Fundación MAPFRE

COVID-19: A PRELIMINARY ANALYSIS OF DEMOGRAPHIC AND INSURANCE INDUSTRY IMPACTS

MAPFRE Economics

COVID-19: a preliminary analysis of demographic and insurance industry impacts

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Contents

Presentation 9

Introduction 11

Executive summary 13

1. Conceptual framework 17
1.1 The COVID-19 pandemic 17
1.2 Methodological aspects of the analysis 24

2. Analysis of excess mortality in select countries 27
2.1 The Americas 27
2.1.1 Canada 27
2.1.2 United States 30
2.1.3 Mexico 33
2.1.4 Brazil 36
2.1.5 Chile 39
2.2 Europe 42
2.2.1 United Kingdom 42
2.2.2 Germany 45
2.2.3 France 48
2.2.4 Italy 52
2.2.5 Spain 55
2.2.6 Russia 58
2.3 Asia-Pacific 61
2.3.1 Taiwan 61
2.3.2 South Korea 63
2.3.3 Australia 64
2.3.4 New Zealand 69

3. Excess mortality from an international perspective 75
3.1 Excess mortality and its link to other structural and circumstantial variables 75
3.2 Efficiency of Pandemic Management Indicator 85

4. Main impacts on insurance activities 89
4.1 Excess mortality and life expectancy 93
4.2 Impacts on Life insurance 96
4.3 Impacts on Non-Life insurance 97
4.3.1 Impacts on Health insurance 97
4.3.2 Impacts on other Non-Life insurance 97
4.4 Prospects: looking towards the immediate future 98

References 101

General bibliographical references 103

Index of tables, charts and boxes 105

Presentation

March 11, 2022, marked two years since COVID-19 was declared a pandemic by the World Health Organization. Since the coronavirus known as SARS-CoV-2 spread from the Chinese city of Wuhan to the rest of the world, as of March 2022, more than 456 million cases have been diagnosed worldwide, with 6 million people reported dead from the disease. While these figures are staggering, the true number of infections and deaths is estimated to be far higher than the official count, due largely to limits in testing capabilities and because many cases have gone unreported. According to some studies, the actual death toll could be around three times higher than reported in an average scenario, representing excess mortality of around 120 deaths per 100,000 people. Therefore, the pandemic could have caused over 18 million deaths worldwide during its first two years.

Since the start of the pandemic, it has been Fundación MAPFRE's priority to support and protect the most vulnerable members of society, which it has done by launching social programs and donations, promoting coronavirus research, and distributing medical supplies and protective equipment to hospitals and nursing homes. Through this new report by MAPFRE Economics on the demographic and insurance industry impacts of COVID-19, Fundación MAPFRE aims to help bring attention to a key aspect of the pandemic, the mortality caused by the virus. Aside from an analysis of observed excess mortality in 2020 and 2021 in 39 countries, this study presents an indicator designed to evaluate the effectiveness of the measures that these countries adopted to manage the pandemic, which could help detect weaknesses reversed in the future.

Fundación MAPFRE is confident that this report by MAPFRE Economics will shed light on some of the demographic aspects most affected by the pandemic while helping the world, as far as possible, to be prepared for and respond better to such events in the post-COVID era.

Fundación MAPFRE

Introduction

The pandemic caused by SARS-CoV-2 coronavirus (COVID-19) has been one of the greatest challenges faced by society worldwide in the last century, due not only to its impact on health but to the economic repercussions of the lockdowns and social distancing measures introduced to stop the virus from spreading. In the wake of an event of global magnitude with repercussions on nearly every aspect of social activity, analyzing its impacts to determine how they can be reversed or absorbed by the economy and society is necessary.

This report aims to make at least preliminary progress towards this purpose. Therefore, it focuses on assessing the pandemic's impact on demographic aspects, particularly on mortality. By examining information from 15 selected countries in the Americas, Europe, and the Asia-Pacific region, it offers an estimate of the excess mortality registered over the first two years of the pandemic. This report also explores the relationships between excess mortality and other economic and health variables, proposing an "Efficiency of Pandemic Management Indicator" that uses a summary index to reflect the combined impact of all the variables mentioned above on a group of 39 countries. Finally, based on the analysis of these factors, the report offers an overview of the pandemic's main impacts on insurance activities.

We are confident that this report will contribute to the preliminary exploration of the primary demographic effects of the health crisis and its impacts on the insurance industry to identify new ways to boost the insurance business in the new environment that is taking shape in the post-pandemic era.

MAPFRE Economics

Executive summary

The pandemic

In December 2019, the World Health Organization (WHO) was first informed of pneumonia of unknown origin affecting people in the city of Wuhan, Hubei province (People's Republic of China), caused by a type-2 coronavirus known as SARS-CoV-2 responsible for severe acute respiratory syndrome. On January 30, 2020, the WHO announced that the outbreak of this new infectious disease (named COVID-19) constituted a Public Health Emergency of International Concern (PHEIC), and on March 11, 2020, after confirming its extensive spread, the WHO declared a global pandemic.

The first pandemic wave, caused by the original SARS-CoV-2 virus, expanded rapidly in a highly interconnected world, overwhelming many healthcare systems around the globe, which were at times unable to assist all the infected patients who required urgent medical care to survive. On December 31, 2020, the first effective vaccine against SARS-CoV-2 (Pfizer-BioNTech's "BNT162b2") was approved for the WHO Emergency Use Listing. Since the appearance of severe acute respiratory syndrome, social distancing measures and the different vaccines developed have played a key role in mitigating the virus's impact on public health and its economic and social consequences.

As of March 14, 2022, the number of cases worldwide has exceeded 456 million, and the COVID-19 death toll has reached 6 million, representing 1.3% of total diagnosed cases. However, the true numbers of diagnosed COVID-19 cases and deaths are unknown, given the limits in testing capacity and because many cases have gone unreported. According to the latest studies, the actual death count could be around three times higher than reported in an average scenario, representing excess mortality of around 120 deaths per 100,000 people. Therefore, fatalities worldwide from the pandemic would have surpassed 18 million in the first two years since the virus appeared. Since the outbreak of the original strain, however, new SARS-CoV-2 variants began to appear, particularly those classified by the WHO as variants of concern; among them, the Alpha, Delta, and Omicron variants should be highlighted for the purposes of excess mortality.

Scope of this report

This study focuses on mortality trends during the first two years of the pandemic (2020 and 2021), particularly the observed excess mortality compared to the pre-pandemic situation in what would be a "normal" environment from the epidemiological point of view. This is calculated using three levels of aggregation (yearly, quarterly, and monthly), organizing the death counts per epidemiological weeks into months, quarters, and calendar years in order to facilitate comparison.

For a group of 15 select countries in the Americas, Europe, and the Asia-Pacific region, the analysis is complemented by a study of daily deaths due to COVID-19, the observed travel restrictions, the economic impacts, and the percentage of fully vaccinated population. Although many countries have overcome the economic impacts of the pandemic or are on the road to recovery, the levels of restrictions around the world remain higher than they were before the pandemic.

An international perspective of excess mortality

The report thoroughly analyzes the observed excess mortality during 2020 and 2021 in a total of 39 countries and proposes an indicator to assess the effectiveness of the measures adopted by these countries to manage the pandemic. This summary indicator, known as the "Efficiency of Pandemic Management Indicator (EPMI)," is based on five partial measures with the rationale that, overall, the countries that did the best job of managing the pandemic were the ones with lower excess mortality and stronger economic recovery in 2021 after the decline in 2020. They also had greater established healthcare capacity to meet the population's needs during the health emergency, higher rates of fully vaccinated population, and lower levels of economic and social restrictions.

According to the EPMI, the country that managed the pandemic most efficiently was South Korea, followed by Norway and New Zealand. Iceland, Denmark, and Japan (whose healthcare system is ranked among the best in the world) also stand out. At the opposite end of the spectrum, the countries with the lowest scores include Mexico, Colombia, Bulgaria, Russia, and Brazil, which all have weak healthcare systems. Also noteworthy are the high excess mortality levels in Mexico, the highest in the sample, as well as in Colombia. Latin America has been hit particularly hard by the pandemic, and despite having weak healthcare systems, the region has made a tremendous effort to vaccinate its population, as highlighted by this partial indicator in most of the countries on the list, especially Chile.

However, based on the calculated excess mortality levels, we can analyze the potential correlations between excess deaths and a series of structural and circumstantial variables that may have had a causal link to increased mortality during the years of the pandemic. Very high correlations are identified between the observed excess mortality and the efficiency of healthcare systems and per capita income levels, explaining 64.3% and 71.2% of the differences, respectively, in the sample of countries analyzed.

It should also be noted that the correlation between excess mortality and the efficiency of healthcare systems during the early phases of the crisis is significantly lower. This reflects the catastrophic nature of pandemics, which can rapidly overwhelm healthcare systems as they are unprepared for them. However, if we consider a longer period, having efficient healthcare systems becomes very important, and countries with weaker systems are far more affected by the consequences of the pandemic waves. Therefore, having robust healthcare systems is fundamental to reduce excess mortality. Equally important are early warning systems and information systems that allow data to be shared worldwide; by doing so, other measures can be swiftly taken at the start of a pandemic, an area in which much progress has been made as a result of this tremendous global crisis.

Impacts on insurance activities

The crisis caused by the pandemic has had significant consequences for the insurance business in terms of revenues and profitability. This impact can be identified by its economic, financial, and legal aspects (concerning, among other factors, the exclusion clauses in contracts for coverage in pandemics), as well as its effects on healthcare systems and technical and actuarial parameters by altering biometric variables that may affect life expectancy worldwide. With regard to the latter, unless a mutation of the virus appears and changes the current trends in mortality and morbidity (which seems unlikely, but cannot be ruled out), the trend seems to point to improvement; also, the world has come a long way and is better prepared to handle an event of this nature.

At the same time, insurers' efforts to remain operational during lockdowns have accelerated digitization processes, ensuring that underwriting and customer service were not paralyzed and furthering many plans to invest in media and technological profiles. Meanwhile, insurance demand among households and companies has received a boost from economic agents' greater sensitivity and aversion to risk despite the increased uncertainty. Over the coming years, the prospects for the insurance markets will be largely influenced by the lingering economic and financial impacts of the pandemic and the consequences of the events between Russia and Ukraine, as explained in the final section of our study.

1. Conceptual framework

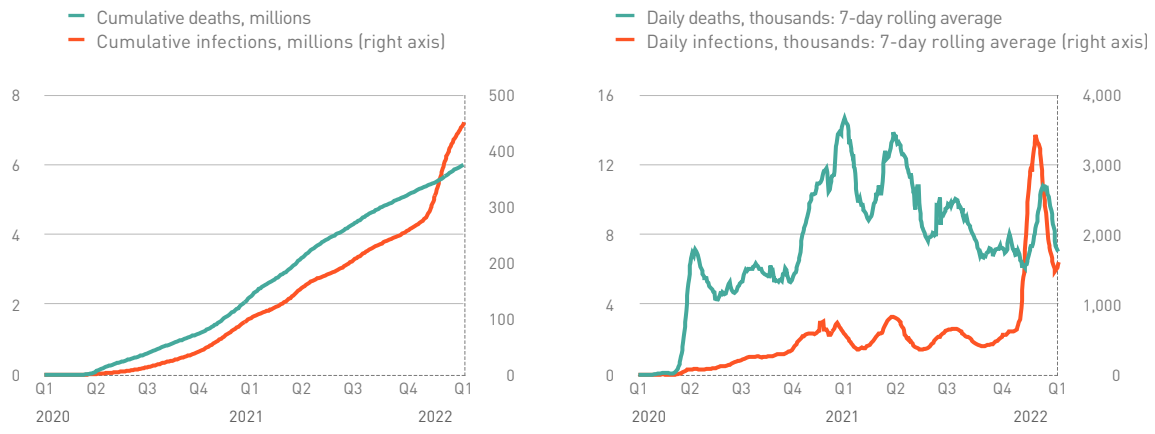
1.1. The COVID-19 pandemic

In December 2019, the World Health Organization (WHO) was first informed of pneumonia of unknown origin affecting people in the city of Wuhan, Hubei province (People's Republic of China), caused by a type-2 coronavirus known as SARS-CoV-2 responsible for severe acute respiratory syndrome. On January 30, 2020, the WHO announced that the outbreak of this new infectious disease (named COVID-19) constituted a Public Health Emergency of International Concern (PHEIC), and on March 11, 2020, after confirming its extensive spread, the WHO declared a global pandemic.

The first pandemic wave, caused by the original SARS-CoV-2 strain, expanded rapidly in a highly interconnected world, overwhelming many healthcare systems around the globe, which were at times unable to assist all the infected patients who required urgent medical care to survive. On December 31, 2020, the first effective vaccine against SARS-CoV-2 (Pfizer-BioNTech's "BNT162b2") was approved for the WHO Emergency Use Listing (EUL). Since the appearance of the severe acute respiratory syndrome, social distancing measures and the different vaccines developed have played a key role in mitigating the virus's impact on public health and its economic and social consequences (see Box 1.1).

As of March 14, 2022, the number of cases around the world has exceeded 456 million, and the COVID-19 death toll has reached 6 million, representing 1.3% of total diagnosed cases, according to data from Johns Hopkins University[1] (see Chart 1.1). However, the number of both diagnosed cases and reported deaths from COVID-19 represent only a fraction of the real data (which is unknown) due to the limits in testing capabilities or underreporting, a circumstance that is particularly observed in most of the emerging and developing countries. The number of vaccines administered as of that date exceeded 10.6 billion. Again, the less developed countries have low percentages of vaccinated population at this time, especially

Chart 1.1:
Global: daily COVID-19 infections and deaths



Source: MAPFRE Economics (based on data from the Coronavirus Government Response Tracker, University of Oxford, updated 3/14/2022)

Box 1.1
COVID-19 vaccines

Vaccines

Although vaccine research and development takes four to seven years, the urgent need for COVID-19 vaccines significantly accelerated this process, allowing them to be approved less than a year after the start of the pandemic. Therefore, some phases of the process were carried out simultaneously to uphold clinical and safety standards. In this regard, several types of COVID-19 vaccines were developed[1]:

- *Vaccines with inactivated or weakened virus*, which use an inactivated or weakened form of the virus that does not cause disease but still generates an immune response.
- *Protein-based vaccines*, which use harmless fragments of proteins or protein shells that mimic the COVID-19 virus to safely generate an immune response.
- *Viral vector vaccines*, which use a safe form of the virus that cannot cause disease, but serves as a platform to produce coronavirus proteins to generate an immune response.
- *RNA and DNA vaccine*, a cutting-edge approach that uses genetically engineered RNA (ribonucleic acid) or DNA (deoxyribonucleic acid) to generate a protein that, in turn, safely prompts an immune response.

There follows a brief overview of the vaccines included in the Emergency Use Listing (EUL) of the World Health Organization (WHO) at the end of 2021 and the dates on which they were added. In the procedure for inclusion in the Emergency Use Listing, COVID-19 vaccines are evaluated for quality, safety, and effectiveness. This is a prerequisite for vaccines to be supplied through the COVAX mechanism, allowing countries to accelerate their own regulatory approval procedures to import and administer vaccines against the virus. COVID-19 Vaccines Global Access (COVAX) is one of the three pillars of the ACT Accelerator (Access to COVID-19 Tools), launched in April 2020 in response to the pandemic. It brings together governments, global health organizations, manufacturers, scientists, the private sector, civil society, and philanthropy to provide innovative, equitable access to COVID-19 testing, treatments, and vaccines.

- *BNT162b2 from Pfizer-BioNTech* (December 31, 2020). Marketed under the name Comirnaty, it contains an mRNA molecule that has instructions to produce the *spike protein* (S protein). This protein is found on the surface of the SARS-CoV-2 virus and is necessary to enter the body's cells. When a person receives the vaccine, some of their cells will read the mRNA instructions and temporarily produce the spike protein. The person's immune system will recognize this protein as foreign and produce antibodies and activated T cells to fight back.
- *ChAdOx1-S/nCoV-19 [recombinant] developed by the University of Oxford and AstraZeneca*. On February 15, 2021, the WHO approved two versions of the AstraZeneca/Oxford vaccine against COVID-19, which are produced by AstraZeneca-SKBio (South Korea) and the Serum Institute of India, for its Emergency Use Listing. Although they are the same vaccine, they required separate review procedures and approvals because they are manufactured in different production facilities. The ChAdOx1-S/nCoV-19 [recombinant] vaccine uses a non-replicative adenovirus vector against 2019 coronavirus disease. It expresses the SARS CoV-2 spike protein gene, sending the receptor cells instructions to synthesize the SARS CoV-2 singular S protein antigen, which enables the body to generate an immune response and retain that

1/ WHO World Health Organization. *Illnesses caused by coronavirus (COVID-19): Vaccines*. Retrieved from: https://www.who.int/en/news-room/questions-and-answers/item/coronavirus-disease-(covid-19)-vaccines

Box 1.1 (continued)
COVID-19 vaccines

information in the immunological memory cells. It is marketed under the names Vaxzebria and Covishield.

- *Ad26.CoV2.S from Janssen* (March 12, 2021). It is also known as the Johnson & Johnson/Janssen COVID-19 vaccine. It is made up of another virus (adenovirus) modified to contain the gene responsible for forming the SARS-CoV-2 spike protein. Once administered, the vaccine releases the SARS-CoV-2 gene inside the body's cells. The cells will use the gene to produce the spike protein.

- *Moderna COVID-19 vaccine [ARNm-1273]* (April 30, 2021). The vaccine's name was changed to Spikevax on June 22, 2021. Like the Pfizer vaccine, it contains a molecule called messenger RNA (mRNA) that carries instructions for making the spike protein.

- *Sinopharm COVID-19 vaccine* (May 7, 2021). Manufactured by the Beijing Institute of Biological Products (BIBP), a China National Biotec Group (CNBG) subsidiary. The Chinese company National Pharmaceutical Group (Sinopharm) is the parent company of the CNBG. The vaccine's brand name is Covilo, and it is also known as BBIBP-CorV. It is an inactivated, whole virus vaccine that uses aluminum hydroxide as an adjuvant.

- *CoronaVac vaccine from Sinovac* (June 1, 2021). Developed by the Chinese pharmaceutical company Sinovac Biotech, it is an inactivated whole virus vaccine strengthened by aluminum hydroxide.

- *BBV152 (Covaxin) vaccine from Bharat Biotech* (November 3, 2021). Developed by the Bharat Biotech laboratory and the Indian Council of Medical Research (ICMR), it is formulated using an inactivated SARS-CoV-2 antigen.

- *NVX-CoV2373 vaccine, called Covovax* (December 17, 2021), is produced by the Serum Institute of India under license from Novavax. It is a subunit of the vaccine developed by Novavax and the Coalition for Epidemic Preparedness Innovations (CEPI). The original product produced by Novavax is called Nuvaxovid. It is a recombinant protein nanoparticle vaccine with Matrix-M adjuvant.

- *Nuvaxovid COVID-19 vaccine*. On December 20, 2021, the WHO granted a second Emergency Use Listing for the Novavax vaccine manufactured by the Serum Institute of India. It contains a laboratory-produced version of a protein found on the surface of SARS-CoV-2 (the spike protein) and an adjuvant, which is a substance that helps strengthen the immune response.

In Europe, five COVID-19 vaccines were granted conditional marketing authorization in the EU/EEA from the European Commission, based on the scientific opinion of the European Medicines Agency: Comirnaty (BNT162b2), Spikevax (mRNA-1273), Vaxzevria (AZD1222), COVID-19 Vaccine Janssen (Ad26.COV 2.5), and Novavax's Nuvaxovid COVID-19 vaccine (NVX-CoV2373). In addition to the above list, mention should be made of the Gam-COVID-Vac (Sputnik V) vaccine, developed by Russia's Gamaleya National Center for Epidemiology and Microbiology, which has been approved in 71 countries. Sputnik V comprises two different viruses in the adenovirus family, Ad26 and Ad5, which have been modified to contain the gene to produce the SARS-CoV-2 spike protein. The two adenoviruses are administered separately: Ad26 is used in the first dose, and Ad5 is used in the second dose to enhance the vaccine's effect.

Box 1.1 (continued)
COVID-19 vaccines

Subsequently, the Russian Ministry of Health registered the single-dose Sputnik Light vaccine, which is based on the first component (recombinant human adenovirus serotype 26 [Ad26]) of the Sputnik V vaccine. Sputnik V is not yet approved by the European Medicines Agency (EMA) or the WHO, which means that COVAX cannot use it.

Effectiveness and safety

After vaccines are approved and put on the market, the regulatory authorities and manufacturers must continue to monitor their effectiveness and safety closely. Examining the medical literature written to verify vaccine effectiveness in real-world settings is one of the tools used to do that monitoring. It has been more than a year since the first vaccine was approved, and prestigious medical journals and government institutions have published the results of numerous studies on vaccine effectiveness in the population.

In the United States, after a vaccine is approved by the Food and Drug Administration (FDA) for emergency use, the Centers for Disease Control and Prevention (CDC) and other federal partners evaluate the effectiveness of COVID-19 vaccines in real conditions. An important system that the CDC uses to track COVID-19-associated hospitalization rates is COVID-NET (Coronavirus Disease 2019 (COVID-19)-Associated Hospitalization Surveillance Network), which covers approximately 10% of the U.S. population. A recent COVID-NET publication evaluated the effectiveness of COVID-19 vaccines in preventing hospitalization among adults aged 65 and older[2]. After the clinical trials of the Pfizer-BioNTech, Moderna, and Janssen (Johnson & Johnson) COVID-19 vaccines showed high efficacy in preventing symptomatic disease (including moderate to severe), this real-world study adds that among adults aged 65 to 74, the effectiveness of full vaccination in preventing hospitalization was 96% for the Pfizer-BioNTech, 96% for the Moderna, and 84% for the Janssen vaccines. Among adults aged 75 and older, the effectiveness of full vaccination in preventing hospitalization was 91% for the Pfizer-BioNTech, 96% for the Moderna, and 85% for the Janssen (Johnson & Johnson) vaccines. It should be noted that this analysis took place before Delta became the predominant variant.

Meanwhile, the European Centre for Disease Prevention and Control (ECDC) is creating a new infrastructure to enable regular monitoring and analysis of COVID-19 vaccine efficacy over time. Since October 2021, more than 30 hospitals in 10 EU countries have participated in this monitoring in hospital settings: Belgium, Czech Republic, Croatia, France, Greece, Ireland, Luxembourg, Malta, Portugal, and Spain. In October 2021, the ECDC published an initial report indicating a high vaccine effectiveness of 90% in preventing hospitalization when evaluated 14 days after the full vaccination protocol for vaccines that received conditional marketing authorization from the European Medicines Agency. Data was collected between December 2020 and June 2021. An update published in January 2022 aims to estimate the vaccine's efficacy among patients with severe acute respiratory infections (SARI), aged 50 and older from the start date of the first vaccination campaign on December 27, 2020, until June 30, 2021. The results suggest high vaccine effectiveness in preventing SARI associated with SARS-CoV-2, confirmed in the laboratory for the vaccines administered during the first six months of the vaccination campaign in countries in the European Union and European Economic Area for all age groups of 50 and older, albeit with broad confidence intervals. Adjusted vaccine effectiveness against laboratory-confirmed

2/ Moline HL, Whitaker M, Deng L, et al (2021). Effectiveness of COVID-19 Vaccines in Preventing Hospitalization Among Adults Aged ≥65 Years — COVID-NET, 13 States, February–April 2021. *MMWR Morb Mortal Wkly Rep* 2021;70:1088-1093. DOI: 10.15585/mmwr.mm7032e3

Box 1.1 (continued)
COVID-19 vaccines

SARS-CoV-2 among hospitalized patients with SARI observed ⩾ 14 days after full vaccination with any vaccine product was 90% (95% confidence interval [CI]: 83–95%). The analysis results by age group showed that adjusted vaccine effectiveness was higher in patients aged 50–64 than in the older age groups. Adjusted vaccine effectiveness for Comirnaty (the only vaccine product that could be used in individual product-adjusted vaccine effectiveness estimates) observed more than 14 days after full vaccination (two doses) was 94% (95% CI: 88-97%)[3].

A study by Andrews et al. (2021)[4] estimates vaccine efficacy over time from the second dose for Comirnaty (Pfizer), Vaxzevria (AstraZeneca), and Spikevax (Moderna) in the United Kingdom. The results "provide evidence of waning of protection against symptomatic infection for the Vaxzevria and Comirnaty vaccines from 10 weeks after receiving the second dose. However, protection against hospitalization and death was sustained at high levels for at least 20 weeks after receipt of the second dose. Beyond 20 weeks, more waning was observed with Vaxzevria than with Comirnaty, although the groups receiving each vaccine differed. Waning protection against hospitalization was greater in older adults and participants in a clinical risk group. Among persons 65 years of age or older who were not in a clinical risk group, however, protection against hospitalization remained close to 95% with Comirnaty and just under 80% with Vaxzevria at 20 weeks or more after receipt of the second dose."

Another study using data from 21 U.S. hospitals in March-August 2021 looks at the effectiveness of Moderna and Pfizer-BioNTech's two-dose mRNA vaccines and Janssen's single-dose viral vector vaccine in preventing hospitalizations. The Moderna and Pfizer vaccines were 93% and 88% effective, respectively, in preventing hospitalization for COVID-19, while Janssen's single-dose vaccine had somewhat lower effectiveness of 71%. People who received the Janssen vaccine also had lower post-vaccination SARS-CoV-2 antibody levels than those who received mRNA vaccines. Although the Janssen vaccine had lower observed effectiveness, a single dose of this vaccine reduced the risk of COVID-19-associated hospitalization by 71%[5].

Although mRNA vaccines have shown high efficacy in preventing symptomatic infection, hospitalization, and death, there is limited data on the duration of immune responses and their relationship to age and side effects. In this regard, the study by Naaber et al. (2021)[6] looked at the antibody and memory T cell responses after the two-dose BNT162b2 (Pfizer) vaccine in 122 volunteers up to 6 months. After the second dose, they found a robust antibody response to the spike protein. However, antibody levels declined at 12 weeks and 6 months post-vaccination, indicating a waning of the immune response over time. A weaker antibody response was found in older vaccinated individuals, which correlated with fewer vaccination side effects. The authors note that the long-lasting effect of mRNA vaccines to protect against reinfections or severe COVID-19

3/ European Centre for Disease Prevention and Control (2022). *Interim analysis of COVID-19 vaccine effectiveness against Severe Acute Respiratory Infection due to laboratory-confirmed SARS-CoV-2 among individuals aged 50 years and older, ECDC multi-country study – first update*. ECDC: Stockholm; 2022. https://www.ecdc.europa.eu/en/publications-data/interim-analysis-covid-19-vaccine-effectiveness-against-severe-acute-respiratory

4/ Andrews N, Tessier E, Stowe J, et al. (2021). Vaccine effectiveness and duration of protection of Comirnaty, Vaxzevria and Spikevax against mild and severe COVID-19 in the UK. medRxiv 2021.09.15.21263583; doi: https://doi.org/10.1101/2021.09.15.21263583

5/ Self WH, Tenforde MW, Rhoads JP et al. (2021). Comparative effectiveness of Moderna, Pfizer-BioNTech, and Janssen (Johnson & Johnson) vaccines in preventing COVID-19 hospitalizations among adults without immunocompromising conditions—United States, March–August 2021. *MMWR Morb Mortal Wkly Rep*. 2021; 70: 1337-1343. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8459899/

6/ Naaber P, Tserel L, Kangro K, Sepp E, Jürjenson V, Adamson A, et al. (2021). Dynamics of antibody response to BNT162b2 vaccine after six months: a longitudinal prospective study. *The Lancet Regional Health – Europe*, Volume 10, November 2021, 100208. DOI: https://doi.org/10.1016/j.lanepe.2021.100208

Box 1.1 (continued)
COVID-19 vaccines

disease remains unclear and might depend on antibody responses and T cell immunity.

Elsewhere, an extensive set of observational data was used in Chile to estimate the effectiveness of the CoronaVac vaccine (Sinovac) in preventing COVID-19, hospitalization, ICU admission, and death in the Chilean population[7]. Vaccine effectiveness among partially immunized persons (14 to 28 days after receipt of the first dose) was estimated to be 15.5% (95% CI, 14.2 to 16.8) for the prevention of COVID-19, 37.4% (95% CI, 34.9 to 39.9) for the prevention of hospitalization, 44.7% (95% CI, 40.8 to 48.3) for the prevention of admission to the ICU, and 45.7% (95% CI, 40.9 to 50.2) for the prevention of COVID-19-related death. In the fully immunized group, adjusted vaccine effectiveness was 65.9% (95% confidence interval [CI], 65.2 to 66.6) for the prevention of COVID-19 and 87.5% (95% CI, 86.7 to 88.2) for the prevention of hospitalization, 90.3% (95% CI, 89.1 to 91.4) for the prevention of admission to the ICU, and 86.3% (95% CI, 84.5 to 87.9) for the prevention of COVID-19-related death.

New virus variants

Since the appearance of SARS-CoV-2, the spread of new variants has raised concerns about their transmissibility, virulence, and ability to evade vaccine protection. The SARS-CoV-2 variant B.1.617.2 (Delta) was first detected in India in December 2020 and became the most common variant in that country, later spreading to other countries and continents. The study by López Bernal et al. (2021)[8] analyzes the effectiveness of the BNT162b2 (Pfizer) and ChAdOx1 nCoV-19 (AstraZeneca) vaccines against this variant. The results indicate that the efficacy of these vaccines after one dose was markedly lower among people with the Delta variant (30.7%; 95% confidence interval [CI], 25.2 to 35.7) than among those with the Alpha variant (48.7%; 95% CI, 45.5 to 51.7); the results were similar for both vaccines. After two doses of vaccine, only modest differences in vaccine efficacy were seen with the Delta variant compared to the Alpha variant, which the researchers believe supports the efforts to maximize vaccine uptake with two doses among vulnerable populations.

Regarding the B.1.1.529 (Omicron) variant, which was first identified in South Africa in November 2021 and quickly became the dominant strain, the study by Collie, et al. (2021)[9] estimated the effectiveness of the two-dose BNT162b2 (Pfizer) vaccine against COVID-19 hospitalization caused by this variant during the period from November 15 to December 7 in South Africa, which they dubbed a proxy for dominance of the Omicron variant (Omicron proxy period), against estimates of vaccine effectiveness in the period when the Delta variant was dominant (comparator period). During the Omicron proxy period, they found a vaccine effectiveness of 70% (95% confidence interval [CI], 62 to 76), significantly different from that measured in the comparator period, when it was 93% effective (95% CI, 90 to 94) against COVID-19 hospitalization.

Regarding the same variant, the results of a study carried out by Public Health England in the UK "suggest that the vaccine's effectiveness against symptomatic disease with the Omicron variant is significantly lower than that of the Delta variant and decreases rapidly. However, protection against hospitalization is much greater than that obtained against symptomatic disease, particularly after a booster dose, where the vaccine's effectiveness against

7/ Jara A, Undurraga EA, Cecilia González C, et al (2021). Effectiveness of an Inactivated SARS-CoV-2 Vaccine in Chile. September 2, 2021; *N Engl J Med* 2021; 385:875-884 DOI: https://www.nejm.org/doi/10.1056/NEJMoa2107715

8/ Lopez Bernal J, Andrews N, Gower C et al. (2021) Effectiveness of COVID-19 vaccines against the B.1.617.2 (Delta) variant. *N Engl J Med*. 2021; 385: 585-594. https://www.nejm.org/doi/full/10.1056/NEJMoa2108891

9/ Collie S, Champion J, Moultrie H, Bekker LG, Gray G (2021). Effectiveness of BNT162b2 Vaccine against Omicron Variant in South Africa. *N Engl J Med*. 2021 Dec 29. doi: 10.1056/NEJMc2119270

Box 1.1 (continued)
COVID-19 vaccines

hospitalization is nearly 90%"[10]. There was no effect against Omicron from 20 weeks after the second dose among patients who received two doses of AstraZeneca. Among those who had received two doses of Pfizer or Moderna, efficacy dropped from around 65–70% to around 10% at 20 weeks after the second dose. From 2 to 4 weeks after a booster dose, the vaccine's effectiveness ranged from 65 to 75%, falling to 55–70% from 5 to 9 weeks and 40–50% from 10 weeks after the booster dose.

The different articles analyzed to evaluate vaccine effectiveness with real-world data support the value of vaccinations in preventing infection, serious illness, and death, even with the emergence of different variants. However, since vaccines are not 100% effective, vaccinated people can still be infected with the disease, although they are less likely to develop serious illness than those who are not vaccinated. Protection after a second dose is also greater than that obtained after the first dose. However, the SARS-CoV-2 infection rate increases continuously as the time since vaccination increases, while protection against COVID-19 hospitalization or death seems to hold up better, although it also wanes. For this reason, some researchers are in favor of administering a third dose of vaccine as a booster to specific high-risk populations.

10/ Public Health England. (2021). SARS-CoV-2 variants of concern and variants under investigation in England. Technical briefing 12. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1045619/Technical-Briefing-31-Dec-2021-Omicron_severity_update.pdf

in Africa, where it is estimated that only 13% of the population has been fully vaccinated[2].

After the original strain was detected in Wuhan, new SARS-CoV-2 variants began to appear, which the WHO has been naming with codes and letters of the Greek alphabet and classifying in the categories set out below.

Variants of interest

The so-called variants of interest (VOI) are variants that show changes in the genome that could affect certain characteristics of the virus, such as its transmissibility, the severity of the illness they cause, and treatment efficacy, among others (see Table 1.1-a).

Variants of concern

On the other hand, those classified as variants of concern (VOC) usually have the same characteristics as the aforementioned variants of interest but can also lead to an increase in transmissibility, more severe cases of the disease, greater virulence, and even the reduced effectiveness of vaccines and treatments (see Table 1.1-b).

In its statement on January 19, 2022, the WHO highlighted the challenges posed by the high transmission levels of the SARS-CoV-2 variant of concern of called Omicron (B.1.1.529) and the corresponding burden on public health

Table 1.1-a
COVID-19: variants of interest

WHO name	Lamda	Mu
Lineage (cov-lineages.com)	C.37	B.1.621
Country of first sample	Peru	Colombia
Date of first sample	December 2020	January 2021
Date designated	June 14, 2021	August 30, 2021

Source: OMS and cov-lineages.org

Table 1.1-b
COVID-19: variants of concern (VOC)

WHO name	Alpha	Beta	Gamma	Delta	Omicron
Lineage (cov-lineages.com)	B.1.1.7	B.1.351	P.1	B.1.617.2	B.1.1.529
Country of first sample	United Kingdom	South Africa	Brazil	India	Many different countries.
Date of first sample	September 2020	May 2020	November 2020	October 2020	November 2021
Date designated	December 18, 2020	December 18, 2020	January 11, 2021	VOI (April 4, 2021) VOC (May 11, 2021)	VOI (November 24, 2021) VOC (November 26, 2021)

Source: OMS and cov-lineages.org

systems and health service delivery, concluding that the COVID-19 pandemic continues to be a Public Health Emergency of International Concern[3].

Currently, Omicron is the last strain to be classified by the WHO as a variant of concern. It has a large number of mutations and high transmissibility, rapidly displacing other variants. According to one of the most recent reports published by the WHO, this variant is present in nearly all countries, although since the start of 2022 case numbers have been decreasing in many affected countries[4].

The relative numbers of hospitalizations and deaths are lower than those caused by other variants, despite the marked increase in cases detected a few weeks after its expansion throughout the different countries. It is still unclear whether this is a consequence of this variant's lower lethality, or whether it is related to its spread among younger populations, or to a combination of both factors.

Variants under monitoring

As these variants may or may not cause risks in the future, they are under continuous study and monitoring to assess their impact and reclassify them as appropriate That is why, for now, the WHO has not named these strains. Currently, these variants correspond to the[5] B.1.1.318, C.1.2, and B.1. 640 lineages.

Formerly monitored variants

These variants were classified as of interest, of concern, or under monitoring and have been reclassified in this category[6] upon verification that they no longer pose significant risks to global health.

1.2 Methodological aspects of the analysis

This study focuses on the behavior of mortality during the first two years of the COVID-19 pandemic (2020 and 2021), and in particular, the observed excess mortality compared to the pre-pandemic situation, in what would be a "normal" environment from the epidemiological point of view. For the purposes of this report, the excess mortality indicator was constructed by comparing the data on deaths per 100,000 people during 2020 and 2021 to the average deaths per 100,000 people in the four years prior to the pandemic (2016–2019). This is calculated using three levels of aggregation (yearly, quarterly, and monthly), organizing the death counts per epidemiological weeks into months, quarters, and calendar years in order to facilitate comparison.

Through these calculations of excess mortality, we can easily identify the different pandemic waves that have impacted the analyzed countries, giving an idea of their

severity (direct and indirect), drawing comparisons, and seeking correlations with other variables that may have influenced the pandemic's impact. These may include the countries' per capita income, efficiency measures implemented by healthcare systems during pre-pandemic periods, travel restrictions, economic management during the pandemic, and implemented vaccination programs.

The calculation in yearly terms is made by comparing annual mortality in 2020 (per 100,000 people) with the average in 2016-2019 to obtain the percentages of annual excess mortality in 2020. Likewise, annual mortality in 2021 is compared with the 2016–2019 average to obtain the percentages of annual excess mortality in 2021 (for all countries with data for the 52 epidemiological weeks in that year). Similarly, to calculate quarterly and monthly excess mortality, we compared the deaths by month and quarter in 2020 and 2021 with the quarterly and monthly averages in the same four years prior to the pandemic (2016-2019).

Excess mortality was calculated using a relative measure that considers the population of the countries in the different years examined to eliminate, as far as possible, the impact of an increase or decrease in a country's population on the absolute number of deaths. For this reason, data on deaths per 100,000 people is used. Furthermore, instead of a longer term, four years were used to calculate the average to avoid the distortion that could be produced by changes in the structure of some countries' population pyramids caused by the transition towards older populations, which leads to a natural increase in the number of deaths. This demographic transition is a slow process, and its potential effects over a relatively short period of four years are negligible, as reflected by the mortality data between 2016 and 2019 in the analyzed countries.

For a group of 15 select countries in the Americas, Europe, and the Asia-Pacific region, the analysis is complemented by a study of daily deaths due to COVID-19 (7-day rolling average), as well as the observed travel restrictions, economic impacts, and the percentage of fully vaccinated population. It should be noted that the index maintained by the University of Oxford, based on high-frequency indicators extracted from the "Our World in Data" platform, was used for travel restrictions (as well as the other two indicators).

2. Analysis of excess mortality in select countries

2.1 The Americas

2.1.1 Canada

In Canada, an analysis of weekly mortality data since 2011 reveals a markedly seasonal pattern with deaths concentrated around January, coinciding with the boreal winter. The same pattern was observed in all the countries in the Northern Hemisphere analyzed in this study. The distortion caused by the SARS-CoV-2 virus is also reflected, with deaths peaking in the spring of 2020 during April and May, which is atypical compared to the rest of the data (see Charts 2.1.1-a and 2.1.1-b).

If we analyze excess mortality from the start of the pandemic and throughout 2020 and 2021, the highest excess deaths were

Chart 2.1.1-a
Canada: Total weekly deaths

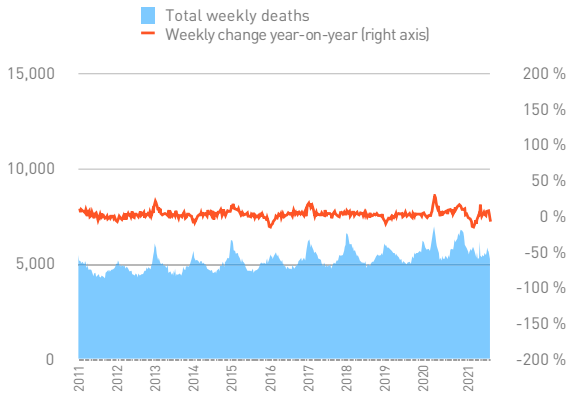


Chart 2.1.1-b
Canada: Total weekly deaths vs. total population

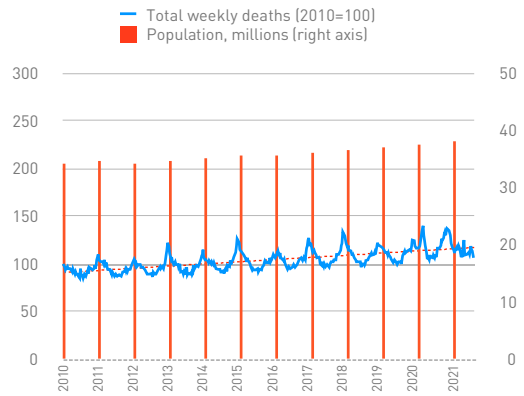


Chart 2.1.1-c
Canada: deaths due to COVID-19 vs. measures adopted

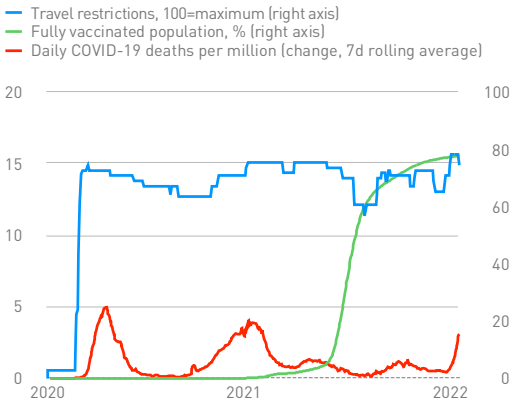
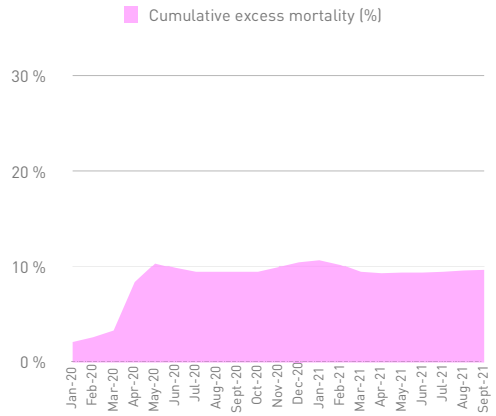


Chart 2.1.1-d
Canada: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

Table 2.1.1
Canada: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-0.2 %	8.5 %
Excess mortality (February)	0.9 %	0.6 %
Excess mortality (March)	2.4 %	-2.4 %
Excess mortality (April)	21.9 %	3.5 %
Excess mortality (May)	16.2 %	6.3 %
Excess mortality (June)	4.7 %	6.8 %
Excess mortality (July)	5.1 %	7.9 %
Excess mortality (August)	6.3 %	8.3 %
Excess mortality (September)	7.5 %	9.5 %
Excess mortality (October)	6.6 %	N/A
Excess mortality (November)	12.5 %	N/A
Excess mortality (December)	13.8 %	N/A
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	1.9 %	3.3 %
Excess mortality (second quarter, Q2)	15.5 %	6.4 %
Excess mortality (third quarter, Q3)	7.2 %	9.5 %
Excess mortality (fourth quarter, Q4)	12.0 %	N/A
Annual excess mortality by age groups (%)		
All ages	8.1 %	N/A
Over 85 years old	8.5 %	N/A
Between 75 and 84 years old	7.6 %	N/A
Between 65 and 74 years old	8.8 %	N/A
Between 0 and 64 years old	7.2 %	N/A
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	24	1,050
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	249	1,137
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	148	547
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	1,111	1,468
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.4	19.0
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	22.5	8.8
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	1.6	4.1
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	16.8	6.5
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	1.6 %	1.8 %
Reported mortality rate Q2 (in the quarter)	9.0 %	0.8 %
Reported mortality rate Q3 (in the quarter)	1.1 %	0.8 %
Reported mortality rate Q4 (in the quarter)	1.5 %	0.4 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	15,321	42,018
Reported COVID-19 deaths (per million people, in the year)	413	383
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	2.7 %	0.9 %
Total population (millions)	37.7	38.1
Total deaths in the year (people, cumulative)	312,265	N/A
Total reported COVID-19 deaths (people, cumulative)	15,736	30,319
Reported COVID-19 mortality rate in relation to total deaths	5.0 %	N/A

Table 2.1.1 (continued)
Canada: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	1.9 %
Percentage of population fully vaccinated Q2	no record	30.9 %
Percentage of population fully vaccinated Q3	no record	71.0 %
Percentage of population fully vaccinated Q4	start	77.3 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	14.5	74.4
Travel restrictions index, mean Q2 (0=no restrictions)	71.5	74.5
Travel restrictions index, mean Q3 (0=no restrictions)	66.3	66.0
Travel restrictions index, mean Q4 (0=no restrictions)	67.5	70.1
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-0.6 %	0.3 %
GDP change year-on-year Q2	-12.4 %	11.8 %
GDP change year-on-year Q3	-4.9 %	4.0 %
GDP change year-on-year Q4	-3.1 %	3.1 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	0.1	1.3
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	0.8	1.2
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	0.2	0.7
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	1.1	0.8
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	0.0	0.2
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	0.2	0.4
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.0	0.2
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.2	0.2
Hospital capacity and healthcare workers at the start of the pandemic	2019 or closest	
Hospital beds per 10,000 people	25	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	27	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	100	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

observed in April and May 2020, coinciding with the first pandemic wave caused by the original SARS-CoV-2 strain. In this period, deaths per 100,000 people were 21.9% and 16.2% higher, respectively, than average for the same months of the previous four years (see Table 2.1.1). To address this situation, the Canadian authorities adopted travel restrictions that peaked in April 2020 (74.45 points out of 100 on the stringency index maintained by the University of Oxford). The next highest excess mortality levels are observed in November and December 2020, coinciding with the pandemic wave caused by the Alpha variant, although they were lower than observed with the original strain of the virus (12.5%and 13.8%, respectively). It should be noted that in those months, the country had not yet started to vaccinate its population (see Chart 2.1.1-c).

Based on the 2021 data, up to epidemiological week 41, it can be deduced that excess mortality was generally positive throughout the year but lower than in 2020, during which full vaccination of 77% of the population was

gradually achieved. Excess mortality in cumulative terms peaked at 10.6% in January 2021 and later stabilized, although a rebound can be observed at the end of the year, which is also reflected in daily deaths (see Charts 2.1.1-c and 2.1.1-d).

2.1.2. United States

Weekly mortality data in the United States since 2015 follows a seasonal pattern, with deaths concentrated around the month of January, coinciding with winter. The distortion caused by the SARS-CoV-2 outbreak is also observed, with a spike in deaths in the spring, during April and May 2020, which is atypical compared to the rest of the data (see Charts 2.1.2-a and 2.1.2-b).

If we analyze the excess mortality observed since the start of the pandemic and throughout 2020 and 2021 (see Table 2.1.2), the first pandemic wave caused by the original SARS-CoV-2 variant had a strong impact. This is reflected in the excess deaths in April and May 2020, which were 35.8% and 20.0% higher, respectively, than the average deaths per 100,000 people during the same months of the previous four years.

However, excess mortality in the United States peaked in December 2020 and January

Chart 2.1.2-a
United States: total weekly deaths

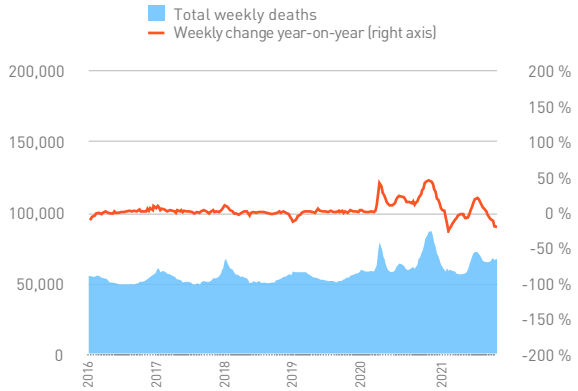


Chart 2.1.2-b
United States: total weekly deaths vs. total population

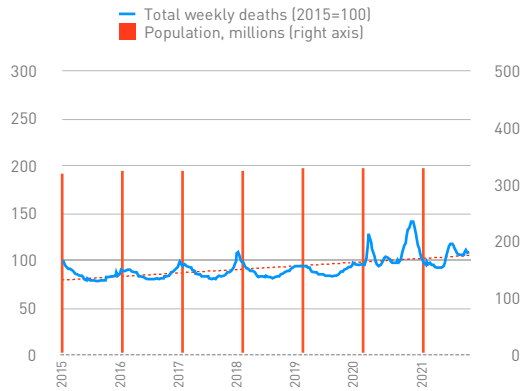


Chart 2.1.2-c
United States: deaths due to COVID-19 vs. measures adopted

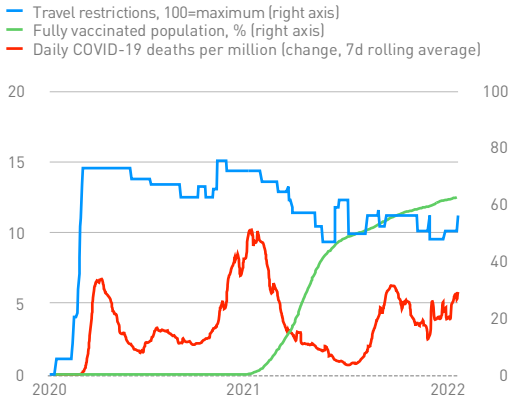
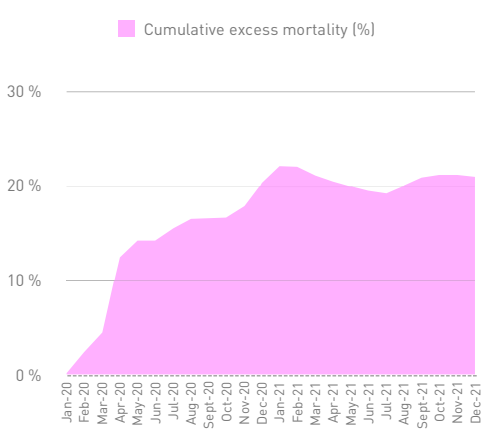


Chart 2.1.2-d
United States: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

Table 2.1.2
United States: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-1.4 %	38.6 %
Excess mortality (February)	3.3 %	18.4 %
Excess mortality (March)	6.9 %	6.1 %
Excess mortality (April)	35.8 %	8.2 %
Excess mortality (May)	20.0 %	9.8 %
Excess mortality (June)	12.3 %	9.0 %
Excess mortality (July)	22.1 %	12.1 %
Excess mortality (August)	22.1 %	32.0 %
Excess mortality (September)	15.4 %	37.5 %
Excess mortality (October)	15.4 %	23.8 %
Excess mortality (November)	28.2 %	17.9 %
Excess mortality (December)	42.2 %	15.1 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	3.5 %	22.1 %
Excess mortality (second quarter, Q2)	23.6 %	9.6 %
Excess mortality (third quarter, Q3)	20.6 %	27.8 %
Excess mortality (fourth quarter, Q4)	29.7 %	19.5 %
Annual excess mortality by age groups (%)		
All ages	18.4 %	18.8 %
Over 85 years old	14.5 %	4.5 %
Between 75 and 84 years old	21.8 %	20.6 %
Between 65 and 74 years old	23.9 %	30.2 %
Between 0 and 64 years old	16.1 %	25.6 %
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	58	3,117
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	737	964
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	1,381	2,928
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	3,891	3,384
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	1.6	60.0
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	36.6	15.9
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	23.9	28.6
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	43.5	38.5
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	2.8 %	1.9 %
Reported mortality rate Q2 (in the quarter)	5.0 %	1.6 %
Reported mortality rate Q3 (in the quarter)	1.7 %	1.0 %
Reported mortality rate Q4 (in the quarter)	1.1 %	1.1 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	60,656	103,928
Reported COVID-19 deaths (per million people, in the year)	1,057	1,429
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	1.7 %	1.4 %
Total population (millions)	331.0	332.9
Total deaths in the year (people, cumulative)	3,439,368	3,412,035
Total reported COVID-19 deaths (people, cumulative)	351,754	827,634
Reported COVID-19 mortality rate in relation to total deaths	10.2 %	13.9 %

Table 2.1.2 (continued)
United States: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	19.1 %
Percentage of population fully vaccinated Q2	no record	48.4 %
Percentage of population fully vaccinated Q3	no record	56.4 %
Percentage of population fully vaccinated Q4	start	61.9 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	17.3	67.9
Travel restrictions index, mean Q2 (0=no restrictions)	72.0	54.4
Travel restrictions index, mean Q3 (0=no restrictions)	66.6	53.7
Travel restrictions index, mean Q4 (0=no restrictions)	68.5	52.0
Economic impacts, change in real GDP		
GDP change year-on-year Q1	0.6 %	0.5 %
GDP change year-on-year Q2	-9.1 %	12.2 %
GDP change year-on-year Q3	-2.9 %	4.9 %
GDP change year-on-year Q4	-2.3 %	5.4 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	4.0
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	1.2
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	1.6	2.9
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	3.7	2.8
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	0.2	0.4
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	0.1	0.3
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.1	0.2
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.2	0.1
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	28	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	26	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	120	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

2021 (42.2% and 38.6%, respectively), coinciding with the pandemic wave caused by the Alpha variant of the SARS-CoV-2 virus. In fact, the travel restrictions reached their peak in those months (71.76 points out of 100). The vaccination process started at the end of December 2020, but by the end of January 2021, only 2% of the population had been vaccinated. The next highest levels of excess mortality were reached in August and September 2021 (32.0% and 37.5%, respectively), coinciding with the expansion of the pandemic wave caused by the Delta variant at a time when 50% to 56% of the population was vaccinated. Daily deaths from COVID-19 increased in these months, but to a lesser extent than in the two previous waves (see Chart 2.1.2-c).

From the 2021 data, it can be deduced that excess mortality continues to grow in cumulative terms, despite subsiding a bit in the first half, and while there is no clear reversal of the upward trend, it is far more moderate compared to the initial phases of the pandemic. Therefore, excess mortality stood at around 20% in 2021 (see Chart 2.1.2-d).

2.1.3 Mexico

The weekly mortality data in Mexico, available since 2012, shows a seasonal pattern with deaths concentrated around January, coinciding with winter and in line with the general trend in all the analyzed countries. The outbreak of the SARS-CoV-2 virus in this country caused an unprecedented distortion, as reflected in Charts 2.1.3-a and 2.1.3-b. It was also the largest distortion among the countries considered in this report.

If we analyze the excess mortality observed since the start of the pandemic and throughout 2020 and 2021 (see Table 2.1.3), the first pandemic wave, caused by the original SARS-CoV-2 variant detected in Wuhan in December 2019, had a strong impact on mortality in Mexico. This is reflected in the excess mortality in the second quarter of 2020 when deaths per 100,000 people were 73% higher than average for the same quarter in the previous four years. It

Chart 2.1.3-a
Mexico: Total weekly deaths

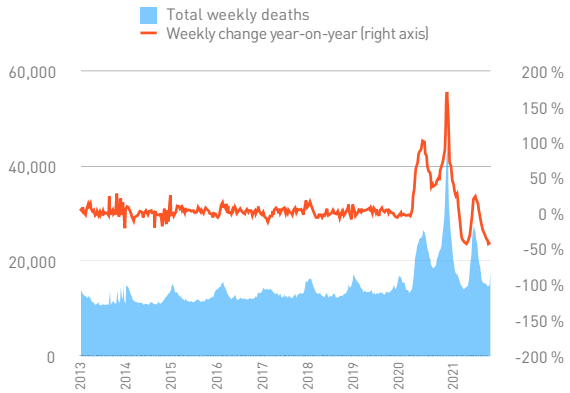


Chart 2.1.3-b
Mexico: Total weekly deaths vs. total population

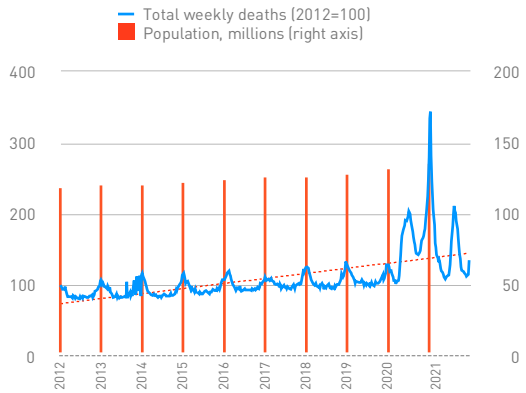


Chart 2.1.3-c
Mexico: deaths due to COVID-19 vs. measures adopted

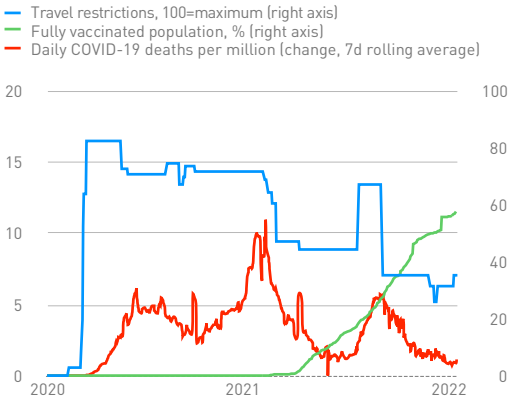
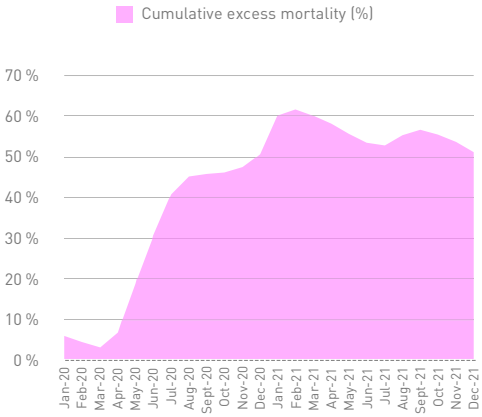


Chart 2.1.3-d
Mexico: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, INEGI, World Mortality Dataset, OECD, and Oxford Economics/Haver)

Table 2.1.3
Mexico: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	3.0 %	149.6 %
Excess mortality (February)	0.0 %	72.4 %
Excess mortality (March)	-2.8 %	32.9 %
Excess mortality (April)	16.0 %	23.4 %
Excess mortality (May)	65.2 %	9.8 %
Excess mortality (June)	90.9 %	10.4 %
Excess mortality (July)	99.3 %	34.6 %
Excess mortality (August)	73.1 %	99.5 %
Excess mortality (September)	47.8 %	75.3 %
Excess mortality (October)	44.7 %	28.4 %
Excess mortality (November)	56.3 %	7.7 %
Excess mortality (December)	76.3 %	-1.5 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	1.3 %	89.3 %
Excess mortality (second quarter, Q2)	58.8 %	15.7 %
Excess mortality (third quarter, Q3)	75.5 %	71.4 %
Excess mortality (fourth quarter, Q4)	61.6 %	12.0 %
Annual excess mortality by age groups (%)		
All ages	46.6 %	45.7 %
Over 85 years old	23.1 %	N/A
Between 75 and 84 years old	42.7 %	N/A
Between 65 and 74 years old	70.2 %	N/A
Between 0 and 64 years old	48.7 %	N/A
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	1	624
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	173	215
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	397	879
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	524	242
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.0	59.4
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	21.3	22.9
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	38.3	34.1
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	37.0	16.8
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	2.4 %	9.5 %
Reported mortality rate Q2 (in the quarter)	12.3 %	10.6 %
Reported mortality rate Q3 (in the quarter)	9.6 %	3.9 %
Reported mortality rate Q4 (in the quarter)	7.1 %	6.9 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	10,948	19,604
Reported COVID-19 deaths (per million people, in the year)	966	1,333
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	8.8 %	6.8 %
Total population (millions)	128.9	130.3
Total deaths in the year (people, cumulative)	1,079,273	1,063,389
Total reported COVID-19 deaths (people, cumulative)	125,807	299,428
Reported COVID-19 mortality rate in relation to total deaths	11.7 %	16.3 %

Table 2.1.3 (continued)
Mexico: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	0.7 %
Percentage of population fully vaccinated Q2	no record	15.0 %
Percentage of population fully vaccinated Q3	no record	35.0 %
Percentage of population fully vaccinated Q4	start	55.9 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	6.8	61.9
Travel restrictions index, mean Q2 (0=no restrictions)	78.8	44.8
Travel restrictions index, mean Q3 (0=no restrictions)	71.7	52.3
Travel restrictions index, mean Q4 (0=no restrictions)	71.9	33.5
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-1.7 %	-2.8 %
GDP change year-on-year Q2	-18.9 %	19.6 %
GDP change year-on-year Q3	-8.4 %	4.7 %
GDP change year-on-year Q4	-4.5 %	1.9 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	-	-
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	-	-
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	10	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	24	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	29	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, INEGI, World Mortality Dataset, OECD, and Oxford Economics/Haver)

should also be noted that excess mortality significantly affected all age groups and was the highest among people aged 65–74 (70.2% in 2020).

The subsequent situation did not markedly improve, and high excess mortality rebounded after the first pandemic wave. The most elevated percentages in the series were reached in December 2020 and January 2021 (76.3% and 149.6%, respectively), coinciding with the expansion of the pandemic wave caused by the Alpha variant, first detected in the United Kingdom, and the appearance of the Gamma strain in Brazil. High excess deaths were also observed in Mexico during

August and September 2021, when the Delta variant was prevalent and vaccination coverage was low, ranging from 20% to 35% of the population.

We therefore observe that the main pandemic waves to date have affected mortality in this country tremendously. However, the Omicron variant seems to be having a significantly lower impact, as reflected by excess mortality in November and December 2021, which is even slightly negative. In these months, daily deaths from COVID-19 decreased (see Chart 2.1.3-c).

Meanwhile, travel restrictions peaked in April and May 2020, with 82.4 points out of 100 (on the stringency index maintained by the University of Oxford). The index then fell gradually, and although restriction levels rose temporarily during the different waves, they remained among the lowest observed in the countries analyzed in this report.

From the 2021 data, it can be deduced that cumulative excess mortality was high, peaking at 60.5% in February 2021. Although these cumulative excesses have since followed a downward trend, they stood at around 50% at the end of 2021, the highest among the countries analyzed (see Chart 2.1.3-d).

2.1.4 Brazil

The weekly mortality data in Brazil, available since 2012, shows a seasonal pattern with deaths concentrated around the month of July, coinciding with the austral winter and in line with the general trend in all the countries analyzed in the Southern Hemisphere. The distortion caused by the SARS-CoV-2 virus in the country can be observed in Charts 2.1.4-a and 2.1.4-b.

If we analyze the excess mortality observed since the start of the pandemic and throughout 2020 and 2021 (see Table 2.1.4), it is clear that the first pandemic wave, caused by the original SARS-CoV-2 variant detected in December 2019, had a significant impact in Brazil. This is reflected in the excess mortality in May and June 2020, which increased by 28.5% and 19.6%, respectively, compared to the average deaths per 100,000 people during the same months of the previous four years.

From that point, excess mortality remained high and surged again in December 2020 and January 2021, coinciding with the expansion of the pandemic wave caused by the Alpha variant, first detected in the United Kingdom, and the emergence of the Gamma variant in Brazil (in Manaus), reaching 23.3% and 37.2%, respectively. March and April 2021 saw the highest levels of excess deaths (85.2% and 74.6%, respectively), also coinciding with the expansion of the Delta variant (originally detected in India) at a time when the vaccination rate in Brazil remained low, from 1% to 7.3% of the population in those months.

Therefore, the main pandemic waves to date have strongly impacted mortality in Brazil, although the data suggests that the Omicron variant is much less impactful, as reflected in the fourth quarter of 2021 when excess mortality was the lowest since the start of the pandemic. During these months, daily deaths from COVID-19 fell sharply. Meanwhile, the

Chart 2.1.4-a
Brazil: total weekly deaths

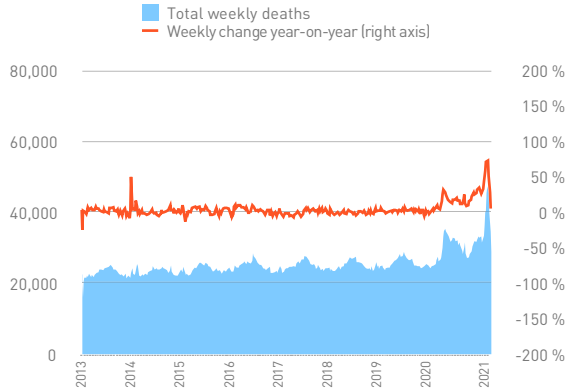


Chart 2.1.4-b
Brazil: total weekly deaths vs. total population

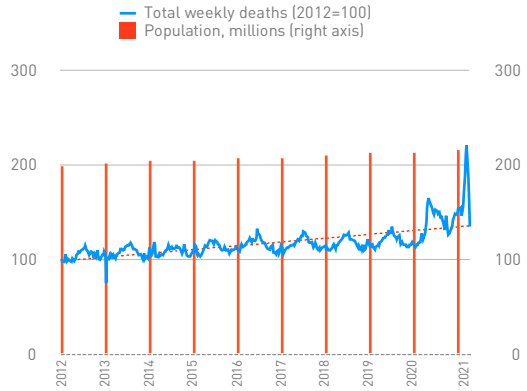


Chart 2.1.4-c
Brazil: deaths due to COVID-19 vs. measures adopted

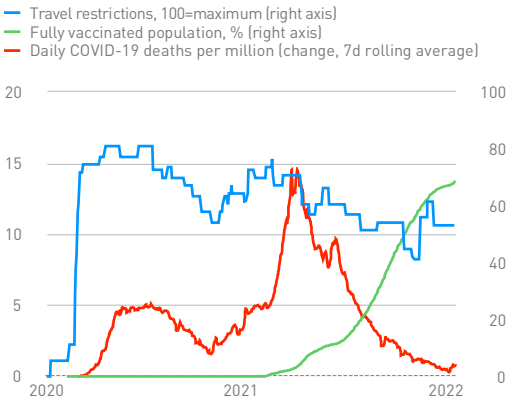
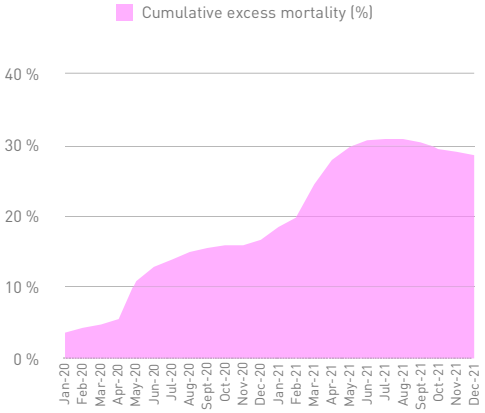


Chart 2.1.4-d
Brazil: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, World Mortality Dataset, Ministério da Saúde-Brasil, OECD, and Oxford Economics/Haver)

travel restrictions adopted peaked in May 2020, reaching a high of 81.02 points out of 100. The index then fell gradually with temporary rebounds during the different waves (see Chart 2.1.4-c).

From the 2021 data, it can be deduced that cumulative excess mortality reached high levels in Brazil, peaking at 30.9% in July and August 2021. These levels have since followed a slight downward trend (see Chart 2.1.4-d).

Table 2.1.4
Brazil: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	1.6 %	37.2 %
Excess mortality (February)	3.2 %	35.5 %
Excess mortality (March)	3.8 %	85.2 %
Excess mortality (April)	5.4 %	74.6 %
Excess mortality (May)	28.5 %	52.8 %
Excess mortality (June)	19.6 %	42.3 %
Excess mortality (July)	17.1 %	30.9 %
Excess mortality (August)	20.4 %	26.9 %
Excess mortality (September)	17.6 %	18.0 %
Excess mortality (October)	16.9 %	8.5 %
Excess mortality (November)	13.9 %	16.3 %
Excess mortality (December)	23.3 %	12.5 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	3.6 %	54.4 %
Excess mortality (second quarter, Q2)	18.9 %	57.3 %
Excess mortality (third quarter, Q3)	19.2 %	26.4 %
Excess mortality (fourth quarter, Q4)	19.0 %	13.1 %
Annual excess mortality by age groups (%)		
All ages	14.5 %	36.9 %
Over 85 years old	14.1 %	N/A
Between 75 and 84 years old	17.5 %	N/A
Between 65 and 74 years old	24.3 %	N/A
Between 0 and 64 years old	9.6 %	N/A
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	3	2,375
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	657	2,714
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	1,591	1,337
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	1,338	402
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.1	59.4
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	27.8	91.8
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	39.4	36.7
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	23.8	10.4
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	3.5 %	2.5 %
Reported mortality rate Q2 (in the quarter)	4.2 %	3.4 %
Reported mortality rate Q3 (in the quarter)	2.5 %	2.7 %
Reported mortality rate Q4 (in the quarter)	1.8 %	2.6 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	35,894	68,277
Reported COVID-19 deaths (per million people, in the year)	912	1,983
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	2.5 %	2.9 %
Total population (millions)	212.6	214.0
Total deaths in the year (people, cumulative)	1,562,838	1,857,040
Total reported COVID-19 deaths (people, cumulative)	195,072	619,334
Reported COVID-19 mortality rate in relation to total deaths	12.5 %	22.8 %

Table 2.1.4 (continued)
Brazil: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	2.4 %
Percentage of population fully vaccinated Q2	no record	12.5 %
Percentage of population fully vaccinated Q3	no record	42.7 %
Percentage of population fully vaccinated Q4	start	67.0 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	16.9	69.5
Travel restrictions index, mean Q2 (0=no restrictions)	77.6	62.9
Travel restrictions index, mean Q3 (0=no restrictions)	73.8	54.5
Travel restrictions index, mean Q4 (0=no restrictions)	60.9	51.7
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-1.4 %	2.6 %
GDP change year-on-year Q2	-10.6 %	12.2 %
GDP change year-on-year Q3	-3.7 %	4.0 %
GDP change year-on-year Q4	-1.0 %	0.4 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	-	-
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	-	-
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	22	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	22	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	101	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, World Mortality Dataset, Ministério da Saúde-Brasil, OECD, and Oxford Economics/Haver)

2.1.5 Chile

The weekly mortality data in Chile, available since 2016, shows a seasonal pattern with deaths concentrated around the month of July, coinciding with the austral winter and in line with what is observed in Brazil and the general trend in all the countries analyzed in the Southern Hemisphere. The distortion caused by the outbreak of the SARS-CoV-2 virus in the country can be observed in Charts 2.1.5-a and 2.1.5-b.

If we analyze the excess mortality observed in Chile since the start of the pandemic and throughout 2020 and 2021 (see Table 2.1.5), we find that the first pandemic wave, caused by the original SARS-CoV-2 variant had a significant impact on excess deaths. This is reflected in May and June 2020, when they increased by 30.3% and 51.6%, respectively, compared to the average deaths per 100,000 people in the same months of the previous four years. Together with Mexico and the United Kingdom, Chile had the highest excess

Table 2.1.5
Chile: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	5.6 %	30.8 %
Excess mortality (February)	3.7 %	32.8 %
Excess mortality (March)	6.0 %	43.4 %
Excess mortality (April)	4.1 %	40.3 %
Excess mortality (May)	30.3 %	35.2 %
Excess mortality (June)	51.6 %	28.8 %
Excess mortality (July)	15.1 %	20.9 %
Excess mortality (August)	8.5 %	9.4 %
Excess mortality (September)	6.7 %	4.8 %
Excess mortality (October)	13.1 %	12.5 %
Excess mortality (November)	10.4 %	19.3 %
Excess mortality (December)	15.1 %	25.3 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	6.1 %	36.3 %
Excess mortality (second quarter, Q2)	31.4 %	35.0 %
Excess mortality (third quarter, Q3)	11.2 %	12.6 %
Excess mortality (fourth quarter, Q4)	13.8 %	19.5 %
Annual excess mortality by age groups (%)		
All ages	15.0 %	24.4 %
Over 85 years old	11.9 %	21.9 %
Between 75 and 84 years old	17.9 %	25.3 %
Between 65 and 74 years old	20.2 %	29.0 %
Between 0 and 64 years old	11.7 %	23.0 %
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	15	2,012
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	1,439	2,917
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	956	512
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	760	792
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.1	34.0
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	29.5	49.0
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	36.7	25.6
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	20.1	8.6
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	0.4 %	1.7 %
Reported mortality rate Q2 (in the quarter)	2.1 %	1.7 %
Reported mortality rate Q3 (in the quarter)	3.8 %	5.0 %
Reported mortality rate Q4 (in the quarter)	2.6 %	1.1 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	31,697	62,331
Reported COVID-19 deaths (per million people, in the year)	864	1,171
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	2.7 %	1.9 %
Total population (millions)	19.1	19.2
Total deaths in the year (people, cumulative)	127,460	137,016
Total reported COVID-19 deaths (people, cumulative)	16,608	39,115
Reported COVID-19 mortality rate in relation to total deaths	13.0 %	16.4 %

Table 2.1.5 (continued)
Chile: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	19.2 %
Percentage of population fully vaccinated Q2	no record	56.1 %
Percentage of population fully vaccinated Q3	no record	73.7 %
Percentage of population fully vaccinated Q4	start	86.1 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	11.1	79.2
Travel restrictions index, mean Q2 (0=no restrictions)	76.0	82.5
Travel restrictions index, mean Q3 (0=no restrictions)	83.7	67.1
Travel restrictions index, mean Q4 (0=no restrictions)	79.5	37.5
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-0.1 %	1.4 %
GDP change year-on-year Q2	-13.7 %	17.5 %
GDP change year-on-year Q3	-9.8 %	17.3 %
GDP change year-on-year Q4	-0.2 %	13.0 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	-	-
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	-	-
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	20	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	26	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	29	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

mortality in these months among the countries considered in this report.

The observed excess mortality fell after the first pandemic wave, but it rebounded between January and May 2021, coinciding with the pandemic wave caused by the Alpha and Gamma variants and, subsequently, with the expansion of the Delta strain, declared a variant of concern by the WHO in May of that year. Excess mortality in Chile then fell significantly, especially in August and September 2021 (9.4% and 4.8%, respectively), when the vaccination rate was high, ranging from 65.4% to 73.7% of the Chilean population.

However, the latest data suggests that the Omicron variant caused excess mortality to rebound in the fourth quarter of 2021, especially in the month of December, when it reached 25.3%. Daily deaths from COVID-19 rose again in this period, yet remained well below the levels reached in previous

Chart 2.1.5-a
Chile: total weekly deaths

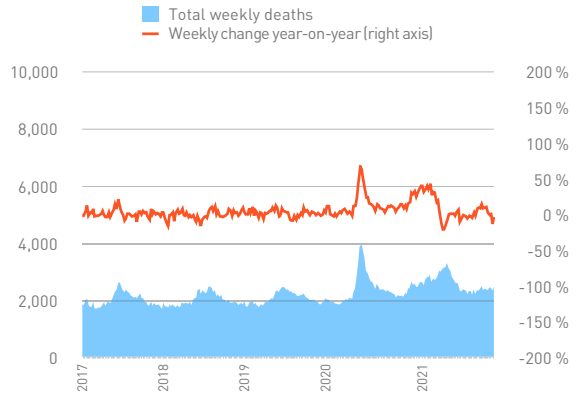


Chart 2.1.5-b
Chile: total weekly deaths vs. total population

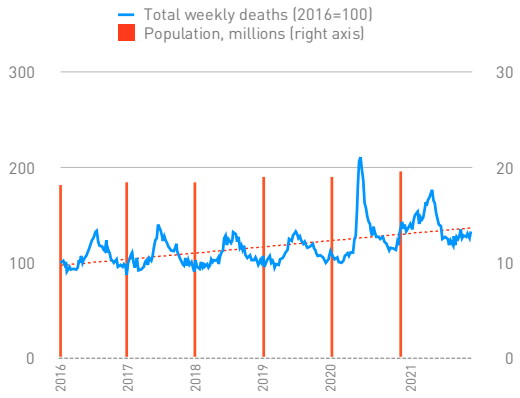


Chart 2.1.5-c
Chile: deaths due to COVID-19 vs. measures adopted

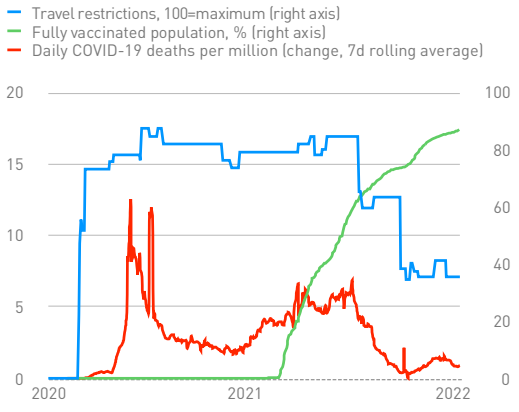
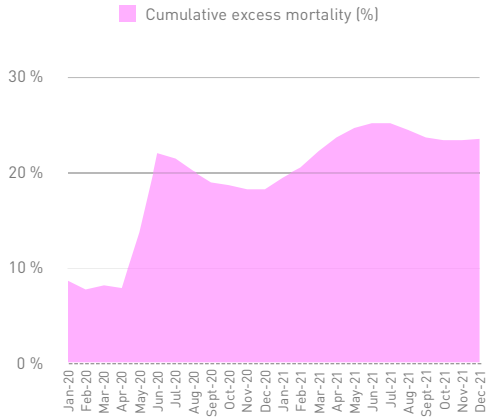


Chart 2.1.5-d
Chile: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

pandemic waves (see Chart 2.1.4-c). The country's travel restrictions peaked in April and July 2021, with a maximum value of 84.72 points out of 100 on the stringency index maintained by the University of Oxford. From that point, the index fell significantly (see Chart 2.1.5-c).

Finally, the 2021 data shows that cumulative excess mortality reached high levels, peaking at 25.1% in June and July 2021. These levels have since followed a slight downward trend, although this was interrupted by the latest upturn in daily mortality (see Chart 2.1.5-d).

2.2 Europe

2.2.1 United Kingdom

The weekly mortality data in the United Kingdom, available since 2015, shows a seasonal pattern with deaths concentrated around the month of January, coinciding with the boreal winter and in line with the general trend in all the countries analyzed in the Northern Hemisphere. The outbreak of the SARS-CoV-2 virus in the UK caused an unprecedented distortion, as can be seen in Charts 2.2.1-a and 2.2.1-b.

Chart 2.2.1-a
United Kingdom: total weekly deaths

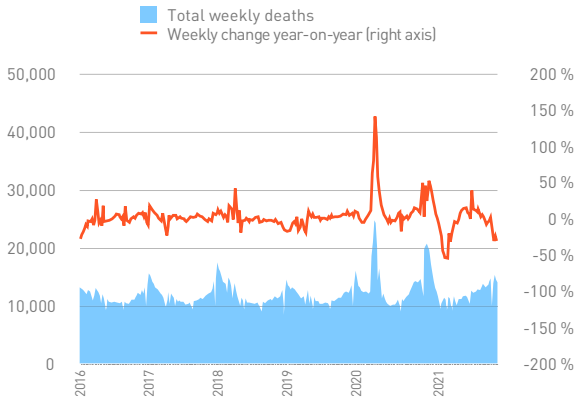


Chart 2.2.1-b
United Kingdom: total weekly deaths vs. total population

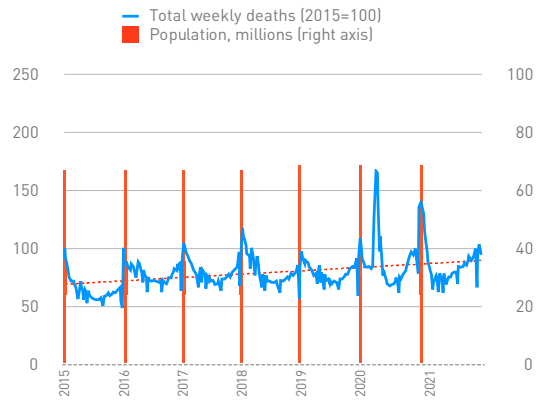


Chart 2.2.1-c
United Kingdom: deaths due to COVID-19 vs. measures adopted

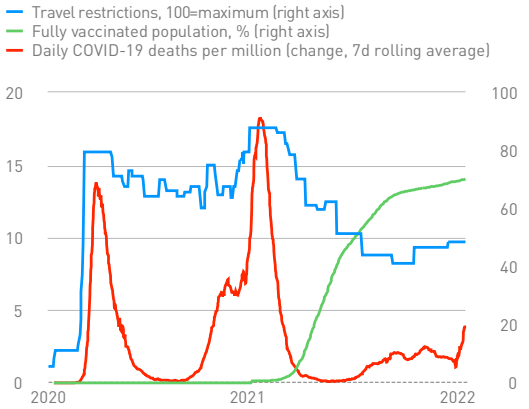
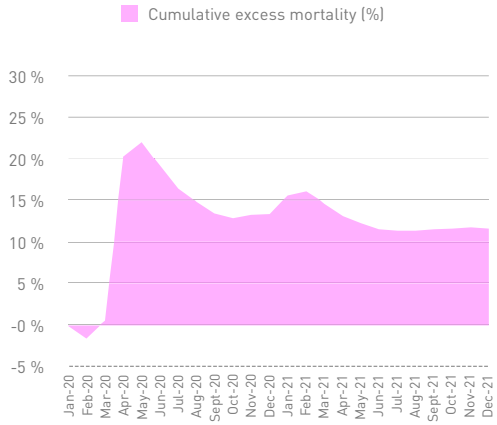


Chart 2.2.1-d
United Kingdom: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

If we analyze the excess deaths observed since the start of the pandemic and throughout 2020 and 2021 (see Table 2.2.1), we find that the first pandemic wave, caused by the original SARS-CoV-2 strain detected in Wuhan in December 2019, strongly impacted mortality in the United Kingdom. This was reflected in excess mortality in April and May 2020, when deaths per 100,000 people were 84.2% and 28.5% higher, respectively, than the average mortality for the same months of the previous four years, among the highest for all countries analyzed during the first pandemic wave.

The situation then improved significantly, especially between July and September after the adoption of travel restrictions. The calculated excess mortality in this period was even negative and was among the lowest observed in the countries analyzed in this report. However, in late 2020 and early 2021, the country saw another surge in excess mortality, which peaked at 35.2% in January 2021, coinciding with the expansion of the pandemic wave caused by Alpha, a variant detected precisely in the UK. Travel restrictions reached their highest level at the time, with a value of 87.96 points out of 100 on

Table 2.2.1
United Kingdom: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-1.5 %	35.2 %
Excess mortality (February)	-4.7 %	20.4 %
Excess mortality (March)	3.7 %	-6.3 %
Excess mortality (April)	84.2 %	-11.6 %
Excess mortality (May)	28.5 %	-4.8 %
Excess mortality (June)	1.3 %	-4.0 %
Excess mortality (July)	-4.4 %	4.4 %
Excess mortality (August)	0.9 %	10.9 %
Excess mortality (September)	-0.5 %	12.3 %
Excess mortality (October)	5.8 %	11.8 %
Excess mortality (November)	16.2 %	11.6 %
Excess mortality (December)	12.1 %	9.0 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	-0.3 %	17.9 %
Excess mortality (second quarter, Q2)	40.1 %	-6.5 %
Excess mortality (third quarter, Q3)	-0.8 %	9.7 %
Excess mortality (fourth quarter, Q4)	12.0 %	11.3 %
Annual excess mortality by age groups (%)		
All ages	11.8 %	7.8 %
Over 85 years old	11.9 %	4.2 %
Between 75 and 84 years old	14.2 %	9.2 %
Between 65 and 74 years old	9.7 %	8.6 %
Between 0 and 64 years old	9.2 %	13.4 %
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	57	2,724
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	360	668
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	249	4,418
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	2,988	7,546
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	3.6	78.0
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	55.7	2.1
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	2.6	12.5
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	46.0	17.6
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	6.4 %	2.9 %
Reported mortality rate Q2 (in the quarter)	15.5 %	0.3 %
Reported mortality rate Q3 (in the quarter)	1.0 %	0.3 %
Reported mortality rate Q4 (in the quarter)	1.5 %	0.2 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	36,533	153,555
Reported COVID-19 deaths (per million people, in the year)	1,079	1,102
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	3.0 %	0.7 %
Total population (millions)	67.9	68.2
Total deaths in the year (people, cumulative)	696,704	665,663
Total reported COVID-19 deaths (people, cumulative)	73,570	148,737
Reported COVID-19 mortality rate in relation to total deaths	10.6 %	11.3 %

Table 2.2.1 (continued)
United Kingdom: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	6.6 %
Percentage of population fully vaccinated Q2	no record	48.5 %
Percentage of population fully vaccinated Q3	no record	65.8 %
Percentage of population fully vaccinated Q4	start	69.5 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	16.7	84.6
Travel restrictions index, mean Q2 (0=no restrictions)	74.9	59.5
Travel restrictions index, mean Q3 (0=no restrictions)	66.2	44.8
Travel restrictions index, mean Q4 (0=no restrictions)	69.5	46.1
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-2.1 %	-5.1 %
GDP change year-on-year Q2	-21.2 %	24.2 %
GDP change year-on-year Q3	-7.8 %	6.8 %
GDP change year-on-year Q4	-6.4 %	6.0 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	1.8	5.8
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	3.2	0.5
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	0.5	1.2
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	3.9	2.1
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	-	0.6
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	0.5	0.1
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.0	0.2
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.3	0.2
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	25	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	30	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	82	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

the stringency index maintained by the University of Oxford in January and February 2021 (see Chart 2.2.1-c).

The situation improved substantially, with negative excess mortality (-11.6% in April 2021) observed at a time when the vaccination rate was still low (ranging from 7.3% to 21.9% of the population in April 2021). After the spread of the Delta variant, excess deaths rose again, but remain well below the levels reached during prior pandemic waves (with vaccination rates above 60%). From the 2021 data, it can be deduced that excess mortality in cumulative terms reached a high of 16.2% in February 2021, when it began to follow a downward trend (see Chart 2.2.1-d).

2.2.2 Germany

The weekly mortality data in Germany, available since 2000, shows a similar behavior pattern to that of the other countries analyzed in the Northern Hemisphere, with a markedly seasonal character and deaths concentrated around the month of January, coinciding with

Chart 2.2.2-a
Germany: total weekly deaths

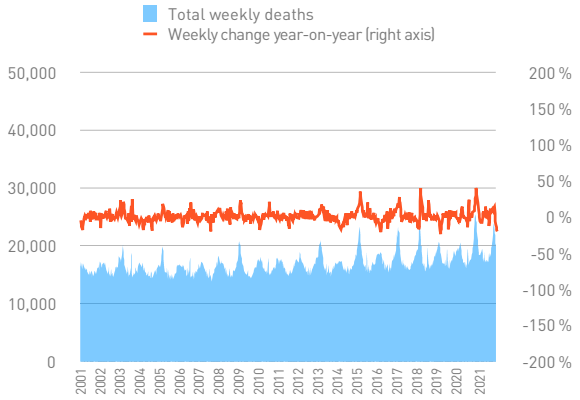


Chart 2.2.2-b
Germany: total weekly deaths vs. total population

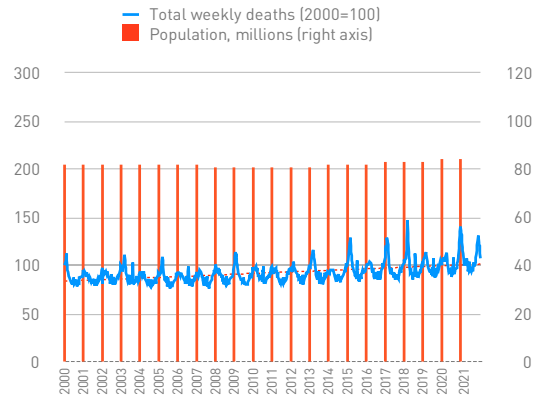


Chart 2.2.2-c
Germany: deaths due to COVID-19 vs. measures adopted

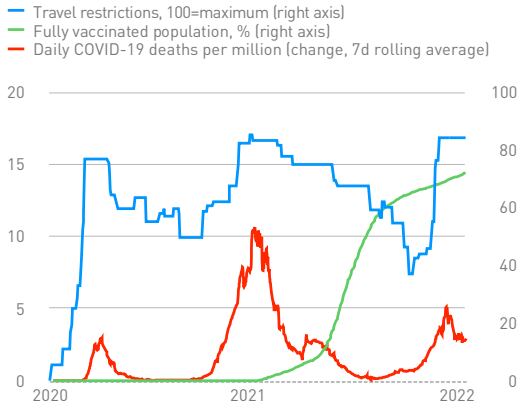
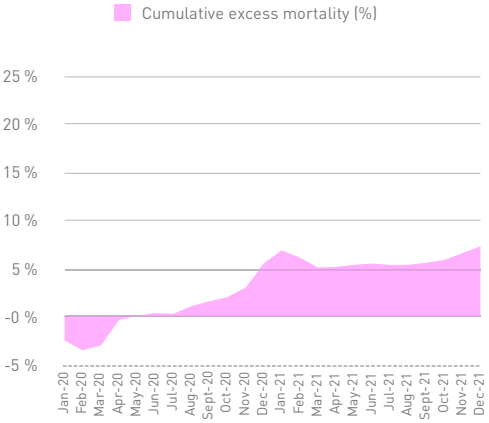


Chart 2.2.2-d
Germany: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

winter (see Charts 2.2.2-a and 2.2.2-b). However, it is observed that the distortion in weekly deaths caused by the SARS-CoV-2 virus presents singularities in the spring of 2020, with a rebound in deaths in April, outside the winter months. Although this phenomenon is less pronounced in Germany than in most countries analyzed.

If we analyze the observed excess mortality since the start of the pandemic and throughout 2020 and 2021, during the month of April 2020 (coinciding with the first pandemic wave caused by the original SARS-CoV-2 variant), deaths per 100,000 people were 7.7% higher than average for the same month in the previous four years (see Table 2.2.2). Therefore, the first pandemic wave had a limited impact in Germany, but excess mortality increased significantly in December 2020 and January 2021, reaching 29.8% and 20.7%, respectively. This coincided with the pandemic wave caused by the Alpha variant and the start of the vaccination process, which was still at its early stages.

Table 2.2.2
Germany: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-3.6 %	20.7 %
Excess mortality (February)	-5.6 %	-3.8 %
Excess mortality (March)	-3.1 %	-9.9 %
Excess mortality (April)	7.7 %	6.1 %
Excess mortality (May)	0.5 %	6.5 %
Excess mortality (June)	1.3 %	7.1 %
Excess mortality (July)	-1.6 %	1.9 %
Excess mortality (August)	6.1 %	3.1 %
Excess mortality (September)	5.0 %	9.8 %
Excess mortality (October)	4.4 %	10.8 %
Excess mortality (November)	12.3 %	21.4 %
Excess mortality (December)	29.8 %	20.7 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	-3.7 %	2.4 %
Excess mortality (second quarter, Q2)	3.6 %	6.7 %
Excess mortality (third quarter, Q3)	3.5 %	5.0 %
Excess mortality (fourth quarter, Q4)	16.3 %	17.9 %
Annual excess mortality by age groups (%)		
All ages	4.4 %	7.5 %
Over 85 years old	8.2 %	11.3 %
Between 75 and 84 years old	2.9 %	2.4 %
Between 65 and 74 years old	3.7 %	13.1 %
Between 0 and 64 years old	-1.4 %	3.0 %
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	86	1,307
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	147	1,064
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	116	600
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	1,733	3,520
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.9	51.0
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	9.8	17.1
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	0.6	3.3
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	29.0	21.9
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	1.1 %	3.9 %
Reported mortality rate Q2 (in the quarter)	6.6 %	1.6 %
Reported mortality rate Q3 (in the quarter)	0.5 %	0.6 %
Reported mortality rate Q4 (in the quarter)	1.7 %	0.6 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	20,821	64,913
Reported COVID-19 deaths (per million people, in the year)	403	933
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	1.9 %	1.4 %
Total population (millions)	83.8	83.9
Total deaths in the year (people, cumulative)	1,001,381	1,015,435
Total reported COVID-19 deaths (people, cumulative)	33,791	112,111
Reported COVID-19 mortality rate in relation to total deaths	3.4 %	7.7 %

Table 2.2.2 (continued)
Germany: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	5.1 %
Percentage of population fully vaccinated Q2	no record	37.2 %
Percentage of population fully vaccinated Q3	no record	64.1 %
Percentage of population fully vaccinated Q4	start	70.6 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	20.3	81.0
Travel restrictions index, mean Q2 (0=no restrictions)	67.3	72.6
Travel restrictions index, mean Q3 (0=no restrictions)	55.1	61.3
Travel restrictions index, mean Q4 (0=no restrictions)	64.3	60.1
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-1.9 %	-3.0 %
GDP change year-on-year Q2	-11.3 %	10.0 %
GDP change year-on-year Q3	-3.7 %	2.6 %
GDP change year-on-year Q4	-2.9 %	1.3 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	-	-
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	0.2	0.7
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	0.3	0.6
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.0	0.2
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.7	0.6
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	79	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	44	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	140	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

Meanwhile, travel restrictions peaked in those months, with 85.19 points out of 100 in January 2021 (see Chart 2.2.2-c). Due to the increase in the stringency index, excess mortality decreased again and was even negative in February and March. However, in November and December 2021, when the pandemic wave caused by the Delta variant had attained high prevalence and the Omicron variant was already spreading, excess mortality increased significantly again, surpassing 20% at a time when around 70% of the population was vaccinated. If we analyze excess mortality in cumulative terms since the start of the pandemic (see Chart 2.2.2-d), excess deaths peaked in January 2021 at 6.9% and then fell. In recent months, however, they have followed a new upward trend.

2.2.3 France

Weekly mortality data in France, available since 2000, has followed a seasonal pattern with deaths concentrated around the month of January, coinciding with winter. This repeats the behavior observed in all the

Chart 2.2.3-a
France: total weekly deaths

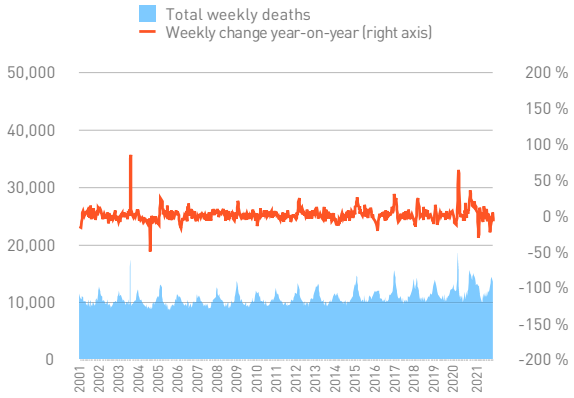


Chart 2.2.3-b
France: total weekly deaths vs. total population

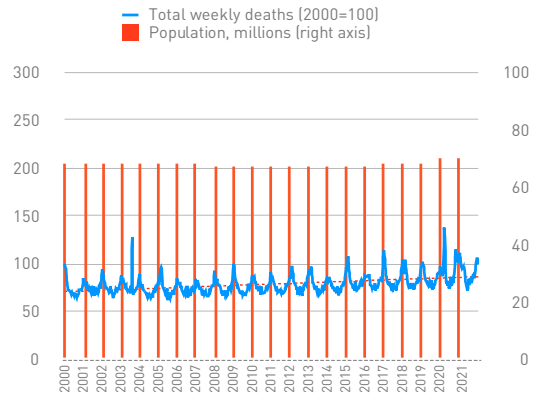


Chart 2.2.3-c
France: deaths due to COVID-19 vs. measures adopted

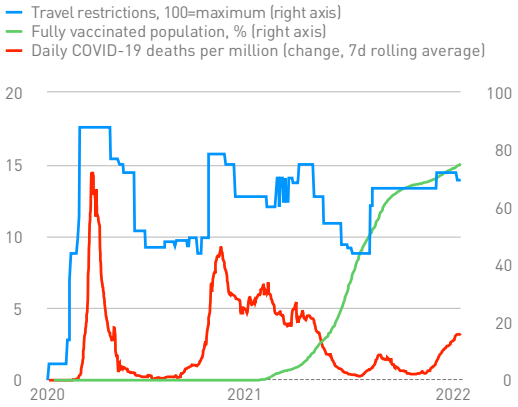
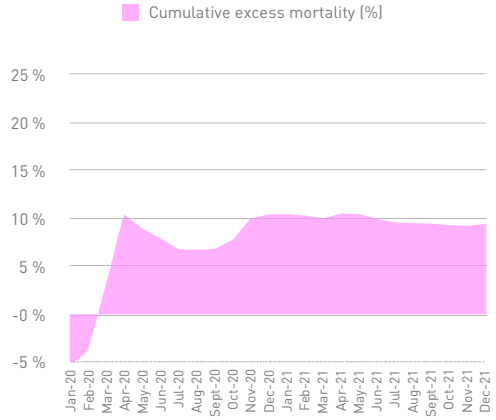


Chart 2.2.3-d
France: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

countries analyzed in this report, although in France, a singular anomaly stands out in epidemiological weeks 32 and 33 of 2003, coinciding with the summer, due to a heatwave that had tragic consequences on mortality in those weeks (see Chart 2.2.3-a). Likewise, the distortion caused by the SARS-CoV-2 outbreak is reflected in deaths in the spring of 2020, which jumped in April and November of the same year (see Chart 2.2.3-b).

If we analyze excess mortality since the start of the pandemic and throughout 2020 and 2021, we find that in March and April 2020 (coinciding with the first pandemic wave caused by the original SARS-CoV-2 variant), deaths per 100,000 people were 17.3% and 34.4% higher than average, respectively, for the same months in the previous four years (see Table 2.2.3). Therefore, the first pandemic wave had a significant impact in France. However, excess mortality dropped significantly in the months after adopting strict travel restrictions, which peaked in that period with a value of 87.96 points out of 100 on the stringency index maintained by the University of Oxford before falling slightly in May (see Chart 2.2.3-c).

In the last quarter of 2020, the excess mortality rebounded substantially to 30.7% in November, coinciding with the pandemic wave caused by the Alpha variant at a time when the vaccination process had not yet started. In

Table 2.2.3
France: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-5.9 %	9.3 %
Excess mortality (February)	-2.8 %	7.6 %
Excess mortality (March)	17.3 %	6.5 %
Excess mortality (April)	34.4 %	16.1 %
Excess mortality (May)	1.4 %	7.8 %
Excess mortality (June)	1.6 %	0.9 %
Excess mortality (July)	-1.1 %	1.4 %
Excess mortality (August)	5.4 %	7.5 %
Excess mortality (September)	6.8 %	6.5 %
Excess mortality (October)	16.4 %	6.2 %
Excess mortality (November)	30.7 %	6.0 %
Excess mortality (December)	14.4 %	12.3 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	2.8 %	8.1 %
Excess mortality (second quarter, Q2)	13.1 %	8.7 %
Excess mortality (third quarter, Q3)	3.9 %	5.3 %
Excess mortality (fourth quarter, Q4)	20.5 %	8.5 %
Annual excess mortality by age groups (%)		
All ages	9.8 %	7.1 %
Over 85 years old	13.6 %	11.5 %
Between 75 and 84 years old	7.2 %	2.7 %
Between 65 and 74 years old	15.1 %	14.7 %
Between 0 and 64 years old	-1.8 %	-5.7 %
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	77	3,004
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	225	1,679
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	593	1,839
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	3,050	4,390
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	5.2	46.0
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	39.0	22.9
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	3.2	8.3
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	48.5	10.5
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	6.8 %	1.5 %
Reported mortality rate Q2 (in the quarter)	17.3 %	1.4 %
Reported mortality rate Q3 (in the quarter)	0.5 %	0.5 %
Reported mortality rate Q4 (in the quarter)	1.6 %	0.2 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	39,463	109,124
Reported COVID-19 deaths (per million people, in the year)	959	877
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	2.4 %	0.8 %
Total population (millions)	65.3	65.4
Total deaths in the year (people, cumulative)	664,335	640,311
Total reported COVID-19 deaths (people, cumulative)	64,644	123,805
Reported COVID-19 mortality rate in relation to total deaths	9.7 %	9.2 %

Table 2.2.3 (continued)
France: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	4.3 %
Percentage of population fully vaccinated Q2	no record	31.3 %
Percentage of population fully vaccinated Q3	no record	65.9 %
Percentage of population fully vaccinated Q4	start	73.5 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	25.4	64.4
Travel restrictions index, mean Q2 (0=no restrictions)	78.1	62.2
Travel restrictions index, mean Q3 (0=no restrictions)	47.9	57.0
Travel restrictions index, mean Q4 (0=no restrictions)	65.7	68.4
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-5.4 %	1.5 %
GDP change year-on-year Q2	-18.6 %	18.8 %
GDP change year-on-year Q3	-3.6 %	3.3 %
GDP change year-on-year Q4	-4.3 %	5.0 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	3.4	4.2
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	4.8	4.6
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	1.2	1.7
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	5.0	2.8
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	0.8	0.8
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	1.0	0.9
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.2	0.3
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.7	0.5
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	58	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	32	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	111	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

those months, travel restrictions increased once again, reaching a value of 78.7 points over 100. Due to the increase in the stringency index, excess mortality dropped again and rebounded only temporarily in April 2021, coinciding with the pandemic wave caused by the Delta variant. The latter had a considerably lower impact on excess mortality in France in months when the vaccination rate remained low, ranging from 9.7% in early May to 31.3% in late June.

In December 2021, however, excess mortality surged again to 12.3% at a time when the Delta variant had achieved high prevalence and the Omicron strain was spreading, when just over 70% of the population was vaccinated. However, if we analyze the evolution of excess mortality in cumulative terms since the start of the pandemic (see Chart 2.2.3-d), we observe that it peaked at 10.5% in April 2021 before following a downward trend.

2.2.4 Italy

The weekly mortality data in Italy, available since 2011, shows a seasonal pattern with deaths concentrated around the month of January, coinciding with winter and in line with the general trend in all the analyzed countries. The outbreak of the SARS-CoV-2 virus caused an unprecedented distortion, as reflected in Charts 2.2.4-a and 2.2.4-b.

If we analyze monthly excess mortality since the start of the pandemic and throughout 2020 and 2021 (see Table 2.2.4), we find that the first pandemic wave, caused by the original SARS-CoV-2 variant detected in Wuhan in December 2019, hit Italy hard (it was the second country after China to suffer the first wave's tragic consequences). This is reflected in the excess mortality in March and April 2020, when deaths per 100,000 people increased by 52.2% and 40.4%, respectively, compared to the averages for the same

Chart 2.2.4-a
Italy: total weekly deaths

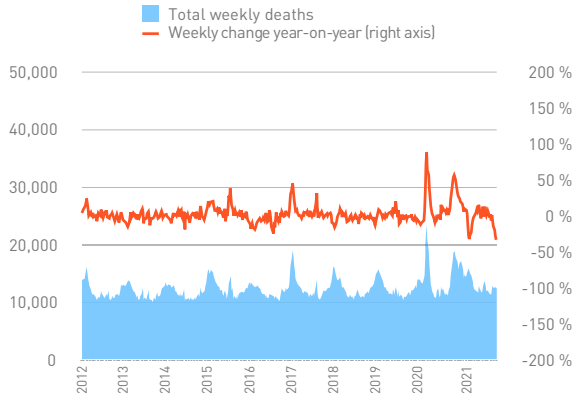


Chart 2.2.4-b
Italy: total weekly deaths
vs. total population

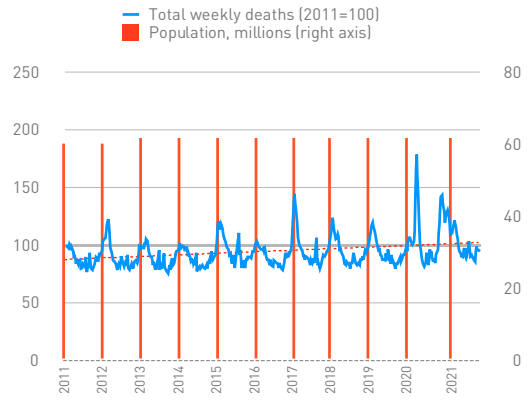


Chart 2.2.4-c
Italy: deaths due to COVID-19
vs. measures adopted

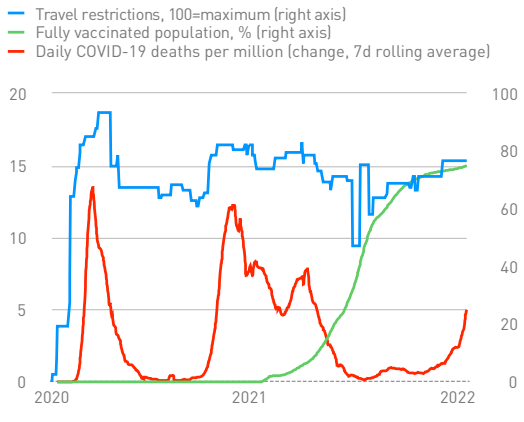
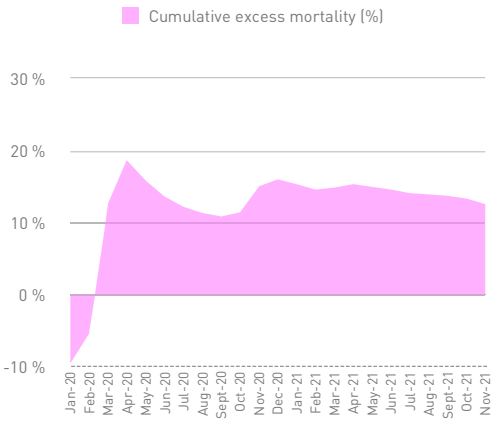


Chart 2.2.4-d
Italy: evolution of
cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

Table 2.2.4
Italy: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-9.3 %	9.1 %
Excess mortality (February)	-0.2 %	5.4 %
Excess mortality (March)	52.2 %	19.6 %
Excess mortality (April)	40.4 %	23.3 %
Excess mortality (May)	3.7 %	8.6 %
Excess mortality (June)	0.5 %	7.3 %
Excess mortality (July)	3.2 %	7.3 %
Excess mortality (August)	5.3 %	11.4 %
Excess mortality (September)	6.7 %	9.5 %
Excess mortality (October)	17.0 %	5.5 %
Excess mortality (November)	52.3 %	5.4 %
Excess mortality (December)	26.5 %	N/A
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	12.8 %	11.1 %
Excess mortality (second quarter, Q2)	15.0 %	13.0 %
Excess mortality (third quarter, Q3)	4.8 %	9.2 %
Excess mortality (fourth quarter, Q4)	31.5 %	N/A
Annual excess mortality by age groups (%)		
All ages	16.4 %	N/A
Over 85 years old	19.1 %	N/A
Between 75 and 84 years old	15.0 %	N/A
Between 65 and 74 years old	18.0 %	N/A
Between 0 and 64 years old	6.6 %	N/A
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	175	2,448
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	223	1,118
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	123	683
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	2,969	2,407
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	20.6	58.3
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	37.0	30.2
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	1.9	5.6
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	63.4	10.7
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	11.7 %	2.4 %
Reported mortality rate Q2 (in the quarter)	16.6 %	2.7 %
Reported mortality rate Q3 (in the quarter)	1.5 %	0.8 %
Reported mortality rate Q4 (in the quarter)	2.1 %	0.4 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	34,906	66,568
Reported COVID-19 deaths (per million people, in the year)	1,228	1,048
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	3.5 %	1.6 %
Total population (millions)	60.5	60.4
Total deaths in the year (people, cumulative)	756,859	N/A
Total reported COVID-19 deaths (people, cumulative)	74,159	137,402
Reported COVID-19 mortality rate in relation to total deaths	9.8 %	N/A

Table 2.2.4 (continued)
Italy: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	5.4 %
Percentage of population fully vaccinated Q2	no record	31.4 %
Percentage of population fully vaccinated Q3	no record	68.0 %
Percentage of population fully vaccinated Q4	start	74.1 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	37.9	77.3
Travel restrictions index, mean Q2 (0=no restrictions)	77.4	73.3
Travel restrictions index, mean Q3 (0=no restrictions)	66.5	64.8
Travel restrictions index, mean Q4 (0=no restrictions)	76.8	72.1
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-5.9 %	-0.6 %
GDP change year-on-year Q2	-18.1 %	17.1 %
GDP change year-on-year Q3	-5.4 %	3.9 %
GDP change year-on-year Q4	-6.6 %	6.2 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	2.5	4.9
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	5.5	5.5
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	0.5	0.8
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	6.4	1.4
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	0.7	0.6
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	0.7	0.6
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.0	0.1
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.6	0.2
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	32	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	41	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	62	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

months of the previous four years. Excess mortality dropped substantially in the months that followed after the adoption of strict travel restrictions, which peaked in April 2020 at 93.52 points out of 100 on the stringency index maintained by the University of Oxford, among the highest worldwide (see Chart 2.2.4-c).

In the last quarter of 2020, excess mortality rebounded significantly, peaking at 52.3% in November and coinciding with the pandemic wave caused by the Alpha variant (detected for the first time in the United Kingdom in October) at a time when the vaccination process had not yet begun. In those months, travel restrictions increased again, reaching a value of 82.4 points. After the stringency index increased, excess mortality dropped again, but Italy saw another rebound in infections in March and April 2021, coinciding with the expansion of the pandemic wave caused by the Delta variant, a period when the vaccination rate remained low, ranging from 2.4% in early March to 10% in late April.

No information was available on mortality in December 2021, when the Delta variant was highly prevalent and the Omicron variant was spreading. Previously, if we analyze the evolution of excess mortality in cumulative terms since the start of the pandemic (see Chart 2.2.4-d), we observe that it peaked at 18.7% in April 2021 before showing a decreasing trend, after the rebound in late 2020 and early 2021.

2.2.5 Spain

The weekly mortality data in Spain, available since 2000, shows a seasonal pattern, with deaths concentrated around the month of January, coinciding with winter and in line with the trend in all the countries analyzed in this report.

The outbreak of the SARS-CoV-2 virus caused an unprecedented distortion in mortality patterns, as reflected in Charts 2.2.5-a and 2.2.5-b.

By analyzing the excess deaths observed since the start of the pandemic and throughout 2020 and 2021 (see Table 2.2.5), we observe that the first pandemic wave caused by the original SARS-CoV-2 virus strongly impacted mortality in Spain. This was reflected in excess mortality in March and April 2020, when deaths per 100,000 people were 59.2% and 75.9% higher than average for

Chart 2.2.5-a
Spain: total weekly deaths

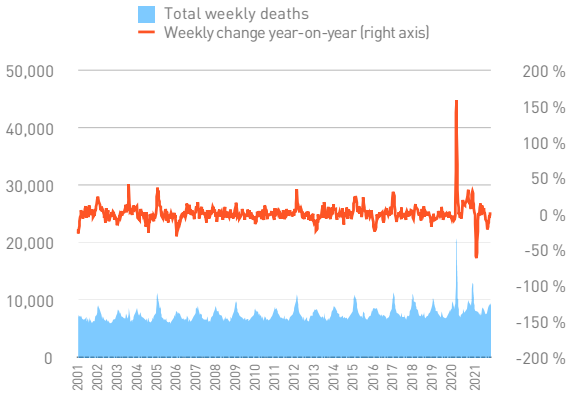


Chart 2.2.5-b
Spain: total weekly deaths
vs. total population

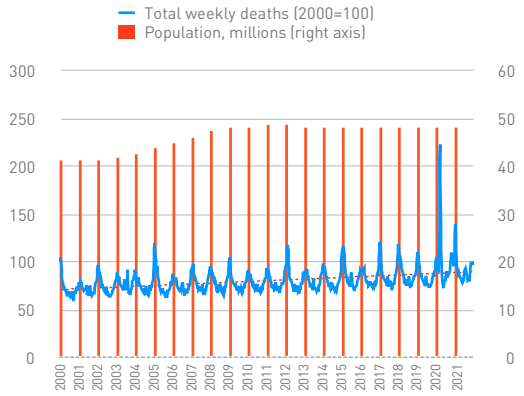


Chart 2.2.5-c
Spain: deaths due to COVID-19
vs. measures adopted

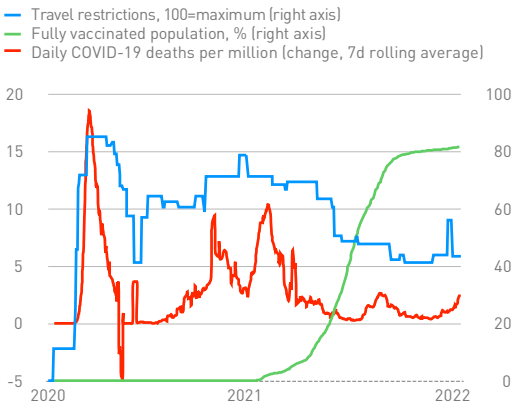
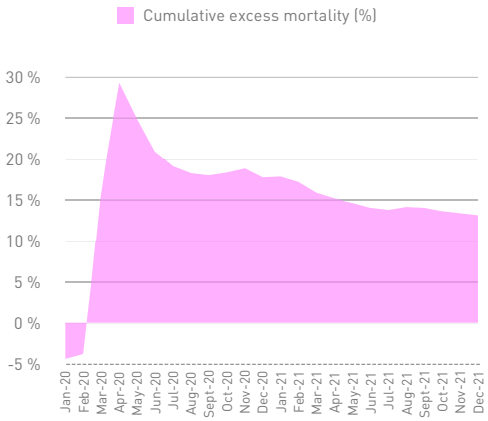


Chart 2.2.5-d
Spain: change in
cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

Table 2.2.5
Spain: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-4.6 %	18.3 %
Excess mortality (February)	-3.1 %	8.7 %
Excess mortality (March)	59.2 %	-0.7 %
Excess mortality (April)	75.9 %	3.5 %
Excess mortality (May)	4.7 %	3.6 %
Excess mortality (June)	-3.0 %	3.5 %
Excess mortality (July)	6.9 %	9.3 %
Excess mortality (August)	12.0 %	20.1 %
Excess mortality (September)	14.9 %	11.2 %
Excess mortality (October)	22.3 %	4.6 %
Excess mortality (November)	23.8 %	9.7 %
Excess mortality (December)	6.5 %	6.7 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	15.9 %	9.3 %
Excess mortality (second quarter, Q2)	26.6 %	3.5 %
Excess mortality (third quarter, Q3)	11.2 %	13.6 %
Excess mortality (fourth quarter, Q4)	17.0 %	7.0 %
Annual excess mortality by age groups (%)		
All ages	17.6 %	8.0 %
Over 85 years old	22.6 %	9.2 %
Between 75 and 84 years old	13.7 %	2.8 %
Between 65 and 74 years old	16.7 %	14.1 %
Between 0 and 64 years old	9.2 %	8.3 %
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	205	2,901
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	328	1,122
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	1,112	2,460
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	2,480	2,857
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	18.1	52.7
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	42.6	11.6
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	7.4	11.9
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	40.7	6.4
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	8.8 %	1.8 %
Reported mortality rate Q2 (in the quarter)	13.0 %	1.0 %
Reported mortality rate Q3 (in the quarter)	0.7 %	0.5 %
Reported mortality rate Q4 (in the quarter)	1.6 %	0.2 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	41,251	93,410
Reported COVID-19 deaths (per million people, in the year)	1,088	825
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	2.6 %	0.9 %
Total population (millions)	46.8	46.7
Total deaths in the year (people, cumulative)	498,699	452,096
Total reported COVID-19 deaths (people, cumulative)	50,837	89,405
Reported COVID-19 mortality rate in relation to total deaths	10.2 %	8.5 %

Table 2.2.5 (continued)
Spain: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	5.8 %
Percentage of population fully vaccinated Q2	no record	38.5 %
Percentage of population fully vaccinated Q3	no record	78.4 %
Percentage of population fully vaccinated Q4	start	81.0 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	21.3	70.6
Travel restrictions index, mean Q2 (0=no restrictions)	72.7	62.3
Travel restrictions index, mean Q3 (0=no restrictions)	61.1	47.0
Travel restrictions index, mean Q4 (0=no restrictions)	69.8	43.5
Economic impacts, change in real GDP		
GDP change year-on-year Q1	-4.3 %	-4.3 %
GDP change year-on-year Q2	-21.5 %	17.7 %
GDP change year-on-year Q3	-8.7 %	3.4 %
GDP change year-on-year Q4	-8.8 %	4.9 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	5.8
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	1.7
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	2.1	1.9
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	3.9	1.9
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	-	1.0
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	-	0.5
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.3	0.4
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.7	0.4
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	30	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	44	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	59	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

the same months of the previous four years and among the highest excesses in all countries analyzed during the first pandemic wave.

The situation improved significantly, especially during the spring of 2020 after adopting strict travel restrictions, which peaked in April 2020 at 85.19 points out of 100 on the stringency index maintained by the University of Oxford (see Chart 2.2.5-c). In this period, the calculated excess deaths even showed a negative value in the month of June. However, they rebounded in the summer of 2020, soaring to 22.3% and 23.8% in October and November, respectively, amid the expansion of the pandemic wave caused by the Alpha variant (detected in the United Kingdom in October). This led to a reactivation of travel restrictions that reached 78.7 points in December 2020, when the vaccination process had not yet begun (see the aforementioned Chart 2.2.5-c).

The situation then improved considerably, and excess mortality was slightly negative in March 2021 (-0.7%). However, after the expansion of the Delta variant, excess deaths increased again in the summer, rising to

20.1% in August, but remained below the level recorded in the previous pandemic waves (between 58.3% and 71.4% of the population was fully vaccinated in August).

According to the data available to date (see Chart 2.2.5-d), cumulative excess mortality in Spain peaked in April 2020, reaching 29.3%. It then started to follow a clear downward trend, standing at 13.1% in December 2021.

2.2.6 Russia

The weekly mortality data in Russia, available from 2000 to 2020, shows a markedly seasonal nature, with deaths concentrated around the month of January, coinciding with winter and following the pattern observed in all the countries we analyzed. In Russia, however, a singular anomaly stands out in epidemiological weeks 30 to 32 of 2010, coinciding with summer, due to a heatwave with a severe impact on mortality in those weeks (see Chart 2.2.6-a). Likewise, the

Chart 2.2.6-a
Russia: total weekly deaths

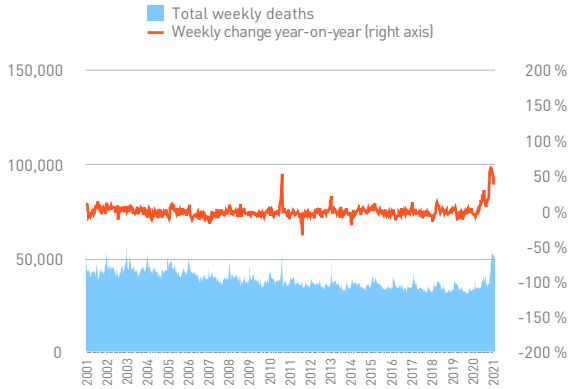


Chart 2.2.6-b
Russia: total weekly deaths
vs. total population

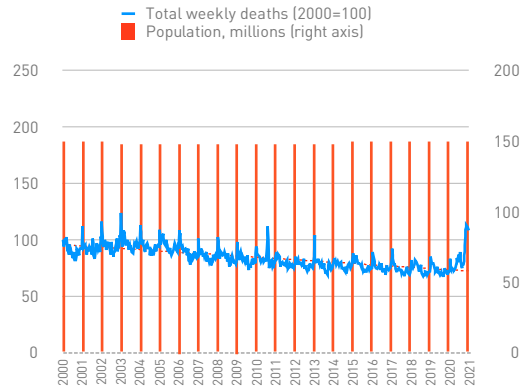


Chart 2.2.6-c
Russia: deaths due to COVID-19
vs. measures adopted

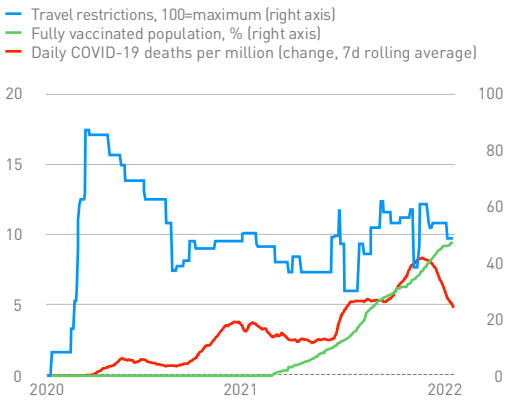
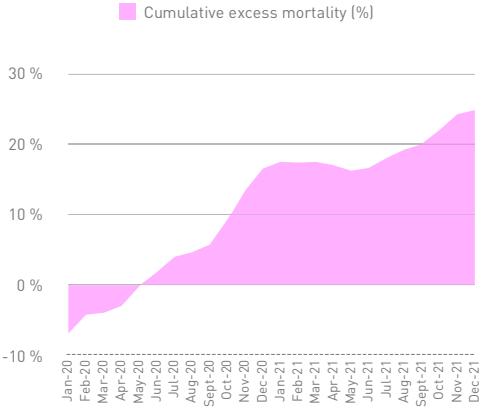


Chart 2.2.6-d
Russia: evolution of
cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, World Mortality Dataset, Human Mortality Database, OECD and Oxford Economics/Haver)

Table 2.2.6
Russia: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-7.1 %	26.8 %
Excess mortality (February)	-1.2 %	15.8 %
Excess mortality (March)	-3.6 %	19.1 %
Excess mortality (April)	-0.2 %	10.2 %
Excess mortality (May)	10.8 %	3.8 %
Excess mortality (June)	12.0 %	23.5 %
Excess mortality (July)	17.7 %	43.6 %
Excess mortality (August)	9.6 %	41.2 %
Excess mortality (September)	13.7 %	38.6 %
Excess mortality (October)	41.1 %	61.6 %
Excess mortality (November)	57.1 %	76.9 %
Excess mortality (December)	49.3 %	38.2 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	-4.1 %	20.8 %
Excess mortality (second quarter, Q2)	7.6 %	12.3 %
Excess mortality (third quarter, Q3)	13.7 %	41.1 %
Excess mortality (fourth quarter, Q4)	49.1 %	58.4 %
Annual excess mortality by age groups (%)		
All ages	16.2 %	36.0 %
Over 85 years old	13.4 %	N/A
Between 75 and 84 years old	9.8 %	N/A
Between 65 and 74 years old	45.9 %	N/A
Between 0 and 64 years old	6.9 %	N/A
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	2	937
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	442	655
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	359	1,337
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	1,341	2,001
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.0	28.1
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	6.4	24.5
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	7.8	48.4
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	24.4	67.9
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	0.7 %	3.0 %
Reported mortality rate Q2 (in the quarter)	1.4 %	3.7 %
Reported mortality rate Q3 (in the quarter)	2.2 %	3.6 %
Reported mortality rate Q4 (in the quarter)	1.8 %	3.4 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	21,433	49,297
Reported COVID-19 deaths (per million people, in the year)	386	1,689
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	1.8 %	3.4 %
Total population (millions)	145.9	145.9
Total deaths in the year (people, cumulative)	2,121,024	2,445,509
Total reported COVID-19 deaths (people, cumulative)	56,271	302,671
Reported COVID-19 mortality rate in relation to total deaths	2.7 %	10.1 %

distortion caused by the SARS-CoV-2 virus in deaths between May and July 2020 is observed, with a significant upturn in April and an even greater one in November of the same year (see Chart 2.2.6-b).

By analyzing the monthly excess mortality observed from the start of the pandemic and throughout 2020 and 2021 (see Table 2.2.6), we notice that the effects of the first pandemic wave, caused by the original SARS-CoV-2 virus, arrived with some delay. Significant excess mortality was observed from May to July when deaths per 100,000 people were 17.7% higher than average for the same month of the previous four years.

This delay was due in part to the country's strict travel restrictions, which peaked in late March and early April at 87.04 points out of 100 on the stringency index maintained by the University of Oxford. These measures were significantly reduced in August, coinciding with a reduction in excess

Table 2.2.6 (continued)
Russia: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	3.0 %
Percentage of population fully vaccinated Q2	no record	11.9 %
Percentage of population fully vaccinated Q3	no record	28.9 %
Percentage of population fully vaccinated Q4	start	45.8 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	17.1	45.4
Travel restrictions index, mean Q2 (0=no restrictions)	78.9	40.0
Travel restrictions index, mean Q3 (0=no restrictions)	54.7	45.0
Travel restrictions index, mean Q4 (0=no restrictions)	46.6	54.1
Economic impacts, change in real GDP		
GDP change year-on-year Q1	1.4 %	-0.7 %
GDP change year-on-year Q2	-7.8 %	10.5 %
GDP change year-on-year Q3	-3.5 %	4.3 %
GDP change year-on-year Q4	-1.8 %	2.6 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	-	-
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	-	-
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	81	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	40	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	85	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, World Mortality Dataset, Human Mortality Database, OECD and Oxford Economics/Haver)

mortality compared to July. Two months later, however, excess mortality rose dramatically to more than 40%, reaching 57.1% in November, which coincided with the pandemic wave caused by the Alpha variant at a time when the vaccination process had not yet started. While monthly excess mortality then decreased, it remained elevated and experienced its worst rebound from June, reaching a high of 76.9% in November 2021, when the Delta variant was the predominant strain, the Omicron variant was spreading. The vaccinated rate was low (ranging from 12% to 39% of the population between June and November).

Finally, if we analyze the evolution of excess mortality in cumulative terms since the start of the pandemic (see Chart 2.2.6-d), we observe that it peaked at 24.8% in December 2021, following a clear rising trend.

2.3 Asia-Pacific

2.3.1 Taiwan

In Taiwan, if we analyze the weekly mortality data available from 2000 to 2020, we observe a similar pattern to that of the other countries analyzed in the Northern Hemisphere, of a markedly seasonal nature, with deaths concentrated around the month of January, coinciding with the winter. However, it is observed that the distortion caused in weekly deaths by the outbreak of the SARS-CoV-2 virus is less marked than in other countries analyzed in this report (see Charts 2.3.1-a and 2.3.1-b).

Based on our analysis of excess mortality since the start of the pandemic and throughout 2020 and 2021, in February 2020 (coinciding with the first pandemic wave, caused by the original SARS-CoV-2 virus detected in Wuhan in late 2019), deaths per 100,000 people in Taiwan were 11% above average for the same month in the previous four years (see Table 2.3.1).

This first pandemic wave had a limited impact, as did the second wave, with excess mortality of 2.9% and 7.4% in November and December 2020, respectively. This coincided with the pandemic wave caused by the Alpha variant when the vaccination process had not yet begun. However, the excess deaths recorded in those months and travel restrictions adopted were considerably lower than those of other countries.

The travel restrictions adopted reached their high of 76.85 points out of 100 on the stringency index maintained by the University of Oxford in May 2021, coinciding with the expansion of the Delta strain, which was declared a variant of concern by the WHO in the same month. Excess mortality rebounded significantly in June, reaching 21.9%, and followed a downward trend over subsequent months until November and December 2021, when it climbed to 13% and 11%, respectively, coinciding with the predominance of the Delta variant and the expansion of the Omicron strain (see Chart 2.3.1-c).

If we analyze the evolution of excess deaths in cumulative terms since the start of the pandemic (see Chart 2.3.1-d), we find that they peaked at 4.1% in February 2020 and then fell, but since June 2021 have once again followed an upward trend. Since then, following a late start, the vaccination process has progressed rapidly, with the vaccination rate climbing from 0.18% in early July 2021 to 67.7% in late December amid the expansion of the Delta variant.

Table 2.3.1
Taiwan: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-3.5 %	7.3 %
Excess mortality (February)	11.0 %	1.5 %
Excess mortality (March)	-6.8 %	-4.9 %
Excess mortality (April)	1.4 %	0.2 %
Excess mortality (May)	-7.5 %	5.1 %
Excess mortality (June)	1.9 %	21.9 %
Excess mortality (July)	0.2 %	6.9 %
Excess mortality (August)	-8.6 %	2.6 %
Excess mortality (September)	4.2 %	4.1 %
Excess mortality (October)	-6.5 %	-0.7 %
Excess mortality (November)	2.9 %	13.0 %
Excess mortality (December)	7.4 %	11.0 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	0.0 %	1.2 %
Excess mortality (second quarter, Q2)	-1.3 %	9.0 %
Excess mortality (third quarter, Q3)	-1.4 %	4.7 %
Excess mortality (fourth quarter, Q4)	1.4 %	7.8 %
Annual excess mortality by age groups (%)		
All ages	-0.5 %	5.4 %
Over 85 years old	1.2 %	N/A
Between 75 and 84 years old	-5.9 %	N/A
Between 65 and 74 years old	4.9 %	N/A
Between 0 and 64 years old	-7.3 %	N/A
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	1	1
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	1	58
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	0	6
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	1	3
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.0	0.0
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	0.0	2.7
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	-	0.8
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	-	0.0
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	1.6 %	1.3 %
Reported mortality rate Q2 (in the quarter)	1.6 %	4.6 %
Reported mortality rate Q3 (in the quarter)	0.0 %	13.7 %
Reported mortality rate Q4 (in the quarter)	0.0 %	1.0 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	33	680
Reported COVID-19 deaths (per million people, in the year)	0	35
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	0.9 %	5.2 %
Total population (millions)	23.8	23.9
Total deaths in the year (people, cumulative)	171,827	183,732
Total reported COVID-19 deaths (people, cumulative)	7	850
Reported COVID-19 mortality rate in relation to total deaths	0.0 %	0.5 %

Table 2.3.1 (continued)
Taiwan: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	0.0 %
Percentage of population fully vaccinated Q2	no record	0.2 %
Percentage of population fully vaccinated Q3	no record	11.1 %
Percentage of population fully vaccinated Q4	start	67.7 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	21.4	23.8
Travel restrictions index, mean Q2 (0=no restrictions)	27.9	48.5
Travel restrictions index, mean Q3 (0=no restrictions)	23.2	60.3
Travel restrictions index, mean Q4 (0=no restrictions)	21.9	30.6
Economic impacts, change in real GDP		
GDP change year-on-year Q1	3.0 %	9.2 %
GDP change year-on-year Q2	0.6 %	7.8 %
GDP change year-on-year Q3	4.3 %	3.7 %
GDP change year-on-year Q4	5.3 %	3.7 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	-	-
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	-	-
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	N/A	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	N/A	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	N/A	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, INEGI, World Mortality Dataset, OECD, and Oxford Economics/Haver)

2.3.2 South Korea

The weekly mortality data in South Korea, available from 2010 to 2020, follows a markedly seasonal pattern, with deaths concentrated around the month of January, coinciding with winter. We also observe that the distortion in weekly deaths caused by the SARS-CoV-2 virus is less pronounced than in other countries analyzed in this report (see Charts 2.3.2-a 2.3.2-b).

If we analyze the observed excess mortality since the start of the pandemic and throughout 2020 and 2021, we find that the first pandemic wave, caused by the original SARS-CoV-2 variant (detected in late 2019), had a limited impact in this country. Deaths per 100,000 people in February 2020 were 6.5% higher than average for the same month of the previous four years (see Table 2.3.2). Meanwhile, the travel restrictions adopted in South Korea peaked at 82.41 points out of 100 in April 2021.

Chart 2.3.1-a
Taiwan: total weekly deaths

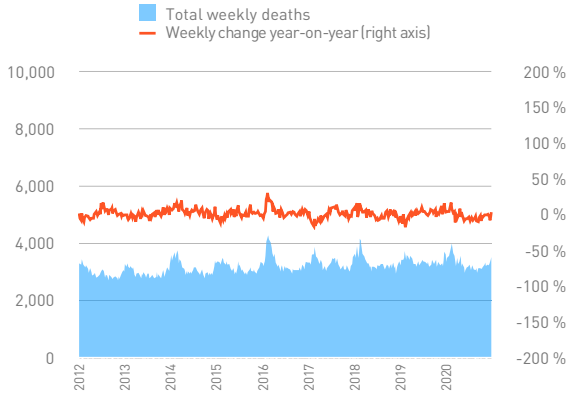


Chart 2.3.1-b
Taiwan: total weekly deaths vs. total population

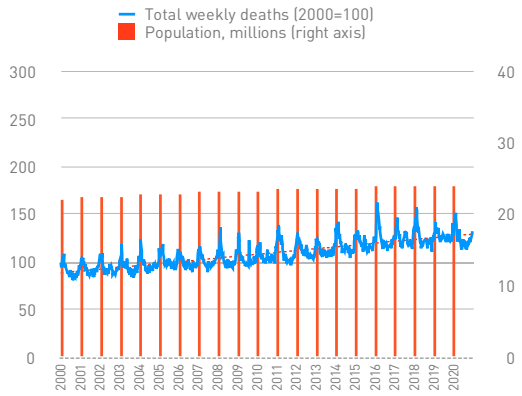


Chart 2.3.1-c
Taiwan: deaths due to COVID-19 vs. measures adopted

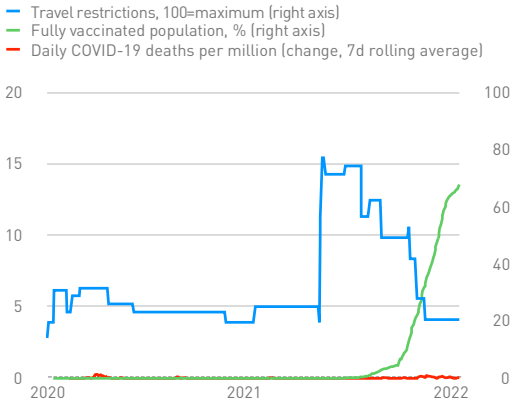
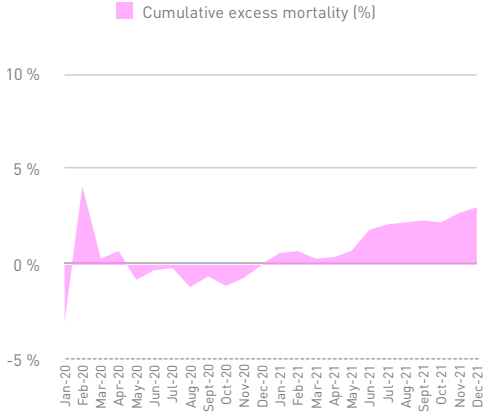


Chart 2.3.1-d
Taiwan: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, INEGI, World Mortality Dataset, OECD, and Oxford Eco-

The country's highest excess deaths are observed in 2021, starting in June and coinciding with the expansion of the pandemic wave caused by the Delta variant. An increase in excess mortality can be observed in July when it reached 11.7%, and it remained at that level over the next three months until data was available. Coinciding with this pandemic wave, the vaccination process strongly accelerated as of June 2021 despite a late start (similar to Taiwan), and the vaccination rate climbed from 10% in early July 2021 to 82.9% in late December (see Chart 2.3.2-c).

Finally, analyzing the evolution of excess mortality in cumulative terms since the start of the pandemic (see Chart 2.3.2-d), we observe that it peaked at 6.2% in October 2021.

2.3.3 Australia

In Australia, based on our analysis of weekly mortality data, available from 2015 until epidemiological week 43 of 2021, we identify a markedly seasonal pattern, with deaths concentrated around the months of July and August, coinciding with the winter in the

Table 2.3.2
South Korea: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	3.6 %	-1.0 %
Excess mortality (February)	6.5 %	-0.7 %
Excess mortality (March)	3.3 %	5.8 %
Excess mortality (April)	5.1 %	6.5 %
Excess mortality (May)	1.7 %	6.6 %
Excess mortality (June)	5.5 %	8.9 %
Excess mortality (July)	4.5 %	11.7 %
Excess mortality (August)	8.3 %	10.7 %
Excess mortality (September)	7.0 %	11.9 %
Excess mortality (October)	6.8 %	11.7 %
Excess mortality (November)	4.9 %	N/A
Excess mortality (December)	1.6 %	N/A
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	4.5 %	1.4 %
Excess mortality (second quarter, Q2)	4.2 %	7.4 %
Excess mortality (third quarter, Q3)	6.7 %	11.5 %
Excess mortality (fourth quarter, Q4)	4.4 %	N/A
Annual excess mortality by age groups (%)		
All ages	4.9 %	N/A
Over 85 years old	16.8 %	N/A
Between 75 and 84 years old	2.2 %	N/A
Between 65 and 74 years old	0.9 %	N/A
Between 0 and 64 years old	-2.6 %	N/A
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	19	82
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	6	105
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	22	304
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	74	627
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.3	1.6
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	0.2	0.6
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	0.3	0.9
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	1.0	6.1
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	1.7 %	2.0 %
Reported mortality rate Q2 (in the quarter)	3.9 %	0.5 %
Reported mortality rate Q3 (in the quarter)	1.2 %	0.3 %
Reported mortality rate Q4 (in the quarter)	1.3 %	1.0 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	1,204	11,178
Reported COVID-19 deaths (per million people, in the year)	18	92
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	1.5 %	0.8 %
Total population (millions)	51.3	51.3
Total deaths in the year (people, cumulative)	309,526	N/A
Total reported COVID-19 deaths (people, cumulative)	917	5,625
Reported COVID-19 mortality rate in relation to total deaths	0.3 %	N/A

Table 2.3.2 (continued)
South Korea: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	0.1 %
Percentage of population fully vaccinated Q2	no record	10.1 %
Percentage of population fully vaccinated Q3	no record	50.4 %
Percentage of population fully vaccinated Q4	start	83.0 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	33.0	62.2
Travel restrictions index, mean Q2 (0=no restrictions)	54.5	53.0
Travel restrictions index, mean Q3 (0=no restrictions)	52.6	47.6
Travel restrictions index, mean Q4 (0=no restrictions)	57.5	43.1
Economic impacts, change in real GDP		
GDP change year-on-year Q1	1.5 %	1.9 %
GDP change year-on-year Q2	-2.7 %	6.0 %
GDP change year-on-year Q3	-1.0 %	4.0 %
GDP change year-on-year Q4	-1.1 %	3.5 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	-	-
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	0.0	0.1
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	0.0	0.0
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.0	0.1
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.1	0.2
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	123	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	24	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	73	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

Southern Hemisphere. We also observe that the distortion in weekly deaths caused by the SARS-CoV-2 virus is less pronounced than in the other countries studied in this report (see Charts 2.3.3-a and 2.3.3-b).

If we analyze the observed excess mortality since the start of the pandemic and throughout 2020 and 2021, we find that the first pandemic wave, caused by the original SARS-CoV-2 variant, had a limited impact in Australia. In February 2020, deaths per 100,000 people were 4.7% higher than

Chart 2.3.2-a
South Korea: total weekly deaths

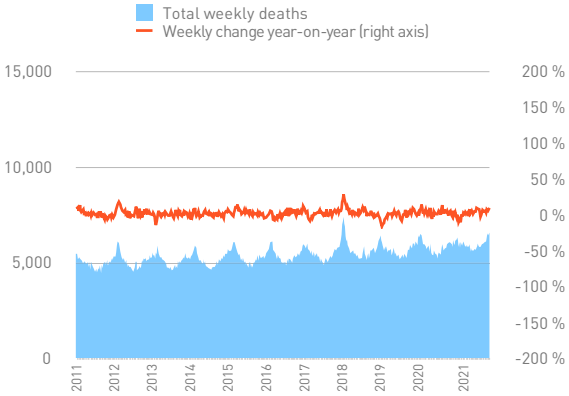


Chart 2.3.2-b
South Korea: total weekly deaths vs. total population

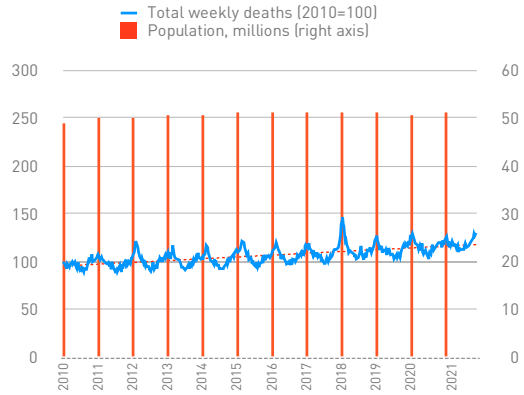


Chart 2.3.2-c
South Korea: COVID-19 deaths vs. measures adopted

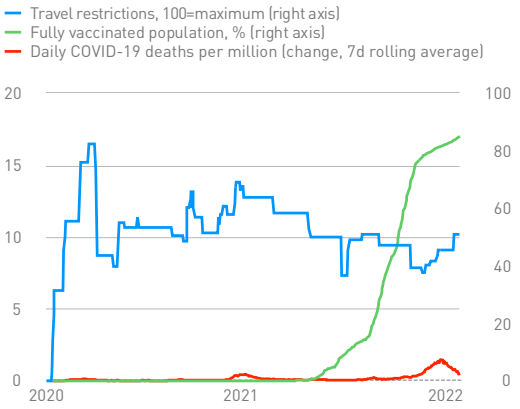
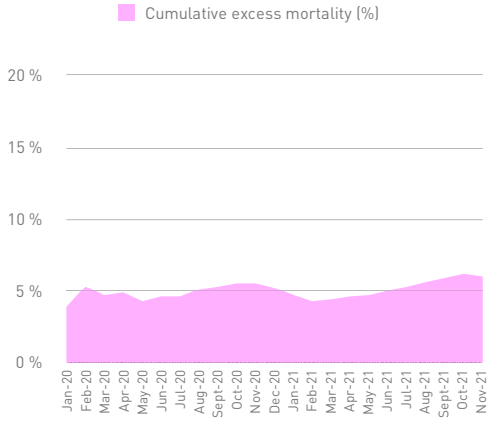


Chart 2.3.2-d
South Korea: change in cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

average for the same month of the previous four years (see Table 2.3.3). Excess mortality then decreased and even became negative in some months until May 2021, when we observe a slight rebound to 3.8%, coinciding with the spread of the Delta variant.

Meanwhile, the travel restrictions adopted reached their highest level in February 2021, at 78.24 points out of 100 on the stringency index maintained by the University of Oxford.

Coinciding with this pandemic wave, the vaccination process strongly accelerated from June 2021 after a delay (as in South Korea and Taiwan), with the vaccination rate increasing from 7% in early July 2021 to 76.6% in late December (see Chart 2.3.3-c).

Table 2.3.3
Australia: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	-1.1 %	0.1 %
Excess mortality (February)	4.7 %	-0.4 %
Excess mortality (March)	3.5 %	2.0 %
Excess mortality (April)	3.2 %	3.0 %
Excess mortality (May)	-1.9 %	3.8 %
Excess mortality (June)	-8.6 %	0.5 %
Excess mortality (July)	-8.2 %	-0.2 %
Excess mortality (August)	-6.8 %	-5.1 %
Excess mortality (September)	-7.5 %	-3.1 %
Excess mortality (October)	-6.1 %	N/A
Excess mortality (November)	-1.3 %	N/A
Excess mortality (December)	1.0 %	N/A
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	3.5 %	1.7 %
Excess mortality (second quarter, Q2)	-1.5 %	3.6 %
Excess mortality (third quarter, Q3)	-6.4 %	-1.7 %
Excess mortality (fourth quarter, Q4)	-1.1 %	N/A
Annual excess mortality by age groups (%)		
All ages	-2.8 %	N/A
Over 85 years old	-4.1 %	N/A
Between 75 and 84 years old	-1.2 %	N/A
Between 65 and 74 years old	-0.5 %	N/A
Between 0 and 64 years old	-4.5 %	N/A
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	18	3
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	13	5
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	74	297
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	5	1,234
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.1	-
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	0.3	0.0
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	3.0	1.6
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	0.1	3.7
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	0.4 %	0.0 %
Reported mortality rate Q2 (in the quarter)	2.6 %	0.1 %
Reported mortality rate Q3 (in the quarter)	4.1 %	0.5 %
Reported mortality rate Q4 (in the quarter)	1.6 %	0.3 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	1,102	15,397
Reported COVID-19 deaths (per million people, in the year)	35	52
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	3.2 %	0.3 %
Total population (millions)	25.5	25.8
Total deaths in the year (people, cumulative)	144,014	N/A
Total reported COVID-19 deaths (people, cumulative)	909	2,253
Reported COVID-19 mortality rate in relation to total deaths	0.6 %	N/A

Table 2.3.3 (continued)
Australia: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	0.3 %
Percentage of population fully vaccinated Q2	no record	6.3 %
Percentage of population fully vaccinated Q3	no record	44.2 %
Percentage of population fully vaccinated Q4	start	76.6 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	19.7	57.9
Travel restrictions index, mean Q2 (0=no restrictions)	64.5	52.6
Travel restrictions index, mean Q3 (0=no restrictions)	73.2	70.1
Travel restrictions index, mean Q4 (0=no restrictions)	65.7	63.8
Economic impacts, change in real GDP		
GDP change year-on-year Q1	1.6 %	1.4 %
GDP change year-on-year Q2	-6.0 %	9.5 %
GDP change year-on-year Q3	-3.5 %	3.9 %
GDP change year-on-year Q4	-0.8 %	1.7 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	0.2	0.0
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	0.2	0.0
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	0.3	0.6
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	0.0	0.6
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	0.0	0.0
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	0.0	0.0
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	0.0	0.1
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	0.0	0.1
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	38	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	38	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	122	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

When we analyze the evolution of excess mortality in cumulative terms since the start of the pandemic (see Chart 2.3.3-d), we observe that it peaked at 2.2% in July 2021 and then showed a slight downward trend.

2.3.4 New Zealand

The weekly mortality data in New Zealand, available from 2010 until the first few weeks of 2022, shows markedly seasonal behavior, following the pattern observed in all the countries analyzed in this report, with deaths concentrated around the months of July and August to coincide with the austral winter. Similarly, the distortion in weekly deaths caused by the SARS-CoV-2 virus is less pronounced than in other countries considered in this study (see Charts 2.3.4-b 2.3.4-b).

Chart 2.3.3-a
Australia: total weekly deaths

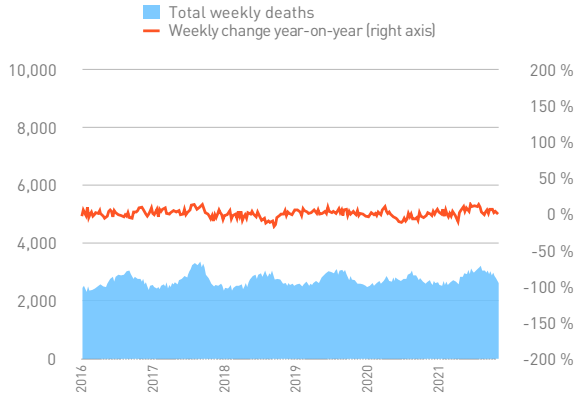


Chart 2.3.3-b
Australia: total weekly deaths vs. total population

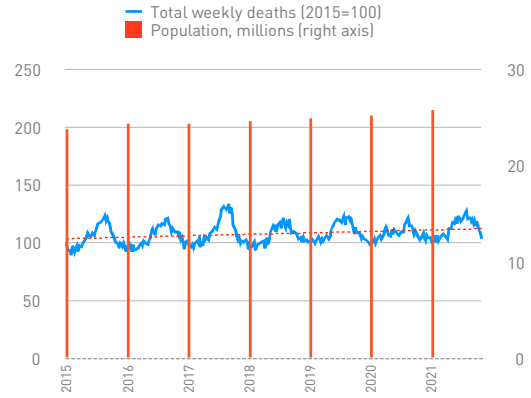


Chart 2.3.3-c
Australia: deaths due to COVID-19 vs. measures adopted

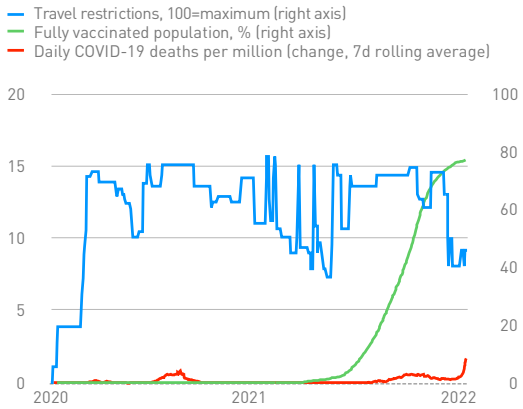
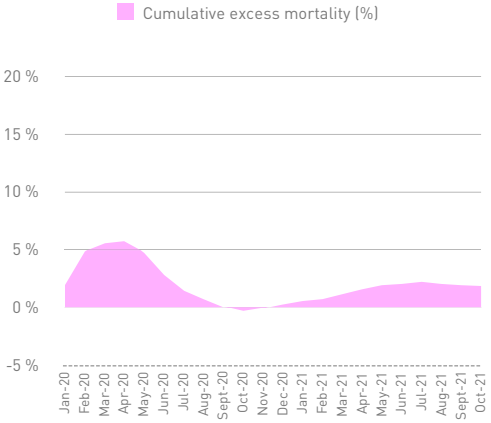


Chart 2.3.3-d
Australia: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

By analyzing the observed excess mortality in New Zealand since the start of the pandemic and throughout 2020 and 2021, we find that the first pandemic wave, caused by the original SARS-CoV-2 variant (detected in Wuhan in late 2019) had a limited impact in New Zealand. In February 2020, deaths per 100,000 people were 7.6% higher than average for the same month of the previous four years (see Table 2.3.4).

The observed excess mortality then decreased significantly and was even negative for some months, until rebounding in

Table 2.3.4
New Zealand: main indicators related to the pandemic

	2020	2021
Monthly excess mortality (%)		
Excess mortality (January)	2.6 %	7.6 %
Excess mortality (February)	7.6 %	5.5 %
Excess mortality (March)	1.9 %	5.1 %
Excess mortality (April)	1.8 %	3.8 %
Excess mortality (May)	-6.6 %	0.2 %
Excess mortality (June)	-9.5 %	-2.1 %
Excess mortality (July)	-9.8 %	0.9 %
Excess mortality (August)	-13.0 %	2.9 %
Excess mortality (September)	-8.8 %	-1.8 %
Excess mortality (October)	-3.5 %	-0.6 %
Excess mortality (November)	0.3 %	4.1 %
Excess mortality (December)	7.7 %	6.0 %
Quarterly excess mortality (%)		
Excess mortality (first quarter, Q1)	4.7 %	6.9 %
Excess mortality (second quarter, Q2)	-4.2 %	1.3 %
Excess mortality (third quarter, Q3)	-9.9 %	1.6 %
Excess mortality (fourth quarter, Q4)	2.2 %	3.9 %
Annual excess mortality by age groups (%)		
All ages	-3.0 %	2.2 %
Over 85 years old	-5.0 %	1.4 %
Between 75 and 84 years old	-0.8 %	6.4 %
Between 65 and 74 years old	-0.8 %	2.2 %
Between 0 and 64 years old	-4.1 %	-2.0 %
Diagnosed COVID-19 cases, quarterly		
Diagnosed COVID-19 cases Q1 x 100,000 people (in the quarter)	13	7
Diagnosed COVID-19 cases Q2 x 100,000 people (in the quarter)	17	5
Diagnosed COVID-19 cases Q3 x 100,000 people (in the quarter)	6	30
Diagnosed COVID-19 cases Q4 x 100,000 people (in the quarter)	6	192
Reported COVID-19 deaths, quarterly		
Reported COVID-19 deaths Q1 x 100,000 people (in the quarter)	0.0	0.0
Reported COVID-19 deaths Q2 x 100,000 people (in the quarter)	0.4	-
Reported COVID-19 cases Q3 x 100,000 people (in the quarter)	0.1	0.0
Reported COVID-19 deaths Q4 x 100,000 people (in the quarter)	-	0.5
Reported COVID-19 mortality rates in relation to diagnosed COVID-19 cases		
Reported mortality rate Q1 (in the quarter)	0.2 %	0.3 %
Reported mortality rate Q2 (in the quarter)	2.4 %	0.0 %
Reported mortality rate Q3 (in the quarter)	0.9 %	0.1 %
Reported mortality rate Q4 (in the quarter)	0.0 %	0.2 %
Diagnosed cases and reported deaths, annual data		
Diagnosed COVID-19 cases (per million people, in the year)	422	2,332
Reported COVID-19 deaths (per million people, in the year)	5	5
Reported COVID-19 mortality rate in relation to diagnosed COVID-19 cases	1.2 %	0.2 %
Total population (millions)	4.8	4.9
Total deaths in the year (people, cumulative)	33,189	34,758
Total reported COVID-19 deaths (people, cumulative)	25	51
Reported COVID-19 mortality rate in relation to total deaths	0.1 %	0.1 %

Table 2.3.4 (continued)
New Zealand: main indicators related to the pandemic

	2020	2021
Measures adopted: vaccination, percentage of population fully vaccinated		
Percentage of population fully vaccinated Q1	no record	0.3 %
Percentage of population fully vaccinated Q2	no record	8.9 %
Percentage of population fully vaccinated Q3	no record	37.7 %
Percentage of population fully vaccinated Q4	start	75.3 %
Measures adopted: travel restrictions		
Travel restrictions index, mean Q1 (0=no restrictions)	23.0	28.4
Travel restrictions index, mean Q2 (0=no restrictions)	59.5	22.2
Travel restrictions index, mean Q3 (0=no restrictions)	40.2	54.5
Travel restrictions index, mean Q4 (0=no restrictions)	23.5	71.4
Economic impacts, change in real GDP		
GDP change year-on-year Q1	1.0 %	3.8 %
GDP change year-on-year Q2	-8.9 %	17.3 %
GDP change year-on-year Q3	2.5 %	-1.7 %
GDP change year-on-year Q4	1.3 %	0.7 %
Patients hospitalized for COVID-19		
Patients hospitalized for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients hospitalized for COVID Q4 x 10,000 people (daily maximum)	-	-
Patients in Intensive Care Units (ICUs) due to COVID-19		
Patients in ICUs for COVID Q1 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q2 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q3 x 10,000 people (daily maximum)	-	-
Patients in ICUs for COVID Q4 x 10,000 people (daily maximum)	-	-
Hospital capacity and healthcare workers at the start of the pandemic	**2019 or closest**	
Hospital beds per 10,000 people	25	
Hospital beds per 10,000 people, OECD average	44	
Physicians per 10,000 people	34	
Physicians per 10,000 people, OECD average	36	
Nurses per 10,000 people	102	
Nurses per 10,000 people, OECD average	88	

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

December 2020 and January 2021 to 7.7% and 7.6%, respectively, coinciding with the spread of the Alpha variant. The travel restrictions adopted by the government of New Zealand peaked at 96.3 points out of 100 on the stringency index maintained by the University of Oxford in March 2020 (coinciding with the first pandemic wave); subsequently they were reduced before rising temporarily in August and November 2021. It is also noteworthy that the country's vaccination process started late (as in Taiwan, South Korea, and Australia), and the vaccination rate increased from 9.1% in early July 2021 to 75.3% in late December (see Chart 2.3.4-c).

Finally, if we analyze the evolution of excess mortality in cumulative terms since the start of the pandemic (see Chart 2.3.4-d), after reaching a high of 7.2% in February 2020, it dropped to negative levels in the second half of the year and bottomed out in September before following an upward trend.

Chart 2.3.4-a
New Zealand: total weekly deaths

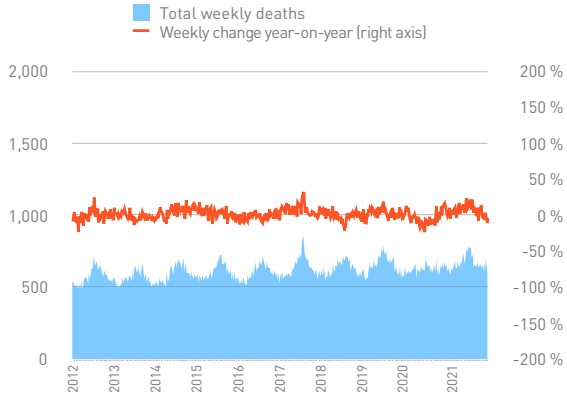


Chart 2.3.4-b
New Zealand: total weekly deaths vs. total population

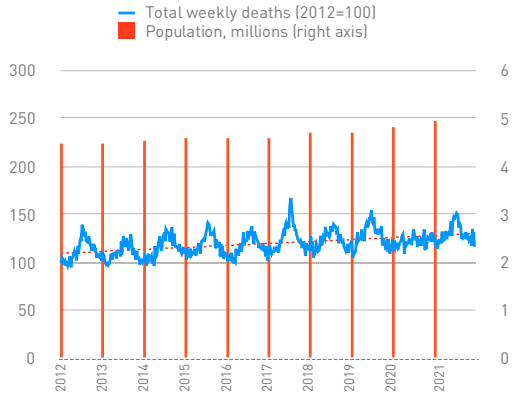


Chart 2.3.4-c
New Zealand: deaths due to COVID-19 vs. measures adopted

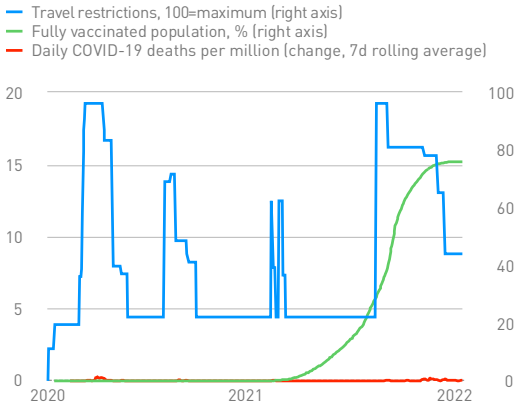
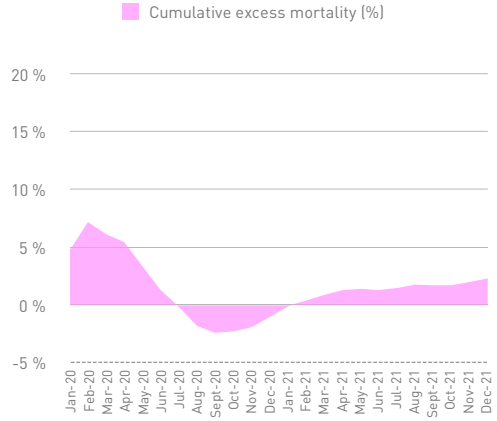


Chart 2.3.4-d
New Zealand: evolution of cumulative excess mortality



Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

3. Excess mortality from an international perspective

3.1 Excess mortality and its link to other structural and circumstantial variables

To analyze the observed excess mortality worldwide during the years of the COVID-19 pandemic, mortality databases with systematized data are needed. As this data is not available for all countries at this time, the exact number of total excess deaths at the global level would be impossible to calculate. Against this backdrop, in this section of the report, we will explore further variables that serve as a basis to calculate excess mortality indicator in 2020 and 2021 in a total of 39 countries. These countries maintain mortality databases with publicly available data systematized by epidemiological weeks. However, it should be noted that despite these limitations, some institutions have attempted to estimate the number of total deaths associated, directly or indirectly, with the COVID-19 pandemic worldwide (see Box 3.1).

Focusing on the sample of 39 countries analyzed[7], excess mortality was calculated on yearly, quarterly, and monthly levels, organizing the information by natural periods to facilitate comparison and following the methodology explained in the conceptual framework of this study. Chart 3.1-a shows, from a geographical perspective, the annual excess mortality levels in the countries considered in the analysis in 2020 and 2021. In many of the countries analyzed in Eastern Europe (Hungary, Bulgaria, Poland, the Baltic countries, and Russia, among others) and South America (Colombia, Brazil, and Chile), we observe that the pandemic waves caused by different SARS-CoV-2 variants in 2021 were worse than the waves in 2020 from the standpoint of excess mortality. In contrast, in Western Europe, in countries such as Spain, France, and Italy, excess mortality tends to decrease. But there are some exceptions, such as Germany, which showed higher excess mortality in 2021 than in 2020.

Likewise, in Tables 3.1-a, 3.1-b, and 3.1-c, the excess death counts aggregated by year, quarter, and month are shown on a heat map, with the greatest impact in terms of observed excess mortality highlighted in red. This information is also presented chronologically, allowing the impact of the different pandemic waves on mortality throughout 2020 and 2021 to be tracked by years/quarters/months in the countries analyzed.

It is also important to analyze the correlations between the calculated excess mortality and a series of structural and circumstantial variables that may have a causal link to excess deaths in the years of the pandemic.

Excess mortality and the efficiency of healthcare systems

The first structural variable that shows a high correlation with the excess deaths observed in 2020 and 2021 is the Healthcare Systems Efficiency Indicator, proposed by MAPFRE Economics (IESS)[8]. A summary indicator, it measures the efficiency of healthcare systems under normal conditions (prior to the pandemic), considering factors such as life expectancy, death rates for children from 0 to 4 years old, and the percentage of deaths among people aged 30 to 70 attributable to cardiovascular disease, cancer, diabetes, and chronic respiratory disease.

As reflected in Chart 3.1-b, when average excess mortality in 2020 and 2021 is compared with the Healthcare Systems

Box 3.1
Global excess mortality estimates

Global estimates

The number of deaths caused by the COVID-19 pandemic worldwide is difficult to determine due to the lack of systematized data from all countries and even the unavailability of data in some of them. All studies of the impact of the COVID-19 pandemic on human life coincide in affirming that the number of reported deaths caused by the disease is far lower than the true death toll. To obtain a more accurate picture of the pandemic's total impact, we must rely on another indicator, *excess mortality* for all causes, which measures the number of deaths above those normally expected in a country and during a period of time, based on historical averages. Excess mortality data currently exists for only a few countries, making it difficult to estimate global excess deaths during the pandemic.

To advise and assist the World Health Organization (WHO) in obtaining estimates of the number of deaths attributable to the pandemic worldwide, the WHO and the United Nations Department of Economic and Social Affairs (UNDESA) convened an expert group made up of epidemiologists, biostatisticians, demographers, and government officials from national statistics offices. With the support of this group, the WHO has published a preliminary assessment of excess mortality, estimating between 1.34 and 1.46 million excess deaths in the Americas in 2020 and 1.11–1.21 million in Europe, representing 60% and 50% more deaths from COVID-19, respectively, than those reported. There are significant data gaps in Africa, the Eastern Mediterranean region, Southeast Asia, and the Western Pacific region, where just over 360,000 total COVID-19 deaths were reported in this period. A tentative extrapolation of the results from the Americas and Europe assessments suggests that there were more than 3 million excess deaths attributable to the COVID-19 pandemic worldwide in 2020, which is more than 1.2 million deaths above the reported COVID-19 death toll of 1.8 million[1].

The Organisation for Economic Co-operation and Development (OECD) has also published estimates of excess mortality in its member countries. As of June 2021, the COVID-19 pandemic had caused around 2.5 million excess deaths in OECD countries, contributing, directly and indirectly, to a 16% increase in the number of expected deaths in 2020 and the first half of 2021[2]. Eurostat has also published statistics on excess mortality in the European Union (EU). According to the Weekly Death Record, between January 2020 and the end of November 2021, around 1.2 million additional deaths were recorded in the EU and the European Free Trade Association (EFTA) states, compared to the average for the same period of 2016–2019[3].

On March 10, 2022, *The Lancet* published a study in which the total number of COVID-19 deaths between January 1, 2020, and December 31, 2021, is estimated to be 18.2 million, compared to the 5.94 million reported deaths. The official death toll would thus be multiplied by 3.1[4]. However, in view of the limited data, they estimate that the real number of deaths could range from 17.1 to 19.6 million, with a 95% confidence level.

The Economist made a similar effort to determine a total, building a machine-learning model to estimate the number of excess deaths

1/ World Health Organization (2021). World health statistics 2021: monitoring health for the SDGs, sustainable development goals. https://apps.who.int/iris/bitstream/handle/10665/342703/9789240027053-eng.pdf

2/ OECD (2021), Health at a Glance 2021: OECD Indicators, OECD Publishing, Paris, https://doi.org/10.1787/ae3016b9-en

3/ Eurostat (2022). Excess mortality in the European Union between January 2020 and December 2021. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Excess_mortality_-_statistics#Excess_mortality_in_the_European_Union_between_January_2020_and_December_2021

4/ See: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)02796-3/fulltext

Box 3.1 (continued)
Global excess mortality estimates

during the pandemic in more than 200 countries, and based on these estimates, to calculate the excess worldwide. In May 2021, it estimated between 7 and 13 million excess deaths globally, which was two to four times higher than the official global COVID-19 death count at the time (3.5 million)[5]. With updated data as of March 2022, it raised the number of excess deaths to 20 million people, compared to the 6 million reported deaths from COVID-19, which means the actual death toll was 3.3 times higher than the official one. Similar to the study by *The Lancet*, based on the aforementioned limitations, they estimate that the real figure could range from 14.2 to 23.8 million, with a 95% confidence level.

Other studies have delved into data collection to provide a more accurate count of deaths caused by COVID-19. For example, Karlinsky and Kobak[6] created a database called the World Mortality Dataset, which includes information on deaths from all causes in 103 countries. Summarizing the estimates of excess mortality in all the countries included in their study, they counted 4.0 million excess deaths, compared to the 2.9 million deaths from COVID-19 reported at the time, which corresponded to an overall undercount rate of 1.4. Another important source of information that projects the total number of deaths from COVID-19 and estimates excess mortality worldwide is the Institute for Health Metrics and Evaluation (IHME), an independent global health research center at the University of Washington. According to its analysis, as of May 13, 2021, the total number of deaths from COVID-19 was 7.1 million, a figure that more than doubles the number of deaths reported on that date, which was 3.33 million[7].

5/ See: https://www.economist.com/graphic-detail/coronavirus-excess-deaths-estimates

6/ Karlinsky A, Kobak D, (2021). Tracking excess mortality across countries during the COVID-19 pandemic with the World Mortality Dataset. eLife 10:e69336. https://elifesciences.org/articles/69336

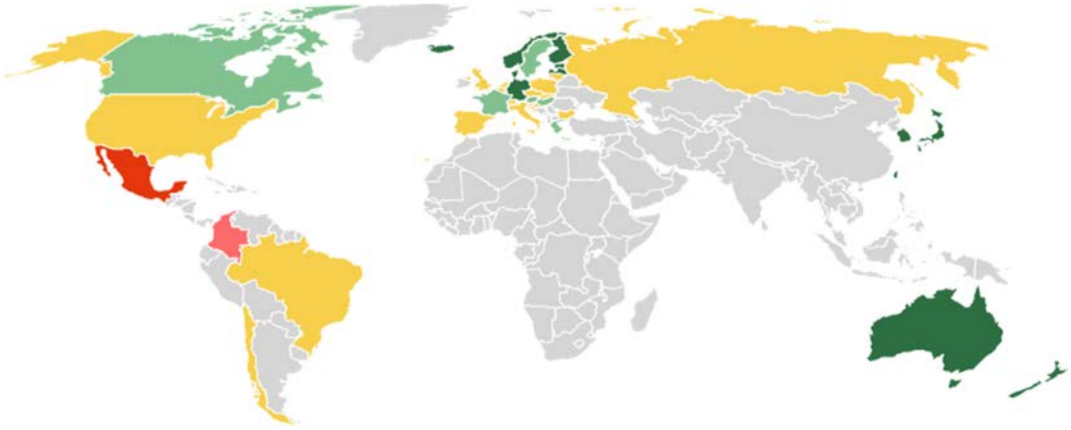
7/ IHME. Estimation of excess mortality due to COVID-19 (2021). https://www.healthdata.org/sites/default/files/files/Projects/COVID/2021/Estimation-of-excess-mortality-due-to-COVID.pdf

Efficiency Indicator of the countries analyzed, the coefficient of determination is 0.6432. This means that among the factors that may explain lower excess mortality in 2020–2021, more efficient pre-existing healthcare systems would explain 64.3% of the differences between the sample countries, while 35.7% would be attributable to other factors.

It is also noteworthy that when the Healthcare Systems Efficiency Indicator is correlated with excess mortality in 2020 (instead of the average for 2020 and 2021), the coefficient of determination is significantly lower (0.2616). This is a reflection of, among other factors, the catastrophic nature of pandemics, an event in which healthcare systems are quickly overwhelmed due to a lack of preparedness.

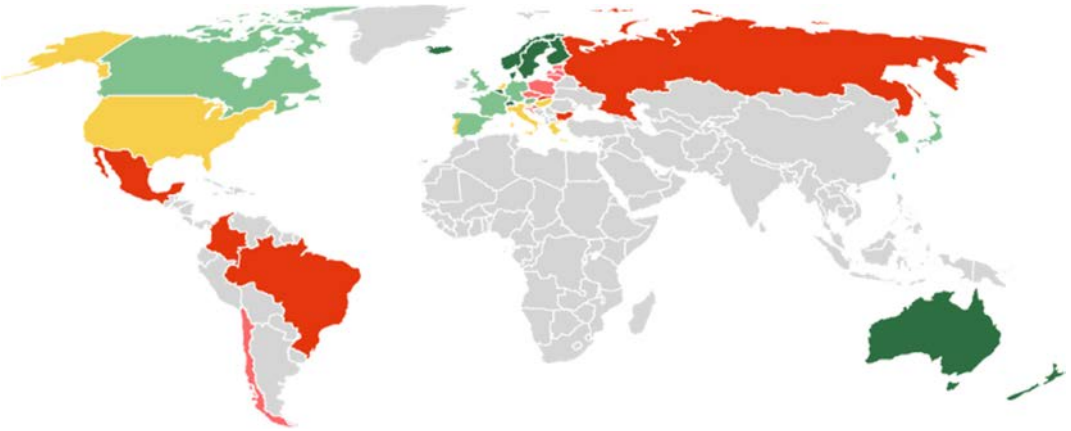
Chart 3.1-a
Select countries: annual excess mortality, 2020 and 2021

2020



Excess mortality ⩽ 5.0%
5.0% < Excess mortality ⩽ 10.0%
10.0% < Excess mortality ⩽ 20.0%
20.0% < Excess mortality ⩽ 30.0%
Excess mortality > 30.0%

2021



Italy: average January-October 2021
Canada: average January-September 2021
South Korea: average January-October 2021
Japan: average January-November 2021
Australia: average January-September 2021

Source: MAPFRE Economics

Table 3.1-a
Select countries: annual deaths per hundred thousand people and excess mortality

		All ages		Over 85 years old		Between 75 and 84 years old		Between 65 and 74 years old		Between 0 and 64 years old	
		Exc.mort.2020	Exc.mort.2021	Exc.mort.2020	Exc.mort.2021	Exc.mort.2020	Exc.mort.2021	Exc.mort.2020	Exc.mort.2021	Exc.mort.2020	Exc.mort.2021
1	Mexico	46.59%	45.74%	23.1%	N/A	42.7%	N/A	70.2%	N/A	48.7%	N/A
2	Colombia	26.53%	50.01%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	Poland	18.88%	28.67%	27.8%	30.5%	12.3%	22.5%	35.4%	54.2%	1.3%	11.1%
4	United States	18.44%	18.77%	14.5%	4.5%	21.8%	20.6%	23.9%	30.2%	16.1%	25.6%
5	Slovenia	18.16%	13.14%	30.2%	17.6%	16.7%	8.4%	17.9%	26.5%	-4.7%	-1.4%
6	Spain	17.60%	8.03%	22.6%	9.2%	13.7%	2.8%	16.7%	14.1%	9.2%	8.3%
7	Bulgaria	17.23%	40.15%	16.7%	32.6%	13.0%	38.6%	26.3%	55.7%	14.5%	34.6%
8	Italy	16.40%	N/A	19.1%	N/A	15.0%	N/A	18.0%	N/A	6.6%	N/A
9	Russia	16.23%	36.00%	13.4%	N/A	9.8%	N/A	45.9%	N/A	6.9%	N/A
10	Czech Republic	15.96%	22.54%	18.4%	13.1%	24.9%	34.6%	13.2%	27.8%	1.2%	N/A
11	Chile	14.95%	24.42%	11.9%	21.9%	17.9%	25.3%	20.2%	29.0%	11.7%	23.0%
12	Belgium	14.60%	0.98%	21.2%	-0.6%	12.7%	0.4%	15.2%	10.6%	-0.5%	-3.5%
13	Brazil	14.52%	36.93%	14.1%	N/A	17.5%	N/A	24.3%	N/A	9.6%	N/A
14	Lithuania	13.71%	23.72%	16.0%	30.0%	10.7%	19.9%	18.3%	29.3%	11.1%	16.3%
15	Portugal	12.01%	13.20%	17.2%	19.0%	8.6%	7.9%	11.1%	15.3%	5.2%	5.6%
16	Switzerland	11.90%	2.54%	17.3%	3.7%	13.3%	5.0%	3.4%	-0.9%	-1.1%	-2.8%
17	United Kingdom	11.77%	7.79%	11.9%	4.2%	14.2%	9.2%	9.7%	8.6%	9.2%	13.4%
18	Netherlands	10.99%	11.67%	12.0%	9.8%	16.2%	19.1%	9.8%	11.1%	-0.4%	3.2%
19	Croatia	10.68%	21.79%	18.3%	N/A	4.4%	N/A	20.4%	N/A	0.0%	N/A
20	Slovakia	10.57%	34.07%	10.5%	N/A	14.6%	N/A	19.2%	N/A	-1.4%	N/A
21	France	9.80%	7.13%	13.6%	11.5%	7.2%	2.7%	15.1%	14.7%	-1.8%	-5.7%
22	Hungary	9.34%	19.89%	10.2%	11.3%	12.1%	20.5%	16.7%	36.3%	-2.4%	12.5%
23	Austria	9.30%	8.39%	8.7%	3.7%	16.2%	15.0%	4.6%	10.5%	3.0%	6.9%
24	Greece	8.67%	19.55%	14.9%	25.1%	1.1%	8.6%	12.1%	27.5%	2.7%	18.6%
25	Canada	8.09%	N/A	8.5%	N/A	7.6%	N/A	8.8%	N/A	7.2%	N/A
26	Sweden	5.97%	-2.19%	5.7%	-5.7%	14.9%	8.7%	-1.9%	-7.8%	-3.7%	-7.1%
27	South Korea	4.85%	8.26%	16.8%	26.0%	2.2%	2.6%	0.9%	8.3%	-2.6%	-4.5%
28	Luxembourg	4.68%	0.35%	10.7%	3.3%	2.9%	-3.3%	1.6%	0.0%	-2.7%	-0.3%
29	Israel	4.55%	6.79%	5.5%	7.4%	3.4%	5.0%	13.6%	16.0%	-4.0%	-0.4%
30	Germany	4.38%	7.45%	8.2%	11.3%	2.9%	2.4%	3.7%	13.1%	-1.4%	3.0%
31	Latvia	4.19%	24.72%	9.7%	35.8%	4.2%	19.6%	5.0%	30.2%	-3.0%	14.0%
32	Japan	3.27%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
33	Finland	2.20%	3.75%	2.6%	5.6%	2.9%	6.8%	5.0%	4.5%	-3.7%	-7.7%
34	Estonia	1.67%	20.07%	6.5%	27.5%	-3.6%	12.0%	5.6%	30.2%	-1.7%	11.0%
35	Taiwan	-0.51%	5.40%	1.2%	N/A	-5.9%	N/A	4.9%	N/A	-7.3%	N/A
36	Denmark	0.62%	4.62%	1.2%	6.5%	7.2%	14.4%	-3.6%	-3.2%	-7.8%	-8.0%
37	Iceland	-0.12%	0.12%	-2.1%	0.8%	0.0%	-4.5%	-0.6%	3.1%	5.1%	3.3%
38	Norway	-2.28%	-0.07%	-4.5%	-2.1%	2.8%	9.9%	-1.2%	-3.1%	-6.2%	-8.6%
39	Australia	-2.79%	N/A	-4.1%	N/A	-1.2%	N/A	-0.5%	N/A	-4.5%	N/A
40	New Zealand	-3.00%	2.21%	-5.0%	1.4%	-0.8%	6.4%	-0.8%	2.2%	-4.1%	-2.0%

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

Table 3.1-b
Select countries: quarterly deaths per hundred thousand people and excess mortality

		Quarterly excess mortality 2020				Quarterly excess mortality 2021			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Mexico	1.3%	58.8%	75.5%	61.6%	89.3%	15.7%	71.4%	12.0%
2	Colombia	5.4%	7.4%	55.9%	42.0%	48.3%	100.5%	42.0%	15.5%
3	Poland	-2.8%	4.6%	9.6%	63.8%	25.9%	35.5%	8.0%	45.4%
4	United States	3.5%	23.6%	20.6%	29.7%	22.1%	9.6%	27.8%	19.5%
5	Slovenia	-2.6%	5.6%	4.7%	65.7%	9.0%	11.4%	2.9%	30.1%
6	Spain	15.9%	26.6%	11.2%	17.0%	9.3%	3.5%	13.6%	7.0%
7	Bulgaria	-3.9%	-0.7%	6.6%	62.7%	21.4%	39.3%	28.2%	69.2%
8	Italy	12.8%	15.0%	4.8%	31.5%	11.1%	13.0%	9.2%	N/A
9	Russia	-4.1%	7.6%	13.7%	49.1%	20.8%	12.3%	41.1%	58.4%
10	Czech Republic	-1.2%	1.5%	7.1%	57.3%	52.0%	12.2%	0.8%	N/A
11	Chile	6.1%	31.4%	11.2%	13.8%	36.3%	35.0%	12.6%	19.5%
12	Belgium	1.1%	25.5%	3.3%	31.8%	-6.9%	3.2%	-1.1%	12.3%
13	Brazil	3.6%	18.9%	19.2%	19.0%	54.4%	57.3%	26.4%	13.1%
14	Lithuania	-6.2%	5.0%	8.4%	43.2%	15.3%	15.9%	21.2%	38.5%
15	Portugal	0.3%	10.6%	16.3%	21.7%	30.2%	-1.5%	9.5%	10.5%
16	Switzerland	0.1%	5.7%	0.7%	43.5%	0.4%	-0.9%	3.5%	11.1%
17	United Kingdom	-0.3%	40.1%	-0.8%	12.0%	17.9%	-6.5%	9.7%	11.3%
18	Netherlands	2.7%	18.8%	3.6%	20.4%	5.8%	7.9%	9.1%	26.3%
19	Croatia	-4.1%	-1.9%	5.1%	41.4%	5.9%	25.5%	12.6%	43.1%
20	Slovakia	-1.4%	-0.3%	3.9%	40.4%	65.8%	15.7%	5.2%	N/A
21	France	2.8%	13.1%	3.9%	20.5%	8.1%	8.7%	5.3%	8.5%
22	Hungary	-5.5%	-0.1%	0.9%	41.2%	19.8%	23.2%	2.8%	32.7%
23	Austria	-0.1%	4.0%	4.2%	31.4%	0.7%	9.1%	7.4%	20.0%
24	Greece	5.7%	1.4%	7.6%	17.8%	2.8%	20.7%	27.6%	28.4%
25	Canada	1.9%	15.5%	7.2%	12.0%	3.3%	6.4%	9.5%	N/A
26	Sweden	-3.4%	23.7%	-2.6%	10.2%	-0.8%	-3.4%	-1.3%	0.2%
27	South Korea	4.5%	4.2%	6.7%	4.4%	1.4%	7.4%	11.5%	14.6%
28	Luxembourg	-6.7%	5.5%	2.8%	24.4%	0.1%	0.7%	-2.7%	9.6%
29	Israel	-2.0%	3.2%	15.0%	10.4%	10.0%	3.4%	18.6%	3.7%
30	Germany	-3.7%	3.6%	3.5%	16.3%	2.4%	6.7%	5.0%	17.9%
31	Latvia	-8.5%	1.9%	2.7%	17.4%	17.0%	16.8%	16.1%	45.1%
32	Japan	-0.2%	3.0%	3.8%	5.4%	4.1%	10.9%	11.1%	N/A
33	Finland	-3.5%	6.2%	3.7%	3.7%	-2.8%	3.2%	11.6%	N/A
34	Estonia	-5.7%	2.3%	4.7%	6.6%	17.4%	19.3%	15.0%	29.4%
35	Taiwan	0.0%	-1.3%	-1.4%	1.4%	1.2%	9.0%	4.7%	7.8%
36	Denmark	-4.8%	1.6%	2.0%	5.7%	-4.0%	2.5%	9.6%	14.2%
37	Iceland	4.3%	-4.0%	-4.8%	6.2%	-0.8%	0.9%	2.8%	1.5%
38	Norway	-3.2%	-1.8%	0.5%	-1.3%	-9.7%	-3.9%	5.3%	13.2%
39	Australia	3.5%	-1.5%	-6.4%	-1.1%	1.7%	3.6%	-1.7%	N/A
40	New Zealand	4.7%	-4.2%	-9.9%	2.2%	6.9%	1.3%	1.6%	3.9%

Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

However, over a longer-term, having efficient healthcare systems becomes very important, and countries with weaker systems suffer far more from the consequences of pandemic waves. Having robust healthcare systems is therefore fundamental in order to reduce excess mortality. However, equally important are early warning systems and information systems that allow data to be shared worldwide; by doing so, other types of measures can be swiftly taken at the initial stages of a pandemic, an area where much progress has been made as a result of this great global crisis.

Excess mortality and per capita income

Another structural variable that correlates with the difference in excess mortality among the 39 countries analyzed is per capita income (see Chart 3.1-c). In this regard, if we take the

Table 3.1-c
Select countries: monthly deaths per hundred thousand people and excess mortality

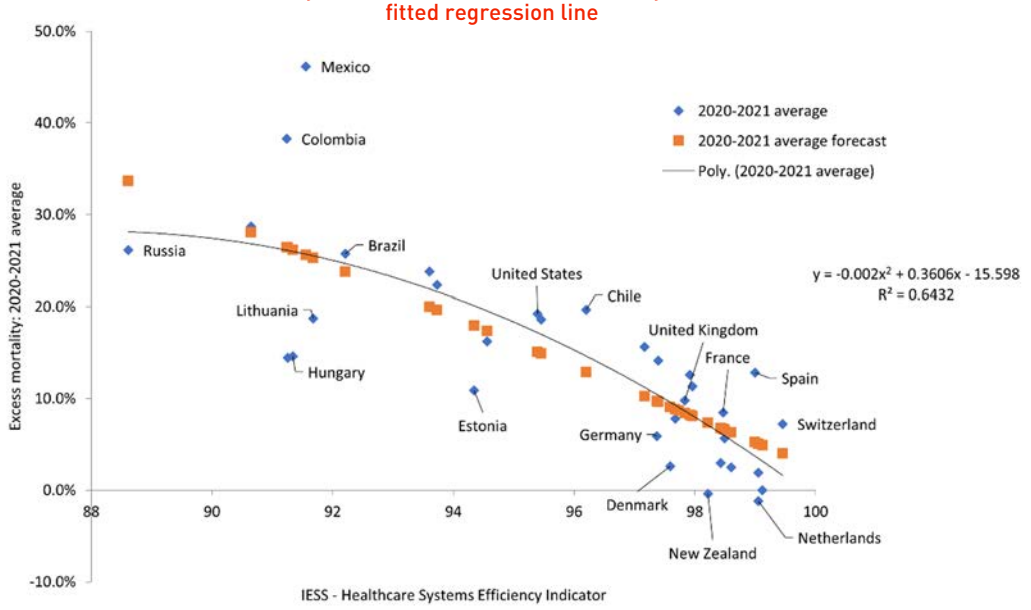
		Monthly excess mortality 2020											
		Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20
1	Mexico	3.0%	0.0%	-2.8%	16.0%	65.2%	90.9%	99.3%	73.1%	47.8%	44.7%	56.3%	76.3%
2	Colombia	4.2%	9.2%	0.0%	-2.8%	0.8%	20.3%	58.0%	62.0%	41.8%	39.2%	38.0%	43.8%
3	Poland	-6.0%	-1.6%	-0.2%	4.0%	4.5%	5.8%	6.1%	11.5%	11.5%	48.2%	96.6%	49.2%
4	United States	-1.4%	3.3%	6.9%	35.8%	20.0%	12.3%	22.1%	22.1%	15.4%	15.4%	28.2%	42.2%
5	Slovenia	-6.2%	0.2%	-1.3%	5.8%	1.6%	9.8%	3.3%	2.5%	8.2%	27.7%	92.8%	76.7%
6	Spain	-4.6%	-3.1%	59.2%	75.9%	4.7%	-3.0%	6.9%	12.0%	14.9%	22.3%	23.8%	6.5%
7	Bulgaria	-9.0%	2.8%	-2.1%	-0.4%	-1.2%	1.8%	7.6%	7.7%	6.8%	15.7%	100.8%	74.1%
8	Italy	-9.3%	-0.2%	52.2%	40.4%	3.7%	0.5%	3.2%	5.3%	6.7%	17.0%	52.3%	26.5%
9	Russia	-7.1%	-1.2%	-3.6%	-0.2%	10.8%	12.0%	17.7%	9.6%	13.7%	41.1%	57.1%	49.3%
10	Czech Republic	-2.5%	-0.6%	-1.1%	2.3%	-1.7%	3.4%	3.6%	6.3%	11.1%	54.9%	73.0%	44.4%
11	Chile	5.6%	3.7%	6.0%	4.1%	30.3%	51.6%	15.1%	8.5%	6.7%	13.1%	10.4%	15.1%
12	Belgium	-5.3%	-6.3%	13.3%	69.1%	5.8%	-2.3%	-8.0%	16.3%	0.4%	23.2%	55.5%	16.7%
13	Brazil	1.6%	3.2%	3.8%	5.4%	28.5%	19.6%	17.1%	20.4%	17.6%	16.9%	13.9%	23.3%
14	Lithuania	-9.5%	-7.4%	2.6%	6.3%	1.4%	12.1%	8.0%	10.6%	11.3%	14.6%	43.2%	76.2%
15	Portugal	-2.3%	-2.8%	7.6%	16.3%	11.4%	4.6%	27.1%	8.2%	14.6%	16.3%	27.8%	21.7%
16	Switzerland	-6.9%	-4.5%	9.7%	21.7%	-5.0%	-2.2%	-1.8%	0.9%	0.8%	12.1%	60.9%	53.3%
17	United Kingdom	-1.5%	-4.7%	3.7%	84.2%	28.5%	1.3%	-4.4%	0.9%	-0.5%	5.8%	16.2%	12.1%
18	Netherlands	-4.5%	-4.7%	16.6%	51.3%	2.9%	0.3%	-3.0%	8.0%	5.4%	18.4%	19.4%	22.4%
19	Croatia	-12.2%	-0.5%	3.9%	-2.1%	-4.4%	2.8%	4.0%	3.6%	9.8%	14.3%	48.9%	61.8%
20	Slovakia	-4.7%	-1.7%	2.2%	-1.6%	0.2%	0.4%	1.2%	5.0%	5.3%	21.3%	39.2%	59.2%
21	France	-5.9%	-2.8%	17.3%	34.4%	1.4%	1.6%	-1.1%	5.4%	6.8%	16.4%	30.7%	14.4%
22	Hungary	-9.4%	-4.9%	-0.9%	1.6%	-1.7%	0.5%	-1.5%	0.0%	4.9%	17.7%	61.4%	45.7%
23	Austria	-3.4%	-2.5%	4.1%	8.7%	0.3%	0.9%	0.5%	3.3%	7.3%	10.9%	46.7%	34.3%
24	Greece	3.3%	7.2%	8.5%	2.0%	4.0%	-0.1%	6.6%	7.0%	11.2%	5.0%	30.2%	19.4%
25	Canada	-0.2%	0.9%	2.4%	21.9%	16.2%	4.7%	5.1%	6.3%	7.5%	6.6%	12.5%	13.8%
26	Sweden	-7.5%	-6.4%	1.8%	36.9%	21.4%	8.6%	-3.1%	-2.6%	-3.8%	-5.3%	10.1%	22.4%
27	South Korea	3.6%	6.5%	3.3%	5.1%	1.7%	5.5%	4.5%	8.3%	7.0%	6.8%	4.9%	1.6%
28	Luxembourg	-11.5%	-15.3%	2.0%	12.8%	2.9%	-4.8%	-4.4%	6.7%	1.2%	1.7%	39.6%	26.0%
29	Israel	-5.0%	-6.5%	1.3%	2.1%	4.0%	-1.6%	5.2%	12.3%	22.3%	23.0%	1.0%	2.9%
30	Germany	-3.6%	-5.6%	-3.1%	7.7%	0.5%	1.3%	-1.6%	6.1%	5.0%	4.4%	12.3%	29.8%
31	Latvia	-6.0%	-6.9%	-9.7%	0.4%	1.7%	7.5%	2.0%	7.4%	2.2%	6.8%	14.7%	33.2%
32	Japan	-0.5%	0.0%	1.0%	4.8%	2.5%	2.6%	1.8%	5.9%	4.7%	6.4%	3.0%	7.7%
33	Finland	-10.0%	-0.8%	0.4%	7.8%	4.9%	5.2%	1.2%	2.9%	6.5%	2.2%	5.6%	3.1%
34	Estonia	-9.9%	-5.9%	-1.1%	4.6%	0.6%	1.5%	3.6%	3.4%	7.0%	-0.2%	6.2%	13.0%
35	Taiwan	-3.5%	11.0%	-6.8%	1.4%	-7.5%	1.9%	0.2%	-8.6%	4.2%	-6.5%	2.9%	7.4%
36	Denmark	-3.2%	-8.1%	-4.2%	5.3%	-1.8%	0.2%	1.1%	0.7%	3.2%	0.8%	4.9%	9.8%
37	Iceland	10.9%	2.4%	-2.8%	2.8%	4.9%	-21.4%	-6.2%	-6.9%	-3.5%	11.0%	2.0%	3.4%
38	Norway	-5.4%	-4.1%	-2.2%	0.7%	-5.1%	-3.4%	-3.4%	-0.5%	3.3%	-0.2%	-1.4%	-4.4%
39	Australia	-1.1%	4.7%	3.5%	3.2%	-1.9%	-8.6%	-8.2%	-6.8%	-7.5%	-6.1%	-1.3%	1.0%
40	New Zealand	2.6%	7.6%	1.9%	1.8%	-6.6%	-9.5%	-9.8%	-13.0%	-8.8%	-3.5%	0.3%	7.7%

Table 3.1-c (continued)
Select countries: monthly deaths per hundred thousand people and excess mortality

		Monthly excess mortality 2021											
		Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
1	Mexico	149.6%	72.4%	32.9%	23.4%	9.8%	10.4%	34.6%	99.5%	75.3%	28.4%	7.7%	-1.5%
2	Colombia	72.5%	38.4%	28.4%	82.7%	97.4%	115.7%	82.7%	24.7%	13.2%	12.4%	15.1%	16.2%
3	Poland	25.5%	11.7%	40.6%	65.2%	26.2%	14.0%	7.8%	6.1%	10.6%	15.7%	52.8%	67.2%
4	United States	38.6%	18.4%	6.1%	8.2%	9.8%	9.0%	12.1%	32.0%	37.5%	23.8%	17.9%	15.1%
5	Slovenia	24.9%	-2.3%	2.6%	10.5%	10.2%	13.7%	-0.9%	-4.8%	14.8%	18.8%	49.7%	23.3%
6	Spain	18.3%	8.7%	-0.7%	3.5%	3.6%	3.5%	9.3%	20.1%	11.2%	4.6%	9.7%	6.7%
7	Bulgaria	1.8%	9.3%	59.5%	80.3%	27.8%	11.6%	10.6%	23.5%	55.5%	79.7%	91.1%	43.8%
8	Italy	9.1%	5.4%	19.6%	23.3%	8.6%	7.3%	7.3%	11.4%	9.5%	5.5%	5.389441%	N/A
9	Russia	26.8%	15.8%	19.1%	10.2%	3.8%	23.5%	43.6%	41.2%	38.6%	61.6%	76.9%	38.2%
10	Czech Republic	53.0%	40.9%	60.8%	29.0%	6.0%	0.2%	-0.5%	-1.4%	4.0%	8.6%	42.3%	N/A
11	Chile	30.8%	32.8%	43.4%	40.3%	35.2%	28.8%	20.9%	9.4%	4.8%	12.5%	19.3%	25.3%
12	Belgium	-0.1%	-10.8%	-11.1%	5.8%	3.2%	-0.7%	-3.5%	-2.2%	1.4%	10.1%	15.2%	10.4%
13	Brazil	37.2%	35.5%	85.2%	74.6%	52.8%	42.3%	30.9%	26.9%	18.0%	8.5%	16.3%	12.5%
14	Lithuania	32.2%	6.2%	9.7%	15.0%	17.6%	19.3%	14.4%	16.5%	37.7%	47.7%	40.8%	32.4%
15	Portugal	63.6%	24.2%	-3.4%	-5.4%	0.7%	1.3%	7.7%	11.5%	10.2%	9.6%	16.3%	7.1%
16	Switzerland	17.0%	-9.9%	-9.6%	-1.3%	-1.3%	-2.3%	-2.5%	4.0%	7.0%	1.6%	11.0%	17.8%
17	United Kingdom	35.2%	20.4%	-6.3%	-11.6%	-4.8%	-4.0%	4.4%	10.9%	12.3%	11.8%	11.6%	9.0%
18	Netherlands	17.0%	2.1%	-3.1%	10.0%	6.8%	6.2%	5.0%	10.0%	11.6%	14.1%	34.6%	29.0%
19	Croatia	9.2%	4.3%	5.5%	34.5%	26.4%	17.2%	8.3%	9.9%	22.2%	26.1%	64.2%	42.1%
20	Slovakia	74.2%	68.2%	54.2%	28.0%	9.7%	8.8%	2.1%	0.8%	12.6%	27.9%	72.6%	N/A
21	France	9.3%	7.6%	6.5%	16.1%	7.8%	0.9%	1.4%	7.5%	6.5%	6.2%	6.0%	12.3%
22	Hungary	5.8%	1.9%	54.0%	49.6%	10.4%	9.5%	5.3%	-0.8%	4.8%	12.3%	50.9%	36.2%
23	Austria	6.6%	-5.4%	-1.1%	9.6%	6.6%	9.8%	3.5%	7.3%	10.3%	10.8%	32.4%	16.0%
24	Greece	-5.6%	-0.9%	18.1%	26.4%	22.2%	15.2%	22.4%	35.8%	26.3%	20.0%	33.0%	33.4%
25	Canada	8.5%	0.6%	-2.4%	3.5%	6.3%	6.8%	7.9%	8.3%	9.5%	N/A	N/A	N/A
26	Sweden	12.1%	-7.6%	-9.6%	-5.8%	-1.5%	-4.6%	-3.9%	-2.9%	1.3%	-2.7%	-0.1%	1.4%
27	South Korea	-1.0%	-0.7%	5.8%	6.5%	6.6%	8.9%	11.7%	10.7%	11.9%	11.7%	14.6%	17.1%
28	Luxembourg	1.8%	-9.1%	2.9%	2.9%	-5.7%	0.9%	-6.1%	-6.1%	0.2%	3.3%	11.5%	9.4%
29	Israel	13.4%	4.9%	5.9%	2.8%	2.1%	0.5%	3.4%	24.7%	22.3%	8.9%	-1.9%	-0.1%
30	Germany	20.7%	-3.8%	-9.9%	6.1%	6.5%	7.1%	1.9%	3.1%	9.8%	10.8%	21.4%	20.7%
31	Latvia	34.6%	17.3%	2.3%	9.9%	18.8%	26.2%	17.8%	12.4%	21.8%	58.9%	60.1%	23.1%
32	Japan	6.0%	2.0%	5.1%	9.7%	12.6%	11.5%	9.3%	12.2%	13.1%	9.3%	7.2%	N/A
33	Finland	-2.5%	-2.2%	-4.2%	-1.2%	5.5%	5.3%	9.8%	12.5%	12.0%	11.8%	14.4%	N/A
34	Estonia	12.1%	9.8%	30.7%	25.4%	14.0%	18.7%	14.2%	10.6%	20.7%	27.7%	39.3%	22.5%
35	Taiwan	7.3%	1.5%	-4.9%	0.2%	5.1%	21.9%	6.9%	2.6%	4.1%	-0.7%	13.0%	11.0%
36	Denmark	9.1%	-9.2%	-12.9%	-3.2%	4.7%	5.0%	6.6%	11.0%	9.9%	12.5%	12.7%	16.0%
37	Iceland	2.0%	0.2%	-6.5%	0.4%	-0.5%	0.8%	9.6%	12.3%	-14.2%	-14.5%	5.4%	12.3%
38	Norway	-8.1%	-13.2%	-10.3%	-5.6%	-4.3%	-3.9%	-1.0%	5.9%	8.7%	8.5%	16.8%	11.7%
39	Australia	0.1%	-0.4%	2.0%	3.0%	3.8%	0.5%	-0.2%	-5.1%	-3.1%	N/A	N/A	N/A
40	New Zealand	7.6%	5.5%	5.1%	3.8%	0.2%	-2.1%	0.9%	2.9%	-1.8%	-0.6%	4.1%	6.0%

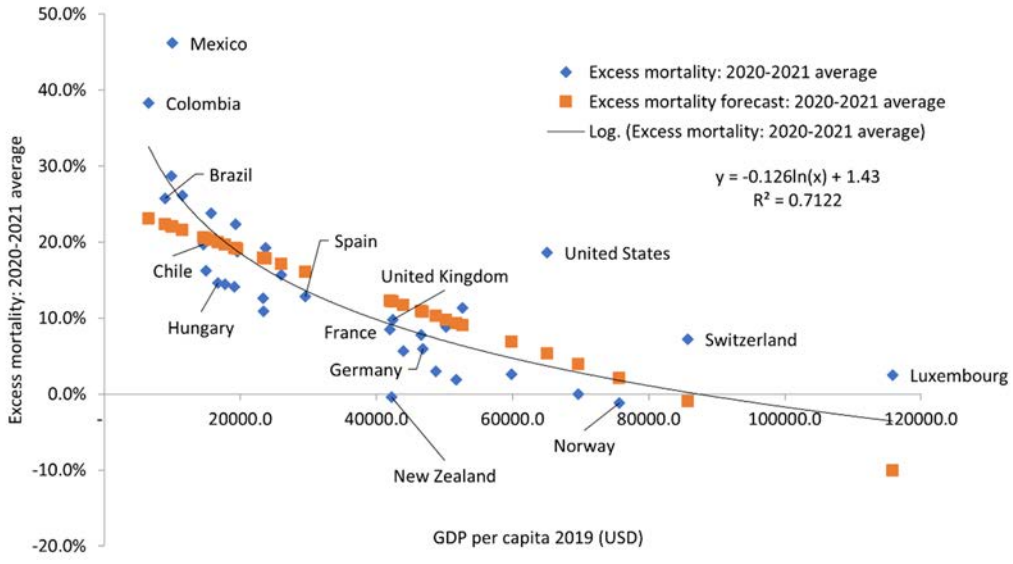
Source: MAPFRE Economics (based on data from Our World in Data, Human Mortality Database, OECD and Oxford Economics/Haver)

Chart 3.1-b
Excess mortality vs. Healthcare Systems Efficiency Indicator (HSEI): fitted regression line



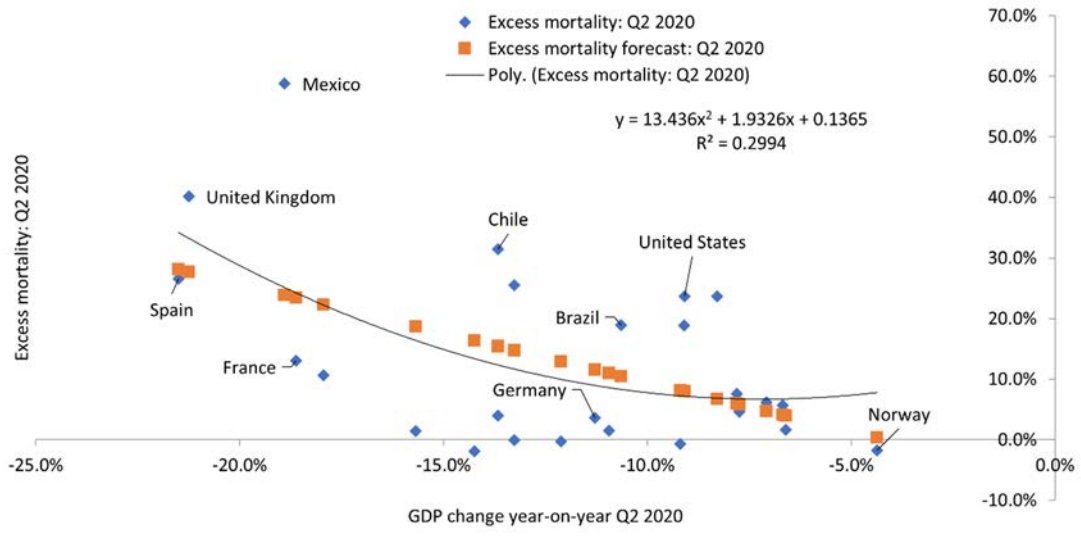
Source: MAPFRE Economics

Chart 3.1-c
Excess mortality vs. GDP per capita: fitted regression line



Source: MAPFRE Economics

Chart 3.1-d
Excess mortality vs. GDP performance:
fitted regression line



Source: MAPFRE Economics

average excess mortality for the sample countries in 2020 and 2021 and calculate the fitted regression line with per capita GDP in the year before the pandemic, the coefficient of determination is 0.7122. In other words, among the various factors that may explain lower excess mortality among countries in 2020-2021, higher per capita income would explain 71.2% of the differences between the sample countries.

It is important to note that comparing the observed excess deaths during the pandemic with per capita income results in an even higher coefficient of determination than with the Healthcare Systems Efficiency Indicator. However, the two analyses are complementary, given that the HSEI is a specific indicator that is in turn influenced by a country's per capita income.

Based on the high coefficients of determination found with both variables in the sample countries, the undeniable conclusion is that the pandemic was more lethal in countries with lower per capita income and weaker healthcare systems (factors that usually go hand in hand), as reflected in excess mortality during the first two years of the pandemic compared to deaths prior to its outbreak in late 2019.

Excess mortality and economic performance

At the economic level, the correlation between excess mortality and the change in GDP during the pandemic in the 39 sample countries is significantly lower than with structural variables. The highest correlation is observed in the second quarter of 2020, coinciding with the first pandemic wave of the SARS-CoV-2 virus. Thus, if excess mortality in the second quarter of 2020 is compared with the change in GDP in the sample countries in the same period, the fitted regression line yields a coefficient of determination of 0.2994 (see Chart 3.1-d). It should be noted that the comparison with annual GDP or with other quarters in the 2020–2021 period obtains lower coefficients of determination.

3.2 Efficiency of Pandemic Management Indicator

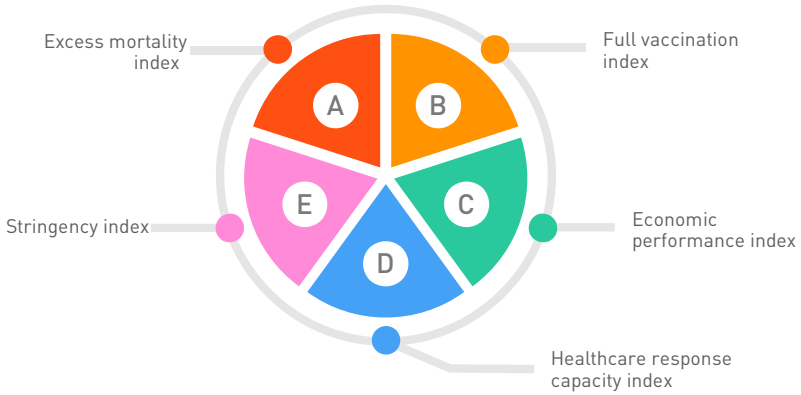
To summarize the above analyses, we can conclude that various factors have influenced the evolution and severity of the pandemic caused by SARS-CoV-2 in different countries. Some of these factors are exogenous (cannot be directly influenced), such as the characteristics of the virus or the demographic profile of the affected population, the existence of densely populated urban centers, or the country's position as a hub with international airports, among others.

Meanwhile, other factors are endogenous, which the authorities of different countries can influence by implementing public policies, such as the speed and efficiency of decision making, lockdowns and social distancing measures (to maximize health benefits and minimize damage to the economy), contact tracing and quarantines, border control, the use of masks in public places, and the research, production, and supply of vaccines, treatments, and diagnostic material, among others.

Ultimately, experience shows that a wide range of public policy measures can be adopted to mitigate massive contagion and its consequences, thereby minimizing the economic and social impacts and preventing an unsustainable increase in the number of victims of disease and the saturation of countries' healthcare systems.

Based on these premises, below we propose an indicator to assess the efficiency of the measures adopted in the 39 countries analyzed in this report, which allows us to assess how efficiently they managed the pandemic. This summary indicator, called the

Chart 3.2-a
Constructing the Efficiency of Pandemic Management Indicator (EPMI)



$$EPMI = \frac{(A * p_a) + (B * p_b) + (C * p_c) + (D * p_d) + (E * p_e)}{(p_a + p_b + p_c + p_d + p_e)}$$

Where:

p_a - Weight of index A
p_b - Weight of index B
p_c - Weight of index C
p_d - Weight of index D
p_e - Weight of index E

Source: MAPFRE Economics

"Efficiency of Pandemic Management Indicator (EPMI)," is made up of 5 indexes:

1) an excess mortality index, based on the excess mortality in 2020 and 2021 estimated in this report.

2) a vaccination index, reflecting the progress towards a fully vaccinated population.

3) an economic performance index, considering the percentage of economic recovery in 2021 compared to the loss in 2020.

4) a healthcare response capacity index, based on the MAPFRE Economics Healthcare Systems Efficiency Index, and

5) a restrictions level index, based on the "stringency index" maintained by the University of Oxford.

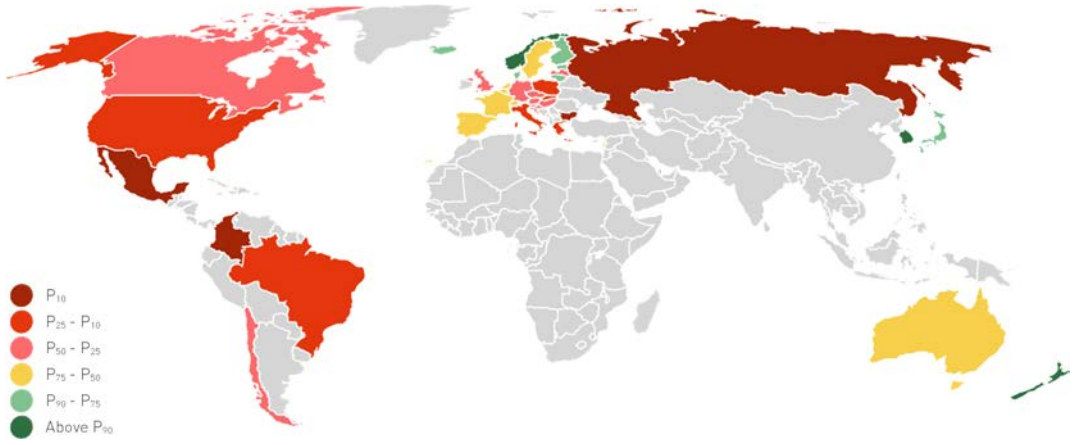
This indicator was created under the rationale that the countries that did the best job of managing the pandemic were the ones with lower excess mortality rates and stronger economic recovery in 2021 after the decline

Table 3.2
Efficiency of Pandemic Management Indicator (EPMI)

		Excess mortality index	Vaccination index (medium-term immunization capacity)	Economic performance index	Healthcare response capacity index	Stringency index	Efficiency of pandemic management index
1	South Korea	84.2	94.0	90.8	94.7	60.5	84.8
2	Norway	98.6	78.9	69.6	91.2	75.8	82.8
3	New Zealand	100.0	83.1	42.3	84.2	86.8	79.3
4	Iceland	94.2	84.1	3.8	92.1	98.6	74.6
5	Denmark	92.7	88.6	29.5	78.9	74.5	72.8
6	Japan	87.4	86.0	0.0	100.0	90.1	72.7
7	Finland	89.5	81.8	13.5	86.0	90.7	72.3
8	Estonia	90.6	66.7	50.6	50.0	100.0	71.6
9	Lithuania	66.3	74.4	100.0	27.2	80.4	69.6
10	Sweden	81.9	80.0	23.8	91.2	67.4	68.9
11	Israel	84.8	70.1	58.8	86.8	40.5	68.2
12	Australia	99.6	85.4	22.2	91.2	35.0	66.7
13	Switzerland	70.0	72.9	22.7	95.6	70.0	66.2
14	Luxembourg	84.5	0.0	79.5	87.7	78.4	66.0
15	Portugal	69.7	100.0	2.9	81.6	42.0	59.2
16	Belgium	64.5	82.6	10.5	79.8	55.7	58.6
17	Netherlands	71.8	77.2	12.8	82.5	46.3	58.1
18	Spain	58.5	89.3	1.5	91.2	43.8	56.8
19	France	74.2	83.1	8.4	86.8	30.9	56.7
20	Canada	77.6	86.8	14.3	88.6	15.6	56.6
21	Austria	75.2	80.7	5.1	79.8	39.8	56.1
22	Chile	63.8	96.9	30.9	66.7	20.6	55.8
23	Latvia	85.5	74.2	17.9	23.7	74.4	55.1
24	Croatia	72.4	56.6	8.4	52.6	83.9	54.8
25	United Kingdom	70.2	76.6	7.5	80.7	38.8	54.8
26	Slovenia	57.3	61.5	23.1	75.4	56.4	54.7
27	Germany	85.1	79.7	2.6	77.2	22.8	53.5
28	Czech Republic	61.8	67.5	5.6	59.6	70.5	53.0
29	Hungary	75.1	67.6	23.5	23.7	66.0	51.2
30	United States	56.8	68.0	26.1	60.5	40.3	50.3
31	Poland	55.9	61.0	31.1	43.9	59.6	50.3
32	Greece	76.5	76.4	8.5	77.2	11.0	49.9
33	Italy	60.9	83.9	6.6	92.1	0.0	48.7
34	Slovakia	72.6	51.0	11.0	44.7	62.9	48.5
35	Brazil	64.7	75.9	14.7	31.6	32.3	43.8
36	Russia	61.2	49.7	24.5	0.0	68.8	40.9
37	Bulgaria	59.2	11.5	14.2	18.4	80.1	36.7
38	Colombia	40.5	66.8	15.2	22.8	21.8	33.4
39	Mexico	0.0	62.9	4.4	26.3	55.0	29.7

Source: MAPFRE Economics

Chart 3.2-b
EPMI geography
(distribution by percentiles)



Source: MAPFRE Economics

in 2020. They also had greater established healthcare capacity to meet the population's needs during the health emergency, higher rates of fully vaccinated population, and lower levels of economic and social restrictions.

To add these factors and create the Efficiency of Pandemic Management Indicator (EPMI), these partial indicators were scaled from 0 to 100, and their arithmetic mean was calculated with equal weights. Table 3.2 and Chart 3.2-b show the results obtained. In addition to the summary indicator, the results of the partial indicators are presented to justify the higher or lower rating, disaggregated by the different factors that comprise it.

As we can observe, according to the EPMI, the country in this analysis that managed the pandemic most effectively was South Korea, followed by Norway and New Zealand. Other outstanding countries include Iceland, Denmark, and Japan (whose healthcare system is rated the best in the world and has managed to fight the pandemic with low travel restrictions compared to the other countries in the sample, although the impact on its economy was very pronounced).

At the opposite end of the spectrum, the countries with the lowest ratings include Mexico, Colombia, Bulgaria, Russia, and Brazil, which all have weak healthcare systems. Also noteworthy are the high excess mortality levels in Mexico, the highest in the sample, as well as in Colombia. Latin America has been hit particularly hard by the pandemic, and despite having weak healthcare systems, the region has made a tremendous effort to vaccinate its population, as highlighted by this partial indicator in most of the countries on the list, especially Chile.

4. Main impacts on insurance activities

Like many other sectors of the economy, the insurance industry is experiencing an unprecedented situation. The health crisis overwhelmed healthcare systems during the first pandemic wave caused by the original SARS-CoV-2 virus, which were, at times, unable to assist all the infected people who required urgent care to survive. This led to a series of social distancing measures and population lockdowns that affected the economy and, by association, the insurance markets in a context of a global economic crisis. This crisis has had significant repercussions on revenues and profitability in the insurance industry due to the economic, financial, and legal effects (related to contractual clauses that exclude pandemic coverage, among other aspects), as well as the effects on healthcare systems and biometrics that may affect the life expectancy of the global population.

At the same time, insurers' efforts to remain operational during lockdowns have accelerated digitization processes, ensuring that underwriting and customer service were not paralyzed and furthering many plans to invest in media and technological profiles.

Economic impacts: insurance demand

In 2020, the first year of the pandemic, the world economy suffered the largest drop recorded since World War II, with a 3.1% decrease in global GDP (compared to 2.8% growth in 2019)[9]. Revenues also fell in the global insurance business, which sustained a 1.3% decrease in insurance premiums in real terms[10], less than the drop in GDP. This was undoubtedly due in part to the rapid fiscal and monetary measures adopted by the different countries to support their respective economies and the strong performance of non-cyclical lines of business, especially home insurance and, to a greater extent, health insurance. These lines tend to behave in a countercyclical manner during periods of economic crisis, particularly in this case due to the health origins of the crisis, which overwhelmed public health systems in many countries around the world.

The slowdown in economic activity in 2020 affected both the developed and the emerging countries, with a 4.6% drop in GDP in the advanced economies (compared to growth of 1.6% in 2019), highlighting the GDP contractions of 3.4% in the United States, 6.5% in the Eurozone, and 4.7% in Japan As a result, aggregate insurance premiums in the developed markets in 2020 dropped 1.8% in real terms, with the U.S. insurance market slowing down as much as 0.6% (versus 3% growth in 2019), that of the Eurozone falling around 6.1%, and the Japanese market sliding 5.4%.

The aggregate downturn of GDP in the emerging economies was 2.1% (compared to 3.7% growth in 2019), less than that of the developed countries due to the stronger performance of the Chinese economy, which decelerated significantly compared to the previous year but did not shrink. Aggregate insurance premiums in the insurance

markets of the emerging economies, excluding China, fell 2.4% in real terms in 2020, while the Chinese insurance market lost some momentum, growing 3.6% (vs. 25% growth in premiums in 2019).

The implementation of extensive monetary and fiscal stimulus packages during 2020 and the gradual reopening of the economy after the strict lockdowns of the first half of the year prevented further falls in GDP. They greatly contributed to the recovery of the economy and the insurance markets in 2021. Together with the approval of the first COVID-19 vaccine in December 2020, all these factors quickly influenced the economy, which grew an estimated 5.8% worldwide in 2021, driven especially by the U.S. and Chinese markets, whose strong recovery spread to the emerging countries. However, this happened unevenly due to the slow vaccination process and the exhaustion of fiscal and monetary capacity, which in many cases forced these countries to reverse some of the measures adopted.

The economic recovery in 2021 spread to the global insurance markets, whose revenues recovered with around 3.4% growth in global insurance premiums in real terms (compared to the decline of 1.3% in 2020)[11]. Growth was driven by aggregate insurance premiums in the emerging markets (excluding China), which rose 5.7% in real terms, while the Chinese insurance market continued to slow down, with 1.5% growth in premiums (compared to the sustained double-digit growth it had been experiencing prior to the pandemic).

Healthcare system impacts

In particular, the saturation of public health systems caused by the pandemic has been a strong boost for the health insurance business. The public health systems were overwhelmed at every level, including hospital and outpatient, emergency services, and primary care health centers. The high saturation levels continue at this stage of the crisis, although the situation is improving. This has generated greater sensitivity to health-related risks, and such risk aversion has led many people to seek private insurance to complement public health coverage.

Financial impacts: liquidity and low interest rates

The ultra-accommodative monetary policy measures implemented by central banks at a global level (providing liquidity to financial markets and sharp cuts in interest rates) greatly complicated the life insurance and annuity business by substantially reducing the guaranteed return on the products sold. The situation was exacerbated by the abrupt economic contraction and the move to cash that takes place at times of extreme uncertainty, such as this crisis, when economic players prefer to keep their savings in sight rather than entering other types of medium or long-term investments ("dash for cash"). Savings-linked Life insurance was greatly affected by this move to cash, which was combined with cuts in monetary policy interest rates; and in some markets, such as the Eurozone and Japan, the prolonged low-interest rate environment had already been a burden before the pandemic.

Additionally, at the start of the pandemic, there was major turbulence in the financial markets that impacted some insurers' balance sheets and solvency positions. During February and March 2020, the stock markets crashed in one of the fastest falls in modern history, with the main indexes dropping nearly 40% in a 20-day period, according to calculations by the European Insurance and Occupational Pensions Authority (EIOPA). Meanwhile, the bond markets, in which insurance companies are large institutional investors, experienced strong volatility, with a rebound in risk premiums on corporate bonds and the majority of sovereign bonds, which led

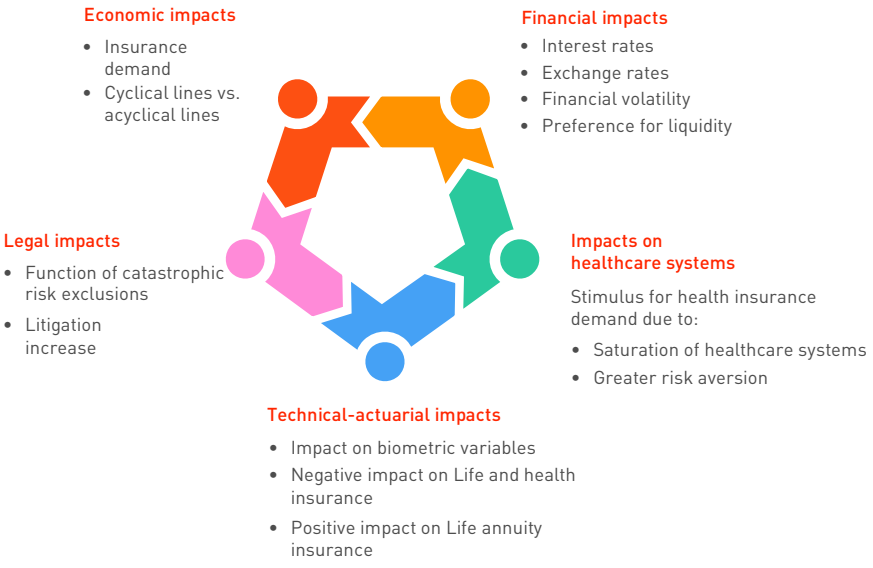
to significant temporary falls in their valuations. Other safe-haven government bonds (such as the U.S. "T-bond" or the German sovereign bond) moved in the opposite direction. Emerging economies suffered strong outflows of portfolio investment and sharp exchange-rate drops, which, coupled with the falls in GDP, will have a marked impact on the revenues and profitability of their respective insurance markets.

However, the rapid intervention of governments, which generally applied both conventional and unconventional ultra-accommodative monetary policies with interest rate cuts, as well as extraordinary measures for quantitative expansion through sovereign and corporate bond purchasing programs, together with expansionary fiscal policies, in an almost immediate and synchronized manner (unprecedented in previous economic crises), greatly helped to stabilize the financial markets and keep them running, providing liquidity to the system and rapidly containing risk premiums. This also allowed governments, households, and companies to continue accessing low-cost financing and corrected the sudden movements in investment portfolio valuations.

The International Association of Insurance Supervisors (IAIS), through its exercises to assess the systemic risk of the global insurance market, concluded that although the greatest impact of the crisis was on assets, which negatively affected the profitability and solvency of the insurance sector, insurers remained resilient both financially and operationally. Meanwhile, the European Insurance and Occupational Pensions Authority (EIOPA) highlighted that European insurers have managed to stave off a desperate situation, with the Solvency II regime helping them to better align their capital with risk, increase their resilience, and enhance their best practices in risk management.

Thus, the situation began to improve in the second half of 2020, and the approval of the first vaccine in December marked a turning

Chart 4:
Summary of the pandemic's impacts on the insurance industry



Source: MAPFRE Economics

point in the financial markets. Equities started to be perceived as an alternative to hedge against the low-interest rate environment and rising inflation, a consequence of monetary expansion, soaring energy prices, and supply chain bottlenecks due to the reopening process. This favored the development of Life insurance products in which the policyholder assumes the investment risk ("unit-linked" or "variable annuity," the latter being more common in markets such as the United States or Brazil, among others)[12]. 2021 was a year in which the stock markets ended with double-digit returns, but this was not the case for the bond market, which saw a slight decline in its valuations at the aggregate level.

Legal impacts: pandemic exclusions

Insurance policies usually contain exclusion clauses in the case of catastrophic risks, including pandemics. These types of low frequency and high severity risks, normally (but not only) associated with natural disasters, are capable of causing damages on a scale that could bankrupt insurers, which would be unable to cover the damages sustained by natural or legal persons with the insurance of those who do not sustain them. However, when such catastrophic events take place, and insurers invoke the exclusions provided for in the contract, litigation over their applicability to the event in question tends to increase.

In the case of the pandemic caused by the SARS-CoV-2 virus and declared by the World Health Organization (WHO), the exclusion clauses that are generating the most litigation are those related to claims for compensation of business interruption, which affected many business sectors due to lockdowns ordered by the authorities of most countries around the world. Some insurance markets, such as those of the United States and the United Kingdom, are being particularly impacted by such litigation and remain immersed in claims pending resolution by the courts in which an agreement (a common solution in this type of litigation) has yet to be reached.

Other lines of business, such as Life insurance with death risk coverage or Health insurance, were also affected. However, this impact has been moderate, as a large number of insurers, calculating that the fatality rate and morbidity from the virus could be managed without putting their solvency at risk, decided individually (and in some countries, even at a sector level) not to apply the pandemic exclusion clauses, serving their customers and paying compensation.

All these factors have caused a certain hardening of the insurance markets that are struggling the most, putting pressure on insurance and reinsurance prices and implying greater limitations in coverage to protect the solvency of the insurers operating in those markets.

Technical and actuarial impacts: impact on biometric variables

Without downplaying the tragedy of the pandemic in terms of human deaths, the biometric effects on the insurance sector have been limited. The detailed analysis of the sample of the countries considered in this report shows that the lethality of the SARS-CoV-2 virus (in its original strain and different variants) affects older cohorts to a greater extent, especially people over the age of 65. In other words, it has a greater impact on a group that normally does not have Life insurance protection policies against the risk of death (Life protection insurance). There are, however, some exceptions, such as the insurance markets in Latin America, where the greatest excess mortality observed has also affected younger cohorts, who usually have more coverage for family protection and linked to mortgage loans or consumption. Therefore, many insurance markets saw their loss ratios significantly affected during the pandemic, which impacted their profitability.

In this regard, Life protection policies (which provide protection against the risk of death) usually take the form of temporary insurance, renewable at the end of a certain period, with premiums that increase with age to achieve the actuarial balance, given that the risk of death increases as we get older. This means that few policyholders reach that age and keep their insurance policies active, opting not to renew them as the cost of insurance increases. In many cases, however, the insurance companies themselves do not market this type of policy to people aged 65 and over, as they cannot offer attractive prices for policyholders.

There are versions of Life protection insurance of a lifetime nature, in which a level premium is set for the entire life of the insured person, but they are rare (except in some markets, such as Japan). Such products are closer in nature to Life savings insurance, in which the biometric risk covered by the insurance company is less than that of pure Life protection insurance. Many guarantee the return of the premiums paid to family members in the event of death, which implies that the actuarial capitalization due to the pooling of the biometric risk is quite low, basically relying on financial capitalization.

However, the detrimental effect on insurance companies' balance sheets caused by deaths above those expected when determining the price of insurance in Life protection insurance is offset by the income that it stops paying in Life annuity insurance, which has the opposite effect compared to Life protection insurance. Thus, depending on the composition of insurers' specific portfolios, this second beneficial effect for insurers' profitability may be significantly greater than the negative effect of Life protection insurance, generating a net profit on their income statements.

4.1 Excess mortality and life expectancy

The situation caused by the COVID-19 pandemic is a catastrophic event that may significantly alter the demographic trends observed in the world in recent decades. The drastic declines in the fertility rate, combined with the general reduction in mortality rates and their positive effect on life expectancy, are driving a demographic transition towards older populations, a process that affects all countries and regions in the world without exception. However, it is more immediate and marked in the developed countries. This dynamic highlights the need to find savings formulas to complement pensions and bear the higher expenses for health or situations of dependency as we age. For example, in the case of pensions, pressure is continually increasing on the sustainability of public systems in which pay-as-you-go components have a greater weight, as the relative weight of the labor force compared to people who reach retirement age is progressively and markedly decreasing.

There is still a significant limitation due to the lack of data in all countries on deaths from all causes with a detailed breakdown by age and sex, which would enable the loss in life expectancy due to the pandemic to be determined. Therefore, there is great uncertainty regarding the impact of the pandemic in the coming years, including how it may have indirectly affected patients who required intensive care or people with diseases that potentially went undiagnosed during lockdowns or who postponed treatment for an existing serious illness. Mortality rates unrelated to COVID-19 could therefore increase in the future.

There are also long-term effects for people infected with COVID-19, that the WHO, through an extensive process of global consensus, has included in a clinical case definition, standardized worldwide, to facilitate the treatment of the sick. The name proposed by the WHO International Classification of Diseases is "post COVID-19 condition," but there are others such as: chronic COVID-19 syndrome, post-acute sequelae of COVID-19, long-haul COVID-19, and long COVID-19, among others. "Post COVID-19 condition occurs in individuals with a history of probable or confirmed SARS CoV-2 infection, usually three months from the onset of COVID-19 with symptoms and that last for at least two months and cannot be explained by an alternative diagnosis. Common symptoms include fatigue, shortness of breath, cognitive dysfunction, and others and generally impact everyday functioning. Symptoms may be new-onset following initial recovery from an acute COVID-19 episode or persist from the initial illness. Symptoms may also fluctuate or relapse over time. A separate definition might be applicable for children."[13].

Despite the unknowns about the long-term impact of the COVID-19 pandemic on life expectancy, the general opinion is that this is a temporary interruption and that improvement in global life expectancy will resume as a trend in a couple of years. However, some demographic projections foresee a slowdown in the improvement of long-term life expectancy, in line with the trend observed in the last decade in some countries before the pandemic.

Meanwhile, the preliminary data for 2020 from the European Union (EU) office of statistics, Eurostat[14], indicates that life expectancy at birth was reduced in the majority of EU member states with available data for 2020 (compared with the 2019 data). The largest decreases were registered in Spain (-1.6) and Bulgaria (-1.5), followed by Lithuania, Poland, and Romania (all -1.4). Life expectancy only increased in Norway (+0.3), Denmark (+0.1), and Finland (+0.1) during that period. The decrease was slightly more marked in the case of men, except for Spain, Cyprus, Luxembourg, and Slovenia.

The OECD[15] has also presented preliminary data on life expectancy in 2020 in 30 member countries, which shows that life expectancy dropped in 24 of them, with the exception of Norway, Japan, Costa Rica, Denmark, Finland, and Lithuania, compared to the 2019 data. The annual reduction was especially significant in the United States (-1.6 years), Spain (-1.5), Lithuania, and Poland (both -1.3), as well as in Belgium and Italy (both -1.2).

If we analyze the data from the OECD and Eurostat[16] on life expectancy at the age of 65 in the countries that provided information, in the case of women, we observe that the countries with the most marked decrease in 2020 compared to 2019 included Spain (-1.5 years), Belgium (-1.3 years), Slovenia (-1.2 years), Poland (-1.2 years), and Italy (-1.1 years). Meanwhile, Liechtenstein (-1.8 years), Poland (-1.6 years), Spain (-1.4 years), and Romania (-1.4 years) are the countries where the life expectancy of men aged 65 has dropped the most. However, life expectancy at age 65 has increased in Norway (+0.2 years), Denmark (+0.2 years), and Costa Rica (+0.1 years) for women, and in Finland (+0.2 years), Iceland (+0.2 years), Norway (+0.2 years), and Estonia (+0.1 years) for men.

Among the national statistics offices, the United Kingdom Office for National Statistics (ONS) published in January 2022 its national population projections based on 2020[17], which are described as "provisional" and contain some adjustments to short-term mortality assumptions to reflect the impact of the COVID-19 pandemic. The projections assume no radical change in future mortality improvement rates as a result of the pandemic and that after 2022, these will be in line with those projected without factoring in

COVID-19. However, several detailed adjustments were made between 2019 and 2024 to reflect the estimated deaths in 2021 and an average of an expert panel's opinions on the estimated improvements by age group over that period. In this regard, life expectancy is expected to increase over time, but not as rapidly as reflected in the projections based on 2018. This is a consequence of life expectancy increasing more slowly in recent years and the projected impact of the COVID-19 pandemic.

The Federal Planning Bureau (Bureau fédéral du Plan) of Belgium expresses a similar outlook in its update of *Population prospects 2019-2070*[18], which indicates that the COVID-19 pandemic will reduce life expectancy in 2020, and from 2021, it will recover a growth rate similar to the one projected before the start of the pandemic.

Meanwhile, the Pensions Advisory Council (Conseil d'orientation des retraites, COR) annually prepares an assessment of the French pension system in relation to its objectives and presents projections for the 2070 horizon based on economic, demographic, and regulatory factors. The June 2021 edition of the report includes the excess mortality linked to COVID-19 until the end of April 2021. The Council also decided to adopt a different demographic scenario from the one used previously, among those prepared by INSEE (Institut national de la statistique et des études économiques), reducing its outlook on fertility and life expectancy due to the recent evolution of the birth rate and mortality, even before the health crisis. In this scenario, based on INSEE population projections, life expectancy at age 65 would be 26.5 years for women and 24.2 years for men in 2070. In 2020, excess mortality among those over age 65 will cause a loss of life expectancy at age 65 of 6 months for women and 8 months for men.

In Spain, the Independent Authority for Fiscal Responsibility (Autoridad Independiente de Responsabilidad Fiscal, AIReF) is responsible for analyzing and assessing the sustainability of public finances, with the evolution of demographic variables being a fundamental determinant for some government expenditure items, especially for spending on pensions. Its updated demographic forecasts[19] reflect the short-term impact of the COVID-19 crisis, showing significant yet temporary decreases in life expectancy. In the long term, life expectancy is projected to improve continually, albeit at a slower pace than in past decades. Thus, life expectancy at birth would stand at 86.8 years in 2050 (around 89.5 years for women and 84.3 years for men), an evolution that does not significantly differ in the long term from the latest projections by the Spanish Statistical Office (Instituto Nacional de Estadística, INE) (2020-2070 population projections) and Eurostat (using population data as of January 1, 2019). According to the INE, the COVID-19 impact is reflected in a temporary decrease in life expectancy at birth in 2020, which should recover in 2021.

Some studies that analyze a broader group of countries[20] estimate that only a few of them saw improvements in their life expectancy at birth in 2020 compared to 2019, such as New Zealand (+0.7 years), Taiwan (+0.4 years), Australia (+0.3 years), Norway (+0.3 years), Japan (+0.3 years), Costa Rica (+0.2 years), South Korea (+0.1 years), Finland (+0.1 years), and Denmark (+0.1 years), with increases in both male and female life expectancy. Latvia maintains the same life expectancy for those two years, as do Cyprus and Iceland in the case of men (women lose 0.1 and 2.2 years, respectively) and Israel in the case of women (men lose 0.3 years). In contrast, if we analyze the data according to sex, the countries where the life expectancy of women saw the most marked decrease included Mexico (-2.5

years), India (-2.3 years), Liechtenstein (- 2.2 years), Russia (-2.1 years), and Bulgaria (-1.3 years). In the case of men, the greatest decreases are found in Mexico (-3.6 years), Liechtenstein (-2.5 years), Russia (-2.3 years), and India (-2.0 years).

In this compilation of research on the impact of COVID-19 on life expectancy, we must mention a series of studies focused on the aging of the population whose objectives include curing diseases. One example is the Telomeres and Telomerase Group of the Spanish National Cancer Research Center, led by María Blasco[21], which has spent decades researching the role of telomeres in tissue regeneration. Telomeres are structures that protect the chromosomes inside each of the body's cells. Their length is a known indicator of aging: every time the cell divides, the telomeres shorten to the point where they cannot exercise their protective function, and the damaged cell stops dividing. Throughout life, the cells constantly divide to regenerate tissues, and when they no longer do so, the body ages because the telomeres are too short. Therefore, in principle, the longer the telomeres, the greater the life expectancy and the lower the risk of disease. This group has spent years researching the role of telomeres in cancer and other diseases, such as pulmonary fibrosis (one of the most severe complications of COVID-19 in seriously ill patients). They are hopeful that since telomerase activation has a therapeutic effect in diseases related to short telomeres, the same therapy could improve some of the lingering pathologies in COVID-19 patients.

4.2 Impacts on Life insurance

Life insurance was the line of insurance most affected by the pandemic in 2020. However, the greatest impact was caused by the economic and financial effects of the crisis described above since the effects of excess mortality had a limited impact, despite the increase in claims for insurance providing protection against the risk of death. The exceptions were some markets where the virus's lethality affected all age groups, including the youngest ones, such as the Latin American market, probably the region most affected by the pandemic in terms of mortality worldwide.[22].

As a result, aggregate Life insurance premiums in the developed markets in 2020 fell 5.7% in real terms, while in the emerging markets, excluding China, they dropped 2.7%, in contrast to the latter's average growth of 4% in real terms (after correction for inflation) in the decade prior to the pandemic. Meanwhile, the Chinese market's life insurance premium growth slowed to 2.8% (compared to their 9% average growth in the decade before the pandemic).

As the economy started growing again in 2021, the Life insurance business partially recovered from the sharp drop in the previous year, with estimated global growth of 3.3% in real terms. The estimated growth of Life insurance premiums in the developed markets was around 4.1%, while in the insurance markets of the emerging countries, excluding China, they increased around 6.9% in real terms. In the case of China, however, they are expected to show a slight decrease.

The marked recovery of the Life business in the emerging markets (significantly above pre-pandemic levels) has been influenced by the resumed growth of a large number of these economies; there, the rebound in the prices of oil, other minerals, and general commodities has played an important role, together with the interest rate hikes that many central banks have been forced to implement as of 2021 due to the rise in inflation. These interest rate hikes favor sales of Life insurance products linked to savings and annuities, as they can offer higher guaranteed interest rates in an environment with a stronger appetite for savings products to hedge against inflation. Likewise, the high mortality due to the SaRs-CoV-2 virus (as reflected in the excess

mortality we have analyzed in this report) has increased sensitivity to the risk of death, boosting the Life protection business.

4.3 Impacts on Non-Life insurance

In 2020, the Non-Life insurance business at an aggregate level was affected to a lesser extent than the Life business due to the disparate behavior of the different lines of business that make up this area, where the sharp decline in the auto business (cyclical line) was offset by the strong performance of the health business (non-cyclical line). The pandemic's impacts on the economy and public health systems were the main reasons for this behavior. Multirisk insurance withstood the economic crisis well, due undoubtedly to the extensive measures implemented by governments to support households and companies through unemployment insurance and temporary workforce reductions, among many other solutions. Therefore, at an aggregate level, the Non-Life segment grew an estimated 1.5% in real terms, while in the decade prior to the pandemic its average growth had been 3.5%. The impact was much greater in the emerging markets (where auto insurance is usually the main line of business), excluding China, which fell 2.0% after showing average growth of 4.3%, in real terms, in the past decade.

However, the economy's resumed growth in 2021, along with economic agents' increased sensitivity to risk due to the situation during the most critical phases of the pandemic, contributed to the recovery of the Non-Life business. At the aggregate level, the Non-Life segment grew 3.3% in real terms, close to its average growth of 3.5% during the decade prior to the pandemic The recovery was much stronger in the emerging markets (excluding China), with estimated growth of around 4.7%, which surpassed the average growth of the last decade (4.3%) Meanwhile, Non-Life premiums in the developed markets showed an estimated growth of 2.8% (coinciding with the decade's average prior to the pandemic).

Despite the fall in Non-Life revenues, profitability was strong in 2020 due to the drop in loss ratios, mainly in the auto business, as a result of the lockdowns that significantly reduced the number of trips throughout the year. The same situation was observed in the health business, in which many insured parties opted to postpone non-urgent medical appointments. However, this caused insurers' loss ratio to increase in 2021, when they handled a large number of claims due to the reopening process and higher repair costs, resulting from inflationary pressures caused by the higher energy prices and supply bottlenecks to address the rise in demand. These factors, combined with the drop in the profitability of investments on account of the ultra accommodating monetary policies, adversely affected the profitability of insurers, putting pressure on the cost of insurance as a result.

4.3.1 Impacts on Health insurance

The saturation of public health systems caused by the pandemic has been a strong boost for the private health insurance business, generating (via greater risk aversion) a growing sensitivity to these risks. This has caused many individuals and companies to maintain and even seek out a private complement to public health coverage through collective insurance for workers. It is estimated that health insurance premiums in 2020 grew nearly 2.0% in real terms worldwide despite the sharp contraction in the economy.

In 2020 this line of business showed strong profitability due to the reduction in loss ratios caused by the fact that many policyholders chose to postpone non-urgent medical appointments during lockdowns. However, this resulted in a rise in benefits in 2021 due to the increased number of medical appointments and procedures amid the reopening process.

4.3.2 Impacts on other Non-Life insurance

As highlighted in this section of the report, sudden drops in GDP bring about sharp drops in premiums for the insurance business at the

aggregate level, in both the emerging and developed markets, although different Non-Life lines of business are impacted asymmetrically. Auto insurance is among the lines of business that tend to suffer the most during economic crises (cyclical line), as observed in the current crisis caused by the pandemic, along with lines of business with less weight, such as travel insurance, when tourism and business trips come to a halt. As observed in past crises, home and homeowners insurance have been more resilient (non-cyclical lines). Similarly, those linked to businesses and companies have also withstood the impact of this crisis. These lines of business were assisted by the ample fiscal aid packages implemented by governments to support households and businesses, along with monetary expansion measures that have allowed them to continue accessing financing at reduced costs.

The auto insurance business is being particularly impacted by supply chain disruptions due to the shortage of chips needed for new vehicle production, which is reducing registrations and having negative effects. This business was the only one that could not recover in 2021 from the decline due to the pandemic, although economic growth resumed. This problem is being aggravated by the rise in energy prices and the scarcity of raw materials such as aluminum and other metals used for manufacturing, due to the invasion of Ukraine and the international sanctions on Russia (many producers having removed their production chains from Russian territory), together with the semiconductor shortage that has yet to be resolved.

4.4 Prospects: looking towards the immediate future

The prospects for the insurance markets in the coming years will be influenced by the pandemic's lingering economic and financial effects as well as the consequences of the events between Russia and Ukraine, as explained in the last section of our study. In terms of excess mortality, unless a virus mutation appears and changes the current direction of mortality and morbidity (which seems unlikely but cannot be ruled out), the trend seems to point to improvement, especially since the world has made significant progress in this area and is better prepared to handle an event of this nature. Meanwhile, despite the increase in uncertainty, economic agents' greater sensitivity to the risk caused by the pandemic is providing an additional boost to insurance demand among households and companies.

The insurance business should therefore continue to grow above the trend observed in recent years, led by the emerging markets, where insurance penetration in the economy is still well below that of the developed markets, providing greater margin for growth in insurance premiums when GDP increases. However, the Chinese insurance market is expected to make less of a contribution due to the marked slowdown in the country's economic growth, a result of the real estate crisis and the decision to maintain an accommodative monetary policy amid the deceleration. This will detract from the dynamism of the insurance business and particularly Life insurance linked to real estate credit and savings. The Chinese authorities' policy for handling the pandemic also diverges from the rest of the world, and they currently have zero tolerance for outbreaks of new strains of the SARS-CoV-2 virus, such as the Omicron variant.

In short, after the insurance markets worldwide showed strong recovery in 2021, the coming years will be marked by a more complex environment. The crisis caused by Russia's invasion of Ukraine is complicating the situation, causing economic growth forecasts to be revised downward, especially in European countries. However, this will have repercussions on economic growth at the global level, thus reducing the growth expectations for the insurance markets. In addition, the strong setbacks and high volatility in the stock markets complicate the sale of Life insurance products in which the policyholder assumes investment risk, in countries in which these types of products have significant weight. This is coupled with persistent inflation that is generating a shift

towards less accommodative monetary policies, with the tightening of monetary policy beyond pre-pandemic levels in some emerging markets, which will encourage the development of Life insurance products linked to savings and traditional annuities. However, it should be noted that persistent inflation ends up eroding savings capacity and, therefore, demand for such products.

The invasion of Ukraine by Russia has reactivated some of the initial impacts of the pandemic on the financial markets, and investors are moving back to cash positions, which is causing high volatility in the bond and securities markets. Additionally, some of the main problems associated with the economic reopening process persist, with supply still unable to keep up with increased demand, the general increase in energy and commodity prices, and the rebound in inflation in an environment of high liquidity. As a result, the main central banks, which had begun to gradually withdraw the extraordinary expansive measures adopted in the developed markets and many of the emerging ones, have had to reverse their course in 2021 due to the marked increase in inflation. This problem has been aggravated due to the conflict in Ukraine, causing persistent bottlenecks and putting pressure on oil, food, mineral, and commodity prices, which continue to soar. There is a risk of some economies running into economic stagnation with high inflation rates (stagflation), which would be especially harmful to all sectors of activity, including the insurance industry.

The supply chain disruptions will continue to affect the automotive sector in particular, weighing down new vehicle registrations and having negative repercussions for the auto insurance business, a situation that is being aggravated by the crisis in the market for certain metals, such as aluminum, of which Russia is a main producer. This is compounded by the semiconductor shortage and the fact that many major automakers have shut down their supply chains in Russia. The Life protection and Health businesses, however, may continue to benefit from the greater sensitivity to the risk of death and illness among households and companies due to the pandemic, which remains strong, especially in countries with weaker healthcare systems, although these effects are likely to be limited over time.

On the other hand, the outlook on insurers' profitability remains favorable, and the pandemic's negative impacts on the loss ratio for Life protection insurance and auto and health insurance as a result of the reopening of the economy are being reversed in general. However, the upswing in inflation could somewhat erode their profitability in claims arising from contracts that do not consider these circumstances in terms of premium rates, driving up the prices of new policies in an environment of higher, more persistent inflation than anticipated.

In the Eurozone, at least in the short term, the savings-linked Life insurance business will remain influenced by the low interest rate environment despite the shift in the European Central Bank's (ECB) monetary policy towards the gradual withdrawal of the extraordinary monetary stimulus measures it introduced in response to the pandemic, focusing on winding down its net bond-purchasing program in the third quarter of 2021. The situation caused by the Russian invasion of Ukraine could modify the original forecasts for interest rate hikes based on inflation and the deterioration of economic conditions. This is reflected by the recent statements on monetary policy by the ECB, which has changed its message, adopting a harsher tone in response to the rise in inflation in the Eurozone, which could lead to interest rate hikes in the coming quarters. Meanwhile, in the United States, this process will be faster, and the Fed is expected to raise interest rates and begin reducing its balance sheet in 2022.

The outlook on Life insurance in which the policyholder takes on the investment risk has become more complicated. Insurers will be forced to adapt their products to a new environment of risk-free interest rates and greater pressure on risk premiums in fixed income and increased volatility in equities due to the conflict in Ukraine. Asset valuations were elevated, with many indexes hitting historic highs, and the announcement by the Federal Reserve and other central banks that monetary stimulus would be withdrawn has coincided with the geopolitical situation caused by the war. This is generating a sharp correction that could negatively impact the balance sheets and solvency of insurers that have not managed these risks adequately.

Finally, the outlook on the emerging markets is quite asymmetrical, and economic growth could slow down less in the emerging Asian markets than in regions like Latin America. While its economy and insurance markets in 2021 recovered much of the ground lost during the crisis, Latin America will receive less of a boost in 2022 against a backdrop of reduced fiscal stimulus, tightening monetary policies, high debt ratios, and increased pressure on its respective currencies due to the interest rate hikes planned by the U.S. Federal Reserve. The deterioration of the public accounts of many of these emerging markets is also fueling depreciations in their exchange rates and inflationary pressures that could weigh down economic recovery and the insurance industry due to its strong link to the economic cycle. This situation could also make insurers less profitable due to the increase in claim costs.

However, the rate hikes underway in some of these markets have generated a favorable interest rate environment for the Life business linked to savings and traditional annuities that may continue to stimulate this business, although the erosion of disposable income due to inflation reduces households' savings capacity. Thus, the positive effects should be less significant than observed in 2021, when turnover in these markets grew considerably due to higher interest rates and stronger demand for protection against the risk of death as a result of the pandemic.

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7/ The following are added to the sample of 15 countries analyzed in the above section: Norway, Iceland, Denmark, Japan, Finland, Estonia, Lithuania, Sweden, Israel, Switzerland, Luxembourg, Portugal, Belgium, Netherlands, Austria, Latvia, Croatia, Slovenia, Czech Republic, Hungary, Poland, Greece, Slovakia, Bulgaria, and Colombia.

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Index of tables, charts and boxes

Tables

Table 1.1-a	COVID-19: variants of interest	23
Table 1.1-b	COVID-19: variants of concern	24
Table 2.1.1	Canada main indicators related to the pandemic	28
Table 2.1.2	United States: main indicators related to the pandemic	31
Table 2.1.3	Mexico: main indicators related to the pandemic	34
Table 2.1.4	Brazil: main indicators related to the pandemic	38
Table 2.1.5	Chile: main indicators related to the pandemic	40
Table 2.2.1	United Kingdom main indicators related to the pandemic	44
Table 2.2.2	Germany: main indicators related to the pandemic	47
Table 2.2.3	France: main indicators related to the pandemic	50
Table 2.2.4	Italy: main indicators related to the pandemic	53
Table 2.2.5	Spain: main indicators related to the pandemic	56
Table 2.2.6	Russia: main indicators related to the pandemic	59
Table 2.3.1	Taiwan: main indicators related to the pandemic	62
Table 2.3.2	South Korea: main indicators related to the pandemic	65
Table 2.3.3	Australia: main indicators related to the pandemic	68
Table 2.3.4	New Zealand: main indicators related to the pandemic	71
Table 3.1-a	Select countries: annual deaths per hundred thousand people and excess mortality	79
Table 3.1-b	Select countries: quarterly deaths per hundred thousand people and excess mortality	80
Table 3.1-c	Select countries: monthly deaths per hundred thousand people and excess mortality	81
Table 3.2	Efficiency of Pandemic Management Indicator (EPMI	86

Charts

Chart 1.1	Global: Daily COVID-19 infections and deaths	17
Chart 2.1.1-a	Canada: Total weekly deaths	27
Chart 2.1.1-b	Canada: total weekly deaths vs. total population	27
Chart 2.1.1-c	Canada: deaths due to COVID-19 vs measures adopted	27
Chart 2.1.1-d	Canada: evolution of cumulative excess mortality	27
Chart 2.1.2-a	United States: Total weekly deaths	30
Chart 2.1.2-b	United States: total weekly deaths vs. total population	30
Chart 2.1.2-c	United States: deaths due to COVID-19 vs measures adopted	30
Chart 2.1.2-d	United States: evolution of cumulative excess mortality	30
Chart 2.1.3-a	Mexico: Total weekly deaths	33

Chart 2.1.3-b Mexico: total weekly deaths vs. total population ... 33
Chart 2.1.3-c Mexico: deaths due to COVID-19 vs measures adopted ... 33
Chart 2.1.3-d Mexico: evolution of cumulative excess mortality ... 33
Chart 2.1.4-a Brazil: Total weekly deaths ... 37
Chart 2.1.4-b Brazil: total weekly deaths vs. total population ... 37
Chart 2.1.4-c Brazil: deaths due to COVID-19 vs measures adopted ... 37
Chart 2.1.4-d Brazil: evolution of cumulative excess mortality ... 37
Chart 2.1.5-a Chile: Total weekly deaths ... 42
Chart 2.1.5-b Chile: total weekly deaths vs. total population ... 42
Chart 2.1.5-c Chile: deaths due to COVID-19 vs measures adopted ... 42
Chart 2.1.5-d Chile: evolution of cumulative excess mortality ... 42
Chart 2.2.1-a United Kingdom: Total weekly deaths ... 43
Chart 2.2.1-b United Kingdom: total weekly deaths vs. total population ... 43
Chart 2.2.1-c United Kingdom: deaths due to COVID-19 vs measures adopted ... 43
Chart 2.2.1-d United Kingdom: evolution of cumulative excess mortality ... 43
Chart 2.2.2-a Germany: Total weekly deaths ... 46
Chart 2.2.2-b Germany: total weekly deaths vs. total population ... 46
Chart 2.2.2-c Germany: deaths due to COVID-19 vs measures adopted ... 46
Chart 2.2.2-d Germany: evolution of cumulative excess mortality ... 46
Chart 2.2.3-a France: Total weekly deaths ... 49
Chart 2.2.3-b France: total weekly deaths vs. total population ... 49
Chart 2.2.3-c France: deaths due to COVID-19 vs measures adopted ... 49
Chart 2.2.3-d France: evolution of cumulative excess mortality ... 49
Chart 2.2.4-a Italy: Total weekly deaths ... 52
Chart 2.2.4-b Italy: total weekly deaths vs. total population ... 52
Chart 2.2.4-c Italy: deaths due to COVID-19 vs measures adopted ... 52
Chart 2.2.4-d Italy: evolution of cumulative excess mortality ... 52
Chart 2.2.5-a Spain: total weekly deaths ... 55
Chart 2.2.5-b Spain: total weekly deaths vs. total population ... 55
Chart 2.2.5-c Spain: deaths due to COVID-19 vs measures adopted ... 55
Chart 2.2.5-d Spain: evolution of cumulative excess mortality ... 55
Chart 2.2.6-a Russia: total weekly deaths ... 58
Chart 2.2.6-b Russia: total weekly deaths vs. total population ... 58
Chart 2.2.6-c Russia: deaths due to COVID-19 vs measures adopted ... 58
Chart 2.2.6-d Russia: evolution of cumulative excess mortality ... 58
Chart 2.3.1-a Taiwan: Total weekly deaths ... 64
Chart 2.3.1-b Taiwan: total weekly deaths vs. total population ... 64
Chart 2.3.1-c Taiwan: deaths due to COVID-19 vs measures adopted ... 64
Chart 2.3.1-d Taiwan: evolution of cumulative excess mortality ... 64
Chart 2.3.2-a South Korea: total weekly deaths ... 67
Chart 2.3.2-b South Korea: total weekly deaths vs. total population ... 67
Chart 2.3.2-c South Korea: deaths due to COVID-19 vs measures adopted ... 67
Chart 2.3.2-d South Korea: evolution of cumulative excess mortality ... 67
Chart 2.3.3-a Australia: Total weekly deaths ... 70
Chart 2.3.3-b Australia: total weekly deaths vs. total population ... 70
Chart 2.3.3-c Australia: deaths due to COVID-19 vs measures adopted ... 70
Chart 2.3.3-d Australia: evolution of cumulative excess mortality ... 70
Chart 2.3.4-a New Zealand: Total weekly deaths ... 73
Chart 2.3.4-b New Zealand: total weekly deaths vs. total population ... 73
Chart 2.3.4-c New Zealand: deaths due to COVID-19 vs measures adopted ... 73
Chart 2.3.4-d New Zealand: evolution of cumulative excess mortality ... 73
Chart 3.1-a Select countries: annual excess mortality, 2020 and 2021 ... 78
Chart 3.1-b Excess mortality vs. Healthcare Systems Efficiency Indicator (HSEI): fitted regression line ... 83

Chart 3.1-c Excess mortality vs. GDP per capita: fitted regression line 83
Chart 3.1-d Excess mortality vs. GDP performance: fitted regression line 84
Chart 3.2-a Construction of the Efficiency of Pandemic Management Indicator (EPMI) 85
Chart 3.2-b Geography of the EPMI 87
Chart 4 Summary of pandemic impacts on the insurance industry 91

Boxes

Box 1.1 COVID-19 vaccines 18
Box 3.1 Global excess mortality estimates 76

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