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Different Demographic Pathways of the Post-Socialist Transition: Mortality Trends in Croatia and Slovenia during COVID-19

The paper discusses the COVID-19 mortality in Slovenia and Croatia in 2020 and 2021. The aim of the paper is to determine similarities and differences in mortality trends during COVID-19 period and to discuss the underlying causes and consequences. It is hypothesised that the unfavourable age structure of both countries was a catalyst of the excess mortality differentials, and that the different paths of post-socialist transitions significantly contributed to differential mortality in 2020. The analyses confirmed a biased effect of the excess mortality indicator, which is applicable only if supported with sufficient attributive data. Moreover, findings confirmed the hypothesis that COVID-19 mortality largely contributed to overall mortality in Slovenia in 2020, particularly due to the increased mortality in long-term care facilities (LTCF) which was about 70% higher compared to that of Croatia.

Keywords: COVID-19, coronavirus, SARS-CoV-2, excess mortality, Slovenia, Croatia, post-socialism.

Različne demografske smeri postsocialistične tranzicije: trendi umrljivosti na Hrvaškem in v Sloveniji v času covida-19

Prispevek obravnava stopnjo umrljivosti zaradi covida-19 v Sloveniji in na Hrvaškem v letih 2020 in 2021. Domnevamo, da je za razlike v stopnji umrljivosti kriva zlasti neugodna starostna struktura v Sloveniji in na Hrvaškem ter da so različne poti postsocialistične tranzicije, zlasti kar zadeva razvoj na področju dolgotrajne oskrbe, pomembno prispevale k povečani umrljivosti leta 2020. Analize so potrdile pristranski učinek kazalnika presežne umrljivosti, ki je uporaben le, če je podprt z zadostnimi opisnimi podatki. Poleg tega so ugotovitve potrdile hipotezo, da je umrljivost zaradi covida-19 pomembno prispevala k skupni umrljivosti v Sloveniji v letu 2020. Pri tem je bilo največ smrti zabeleženih v zavodih za dolgotrajno oskrbo, katerih smrtnost je bila približno 70 odstotkov višja kot na Hrvaškem.

Ključne besede: *covid-19, koronavirus, SARS-CoV-2, presežna umrljivost, Slovenija, Hrvaška, postsocializem.*

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1. Introduction

COVID-19 was a completely new phenomenon not only for Slovenia and Croatia, but also for the whole of Europe at the beginning of 2020. It presented a challenge in following it methodologically and measuring its medical-demographic effects. The latter is the primary concern of this paper. From the European epicentres in Bergamo (Italy) and Ischgl (Austria), the initial wave quickly reached Slovenia (officially on 13 February 2020) and, shortly after, Croatia (officially on 25 February 2020). The geographic sequence of the initial spread was easily discernible (Josipovič 2020). The subsequent waves of new variants were blurred by the diverging responses of governments, but the pattern of spatial replacement of the former dominant variants followed the distinguished geographic sequence.

Between February 2020 and the end of 2021, a total of 464,121 confirmed cases and 6,129 COVID-19 deaths were reported in Slovenia, while in Croatia as many as 715,245 confirmed cases and 12,538 deaths were reported (NIJZ 2021; Croatian Institute of Public Health 2021a). With a population of about 2.1 million, Slovenia has the equivalent of approximately 55% of Croatia's population (3.9 million). So, the overall impression was that Slovenia had somewhat more infections (65% of the total number of infections registered in Croatia) but a lower death rate (49% of the total number registered in Croatia) confirmed with PCR (polymerase chain reaction) tests. However, the question is not only about the extent of testing and the reliability of tests; it is about the reasons for these differentials. In this paper, the primary aim was to examine the temporal spread of COVID-19 deaths and to compare the excess death rates in the two countries.

Knowing that mortality rates may render skewed results depending on age structure, we also took into consideration data on the age structure of the populations, COVID-19 deaths by age, and COVID-19 deaths within long-term care facilities (LTCF) where such a distinction was possible. The initial data on LTCF units did not allow for a week-to-week comparison for Croatia, while this differentiation was possible for Slovenia. Since we assumed that the number of COVID-19 deaths and the mortality of COVID-19 patients within LTCF units was the major difference between the two countries, we found auxiliary ways to bridge it. In the next stage, we thus analysed the comparative European data for 19 EU/EEA states, which we obtained through the European Centre for Disease Prevention and Control (hereafter ECDC) (ECDC 2021). These data allowed us to answer our main research questions: a) Were there differences between the two countries in COVID-19 mortality and excess mortality?, and b) Although at first glance COVID-19 mortality seemed similar in both countries, was the mortality of the elderly population in long-term facilities in 2020 an important catalyst of differentiation? The observed difference is a consequence of diverging demographic paths in the post-socialist transition having its roots not only in

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the dissolution of Yugoslavia and the subsequent war in Croatia, but also in the differing internal processes of democratisations and rising autonomies of Yugoslav republics, especially in Slovenia and Croatia.

Researchers around the world have been unprecedentedly responsive in analysing the spread and effects of COVID-19 and have produced a large number of COVID-19-related papers. However, we have found none to address or assess the main research questions of this paper, i.e., not only to address the question of elderly care during the pandemic, but to connect its disparities to a specific demographic pathway in the post-socialist countries of Slovenia and Croatia.

2. Data and Methods

All analyses in this paper are based on official and openly accessible data provided by the representative national institutions in both countries: the Croatian Bureau of Statistics, the Croatian Institute of Public Health, the Statistical Office of the Republic of Slovenia (hereafter SORS), and the National Institute of Public Health (NIJZ). In cases where the national statistics on COVID-19 mortality and related more specific demographic data were missing or incomplete, other databases were consulted, such as the ECDC and the World Bank.

The Croatian Institute of Public Health regularly published data regarding confirmed cases and deaths caused by COVID-19, the age structure of the deceased, as well as the data on all causes of death. However, both national bureaus of statistics provide the data related to overall mortality by month. For calculating the excess mortality, we used the P-score, counted as the percentage difference between the reported and projected number of deaths.

For Croatia, we calculated the excess mortality for 2020 and 2021 by comparing the number of reported deaths in each year by month and then comparing it to the projected deaths based on the average monthly deaths for the five-year pre-epidemic period between 2015 and 2019. The Slovene data was more up-to-date and readily available (notwithstanding other methodological problems, such as the spatial level of presentation, age-specific aggregations, specific distributions, etc.). Since the Slovene data was better amassed, we were not able to directly compare some of the indicators, for example the age structure of the deceased in nursing homes. Additionally, in order to provide a thorough preview of COVID-19 mortality in both countries, we used all the accessible data and made the necessary comparisons.

3. Results

3.1 Croatia

The first wave of COVID-19 in Croatia started in March 2020, but the number of confirmed cases and the number of COVID-19 deaths were significantly

lower compared to Slovenia and compared to the subsequent waves following the initially strict public health measures (lockdown). Namely, the infection and mortality rates differed among different countries during the first wave in spring 2020. In some western and southern European countries (particularly in Spain and Italy) the number of confirmed cases and deaths were particularly high (Kontis et al. 2020; Josipovič 2020). On the other hand, some countries (including Croatia and Slovenia) introduced timely public health measures (social distancing, various limitations regarding gatherings, and, ultimately, lockdown), thus avoiding the large increase in the number of cases and deaths (Brauner et al. 2021; Hale et al. 2021; Sharma et al. 2021). During the summer, the infection continued to spread, but with a lesser intensity. Consequently, many countries, including Croatia, reopened their state borders and largely eased restrictions (Hale et al. 2021).

The second wave in Croatia started in the second half of October 2020 (Chart 1), and the number of cases and deaths was incomparably higher than in the first wave and much higher than in the subsequent wave. Similar trends were observed in Slovenia and other countries (Islam et al. 2021). The first wave predominantly affected the older population (Klempić Bogadi 2021), but in the second wave, the infection spread rapidly among younger generations and spread secondarily among older generations (Aleta & Moreno 2020). The peak number of confirmed cases in this wave was recorded in week 50 (7–12 December 2020; 25,095 cases), and the peak number of deaths was recorded a week later (week 51; 14–20 December 2020; 537 deaths). The increased numbers in this wave were largely the result of mild restrictions (Čipin et al. 2021). In late December 2020, the COVID-19 vaccination became available in Croatia.

The third wave in Croatia began in early March 2021, and the number of weekly confirmed cases and deaths were lower than in the previous wave. However, it is highly likely that the actual number of infected persons was not accurate, because at that time the official recommendations were that only one household member should be tested and the others were treated as probably infected (Croatian Institute of Public Health 2021b). The peak number of confirmed cases was recorded in week 15 (12–18 April 2021; 15,256 cases) and the peak number of deaths in week 17 (26 April – 2 May 2021; 328 deaths). At the beginning of this wave, Civil Protection introduced a number of restrictions (e.g., limited number of people at gatherings, limited working hours, cancellation of various events, online classes in schools and universities, mandatory face masks, etc.), which evidently had an effect (Odluka ... 2022).

The fourth wave of the pandemic started late in the summer of 2021 and lasted into the beginning of 2022. At the end of 2021, the number of confirmed cases reached 715,245 and the number of deaths was 12,538. Also, by the end of 2021, 56.8% of the total population of Croatia was fully vaccinated (57.6% in Slovenia), including 67.2% (67.7% in Slovenia) of the adult population (ECDC

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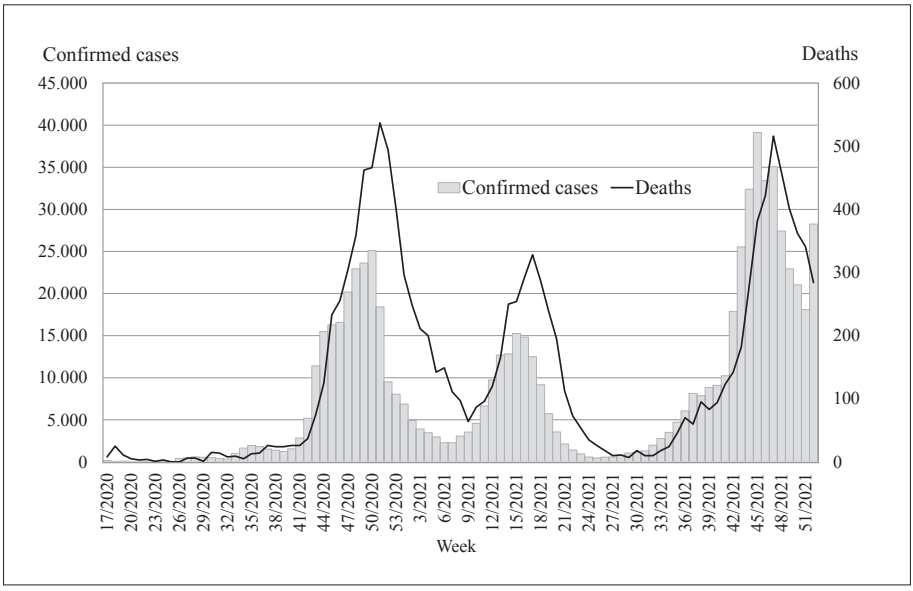
2022). The vaccination rate was well below the expectations set forth by both governments. During this wave, the restrictions were less strict than during the previous waves and the pandemic began to spread rapidly. Additionally, an increasing number of breakthrough COVID-19 cases were reported around the world caused by variants that evaded the immune protection offered by the vaccines (Parums 2021).

Chart 1: Weekly number of confirmed cases and COVID-19 deaths in Croatia from mid-April 2020 to the end of 2021



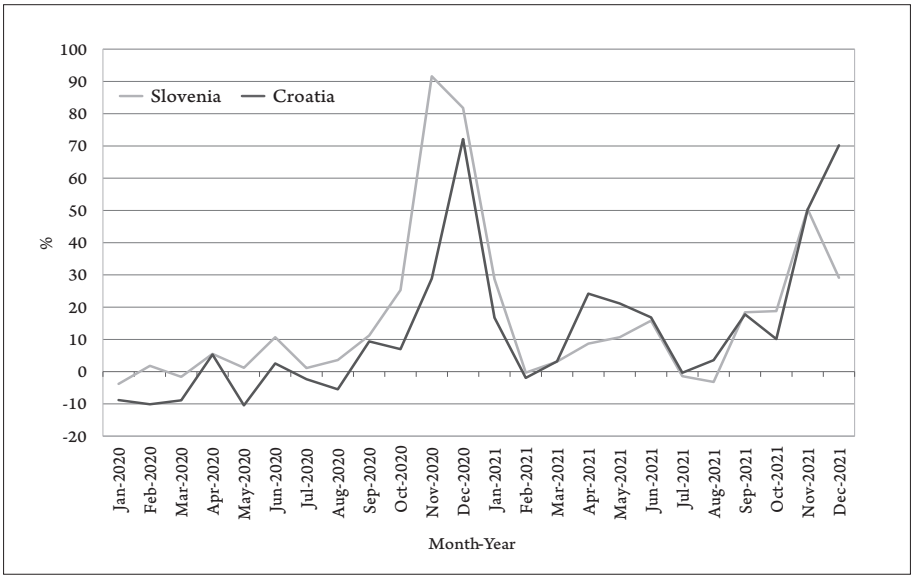
Source: Croatian Institute of Public Health (2021a).

To analyse the effects of COVID-19 mortality on overall mortality we compared the mortality from all causes during the epidemic with the mortality during the pre-epidemic five-year period (i.e., excess mortality). Spurred by the rapid spread of the pandemic in early 2020, many countries, including Croatia and Slovenia, began to experience excess mortality (Kapitsinis 2021). In Croatia, excess mortality was first detected during the first wave of the pandemic (April 2020; Chart 2), and then in June and September, but it was below 10.0% and subject to expected fluctuations. However, the first notably high excess mortality was recorded during the second wave (November and, particularly, December 2020), when the excess mortality in November rose to 28.9% and in December to as much as 72.1%.

In the following year (2021), excess mortality was recorded in all months except in February (–2.0%) and July (–0.4%), with the highest rate in December (70.2%) during the fourth wave of the pandemic. In 2020, about 8.1% (4,278)

more deaths were recorded in comparison to the 2015–2019 period. In 2021, the situation was much worse – 9,967 more deaths (18.9% more deaths than in the 2015–2019 period). A study conducted in Croatia in 2020 revealed differences in case fatality between the spring and summer periods (Kristić et al. 2020). During the summer, the number of confirmed cases nearly quadrupled, but case fatality decreased. However, cardiovascular comorbidities were still an important risk factor for case fatality. The case fatality rate decline during the summer could have been caused by several factors, broadly classifiable into pathogen-related, host-related, or environmental (and any combination or interaction thereof) (Kristić et al. 2020).

Chart 2: Excess mortality in Slovenia and Croatia by month in 2020 and 2021 – deaths from all causes compared to the average for 2015–2019



Source: Croatian Bureau of Statistics (2021), Croatian Institute for Public Health (2021a), SORS (2021), authors' calculations.

The analysis of case fatalities by age and sex in Croatia revealed that there were some significant differences between men and women and among different ages. Most of the fatalities were recorded in older age groups (60+). In the 60–69 and 70–79 age groups, more fatalities were recorded among men (20.1% and 33.6%, respectively) than among women (12.6% and 26.4%, respectively) (Chart 3, Table 1). In the 80+ age groups, the differences were not so pronounced. The largest proportion of case fatalities was recorded in the 80–89 age group, followed by 70–79 (Chart 3). Similar trends were observed in other European countries (Medford & Trias-Llimós 2020).

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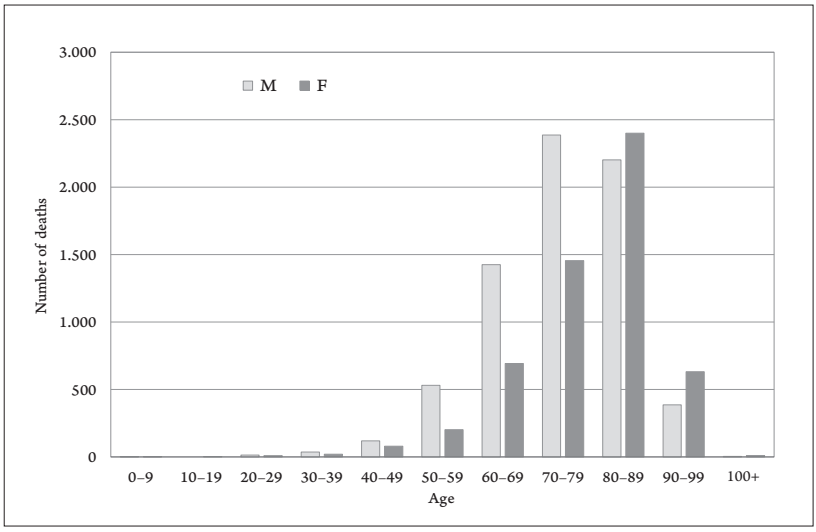
Chart 3: Total number of COVID-19 deaths in Croatia by age group between February 2020 and the end of 2021



Source: Croatian Institute of Public Health (2021c).

Table 1: COVID-19 case fatalities (percentage) in Croatia by age and sex between March 2020 and the end of 2021

Age	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80+	Total
Men	0.0	0.0	0.2	0.5	1.7	7.5	20.1	33.6	36.5	56.3
Women	0.0	0.1	0.2	0.4	1.4	3.7	12.6	26.4	55.3	43.7
Total	0.0	0.0	0.2	0.4	1.6	5.8	16.8	30.5	44.7	100.0

Source: Croatian Institute of Public Health (2021c).

If we compare the mortality by age and sex in 2020 (deaths from all causes) with the average mortality for the pre-epidemic period (2015–2019), we can clearly see that mortality substantially increased in the 60+ age groups for both sexes, and, as previously discussed, most of the COVID-19 case fatalities were recorded in those age groups (Table 2).

Table 2: Excess mortality (percentage) in Croatia by age and sex in 2020 – deaths from all causes compared to the average for 2015–2019

Age	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80+
Men	–11.9	1.0	–3.0	–9.2	–9.0	–5.5	8.1	9.9	15.2
Women	–3.5	–17.3	–21.5	–4.3	4.3	–8.8	9.2	3.5	9.8
Total	–8.3	–4.7	–7.5	–7.8	–4.9	–6.5	8.4	7.0	11.7

Source: Croatian Bureau of Statistics (2021), Croatian Institute for Public Health (2021a), SORS (2021), authors' calculations.

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Excess mortality in older age groups should also be considered through the prism of population ageing. Both Croatia and Slovenia are positioned among the oldest populations in Europe. In 2020 in Croatia, the percentage of the population aged 65+ was 21.0%, and in the 2015–2020 period, the share of the oldest age group (aged 80+) increased by almost 16.0% (22.8% for men and 12.7% for women), mostly due to the increasing number of baby boomers reaching old age (Croatian Bureau of Statistics 2022). However, the differences in the age patterns of COVID-19 deaths among different countries are not dependent solely on the age structure of a certain population, but also on other country-specific factors (Medford & Trias-Llimós 2020).

3.2 Slovenia

A combined view into the COVID-19 morbidity and overall mortality in Slovenia and its comparison to Croatia revealed many striking findings. We looked into the official data on COVID-19 infections and deaths through 2020 and 2021 separately for the residents in nursing homes and the rest of the population (Charts 4 and 5). Mortality among the residents of LTCF units was about thirtyfold higher compared to the rest of population. While nursing home residents experienced almost complete virus spread of the early Wuhan and Alfa variants in 2020, their death toll in Slovenia was around 19% (the second wave; weeks 42-2020 throu 5-2021). The ratio is rather accurate because the testing was more complete – almost the whole populations of the LTCF units – while the rest of population, as in Croatia, remained partly untested. Hence, the mortality among the rest of population appears overstated. With an average of 1.2% during the late 2020/early 2021 period of peaking deaths, the ratio among the overall population remained the highest from the onset of the pandemic. With the introduction of the vaccine, the elderly population, including those in nursing homes, experienced a high level of protection against death, so the original and Alfa variants were quickly replaced by Delta, for which the existing vaccines were not that effective. During spring 2021 (from week 24-2021), the mortality rates plunged in all groups. With the onset of autumn 2021 and the rapid spread of the more transmissive Delta variant, the crude deaths, especially among the unvaccinated, surged to the levels of the second wave. As the population in nursing homes were already reduced and highly vaccinated, the absolute death toll was much higher among the remainder of population, though the infection to death ratio lowered substantially – to as low as 0.6% (weeks 37-51 of 2021).

Striking regional disparities found between the ratio of COVID-19 deaths to SARS-CoV-2 infections (Josipovič 2020) gave rise to further investigation into the age and gender structure of the deceased. There are two major divides within the age structure of the elderly population in Slovenia. The first is the internationally recognised average expected age of transition to retirement (or inactivity), which is around 65 years. But with the increasing mean age at death,

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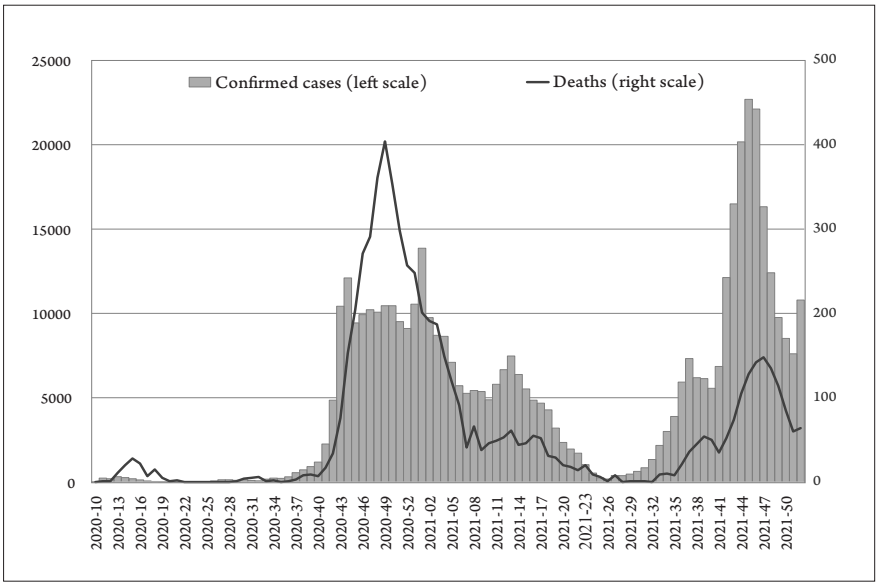
the most relevant age group becomes those aged 85 or above, as the average age at death in 2020 rose by two years in Slovenia (SORS 2021). There has been a tremendous increase in the population aged 65+ over the past pre-pandemic five years.

Chart 4: Weekly number of confirmed cases and COVID-19 deaths in Slovenia between mid-April 2020 and the end of 2021



Source: NIJZ (2021).

The post-WWII baby boom generations are gradually entering old age (65+). An increase in the retired population, especially men, was expected, since the higher proportion of men within the former labour contingent who immigrated from other Yugoslav republics prior to 1991 influenced gender differentials (Josipovič 2006). On the other hand, the oldest generations have seen an increase in their life expectancy, so the probability of an increased death rate has risen with each year. To fully appreciate the rising share of elderly people (65+), it is necessary to look at the 85+ age group, which comprises one-fifth (11,000 of 55,000) of the whole increase in the elderly contingent (Tables 3 and 4).

Table 3: Population by age and gender (65 years of age and over) in Slovenia

	1.1.2015	1.1.2020	Difference
Total	369,386	424,004	+54,618
Men	151,416	181,767	+30,351
Women	217,970	242,237	+24,267

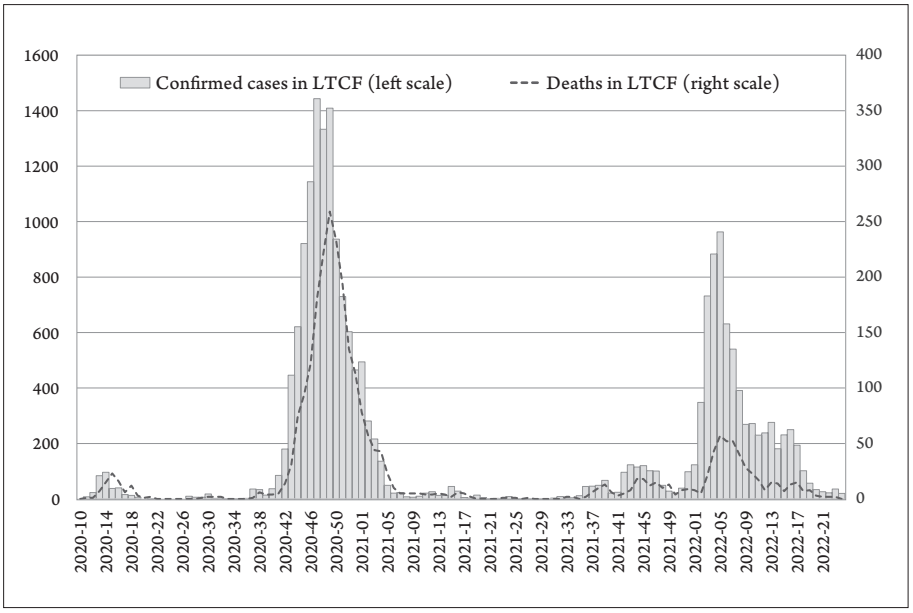
Source: SORS (2021).

Table 4: Population aged 85 years and over by gender in Slovenia, 2015–2020

Year	Total	Men	Women
1.1.2015	43,382	10,990	32,392
1.1.2016	46,171	12,076	34,095
1.1.2017	48,288	12,911	35,377
1.1.2018	50,395	13,635	36,760
1.1.2019	52,276	14,326	37,950
1.1.2020	54,136	15,236	38,900

Source: SORS (2021).

Chart 5: Weekly number of confirmed cases and COVID-19 deaths in nursing homes (LTCF) in Slovenia between mid-April 2020 and the end of 2021



Source: NIJZ (2021).

Despite the historically high percentages of the elderly population and the rising age at death in 2020 by two years, the COVID-19 mortality broken down into 10-year age-groups shows a striking picture. More than four out of five were aged 70 and up. A major jump occurs with men aged 60 or more and with women aged 70 or more. Altogether, 97.2% of the COVID-19 death toll was recorded in the population aged 60 years and above (Table 5). Comparing these demographics with those of Croatia in Table 1, one can observe that the death-toll was similar but slightly lower in age (see Tables 1 and 5).

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Table 5: COVID-19 case fatalities (percentage) in Slovenia by age and sex between March 2020 and the end of 2021

Age	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80+	Total
Men	0.0	0.0	0.0	0.1	0.6	3.3	10.4	27.3	58.2	46.2
Women	0.0	0.0	0.1	0.0	0.5	1.0	4.1	15.7	78.6	53.8
Total	0.0	0.0	0.0	0.1	0.6	2.1	7.0	21.1	69.2	100.0

Source: NIJZ (2021).

When looking at the monthly number of deaths over the last 20 years, we can observe that the largest number of deaths in Slovenia was recorded in January 2017 (2,425) when the seasonal flu, which was spread all over Europe in the winter of 2016/17, reached its peak in Slovenia. Before the COVID-19 epidemic, 29 January 2017 was the only day when the number of deaths in one day exceeded one hundred (Dolenc 2020). In just a five-year period, the number of men aged 85+ increased by roughly 50.0%, to 15,000, while the number of 85+ women increased by 22.0%, to 39,000 (Table 4). Thus, the gender gap is narrowing, notwithstanding the fact that we are dealing here with a highly vulnerable and fragile population, and that the situation may change at any moment, as it did with the excess deaths of approximately 3,000 in 2020 (Chart 2).

The age structure of the deceased should therefore be compared to the average gain or surplus within each age group. Only then can excess deaths be clearly attributed and interpreted. The next step is to compare excess mortality with COVID-19 mortality. If the data are reliable, the majority of variance in the distribution of excess mortality by age should be explained as COVID-19 deaths.

Accordingly, we regrouped the age-specific mortality rates and compared the two averages (2017–2019 and 2015–2016) to assess the age-specific differentials. Chart 6 shows striking features with a negative change (increased mortality) specifically in the 85+ and, remarkably, the 65–69 age groups. Most of the other age groups expressed positive change (decreased mortality), or at least a lack of change.

But how can the excess deaths be analytically defined and how can the share of COVID-19 deaths be identified within this surplus? Excess deaths in Slovenia are defined as a yearly surplus value compared to a given three-to-five-year average. The expected average of 40 per day in the two-week period from 8 to 21 February 2021, while at the same time the number of COVID-19 positive among them, decreased (–40% or 23.7 fewer patients per day). However, the mortality was still high: one death per every four hospitalised with COVID-19. As such, scrutinising age-specific rates is necessary.

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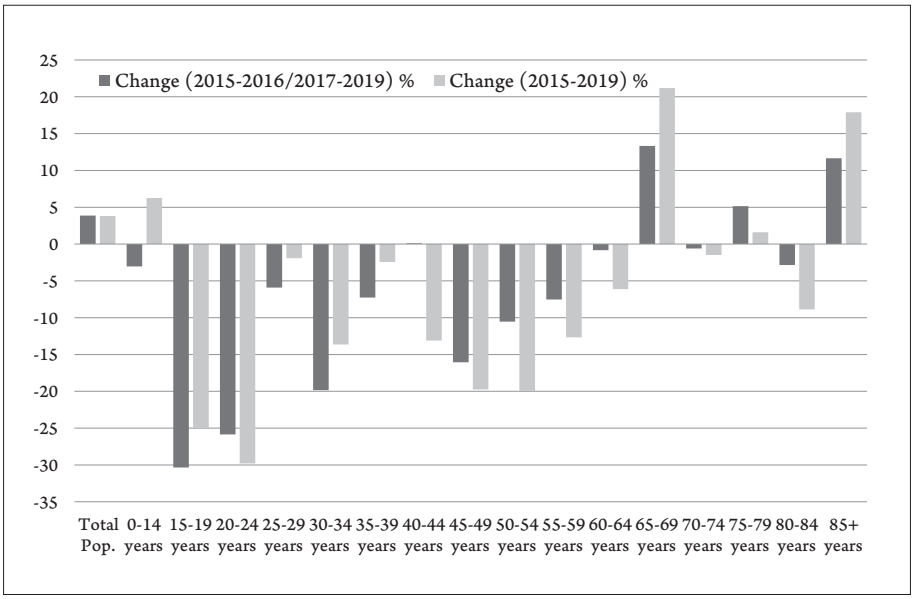
Chart 6: Age-specific changes in the mortality pattern, 2015–2019, Slovenia



Source: SORS (2021).

Based on the data presented in Chart 6, we identified an overall 3.9% increase in projected mortality in 2020 (excluding the effect of COVID-19 deaths), since the raw data for specific age groups were not available. The provisional number of deaths (23,891) was reduced by the expected number (in accordance with the age-specific mortality trends from 2015–2019) of 21,391 usual deaths in 2020. The difference of 2,500 deaths may thus be ascribed to premature deaths resulting from COVID-19 (and other numerous stressors), since all other deaths were expected within the already augmented number. Otherwise, COVID-19 would have been affecting mortality rates in the years prior to 2020, which it did not, though the evidence is scarce (Josipovič 2020). However, the difference between the 2,500 excess deaths identified by this analysis and the official number of COVID-19 deaths supplied by the NIJZ in 2020 (3,126) is quite high. The NIJZ chart of COVID-19 deaths, which exceeds the projected value by 626 or almost a quarter (25%), seems exaggerated. There are many possible reasons for such a discrepancy. One very important reason might be the number of amplification cycles applied in the molecular tests (RT-PCR) which were carried out at 40 cycles.[1] Namely, with the increasing number of these repetitions beyond a margin of 30 cycles, the RT-PCR procedure increasingly produces false positive results (Borger et al. 2021).

Despite the introduction of vaccination in the elderly population (above 80 years of age) early in January 2021, the following five-month period (roughly until week 21-2021), during which they received the second of the two advised

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doses (with three weeks or more between the two or more dosages depending on the type and manufacturer of the vaccine), paints a rather confusing picture. Despite a sharp decline and no newly discovered cases of SARS-CoV-2 in nursing homes, the overall number of infected people remained stagnant (see Charts 4 and 5). This corroborates the above statement (cf. Parums 2021) concerning the partial immune protection evasion of the Delta variant, which swiftly displaced the original and Alfa strains shortly after the mass vaccination process began. The fourth wave in Slovenia (the Delta-driven wave) took a deadly turn among the elderly, largely unvaccinated population (65+), sparing the nursing home protegees with a high vaccine intake. In December 2021, the first cases of Omicron appeared in Slovenia (NIJZ 2021).

3.3 The Results of Both Countries from a Comparative Perspective

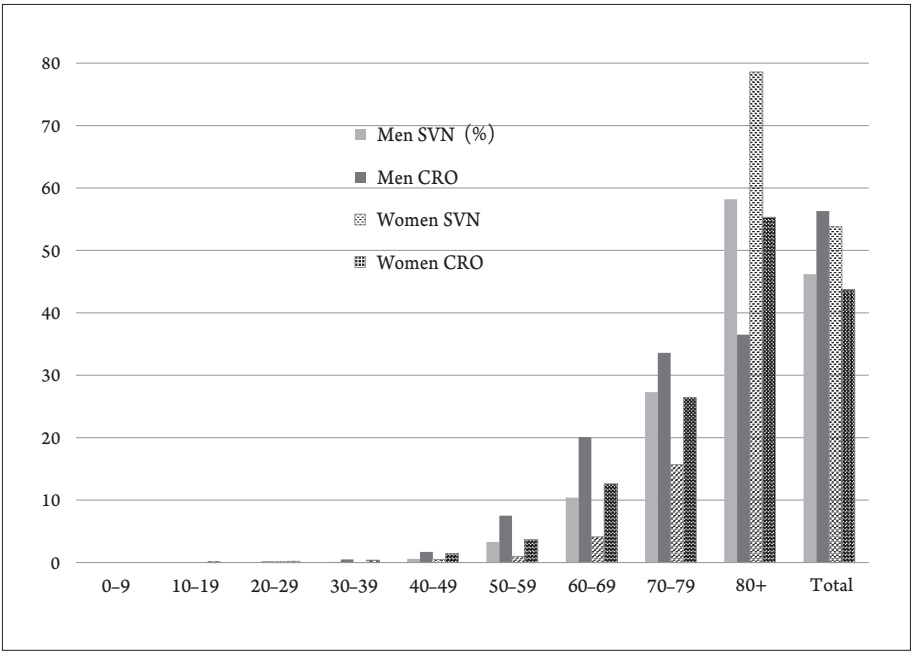
The data provided by the respective institutions for both Slovenia and Croatia show, as was the case in other countries, that cumulative infection rates were the lowest among children and adolescents aged 0–19. On the other hand, they were the highest in the working age groups, particularly among women. The higher number of COVID-19 infections among women in working age groups is closely connected to their high representation in professions that are particularly exposed to the disease (Sobotka et al. 2020), such as nursing, for example. However, according to Sobotka et al. (2020), this pattern changes in older age groups – there are more confirmed cases among men than among women. In contrast to Slovenia, no changes were detected in Croatia, since the confirmed cases among women still outnumber the cases among men. This is probably the result of a higher representation of women in those age groups.

In contrast with the cumulative infection rates by age group, case fatalities by age group are quite different – more than 90.0 % of case fatalities in both countries were recorded in the 60+ age groups. These age groups also recorded significant excess mortality in comparison to the pre-epidemic period. Higher mortality among older people is closely related to their weaker immune systems (Shang & Xu 2021), to cardiovascular and respiratory diseases (Yang et al. 2020), and other comorbidities. COVID-19 patients who had comorbidities, such as obesity, hypertension, or diabetes mellitus, were more likely to develop a more severe course and progression of the disease. Additionally, older patients, particularly those in the 65+ age groups who had comorbidities and were infected, had an increased admission rate into intensive care units and COVID-19 mortality (Sanyaolu et al. 2020). Even before the coronavirus outbreak in Croatia, cardiovascular diseases along with endocrine and metabolic diseases were the first and third causes of death in Croatia (with neoplasms being the second most common cause of death) (Erceg & Miler Knežević 2020). In

Slovenia, the situation was similar; the most pronounced causes of death were cardiovascular diseases, followed by neoplasms and diseases of the respiratory system (NIJZ 2021).

There are significant differences regarding COVID-19 mortality according to sex. In the age groups with the highest number of fatal cases (60–79 in both countries) most of the cases were recorded among men. In the 80+ age groups in both countries, more fatalities were recorded among women, which is closely connected to their higher representation in those age groups. While men in Croatia had significant mortality in the 60+ groups, men in Slovenia exceeded Croatian male mortality only in the age groups above 80 years. Similarly, with lower shares in the 60–79 age group, women in Slovenia only exhibited higher mortality compared to men in the 80+ age group (Chart 7).

Chart 7: COVID-19 case fatalities (percentage) in Slovenia and Croatia by age and sex between March 2020 and the end of 2021



Sources: NIJZ (2021), Croatian Institute of Public Health (2021c).

According to Bwire (2020), the biological differences between men's and women's immune systems may impact their ability to fight an infection, including the COVID-19 infection. Women are, in general, more resistant to infections than men, and this is likely mediated by various factors, such as hormones and a high expression of coronavirus receptors in men. Also, certain lifestyle differences, such as higher rates of smoking and alcohol consumption among men,

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may affect the differential mortality. Women also tended to be more responsible during the pandemic, particularly in terms of frequent hand washing, wearing protective face masks, and social distancing (Bwire 2020).

For the first year of the pandemic in 2020, the analysis of the excess mortality in Slovenia showed an overestimated official number of COVID-19 deaths (Josipovič 2021). While the official number of COVID-19 deaths for 2020 published in January 2021 by the Slovenian Institute of Public Health (NIJZ 2021) was 3,126, the analysis confirmed only 2,500 excess deaths, considering the mortality trends within the last five-year period (2015–2019). So, the official number of COVID deaths was inflated by 626 deaths or as much as 25.0% compared to the projected value based on recent trends.

Despite the later confirmed high percentage of excess deaths in 2020, the officially reported number of COVID-19 deaths seemed to fit into the existing mortality gap, but only upon first glance. Namely, SORS published the provisional number of 3,301 excess deaths. Accordingly, the reported NIJZ number of 3,126 deaths seemed appropriate. Nevertheless, it disregarded the tempo effect and momentum of the population given an unfavourable age structure and the process of accelerated ageing with numerous generations of baby boomers reaching retirement age (Josipovič 2021). By mid-2021, SORS published the definitive data on mortality in 2020. The mortality gap increased to 2,625 but was still 20.0% or 501 lower than the number of COVID-19 deaths published by NIJZ. After almost a year (in December 2021), the Government Communication Office of the Republic of Slovenia (UKOM 2021) published the final number of COVID-19 deaths for 2020 – 2,725 – a reduction of 401 formerly ascribed as COVID-19 deaths, though there is still a gap of one hundred overstated COVID-19 deaths.

Another important difference regarding the effect of COVID-19 mortality in both countries is related to life expectancy at birth. Namely, in comparison to 2019, in 2021, life expectancy at birth in Croatia lowered by 1.9 years, while in Slovenia it lowered by 0.9 years.

4. Discussion

The presented data reveals similarities and differences in the COVID-19 spread in Slovenia and Croatia. In the following section will cover the main research question on what triggered the differences in COVID-19 mortality, and to what extent the similarities are a consequence of a joint geo-political past, first within the Austro-Hungarian Empire and then within the Yugoslav state.

The strongest impact on the economy and social affairs, and the specific transition pathways after gaining independence, compared to other post-socialist countries, can undoubtedly be found in the membership of both countries in the post-WWII socialist Yugoslav federation. As its westernmost republics (with

only Slovenia having state boundaries with the western capitalist countries of Italy and Austria) and the former constitutive regions of the Habsburg Empire, both countries entered the first Yugoslavia (The Kingdom of Serbs, Croats, and Slovenes) as economically most advanced.

With the socialist revolution after the end of WWII and the collectivization of means of production, both countries remained the drivers of post-war rebuilding and economic development. The subsequent extensive industrialization in the 1960's and open borders with its western capitalist neighbours allowed for the development of a relatively open Yugoslav society with close ties to western Europe. The first period of state centralization and governance gradually evolved into progressively republic-oriented socio-economic development, including the innovative form of self-governance first applied in the large state-owned industrial systems. The new constitution of 1963 already acknowledged these trends by renaming the Federal People's Republic of Yugoslavia as the Socialist Federal Republic of Yugoslavia. The system of self-government (or self-governance) differed strongly from the Soviet centralized system behind the Iron Curtain applied in the member states of Council for Mutual Cooperation (the then Eastern Bloc). Increasing independence in companies' decision-making processes, which had already started in the late 1950's, slowly led to a rising political autonomy of the republics. These tendencies strengthened most in Slovenia and Croatia and resulted in the more nationalist-oriented Communist Party (The Association of Communists) leadership in both republics. With the liberal revolution in the late 1960's, and the MASPOK movement of the masses in 1971, the way was paved first to state intervention and immediate restriction of autonomies, but in its softened effect, it resulted in the new constitution of 1974, which granted the six republics the status of states in a federation with the right to self-declaration. After Tito's death, the long-reigning post-war Yugoslav president, in 1980, the autonomies and differentiation further developed, and with the decisive help of both diasporas in the late 1980s, eventually resulted in the break-up of Yugoslavia by the simultaneous proclamation of Slovenia's and Croatia's independence in 1991.

Starting in the 1970's, the otherwise closely intertwined republics of Slovenia and Croatia started to differ in some aspects of their socio-economic and demographic development. One striking difference between the two was the migration of temporary workers primarily to Germany, Austria, Switzerland, France, and Sweden, but elsewhere as well (Josipovič 2006). This was initially labelled a temporary migration, which started after the liberalization of the border regime in 1962, but it turned into large, permanent emigration. While Slovene emigration was much lesser in numbers (7.1% by 1971 of all Yugoslavs abroad, according to the official census), it also compensated with immigration from other republics of Yugoslavia, while Croatia suffered higher emigration rates (33.9% by 1971 of all Yugoslavs abroad, according to the official census)

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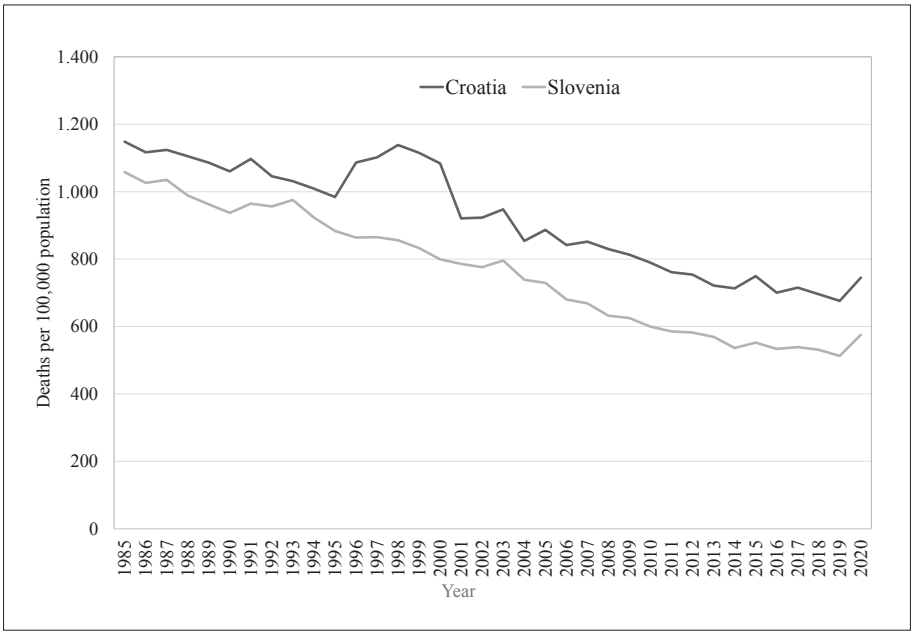
with much lower compensating migration from other republics. This differential emigration strongly affected the steadily diverging Slovene and Croatian mortality rates, as Croatia started facing population ageing earlier on and the mortality rates remained above those in Slovenia (Chart 8).

When considering the hypothesis on the prevailing demographic outcome of diverging paths of the socio-economic and political transition in Slovenia and Croatia, one could synthetically describe it with the diverging mortality pattern. As the mortality rates coincided until the mid-1970s, the gap between the two appeared after 1976 and grew to the present day. The average general mortality rates in both countries oscillated around 10 deaths per 1000 in the 1960–1975 period. In the 1976–1990 period, the gap rose to 0.9 in favour of Slovenia. After the break-up of Yugoslavia and the war in Croatia (1991–1995), the mortality rates rose to 11.2 in Croatia and remained low in Slovenia (9.8). In the last 25 years, the average mortality rate in Croatia climbed to 11.9, and stagnated in Slovenia (9.5), with the sole exception of a leap in the first year of COVID-19. For the whole period of 1960–2020 the relationship between mortality rates in both countries was moderately negative (–0.36; P<0.001).

Chart 8: Age-standardized death rates in Croatia and Slovenia, all causes of death per 100,000 population in 1985–2020



Source: World Health Organization – European Health Information Gateway (2022).

A more precise indicator when comparing mortality between two or more countries is age-standardized death rate (deaths per 100,000). The available data

for the age-standardized death rates in the period between 1985 and 2020[2] also indicate that the death rates per 100,000 have been diverging since the 1980s. Since then, it has been continuously higher in Croatia, and the gap has steadily increased (Chart 8). However, the causality of these differences can be related to the differentials in the rates of in- or out- migration, where Croatia experienced dramatically higher rates compared to Slovenia, with these continuing to the present day (Josipovič 2018). Hence, COVID-19 deaths in 2020 and 2021, despite the considerable excess mortality, have not changed the general mortality differentials between the two countries.

Comparing the numbers of COVID-19 deaths in Slovenia and Croatia relative to the size of each country brings forth another important difference – the share of COVID-19 deaths in nursing homes – which likewise marks a difference in the process of post-socialist transition in both countries. A comparison of the excess deaths confirms the larger initial shock of the COVID-19 deaths in Slovenia than in Croatia. The main portion of deaths occurred in nursing homes, which contributed to as much as 60% of all COVID deaths at the end of 2020 in Slovenia. After the depletion of the elderly population in nursing homes, the remaining old population diminished to the extent that it could not affect the overall death rates in 2021 to the same extremity as in 2020. This is where Croatia differs. While experiencing a steadier rise in excess deaths, Croatia maintained higher rates of excess deaths throughout 2021 compared to Slovenia, thus effectively annihilating the formerly achieved advantageous position. The assumption that the vaccination rates contributed to the lower excess deaths in any of countries should be dismissed because of the comparably high vaccination rates in both countries – close to 60%, which was below the European average but still significantly higher than in Bulgaria or Romania. The trend of lesser vaccination uptake is to some degree observable throughout the former socialist countries. One could argue that not only the transition from state socialism to market economy, but also the lasting dissatisfaction with leading political elites bear the sentiment of cautiousness among the population in various aspects of everyday life.

So, the main reasons for differences in COVID-19 deaths during 2020 and 2021 should be sought elsewhere. As pointed out, the primary variable of concern is the excess deaths in nursing homes. While this topic could present a separate analysis given its complexity, we touch only briefly upon it, since it brings some clarity to the differentials of COVID-19 mortality in both countries in each of the analysed years (2020 and 2021). There is no systematic database for excess death estimations in nursing homes, though Slovenia carefully distinguished between COVID-19 deaths in nursing homes (regardless of the ownership status) and elsewhere. Thus, the ratio between the two on a daily or weekly basis is easily representable, as shown in Chart 4. The situation regarding data availability is less favourable in Croatia, where no such database exists. To be

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able to compare both countries, we relied on the international survey on long-term care facilities (LTCF) within 17 countries of the EU/EEA, including both Slovenia and Croatia (ECDC 2021).

Given the differences in COVID-19 reporting, as to the number of LTCF units, the number of beds, and the number of confirmed cases for varied time periods, we needed to standardize the data to render it comparable. The accessible data is summarized in Table 6.

Table 6: COVID-19 cases and fatalities (percentage) within LTCF units in Slovenia and Croatia between May and November 2021

Country	N of LTCF units	N of LTCF beds	Average N of beds per LTCF unit	N of LTCF residents	Population >80 years in country	Estimated % of 80+ residents in LTCF units	Reported fatality (deaths per 100 COVID-19 cases) in LTCF units
Slovenia	104	21,321	205	19,799	111,033	17.8	14.1
Croatia	325*	37,375	115	33,482	217,633	15.4	8.3

Source: ECDC (2021).

*Data reported for 2016.

The first impression on why Croatia experienced lower COVID-19 mortality during the first year of pandemic (Chart 2) may be obtained from Table 6. Being one of the decisive factors in the rates of COVID-19 mortality, patient density measured by the number of beds per LTCF unit is much lower in Croatia (205 vs. 115). With lower patient density, it is usually easier to arrange internal quarantine with suitable distances and isolation rooms within the buildings themselves. Another important factor is the population pertaining to LTCF units. While Croatia exhibits a percentage of the population above 80 years of age that is very similar to that of Slovenia, the percentage of elderly people in Croatian LTCF units is about a tenth lower. While this difference is insignificant, the reported fatality rates within LTCF units reveals that Slovenia suffered 70% higher mortality compared to Croatia in the reported period (Table 6).

By the end of 2021, approximately 58.0% of Slovenia's and 57.0% of Croatia's population was fully vaccinated (ECDC 2022). However, Croatia had 45.9% more confirmed cases than Slovenia, which indicates that the infection spread more vigorously among Slovenia's population. On the other hand, Croatia had 108.6% more COVID-19 deaths than Slovenia, alluding to a rather worse scenario after hospitalization compared to Slovenia. In fact, at the end of 2021, Croatia was among the top five EU countries according to the highest 14-day notification rate of reported deaths. Additionally, the observed case-fatality ratio (deaths per 100 confirmed cases) in Croatia was 1.77, while it was 1.24 in Slovenia. Similarly, the number of cumulative COVID-19 deaths per 100,000 inhabitants was 269.2 in Croatia and 248.7 in Slovenia. In Table 7, we summarize the main identified factors impacting the excess deaths in both countries.

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The identified factors are assessed according to their estimated impact regarding the extent of excess deaths and mortality differentials (Table 7).

Table 7: Summary table of the main identified factors impacting the excess deaths and mortality differentials in Slovenia and Croatia with their estimated impact

Identified factors	Estimated impacts
Actual age structure of the population	Strong impact
Conditions in long-term care facilities	Diminishing impact / stronger in 2020
Vaccination	Diminishing impact
Preexisting mortality trends	Moderate impact
Existing comorbidities	Strong impact

Source: The results of the expert assessment analyses.

5. Conclusion

Both Croatia and Slovenia have been strongly affected by the COVID-19 pandemic – during the several waves of infections a significant part of the populations were affected. We determined that in both countries, COVID-19 had a significant impact on the overall mortality. The number of deaths was similarly distributed per 100,000 inhabitants, but in contrast to the previous year, Slovenia had a better score in 2021 compared to Croatia. In the whole studied period (2020–2021), Slovenia experienced two spikes of high mortality rates: the first around week 50 in 2020 with around 190 deaths per million, and the second in week 47 in 2021 with around 70 deaths per million. The first spike in Croatia was detected at the same time but was significantly weaker (around 140 deaths per million). In contrast with Slovenia, Croatia had two spikes in the following year when it lost the more favourable position against Slovenia: the first one in week 17 in 2021 with 80 deaths per million, and the second one in week 47 with around 130 deaths per million.

Additionally, Slovenia managed to ameliorate one of the highest nursing home mortalities in Europe in 2020, but it did not manage to decrease the number of deaths among the rest of population in the consecutive year despite its high immunization rate (93.3 ± 2%). Before the end of 2021, prior to the Omicron wave, of 2.1 million inhabitants 1.2 mil. were fully vaccinated, 0.55 mil. had been infected, and 0.2 mil. were naturally immune. Only about 0.1 million were left for the eventual contagion. Thus, COVID-19 mortality did not only affect general mortality in both countries, but also life expectancy. However, since the peak of the pandemic is over, and more detailed information is gradually becoming accessible, there is a strong need to examine the further impacts, especially those affecting life expectancy.

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All the indicators included in the analysis show that the excess mortality for both years was higher in Croatia than in Slovenia, particularly if we compare the cumulative number of confirmed cases and deaths. The most striking difference between the countries is that in Croatia the excess mortality in 2021 was higher than in 2020 in all months, while in Slovenia it was the opposite. Slovenia had a higher number of cases against deaths than Croatia owing to more extensive testing. This can be explained by a delay or postponed deaths from 2020 to 2021 in Croatia. Additionally, the estimation of the impact of COVID-19 fatalities in LTCF units reveals part of the answer to why Croatia was in fact better off during 2020. Further analyses confirmed the long-lasting effect of the unfavourable age structure of the Croatian population compared to Slovenia. Thus, excess mortality renders itself a biased indicator in comparing various countries among themselves. The mean age at death and the life expectancy indicators as important descriptors of mortality differentials are yet to be closely scrutinised because of data availability, as they offer an insight into the age-specific disparities in mortality between Slovenia and Croatia. With this analysis, we touched upon factors affecting mortality in both countries. In a summary table, we identify them and assess their impact qualitatively. The results confirm the assumption on the complexity of factors in the interplay and suggest their further examination. The findings confirm the initial hypothesis that COVID-19 mortality largely contributed to overall mortality in Slovenia in 2020, where the mortality in LTCF units was of chief importance. The COVID-19 mortality in LTCF units in Slovenia was about 70% higher compared to that of Croatia. However, the results have somewhat unexpectedly shown that the overall picture was worse and the demographic losses higher in Croatia.

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Notes

[1] RT-PCR test (also called a molecular test) detects genetic material of the SARS-CoV-2 virus (that causes COVID-19) in a fluid sample (collected by nose or throat swab) by using a lab technique called reverse transcription polymerase chain reaction (RT-PCR) (Mayo Clinic 2022).

[2] Age-standardized death rates for the period before 1985 were not available.

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