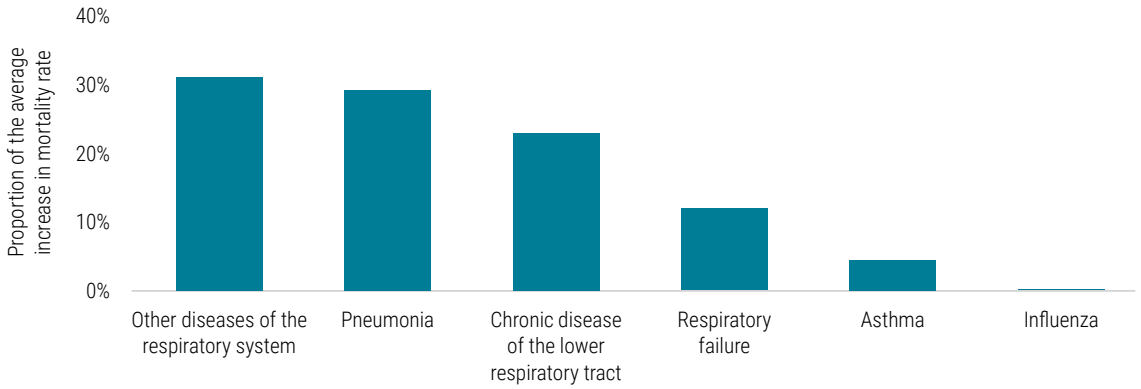
»»» **Figure 10. Average change in mortality rates due to diseases of the respiratory system in 2020 compared to 2015-2019 by month**



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations. The data represented in the graph exclude COVID-19 as a respiratory system disease.

The mortality rate for diseases of the respiratory system increased in March, mainly due to the increase in the number of deaths from pneumonia (29% of the total increase) and from chronic disease of the lower respiratory tract except asthma (23% of the total increase) (»»» Figure 11).

»»» **Figure 11. Distribution of the average mortality rate increase due to diseases of the respiratory system in March 2020 with respect to March 2015-2019**

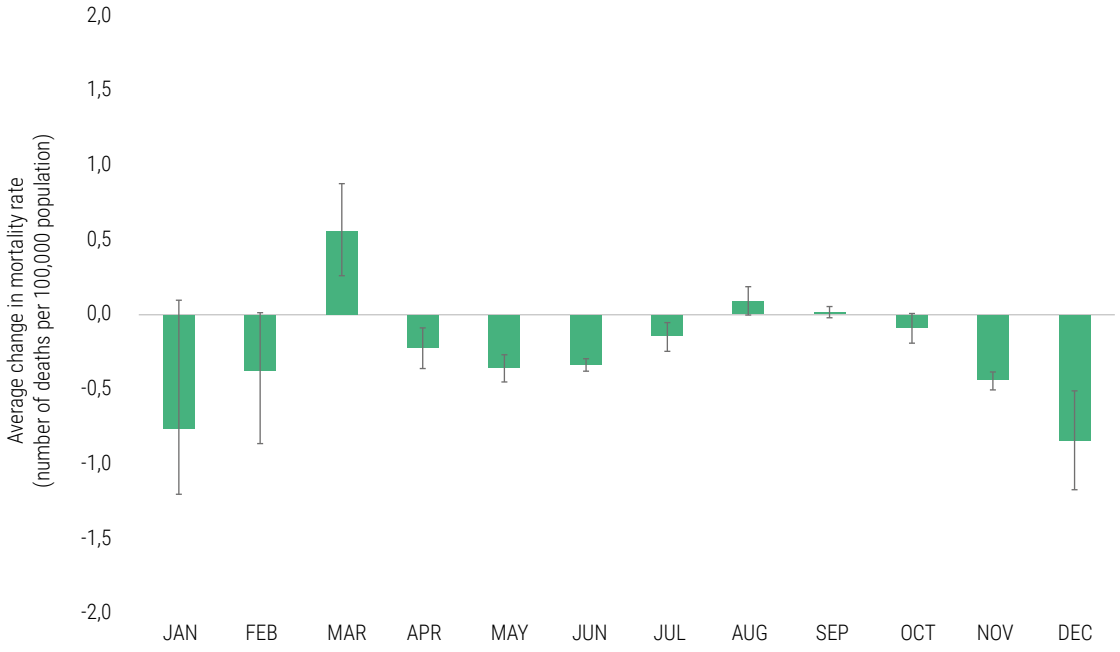


Source: Developed by the authors based on data from the INE death statistics[18].

Specifically, the number of deaths due to pneumonia increased by 0.57 (SD: 0.31) per 100,000 inhabitants (»»» Figure 12) and for chronic diseases of the lower respiratory tract except asthma by 0.44 (SD: 0.45) in March 2020 (»»» Figure 13).

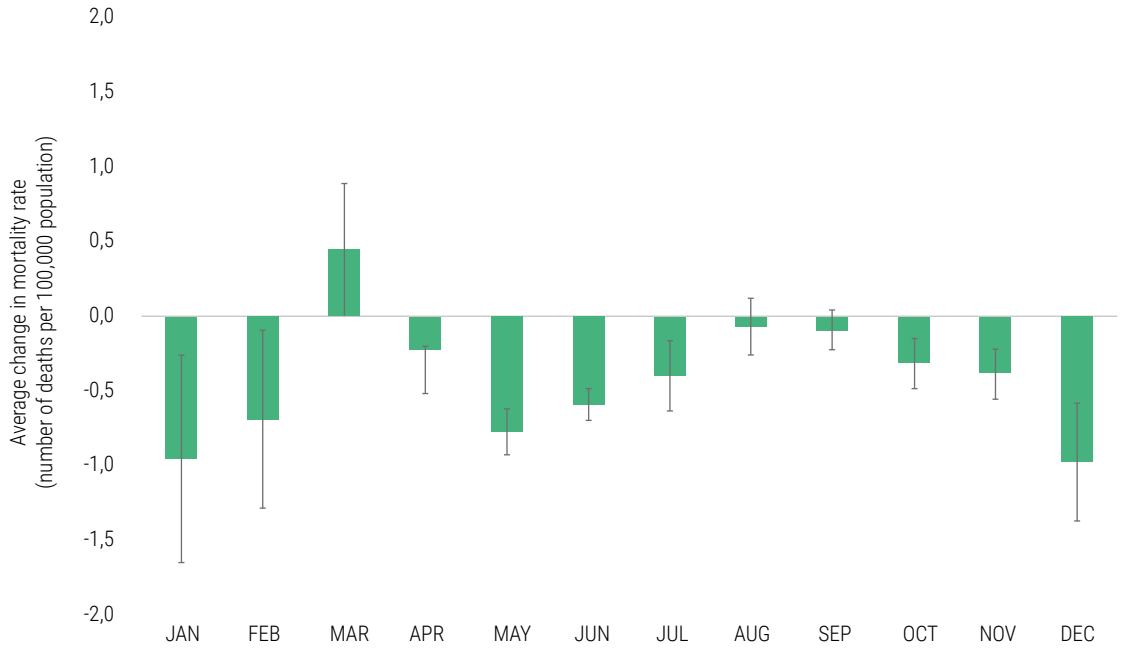
INDEX

»»» Figure 12. Average change in pneumonia mortality rate in 2020 with respect to 2015-2019 by month



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

»»» Figure 13. Average change in mortality rate due to chronic lower respiratory tract diseases in 2020 with respect to 2015-2019 by month



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

INDEX

The notable excess mortality rate in **RESPIRATORY SYSTEM DISEASES** not coded as COVID-19 in the month of March 2020 could be associated with the peak of hospital overload recorded at that time. However, this excess disappears in the following months, so the excess mortality was probably due to the low diagnostic capacity of COVID-19 at the beginning of the pandemic. That is, many causes of death were erroneously associated with a classic respiratory system disease rather than with COVID-19.

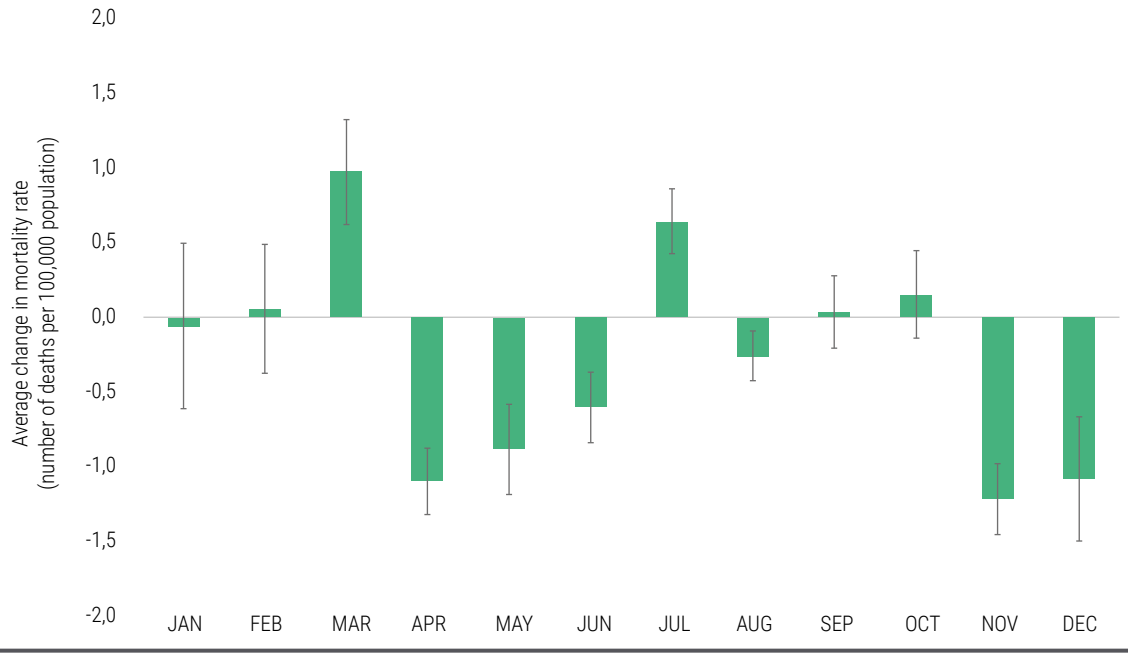
On the other hand, COVID-19 could have precipitated death due to other causes, especially in chronic pathologies and vulnerable populations.

4.2.2. Excess mortality due to neoplasms

For a detailed analysis of excess mortality due to neoplasms, please refer to section 2 of »»» Annex 5.

In 2020, the change in mortality rate with respect to the 2015-2019 period due to neoplasms described a similar curve to that of all causes, with a significant increase in March (1.04 deaths per 100.000 inhabitants; SD: 0.37) and July (0.68; SD: 0.23), and a significant reduction in April (1.17; SD: 0.23), May (0.94; SD: 0.32), June (0.64; SD: 0.25), November (1.30; SD: 0.25), and December (1.16; SD: 0.44) (»»» Figure 14).

»»» Figure 14. Average change in mortality rate due to neoplasms in 2020 with respect to 2015-2019 by month



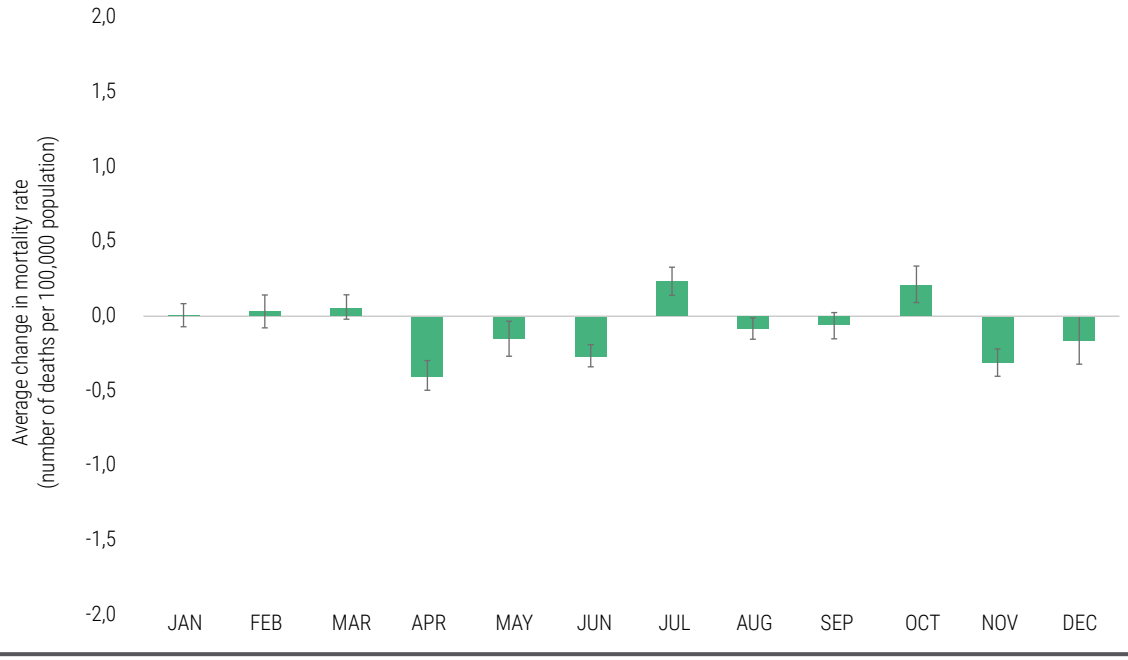
Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

Considering the peaks of excess mortality from all causes according to the MoMo System, a mean reduction in neoplasm-related mortality rate of 2.75 (SD: 0.51) deaths per 100,000 population was observed, mainly due to malignant tumors of the trachea, bronchi, and lung (0.82; SD: 0.16) and malignant tumors of the colon (0.51; SD: 0.18).

For malignant tumors of the trachea, bronchi, and lung, the greatest reduction in mortality rates in 2020 with respect to the 2015-2019 period was observed from April to June and from November to December, with the

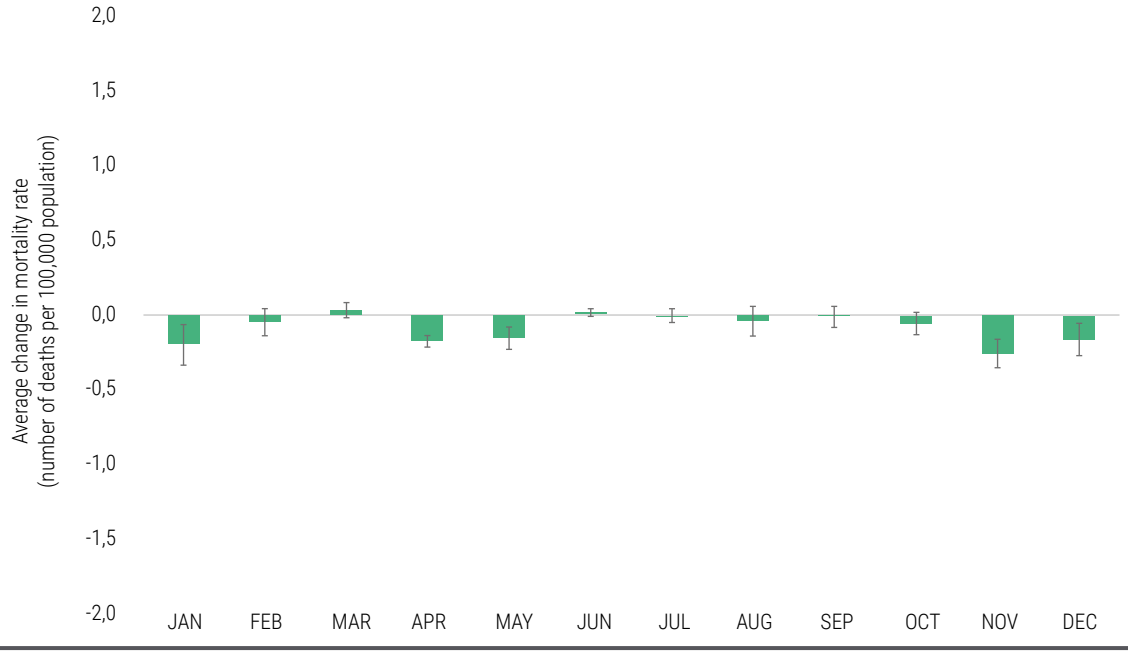
first month of each range concurring with the peaks of excess all-cause mortality according to the MoMo system (»»» Figure 15). Likewise, a reduction in the mortality rate associated with malignant tumors of the colon was observed in the months of April and May, and November and December (»»» Figure 16).

»»» Figure 15. Average change in mortality rate due to malignant tumors of the trachea, bronchi, and lung in 2020 with respect to 2015-2019 by month



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

»»» Figure 16. Average change in mortality rate due to malignant tumors of the colon in 2020 with respect to 2015-2019 by month



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

INDEX

The excess mortality rate due to NEOPLASMS in the month of March 2020 may have been due in part to the low COVID-19 diagnostic capacity. That is, some of these patients may have died from COVID-19.

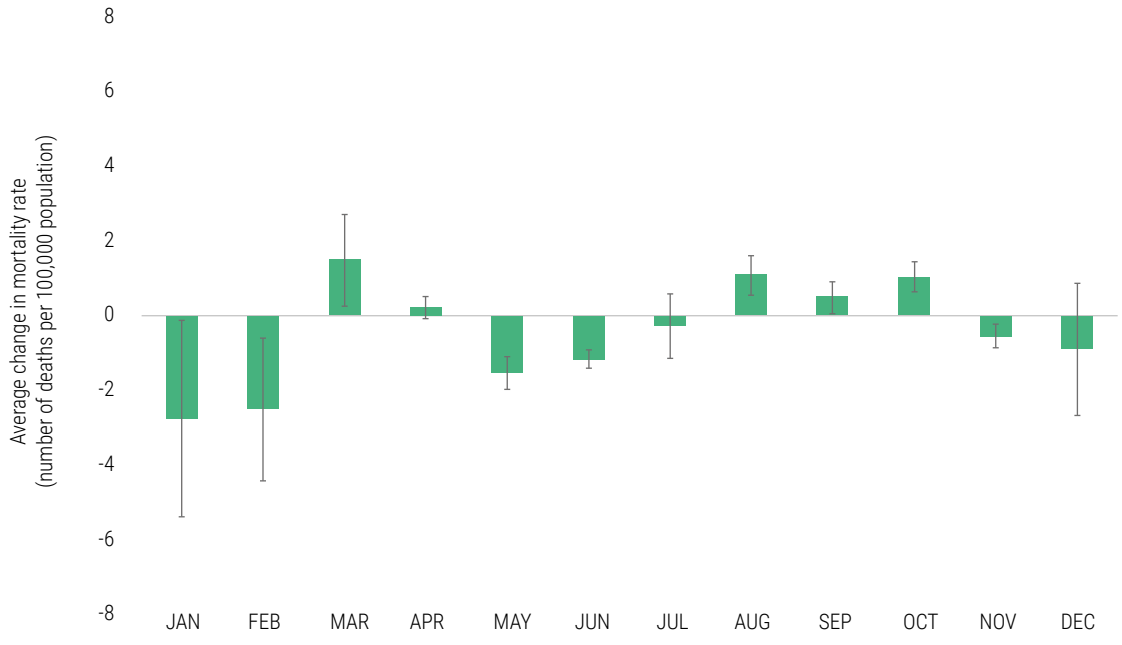
On the other hand, in July 2020, with the end of the state of alarm and the relaxation of the use of the mask, an excess mortality not attributable to COVID-19 was observed, as the diagnostic capacity had increased fivefold. It is possible that at that time these patients were more exposed to the virus and contagion precipitated their death or that they had reduced access to the healthcare system (either due to fear or healthcare overload).

4.2.3. Excess mortality due to diseases of the circulatory system

For a detailed analysis of excess mortality due to diseases of the circulatory system, please refer to section 3 of »»» Annex 5.

In 2020 the change in mortality rate with respect to period 2015-2019 period due to diseases of the circulatory system described a similar curve to that of all causes, with an increase being recorded in March (1.59 deaths per 100,000 inhabitants; SD: 1.31), April (0.22; SD: 0.30), August (1.15; SD: 0.56), September (0.52; SD: 0.46), and October (1.11; SD: 0.43) (»»» Figure 17).

»»» Figure 17. Average change in the mortality rate due to diseases of the circulatory system in 2020 with respect to 2015-2019 by month



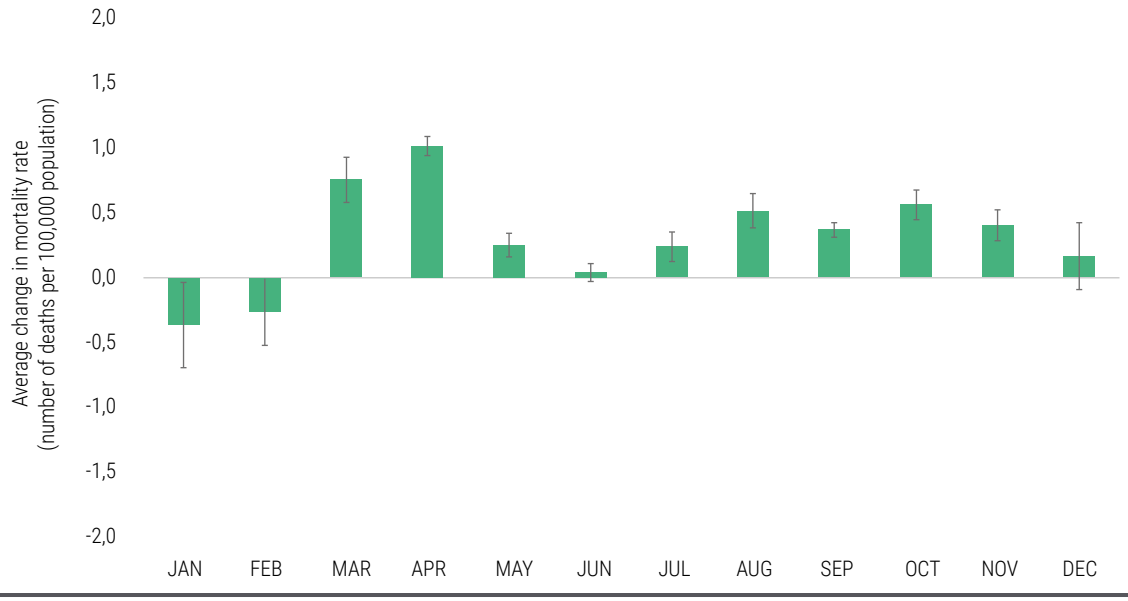
Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

Thus, considering the peaks of excess mortality from all causes according to the MoMo System, a mean increase in the mortality rate associated with diseases of the circulatory system of 0.76 (SD: 0.89) deaths per 100,000 population was observed, mainly due to deaths coded as hypertensive disease[s] (1.92; SD: 0.18).

s In no case can hypertensive disease be understood as a cause of death, but as a risk factor.

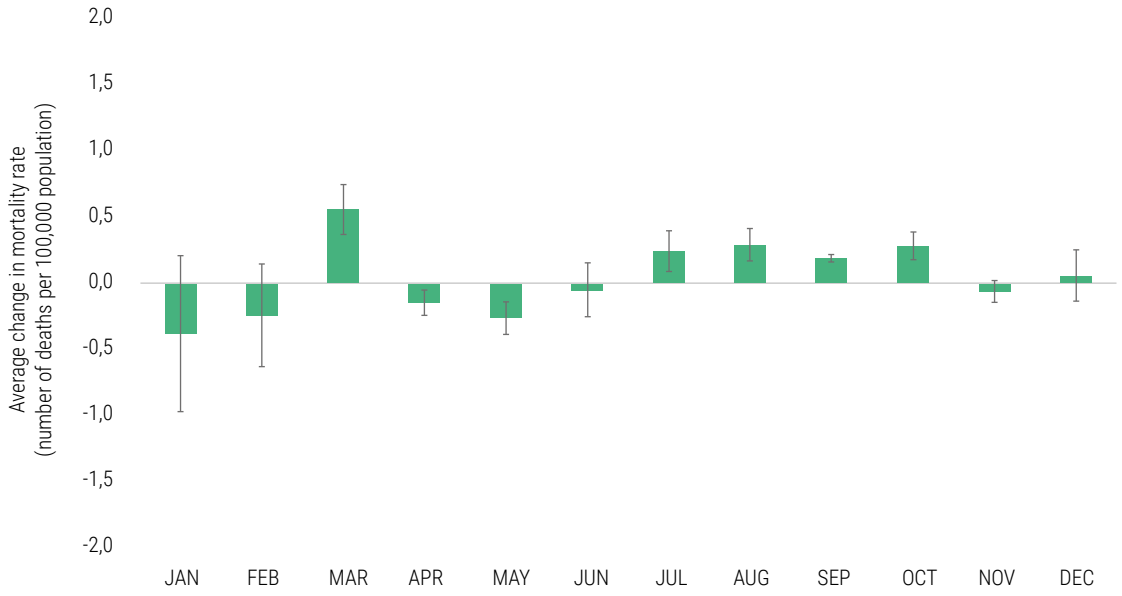
In March 2020, the mortality rate increased with respect to the months of march in the 2015-2019 period, mainly due to an increase in the number of deaths from hypertensive disease by 0.75 per 100,000 inhabitants (»»» Figure 18) and due to heart failure by 0.55 per 100,000 inhabitants (»»» Figure 19). This change, though subtle, was also observed in August, September, and October for both causes. Finally, April recorded an even greater increase in the number of deaths due to hypertensive diseases, reaching an excess of 1.01 deaths per 100,000 inhabitants in 2020 with respect to the months of April in the 2015-2019 period.

»»» Figure 18. Average change in the mortality rate due to hypertensive diseases in 2020 with respect to 2015-2019 by month



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent standard deviations.

»»» Figure 19. Average change in heart failure mortality rate in 2020 with respect to 2015-2019 by months



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** Error bars represent the standard deviations.

INDEX

The excess mortality rate for **CIRCULATORY SYSTEM DISEASES** in the month of March 2020 may have been due in part to the low COVID-19 diagnostic capacity. That is, some of these patients could have died from COVID-19, but also from COVID-19-derived thromboembolism, underdiagnosed due to the lack of knowledge of such a link at that time.

On the other hand, in July 2020, with the end of the state of alarm and the relaxation of the use of the mask, an excess mortality not attributable to COVID-19 was again recorded, since at that time the diagnostic capacity had increased fivefold. It is possible that at that time these patients were more exposed to the virus and contagion precipitated their death or that they had reduced access to the healthcare system (either due to fear or system overload).

4.3. ANALYSIS OF EXCESS IN-HOSPITAL MORTALITY

In 2020, there was an excess of absolute all-cause in-hospital mortality amounting to 30,738 excess deaths compared to the 2015-2019 period. While in this period, 4.3% of hospital discharges were due to exitus, in 2020 they accounted for 5.5%, i.e. 29.1% more than in the 2015-2019 period.

In 2020, TOTAL **INTRA-HOSPITAL MORTALITY** increased by 29% over the previous 5 years, despite the provision of additional hospitals and ICU beds.

This suggests that not only was there a greater need for hospital admissions among the population, but also that the clinical profile of the patients admitted was more severe, which could in turn generate greater pressure on health care capacity.

Regarding the variation in in-hospital mortality from non-COVID-19 causes, the analysis focuses on three disease blocks where the COVID-19 pandemic had the greatest impact:

1). diseases of the respiratory system

2). neoplasms

3). diseases of the circulatory system

4.3.1. Excess in-hospital mortality due to diseases of the respiratory system

For a detailed analysis of excess in-hospital mortality from diseases of the respiratory system, please refer to section 1 of »»» Annex 6.

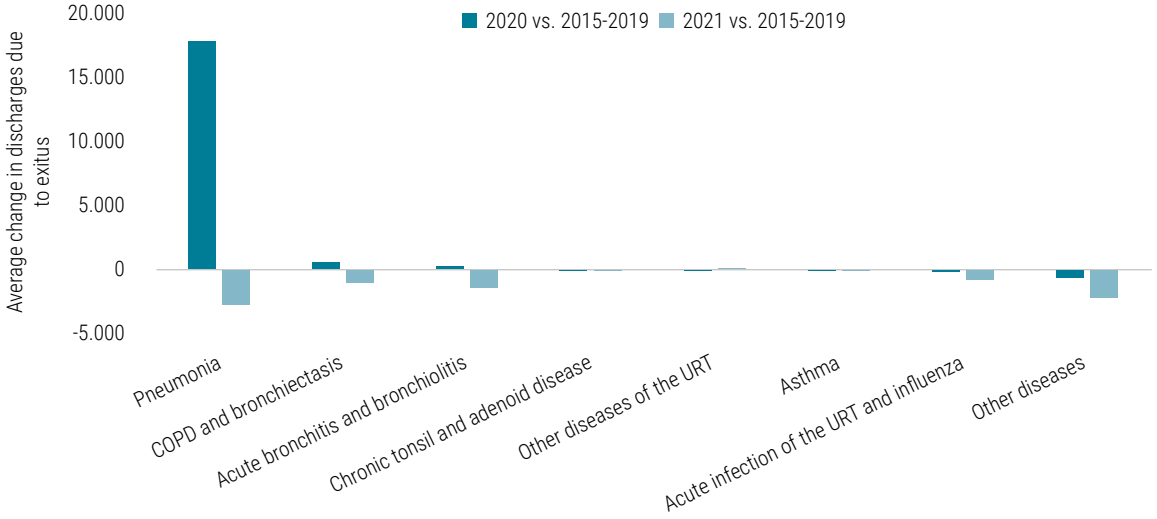
In 2020, there was an absolute increase in hospital discharges due to exitus in people with respiratory system diseases such as pneumonia, COPD and bronchiectasis, and acute bronchitis and bronchiolitis. In contrast, there was an absolute reduction in discharges due to exitus in people with asthma or with acute upper respiratory tract infection and influenza (»»» Figure 20). In all these cases, the rate of discharges due to exitus increased (»»» Figure 21).

In contrast, in 2021, there was an absolute reduction in hospital discharges due to exitus in virtually all diseases of the respiratory system, especially in pneumonia, COPD and bronchiectasis, acute bronchitis

INDEX

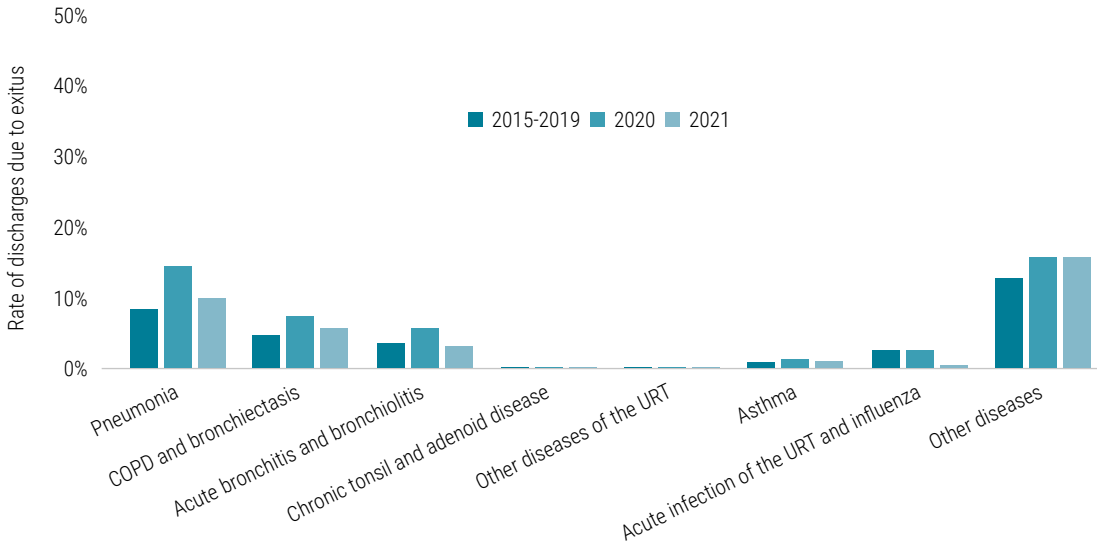
and bronchiolitis, asthma, and acute lower respiratory tract infection and influenza (»»» Figure 20). While pneumonia, COPD and bronchiectasis, and asthma continued to register an increase in the rate of discharges due to exitus, acute bronchitis and bronchiolitis, as well as acute upper respiratory tract infection and influenza registered a decrease in the rate of discharges due to exitus (»»» Figure 21).

»»» Figure 20. Average change in the number of hospital discharges due to exitus in people with diseases of the respiratory system in 2020 and 2021 with respect to the period 2015-2019



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Abbreviations:** **COPD**, chronic obstructive pulmonary disease; **URT**, upper respiratory tract.

»»» Figure 21. Rate of hospital discharges due to exitus in people with diseases of the respiratory system in the period 2015-2019, 2020, and 2021



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** For the period 2015-2019 the average annual rate is shown. The data represented in the graph exclude COVID-19 as a respiratory system disease. **Abbreviations:** **COPD**, chronic obstructive pulmonary disease; **URT**, upper respiratory tract.

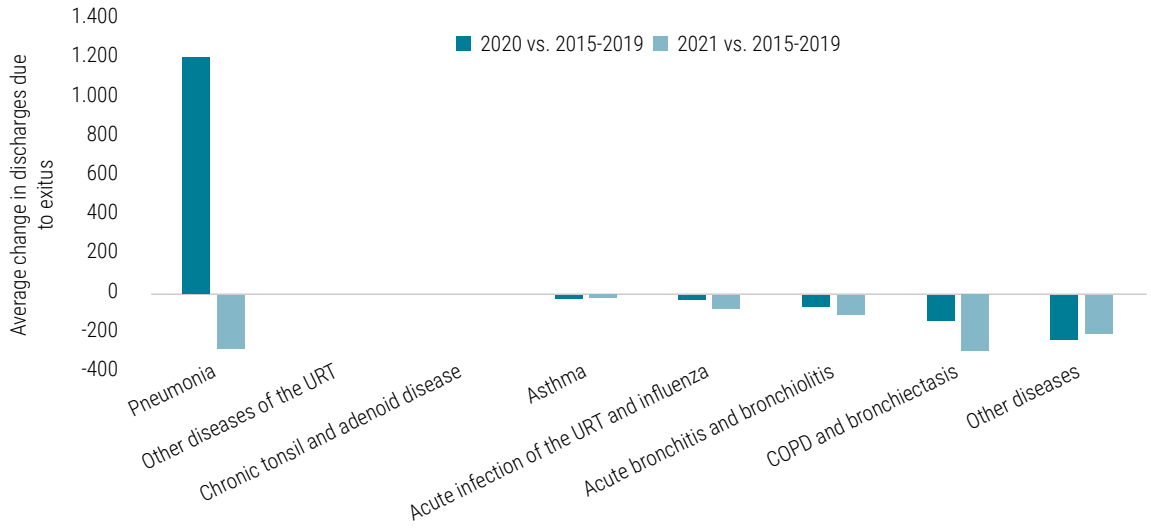
INDEX

The results of the analysis of the variation in in-hospital mortality due to respiratory system diseases in those services most relevant to their management during the COVID-19 pandemic are presented below.

Pneumology Service

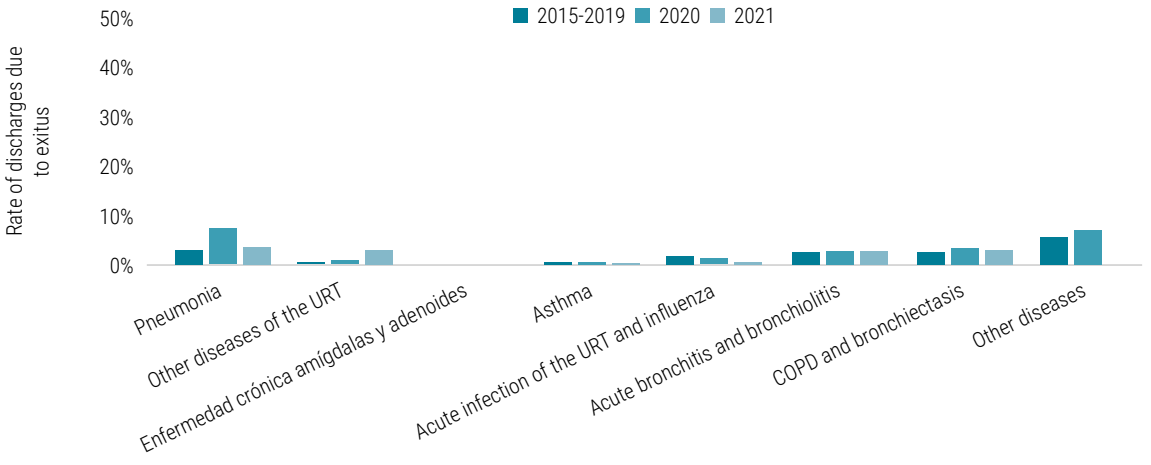
In the Pneumology Service, there was an excess of discharges due to exitus in people with pneumonia in 2020, while in 2021 a reduction with respect to the period from 2015 to 2019 was recorded. Other diseases contemplated showed a reduction in discharges due to exitus in 2020 and 2021 with respect to the period from 2015 to 2019 (»»» Figure 22). In addition, the rate of discharges due to exitus in people with pneumonia increased in 2020 and 2021 with respect to the period from 2015 to 2019, decreasing notably in 2021 with respect to 2020. The same is observed in people with COPD and bronchiectasis, and with acute bronchitis and bronchiolitis (»»» Figure 23).

»»» Figure 22. Average variation in the number of hospital discharges due to exitus in the Pneumology Service in 2020 and 2021 with respect to the period 2015-2019



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Abbreviations: COPD**, chronic obstructive pulmonary disease; **URT**, upper respiratory tract.

»»» Figure 23. Rate of hospital discharges due to exitus in the Pneumology Service in the period 2015-2019, 2020, and 2021

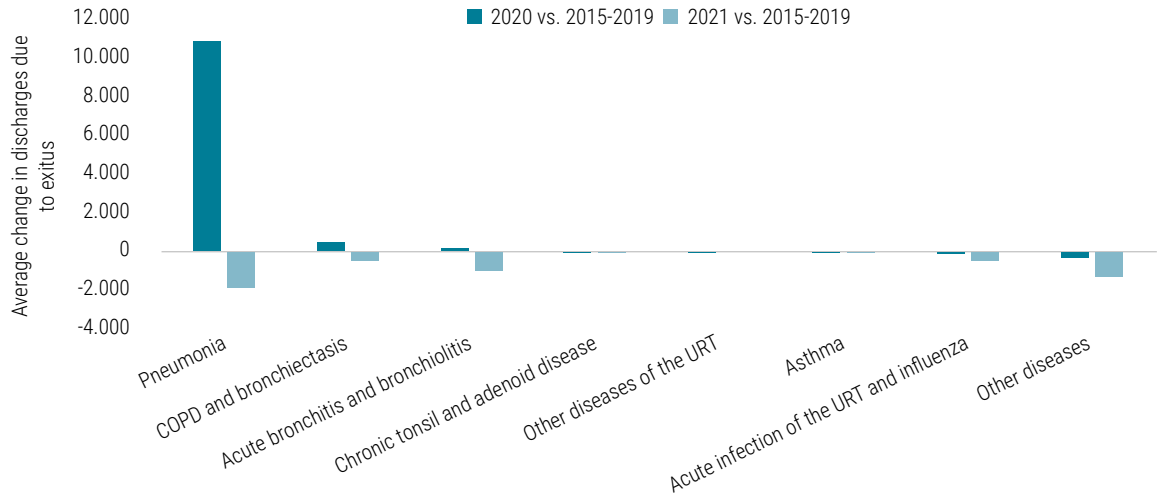


Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** For the period 2015-2019 the average annual rate is shown. **Abbreviations: COPD**, chronic obstructive pulmonary disease; **URT,** upper respiratory tract

Internal Medicine Service

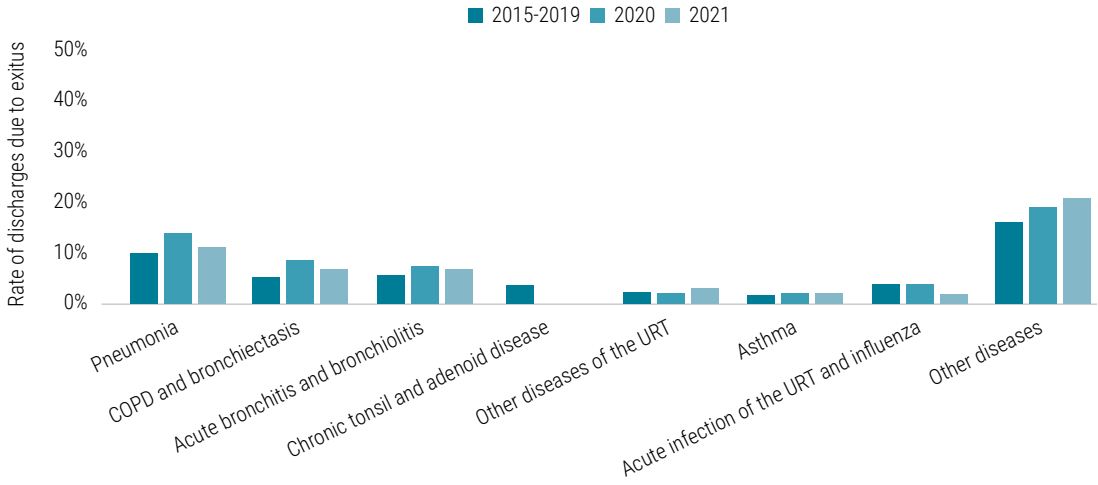
In the Internal Medicine Service, an excess of discharges due to exitus was observed for pneumonia in 2020, while in 2021, a reduction with respect to the period from 2015 to 2019 was recorded. The same is observed in people with COPD and bronchiectasis, and with acute bronchitis and bronchiolitis (»»» Figure 24). Moreover, the rate of discharges due to exitus in people with pneumonia increased in 2020 and 2021 with respect to the period from 2015 to 2019, decreasing in 2021 with respect to 2020. The same is observed in people with COPD and bronchiectasis, and with acute bronchitis and bronchiolitis (»»» Figure 25).

»»» Figure 24. Average variation in the number of hospital discharges due to exitus in the Internal Medicine Service in 2020 and 2021 with respect to the period 2015-2019



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Abbreviations: COPD**, chronic obstructive pulmonary disease; **URT,** upper respiratory tract.

»»» Figure 25. Rate of hospital discharges due to exitus in the Internal Medicine Service in the period 2015-2019, 2020, and 2021



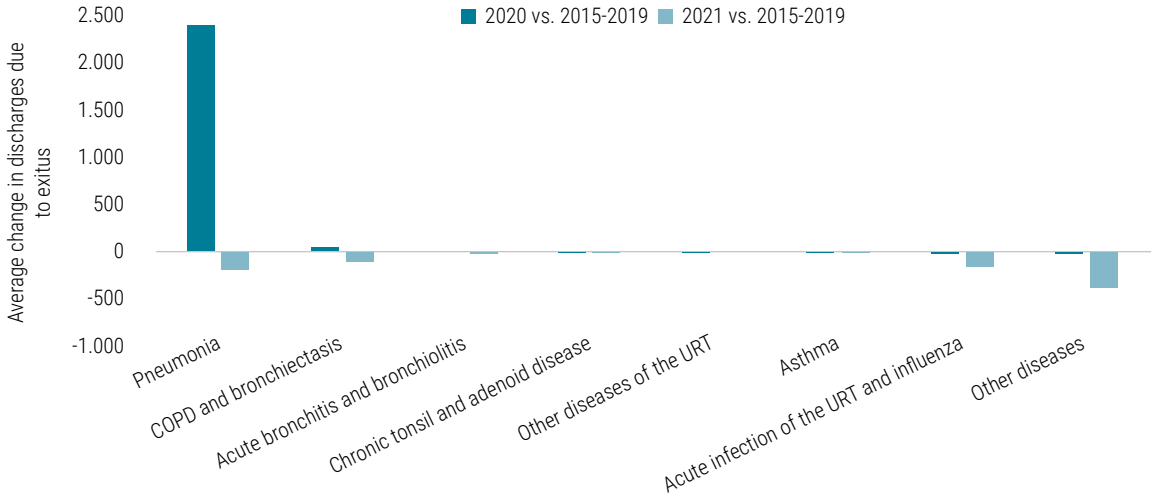
Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** For the period 2015-2019 the average annual rate is shown. **Abbreviations: COPD**, chronic obstructive pulmonary disease; **URT**, upper respiratory tract; URD.

INDEX

Intensive Care Medicine Service

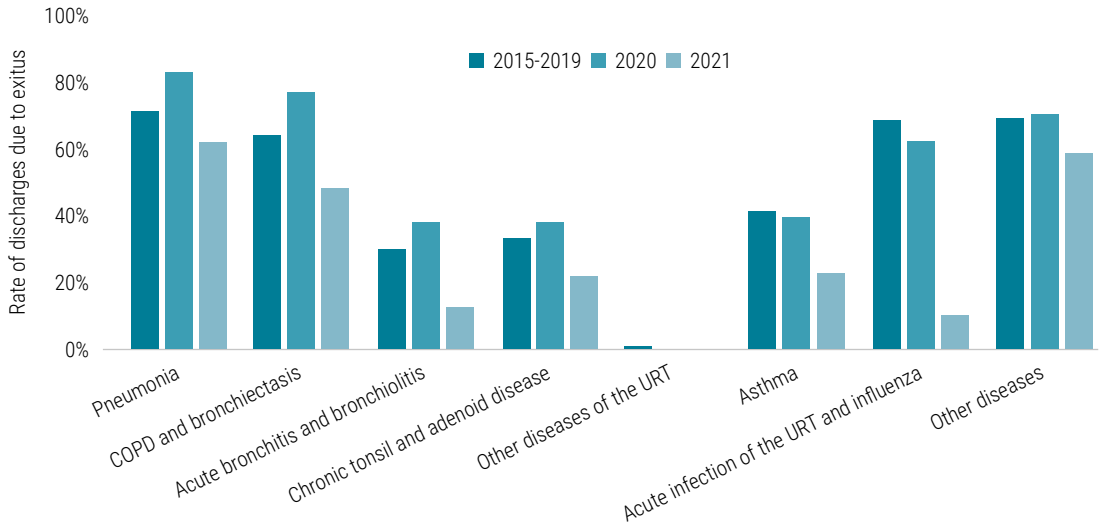
In the Intensive Care Medicine Service, an excess of discharges due to exitus was reported in 2020 for pneumonia, while in 2021 a reduction in the number of deaths with respect to the period from 2015 to 2019 was reported. The same is observed, although with much lower values, in people with COPD and bronchiectasis, and acute bronchitis and bronchiolitis (»»» Figure 26). Moreover, the rate of discharges due to exitus in people with pneumonia increased in 2020 with respect to the period from 2015 to 2019 and decreased in 2021 with respect to the same period. The same was recorded in people with COPD and bronchiectasis, and with acute bronchitis and bronchiolitis. In contrast, there was a decrease in discharge rates due to exitus in 2020 and 2021 compared to the 2015-2019 period in people with asthma, and acute upper respiratory tract infection and influenza (»»» Figure 27).

»»» Figure 26. Average variation in the number of hospital discharges due to exitus in the Intensive Care Medicine Service in 2020 and 2021 with respect to the period 2015-2019



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Abbreviations**: **COPD,** chronic obstructive pulmonary disease; **URT**, upper respiratory tract.

»»» Figure 27. Rate of hospital discharges due to exitus in the Intensive Care Medicine Service in the period 2015-2019, 2020, and 2021



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** For the period 2015-2019 the average annual rate is shown. Abbreviations: **COPD**, chronic obstructive pulmonary disease; **URT**, upper respiratory tract.

INDEX

The excess in the number of **HOSPITAL DISCHARGES DUE TO EXITUS** in 2020, coded as RESPIRATORY SYSTEM DISEASES such as pneumonia, COPD, or bronchitis, may be attributed in part to the low COVID-19 diagnostic capacity. In other words, some of these patients may have died from COVID-19.

However, in 2021 and despite the lower number of discharges due to exitus compared to the 2015-2019 period, the in-hospital mortality rate increased, possibly due to hospitalization being restricted to more seriously ill patients.

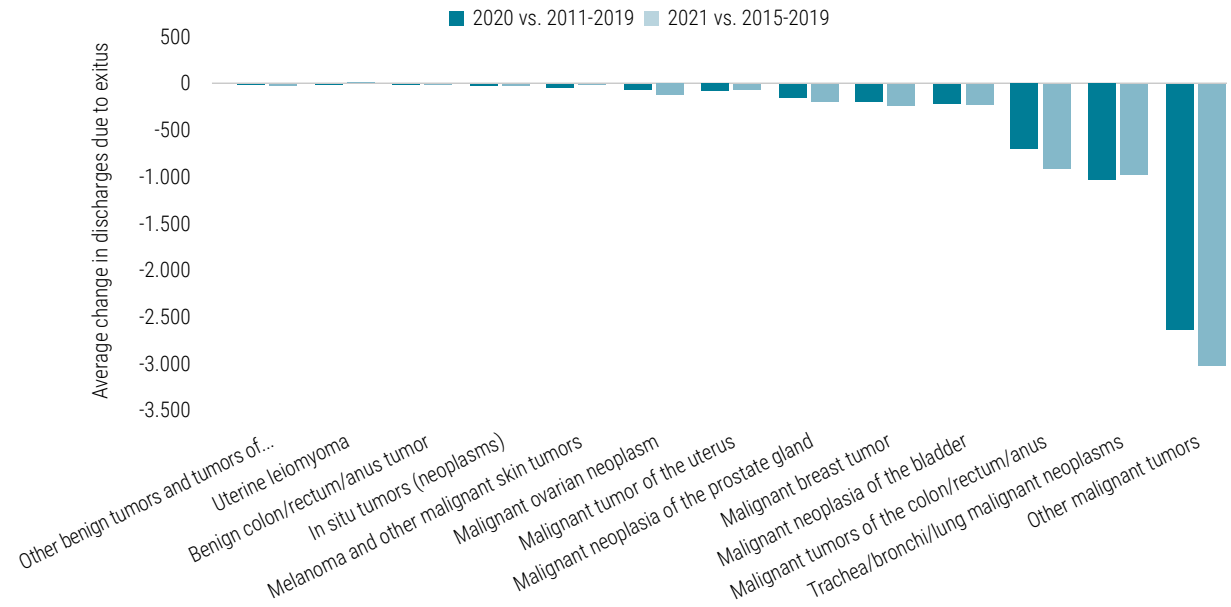
The percentage of elderly patients (>80 years) occupying ICU beds in 2020 and 2021 was significantly lower with respect to the 2016 to 2019 period, possibly due to ICU capacity saturation and the subsequent limitation of ICU access, which contemplated age among other exclusion criteria. Therefore, the excess in-hospital mortality due to non-COVID-19 respiratory diseases could be linked to such overload.

4.3.2. Excess in-hospital mortality due to neoplasms

For a detailed analysis of the analysis of excess in-hospital mortality due to neoplasms, please refer to section 2 of »»» Annex 6.

In 2020 and 2021, there was an absolute reduction in hospital discharges due to exitus with respect to 2015-2019 in people with neoplasms, especially in those with malignant neoplasms of the trachea, bronchi, and lung (»»» Figure 28). Likewise, an overall reduction in the rate of discharges due to exitus was observed in people with neoplasms, with respect to the same period of time (»»» Figure 29).

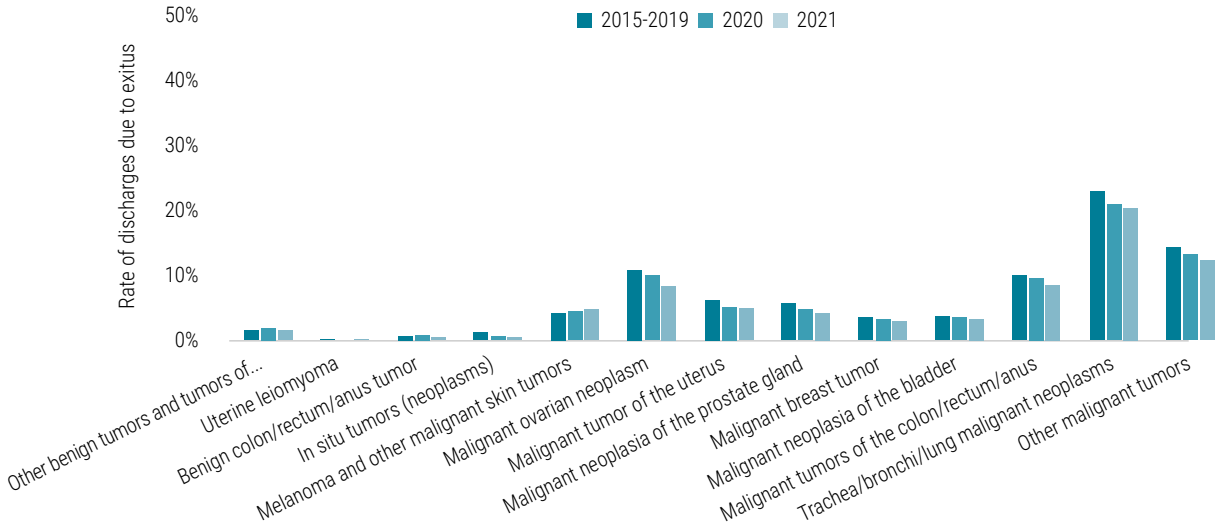
»»» Figure 28. Average change in the number of hospital discharges due to exitus in people with neoplasms in 2020 and 2021 with respect to the period 2015-2019



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** "Other benign tumors and tumors of..." refers to "Other benign tumors and tumors of uncertain or unknown behavior".

INDEX

»»» Figure 29. Rate of hospital discharges due to exitus in people with neoplasms in the period 2015-2019, 2020, and 2021



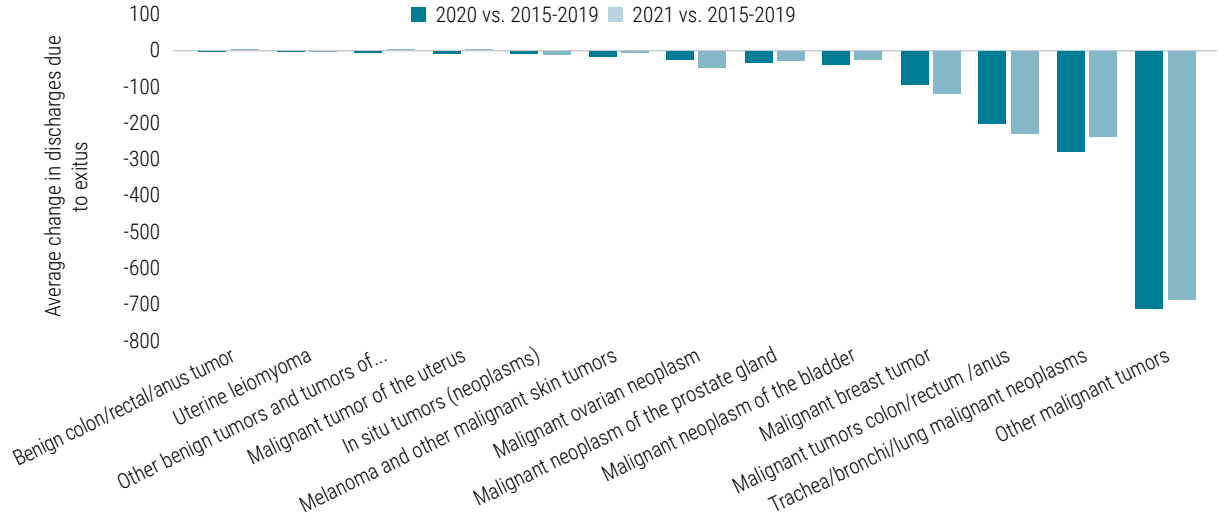
Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** For the period 2015-2019 the average annual rate is shown. "Other benign tumors and tumors of..." refers to "Other benign tumors and tumors of uncertain or unknown behavior".

The results of the analysis of the variation in in-hospital mortality from neoplasms in those services most relevant to their management during the COVID-19 pandemic are shown below.

Medical Oncology Service

In the Medical Oncology Service, a generalized reduction in discharges due to exitus was observed both in 2020 and 2021 with respect to the period from 2015 to 2019, being slightly smaller in 2021 than in 2020 (»»» Figure 30). Likewise, the rate of discharges due to exitus in 2020 and 2021 was lower than in the 2015-2019 period, with a slight increase in 2021 (»»» Figure 31).

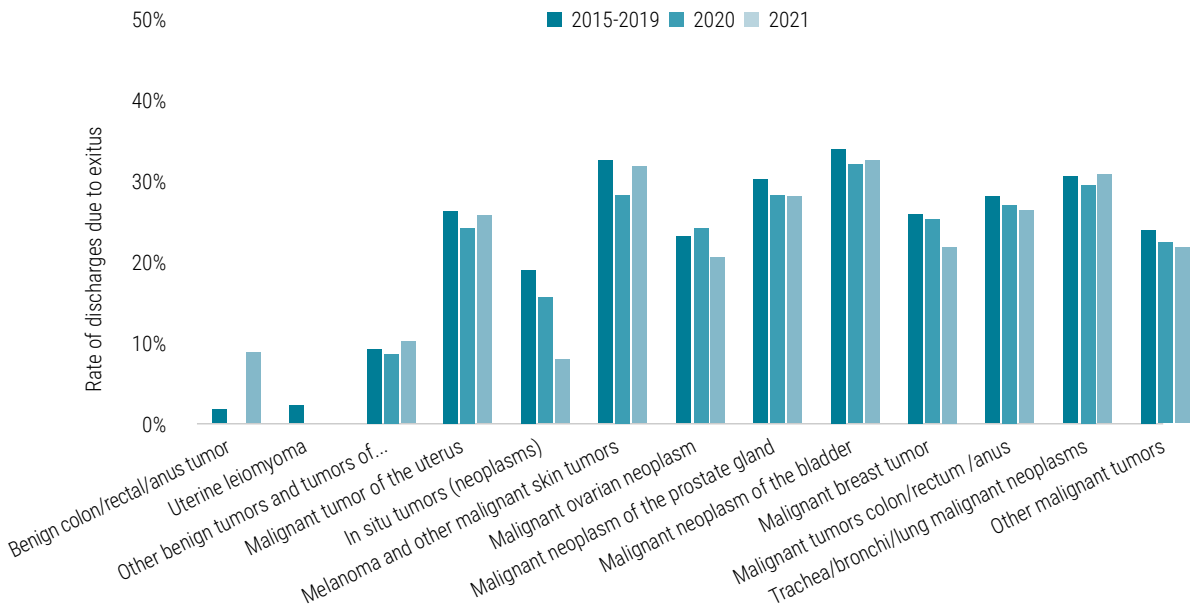
»»» Figure 30. Average change in the number of hospital discharges due to exitus in the Medical Oncology Service in 2020 and 2021 with respect to the 2015-2019 period



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** "Other benign tumors and tumors of..." refers to "Other benign tumors and tumors of uncertain or unknown behavior".

INDEX

»»» **Figure 31. Rate of hospital discharges due to exitus in the Medical Oncology Service in the period 2015-2019, 2020, and 2021**

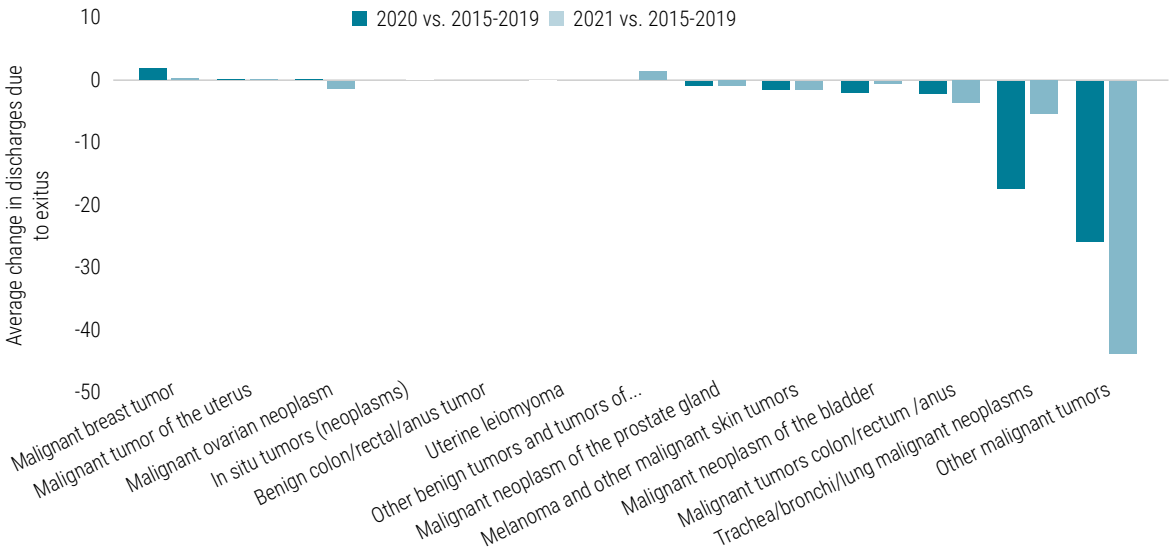


Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** For the period 2015-2019 the average annual rate is shown. "Other benign tumors and tumors of..." refers to "Other benign tumors and tumors of uncertain or unknown behavior".

Radiation Oncology Service

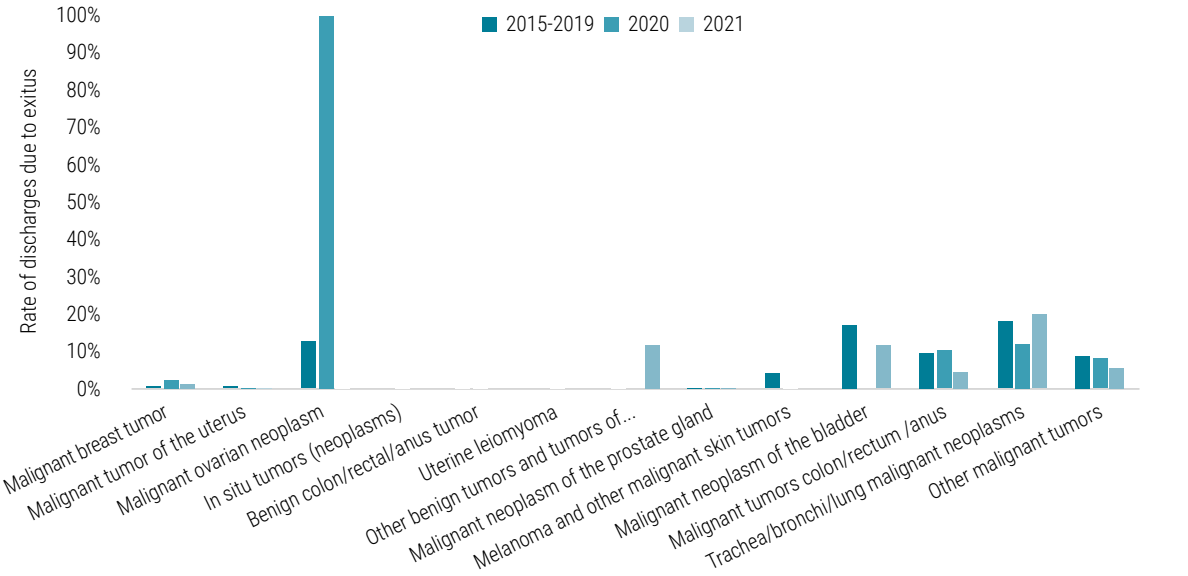
In the Radiation Oncology Service, the difference in discharges due to exitus between 2020 and 2021 with respect to the 2015-2019 period is low and there is no clear trend in terms of the number or rate of discharges due to exitus, so it is considered that its interpretation could introduce a considerable bias. However, with regard to discharges for malignant neoplasms of the trachea, bronchi, and lung, which present the greatest difference, discharges due to exitus were lower than the period 2015 to 2019 in both 2020 and 2021, being slightly lower in 2021 than in 2020 (»»» Figure 32). In addition, the rate of discharges due to exitus in 2020 was lower than in the 2015-2019 period, increasing slightly in 2021 with respect to 2020 and to the 2015 to 2019 period (»»» Figure 33). Those observations are in line with those on the Medical Oncology Service.

»»» **Figure 32. Average change in the number of hospital discharges due to exitus in the Radiation Oncology Service in 2020 and 2021 with respect to the period 2015-2019**



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** "Other benign tumors and tumors of..." refers to "Other benign tumors and tumors of uncertain or unknown behavior".

»»» **Figure 33. Rate of hospital discharges due to exitus in the Radiation Oncology Service in the period 2015-2019, 2020, and 2021**



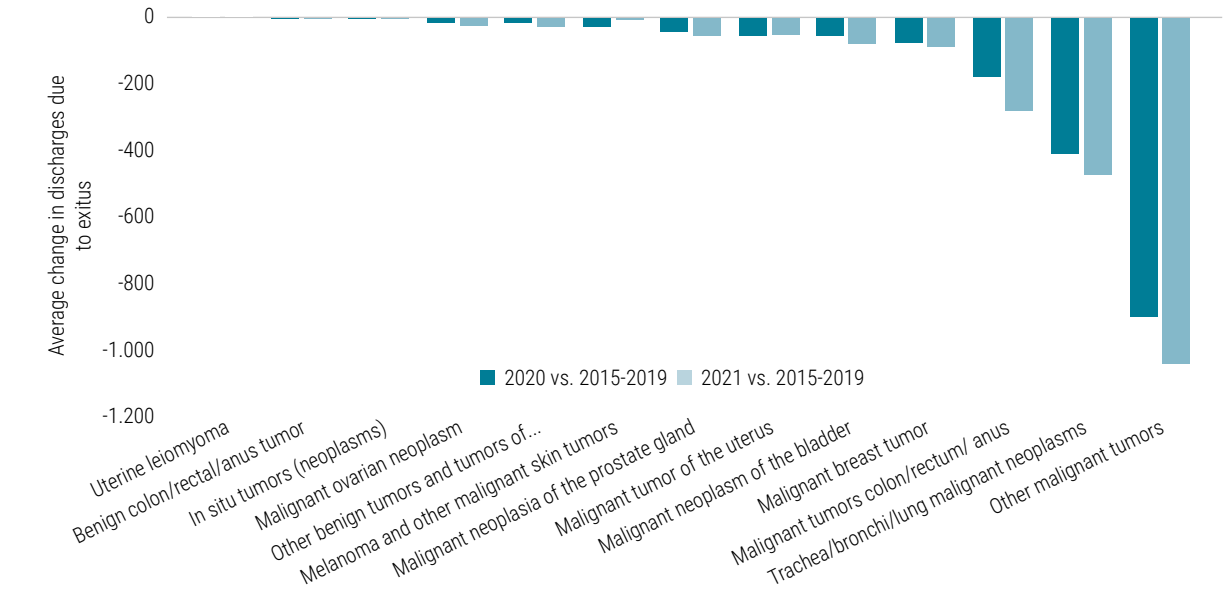
Source: Developed by the aythors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** For the period 2015-2019 the average annual rate is shown. "Other benign tumors and tumors of..." refers to "Other benign tumors and tumors of uncertain or unknown behavior".

Palliative Care Service

In the Palliative Care Service, 2020 and 2021 showed a generalized decrease in discharges due to exitus with respect to the period from 2015 to 2019, being more pronounced in 2021 than in 2020 (»»» Figure 34). Likewise, the rate of discharges due to exitus in 2020 and 2021 was lower than in the 2015-2019 period, with a slight increase in 2021 (»»» Figure 35).

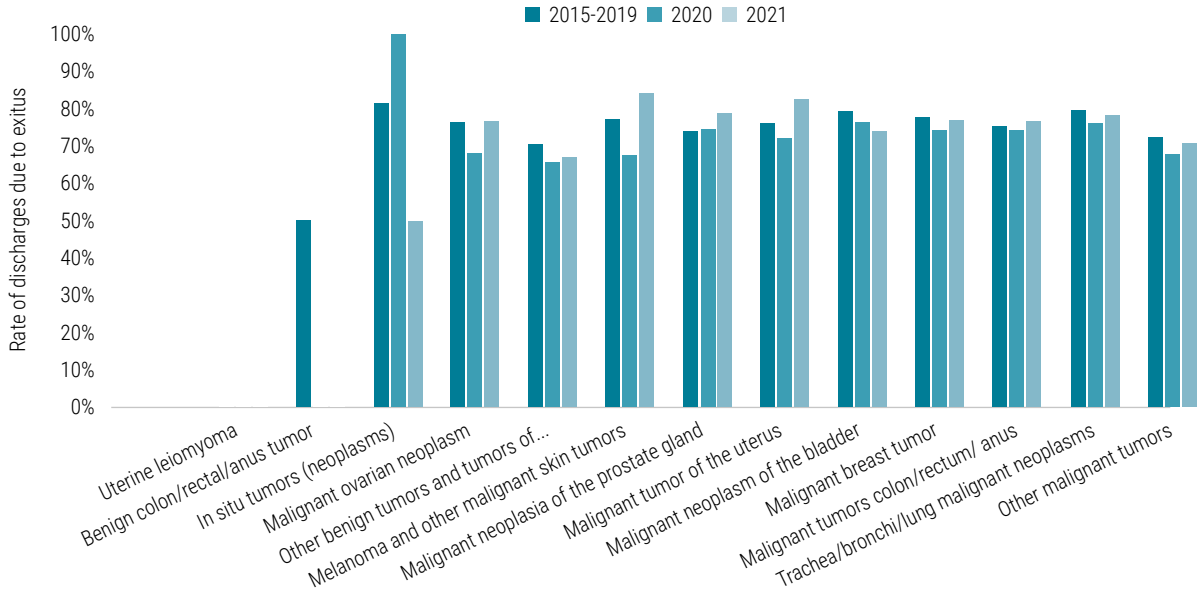
INDEX

»»» Figure 34. Average change in the number of hospital discharges due to exitus in the Palliative Care Service in 2020 and 2021 with respect to the period 2015-2019



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** "Other benign tumors and tumors of..." refers to "Other benign tumors and tumors of uncertain or unknown behavior".

»»» Figure 35. Rate of hospital discharges due to exitus in the Palliative Care Service in the period 2015-2019, 2020, and 2021



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note**: For the period 2015-2019 the average annual rate is shown. "Other benign tumors and tumors of..." refers to "Other benign tumors and tumors of uncertain or unknown behavior".

INDEX

In 2020 and 2021, a reduction in **IN-HOSPITAL MORTALITY** due to **NEOPLASMS** was observed with respect to the 2015-2019 period, possibly associated with out-of-hospital deaths for these patients.

However, this reduction was smaller in 2021, which may be indicative of a recovery in the care of these patients.

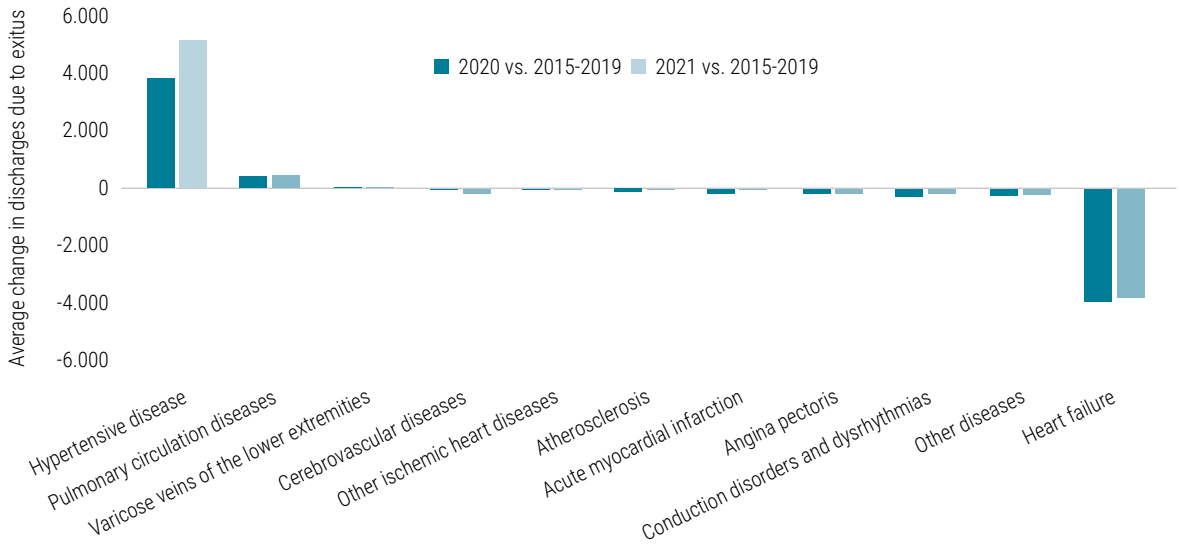
4.3.3. Excess in-hospital mortality due to diseases of the circulatory system

For a detailed analysis of the analysis of excess in-hospital mortality due to diseases of the circulatory system, please refer to section 3 of »»» Annex 6.

In 2020, there was a large increase in hospital discharges due to exitus in people admitted with hypertensive disease, followed by those admitted for pulmonary vascular disease (»»» Figure 36). Likewise, the rate of discharges due to exitus increased in both cases (»»» Figure 37). In contrast, there was a large reduction in discharges due to exitus in people with heart failure, followed by conduction disorders and dysrhythmias, angina pectoris, acute myocardial infarction, atherosclerosis, other ischemic heart disease, and cerebrovascular disease (»»» Figure 36). Except for conduction disorders and dysrhythmias, angina pectoris, and acute myocardial infarction, which showed a reduction in the rate of discharges due to exitus, the remaining cases showed an increase in the rate of discharges due to exitus (»»» Figure 37).

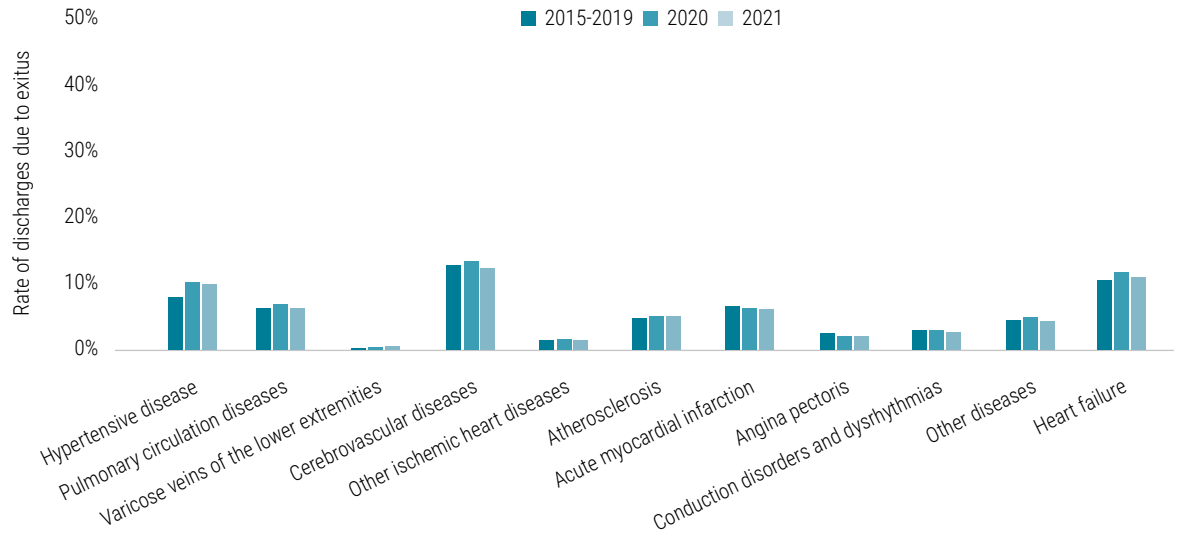
In 2021, the increase in discharges and the rate of discharges due to exitus for people with hypertensive disease was maintained with respect to the 2015-2019 period, and the rate of discharges due to exitus for pulmonary vascular diseases was slightly reduced (»»» Figure 36 y »»» Figure 37). On the other hand, the reduction in discharges due to exitus described above was maintained (»»» Figure 36), but in the case of cerebrovascular diseases, and in contrast to what occurred in 2020, the rate of discharges due to exitus was reduced (»»» Figure 37).

»»» **Figure 36. Average change in the number of hospital discharges due to exitus in people with diseases of the circulatory system in 2020 and 2021 compared to the period 2015-2019**



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19].

»»» Figure 37. Rate of hospital discharges due to exitus in people with diseases of the circulatory system in the period 2015-2019, 2020, and 2021



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** The average annual rate is shown for the period 2015-2019.

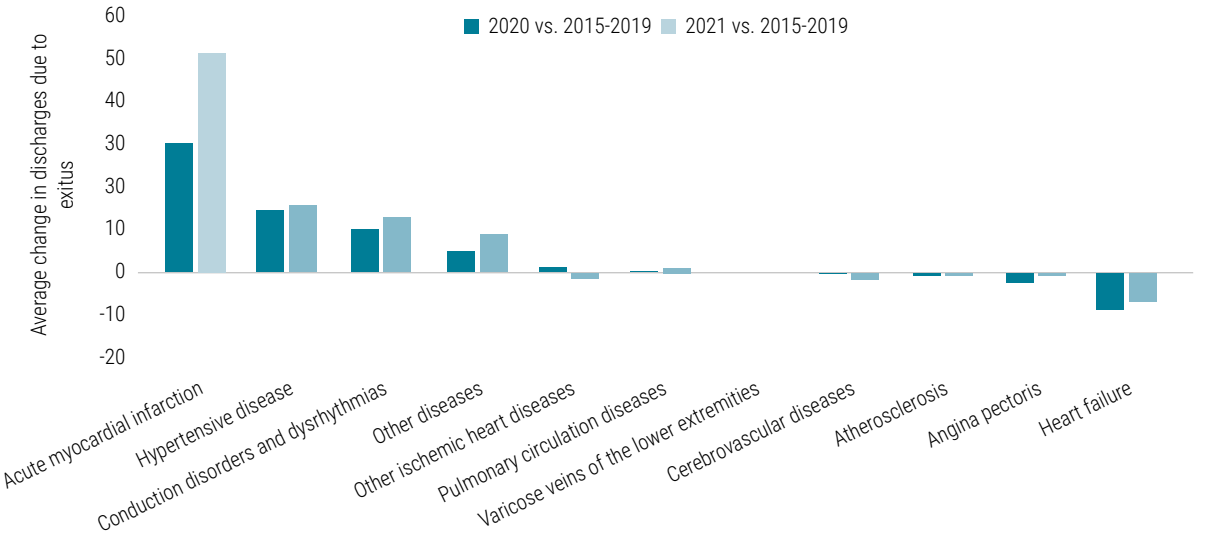
The results of the analysis of the variation in in-hospital mortality due to circulatory system diseases in those services most relevant to their management during the COVID-19 pandemic are shown below.

Coronary Care Unit

In the Coronary Care Unit, the difference in discharges due to exitus between 2020 and 2021 with respect to the 2015-2019 period is low and there is no clear trend in terms of the rate of discharges due to exitus. Therefore, its interpretation could introduce a considerable bias. However, an increase of discharges due to exitus in both 2020 and 2021 with respect to the 2015-2019 period is observed, being slightly higher in 2021 than in 2020, in people with acute myocardial infarction, hypertensive disease, and conduction disorders and dysrhythmias. In contrast, a reduction in discharges due to exitus is observed in people with heart failure in both 2020 and 2021 with respect to the period from 2015 to 2019, and somewhat less pronounced in 2021 (»»» Figure 38). As for the rate of discharges due to exitus in people with hypertensive disease, it increased considerably in 2020 with respect to the period from 2015 to 2019, and decreased in 2021 to a lower rate than that of the period 2015-2019. In contrast, in people with acute myocardial infarction, conduction disorders and dysrhythmias, and heart failure, a reduction in the rate of discharges due to exitus was observed in 2020 with respect to the period from 2015 to 2019, followed by an increase in 2021 to levels of 2015-2019 (»»» Figure 39).

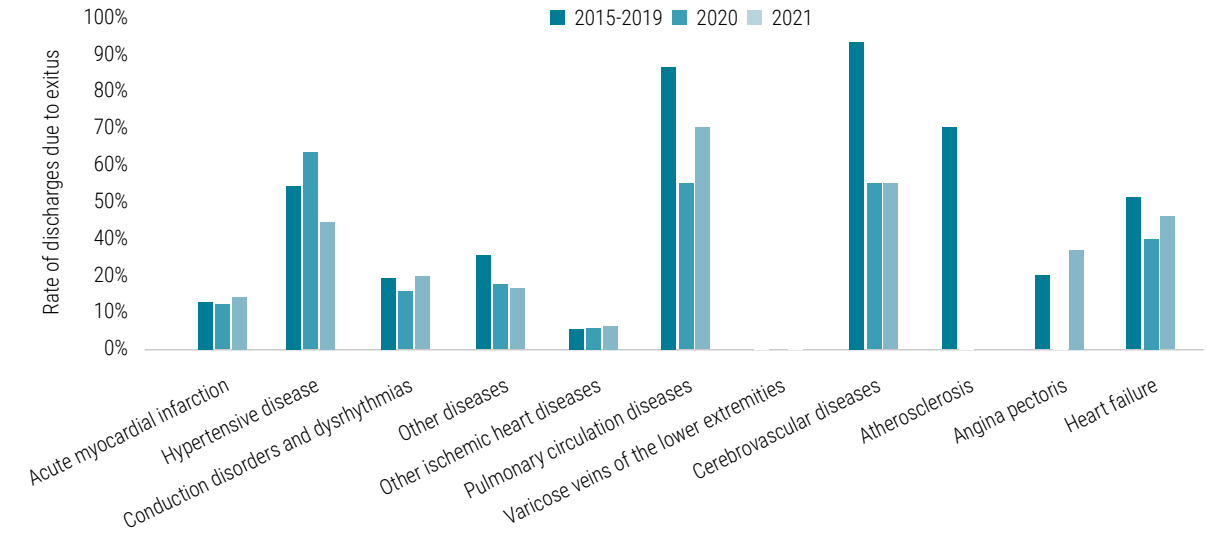
INDEX

»»» Figure 38. Average variation in the number of hospital discharges due to exitus in the Coronary Care Unit in 2020 and 2021 with respect to the period 2015-2019



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19].

»»» Figure 39. Rate of hospital discharges due to exitus in the Coronary Care Unit in the period 2015-2019, 2020, and 2021



Source: Developed by the authors based on hospital discharges due to exitus from the SNHS RAE-CMBD[19]. **Note:** The average annual rate is shown for the period 2015-2019.

INDEX

The excess in the number and rate of **HOSPITAL DISCHARGES DUE TO EXITUS** in 2020 and 2021 coded as **HYPERTENSIVE DISEASE** may have been due in part to the low COVID-19 diagnostic capacity. That is, some of these patients may have died from COVID-19. In no case can hypertensive disease be understood as a cause of death, but as a risk factor.

In contrast, despite the reduction in the number of discharges due to exitus in 2020 and 2021 compared to 2015-2019 due to **HEART FAILURE**, the in-hospital mortality rate increased, possibly due to hospitalization being restricted to more severely ill patients.

The percentage of patients older than 80 years occupying ICU beds in 2020 and 2021 was significantly lower than in the period from 2016 to 2019, possibly due to ICU saturation and subsequent limitation of ICU access, which contemplated age among other exclusion criteria. Therefore, the excess in-hospital mortality due to non-COVID-19 circulatory system diseases could be linked to such saturation.

4.4. CAUSE-SPECIFIC EXCESS MORTALITY ANALYSIS

The results of the detailed analysis of those non-COVID-19 causes of death selected by the Advisory Committee on the basis of the exploration, discussion, and interpretation of the in-hospital mortality analysis are shown below. These causes of death have been classified into the following blocks:

4.4.1. Diseases of the respiratory system

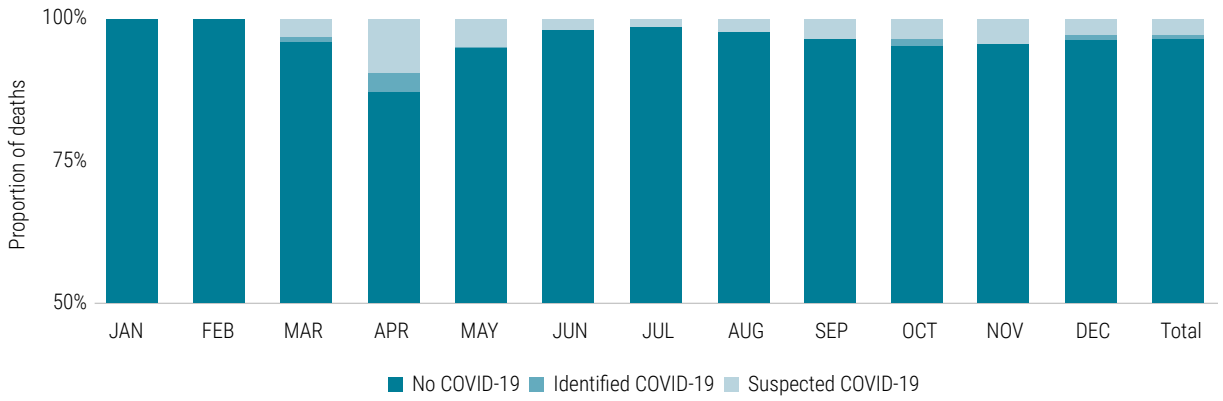
For a detailed analysis of excess mortality from diseases of the respiratory system, please refer to section 1 of »»» Annex 7.

Pneumonia

According to the analysis of the INE death statistics by cause of death, in March 2020, an excess of 0.57 deaths per 100,000 inhabitants was recorded for pneumonia, being the disease that contributed most to excess mortality from diseases of the respiratory system after COVID-19. This also applies at the in-hospital level, further observing an increase in the rate of discharges due to exitus from 2015-2019 (8.6% of admissions) to 2020 (14.5% of admissions). On the contrary, 2021 showed a reduction of discharges due to exitus, while maintaining a positive rate of discharges due to exitus (10.1% of admissions).

According to the Advisory Committee of this study, the increase in the number of discharges due to exitus in people with pneumonia in 2020 could be due to COVID-19 being the main cause of death. After including additional causes of death into the analysis, of those who died from pneumonia in 2020, 3.3% had identified or suspected COVID-19. In March 2020, 4.0% of those who died of pneumonia had identified or suspected COVID-19, rising to 12.7% in April (»»» Figure 40).

»»» Figure 40. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to pneumonia in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

In addition, people who died from pneumonia in 2020 also had respiratory failure, other heart diseases, and/or heart failure, among others, as an additional cause of death (»»» Table 2).

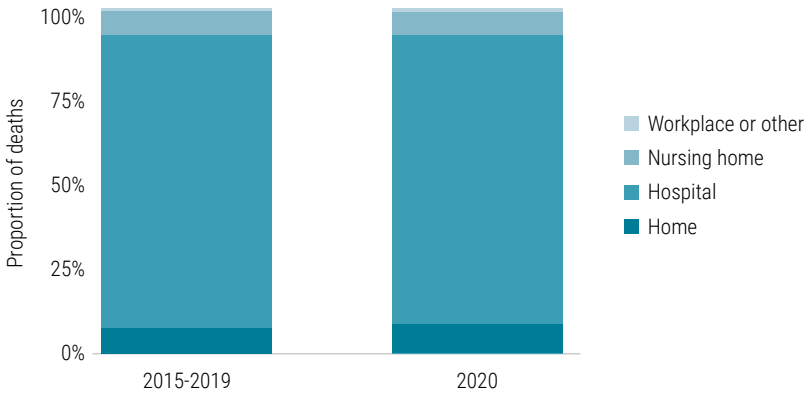
»»» Table 2. Distribution of causes of death in addition to pneumonia in 2020

Additional causes of death	Proportion
Pneumonia	91.4%
Respiratory failure	55.6%
Other heart diseases	34.3%
Heart failure	13.4%
Hypertensive diseases	5.5%
Other heart diseases	5.3%
Diseases of the kidney and ureter	4.8%
Pneumonia	3.9%
Sepsis	3.6%
Pneumonia	3.5%

Source: Developed by the authors based on data from the INE death statistics[18].

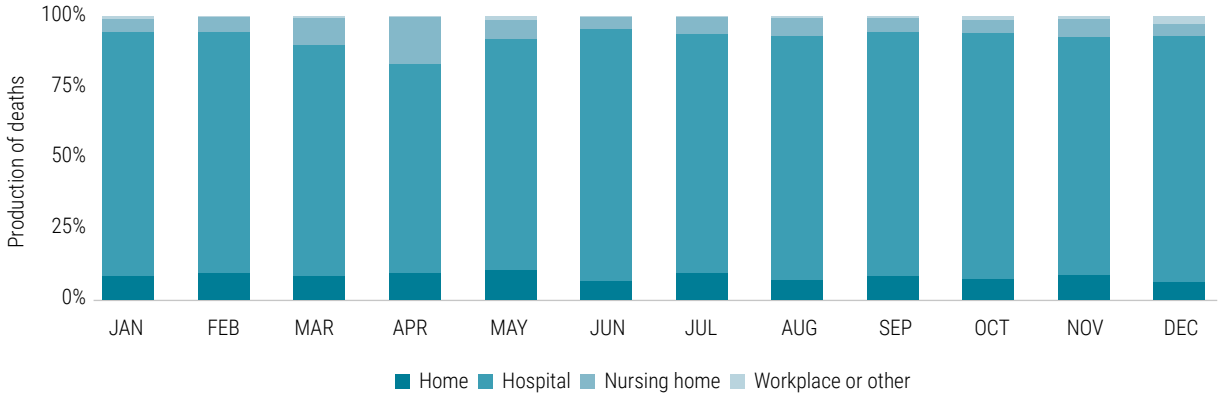
In 2020, the majority of patients who died of pneumonia did so in hospital (84.1%) (»»» Figure 41), but in April the proportion of patients dying from pneumonia in nursing homes increased significantly to 16.3% (»»» Figure 42), at the same time the highest percentage of patients who died of pneumonia who also had identified or suspected COVID-19 was recorded (22.6%) (»»» Figure 43).

»»» Figure 41. Distribution of pneumonia-associated deaths by place of death in 2015-2019 and in 2020



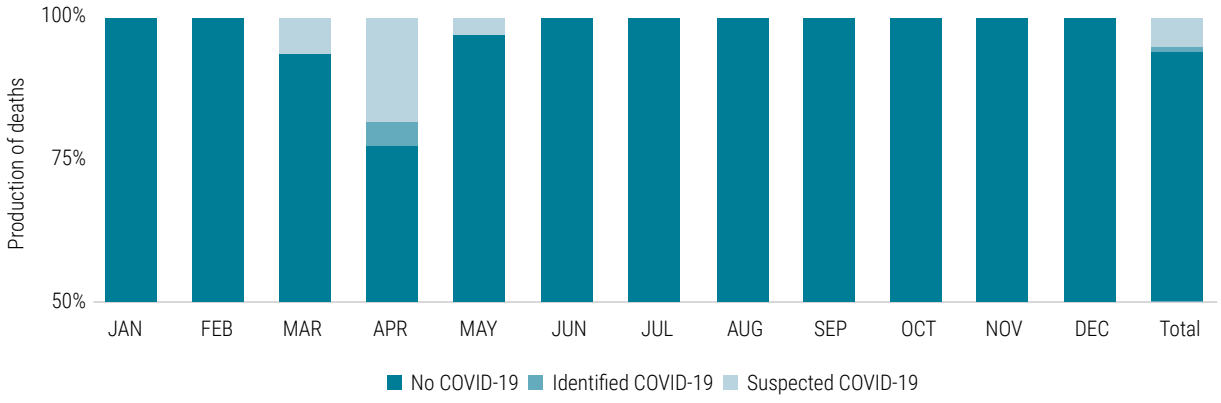
Source: Developed by the authors based on data from the INE death statistics[18].

»»» Figure 42. Distribution of pneumonia-associated deaths by place of death in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

»»» Figure 43. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to pneumonia in nursing homes in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

INDEX

On the other hand, the Advisory Committee attributed the decrease in the number of discharges due to exitus in people with pneumonia in 2021 to improvements in disease management, COVID-19 coding, and access to polymerase chain reaction (PCR) tests. In this regard, the COVID-19 diagnostic capacity had increased by a factor of 5 in the second half of 2020 (»»» Figure 3). Finally, the fact that the discharge rate due to exitus was still positive in 2021 could reflect that only the most severe patients were admitted.

The observation that most of the patients who died of pneumonia died in hospital raised the question of whether these patients died due to ICU overcrowding. In this regard, the Advisory Committee stated that deaths occurring outside the Intensive Care Medicine Service would be indicative of either a non-ICU candidate in the case of an elderly person with comorbidities, or an ICU candidate in the case of a young person without comorbidities who could not access the ICU due to saturation. In those services in which there was a variation of at least 50 discharges due to exitus, the greatest increase in people with pneumonia in 2020 was recorded in the Infectious Diseases Service (+238%), followed by the Pneumology Service (+136%), and the Emergency Department (+132%). In addition to the fact that the increase in the Intensive Care Medicine Service was smaller (+16%), multiple additional diseases were identified in patients who died of pneumonia (»»» Table 2).

Chronic obstructive pulmonary disease and bronchiectasis

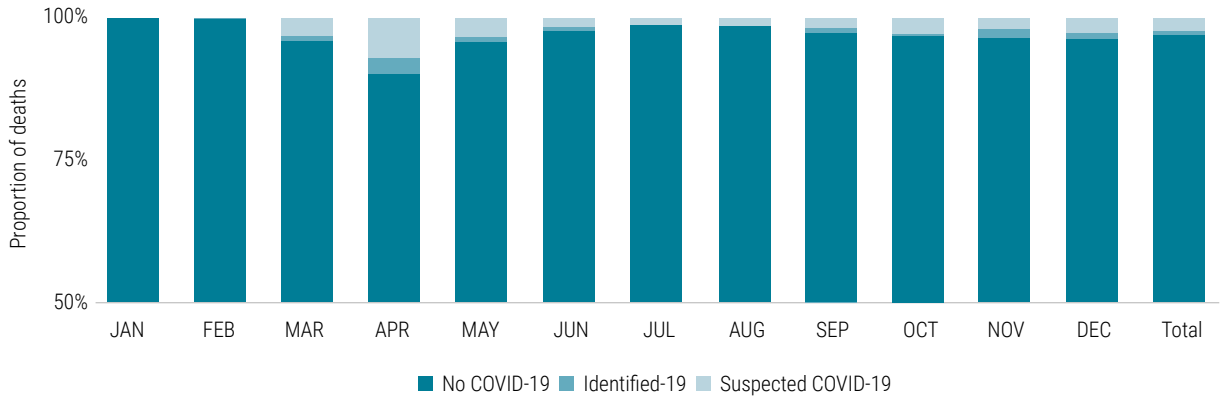
According to the analysis of the INE death statistics by cause of death, in March 2020 an excess of 0.44 deaths per 100,000 inhabitants was recorded for chronic diseases of the lower respiratory tract (except asthma)t, being the disease that most contributed to excess mortality of all diseases of the respiratory system after COVID-19 and pneumonia. At the in-hospital level, the same observation was made for COPD and bronchiectasisu , further recording an increase in the rate of discharges due to exitus from 2015-2019 (4.8% of admissions) to 2020 (7.5% of admissions). On the contrary, 2021 showed a a reduction in the number of discharges due to exitus but maintaining a positive rate of discharges due to exitus (5.9% of admissions).

According to the Advisory Committee of this study, the increase in the number of discharges due to exitus in people with COPD and bronchiectasis in 2020 could be associated with COVID-19 as the main causal agent. After the including additional causes of death into the analysis, of those who died from chronic lower respiratory tract diseases (except asthma) in 2020, 3.1% also had identified or suspected COVID-19. In March 2020, 5.4% of the people who died from chronic lower respiratory tract diseases (except asthma) also had identified or suspected COVID-19, rising to 9.8% in April (»»» Figure 44).

t INE code 64 (chronic diseases of the lower respiratory tract (except asthma)): correspondence with ICD-10 codes 1006 (COPD and bronchiectasis) and 1003 (acute bronchitis and bronchiolitis) of the ICD-10 used by the SNS.

u ICD-10 code 1006 used by the SNS (COPD and bronchiectasis): correspondence with INE code 64 (chronic diseases of the lower respiratory dut (except asthma)).

»»» **Figure 44. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to chronic lower respiratory tract diseases (except asthma) in 2020, by month**



Source: Developed by the authors based on data from the INE death statistics[18].

In addition, people who died from chronic lower respiratory tract diseases (except asthma) in 2020 also had other diseases of the respiratory system and heart, heart failure, hypertensive diseases, and/or pneumonia, among others, as additional causes of death (»»» Table 3).

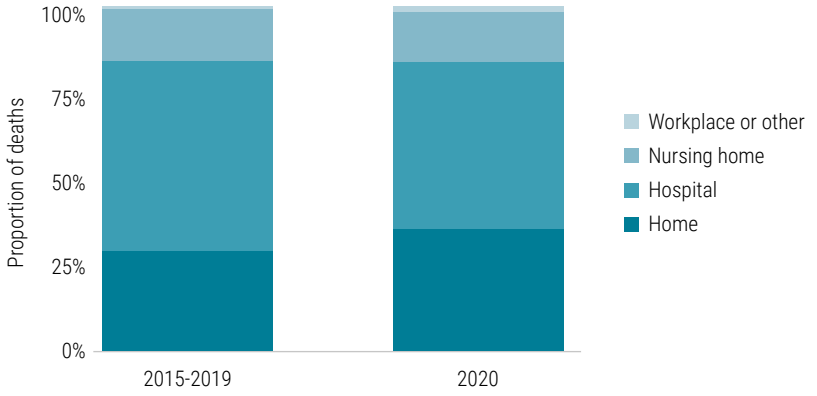
»»» **Table 3. Distribution of causes of death in addition to chronic lower respiratory tract diseases (except asthma) in 2020**

Additional causes of death	Proportion
Chronic diseases of the lower respiratory tract (except asthma)	85.1%
Other diseases of the respiratory system	50.3%
Other heart diseases	38.6%
Heart failure	18.7%
Hypertensive diseases	13.8%
Pneumonia	11.2%
Other heart diseases	9.2%
Chronic diseases of the lower respiratory tract (except asthma)	8.1%
Organic, senile, and presenile mental disorders	5.5%

Source: Developed by the authors based on data from the INE death statistics[18].

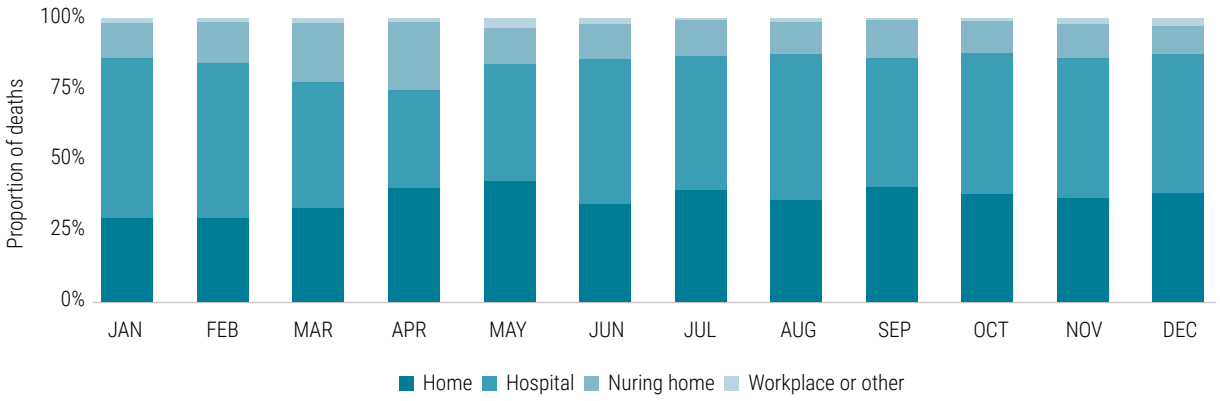
In 2020, patients who died from chronic lower respiratory tract diseases (except asthma) died in hospital (48.3%) or at home (35.5%), in contrast to the period 2015-2019 when more people died in hospital (54.9%) and fewer at home (48.3%) (»»» Figure 45). In addition, from March 2020 onwards, there is a notable reduction in the proportion of deaths in hospital (reaching 34.9% in April) and a notable increase in the proportion deaths by chronic lower respiratory tract diseases (except asthma) at home (reaching 40.0% in April) and in nursing homes (reaching 23.9% in April) (»»» Figure 46). In April 2020, while 2.0% of deaths at home were accompanied by suspected COVID-19, in nursing homes 14.6% of people died of chronic lower respiratory tract diseases (except asthma) and also had identified or suspected COVID-19 (»»» Figure 47).

»»» Figure 45. Distribution of deaths from chronic lower respiratory tract diseases (except asthma) by place of death in the period 2015-2019 and in 2020



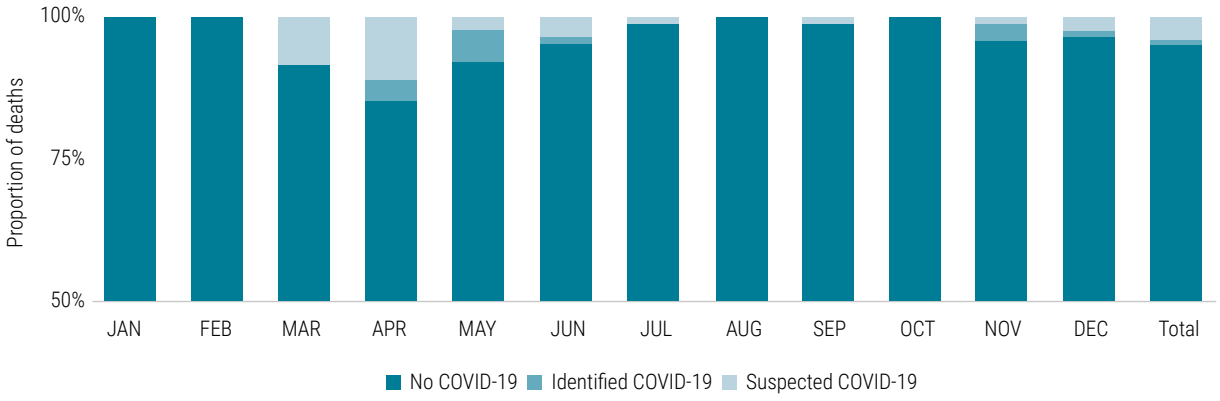
Source: Developed by the authors based on data from the INE death statistics[18].

»»» Figure 46. Distribution of deaths due to chronic lower respiratory tract diseases (except asthma) by place of death in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

»»» Figure 47. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to chronic lower respiratory tract diseases (except asthma) in nursing homes in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

INDEX

On the other hand, the Advisory Committee considers that in 2021, the decrease in the number of discharges due to exitus in people with COPD and bronchiectasis may be attributed to improvements in disease management, COVID-19 coding, and access to PCR testing. In this regard, the COVID-19 diagnostic capacity increased by five-fold in the second half of 2020 (»»» Figure 3). Finally, the positive discharge rate due to exitus in 2021 could reflect that only the most severe patients were admitted.

In addition, the Advisory Committee noted the potential impact of a change in therapeutic adherence on mortality in people with COPD. In this regard, a reduction of at least 30% was observed in the dispensing of the following COPD medications (»»» Table 4):

»»» Table 4. Percentage change in the number of people on medication according to COPD pharmacological subgroup in 2020 and 2021 compared to 2019

Pharmacological subgroup for COPD	2020 vs. 2019	2021 vs. 2020
R03C - Adrenergics for systemic use (antiasthmatics)	-53.1%	7.5%
R05D - Antitussives, excluding association with expectorants	-40.0%	-6.9%
R05C - Expectorants, excluding association with cough suppressants	-39.6%	-0.5%
R05X - Other combined cold preparations	-38.9%	-46.9%
R03D - Other for airway obstruction, systemic use	-32.2%	-5.9%
J01F - Macrolides and lincosamides (systemic anti-infectives)	-31.7%	-3.3%

Source: Developed by the authors based on data from the Primary Care Clinical Database (BDCAP) on the dispensing of medicines in community pharmacies[39]. **Note:** Only those drugs whose pharmaceutical dispensing in 2020 was reduced by at least 30% compared to 2019 are shown. The full analysis can be found in »»» Annex 4.

Regarding the observation of a decrease in Pneumology Service discharges due to exitus in people with COPD and bronchiectasis in 2020, the Advisory Committee considered that these patients did not die in other services. In this regard, of those services in which a variation of at least 50 discharges due to exitus was recorded, the largest increase in the rate of discharges due to exitus in people with COPD and bronchiectasis in 2020 was recorded in the Infectious Diseases Service (+332%), followed by the Internal Medicine Service (+56%), and the Intensive Care Medicine Service (+21%). According to the Advisory Committee, despite the fact that in 2020 and 2021 the number of admissions for non-COVID-19 diseases was very low, they could be admitted to hospital for various reasons. On the one hand, patients with non-COVID-19 diseases could be admitted on the basis of disease severity, hence the positive discharge rate due to exitus (»»» Figure 23) in spite of the reduced number of discharges due to exitus (»»» Figure 22). On the other hand, these patients could be admitted due to COVID-19 (»»» Figure 44). According to the Advisory Committee, these comments are also applicable to Internal Medicine and Intensive Care Medicine services.

Acute bronchitis and bronchiolitis

According to the analysis of the INE death statistics by cause of death, in March 2020 an excess of 0.44 deaths per 100,000 inhabitants was recorded for chronic diseases of the lower respiratory tract (except asthma)[v], being the disease that most contributed to excess mortality among diseases of the respiratory system, after COVID-19 and pneumonia. At the in-hospital level, the same observation was made regarding

v INE code 64 (chronic diseases of the lower respiratory tract (except asthma)): correspondence with ICD-10 codes 1006 (COPD and bronchiectasis) and 1003 (acute bronchitis and bronchiolitis) of the ICD-10 used by the SNS.

acute bronchitis and bronchiolitis[w], further recording an increase in the rate of discharges due to exitus from 2015-2019 (3.7% of admissions) to 2020 (5.8% of admissions). On the contrary, a reduction in the number and rate of discharges due to exitus was reported in 2021 with respect to the 2015-2019 period.

Acute bronchitis and bronchiolitis, along with COPD and bronchiectasis, are included in the chronic diseases of the lower respiratory tract (except asthma)[x] in the analysis of the INE data. Therefore, the results of the additional analyses for COPD and bronchiectasis also apply to acute bronchitis and bronchiolitis.

Regarding the observation of a decrease in Pneumology Service discharges due to exitus in people with acute bronchitis and bronchiolitis in 2020, the Advisory Committee considered that these patients did not die in other services. In this regard, of those services in which a variation of at least 50 discharges due to exitus was recorded, the largest increase in the rate of discharges due to exitus in people with acute bronchitis and bronchiolitis in 2020 was recorded in the Infectious Diseases Service (+9%) followed by the Internal Medicine Service (+8%). According to the Advisory Committee, despite the fact that in 2020 and 2021 the number of admissions for non-COVID-19 diseases was very low, they could be admitted to hospital for various reasons. On the one hand, patients with non-COVID-19 diseases could be admitted on the basis of disease severity, hence positive discharge rate due to exitus (»»» Figure 22) in spite of the reduced number of discharges due to exitus (»»» Figure 23) or by COVID-19 (»»» Figure 44). According to the Advisory Committee, these comments are also applicable to Internal Medicine and Intensive Care Medicine services.

The excess mortality from **PNEUMONIA** and **LOWER RESPIRATORY CHRONIC DISEASE** matches the first peak of COVID-19 cases. The low diagnostic capacity at the time could indicate that such an excess was due to COVID-19. This is reproduced at the in-hospital level. On the contrary, a reduction in the number of deaths was reported in 2021, alongside an increase in the in-hospital mortality rate, which could indicate that admissions were limited to more severe patients.

Of the patients who died in March 2020, some also had identified or suspected COVID-19. In April 2020, this proportion increased significantly, matching the increase in the proportion of patients dying in nursing homes. These patients, who are usually elderly patients with comorbidities, may have had limited their hospital admission at the first peak of ICU occupancy, as age, among other factors, is a criterion for ICU access.

4.4.2. Neoplasms

For a detailed analysis of excess mortality due to neoplasms, please refer to section 2 of »»» Annex 7.

Malignant neoplasms of trachea, bronchi, and lung

According to the analysis of the INE death statistics by cause of death, considering the peaks of excess mortality from all causes according to the MoMo System, there was an average reduction in the mortality rate of 2.75 (SD: 0.51) deaths per 100,000 inhabitants due to neoplasms, mainly due to malignant tumors of the trachea, bronchi, and lung (0.82; SD: 0.16), decreasing especially in April (-0.41; SD: 0.10) and November

w ICD-10 code 1003 used by the SNS (acute bronchitis and bronchiolitis): correspondence with INE code 64 (chronic diseases of the lower respiratory tract (except asthma)).

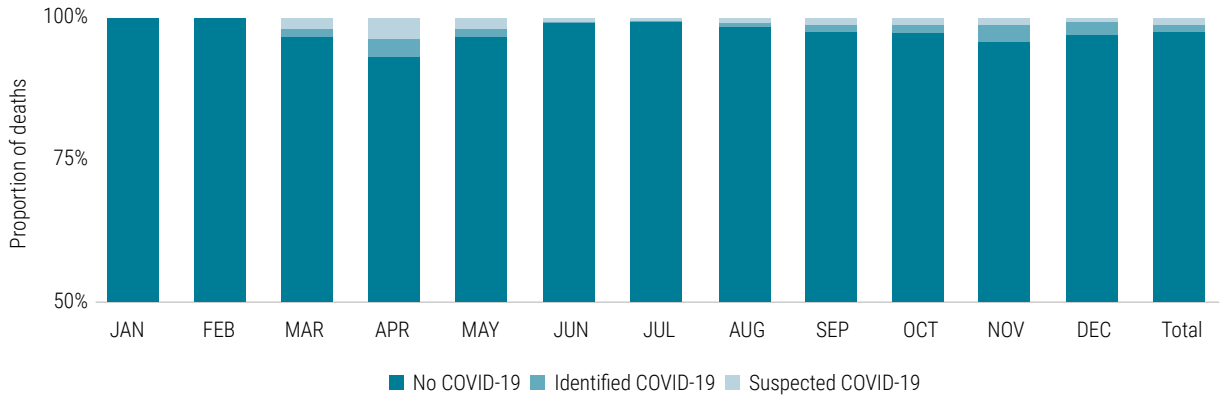
x INE code 64 (chronic diseases of the lower respiratory tract (except asthma)): correspondence with ICD-10 codes 1006 (COPD and bronchiectasis) and 1003 (acute bronchitis and bronchiolitis) of the ICD-10 used by the SNS.

(-0.32; SD: 0.09). At the in-hospital level, in 2020 and 2021 there was a reduction in the number of discharges due to exitus in people with neoplasms with respect to the 2015-2019 period, especially in people with malignant neoplasms of the trachea, bronchi, and lung. Furthermore, a reduction in the rate of discharges due to exitus was further recorded from 22.8% in the 2015-2019 period to 20.9% in 2020 and 20.3% in 2021.

According to the Advisory Committee of this study, the reduction in the number and rate of discharges due to exitus in people with malignancies in 2020 and 2021 with respect to 2015-2019 could be due to a lack of diagnosis, as patients were afraid to visit the hospital or were admitted without a diagnosis and died from COVID-19.

After incorporating additional causes of death into the analysis of the INE death statistics by cause of death, 2.2% of those who died from malignant neoplasms of the trachea, bronchi, and lung in 2020 also had identified or suspected COVID-19. In March 2020, 3.2% of people who died from malignant neoplasms of the trachea, bronchi, and lung also had identified or suspected COVID-19, rising to 6.6% in April, and 3.2% again in May (»»» Figure 48). However, according to the Advisory Committee, deaths due to neoplasms do not require a trigger and are therefore deaths due to neoplasms.

»»» Figure 48. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to malignant neoplasms of the trachea, bronchi, and lung in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

In addition, people who died from malignant neoplasms of the trachea, bronchi, and lung in 2020 also had other malignant tumors of the trachea, bronchi, and lung, as well as respiratory failure and other heart diseases, among others, as additional causes of death (»»» Table 5). However, according to the Advisory Committee, deaths due to neoplasms do not require a trigger and are therefore deaths due to neoplasms.

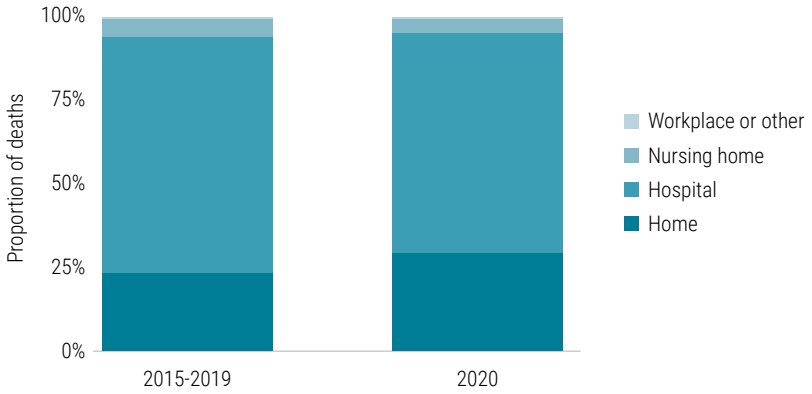
»»» Table 5. Distribution of causes of death in addition to malignant neoplasms of the trachea, bronchi, and lung in 2020

Additional causes of death	Proportion
Malignant tumor of the trachea, bronchi, and lung	99.6%
Respiratory failure	38.8%
Other heart diseases	35.5%
Malignant tumor of ill-defined sites, secondary, and unspecified sites	5.9%
Hypertensive diseases	5.7%
Chronic diseases of the lower respiratory tract (except asthma)	5.4%
Pneumonia	5.0%
Diabetes mellitus	3.0%
Other symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	2.9%

Source: Developed by the authors based on data from the INE death statistics[18].

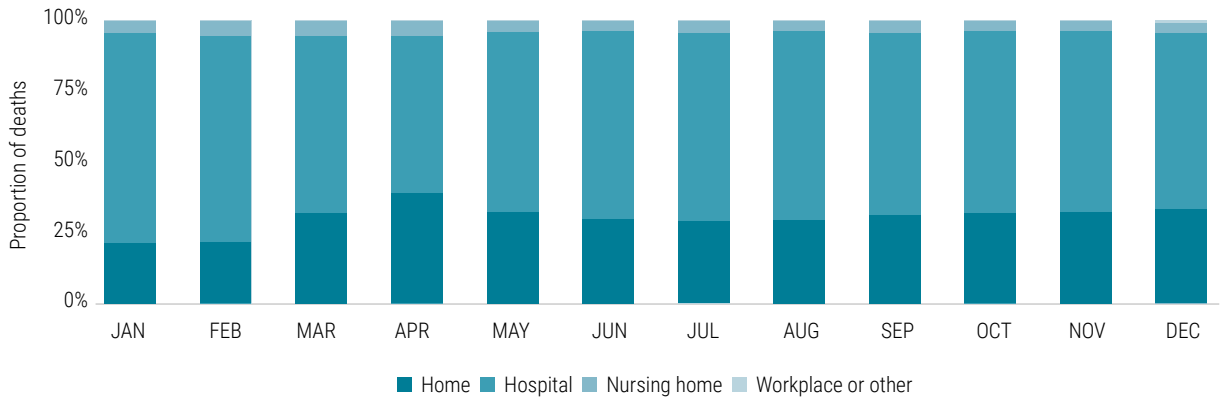
In 2020, patients who died from malignant neoplasms of the trachea, bronchi, and lung died in hospital (65.5%) or at home (30.1%), whereas in the 2015-2019 period more people died in hospital (70.0%) and fewer at home (24.1%) (»»» Figure 49). In addition, from March 2020 onwards, there is a notable reduction in the proportion of deaths from malignant neoplasms of the trachea, bronchi, and lung in hospital (reaching 55.4% in April), and a notable increase in the proportion deaths at home (reaching 39.1% in April) (»»» Figure 50). In April 2020, while 1.7% of deaths that occurred at home had suspected COVID-19, 9.9% and 9.6% of those who died in hospitals and nursing homes, respectively, had identified or suspected COVID-19 in addition to malignant neoplasms of the trachea, bronchi, and lung (»»» Figure 51 and »»» Figure 52).

»»» Figure 49. Distribution of deaths from malignant neoplasms of the trachea, bronchi, and lung by place of death in the period 2015-2019 and in 20200



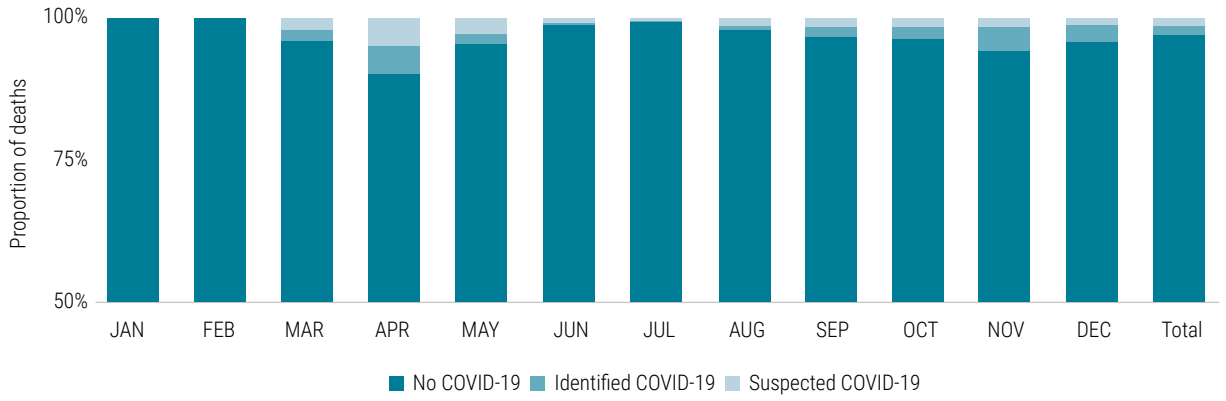
Source: Developed by the authors based on data from the INE death statistics[18].

»»» **Figure 50. Distribution of deaths from malignant neoplasms of the trachea, bronchi, and lung by place of death in 2020, by month**



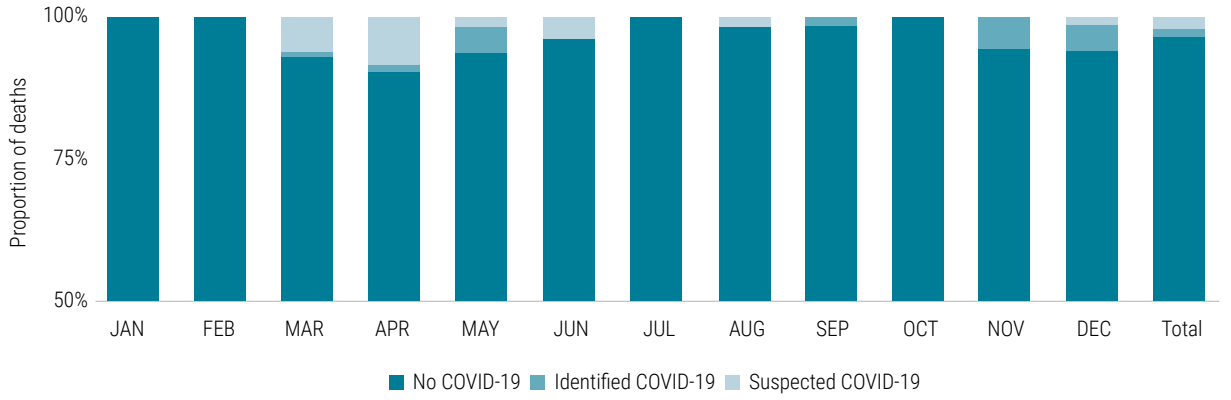
Source: Developed by the authors based on data from the INE death statistics[18].

»»» **Figure 51. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to malignant neoplasms of the trachea, bronchi, and lung in hospitals in 2020, by month**



Source: Developed by the authors based on data from the INE death statistics[18].

»»» **Figure 52. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to malignant neoplasms of trachea, bronchi, and lung in nursing homes in 2020, by month**



Source: Developed by the authors based on data from the INE death statistics[18].

The excess mortality from **NEOPLASMS** in March 2020 could be due to COVID-19 because of the low diagnostic capacity at that time.

However, at the in-hospital level, the number and rate of discharges due to exitus decreased notably. This could be attributed to a significant increase in out-of-hospital mortality.

It is possible that these patients had their medical appointments cancelled or were afraid to visit the hospital at a time of high COVID-19 incidence.

4.4.3. Diseases of the circulatory system

For a detailed analysis of the analysis of excess in-hospital mortality due to diseases of the circulatory system, please refer to »»» Annex 7.

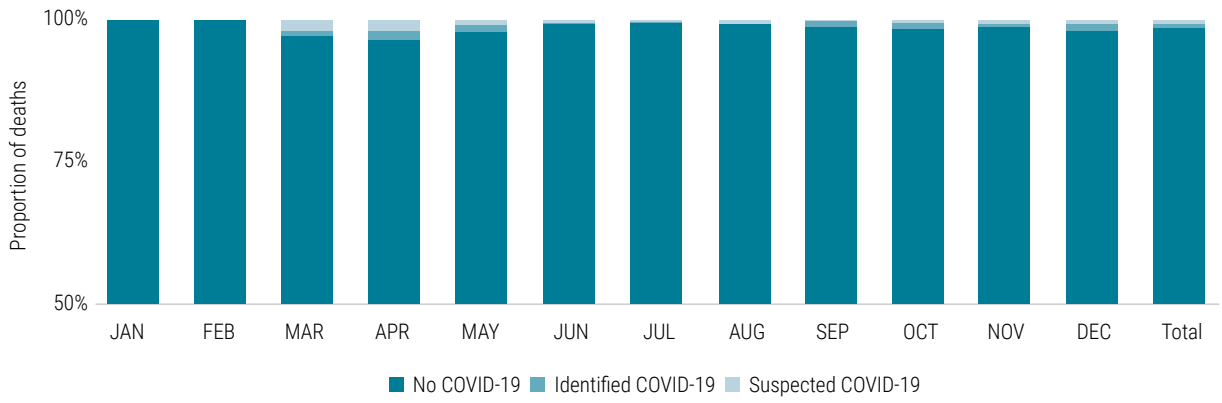
Hypertensive diseases

According to the analysis of the INE death statistics by cause of death, and considering the peaks of excess mortality from all causes according to the MoMo System, there was an average increase in the mortality rate of 0.76 (SD: 0.89) deaths per 100,000 inhabitants due to diseases of the circulatory system, mainly due to hypertensive diseases (1.92; SD: 0.18), and increasing especially in March (+0.75; SD: 0.17) and April (+1.01; SD: 0.07) in 2020 compared to the period 2015-2019. At the in-hospital level, in 2020 and 2021 there was an increase in the number of discharges due to exitus in people with hypertensive disease with respect to the 2015-2019 period, with an increase in the rate of discharges due to exitus also being recorded from the 2015-2019 period (8.0% of admissions) to 2020 (10.2% of admissions) and 2021 (9.9% of admissions). Of all diagnoses, hypertensive disease presented the highest excess of discharges due to exitus, following COVID-19 and pneumonia.

According to the Advisory Committee of this study, the increase in the number of discharges due to exitus in people with hypertensive disease in 2020 and 2021 could be biased. They consider hypertensive disease

a cardiovascular risk factor, an adjuvant to developing severe COVID-19, or an adjuvant to dying from COVID-19, and not a basic cause of death. After including additional causes of death into the analysis of the INE death statistics by cause of death, of those who died from hypertensive diseases in 2020, 1.4% had identified or suspected COVID-19. In March 2020, 2.6% of those who died from hypertensive diseases also had identified or suspected COVID-19, rising to 3.4% in April (»»» Figure 53).

»»» Figure 53. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to hypertensive disease in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

In addition, people who died from hypertensive disease in 2020 had other hypertensive and heart diseases, and heart failure, among others, as additional causes of death (»»» Table 6).

»»» Table 6. Distribution of causes of death additional to hypertensive disease in 2020

Additional causes of death	Proportion
Hypertensive diseases	83.2%
Other heart diseases	50.7%
Heart failure	41.2%
Hypertensive diseases	20.2%
Other heart diseases	16.1%
Respiratory failure	15.3%
Diseases of the kidney and ureter	12.9%
Organic, senile, and presenile mental disorders	11.1%
Diabetes Mellitus	11.0%
Senility	7.6%

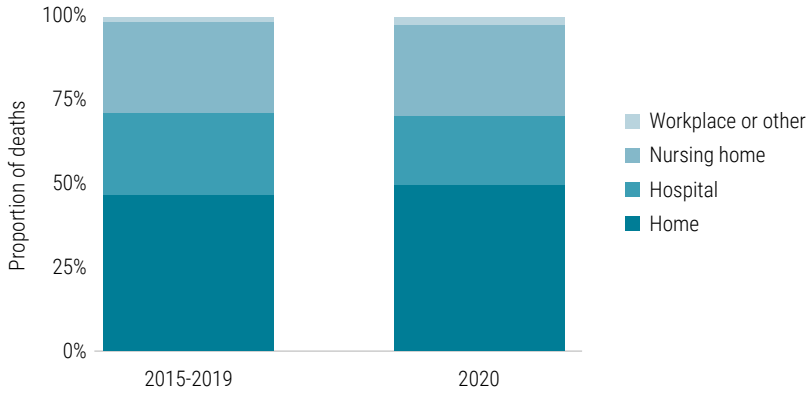
Source: Developed by the authors based on data from the INE death statistics[18].

In 2020, patients who died from hypertensive disease did so at home (50.1%), followed by the nursing home (27.2%), and the hospital (20.5%). In contrast, during 2015-2019 more people died in the hospital (24.3%) and fewer at home (47.0%) (»»» Figure 54). Furthermore, from March 2020 onwards, there was a notable increase in the proportion of hypertensive disease deaths occurring at home (48.0% in April) and in nursing homes (reaching a maximum of 35.2% in April), and a notable reduction in the proportion of deaths in the hospital

INDEX

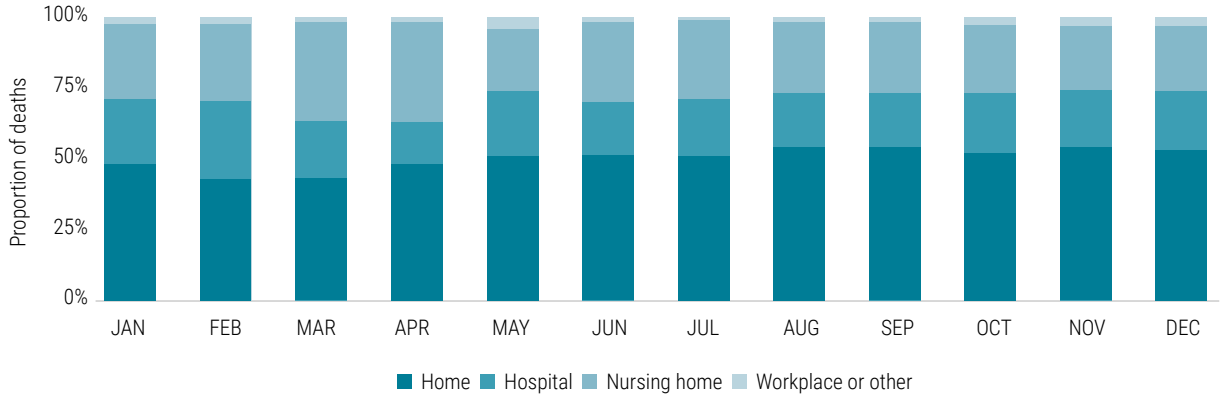
(reaching a minimum of 14.6% in April) (»»» Figure 55). In April 2020, of all hypertensive disease deaths, 7.8% of those occurring in hospital, 7.4% of those occurring in the workplace or other setting, 5.0% of those occurring in nursing homes, and 0.7% of those occurring at home also had identified or suspected COVID-19 (»»» Figure 56).

»»» Figure 54. Distribution of deaths from hypertensive disease by place of death in 2015-2019 and in 2020



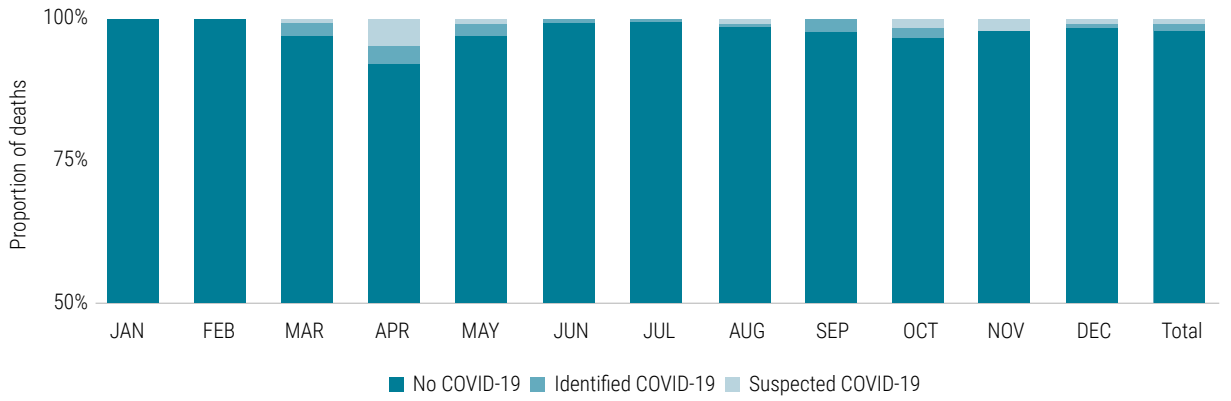
Source: Prepared by the authors based on data from the INE death statistics[18].

»»» Figure 55. Distribution of deaths from hypertensive disease by place of death in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

»»» **Figure 56. Distribution of identified COVID-19, suspected COVID-19, and non-COVID-19 as causes of death in addition to hypertensive disease in the hospital in 2020, by month**



Source: Developed by the authors based on data from the INE death statistics[18].

In addition, the Advisory Committee pointed out the possible impact of a change in therapeutic adherence on mortality in people with hypertensive disease. In this regard, decreases of up to 11% in the dispensing of drugs for hypertensive disease were detected in 2020 compared to the previous year.

Pulmonary vascular diseases

Pulmonary vascular diseases analyzed in the RAE-CMBD are equivalent to codes I26-I28 of the ICD-10 detailed list, included in code 058 "Other heart diseases" of the INE reduced list, which in turn includes additional causes of death. Therefore, the analysis of the INE death statistics according to cause of death would not be representative of deaths due to pulmonary vascular diseases.

At the in-hospital level, in 2020 and 2021, there was an increase in the number of discharges due to exitus in people with circulatory system diseases with respect to the 2015-2019 period. The rate of discharges due to exitus also increased from the 2015-2019 period (6.4% of admissions) to 2020 (6.9% of admissions) and decreased in 2021 (6.4% of admissions). According to the Advisory Committee of this study, the slight reduction in the rate of discharges due to exitus in 2021 compared to the 2015-2019 period (-0.8%) could reflect the introduction of prophylaxis upon discovery that COVID-19 was a risk factor for thromboembolism. Therefore, the variation in discharges due to exitus in people with circulatory system diseases should be considered in relation to severe COVID-19.

Heart failure

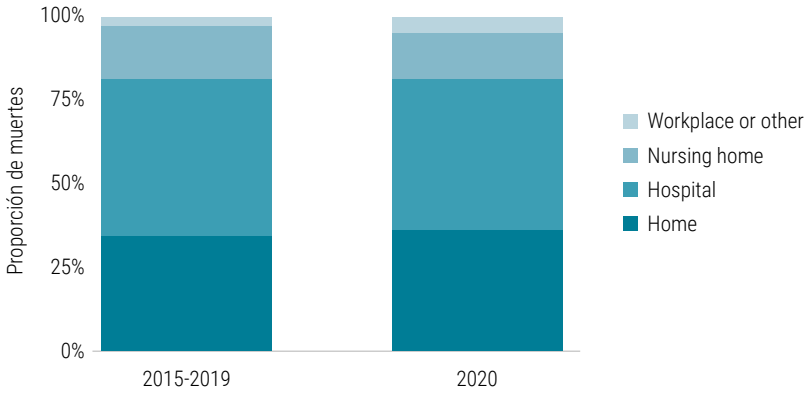
According to the analysis of the INE death statistics according to cause of death, the greatest variation in the rate of deaths per 100,000 inhabitants due to heart failure was recorded in March 2020, with an excess of 0.55 deaths per 100,000 inhabitants. Following hypertensive disease, heart failure contributed the most to excess mortality in the circulatory system. In contrast, at the in-hospital level, 2020 and 2021 presented a large reduction in the number of discharges due to exitus compared to the 2015-2019 period. In parallel, an increase in the rate of discharges due to exitus from the 2015-2019 period (10.6% of admissions) to 2020 (11.7% of admissions) and 2021 (11.0% of admissions) was recorded.

According to the Advisory Committee of this study, the reduction observed in 2020 in the number of discharges due to exitus in people with heart failure could indicate that these patients died in the out-of-hos-

INDEX

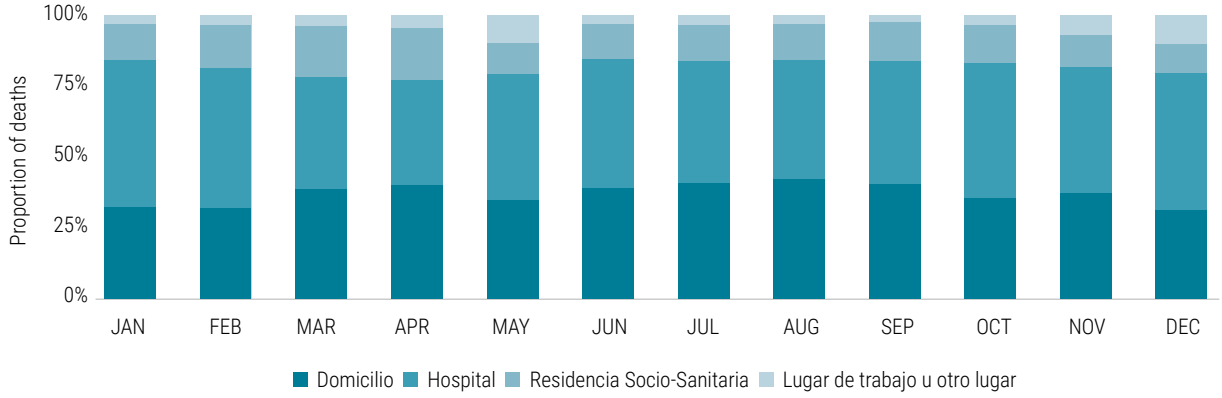
pital setting (e.g., at home). On the other hand, the increase in the rate of discharges due to exitus could reflect that only the most seriously ill patients were admitted. Following the analysis of excess mortality according to place of death, the majority of patients dying of heart failure in 2020 did so in hospital (45.0%), although in a lower proportion than in the 2015-2019 period (46.9%). In contrast, the proportion of patients who died at home in 2020 (36.6%) was higher than in the 2015-2019 period (34.7%) (»»» Figure 57). In April 2020, the majority of patients who died of heart failure did so at home (40.0%), and 36.9% in hospital (»»» Figure 58).

»»» Figure 57. Distribution of deaths due to heart failure according to place of death in 2015-2019 and in 2020



Source: Developed by the authors based on data from the INE death statistics[18].

»»» Figure 58. Distribution of deaths due to heart failure by place of death in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

In addition, the Advisory Committee noted the possible impact of a change in therapeutic adherence on mortality in people with heart failure. In this regard, a reduction of at least 30% was observed in the dispensing of the following heart failure drugs (»»» Table 7):

»»» Table 7. Year-on-year percentage change in the number of people on medication according to pharmacological subgroup for heart failure in 2020 and 2021 compared to 2019

Pharmacological subgroup for heart failure	2020 vs. 2019	2021 vs. 2019
R03C - Adrenergics for systemic use (antiasthmatics)	-53.1%	7.5%
R03D - Other for airway obstruction, systemic use	-32.2%	-5.9%
S01A - Anti-infectives (ophthalmic)	-31.0%	4.0%

Source: Developed by the authors based on data from the Primary Care Clinical Database (BDCAP) on the dispensing of medicines in community pharmacies[39]. **Note:** Only those drugs whose pharmaceutical dispensing in 2020 was reduced by at least 30% compared to 2019 are shown. The full analysis can be found in »»» Annex 4

Other diseases of the circulatory system

Other diseases of the circulatory system analyzed in the RAE-CMBD are included in codes I71-I99 of the ICD-10 detailed list, which is equivalent to code 061 "other diseases of the blood vessels" of the INE reduced list, which in turn includes additional causes of death. Therefore, the analysis of death statistics according to cause of death of the INE would not be representative of death due to other diseases of the circulatory system.

At the in-hospital level, in 2020 and 2021 there was a reduction in the number of discharges due to exitus in people with other diseases of the circulatory system with respect to the 2015-2019 period. However, an increase in the rate of discharges due to exitus from the 2015-2019 period (4.5% of admissions) to 2020 (4.9% of admissions) and a reduction in 2021 (4.4% of admissions) was recorded. According to the Advisory Committee of this study, as was the case with heart failure, the reduction observed in 2020 in the number of discharges due to exitus for other diseases of the circulatory system could reflect that these patients died in the out-of-hospital setting (e.g., at home). On the other hand, the increase in the rate of discharges due to exitus could reflect the that only the most severe patients were admitted.

Atherosclerosis

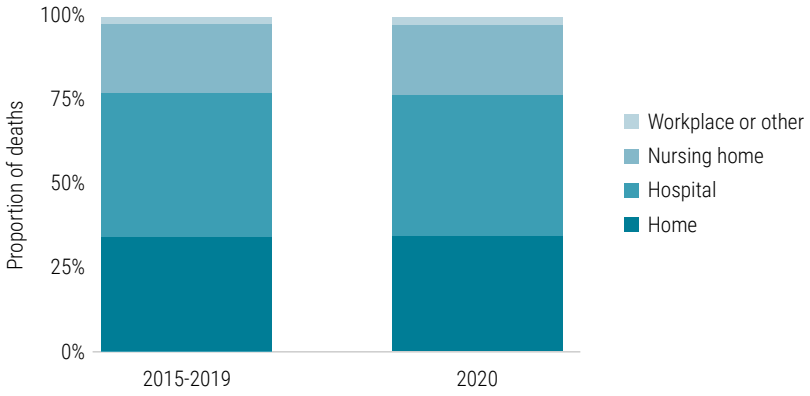
According to the analysis of the INE death statistics by cause of death, the greatest variation in the rate of deaths per 100,000 inhabitants due to atherosclerosis[y] was recorded in November 2020, with 0.07 deaths per 100,000 inhabitants less than in 2015-2019. Moreover, at the in-hospital level, in 2020 and 2021 there was a reduction in the number of discharges due to exitus compared to the 2015-2019 period. However, an increase in the rate of discharges due to exitus from the 2015-2019 period (4.8% of admissions) to 2020 (5.1% of admissions) and 2021 (5.2% of admissions) was recorded.

According to the Advisory Committee of this study, as was the case with heart failure, the reduction observed in 2020 in the number of discharges due to exitus in people with atherosclerosis could reflect that these patients died in the out-of-hospital setting (e.g., at home). On the other hand, the increase in the rate of discharges due to exitus could reflect that only the most severe patients were admitted. Following the analysis of excess mortality according to place of death, in 2020 most patients who died of atherosclerosis did so in hospital (42.0%), although in a lower proportion than in the period 2015-2019 (43.0%). In contrast, the proportion of patients dying at home or in nursing homes in 2020 (34.9% and 20.9%, respectively) was higher than in the 2015-2019 period (34.5% and 20.6%, respectively) (»»» Figure 59). The lowest proportion

y In no case can atherosclerosis be a cause of death, but rather as a risk factor.

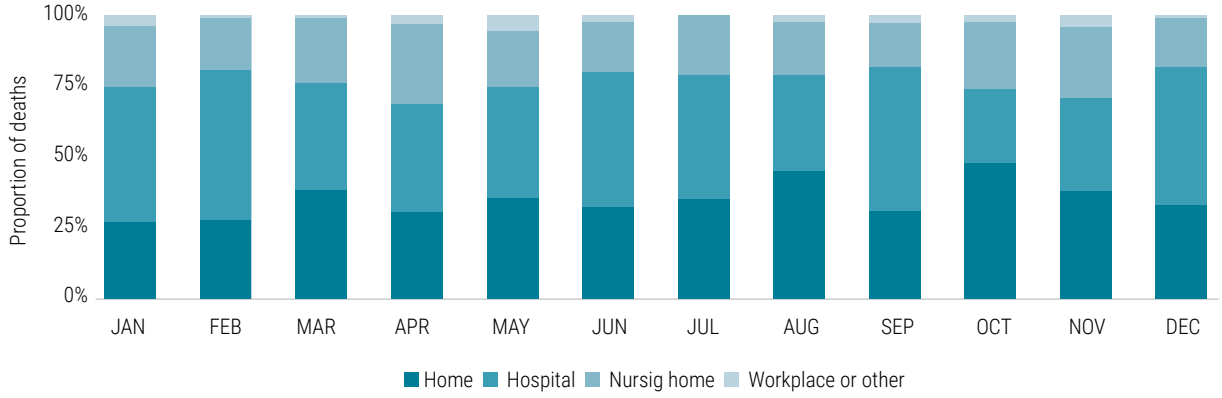
of in-hospital deaths due to atherosclerosis was in October 2020 (26.6%), where most patients dying from atherosclerosis did so at home (47.9%) (»»» Figure 60).

»»» Figure 59. Distribution of deaths due to atherosclerosis by place of death in 2015-2019 and in 2020



Source: Developed by the authors based on data from the INE death statistics[18].

»»» Figure 60. Distribution of deaths due to atherosclerosis by place of death in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18].

In addition, the Advisory Committee pointed out the possible impact of a change in therapeutic adherence on mortality in people with atherosclerosis. In this regard, a decrease of up to 5% in the dispensing of drugs for atherosclerosis was detected in 2020 compared to the previous year.

Other ischemic heart diseases

"Other ischemic heart diseases" analyzed in the RAE-CMBD is equivalent to code 056 "Other ischemic heart diseases" of the INE short list, which includes angina pectoris. Since the in-hospital mortality results for "angina pectoris" are slightly different from those for "other ischemic heart diseases", the analysis of the INE death statistics according to cause of death would not be representative of death from "other ischemic heart diseases" according to the RAE-CMBD.

At the in-hospital level, in 2020 and 2021 there was a reduction in the number of discharges due to exitus in people with "other ischemic heart diseases" compared to the 2015-2019 period, with an increase in the rate

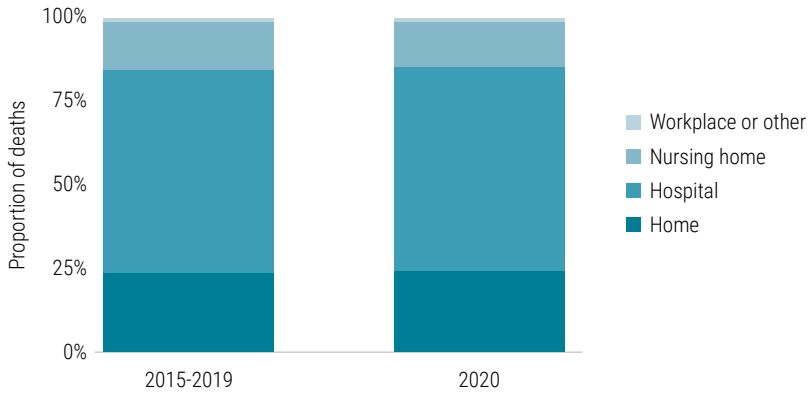
of discharges due to exitus from the 2015-2019 period (1.6% of admissions) to 2020 (1.7% of admissions) and 2021 (1.7% of admissions). According to the Advisory Committee of this study, as was the case with heart failure, the reduction observed in 2020 in the number of discharges due to exitus for "other ischemic heart diseases" could reflect that these patients died in the out-of-hospital setting (e.g., at home). On the other hand, the increase in the rate of discharges due to exitus could reflect that only the most severe patients were admitted.

Cerebrovascular diseases

According to the analysis of the INE death statistics by cause of death, the greatest variation in the rate of deaths per 100,000 inhabitants due to cerebrovascular diseases was recorded in February 2020, with 0.72 deaths per 100,000 inhabitants less with respect to 2015-2019, followed by May and November (-0.53 in both cases). At the in-hospital level, a reduction in the number of discharges due to exitus was observed in 2020 and 2021 with respect to the 2015-2019 period. However, an increase in the rate of discharges due to exitus from the 2015-2019 period (12.9% of admissions) to 2020 (13.4% of admissions) and a reduction in 2021 (12.4% of admissions) was recorded.

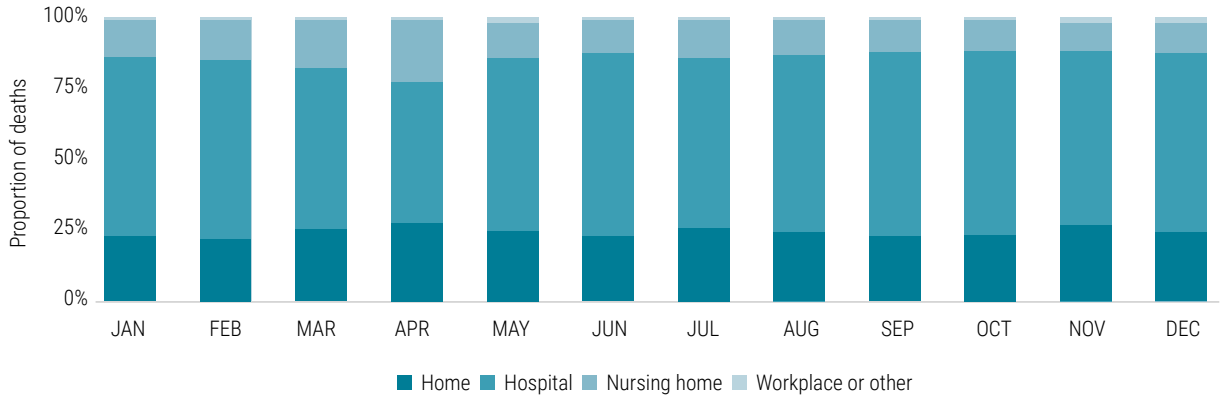
According to the Advisory Committee of this study, as was the case with heart failure, the reduction observed in 2020 in the number of discharges due to exitus for cerebrovascular disease could reflect that these patients died in the out-of-hospital setting (e.g., at home). On the other hand, the increase in the rate of discharges due to exitus could reflect that only the most severe patients were admitted. Following the analysis of excess mortality according to place of death, in 2020 most patients dying from cerebrovascular disease died in hospital (61.2%), although in a lower proportion than in the period 2015-2019 (61.5%). In contrast, the proportion of patients dying at home in 2020 (24.5%) was higher than in the 2015-2019 period (23.6%) (»»» Figure 61). The lowest proportion of in-hospital deaths from cerebrovascular disease was recorded in April 2020 (49.8%), with 27.7% dying at home and 21.6% in nursing homes (»»» Figure 62).

»»» Figure 61. Distribution of deaths due to cerebrovascular diseases according to place of death in 2015-2019 and in 2020



Source: Developed by the authors based on data from the INE death statistics[18].

»»» **Figure 62. Distribution of deaths from cerebrovascular diseases by place of death in 2020, by month**



Source: Developed by the authors based on data from the INE death statistics[18].

According to the Advisory Committee, the steep increase in the proportion of people who died in nursing homes from cerebrovascular disease in April 2020 could be interpreted as these patients enduring longer in nursing homes. In contrast, the less pronounced increase in the proportion of people who died at home may reflect that these patients were delaying hospital visits.

Conduction disorders and cardiac dysrhythmias

Conduction disorders and cardiac dysrhythmias analyzed in the RAE-CMBD are included in codes I71-I99 of the ICD-10 detailed list, which is equivalent to code 061 "Other blood vessel diseases" of the INE reduced list, which in turn includes additional causes of death. Therefore, the analysis of death statistics according to cause of death of the INE would not be representative of death due to other diseases of the circulatory system.

At the in-hospital level, in 2020 and 2021, there was a reduction in the number of discharges due to exitus in people with conduction disorders and dysrhythmias compared to the 2015-2019 period, with a reduction in the rate of discharges due to exitus from the 2015-2019 period (3.0% of admissions) to 2020 (3.0% of admissions) and 2021 (2.9% of admissions). According to the Advisory Committee of this study, the reduction observed in 2020 in the number of discharges for exitus due to conduction disorders and cardiac dysrhythmias could reflect the fact that these patients were dying in the out-of-hospital setting (e.g., at home).

Angina pectoris

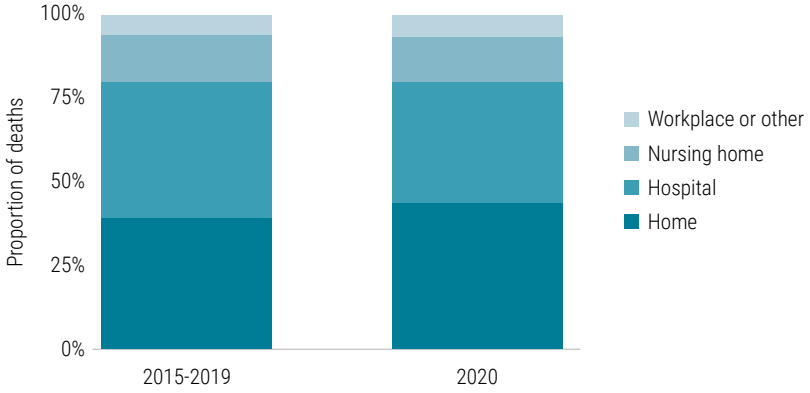
Angina pectoris, analyzed in the RAE-CMBD, is equivalent to code 056 "Other ischemic heart diseases" of the INE short list, which in turn includes "Other ischemic heart diseases". Since the in-hospital mortality results for "Other ischemic heart diseases" are slightly different from those for angina pectoris, the analysis of the INE death statistics would not be representative of death from "Other ischemic heart diseases" according to the RAE-CMBD.

At the in-hospital level, in 2020 and 2021 there was a reduction in the number of discharges due to exitus in people with angina pectoris with respect to the 2015-2019 period, with a reduction in the rate of discharges due to exitus from the 2015-2019 period (2.5% of admissions) to 2020 (2.1% of admissions) and 2021 (2.2% of admissions). According to the Advisory Committee of this study, as was the case for conduction

INDEX

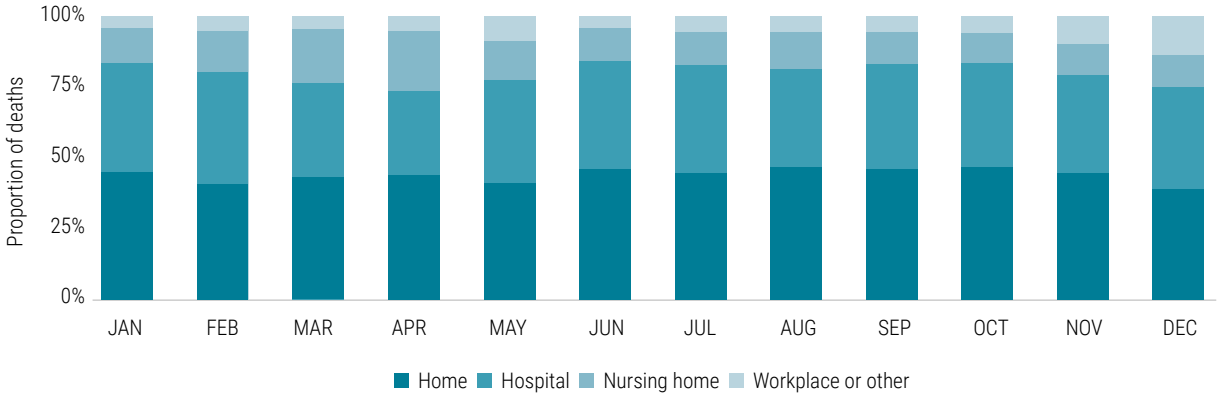
disorders and cardiac dysrhythmias, the reduction observed in 2020 in the number of discharges for exitus due to angina pectoris could reflect that these patients were dying in the out-of-hospital setting (e.g., at home). This same observation was also made for other ischemic heart diseases, so we analyzed excess mortality by place of death for other ischemic heart diseases and angina pectoris together. This analysis observed that in 2020 most patients dying from these diseases died at home (43.9%) in a higher proportion than in the period 2015-2019 (39.3%). In contrast, the proportion of patients dying in hospital in 2020 (36.1%) was lower than in the period 2015-2019 (40.6%) (»»» Figure 63). The lowest proportion of in-hospital deaths from these diseases was recorded in April 2020 (29.7%), with 44.1% dying at home and 21.1% in nursing homes (»»» Figure 64).

»»» Figure 63. Distribution of deaths from other ischemic heart diseases by place of death in 2015-2019 and in 2020



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** This graph shows the proportion of deaths by place of death of people with other ischemic heart diseases according to code 056 of the INE reduced list, which includes both angina pectoris and other ischemic heart diseases.

»»» Figure 64. Distribution of deaths from other ischemic heart diseases by place of death in 2020, by month



Source: Developed by the authors based on data from the INE death statistics[18]. **Note:** This graph shows the proportion of deaths by place of death of people with other ischemic heart diseases according to code 056 of the INE reduced list, which includes both angina pectoris and other ischemic heart diseases.

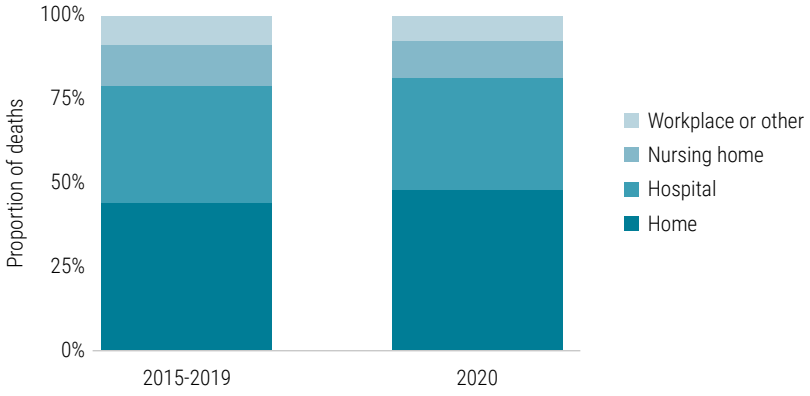
INDEX

Acute myocardial infarction

According to the analysis of the INE death statistics according to cause of death, the greatest variation in the rate of deaths per 100,000 inhabitants due to acute myocardial infarction was recorded in January 2020, with a 0.60 deaths per 100,000 inhabitants less than in 2015-2019. At the in-hospital level, a reduction in the number of discharges due to exitus was observed in 2020 and 2021 with respect to the 2015-2019 period, further recording a reduction in the rate of discharges due to exitus from the 2015-2019 period (6.6% of admissions) to 2020 (6.5% of admissions) and to 2021 (6.2% of admissions).

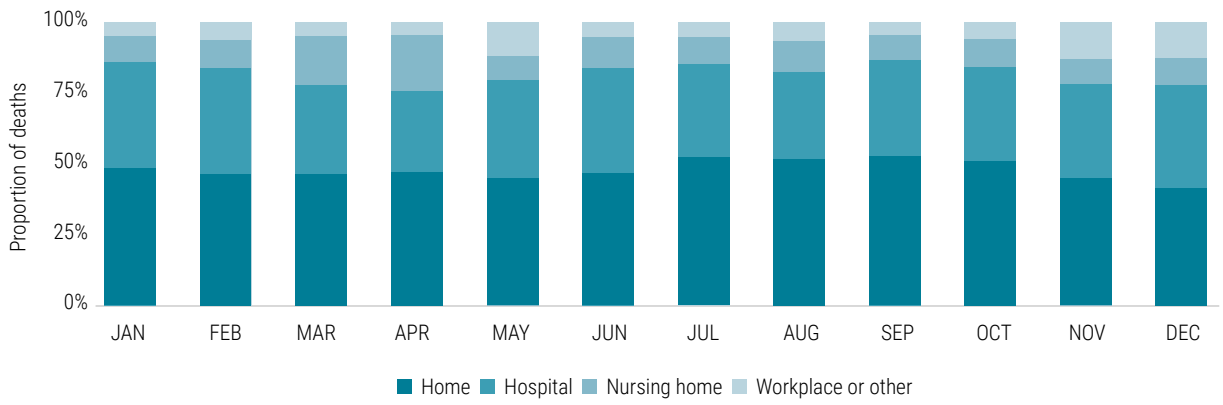
According to the Advisory Committee of this study, as was the case with cardiac conduction disorders and dysrhythmias, and angina pectoris, the reduction observed in 2020 in the number and rate of discharges due to exitus in people with acute myocardial infarction could reflect that these patients died in the out-of-hospital setting (e.g., at home). Following the analysis of excess mortality according to place of death, in 2020 most patients dying from acute myocardial infarction died at home (47.6%), although in a lower proportion than in the period 2015-2019 (43.7%). In contrast, the proportion of patients who died in hospital in 2020 (33.9%) was lower than in the 2015-2019 period (35.6%) (»»» Figure 65). The lowest proportion of in-hospital deaths due to acute myocardial infarction was recorded in April 2020 (28.7%), with 47.0% dying at home and 19.6% in nursing homes (»»» Figure 66).

»»» Figure 65. Distribution of deaths due to acute myocardial infarction according to place of death in 2015-2019 and in 2020



Source: Developed by the authors based on data from the INE death statistics[18].

»»» **Figure 66. Distribution of deaths due to acute myocardial infarction according to place of death in 2020, by month**



Source: Developed by the authors based on data from the INE death statistics[18].

The peak of excess mortality due to **HYPERTENSIVE DISEASE** recorded in March 2020 matched an excess in the number and rate of discharges due to exitus in people with hypertensive disease. Given that hypertensive disease is not a basic cause of death, other cardiovascular diseases or COVID-19 may have been responsible.

The peak of excess mortality due to **HEART FAILURE** recorded in March 2020 matched the reduction in the number of hospital discharges due to exitus and an increase in mortality rates, so it could be indicative that only the most severe patients were admitted due to generalized hospital saturation.

In addition, a reduction in the proportion of in-hospital deaths due to heart failure occurred in parallel to a significant increase in out-of-hospital mortality, especially in nursing homes and at home, possibly associated with patients being afraid to go to the hospital. In addition, the patients who died in nursing homes were older and had comorbidities, which, among other factors, determined access to the hospital, at a time of peak ICU occupancy, when the proportion of admissions of non-COVID-19 patients also decreased notably.

This same observation also applies to discharges due to exitus in people with **CEREBROVASCULAR DISEASES, ANGINA PECTORIS and ACUTE MYOCARDIAL INFARCTION**.

05 [DISCUSSION AND CONCLUSIONS]

This report describes changes regarding in-hospital and out-of-hospital mortality during the COVID-19 pandemic in Spain compared to the 2015-2019 period, prior to the pandemic. In 2020, all-cause mortality increased by 17.34% compared to the 2015-2019 period, in line with other studies[21,45,46]. Since the onset of the pandemic, there was an excess mortality whose peak was estimated at 79.74% in April 2020, mainly attributable to the increase in COVID-19 mortality. Focusing on non-COVID-19 diseases, in-hospital and out-of-hospital mortality records reflect differences between causes. The mortality rate was either too high or too low during the COVID-19 pandemic compared to a pre-pandemic period. Thus, **the variation in mortality must be interpreted both individually for each cause and as a whole, within the health, political, and social context**.

Following the results of this study, common patterns underlying several causes of mortality have been identified that allow us to hypothesize about a possible link between healthcare system overload and mortality from non-COVID-19 causes of death. An example of this is the observation of a lower number of hospital deaths in parallel to a higher hospital mortality rate during the pandemic with respect to the pre-pandemic period, possibly due to more severe patients being admitted at certain points, potentially generating even more pressure on the healthcare system. This pattern was observed in patients with pneumonia, COPD and bronchiectasis, and bronchitis and bronchiolitis in the year 2021, as well as in patients with heart failure in the years 2020 and 2021. In line with this pattern, a study observed that, along with the decrease in hospitalizations for non-COVID-19 diseases during the first wave of the pandemic in a hospital in Seville, older, more severe patients were admitted through the emergency department with longer hospital stays. In these patients, as identified in the present study, there was an increase in the hospital mortality rate due to heart failure and cerebrovascular disease, among others[2].

Another pattern that was common to several cases, indicating a possible link between the health system overload and mortality due to non-COVID-19 causes of death, was that in 2020 (compared to the period 2015-2019) while the proportion of deaths occurring in the hospital setting decreased, out-of-hospital deaths increased (at home and/or nursing homes). This change in the proportion of deaths according to place of death was also observed throughout 2020, especially in the first overall excess mortality peak, matching the peak of maximum ICU occupancy, where the proportion of non-COVID-19 patients admitted was markedly reduced. This pattern was clearly observed in this study in patients with chronic lower tract diseases, in some malignant neoplasms such as those of the trachea, bronchi, and lung (who died more at home) and in most diseases of the circulatory system such as heart failure, cerebrovascular disease, angina pectoris, and acute myocardial infarction, among others. However, the design of this study may not establish a causal relationship between hospital saturation and mortality due to non-COVID-19 causes of death. Furthermore, it is likely that the people who died in nursing homes were elderly and frail, limiting their access to hospital admission, since age was one of the ICU access factors, among others. In addition, death at home could be indicative of a delay in medical care, due to factors such as fear of going to a health center or overload of the healthcare system. A nationwide study highlighted this by noting that, during the first

INDEX

wave of the pandemic, the number of out-of-hospital resuscitations dropped significantly compared to the same period in 2017 and 2018, which consequently reduced the survival of these patients[8].

Unlike most of the studies published in scientific literature, which studied the direct impact of the COVID-19 pandemic on total mortality, the present study describes both the direct and indirect impact of the pandemic on mortality from causes not coded as COVID-19. In addition, most of the studies that analyzed non-COVID-19 causes of death focused on a region of Spain[9,10,12–16,24,47–52], the in-hospital setting[2,8,10–13,16,47,48], or a specific population[8–16,24,47–53], while a minority focused on the out-of-hospital setting[8,10]. Moreover, many of these studies analyzed mortality during the COVID-19 pandemic over a short period of time (i.e., not covering the entire 2020s from the onset of the pandemic)[8–14,24,47,48,52] and compared it to an immediately preceding pre-pandemic period[12–14,48,49], introducing a seasonality and temporality bias.

Therefore, the present study shows **strengths** with respect to the published literature as it analyzes the direct and indirect impact of the COVID-19 pandemic at a national level, both in-hospital (by services) and out-of-hospital (by place of death), on multiple causes of mortality. In addition, it compares annual and monthly mortality during the COVID-19 pandemic, with respect to the corresponding time in the previous 5 years (2015-2019), reducing temporality and seasonality bias. Another strength of this study lies in the support of an Advisory Committee, composed of healthcare professionals linked to different hospital services involved in healthcare during the COVID-19 pandemic in Spain, who discussed and interpreted the data analyzed based on their experience and expertise. For example, the Advisory Committee helped identify COVID-19 as a basic cause of death, miscoded as a non-COVID-19 cause, reflecting the direct impact of the COVID-19 pandemic on mortality. Similarly, they identified non-COVID-19 causes of mortality associated with the development of severe COVID-19 (e.g., pulmonary vascular diseases or hypertension) that could reflect COVID-19 deaths. Likewise, in chronically frail patients, COVID-19 may have precipitated death without being the primary cause of death. In addition, in the case of mortality due to neoplasms, the Advisory Committee noted that the decline in mortality during the COVID-19 pandemic compared to previous years could be due to underdiagnosis and its subsequent impact on mortality. Finally, to facilitate interpretation of the results, these were contextualized by an analysis of possible determining factors such as pharmacological adherence in non-COVID-19 diseases or ICU occupancy throughout the pandemic.

This study has some **limitations** to consider in the interpretation of the results. First, a different composition of the Advisory Committee could have resulted in the analysis of other relevant diseases and/or a different interpretation of the data. Second, the method of analysis used does not allow data comparison between geographical areas with different seasonality[4,7]. However, if we compare the excess all-cause mortality in 2020 obtained using this methodology with another methodology based on the estimation of expected mortality from the historically observed mortality series and considering temporal and seasonal trends, the excess mortality is similar[4]. Furthermore, according to the study's Advisory Committee, disease coding (main diagnosis and cause of death) could be biased as, for example, comorbidities such as hypertension or atherosclerosis were detected as the main cause of death, or diseases such as influenza were reported at a time when the circulation of this virus was very low. Moreover, it should be borne in mind that the diagnostic capacity of COVID-19 in the first months of the pandemic was very limited[6]. Moreover, some diagnoses identified by the Advisory Committee in the analysis of in-hospital mortality were not equivalent to diseases in the reduced ICD-10 list and therefore could not be analyzed in more detail.

INDEX

The volume and complexity of the data analyzed, the limitations described above, and the multifactorial nature of the impact of the COVID-19 pandemic on mortality preclude establishing a cause-effect relationship. Likewise, the data analyzed do not allow us to confirm the exploratory objective of the possible impact of healthcare system overload on mortality due to non-COVID-19 causes of death. Nevertheless, together with the experience and knowledge provided by the Advisory Committee, this study provides a basis from which to continue the study of the indirect impact of the COVID-19 pandemic. We recommend that a long-term analysis be included in future studies of the impact of the COVID-19 pandemic on mortality, taking into account interregional variations and including patient characteristics such as age and severity level.

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INDEX

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INDEX

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INDEX

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EXCESS MORTALITY DURING THE COVID-19 PANDEMIC IN SPAIN BY NON-COVID-19 CAUSES OF DEATH

[ANNEX 1]

BREAKDOWN OF CAUSES OF DEATH: REDUCED LIST OF THE INTERNATIONAL CLASSIFICATION OF DISEASES (ICD-10)

001-102 I-XXII. All causes

001-008 I. Infectious and Parasitic Diseases

00A COVID-19 identified virus
00B COVID-19 unidentified virus (suspected)
001 Intestinal infectious diseases
002 Tuberculosis and its late effects
003 Meningococcal disease
004 Septicemia
005 Viral hepatitis
006 AIDS
007 HIV+ (carrier, laboratory evidence of HIV,...)
008 Rest of infectious and parasitic diseases, and their late effects

009-041 II. Tumors

009 Malignant tumor of the lip, oral cavity, and pharynx
010 Malignant tumor of the esophagus
011 Malignant tumor of the stomach
012 Malignant colon tumor
013 Malignant tumor of the rectum, rectosigmoid portion, and anus
014 Malignant tumor of the liver and intrahepatic biliary tract
015 Malignant tumor of the pancreas
016 Other malignant digestive tumors
017 Malignant tumor of the larynx
018 Malignant tumor of the trachea, bronchi, and lung
019 Other respiratory and intrathoracic malignant tumors
020 Malignant tumors of bone and articular cartilage
021 Malignant melanoma of the skin
022 Other malignant tumors of skin and soft tissues
023 Malignant breast tumor
024 Malignant tumor of the uterine cervix
025 Malignant tumor of other parts of the uterus
026 Malignant tumor of the ovary
027 Malignant tumors of other female genitalia
028 Malignant prostate tumor
029 Malignant tumors of other male genital organs
030 Malignant tumor of the kidney, except renal pelvis
031 Malignant bladder tumor
032 Other malignant tumors of the urinary tract
033 Malignant tumor of the brain
034 Other neurological and endocrine malignancies
035 Malignant tumor of ill-defined sites, secondary and unspecified sites
036 Malignant tumors of lymphatic tissue, hematopoietic organs and related tissues, except leukemia
037 Leukemia
038 Tumors in situ
039 Benign tumors
040 Myelodysplastic syndrome
041 Other tumors of uncertain or unknown behavior

042-043 III. Diseases of the blood and hematopoietic organs, and certain disorders affecting the mechanism of immunity

042 Diseases of the blood and hematopoietic organs
043 Certain disorders affecting the mechanism of immunity

INDEX

044-045 IV. Endocrine, Nutritional, and Metabolic Diseases

044 Diabetes mellitus
045 Other endocrine, nutritional, and metabolic diseases

046-049 V. Mental and behavioral disorders

046 Organic mental disorders, senile and presenile
047 Mental disorders due to the use of alcohol
048 Mental disorders due to drug use (drug dependence, drug addiction)
049 Other mental and behavioral disorderss

050-052 VI-VIII. Organic mental disorders, senile and presenile

047 Mental disorders due to the use of alcohol
048 Mental disorders due to drug use (drug dependence, drug addiction)
049 Other mental and behavioral disorders
050 Meningitis (otras en 003)
051 Enfermedad de Alzheimer
052 Otras enfermedades del sistema nervioso y de los órganos de los sentidos

053-061 IX. Diseases of the circulatory system

053 Chronic rheumatic heart diseases
054 Hypertensive diseases
055 Acute myocardial infarction
056 Other ischemic heart diseases
057 Heart failure
058 Other heart diseases
059 Cerebrovascular diseases
060 Atherosclerosis
061 Other blood vessel diseases

062-067 X. Diseases of the respiratory system

062 Influenza (flu) (includes influenza due to identified pandemic or zoonotic influenza viruses)
063 Pneumonia
064 Chronic diseases of the lower respiratory tract (except asthma)
065 Asthma
066 Respiratory failure
067 Other diseases of the respiratory system

068-072 XI. Digestive system diseases

068 Ulcer of stomach, duodenum, and jejunum
069 Enteritis and non-infectious colitis
070 Intestinal vascular disease
071 Cirrhosis and other chronic liver diseases
072 Other diseases of the digestive system

073 XII. Diseases of the skin and subcutaneous tissue

074-076 XIII. Diseases of the musculoskeletal system and connective tissue

074 Rheumatoid arthritis and osteoarthrosis
075 Osteoporosis and pathological fractures
076 Other musculoskeletal system and connective tissue diseases

077-080 XIV. Diseases of the genitourinary system

077 Diseases of the kidney and ureter
078 Diseases of the male genital organs
079 Diseases of female genital organs and breast disorders
080 Other diseases of the genitourinary system

081 XV. Pregnancy, childbirth, and puerperium

082 XVI. Conditions originating in the perinatal period

083-085 XVII. Congenital malformations, deformities, and chromosomal anomalies

083 Congenital malformations of the nervous system
084 Congenital malformations of the circulatory system
085 Other congenital malformations, deformities, and chromosomal anomalies

INDEX

086-089 XVIII. Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified

086 Cardiac arrest, unassisted death, and other unknown cause of death
087 Senility
088 Sudden infant death
089 Other symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified

090-102 XX. Causas externas de mortalidad

090 Traffic accidents
091 Other transportation accidents
092 Accidental falls
093 Accidental drowning, submersion, and suffocation
094 Fire, smoke, and hot substance accidents
095 Accidental poisoning by psychotropic drugs and drugs of abuse
096 Other accidental poisonings
097 Other accidents
098 Suicide and self-inflicted injuries
099 Assaults (Homicide)
100 Events of undetermined intent
101 Complications of medical and surgical care
102 Other external causes and their late effects

[ANNEX 2]

BREAKDOWN OF MAIN DIAGNOSES: REDUCED LIST FOR THE TABULATION OF HOSPITAL MORBIDITY (ISHMT) ACCORDING TO ICD-10

0100 Certain infectious and parasitic diseases

0101 Intestinal infectious diseases except diarrhea
0102 Intestinal infections, ill-defined
0103 Tuberculosis
0104 Septicemia
0105 Human immunodeficiency virus infection
0106 Other infectious and parasitic diseases

0200 Neoplasms

0201 Malignant tumors of the colon, rectum, and anus
0202 Malignant neoplasms of the trachea, bronchi, and lung
0203 Melanoma and other malignant skin tumors
0204 Malignant breast tumor
0205 Malignant tumor of the uterus
0206 Malignant ovarian neoplasm
0207 Malignant prostate neoplasia
0208 Malignant neoplasm of the bladder
0209 Other malignant tumors
0210 Tumors [Neoplasms] in situ
0211 Benign tumor of the colon, rectum, anal canal, and anus
0212 Uterine leiomyoma
0213 Other benign tumors and tumors of uncertain or unknown behavior

0300 Diseases of the blood and hematopoietic organs, and certain disorders affecting the immune system

0301 Anemias
0302 Other diseases of the blood and hematopoietic organs, and certain disorders affecting the mechanism of immunity

0400 Endocrine, nutritional, and metabolic diseases

0401 Diabetes mellitus
0402 Other endocrine, nutritional, and metabolic diseases

0500 Mental disorders

0501 Dementia
0502 Mental and behavioral disorders due to alcohol use
0503 Mental and behavioral disorders due to the use of other psychoactive substances
0504 Schizophrenia, schizotypal, and delusional disorders
0505 Mood disorders [affective].
0506 Other mental and behavioral disorders

0600 Inflammatory diseases of the nervous system

0601 Alzheimer's disease
0602 Multiple sclerosis
0603 Epilepsy
0604 Transient cerebral ischemia
0605 Other inflammatory diseases of the nervous system

0700 Diseases of the eye and its appendages

0701 Cataract
0702 Other diseases of the eye and its appendages

0800 Diseases of the ear and mastoid process

0800 Diseases of the ear and the mastoid process

INDEX

0900 Diseases of the circulatory system

0901 Hypertensive disease
0902 Angina pectoris
0903 Acute myocardial infarction
0904 Other ischemic heart diseases
0905 Diseases of the pulmonary circulation
0906 Cardiac conduction disorders and Dysrhythmias
0907 Heart failure
0908 Cerebrovascular diseases
0909 Atherosclerosis
0910 Varicose veins of the lower extremities
0911 Other diseases of the circulatory system

1000 Diseases of the respiratory system

1001 Acute upper respiratory tract infections and influenza
1002 Pneumonia
1003 Bronchitis and acute bronchiolitis
1004 Chronic tonsil and adenoid disease
1005 Other diseases of the upper respiratory tract
1006 Chronic obstructive pulmonary disease and bronchiectasis
1007 Asma
1008 Other diseases of the respiratory system

1100 Diseases of the digestive system

1101101 Disorders of the teeth and supporting structures
1102 Other diseases of the oral cavity, salivary, and maxillary glands
1103 Diseases of the esophagus
1104 Peptic ulcer
1105 Dyspepsia, and other stomach and duodenal diseases
1106 Apendicitis
1107 Inguinal hernia
1108 Other abdominal hernia
1109 Crohn's disease and ulcerative colitis
1110 Other non-infectious gastroenteritis and colitis, and those not specified
1111 Intestinal obstruction without mention of hernia
1112 Intestinal diverticula
1113 Diseases of the anus and rectum
1114 Other diseases of the intestine
1115 Alcoholic liver disease
1116 Other liver diseases
1117 Colelithiasis
1118 Other gallbladder and biliary tract diseases
1119 Pancreatic diseases
1120 Other diseases of the digestive tract

1200 Skin and subcutaneous tissue diseases

1201 Infections of the skin and subcutaneous cellular tissue
1202 Dermatitis, eczema, and papulosquamous disorders
1203 Other skin and subcutaneous tissue diseases

1300 Diseases of the musculoskeletal system and connective tissue

1301 Coxarthrosis [osteoarthrosis of the hip]
1302 Gonarthrosis [knee osteoarthritis]
1303 Internal knee disorder
1304 Other arthropathies
1305 Systemic connective tissue disorders
1306 Deforming dorsopathies and spondylopathies
1307 Intervertebral disc disorder
1308 Dorsalgia
1309 Soft tissue disorders
1310 Other musculoskeletal system and connective tissue diseases

1400 Diseases of the genitourinary system

1401 Glomerular and renal tubulo-interstitial diseases
1402 Renal insufficiency
1403 Urinary lithiasis
1404 Other diseases of the urinary system
1405 Prostatic hyperplasia
1406 Other diseases of the male genitalia
1407 Breast disorders
1408 Inflammatory disease of the female pelvic organs
1409 Menstruation disorders, menopause, and other disorders of the female genital system
1410 Other genitourinary system disorders

INDEX

1500 Complications of Pregnancy, childbirth, and puerperium

1501 Legally induced abortion
1502 Another pregnancy with abortive outcome
1503 Complications of pregnancy mainly in the antenatal period
1504 Complications of labor and delivery
1505 Chlidbirth in a totally normal case
1506 Other deliveries
1507 Complications of the postpartum period
1508 Other obstetrical conditions not elsewhere classified

1600 Certain diseases with origin in the perinatal periodl

1601 Disorders related to shortened gestation and low birth weight
1602 Other conditions with origin in the perinatal period

1700 Congenital anomalies

1700 Congenital anomalies

1800 Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified

1801 Sore throat and chest pain
1802 Abdominal pain
1803 Other unspecified unknown causes of morbidity and mortality
1804 Other symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified.

1900-Injuries and poisonings

1901 Intracranial Trauma
1902 Other head injuries
1903 Radius and ulna fracture
1904 Fracture of the femur
1905 Fracture of the leg, including the ankle
1906 Other trauma
1907 Burns
1908 Poisonings by drugs, medicines, and biological substances, and toxic effects of mainly non-medicinal substances with respect to their origin.
1909 Complications of surgical and medical care not elsewhere classified
1910 Late effects of injuries, poisoning, toxic effects, and other external causes
1911 Other effects and unspecified effects of external causes

2100 Factors influencing health status and contact with health care services

2101 Observation and evaluation for suspected illness not found
2102 Contraceptive assistance
2103 Live newborns by type of delivery
2104 Other medical care (including radiotherapy and chemotherapy sessions)
2105 Other factors influencing health status and contact with health services

2201-COVID-19

Not determined

INDEX

[ANNEX 3]

BREAKDOWN OF SERVICE AT HOSPITALIZATION DISCHARGE

Royal Decree 69/2015 Annex II.b Table of Services and Units

ACL Clinical Analysis
ACV Angiology and Vascular Surgery
ADM Admission and clinical documentation
ALG Allergology
ANR Anesthesia and Resuscitation
APA Anatomic Pathology
BCS Blood Bank
BIO Clinical Biochemistry
CAR Cardiology
CCA Cardiac Surgery
CCI Children's Cardiac Surgery
CIR General and Digestive Surgery
CMF Maxillofacial Surgery
CPE Pediatric Surgery
CPL Plastic and Reconstructive Surgery
CTO Thoracic Surgery
DCL Clinical Documentation
DER Dermatology
DIE Dietetics
DIG Digestive
NDT Endocrinology
EST Stomatology
FAC Clinical Pharmacology
FAR Pharmacy
GEN Genetics
GRT Geriatrics
HEL Hematology Laboratory
HEM Clinical Hematology
INF Infectious diseases
INM Immunology
LAB Laboratories
LIT Lithotripsy
MFC Family and Community Medicine
MIC Microbiology and Parasitology
MIN Neonatal Intensive Care Medicine
IPM Pediatric Intensive Care Medicine
MIR Internal Medicine
IVM Intensive Medicine
MUN Nuclear Medicine
MPR Preventive Medicine
NEF Nephrology
NEO Neonatology
NFC Clinical Neurophysiology
NML Pneumology
NRC Neurosurgery
NRL Neurology
OBG Obstetrics & Gynecology
OFT Ophthalmology
ONC Medical Oncology
ONR Radiation Oncology
ENT Otorhinolaryngology
OTR Other
PED Pediatrics
PSQ Psychiatry
RAD Radiology
RAI Interventional Radiology
RDT Radiotherapy
REH Rehabilitation
REU Rheumatology
TRA Traumatology and Orthopedic Surgery
UCE Short Stay Unit
UCP Palliative Care Unit
UCR Coronary Unit
UDO Pain Unit
UHD Hemodialysis Unit
ULE Long Stay Unit
ULM Spinal Cord Injury Unit
URG Emergencies
HRU Human Reproduction Unit
URO Urology
USO Sleep Unit
RTU Extraction and Transplant Units
UTX Detoxification Unit
ZZZ Other/unknown

INDEX

[ANNEX 4]

ANALYSIS OF THERAPEUTIC ADHERENCE

»»» Table 1. Year-on-year percentage change in the number of people on medication by pharmacological subgroup in 2017-2021 for pneumonia, COPD, hypertensive diseases, atherosclerosis, heart failure, and cerebrovascular disease

Pharmacological subgroup	2018 vs. 2017	2019 vs. 2018	2020 vs. 2019	2021 vs. 2020
A05A - BILIARY THERAPY	51%	43%	3%	7%
A05B - HEPATIC THERAPY, LIPOTROPICS	-63%	56%	-9%	35%
A10A - INSULINS AND ANALOGS	51%	47%	2%	1%
A10B - ORAL ANTIDIABETICS, EXCL. INSULINS	48%	49%	2%	5%
B01A - ANTITHROMBOTICS	49%	40%	-2%	5%
C01A - CARDIAC GLYCOSIDES	22%	26%	-8%	-8%
C01B - ANTIARRHYTHMICS	42%	53%	-1%	4%
C01C - CARDIAC STIMULANTS, EXCLUDING CARDIAC GLYCOSIDES	77%	52%	-11%	16%
C01D - VASODILATORS USED IN CARDIOTHERAPY	32%	41%	-3%	-3%
C01E - OTHER CARDIAC PREPARATIONS	49%	35%	-5%	1%
C02A - CENTRALLY ACTING ANTIADRENERGICS (ANTIHYPERTENSIVES)	68%	51%	-6%	2%
C02C - PERIPHERALLY ACTING ANTIADRENERGICS (ANTIHYPERTENSIVES)	55%	44%	-1%	2%
C02D - ANTIHYPERTENSIVES SMOOTH MUSCLE ACTION ARTERIOLES	65%	202%	14%	30%
C03A - LOW CEILING DIURETICS, THIAZIDES	51%	109%	1%	1%
C03B - LOW CEILING DIURETICS, EXCLUDING THIAZIDES	41%	32%	-9%	-14%
C03C - HIGH CEILING DIURETICS	43%	39%	2%	-1%
C03D - POTASSIUM-SPARING DIURETICS	46%	40%	4%	5%
C03E - POTASSIUM-SPARING DIURETICS WITH OTHER DIURETICS	23%	17%	-6%	-5%
C04A - PERIPHERAL VASODILATORS	62%	41%	-4%	7%
C07A - BETA-BLOCKERS ALONE	49%	48%	1%	4%
C07B - BETA-BLOCKERS ASSOCIATED WITH THIAZIDES	43%	37%	-4%	1%
C07C - BETA-BLOCKERS ASOC. TO OTHER DIURETICS	39%	34%	-8%	-5%
C07F - BETA-BLOCKERS IN ASSOCIATION WITH OTHER ANTIHYPERTENSIVES	75%	66%	2%	1%
C08C - BLOCK. SELECTIVE CALCIUM CHANNELS VASCULAR EFFECT	47%	54%	1%	5%
C08D - BLOCK. SELECTIVE CALCIUM CHANNELS CARDIAC EFFECT	28%	27%	-7%	-5%
C09A - ANGIOTENSIN CONVERTING ENZYME INHIBITORS -IECA-	46%	51%	-2%	3%
C09B - ANGIOTENSIN CONVERTING ENZYME INHIBITORS IN ASOC	54%	49%	-2%	4%
C09C - ANGIOTENSIN II ANTAGONISTS	39%	44%	-2%	4%
C09D - ANGIOTENSIN II ANTAGONISTS IN ASSOCIATION	40%	44%	1%	5%
C09X - OTHER AGENTS ACTING ON THE RENIN-ANGIOTENSIN SYSTEM	9%	13%	-11%	-10%
C10A - LIPID MODIFIERS ALONE	33%	41%	-2%	7%
C10B - LIPID MODIFIERS IN ASSOCIATION	52%	52%	11%	29%
G04B - OTHER UROLOGICAL PREPARATIONS, INCL. ANTISPASMODICS	45%	48%	-2%	15%

INDEX

Pharmacological subgroup	2018 vs. 2017	2019 vs. 2018	2020 vs. 2019	2021 vs. 2020
G04C - DRUGS FOR BENIGN PROSTATIC HYPERTROPHY	44%	48%	1%	6%
H02A - CORTICOSTEROIDS FOR SYSTEMIC USE, ALONE	81%	48%	-21%	13%
J01A - TETRACYCLINES (ANTI-INFECTIVES FOR SYSTEMIC USE)	74%	43%	-6%	21%
J01C - BETA-LACTAM ANTIBACTERIAL AGENTS, PENICILLINS	60%	42%	-30%	-5%
J01D - OTHER BETA-LACTAM ANTIBACTERIALS	67%	50%	-17%	4%
J01E - SULFONAMIDES AND TRIMETHOPRIM (SYSTEMIC ANTI-INFECTIVES)	69%	36%	-4%	11%
J01F - MACROLIDES AND LINCOSAMIDES (SYSTEMIC ANTIINFECTIVES)	53%	34%	-32%	-3%
J01G - AMINOGLUCOSIDE ANTIBACTERIALS (ANTIINFEC. SISTEM)	63%	27%	-4%	-1%
J01M - QUINOLONE-DERIVED ANTIBACTERIALS (SISTEM)	55%	24%	-22%	-4%
J01R - ANTIBACTERIAL ASSOCIATIONS (ANTIINFEC.SISTEM)	10%	32%	12%	-10%
J01X - OTHER ANTIBACTERIALS (SYSTEMIC ANTI-INFECTIVES)	76%	50%	-3%	8%
J07A - BACTERIAL VACCINES	111%	30%	-64%	21%
J07B - VIRAL VACCINES	191%	100%	-38%	23%
N06A - ANTIDEPRESSANTS	44%	49%	1%	9%
N06B - PSYCHOSTIMULANTS, ADHD AND NOOTROPIC MEDS	38%	47%	-5%	4%
N06C - PSYCHOLEPTICS AND PSYCHOANALEPTICS IN ASSOCIATION	8%	62%	-1%	9%
N06D - ANTI-DEMENTIA DRUGS	46%	33%	2%	0%
P01A - AMOEBICIDES AND OTHER ANTIPROTOZOALS	85%	59%	-24%	33%
P01B - ANTIMALARIALS	66%	46%	-29%	6%
R03A - INHALED ADRENERGICS (ANTIASTHMATICS)	59%	44%	-14%	1%
R03B - OTHERS FOR AIRWAY OBSTRUCTION, INHALED	74%	49%	-21%	-5%
R03C - ADRENERGICS FOR SYSTEMIC USE (ANTIASTHMATICS)	36%	26%	-53%	7%
R03D - OTHER FOR AIRWAY OBSTRUCTION, SYSTEMIC USE	79%	35%	-32%	-6%
R05C - EXPECTORANTS, EXCL. ASSOCIAC. WITH ANTITUSSIVES	11%	44%	-40%	-1%
R05D - ANTITUSSIVES, EXCL. ASSOCIATIONS WITH EXPECT	7%	58%	-40%	-7%
R05F - ANTITUSSIVES AND EXPECTORANTS IN ASSOCIATION	13%	-37%	-21%	-2%
R05X - OTHER COMBINED COLD PREPARATIONS	ND	118%	-39%	-47%
S01A - ANTI-INFECTIVES (OPHTHALMIC)	74%	51%	-31%	4%
S01B - ANTI-INFLAMMATORY DRUGS (OPHTHALMIC)	79%	34%	-18%	17%
S01C - ANTI-INFLAMMATORY DRUGS ASOC. TO ANTI-INFECTIVES (OPHTALMIC)	70%	46%	-28%	5%
S01E - ANTIGLAUCOMA AND MYOTIC PREPARATIONS	45%	50%	-2%	2%
S01F - MYDRIATICS AND CYCLOPLEGICS	120%	72%	-23%	23%
S01G - DECONGESTANTS AND ANTIALLERGICS (OPHTHALMIC)	67%	42%	-9%	8%
S01H - LOCAL ANESTHETICS (OPHTHALMIC)	70%	73%	4%	1%
S01X -OTHER OPHTHALMIC	23%	48%	-3%	7%

Source: Developed by the authors based on data from the Primary Care Clinical Database (BDCAP) on the dispensing of medicines in community pharmacies[1]. **Abbreviations:** NA, not available.

INDEX

[ANNEX 5]

ANALYSIS OF OVERALL EXCESS MORTALITY

1. Analysis of overall excess mortality due to respiratory system diseases

»»» Table 2. Average change in the mortality rate due to respiratory system diseases in 2020 with respect to 2015-2019 by month (number of deaths per 100,000 population)

Cause of Death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
062 Influenza (flu) (includes influenza due to identified pandemic or zoonotic influenza viruses)	-0.32	0.02	0.00	-0.07	-0.02	0.00	0.00	0.00	0.00	0.00	-0.01	-0.12
063 Pneumonia	-0.49	-0.38	0.57	-0.23	-0.36	-0.34	-0.15	0.09	0.01	-0.10	-0.45	-0.85
064 Chronic diseases of the lower respiratory tract (except asthma)	-0.97	-0.70	0.44	-0.37	-0.79	-0.60	-0.41	-0.08	-0.10	-0.32	-0.39	-0.99
065 Asthma	-0.07	-0.11	0.09	0.01	-0.06	-0.04	-0.05	-0.02	0.01	0.02	-0.02	-0.08
066 Respiratory failure	-0.13	-0.06	0.23	0.05	-0.08	-0.07	-0.01	0.00	-0.03	-0.01	-0.08	-0.08
067 Other diseases of the respiratory system	-1.26	-0.88	0.60	-0.65	-1.31	-1.02	-0.51	-0.29	-0.35	-0.69	-1.06	-1.90
062-067 X. Diseases of the respiratory system	**-3.23**	**-2.12**	**1.94**	**-1.25**	**-2.62**	**-2.08**	**-1.13**	**-0.29**	**-0.45**	**-1.11**	**-2.02**	**-4.01**

Source: Developed by the authors based on data from the INE death statistics[2].

»»» Table 3. Standard deviation of the mean change in the mortality rate due to respiratory system diseases in 2020 with respect to 2015-2019 by month (number of deaths per 100,000 population)

Cause of death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
062 Influenza (flu) (includes influenza due to identified pandemic or zoonotic influenza viruses)	0.87	0.46	0.22	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.12
063 Pneumonia	0.72	0.49	0.31	0.13	0.09	0.04	0.09	0.10	0.03	0.10	0.06	0.33
064 Chronic diseases of the lower respiratory tract (except asthma)	0.70	0.60	0.45	0.16	0.15	0.10	0.23	0.19	0.13	0.17	0.16	0.40
065 Asthma	0.07	0.05	0.04	0.02	0.02	0.01	0.02	0.01	0.02	0.03	0.01	0.04
066 Respiratory failure	0.08	0.07	0.02	0.05	0.03	0.02	0.04	0.03	0.03	0.04	0.04	0.04
067 Other diseases of the respiratory system	1.53	0.90	0.57	0.46	0.26	0.24	0.40	0.34	0.20	0.13	0.23	0.65
062-067 X. Diseases of the respiratory system	**3.62**	**2.15**	**1.25**	**0.64**	**0.29**	**0.19**	**0.74**	**0.51**	**0.24**	**0.27**	**0.30**	**1.47**

Source: Developed by the authors based on data from the INE death statistics[2].

»»» Table 4. Average change in mortality rate (sum of excess mortality peaks) for diseases of the respiratory system in 2020 with respect to 2015-2019 (number of deaths per 100,000 population)

Cause of death	Mean	SD
062 Influenza (flu) (includes influenza due to identified pandemic or zoonotic influenza viruses)	-0.08	0.11
063 Pneumonia	-0.59	0.19
064 Chronic diseases of the lower respiratory tract (except asthma)	-0.84	0.44
065 Asthma	-0.03	0.03
066 Respiratory failure	-0.03	0.10
067 Other diseases of the respiratory system	-2.00	0.90
062-067 X. Diseases of the respiratory system	**-3.56**	**1.15**

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** The variation in the mortality rate was estimated from the sum of the mortality rates in the peaks of excess mortality from all causes according to the MoMo System.

2. Analysis of the overall excess mortality due to neoplasms

»»» Table 5. Average variation of the mortality rate due to neoplasms in 2020 with respect to 2015-2019 by month (number of deaths per 100,000 population)

Cause of Death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
009 Malignant tumor of the lip, oral cavity, and pharynx	0.05	0.01	0.01	-0.04	0.03	-0.02	0.06	-0.04	-0.02	-0.01	-0.07	0.00
010 Malignant tumor of the esophagus	-0.05	0.00	-0.01	-0.03	-0.02	0.01	-0.01	0.01	0.02	0.05	-0.03	-0.08
011 Malignant tumor of the stomach	0.00	0.02	-0.01	-0.12	-0.11	0.01	-0.03	-0.12	-0.11	-0.13	-0.09	-0.13
012 Malignant colon tumor	-0.22	-0.06	0.03	-0.19	-0.17	0.01	-0.01	-0.05	-0.02	-0.06	-0.28	-0.17
013 Malignant tumor of the rectum, rectosigmoid portion, and anus	-0.03	0.02	0.08	0.00	-0.06	0.07	-0.03	-0.01	0.03	-0.07	-0.02	-0.05
014 Malignant tumor of the liver and intrahepatic biliary tract	0.04	0.05	0.04	-0.10	-0.17	-0.01	0.01	-0.14	0.01	0.03	-0.06	-0.06
015 Malignant tumor of the pancreas	0.09	0.08	0.07	0.03	0.13	0.04	0.22	0.02	0.15	0.07	-0.11	0.10
016 Other malignant digestive tumors	0.02	-0.05	0.02	0.00	-0.05	-0.01	0.05	0.03	-0.03	-0.01	0.02	-0.04
017 Malignant tumor of the larynx	-0.04	-0.02	-0.01	-0.07	0.00	-0.06	-0.02	0.00	0.00	0.00	-0.04	-0.05
018 Malignant tumor of the trachea, bronchi, and lung	0.01	0.03	0.06	-0.41	-0.16	-0.28	0.24	-0.09	-0.07	0.21	-0.32	-0.17
019 Other respiratory and intrathoracic malignant tumors	0.00	0.00	0.01	-0.01	0.00	-0.01	-0.01	-0.01	0.01	0.01	0.02	-0.01
020 Malignant tumors of bone and articular cartilage	0.00	0.02	0.03	-0.02	-0.01	0.00	-0.01	0.01	-0.01	-0.01	0.01	-0.01
021 Malignant melanoma of the skin	0.01	0.00	0.05	0.03	0.01	0.00	0.00	0.04	-0.04	-0.03	-0.01	0.04
022 Other malignant tumors of the skin and soft tissues	0.00	0.02	0.00	0.04	0.02	0.04	0.02	0.05	0.02	0.02	0.00	0.00
023 Malignant breast tumor	0.10	0.04	-0.03	0.06	-0.07	0.07	0.03	0.02	0.04	-0.03	-0.02	-0.08
024 Malignant tumor of the uterine cervix	0.01	0.00	0.01	0.01	-0.02	-0.01	-0.01	0.01	0.00	0.02	0.00	0.01
025 Malignant tumor of other parts of the uterus	0.01	0.05	-0.06	-0.02	-0.04	-0.03	-0.01	0.02	-0.02	0.01	0.02	-0.01
026 Malignant ovarian tumor	-0.02	-0.01	-0.01	-0.04	0.01	-0.01	0.10	0.05	0.01	0.03	-0.01	-0.03
027 Malignant tumors of other female genitalia	0.04	-0.01	0.01	0.01	0.01	-0.01	0.01	0.00	0.01	-0.02	-0.01	0.01
028 Malignant prostate tumor	0.03	0.05	0.18	-0.06	-0.04	-0.03	-0.04	0.00	0.06	-0.07	-0.03	-0.02

INDEX

Cause of Death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
029 Malignant tumors of other male genital organs	-0.02	0.01	0.01	0.01	0.01	-0.02	-0.01	0.00	0.01	0.01	-0.01	-0.01
030 Malignant tumor of the kidney, except renal pelvis	-0.04	-0.01	0.08	-0.02	-0.02	-0.03	0.01	-0.01	-0.06	0.04	0.00	-0.07
031 Malignant bladder tumor	-0.13	-0.06	-0.01	-0.10	0.02	-0.10	-0.02	0.00	0.03	-0.03	-0.07	-0.08
032 Other malignant tumors of the urinary tract	0.08	0.06	0.06	0.01	0.04	-0.01	0.01	-0.01	0.04	-0.01	0.00	0.01
033 Malignant tumor of the brain	0.02	-0.02	0.06	-0.05	-0.06	-0.03	0.03	0.05	0.03	0.02	0.02	0.00
034 Other neurological and endocrine malignancies	0.01	-0.01	0.04	0.02	0.03	0.00	0.02	-0.01	0.02	0.01	-0.05	-0.01
035 Malignant tumor of ill-defined sites, secondary and unspecified sites	0.02	-0.03	0.02	-0.10	-0.11	-0.04	0.00	-0.04	-0.03	0.07	-0.10	-0.02
036 Malignant tumors of lymphatic tissue, hematopoietic organs, and related tissues, except leukemia	0.03	-0.06	0.14	-0.10	0.03	-0.07	0.04	-0.01	0.01	0.07	-0.07	-0.10
037 Leukemia	-0.07	0.00	0.05	0.03	-0.11	-0.01	-0.01	-0.04	-0.04	-0.07	0.02	-0.04
038 Tumors in situ	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
039 Benign tumors	-0.02	-0.02	0.02	0.01	-0.01	0.00	0.00	0.01	-0.03	0.02	0.00	0.01
040 Myelodysplastic syndrome	0.04	-0.02	0.03	0.04	-0.02	-0.05	-0.01	0.00	0.00	0.01	0.03	-0.03
041 Other tumors of uncertain or unknown behavior	0.00	-0.03	0.04	0.00	-0.03	-0.07	0.05	-0.02	0.04	0.01	-0.05	-0.07
009-041 II. Tumors	**-0.06**	**0.05**	**1.04**	**-1.17**	**-0.94**	**-0.64**	**0.68**	**-0.28**	**0.04**	**0.16**	**-1.30**	**-1.16**

Source: Developed by the authors based on data from the INE death statistics[2].

»»» Table 6. Standard deviation of the average variation of the mortality rate due to neoplasms in 2020 with respect to 2015-2019 by month (number of deaths per 100,000 population)

Cause of Death	ENE	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
009 Malignant tumor of the lip, oral cavity, and pharynx	0.03	0.02	0.03	0.03	0.02	0.02	0.02	0.04	0.03	0.03	0.03	0.03
010 Malignant tumor of the esophagus	0.01	0.04	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.04	0.03	0.02
011 Malignant tumor of the stomach	0.07	0.09	0.03	0.06	0.04	0.05	0.08	0.06	0.06	0.06	0.07	0.05
012 Malignant colon tumor	0.14	0.09	0.05	0.04	0.08	0.03	0.05	0.11	0.07	0.08	0.10	0.11
013 Malignant tumor of the rectum, rectosigmoid portion, and anus	0.01	0.04	0.06	0.01	0.05	0.05	0.03	0.02	0.06	0.03	0.05	0.09
014 Malignant tumor of the liver and intrahepatic biliary tract	0.03	0.05	0.03	0.02	0.04	0.05	0.05	0.06	0.05	0.04	0.07	0.06
015 Malignant tumor of the pancreas	0.09	0.06	0.07	0.07	0.08	0.07	0.04	0.10	0.06	0.10	0.06	0.06
016 Other malignant digestive tumors	0.02	0.04	0.04	0.02	0.02	0.03	0.02	0.05	0.03	0.06	0.02	0.03
017 Malignant tumor of the larynx	0.02	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.03	0.03	0.03
018 Malignant tumor of the trachea, bronchi, and lung	0.08	0.11	0.08	0.10	0.12	0.07	0.10	0.07	0.09	0.12	0.09	0.16
019 Other respiratory and intrathoracic malignant tumors	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01
020 Malignant tumors of bone and articular cartilage	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
021 Malignant melanoma of the skin	0.01	0.03	0.03	0.02	0.03	0.03	0.02	0.01	0.02	0.02	0.01	0.02
022 Other malignant tumors of the skin and soft tissues	0.02	0.02	0.02	0.03	0.01	0.01	0.01	0.04	0.02	0.03	0.03	0.02
023 Malignant breast tumor	0.07	0.05	0.09	0.07	0.10	0.07	0.04	0.03	0.06	0.04	0.05	0.03
024 Malignant tumor of the uterine cervix	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02
025 Malignant tumor of other parts of the uterus	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.01	0.03	0.03	0.01	0.01

INDEX

Cause of Death	ENE	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
026 Malignant ovarian tumor	0.04	0.01	0.02	0.02	0.03	0.04	0.05	0.01	0.02	0.02	0.02	0.03
027 Malignant tumors of other female genitalia	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02
028 Malignant prostate tumor	0.11	0.05	0.04	0.02	0.04	0.08	0.04	0.06	0.03	0.03	0.06	0.03
029 Malignant tumors of other male genital organs	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
030 Malignant tumor of the kidney, except renal pelvis	0.05	0.03	0.02	0.03	0.01	0.02	0.02	0.05	0.02	0.03	0.04	0.03
031 Malignant bladder tumor	0.06	0.06	0.07	0.05	0.03	0.05	0.07	0.05	0.07	0.06	0.10	0.05
032 Other malignant tumors of the urinary tract	0.05	0.05	0.05	0.03	0.06	0.02	0.06	0.03	0.06	0.06	0.05	0.03
033 Malignant tumor of the brain	0.02	0.04	0.03	0.04	0.05	0.04	0.05	0.03	0.04	0.04	0.02	0.03
034 Other neurological and endocrine malignancies	0.03	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02
035 Malignant tumor of ill-defined sites, secondary and unspecified sites	0.07	0.03	0.05	0.05	0.05	0.04	0.05	0.03	0.01	0.05	0.04	0.04
036 Malignant tumors of lymphatic tissue, hematopoietic organs, and related tissues, except leukemia	0.07	0.03	0.02	0.04	0.08	0.04	0.02	0.05	0.04	0.03	0.06	0.05
037 Leukemia	0.04	0.04	0.05	0.05	0.02	0.04	0.04	0.05	0.03	0.04	0.02	0.04
038 Tumors in situ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
039 Benign tumors	0.03	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.03
040 Myelodysplastic syndrome	0.02	0.02	0.02	0.02	0.01	0.02	0.03	0.01	0.02	0.02	0.01	0.02
041 Other tumors of uncertain or unknown behavior	0.03	0.04	0.03	0.03	0.03	0.04	0.03	0.01	0.03	0.03	0.05	0.03
009-041 II. Tumors	**0.59**	**0.46**	**0.37**	**0.23**	**0.32**	**0.25**	**0.23**	**0.17**	**0.26**	**0.31**	**0.25**	**0.44**

Source: Developed by the authors based on data from the INE death statistics[2].

»»» Table 7. Average change in mortality rate (sum of excess mortality peaks) due to neoplasms in 2020 with respect to 2015-2019 (number of deaths per 100,000 population)

Cause of Death	Mean	SD
009 Malignant tumor of the lip, oral cavity, and pharynx	-0.15	0.07
010 Malignant tumor of the esophagus	-0.05	0.05
011 Malignant tumor of the stomach	-0.33	0.15
012 Malignant colon tumor	-0.51	0.18
013 Malignant tumor of the rectum, rectosigmoid portion, and anus	-0.03	0.05
014 Malignant tumor of the liver and intrahepatic biliary tract	-0.30	0.09
015 Malignant tumor of the pancreas	-0.06	0.18
016 Other malignant digestive tumors	0.04	0.07
017 Malignant tumor of the larynx	-0.10	0.04
018 Malignant tumor of the trachea, bronchi, and lung	-0.82	0.16
019 Other respiratory and intrathoracic malignant tumors	-0.01	0.03
020 Malignant tumors of bone and articular cartilage	0.00	0.02
021 Malignant melanoma of the skin	0.06	0.01
022 Other malignant tumors of skin and soft tissues	0.10	0.07
023 Malignant breast tumor	0.05	0.11

INDEX

Cause of Death	Mean	SD
024 Malignant tumor of the uterine cervix	0.02	0.03
025 Malignant tumor of other parts of the uterus	0.03	0.02
026 Malignant tumor of the ovary	-0.01	0.05
027 Malignant tumors of other female genitalia	0.01	0.01
028 Malignant prostate tumor	-0.09	0.05
029 Malignant tumors of other male genital organs	0.00	0.01
030 Malignant tumor of the kidney, except renal pelvis	-0.03	0.09
031 Malignant bladder tumor	-0.16	0.16
032 Other malignant tumors of the urinary tract	-0.01	0.10
033 Malignant tumor of the brain	0.03	0.04
034 Other neurological and endocrine malignancies	-0.03	0.01
035 Malignant tumor of ill-defined sites, secondary and unspecified sites	-0.24	0.10
036 Malignant tumors of lymphatic tissue, hematopoietic organs, and related tissues, except leukemia	-0.19	0.09
037 Leukemia	0.01	0.11
038 Tumors in situ	0.00	0.00
039 Benign tumors	0.02	0.02
040 Myelodysplastic syndrome	0.08	0.03
041 Other tumors of uncertain or unknown behavior	-0.07	0.06
009-041 II. Tumors	**-2.75**	**0.51**

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** The variation in the mortality rate was estimated from the sum of the mortality rates in the peaks of excess mortality from all causes according to the MoMo System.

3. Analysis of overall excess mortality from diseases of the circulatory system

»»» Table 8. Average change in the mortality rate due to diseases of the circulatory system in 2020 with respect to 2015-2019 by month (number of deaths per 100,000 population)

Cause of Death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
053 Chronic rheumatic heart diseases	-0.11	-0.07	-0.05	-0.03	-0.09	-0.09	-0.04	-0.04	-0.02	-0.03	-0.05	-0.06
054 Hypertensive diseases	-0.36	-0.26	0.75	1.01	0.25	0.04	0.24	0.51	0.37	0.56	0.40	0.16
055 Acute myocardial infarction	-0.60	-0.47	-0.19	-0.12	-0.20	-0.17	-0.03	0.07	-0.23	0.06	-0.18	-0.29
056 Other ischemic heart diseases	-0.77	-0.60	0.14	-0.17	-0.35	-0.51	-0.26	-0.06	0.03	0.08	-0.18	-0.42
057 Heart failure	-0.39	-0.25	0.55	-0.15	-0.27	-0.05	0.24	0.29	0.18	0.28	-0.07	0.05
058 Other heart diseases	-0.18	-0.31	0.45	-0.24	-0.37	-0.08	-0.09	0.22	0.21	0.18	0.09	-0.19
059 Cerebrovascular diseases	-0.54	-0.72	-0.05	0.13	-0.53	-0.40	-0.35	0.15	-0.06	-0.03	-0.53	-0.31
060 Atherosclerosis	-0.04	-0.02	-0.02	-0.04	-0.04	-0.03	-0.05	0.01	-0.02	-0.01	-0.07	-0.02
061 Other blood vessel diseases	0.00	-0.03	0.01	-0.17	-0.07	0.02	0.01	0.00	0.06	0.02	-0.04	0.10
053-061 IX. Diseases of the circulatory system	**-3.00**	**-2.72**	**1.59**	**0.22**	**-1.66**	**-1.27**	**-0.32**	**1.15**	**0.52**	**1.11**	**-0.62**	**-0.98**

Source: Developed by the authors based on data from the INE death statistics[2].

INDEX

»»» Table 9. Standard deviation of the average variation of the mortality rate due to diseases of the circulatory system in 2020 with respect to the period 2015-2019 by month (number of deaths per 100,000 population)

Cause of Death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
053 Chronic rheumatic heart diseases	0.07	0.03	0.03	0.03	0.03	0.05	0.02	0.02	0.02	0.02	0.02	0.05
054 Hypertensive diseases	0.33	0.26	0.17	0.07	0.09	0.07	0.11	0.13	0.05	0.11	0.12	0.26
055 Acute myocardial infarction	0.43	0.32	0.34	0.13	0.18	0.07	0.13	0.11	0.11	0.10	0.12	0.34
056 Other ischemic heart diseases	0.40	0.38	0.26	0.15	0.18	0.18	0.19	0.11	0.13	0.08	0.19	0.44
057 Heart failure	0.59	0.39	0.19	0.10	0.12	0.20	0.15	0.12	0.02	0.10	0.08	0.19
058 Other heart diseases	0.53	0.28	0.19	0.17	0.16	0.19	0.14	0.18	0.09	0.10	0.21	0.38
059 Cerebrovascular diseases	0.58	0.56	0.32	0.16	0.16	0.29	0.27	0.15	0.21	0.16	0.09	0.33
060 Atherosclerosis	0.04	0.02	0.02	0.03	0.01	0.01	0.02	0.02	0.03	0.05	0.02	0.04
061 Other blood vessel diseases	0.08	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.07	0.06
053-061 IX. Diseases of the circulatory system	**2.83**	**2.05**	**1.31**	**0.30**	**0.47**	**0.25**	**0.92**	**0.56**	**0.46**	**0.43**	**0.35**	**1.91**

Source: Developed by the authors based on data from the INE death statistics [2].

»»» Table 10. Standard deviation of the average variation of the mortality rate due to diseases of the circulatory system in 2020 with respect to the period 2015-2019 by month (number of deaths per 100,000 population)

Cause of Death	Mean	SD
053 Chronic rheumatic heart diseases	-0.12	0.05
054 Hypertensive diseases	1.92	0.18
055 Acute myocardial infarction	-0.23	0.28
056 Other ischemic heart diseases	-0.41	0.42
057 Heart failure	0.07	0.19
058 Other heart diseases	0.08	0.47
059 Cerebrovascular diseases	-0.26	0.33
060 Atherosclerosis	-0.10	0.05
061 Other blood vessel diseases	-0.21	0.10
053-061 IX. Diseases of the circulatory system	**0.76**	**0.89**

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** The variation in the mortality rate was estimated from the sum of the mortality rates in the peaks of excess mortality from all causes according to the MoMo System.

[ANNEX 6]

ANALYSIS OF EXCESS IN-HOSPITAL MORTALITY

1. Analysis of excess in-hospital mortality due to respiratory system diseases

»»» Table 11. Comparison of hospital discharges due to exitus of people with respiratory system diseases in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	**Change in discharges due to exitus**	**Rate of discharges due to exitus 2015-2019†**	**Rate of discharges due to exitus 2020**	**Change in rate of discharges due to exitus**	**Change in discharges due to exitus**	**Rate of discharges due to exitus 2015-2019†**	**Rate of discharges due to exitus 2021**	**Change in rate of discharges due to exitus**
Pneumonia	17,948	8.6%	14.5%	69.4%	-2.923	8.6%	10.1%	17.4%
COPD and bronchiectasis	585	4.8%	7.5%	56.4%	-1.039	4.8%	5.9%	22.8%
Acute bronchitis and bronchiolitis	243	3.7%	5.8%	57.5%	-1.475	3.7%	3.4%	-7.4%
Chronic tonsil and adenoid disease	-1	0.0%	0.0%	2.9%	-1	0.0%	0.0%	13.4%
Other diseases of the URT	-7	0.1%	0.2%	23.4%	4	0.1%	0.2%	34.1%
Asthma	-75	1.1%	1.4%	22.1%	-97	1.1%	1.3%	9.5%
Acute URT infection and influenza	-215	2.7%	2.8%	5.0%	-894	2.7%	0.7%	-73.9%
Other diseases	-707	12.9%	15.8%	22.6%	-2.286	12.9%	16.0%	23.5%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate. **Abbreviations:** COPD, chronic obstructive pulmonary disease; URT, upper respiratory tract.

»»» Table 12. Comparison of hospital discharges due to exitus in the Pneumology Service according to main diagnosis in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	**Change in discharges due to exitus**	**Rate of discharges due to exitus 2015-2019†**	**Rate of discharges due to exitus 2020**	**Change in rate of discharges due to exitus**	**Change in discharges due to exitus**	**Rate of discharges due to exitus 2015-2019†**	**Rate of discharges due to exitus 2021**	**Change in rate of discharges due to exitus**
Pneumonia	1,211	3.2%	7.5%	136.1%	-281	3.2%	3.7%	15.5%
Other diseases of the URT	0	0.7%	1.0%	36.7%	5	0.7%	3.1%	322.3%
Chronic tonsil and adenoid disease	0	0.0%	0.0%	ND	0	0.0%	0.0%	ND
Asthma	-21	0.6%	0.6%	-1.4%	-21	0.6%	0.6%	-0.4%
Acute URT infection and influenza	-25	2.1%	1.5%	-28.6%	-76	2.1%	0.6%	-69.8%
Acute bronchitis and bronchiolitis	-65	2.8%	3.0%	7.1%	-105	2.8%	3.0%	6.5%
COPD and bronchiectasis	-137	2.7%	3.6%	29.7%	-291	2.7%	3.2%	15.8%
Other diseases	-230	5.9%	7.1%	20.7%	-200	5.9%	7.7%	30.3%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate. **Abbreviations:** COPD, chronic obstructive pulmonary disease; NA, value not available because a division by 0 was included in the calculation process; URT, upper respiratory tract.

INDEX

»»» Table 13. Comparison of hospital discharges due to exitus in the Internal Medicine Service according to main diagnosis in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2020	Change in rate of discharges due to exitus	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2021	Change in rate of discharges due to exitus
Pneumonia	10,924	10.3%	14.1%	37.2%	-1.867	10.3%	11.5%	12.3%
COVID-19	10,119	ND	12.3%	ND	14.701	ND	10.1%	ND
COPD and bronchiectasis	506	5.7%	8.9%	56.5%	-488	5.7%	7.2%	27.0%
Acute bronchitis and bronchiolitis	248	6.0%	7.8%	30.2%	-998	6.0%	7.2%	19.7%
Chronic tonsil and adenoid disease	-1	4.1%	0.0%	-100.0%	-1	4.1%	0.0%	-100.0%
Other diseases of the URT	-2	2.7%	2.7%	-1.5%	2	2.7%	3.5%	31.0%
Asthma	-39	2.2%	2.5%	14.6%	-50	2.2%	2.5%	14.2%
Acute URT infection and influenza	-105	4.2%	4.2%	0.1%	-487	4.2%	2.4%	-43.0%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate. **Abbreviations:** COPD, chronic obstructive pulmonary disease; NA, value not available because a division by 0 was included in the calculation process; URT, upper respiratory tract.

»»» Table 14. Comparison of hospital discharges due to exitus in the Intensive Care Medicine Service according to main diagnosis in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2020	Change in rate of discharges due to exitus	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2021	Change in rate of discharges due to exitus
Pneumonia	2,398	72.4%	84.0%	16.1%	-201	72.4%	62.8%	-13.3%
COPD and bronchiectasis	53	64.7%	78.3%	21.1%	-111	64.7%	49.2%	-24.0%
Acute bronchitis and bronchiolitis	16	30.6%	39.0%	27.6%	-24	30.6%	12.8%	-58.1%
Other diseases of the URT	0	34.0%	38.5%	13.2%	-1	34.0%	22.5%	-33.8%
Chronic tonsil and adenoid disease	0	1.3%	0.0%	-100.0%	0	1.3%	0.0%	-100.0%
Asthma	-6	42.0%	40.0%	-4.8%	-7	42.0%	23.1%	-45.1%
Acute URT infection and influenza	-26	69.4%	63.3%	-8.8%	-156	69.4%	10.3%	-85.1%
Other diseases	-29	70.0%	71.5%	2.1%	-388	70.0%	59.3%	-15.2%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate. **Abbreviations:** COPD, chronic obstructive pulmonary disease; URT, upper respiratory tract

INDEX

2. Analysis of excess in-hospital mortality due to neoplasms

»»» Table 15. Comparison of hospital discharges due to exitus of persons with neoplasms in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2020	Change in rate of discharges due to exitus	Change in dischar-ges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2021	Change in rate of discharges due to exitus
Other benign tumors and tumors of unknown or uncertain behavior	-1	1.6%	1.9%	16.8%	-33	1.6%	1.6%	1.6%
Uterine leiomyoma	-3	0.0%	0.0%	-100.0%	3	0.0%	0.0%	112.1%
Benign tumor of the colon, rectum, anal canal, and anus	-4	0.6%	0.8%	25.8%	-10	0.6%	0.5%	-12.w8%
Tumors [Neoplasms] in situ	-29	1.1%	0.6%	-44.0%	-30	1.1%	0.5%	-53.2%
Melanoma and other malignant skin tumors	-50	4.3%	4.4%	2.7%	-16	4.3%	4.8%	11.9%
Malignant ovarian neoplasm	-75	10.8%	9.9%	-8.9%	-123	10.8%	8.3%	-23.7%
Malignant tumor of the uterus	-85	6.2%	5.2%	-16.0%	-72	6.2%	5.0%	-19.0%
Malignant neoplasia of the prostate gland	-160	5.6%	4.8%	-13.0%	-196	5.6%	4.2%	-23.6%
Malignant breast tumor	-207	3.5%	3.3%	-5.4%	-246	3.5%	2.9%	-18.4%
Malignant neoplasia of the bladder	-216	3.7%	3.5%	-5.3%	-226	3.7%	3.4%	-9.2%
Malignant tumors of the colon, rectum, and anus	-719	10.0%	9.7%	-3.2%	-912	10.0%	8.6%	-13.9%
Malignant neoplasms of the trachea, bronchi, and lung	-1,045	22.8%	20.9%	-8.2%	-982	22.8%	20.3%	-11.1%
Other malignant tumors	-2,642	14.2%	13.2%	-7.5%	-3.033	14.2%	12.3%	-13.2%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate.

»»» Table 16. Comparison of hospital discharges due to exitus in the Medical Oncology Service in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2020	Change in rate of discharges due to exitus	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2021	Change in rate of discharges due to exitus
Benign colon/rectal/anus tumor	0	1.7%	0.0%	-100.0%	1	1.7%	8.8%	429.4%
Uterine leiomyoma	0	2.2%	0.0%	-100.0%	0	2.2%	0.0%	-100.0%
Other benign and of uncertain/unknown behavior	-5	9.2%	8.6%	-6.5%	0	9.2%	10.2%	10.5%
Malignant tumor of the uterus	-9	26.3%	24.3%	-7.6%	3	26.3%	25.8%	-2.0%
Tumors [Neoplasms] in situ	-9	19.0%	15.6%	-17.8%	-13	19.0%	7.9%	-58.5%
Melanoma and other malignant skin tumors	-17	32.7%	28.4%	-13.0%	-7	32.7%	31.9%	-2.6%
Malignant ovarian neoplasm	-25	23.2%	24.3%	4.5%	-47	23.2%	20.7%	-11.0%
Malignant neoplasm of the prostate gland	-31	30.4%	28.4%	-6.6%	-28	30.4%	28.2%	-7.3%
Malignant neoplasm of the bladder	-39	34.1%	32.2%	-5.8%	-26	34.1%	32.7%	-4.2%
Malignant breast tumor	-92	26.1%	25.4%	-2.8%	-120	26.1%	21.9%	-16.2%
Malignant tumors colon/rectum /anus	-203	28.1%	27.1%	-3.5%	-231	28.1%	26.3%	-6.3%
Trachea/bronchi/lung malignant neoplasms	-280	30.6%	29.7%	-3.1%	-241	30.6%	30.9%	0.8%
Other malignant tumors	-716	24.0%	22.4%	-6.9%	-693	24.0%	22.0%	-8.4%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate.

INDEX

»»» Table 17. Comparison of hospital discharges due to exitus in the Radiation Oncology Service in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2020	Change in rate of discharges due to exitus	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2021	Change in rate of discharges due to exitus
Malignant breast tumor	2	0.5%	2.3%	353.7%	0	0.5%	1.3%	146.1%
Malignant tumor of the uterus	0	0.5%	0.3%	-38.5%	0	0.5%	0.3%	-36.2%
Malignant ovarian neoplasm	0	12.7%	100.0%	687.6%	-1	12.7%	ND	ND
Tumors [Neoplasms] in situ	0	0.0%	0.0%	ND	0	0.0%	0.0%	ND
Benign colon/rectal/anus tumor	0	0.0%	ND	ND	0	0.0%	ND	ND
Uterine leiomyoma	0	ND	ND	ND	0	ND	ND	ND
Other benign and of uncertain/unknown behavior	0	0.0%	0.0%	ND	2	0.0%	11.5%	ND
Malignant neoplasm of the prostate gland	-1	0.3%	0.2%	-37.3%	-1	0.3%	0.2%	-25.8%
Melanoma and other malignant skin tumors	-2	4.0%	0.0%	-100.0%	-2	4.0%	0.0%	-100.0%
Malignant neoplasm of the bladder	-2	17.0%	0.0%	-100.0%	-1	17.0%	11.5%	-32.1%
Malignant tumors colon/rectum /anus	-2	9.6%	10.3%	7.9%	-4	9.6%	4.5%	-52.6%
Trachea/bronchi/lung malignant neoplasms	-17	18.1%	12.1%	-32.8%	-5	18.1%	20.0%	10.8%
Other malignant tumors	-26	8.6%	8.2%	-5.7%	-44	8.6%	5.6%	-34.9%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate. **Abbreviations:** NA, value not available due to the inclusion of a division by 0 in the calculation process

»»» Table 18. Comparison of hospital discharges due to exitus in the Palliative Care Service in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2020	Change in rate of discharges due to exitus	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2021	Change in rate of discharges due to exitus
Uterine leiomyoma	0	ND	ND	ND	0	ND	ND	ND
Benign colon/rectal/anus tumor	0	50.0%	0.0%	-100.0%	0	50.0%	ND	ND
Tumors [Neoplasms] in situ	-2	81.4%	100.0%	22.9%	-5	81.4%	50.0%	-38.6%
Malignant ovarian neoplasm	-15	76.5%	68.1%	-11.0%	-23	76.5%	76.8%	0.3%
Other benign and of uncertain/unknown behavior	-15	70.2%	65.7%	-6.4%	-29	70.2%	67.1%	-4.4%
Melanoma and other malignant skin tumors	-27	77.3%	67.5%	-12.6%	-9	77.3%	84.3%	9.1%
Malignant neoplasia of the prostate gland	-44	73.9%	74.6%	0.9%	-56	73.9%	78.9%	6.8%
Malignant tumor of the uterus	-54	76.0%	72.0%	-5.4%	-50	76.0%	82.5%	8.5%
Malignant neoplasm of the bladder	-56	79.2%	76.4%	-3.5%	-81	79.2%	73.8%	-6.8%
Malignant breast tumor	-78	77.8%	73.3%	-5.8%	-88	77.8%	76.8%	-1.2%
Malignant tumors colon/rectum/ anus	-180	75.3%	74.3%	-1.3%	-279	75.3%	76.6%	1.8%
Trachea/bronchi/lung malignant neoplasms	-409	79.7%	76.2%	-4.4%	-471	79.7%	78.3%	-1.8%
Other malignant tumors	-898	72.3%	67.9%	-6.1%	-1.037	72.3%	70.8%	-2.1%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate. **Abbreviations:** NA, value not available due to the inclusion of a division by 0 in the calculation process

INDEX

3. Analysis of excess in-hospital mortality due to diseases of the circulatory system

»»» Table 19. Comparison of hospital discharges due to exitus of people with neoplasms in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2020	Change in rate of discharges due to exitus	Change in discharges due to exitus	Rate of discharges due to exitus 2015-2019†	Rate of discharges due to exitus 2021	Change in rate of discharges due to exitus
Hypertensive disease	3,783	8.0%	10.2%	27.9%	5,131	8.0%	9.9%	24.0%
Diseases of the pulmonary circulation	409	6.4%	6.9%	7.3%	449	6.4%	6.4%	-0.8%
Varicose veins of the lower extremities	4	0.3%	0.6%	114.6%	5	0.3%	0.6%	113.7%
Cerebrovascular diseases	-43	12.9%	13.4%	4.0%	-216	12.9%	12.4%	-3.6%
Other ischemic heart diseases	-66	1.6%	1.7%	11.1%	-61	1.6%	1.7%	5.6%
Atherosclerosis	-152	4.8%	5.1%	7.3%	-83	4.8%	5.2%	8.5%
Acute myocardial infarction	-193	6.6%	6.5%	-2.8%	-77	6.6%	6.2%	-6.5%
Angina pectoris	-214	2.5%	2.1%	-15.4%	-206	2.5%	2.2%	-11.8%
Conduction disorders and cardiac dysrhythmias	-315	3.0%	3.0%	-1.0%	-185	3.0%	2.9%	-5.2%
Other diseases of the circulatory system	-320	4.5%	4.9%	7.8%	-258	4.5%	4.4%	-2.8%
Heart failure	-3,971	10.6%	11.7%	10.6%	-3,839	10.6%	11.0%	4.6%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate.

»»» Table 20. Comparison of hospital discharges due to exitus in the Coronary Care Unit in 2020 and 2021 with respect to 2015-2019

	2020 vs. 2015-2019				2021 vs. 2015-2019			
Main diagnosis*	Variación en altas por exitus	Tasa altas por exitus 2015-2019†	Tasa altas por exitus 2020	Variación en tasa altas por exitus	Variación en altas por exitus	Tasa altas por exitus 2015-2019†	Tasa altas por exitus 2021	Variación en tasa altas por exitus
Acute myocardial infarction	30	14.5%	13.5%	-7.2%	51	14.5%	15.9%	9.3%
Hypertensive disease	15	49.1%	59.4%	21.0%	16	49.1%	38.5%	-21.6%
Conduction disorders and dysrhythmias	10	21.6%	17.4%	-19.4%	13	21.6%	22.1%	2.2%
Other diseases of the circulatory system	5	28.5%	19.5%	-31.5%	9	28.5%	18.3%	-35.9%
Other ischemic heart diseases	1	6.4%	6.7%	4.0%	-2	6.4%	7.2%	12.5%
Diseases of the pulmonary circulation	0	84.7%	50.0%	-41.0%	1	84.7%	66.7%	-21.3%
Varicose veins lower extremities	0	ND	ND	ND	0	ND	ND	ND
Cerebrovascular diseasess	0	92.3%	50.0%	-45.8%	-2	92.3%	50.0%	-45.8%
Atherosclerosis	-1	66.7%	ND	ND	-1	66.7%	0.0%	-100.0%
Angina pectoris	-2	22.3%	0.0%	-100.0%	-1	22.3%	30.0%	34.8%
Heart failure	-9	45.5%	33.3%	-26.7%	-7	45.5%	40.0%	-12.1%

Source: Developed by the authors based on hospital discharges due to exitus from the RAE-CMBD of the SNHS[3]. **Note:** *Affection that, after the study, is established as the cause of contact with the hospital center. †Mean annual rate. Abbreviations: NA, value not available due to the inclusion of a division by 0 in the calculation process.

INDEX

[ANNEX 7]

ANALYSIS OF EXCESS MORTALITY BY SPECIFIC CAUSES

1. Analysis of excess mortality by specific causes within diseases of the respiratory system

Pneumonia

»»» **Table 21. Distribution of presence or suspected COVID-19 as a cause of death in addition to pneumonia in 2020, by place of death and month**

Place of death	COVID-19	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Home	No	100.0%	100.0%	97.3%	97.0%	96.3%	96.4%	100.0%	100.0%	100.0%	97.8%	100.0%	97.1%	**98.6%**
	Yes	0.0%	0.0%	0.9%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.3%**
	Suspected	0.0%	0.0%	1.8%	1.5%	3.7%	3.6%	0.0%	0.0%	0.0%	2.2%	0.0%	2.9%	**1.1%**
Hospital	No	100.0%	100.0%	96.1%	88.1%	94.4%	98.2%	98.5%	97.3%	96.0%	94.8%	94.8%	95.9%	**96.7%**
	Yes	0.0%	0.0%	1.2%	3.5%	0.5%	0.0%	0.0%	0.2%	0.0%	1.3%	0.0%	1.0%	**0.6%**
	Suspected	0.0%	0.0%	2.7%	8.4%	5.1%	1.8%	1.5%	2.5%	4.0%	3.8%	5.2%	3.0%	**2.7%**
Nursing home	No	100.0%	100.0%	93.7%	77.4%	97.1%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**93.9%**
	Yes	0.0%	0.0%	0.0%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.9%**
	Suspected	0.0%	0.0%	6.3%	18.3%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**5.2%**
Workplace or other	No	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**100.0%**
	Yes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	Suspected	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**No**	**100.0%**	**100.0%**	**96.0%**	**87.3%**	**94.9%**	**98.2%**	**98.7%**	**97.7%**	**96.6%**	**95.3%**	**95.6%**	**96.3%**	**96.7%**
	Yes	**0.0%**	**0.0%**	**1.1%**	**3.4%**	**0.4%**	**0.0%**	**0.0%**	**0.2%**	**0.0%**	**1.2%**	**0.0%**	**0.9%**	**0.6%**
	Suspected	**0.0%**	**0.0%**	**2.9%**	**9.3%**	**4.7%**	**1.8%**	**1.3%**	**2.2%**	**3.4%**	**3.5%**	**4.4%**	**2.8%**	**2.7%**

Source: Developed by the authors based on data from the INE death statistics[2].

»»» **Table 22. Distribution of pneumonia-associated deaths by place of death in 2015-2019 and 2020**

Place of death	2015-2019†	2020
Home	7.7%	8.4%
Hospital	84.7%	84.1%
Nursing home	6.9%	6.7%
Workplace or other	0.7%	0.8%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

INDEX

»»» Table 23. Distribution of pneumonia-associated deaths by place of death in 2020, by month

Place of death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Home	8.3%	9.1%	8.6%	9.5%	10.2%	6.3%	9.2%	7.1%	8.4%	7.5%	8.9%	6.0%
Hospital	86.5%	85.4%	81.1%	73.8%	81.8%	89.3%	84.2%	86.2%	86.3%	87.1%	83.7%	87.3%
Nursing home	4.3%	5.0%	9.7%	16.3%	6.6%	3.9%	6.3%	6.0%	4.8%	4.3%	6.6%	4.2%
Workplace or other	0.9%	0.5%	0.6%	0.4%	1.3%	0.5%	0.4%	0.7%	0.6%	1.0%	0.8%	2.5%

Source: Developed by the authors based on data from the INE death statistics[2].

Chronic obstructive pulmonary disease and bronchiectasis / acute bronchitis and bronchiolitis[a]

»»» Table 24. Distribution of presence or suspected COVID-19 as cause of death in addition to chronic lower respiratory tract diseases (except asthma) in 2020, by place of death and month

Lugar de fallecimiento	COVID-19	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Home	No	100.0%	100.0%	97.4%	98.0%	98.7%	99.2%	99.3%	99.3%	99.3%	99.0%	99.0%	97.9%	**98.9%**
	Yes	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	0.3%	0.9%	**0.2%**
	Suspected	0.0%	0.0%	2.1%	2.0%	1.3%	0.8%	0.7%	0.7%	0.0%	1.0%	0.7%	1.2%	**0.9%**
Hospital	No	100.0%	99.9%	93.7%	84.2%	93.8%	97.5%	98.4%	97.7%	95.6%	94.9%	94.8%	94.9%	**96.0%**
	Yes	0.0%	0.1%	3.6%	5.5%	0.3%	1.1%	0.0%	0.0%	1.2%	0.3%	2.5%	1.6%	**1.3%**
	Suspected	0.0%	0.0%	2.7%	10.3%	5.8%	1.4%	1.6%	2.3%	3.2%	4.8%	2.7%	3.5%	**2.7%**
Nursing home	No	100.0%	100.0%	91.5%	85.4%	92.1%	95.4%	99.0%	100.0%	99.0%	100.0%	95.8%	96.5%	**95.0%**
	Yes	0.0%	0.0%	0.0%	3.8%	5.6%	1.1%	0.0%	0.0%	0.0%	0.0%	3.2%	1.2%	**1.1%**
	Suspected	0.0%	0.0%	8.5%	10.9%	2.2%	3.4%	1.0%	0.0%	1.0%	0.0%	1.1%	2.4%	**3.8%**
Workplace or other	No	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	94.4%	100.0%	**99.4%**
	Yes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	Suspected	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.6%	0.0%	0.6%
Total	**No**	**100.0%**	**99.9%**	**94.6%**	**90.2%**	**95.9%**	**97.8%**	**98.8%**	**98.6%**	**97.6%**	**97.1%**	**96.5%**	**96.3%**	**96.9%**
	Yes	**0.0%**	**0.1%**	**1.8%**	**2.8%**	**0.8%**	**0.7%**	**0.0%**	**0.0%**	**0.8%**	**0.1%**	**1.7%**	**1.3%**	**0.9%**
	Suspected	**0.0%**	**0.0%**	**3.7%**	**7.0%**	**3.3%**	**1.4%**	**1.2%**	**1.4%**	**1.6%**	**2.8%**	**1.8%**	**2.4%**	**2.2%**

Source: Developed by the authors based on data from the INE death statistics[2].

»»» Table 25. Distribution of deaths from chronic lower respiratory tract diseases (except asthma) by place of death in the period 2015-2019 and 2020

Place of death	2015-2019†	2020
Home	29.5%	35.5%
Hospital	54.9%	48.3%
Nursing home	14.7%	14.6%
Workplace or other	0.9%	1.6%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

a INE code 64 (chronic diseases of the lower respiratory tract (except asthma)): correspondence with ICD-10 codes 1006 (COPD and bronchiectasis) and 1003 (acute bronchitis and bronchiolitis) of the ICD-10 used by the SNHS.

»»» Table 26. Distribution of deaths from chronic lower respiratory tract diseases (except asthma) by place of death in 2020, by month

Place of death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Home	29.6%	29.7%	32.6%	40.0%	42.6%	34.1%	39.2%	35.7%	40.3%	38.0%	36.7%	38.0%
Hospital	56.5%	54.4%	44.7%	34.9%	41.2%	51.4%	47.2%	51.6%	45.5%	49.3%	49.6%	49.7%
Nursing home	12.5%	14.7%	21.0%	23.9%	12.6%	12.5%	12.8%	11.6%	13.2%	12.2%	11.6%	9.8%
Workplace or other	1.5%	1.1%	1.7%	1.2%	3.5%	2.0%	0.8%	1.1%	0.9%	0.5%	2.2%	2.5%

Source: Developed by the authors based on data from the INE death statistics[2].

2. Analysis of excess mortality by specific causes within neoplasms

Malignant neoplasms of trachea, bronchi, and lung

»»» Table 27. Distribution of presence or suspected COVID-19 as cause of death in addition to malignant neoplasms of the trachea, bronchi, and lung in 2020, by place of death and month

Place of death	COVID-19	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Home	No	100.0%	100.0%	99.0%	98.4%	99.5%	100.0%	99.6%	100.0%	99.5%	99.7%	98.9%	99.7%	**99.5%**
	Yes	0.0%	0.0%	0.5%	0.2%	0.4%	0.0%	0.0%	0.0%	0.2%	0.2%	0.9%	0.3%	**0.2%**
	Suspected	0.0%	0.0%	0.5%	1.5%	0.2%	0.0%	0.4%	0.0%	0.4%	0.2%	0.2%	0.0%	**0.3%**
Hospital	No	100.0%	100.0%	96.0%	90.1%	95.7%	98.9%	99.3%	97.9%	96.8%	96.3%	94.2%	95.9%	**97.0%**
	Yes	0.0%	0.0%	2.1%	5.0%	1.5%	0.4%	0.3%	0.8%	1.8%	2.1%	4.3%	3.0%	**1.6%**
	Suspected	0.0%	0.0%	1.9%	4.9%	2.8%	0.7%	0.4%	1.3%	1.4%	1.6%	1.5%	1.0%	**1.3%**
Nursing home	No	100.0%	100.0%	93.1%	90.4%	93.7%	96.4%	100.0%	98.4%	98.6%	100.0%	94.4%	94.3%	**96.6%**
	Yes	0.0%	0.0%	1.0%	1.2%	4.8%	0.0%	0.0%	0.0%	1.4%	0.0%	5.6%	4.3%	**1.4%**
	Suspected	0.0%	0.0%	5.9%	8.4%	1.6%	3.6%	0.0%	1.6%	0.0%	0.0%	0.0%	1.4%	**2.0%**
Workplace or other	No	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**100.0%**
	Yes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	Suspected	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**No**	**100.0%**	**100.0%**	**96.8%**	**93.4%**	**96.8%**	**99.1%**	**99.4%**	**98.5%**	**97.7%**	**97.5%**	**95.8%**	**97.1%**	**97.8%**
	Yes	**0.0%**	**0.0%**	**1.5%**	**2.9%**	**1.3%**	**0.2%**	**0.2%**	**0.5%**	**1.3%**	**1.4%**	**3.2%**	**2.2%**	**1.2%**
	Suspected	**0.0%**	**0.0%**	**1.7%**	**3.7%**	**1.9%**	**0.6%**	**0.4%**	**0.9%**	**1.0%**	**1.1%**	**1.0%**	**0.7%**	**1.1%**

Source: Developed by the authors based on data from the INE death statistics[2].

»»» Table 28. Distribution of deaths from malignant neoplasms of the trachea, bronchi, and lung according to place of death in the period 2015-2019 and 2020

Place of death	2015-2019†	2020
Home	24.1%	30.1%
Hospital	70.0%	65.5%
Nursing home	5.6%	4.1%
Workplace or other	0.3%	0.3%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

»»» Table 29. Distribution of deaths from malignant neoplasms of the trachea, bronchi, and lung by place of death in 2020, by month

Place of death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Home	21.4%	21.7%	31.7%	39.1%	32.2%	30.2%	28.9%	29.4%	31.5%	31.8%	32.4%	33.2%
Hospital	74.0%	72.7%	62.8%	55.4%	63.9%	66.0%	66.7%	66.8%	64.0%	64.7%	64.0%	62.4%
Nursing home	4.4%	5.4%	5.3%	5.2%	3.6%	3.4%	3.9%	3.6%	4.3%	3.2%	3.2%	3.8%
Workplace or other	0.2%	0.2%	0.3%	0.3%	0.3%	0.4%	0.5%	0.2%	0.3%	0.4%	0.4%	0.7%

Source: Developed by the authors based on data from the INE death statistics[2].

3. Analysis of excess mortality by specific causes within diseases of the circulatory system

Hypertensive disease

»»» Table 30. Distribution of presence or suspected COVID-19 as cause of death in addition to hypertensive disease in 2020, by place of death and month

Place of death	COVID-19	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Home	No	100.0%	100.0%	98.8%	99.3%	99.3%	99.8%	99.8%	99.7%	99.6%	99.5%	99.7%	98.8%	**99.5%**
	Yes	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.3%	0.3%	0.8%	**0.2%**
	Suspected	0.0%	0.0%	0.9%	0.7%	0.7%	0.2%	0.2%	0.3%	0.0%	0.2%	0.0%	0.5%	**0.3%**
Hospital	No	100.0%	100.0%	97.0%	92.2%	97.1%	99.4%	99.5%	98.6%	97.8%	96.7%	97.9%	98.4%	**97.9%**
	Yes	0.0%	0.0%	2.3%	3.2%	2.0%	0.6%	0.5%	0.5%	2.2%	1.6%	0.0%	0.8%	**1.1%**
	Suspected	0.0%	0.0%	0.7%	4.6%	0.8%	0.0%	0.0%	0.9%	0.0%	1.6%	2.1%	0.8%	**0.9%**
Nursing home	No	100.0%	100.0%	95.6%	95.0%	95.7%	98.4%	99.0%	99.3%	98.3%	98.2%	97.7%	96.8%	**97.6%**
	Yes	0.0%	0.0%	0.6%	3.1%	3.0%	0.4%	0.0%	0.0%	1.3%	1.8%	1.9%	2.8%	**1.3%**
	Suspected	0.0%	0.0%	3.8%	1.9%	1.3%	1.2%	1.0%	0.7%	0.4%	0.0%	0.4%	0.4%	**1.2%**
Workplace or other	No	100.0%	100.0%	100.0%	92.6%	100.0%	100.0%	100.0%	100.0%	100.0%	96.6%	100.0%	100.0%	**99.0%**
	Yes	0.0%	0.0%	0.0%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%	0.0%	**0.6%**
	Suspected	0.0%	0.0%	0.0%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.3%**
Total	**No**	**100.0%**	**100.0%**	**97.4%**	**96.6%**	**98.0%**	**99.3%**	**99.5%**	**99.4%**	**99.0%**	**98.5%**	**98.9%**	**98.3%**	**98.6%**
	Yes	**0.0%**	**0.0%**	**0.8%**	**1.6%**	**1.1%**	**0.2%**	**0.1%**	**0.1%**	**0.9%**	**1.0%**	**0.6%**	**1.2%**	**0.7%**
	Suspected	**0.0%**	**0.0%**	**1.8%**	**1.7%**	**0.8%**	**0.4%**	**0.4%**	**0.5%**	**0.1%**	**0.4%**	**0.5%**	**0.5%**	**0.7%**

Source: Developed by the authors based on data from the INE death statistics[2].

INDEX

»»» Table 31. Distribution of deaths due to hypertensive disease according to place of death in 2015-2019 and 2020

Place of death	2015-2019†	2020
Home	47.0%	50.1%
Hospital	24.3%	20.5%
Nursing home	27.3%	27.2%
Workplace or other	1.5%	2.2%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

»»» Table 32. Distribution of deaths from hypertensive disease by place of death in 2020, by month

Place of death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Home	48.3%	43.4%	43.2%	48.5%	51.0%	51.1%	51.3%	54.0%	54.2%	52.2%	54.1%	53.2%
Hospital	23.2%	27.1%	20.1%	14.6%	22.9%	19.0%	19.8%	19.3%	19.1%	21.2%	20.3%	20.7%
Nursing home	26.4%	27.5%	34.9%	35.2%	22.1%	28.2%	27.9%	25.1%	24.8%	24.0%	22.7%	22.9%
Workplace or other	2.1%	2.0%	1.8%	1.8%	3.9%	1.7%	1.0%	1.7%	1.9%	2.5%	3.0%	3.3%

Source: Developed by the authors based on data from the INE death statistics[2].

Heart failure

»»» Table 33. Distribution of presence or suspected COVID-19 as a cause of death in addition to heart failure in 2020, by place of death and month

Place of death	COVID-19	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Home	No	100.0%	100.0%	99.6%	98.8%	100.0%	100.0%	99.7%	100.0%	99.8%	99.4%	99.5%	99.5%	**99.7%**
	Yes	0.0%	0.0%	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.5%	0.4%	**0.1%**
	Suspected	0.0%	0.0%	0.3%	1.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.6%	0.0%	0.2%	**0.2%**
Hospital	No	100.0%	100.0%	98.2%	94.9%	97.0%	99.4%	98.9%	98.2%	98.4%	97.5%	98.5%	97.6%	**98.3%**
	Yes	0.0%	0.0%	0.6%	0.5%	0.5%	0.0%	0.0%	0.2%	0.5%	0.8%	0.4%	0.8%	**0.4%**
	Suspected	0.0%	0.0%	1.2%	4.5%	2.5%	0.6%	1.1%	1.7%	1.1%	1.7%	1.0%	1.6%	**1.3%**
Nursing home	No	100.0%	100.0%	98.2%	93.1%	96.7%	97.7%	99.0%	98.9%	98.8%	98.5%	98.8%	99.5%	**98.2%**
	Yes	0.0%	0.0%	0.0%	2.2%	2.0%	0.6%	1.0%	0.0%	0.6%	1.0%	0.6%	0.0%	**0.6%**
	Suspected	0.0%	0.0%	1.8%	4.7%	1.3%	1.8%	0.0%	1.1%	0.6%	0.5%	0.6%	0.5%	**1.2%**
Workplace or other	No	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**100.0%**
	Yes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	Suspected	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**No**	**100.0%**	**100.0%**	**98.8%**	**96.4%**	**98.3%**	**99.4%**	**99.3%**	**99.1%**	**99.1%**	**98.4%**	**99.0%**	**98.6%**	**98.9%**
	Sí	**0.0%**	**0.0%**	**0.3%**	**0.7%**	**0.4%**	**0.1%**	**0.1%**	**0.1%**	**0.4%**	**0.5%**	**0.5%**	**0.5%**	**0.3%**
	Suspected	**0.0%**	**0.0%**	**0.9%**	**2.9%**	**1.3%**	**0.5%**	**0.6%**	**0.8%**	**0.6%**	**1.1%**	**0.5%**	**0.9%**	**0.8%**

Source: Developed by the authors based on data from the INE death statistics[2].

INDEX

»»» Table 34. Distribution of deaths due to heart failure according to place of death in the period 2015-2019 and 2020

Place of death	2015-2019†	2020
Home	34.7%	36.6%
Hospital	46.9%	45.0%
Nursing home	15.9%	13.6%
Workplace or other	2.5%	4.8%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

»»» Table 35. Distribution of deaths due to heart failure by place of death in 2020, by month

Lugar de fallecimiento	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Home	32.4%	32.0%	38.5%	40.0%	34.6%	39.1%	41.0%	41.9%	40.4%	35.1%	37.0%	31.1%
Hospital	51.7%	49.5%	39.6%	36.9%	44.9%	45.5%	42.5%	42.3%	43.3%	48.1%	45.0%	48.5%
Nursing home	12.9%	14.8%	18.4%	18.5%	10.5%	12.5%	13.0%	12.6%	13.5%	13.0%	11.1%	10.2%
Workplace or other	3.0%	3.6%	3.5%	4.6%	9.9%	2.9%	3.5%	3.2%	2.8%	3.7%	6.9%	10.2%

Source: Developed by the authors based on data from the INE death statistics[2].

Atherosclerosis

»»» Table 36. Distribution of presence or suspected COVID-19 as a cause of death in addition to atherosclerosis in 2020, by place of death and month

Place of death	COVID-19	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Home	No	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**100.0%**
	Yes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	Suspected	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Hospital	No	100.0%	100.0%	97.8%	94.7%	97.6%	97.9%	100.0%	100.0%	100.0%	96.0%	100.0%	94.4%	**98.2%**
	Yes	0.0%	0.0%	2.2%	2.6%	2.4%	2.1%	0.0%	0.0%	0.0%	4.0%	0.0%	3.7%	**1.4%**
	Suspected	0.0%	0.0%	0.0%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	**0.4%**
Nursing home	No	100.0%	100.0%	100.0%	92.9%	100.0%	94.4%	100.0%	100.0%	91.7%	100.0%	100.0%	100.0%	**98.4%**
	Yes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.3%	0.0%	0.0%	0.0%	**0.4%**
	Suspected	0.0%	0.0%	0.0%	7.1%	0.0%	5.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**1.2%**
Workplace or other	No	100.0%	100.0%	100.0%	100.0%	83.3%	100.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**96.4%**
	Yes	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**3.6%**
	Suspected	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**No**	**100.0%**	**100.0%**	**99.2%**	**96.0%**	**98.1%**	**98.0%**	**100.0%**	**100.0%**	**98.7%**	**98.9%**	**100.0%**	**97.3%**	**98.9%**
	Yes	**0.0%**	**0.0%**	**0.8%**	**1.0%**	**1.9%**	**1.0%**	**0.0%**	**0.0%**	**1.3%**	**1.1%**	**0.0%**	**1.8%**	**0.7%**
	Suspected	**0.0%**	**0.0%**	**0.0%**	**3.0%**	**0.0%**	**1.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.9%**	**0.4%**

Source: Developed by the authors based on data from the INE death statistics[2].

INDEX

»»» Table 37. Distribution of deaths due to atherosclerosis according to place of death in 2015-2019 and 2020

Place of death	2015-2019†	2020
Home	34.5%	34.9%
Hospital	43.0%	42.0%
Nursing home	20.6%	20.9%
Workplace or other	1.9%	2.3%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

»»» Table 38. Distribution of deaths due to atherosclerosis by place of death in 2020, by month

Lugar de fallecimiento	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Home	27.4%	27.8%	38.5%	30.3%	35.8%	32.3%	35.3%	45.0%	31.2%	47.9%	38.2%	32.7%
Hospital	47.4%	53.0%	37.7%	38.4%	38.7%	47.5%	43.5%	34.0%	50.6%	26.6%	32.9%	49.1%
Nursing home	21.5%	18.3%	23.0%	28.3%	19.8%	18.2%	21.2%	19.0%	15.6%	23.4%	25.0%	17.3%
Workplace or other	3.7%	0.9%	0.8%	3.0%	5.7%	2.0%	0.0%	2.0%	2.6%	2.1%	3.9%	0.9%

Source: Developed by the authors based on data from the INE death statistics[2].

Cerebrovascular disease

»»» Table 39. Distribution of presence or suspected COVID-19 as a cause of death in addition to cerebrovascular disease in 2020, by place of death and month

Place of death	COVID-19	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	Total
Home	No	100.0%	100.0%	99.7%	98.6%	99.4%	99.5%	99.6%	99.8%	99.8%	99.6%	98.9%	99.6%	**99.5%**
	Yes	0.0%	0.0%	0.0%	0.2%	0.4%	0.0%	0.2%	0.2%	0.0%	0.4%	0.6%	0.0%	**0.2%**
	Suspected	0.0%	0.0%	0.3%	1.3%	0.2%	0.5%	0.2%	0.0%	0.2%	0.0%	0.6%	0.4%	**0.3%**
Hospital	No	100.0%	100.0%	97.8%	93.1%	96.6%	98.2%	98.7%	99.1%	98.9%	97.4%	96.9%	97.8%	**98.0%**
	Yes	0.0%	0.0%	1.2%	3.5%	1.4%	0.9%	0.3%	0.3%	0.9%	1.5%	2.2%	1.4%	**1.1%**
	Suspected	0.0%	0.0%	1.0%	3.4%	2.0%	0.9%	1.1%	0.6%	0.2%	1.1%	0.9%	0.8%	**0.9%**
Nursing home	No	100.0%	100.0%	95.2%	91.8%	96.1%	99.1%	98.9%	98.8%	97.2%	97.8%	96.5%	98.8%	**97.1%**
	Yes	0.0%	0.0%	0.2%	2.5%	2.1%	0.0%	0.0%	0.4%	1.9%	1.3%	2.0%	1.2%	**1.0%**
	Suspected	0.0%	0.0%	4.6%	5.7%	1.7%	0.9%	1.1%	0.8%	0.9%	0.9%	1.5%	0.0%	**1.9%**
Workplace or other	No	100.0%	100.0%	92.9%	95.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**99.2%**
	Yes	0.0%	0.0%	7.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.4%**
	Suspected	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.4%**
Total	**No**	**100.0%**	**100.0%**	**97.8%**	**94.4%**	**97.3%**	**98.6%**	**98.9%**	**99.2%**	**98.9%**	**98.0%**	**97.4%**	**98.4%**	**98.2%**
	Yes	**0.0%**	**0.0%**	**0.8%**	**2.3%**	**1.2%**	**0.6%**	**0.2%**	**0.3%**	**0.8%**	**1.2%**	**1.7%**	**1.0%**	**0.8%**
	Suspected	**0.0%**	**0.0%**	**1.4%**	**3.3%**	**1.5%**	**0.8%**	**0.9%**	**0.5%**	**0.3%**	**0.8%**	**0.9%**	**0.6%**	**0.9%**

Source: Developed by the authors based on data from the INE death statistics[2].

INDEX

»»» Table 40. Distribution of deaths due to cerebrovascular disease according to place of death in 2015-2019 and 2020

Place of death	2015-2019†	2020
Home	23.6%	24.5%
Hospital	61.5%	61.2%
Nursing home	14.0%	13.3%
Workplace or other	1.0%	1.0%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

»»» Table 41. Distribution of deaths from cerebrovascular disease by place of death in 2020, by month

Place of death	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC
Home	23.0%	21.9%	25.1%	27.7%	24.8%	23.1%	25.9%	24.5%	23.2%	23.6%	26.7%	24.3%
Hospital	63.0%	63.3%	57.1%	49.8%	61.5%	64.5%	60.2%	62.5%	64.7%	65.0%	61.7%	62.9%
Nursing home	13.0%	13.8%	17.2%	21.6%	12.2%	11.9%	13.3%	12.2%	11.3%	10.6%	10.1%	11.2%
Workplace or other	1.0%	0.9%	0.6%	0.9%	1.6%	0.5%	0.6%	0.9%	0.9%	0.8%	1.6%	1.6%

Source: Developed by the authors based on data from the INE death statistics[2].

Other ischemic heart diseases

»»» Table 42. Distribution of presence or suspected COVID-19 as a cause of death in addition to other ischemic heart diseases in 2020, by place of death and month

Place of death	COVID-19	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	Total
Home	No	100.0%	100.0%	98.3%	97.7%	99.6%	100.0%	99.8%	99.8%	99.4%	99.2%	98.7%	98.9%	**99.3%**
	Sí	0.0%	0.0%	0.6%	0.5%	0.2%	0.0%	0.2%	0.2%	0.4%	0.2%	1.1%	0.7%	**0.3%**
	Suspected	0.0%	0.0%	1.1%	1.7%	0.2%	0.0%	0.0%	0.0%	0.2%	0.7%	0.2%	0.4%	**0.4%**
Hospital	No	100.0%	100.0%	92.7%	88.9%	94.5%	98.2%	99.1%	97.7%	96.9%	96.7%	96.3%	95.9%	**96.5%**
	Sí	0.0%	0.0%	5.6%	7.8%	2.5%	0.8%	0.5%	1.0%	2.4%	2.3%	3.0%	2.4%	**2.3%**
	Suspected	0.0%	0.0%	1.6%	3.4%	3.0%	1.0%	0.5%	1.3%	0.7%	1.0%	0.7%	1.8%	**1.2%**
Nursing home	No	100.0%	100.0%	94.7%	83.6%	93.7%	97.4%	99.3%	100.0%	98.5%	98.5%	91.0%	97.5%	**95.4%**
	Sí	0.0%	0.0%	2.3%	4.0%	2.5%	0.0%	0.7%	0.0%	1.5%	0.7%	8.2%	1.9%	**1.9%**
	Suspected	0.0%	0.0%	3.0%	12.4%	3.8%	2.6%	0.0%	0.0%	0.0%	0.7%	0.7%	0.6%	**2.6%**
Workplace or other	No	100.0%	100.0%	100.0%	100.0%	99.1%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.5%	**99.8%**
	Sí	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	**0.1%**
	Suspected	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.1%**
Total	**No**	**100.0%**	**100.0%**	**95.9%**	**92.3%**	**96.9%**	**99.0%**	**99.5%**	**99.1%**	**98.4%**	**98.2%**	**97.2%**	**97.7%**	**97.8%**
	Sí	**0.0%**	**0.0%**	**2.6%**	**3.4%**	**1.3%**	**0.3%**	**0.3%**	**0.4%**	**1.2%**	**1.0%**	**2.4%**	**1.4%**	**1.2%**
	Suspected	**0.0%**	**0.0%**	**1.6%**	**4.4%**	**1.8%**	**0.7%**	**0.2%**	**0.4%**	**0.3%**	**0.8%**	**0.4%**	**0.9%**	**1.0%**

Source: Developed by the authors based on data from the INE death statistics[2].

INDEX

»»» Table 43. Distribution of deaths from other ischemic heart diseases according to place of death in 2015-2019 and 2020

Place of death	2015-2019†	2020
Home	39.3%	43.9%
Hospital	40.6%	36.1%
Nursing home	14.2%	13.5%
Workplace or other	5.9%	6.5%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

»»» Table 44. Distribution of deaths from other ischemic heart diseases by place of death in 2020, by month

Place of death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Home	45.2%	40.6%	43.4%	44.1%	41.2%	46.1%	44.5%	46.8%	46.2%	46.9%	44.6%	38.8%
Hospital	38.7%	40.0%	33.4%	29.7%	36.4%	38.2%	38.3%	34.4%	36.9%	36.9%	34.9%	36.5%
Nursing home	11.9%	14.2%	18.5%	21.1%	13.4%	11.5%	11.8%	13.5%	11.6%	10.3%	10.7%	11.3%
Workplace or other	4.2%	5.2%	4.7%	5.1%	8.9%	4.2%	5.4%	5.3%	5.3%	6.0%	9.8%	13.5%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

Acute myocardial infarction

»»» Table 45. Distribution of presence or suspected COVID-19 as cause of death in addition to acute myocardial infarction in 2020, by place of death and month

Place of death	COVID-19	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Home	No	100.0%	100.0%	99.2%	98.9%	99.4%	100.0%	100.0%	99.8%	99.6%	99.7%	99.2%	99.0%	**99.6%**
	Yes	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	0.2%	0.2%	0.2%	1.0%	**0.2%**
	Suspected	0.0%	0.0%	0.8%	0.9%	0.6%	0.0%	0.0%	0.0%	0.2%	0.2%	0.6%	0.0%	**0.3%**
Hospital	No	100.0%	100.0%	96.5%	91.7%	97.0%	100.0%	99.7%	98.8%	97.1%	96.9%	95.3%	98.4%	**97.8%**
	Yes	0.0%	0.0%	2.0%	3.4%	0.8%	0.0%	0.3%	0.6%	1.6%	1.8%	2.9%	1.3%	**1.2%**
	Suspected	0.0%	0.0%	1.5%	4.9%	2.2%	0.0%	0.0%	0.6%	1.3%	1.3%	1.8%	0.2%	**1.1%**
Nursing home	No	100.0%	100.0%	98.6%	96.4%	95.7%	99.1%	100.0%	100.0%	98.8%	97.4%	94.0%	94.1%	**97.8%**
	Yes	0.0%	0.0%	0.0%	0.9%	2.1%	0.0%	0.0%	0.0%	1.2%	1.7%	4.0%	5.9%	**1.2%**
	Suspected	0.0%	0.0%	1.4%	2.7%	2.1%	0.9%	0.0%	0.0%	0.0%	0.9%	2.0%	0.0%	**1.0%**
Workplace or other	No	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.3%	100.0%	**99.9%**
	Yes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	Suspected	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	**0.1%**
Total	**No**	**100.0%**	**100.0%**	**98.3%**	**96.4%**	**98.3%**	**99.9%**	**99.9%**	**99.5%**	**98.7%**	**98.5%**	**97.5%**	**98.5%**	**98.8%**
	Yes	**0.0%**	**0.0%**	**0.6%**	**1.2%**	**0.5%**	**0.0%**	**0.1%**	**0.3%**	**0.8%**	**0.9%**	**1.4%**	**1.4%**	**0.6%**
	Suspected	**0.0%**	**0.0%**	**1.1%**	**2.4%**	**1.2%**	**0.1%**	**0.0%**	**0.2%**	**0.6%**	**0.6%**	**1.1%**	**0.1%**	**0.6%**

Source: Developed by the authors based on data from the INE death statistics[2].

INDEX

»»» Table 46. Distribution of deaths due to acute myocardial infarction according to place of death in the period 2015-2019 and 2020

Place of death	2015-2019†	2020
Home	43.7%	47.6%
Hospital	35.6%	33.9%
Nursing home	12.2%	11.1%
Workplace or other	8.5%	7.3%

Source: Developed by the authors based on data from the INE death statistics[2]. **Note:** †Mean annual proportion.

»»» Table 47. Distribution of deaths due to acute myocardial infarction according to place of death in 2020, by month

Place of death	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Home	48.4%	46.4%	46.3%	47.0%	44.6%	46.6%	52.2%	51.6%	52.5%	51.0%	44.6%	41.5%
Hospital	37.5%	37.5%	31.2%	28.7%	34.6%	36.9%	32.9%	30.6%	33.9%	33.3%	33.4%	36.2%
Nursing home	8.9%	9.5%	17.3%	19.6%	8.8%	10.9%	9.6%	11.2%	9.0%	10.0%	8.8%	9.6%
Workplace or other	5.2%	6.6%	5.2%	4.7%	11.9%	5.6%	5.3%	6.6%	4.6%	5.7%	13.2%	12.7%

Source: Developed by the authors based on data from the INE death statistics[2].

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[INDEX OF FIGURES]

INDEX

INDEX

[TABLE INDEX]

[ANNEXES]

INDEX

Excess mortality during the COVID-19 pandemic in Spain by non-COVID-19 causes of death