Mortality during the COVID-19 pandemic in Uruguay

Catalina Torres, Victoria Prieto, Gonzalo De Armas, Mariana Paredes, Raquel Pollero

Short abstract

In 2020, while many countries were experiencing excess mortality associated with the COVID-19 pandemic, in Uruguay there were less deaths compared to those registered in 2019. However, the following two years were marked by unprecedentedly high numbers of deaths, exceeding considerably those observed during the preceding decades. In this study we explore mortality levels and changes during the COVID-19 pandemic in Uruguay. We try to quantify the lethal impact of the pandemic, by estimating the number of annual and monthly excess deaths in 2020-2022. Furthermore, we compare the mortality levels during those years with those of a pre-pandemic period, decomposing the changes in life expectancy into the contributions by age and cause of death. We find that, contrary to what was observed in most countries (in Latin American and beyond), there was a life-expectancy increase in 2020 in Uruguay. However, in 2021 and 2022, there was a considerable loss in life expectancy, as the number of deaths registered exceeded by almost 19% and 13% the expected numbers for those years, respectively. In addition, the decomposition results indicate that most of the losses in life expectancy during the pandemic can be directly attributed to COVID-19. However, substantial, negative contributions from other causes were observed as well, especially in 2022, showing the impact the pandemic might have had on other causes of death and the health system.

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1. Introduction

In 2020, many countries around the world – including in Latin America (Lima et al. 2021) – experienced substantial increases in mortality, as the SARS-CoV-2 virus spread globally. In the absence of vaccines, local and national governments implemented non-pharmaceutical measures in an effort to prevent the fast spread of the disease. The nature and strength of those measures varied from place to place; some of the most common were periods of lockdown, restricted mobility and mandatory face-mask use.

In Uruguay, numerous non-pharmaceutical measures were implemented in the course of the year 2020, such as teleworking, partial border closure, school and university closures, mandatory face-mask use in public places, non-mandatory quarantine, massive distribution of hand sanitising gels, home-visits from medical staff to persons with suspected infection, virtual medical consultations, and delay of scheduled surgeries, among others. In fact, most measures were implemented between March and December 2020, that is before the first wave hit the country in the first half of 2021 (Bengochea et al., 2022; Cabana et al., 2021). For example, as a result of mobility restrictions, urban mobility fell by 26% on average in 2020, with a maximum monthly decrease of 57% in April (with respect to the levels recorded in February 2020). Similarly, the creation of programs to mitigate the impact of the pandemic and most measures related to the interruption of activities (such as school closures) were implemented in 2020. Since May 2021, activities returned to normal progressively, as vaccination coverage rose.The first vaccines were administered in late February 2021; by the end of August about 71% of the population (that is, about 2.5 million people) had received the complete vaccination protocol. Face-to-face medical appointments (instead of virtual ones) and surgeries resumed progressively from mid-May 2021 and fully from mid-July (only medical appointments). Surgeries that were postponed resumed fully from August 1.

With respect to the implementation of non-pharmaceutical interventions (especially during 2020), it is possible that changes in behaviour like the ones mentioned above affected the contagion patterns of the SARS-CoV-2 virus, but also the exposure to other diseases. In any case, it is noteworthy that the total number of deaths registered in Uruguay in 2020 was below the number registered the previous year (34,807 in 2019 and 32,638 deaths in 2020). However, the following year was marked by an unprecedentedly high number of deaths (41,168 in 2021). A considerable death toll was recorded then again in the year 2022 (39,322 deaths), despite that the worst of the pandemic seemed relatively far-off by then, thanks to successful vaccination during 2021.

Are the numbers of deaths recorded in 2021 and 2022 significantly higher than expected? In this study we quantify the lethal impact of the COVID-19 pandemic in Uruguay, by estimating the number of annual and monthly excess deaths in 2020-2022. Furthermore, we aim to shed light on the impact of the pandemic on the behaviour of the other causes of death, by comparing the mortality levels registered during those years with those of a pre-pandemic period. Here we present some preliminary results of those analyses. We use the *Health Transition* as our theoretical framework (Frenk et al. 1991), as it considers that changes in health conditions in a population are determined by the interaction between epidemiologic changes and changes in social health responses. More broadly, Bernabeu-Mestre and Robles (2000) consider that health and disease patterns in a population are the result of the dynamic

interaction between biological, demographic, socioeconomic, technological, political and cultural factors.

2. Methods and Data

We estimate the expected number of monthly deaths for the years 2020, 2021 and 2022, based on the monthly distribution of deaths for the previous years since 1997. We used the method proposed by the 'Technical Advisory Group (TAG) on COVID-19 Mortality Assessment' for countries with monthly death counts (the case of Uruguay): a Generalised Additive Model (GAM) with a negative binomial distribution (WHO 2023a). Monthly estimates require two terms in the model, one capturing the annual trends and another one capturing the seasonal variations within a year, while annual estimates require only the annual trend.

Then, we obtain the annual and monthly excess deaths by subtracting the estimated expected deaths from the observed ones in 2020, 2021, and 2022. Finally, we compute P-scores for each year and month, i.e., the relative difference between the expected and the observed deaths.

In addition, we decompose the differences in life expectancy between 2019 and each subsequent year from 2020 to 2022, using the method proposed by Schkolnikov et al. (2001). This decomposition proceeds in three steps: first, we estimate annual values of life expectancy at birth and compute the difference between defined year groups ($year_i$ and $year_{i+n}$); next, we use the equation for the age component to estimate the contribution of each age category to the observed differences; finally, we estimate the weighted differences between cause and age-specific mortality rates accounting for the age component. In this document we show only the total contributions by cause of death (Figure 2), but we will include the entire set of detailed results by age and sex later on.

Concerning the data, we used annual and monthly death counts from the vital statistics published by the Health Ministry (*Ministerio de Salud Pública*, MSP) and annual population estimates from the most recent revision published by the national statistics office (*Instituto nacional de estadística*, INE). Death counts disaggregated by age, sex and cause of death were used for the decomposition analysis. For the results by cause of death included in the present document, we use seven major groups of causes of death that account for approximately 75% of total mortality in 2021, a residual group including 10 groups[1], and a group for the ill-defined causes (10.8% in 2021). We group confirmed and suspected COVID-19 deaths together.

Although our results cover the pandemic years, that is 2020, 2021, and 2022, we use data for earlier years in order to perform the analyses described above. For instance, for estimating the annual excess deaths from 2020 to 2022, we use the complete time series of annual deaths in Uruguay, which starts in 1900[2]. Then, for estimating the monthly excess deaths in the same three pandemic years, we use the monthly death counts observed from 1997 until 2019.

[1] The groups included in the residual group are: Diseases of the blood or blood-forming organs; Endocrine, nutritional or metabolic diseases; Diseases of the nervous system; Diseases of the digestive system; Diseases of the musculoskeletal system or connective tissue; Diseases of the genitourinary system; Pregnancy, childbirth or the puerperium; Certain conditions originating in the perinatal period; Developmental anomalies; and Diseases of the eye and adnexa.

[2] For estimating the number of expected deaths, we exclude the years 2020-2022.

3. Preliminary results

There were less deaths than expected in 2020 in Uruguay (-5.2%). However, in 2021 and 2022, there were approximately 6,517 and 4,443 more deaths than expected, which represent an excess of about 19% and 13% for each year respectively. Compared to 2019 –a seemingly normal pre-pandemic year–, life expectancy at birth (e_0) increased by 0.89 years in 2020 ($e_{0(2019)}$= 77.2 and $e_{0(2020)}$ = 78.1), whereas it decreased by 1.89 years in 2021 ($e_{0(2021)}$ = 75.3) and 0.89 years in 2022 ($e_{0(2022)}$ = 76.4).

In 2020, there were fewer deaths than expected in most months of the year, especially from April until October (Figure 1). However, in November and December the number of COVID-19 deaths started to rise substantially, contributing to about half of the total estimated excess deaths for those months. The decomposition results (Figure 2) indicate that mortality from cardiovascular diseases was the only other cause of death (besides COVID-19) with small negative contributions to the differences in life expectancy between 2019 and 2020. The other causes have positive contributions and explain the life-expectancy gain of 0.89 years in 2020 (with respect to 2019). In particular, positive contributions from some external causes (like traffic accidents) and respiratory diseases may be linked to the impact of non-pharmaceutical measures implemented in 2020 to stop the spread of COVID-19.

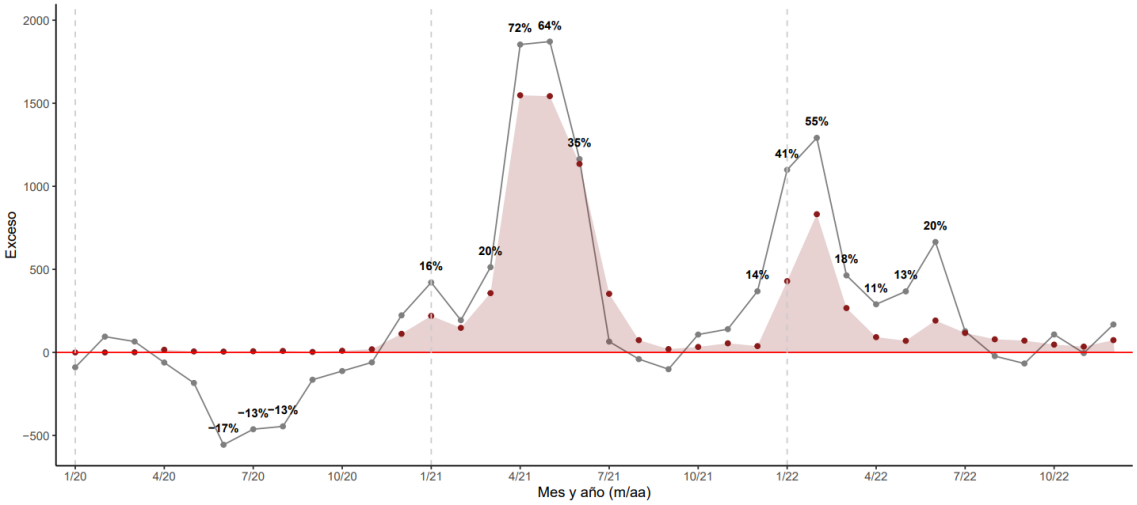
Excess mortality during 2021 and 2022 was concentrated in two main periods: the first, most intense one went from March until June 2021 (Figure 1). The second started in December 2021 and went until March 2022. This is quite atypical, as the lowest mortality rates are usually observed during summer (which in Uruguay goes from December until February). There is a third, smaller peak in 2022, in June. The maximum monthly P-scores in each period are 72% in April 2021, 55% in February 2022, and 20% in June 2022.

Figure 1 also indicates that COVID-19 deaths and excess deaths had a similar evolution during 2021 and 2022, as they increased and decreased in the same months. However, the part of excess deaths that could be attributed to COVID-19 seems to decrease over time. In the first peak, COVID-19 deaths represent 80% or more of the total excess deaths. In the second and third peaks, that share falls to two thirds and one third respectively.

Figure 2 helps disentangling the results shown in Figure 1, as it reveals the extent to which each group of causes of death contributed to the differences in life expectancy, when comparing each pandemic year with 2019. In 2021, most of the total life-expectancy loss of 1.89 years is due to the large negative contribution of COVID-19. Negative contributions of about -0.25 years are also observed from cardiovascular diseases and ill-defined causes. In contrast, in 2022 the share of COVID-19 among the causes that reduce life-expectancy is visibly smaller. In that year, higher mortality from cardiovascular diseases, respiratory diseases, ill-defined diseases, and, to a smaller extent, external causes contributed negatively to the differences in life expectancy with the pre-pandemic year. The substantial negative contribution of the ill-defined causes most likely reflects difficulties in the registration of deaths during the pandemic.

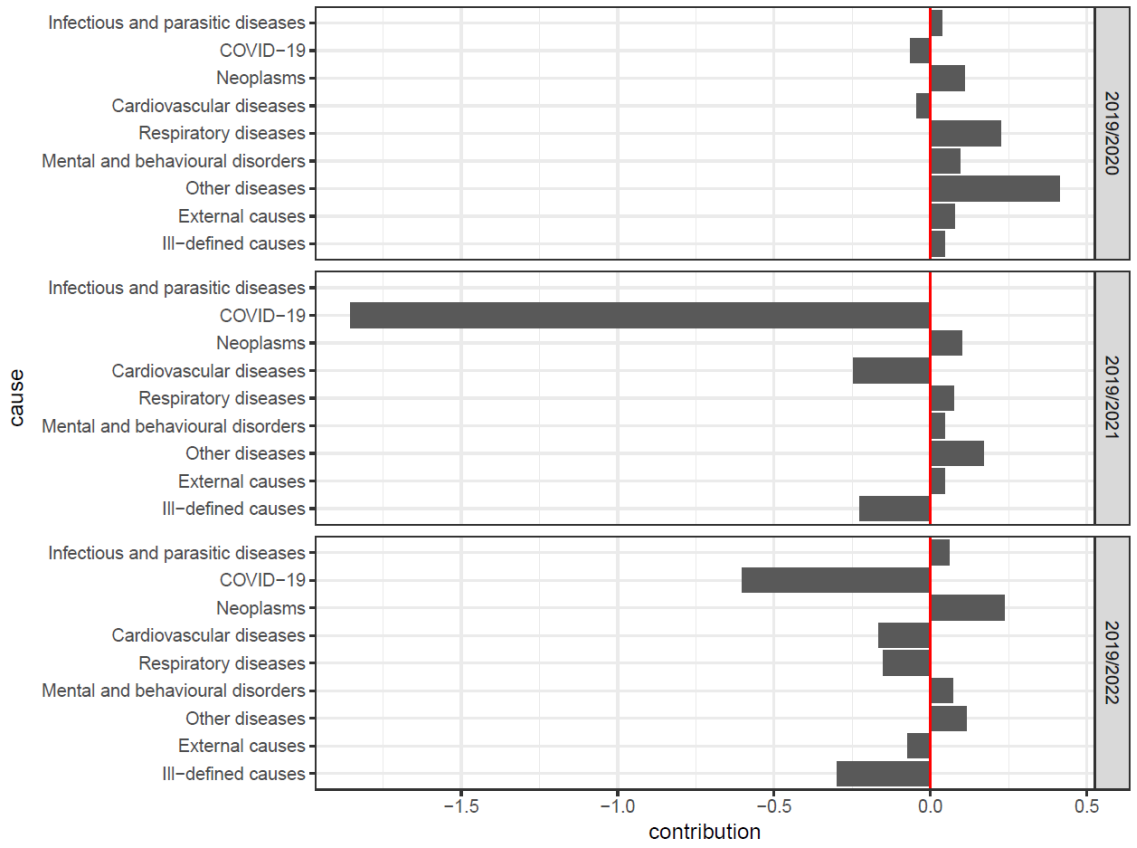
Finally, in some months, the number of COVID-19 deaths was moderately higher than the number of excess deaths, which could mean that in those months there were fewer deaths than expected from other causes.

Figure 1. Excess monthly deaths and COVID-19 deaths



Note: The grey line with dots shows the monthly number of excess deaths. The red area with red dots shows the monthly number of COVID-19 deaths (confirmed + suspected). The percentages near the excess-deaths curve indicate the estimated P-score for the corresponding month. Only the P-scores below or above 10% are shown.

Figure 2. Total contribution from each group of causes of death to the differences in life expectancy between 2019 and 2020, 2021 and 2022 (both sexes combined)



4. Discussion and further work

This study shows that, contrary to what was observed in other countries, mortality decreased in Uruguay in 2020, as the early introduction of non-pharmaceutical interventions decreased the number of expected deaths from other causes (for example external and respiratory deaths). However, unprecedentedly high mortality levels were observed in the two following years, as many restrictions were progressively lifted.

High mortality during the pandemic resulted mainly from COVID-19 deaths. However, as the pandemic progressed, the share of COVID-19 deaths among the number of excess deaths decreased. In particular, in the decomposition between 2019 and 2022, we observed large negative contributions from cardiovascular, respiratory and ill-defined diseases. Previous studies show that cardiovascular deaths increased in some areas during the COVID-19 pandemic; some of the reasons mentioned in the literature are a rise in home-deaths, the cancellation of medical appointments, delays in access to medication prescriptions, and the collapse of the health system (Brant et al. 2020, Wadhera et al. 2021). Respiratory diseases and external causes of death show both positive contributions in 2020 and 2021, pointing to a positive effect of social distancing measures, decline in mobility and reduced exposure to air pollution (Calderon Anyosa & Kaufman 2021; Santos et al 2021; Son et al 2020; Zuo et al 2023). However, once activity resumed to pre-pandemic levels both causes account for negative contributions to the difference in life expectancy in between 2019 and 2022.

Finally, regarding the next steps in our research, we will include the detailed results of the decompositions by age and cause of death, for women and men separately. Furthermore, given that estimates of excess deaths in 2020 and 2021 are available for all countries (WHO 2023b), we will compare the estimates for Uruguay with those for other countries in the Latin American region. This will enlighten our understanding of the impact of COVID-19 in Uruguay, in the Latin American context.

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