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IMPACT OF THE COVID-19 EPIDEMIC ON THE AGEING OF THE EUROPEAN POPULATION

The COVID-19 epidemic caused an increase in excess deaths worldwide, most of which were in the elderly. This study aims to identify the impact of the COVID-19 epidemic on reducing the intensity of change in population aging between 2020 and 2022 in selected European countries. Time-series analysis methods with trend and seasonality are used to estimate excess deaths. The study found that of the nearly 1.5 million excess deaths observed between 2020 and 2022 in the 28 European countries analyzed, almost 93% of these were in people aged 60 years and older. The results of the study indicate that in some countries (mainly central and eastern Europe), the scale of deaths due to the COVID-19 epidemic was large enough to clearly inhibit the aging dynamics of their populations.

Keywords: COVID-19 pandemic, excess deaths, population ageing, Europe.

1. INTRODUCTION

The ageing process is one of the most important issues facing societies in the world today. It is a consequence of 3 main factors, i.e. changes in fertility, mortality and migration (Preston et al., 1989). On the one hand, declining birth rates are reducing the proportion of the youngest people in the population, while on the other, lower mortality rates, especially in older age groups, are increasing life expectancy and the proportion of older people in the population. This is compounded by migratory movements, which modify the dynamics and sophistication of population ageing processes resulting from natural movement, especially as migrant populations are largely dominated by young people. Nevertheless, in most high-income countries, population ageing is expected to continue or even accelerate in the coming decades (World Bank Group, 2021).

These global ageing processes have been compounded by an outbreak of the SARS-CoV-2 virus causing COVID-19 disease since December 2019, which started in the city of Wuhan, Hubei Province, People's Republic of China (Onder et al., 2020), and within a short period of time evolved into an international public health emergency that has continued with varying degrees of severity until as late as 2022. As is usually the case with any epidemic, it is the elderly who have the highest risk of severe disease and the greatest risk of death, particularly if they also have other medical conditions. It is well known that immune system function deteriorates with age, making older people more susceptible to COVID-19 (Lloyd-Sherlock, Bachmann, 2020). Even before the COVID-19 epidemic,

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morbidity and mortality from infectious diseases, particularly respiratory infections, remained significant in the elderly population (Kassebaum, 2019). The progressive deterioration of immune function with age increases the susceptibility of older people to infections and the risk of serious complications if they become ill (Haynes, 2020). On the other hand, however, older people have the lowest average number of contacts (Hoang et al., 2021) that could potentially lead to infection and disease transmission, so their morbidity should be much lower than that of younger people (Bartoszko, Loeb, 2021). Therefore, the COVID-19 pandemic had a disproportionately negative impact on the elderly population residing in long-term care facilities, where the number of interpersonal interactions among the elderly is much higher (Cronin, Evans, 2022; Modig et al., 2021). Several aspects of long-term care homes (e.g., shared meals, group activities, staff rotation) make them an optimal environment for the rapid spread of many infectious diseases (Gardner et al., 2020). In addition, many residents of long-term care homes for the elderly have chronic diseases, which, in addition to old age, may further increase the severity of infection. Nevertheless, in most high-income countries, long-term care residents represent only a minority of the elderly population. The majority of older people tend to live alone or with a partner. In addition, in some regions, health care systems were overburdened, which may have made it difficult for seniors (or indeed anyone) to access necessary medical services. In turn, the medical industry's focus on the COVID-19 outbreak may have led to delays in the diagnosis and treatment of other diseases, possibly translating into increased mortality rates in future years. Additionally, the vaccination process against COVID-19 started at the beginning of 2021, which could have helped to protect the elderly from serious cases of the disease and its associated complications, reducing the risk of death associated with COVID-19. Therefore, the COVID-19 pandemic is expected to affect the rate of population ageing, due to increased mortality among older age groups.

The impact of a pandemic on population ageing may vary by region or country, actions taken by authorities, availability of healthcare and many other factors. Therefore, the main objective of the study was to identify the impact of the COVID-19 epidemic on reducing the intensity of change in population ageing between 2020 and 2022 in selected European countries. The study hypothesised that the pandemic had a negative impact on the rate of population ageing, increasing the number of deaths among the elderly and consequently reducing the rate of population ageing. However, the impact of the COVID-19 pandemic on the age structure of the population may have varied in different regions of the world. Some areas may have been more affected by deaths among the elderly than others, affecting the overall demography of the region.

Conducting this study is important because while the COVID-19 pandemic has been extensively studied in terms of its impact on public health and the economy, less attention has been paid to long-term demographic changes, including the impact on ageing populations. Existing studies mainly focus on the short-term effects of the pandemic, such as the number of deaths and the burden on health systems. As a result, there is a lack of detailed analyses of the structure of excess deaths by age and sex and their impact on demography in the long term. This study aims to fill this gap by offering a detailed analysis of excess deaths in selected European countries and their impact on the rate of population ageing. The study makes a new contribution by providing an understanding of how a pandemic may change the demographic structure at a macro and long-term level, and how these changes may vary by region. The results obtained may help to better understand potential future demographic challenges, such as the need to adapt social and health policies to new demographic realities after a pandemic. In addition, the study attempts to estimate the structure of excess deaths by age and sex and the magnitude of excess deaths among the oldest population groups. Excess deaths are those deaths that would most likely not have occurred had the COVID-19 epidemic not occurred. Thus, this analysis provides a better understanding not only of the immediate impact of the pandemic on the older generations, but also of the long-term effects on the ageing processes of entire populations.

2. THEORETICAL BACKGROUND

During any epidemic, there is an increase in the number of deaths that are directly caused by the disease in question, as well as deaths that are indirectly related to the disease due to, for example, constraints on the functioning of health services. There is an academic consensus (Kontis, Bennett, Rashid et al. 2020; Beaney, Clarke, Jain et al. 2020; Leon, Shkolnikov, Smeeth et al. 2020) indicating that the most objective way to measure the impact of an epidemic on mortality in epidemiology and public health is through an indicator termed excess deaths, which refers to the number of deaths from all causes during an epidemic or other crisis exceeding the number of deaths we would expect under 'normal' conditions (Checchi, Roberts, 2005). The excess number of deaths caused by an epidemic, for example, is simply the difference between the observed and expected (under normal conditions) number of deaths. It can also be negative, meaning that fewer deaths occurred in a given month compared to the baseline period. This figure unfortunately cannot be known exactly, but it can be estimated in a number of ways. This kind of calculation will allow an objective assessment of the overall impact of the epidemic on mortality by showing both the direct burden of the epidemic (including those deaths due to COVID-19 that were not correctly diagnosed and reported in the country's cause-of-death diagnosis system) and its indirect impact on the number of deaths due to, among other things, disruptions in access to healthcare services due to other conditions in the most affected areas of the country. Statistics on excess deaths can be used for international comparisons, as they no longer contain restrictions on their proper measurement as the reported number of deaths from various causes. The World Health Organisation recommends that deaths due to COVID-19 be captured very broadly and counted in all probable or confirmed cases, unless there is a clear alternative cause of death that cannot be linked to COVID-19 disease (e.g. trauma). These deaths should not be attributed to another disease, e.g. cancer, and should be counted independently of pre-existing conditions that are suspected of causing COVID-19 severity (WHO, 2020). Despite this, many countries use different ways of counting deaths due to Covid-19 which means that the mortality data published daily by different countries related to the disease are not comparable. The Economist built a machine learning model to estimate the number of excess deaths during a pandemic according to which, globally, the total number of excess deaths is two to four times higher than the reported number of confirmed COVID-19 deaths (Wang et al. 2022). Therefore, in many countries and globally, the number of confirmed deaths due to COVID-19 is much lower than the full number of pandemic fatalities.

3. METHODOLOGICAL BACKGROUND

A key methodological challenge in estimating excess deaths is to determine the expected mortality as if the epidemic had never happened. The most common method of calculating the expected number of deaths over the period under study is to calculate a so-called historical average based on the values of deaths from several earlier periods. This was the method used by the Statistical Office of the European Union during the COVID-19 epidemic by comparing the current number of deaths in a given month with the average number of deaths from 2016 to 2019 (Eurostat, 2023). However, this approach has some important limitations, i.e. it does not take into account long-term mortality trends (as can be evidenced by the statistically significant trend coefficient in the regression equation). For example, for countries with an upward trend in mortality, such as Poland, the average over several prior periods will be underestimated and vice versa in other cases.

Various methods of time series analysis were used to model the time series under study for men and women and the 20-year age groups in the study: forecasting based on the historical average, the indicator method of extracting seasonal fluctuations with a trend of both multiplicative and additive versions, the regression method with trend and seasonality described by zero-one variables. Data from two periods, i.e. a shorter period from 2015 to 2019 and a longer period covering the years 2010 to 2019, were used to forecast the weekly volume of deaths from 2020 to 2022. Ultimately, the model with the smallest error, measured by the standard deviation of the residual component and the coefficient of random variation, which determines what proportion of the average level of the phenomenon under study is accounted for by random variation, was selected. In general, it usually turned out that the data from the shorter period, i.e. 2015–2019, were better matched to the empirical data, i.e. had a smaller random component error than the data from the longer period, i.e. 2020–2019, regardless of the method used. At the same time, the data for deaths of young people, i.e. in the groups 0–19, 20–39 and sometimes for those aged 40–59, did not show a developmental trend (the trend parameter turned out not to be statistically significant) and the seasonal variations were weak (i.e. most or all of the weekly seasonality indicators turned out not to be statistically significant). Therefore, to model the time series of youth deaths and to estimate projections of these deaths for 2020–2022, the weekly average of 2015–2019 for individual weeks of the year was mostly used. These data were largely relatively random, especially for small countries where the law of large numbers did not reveal itself sufficiently, so the estimates in this case are subject to considerable uncertainty. Nevertheless, the majority of deaths were in people aged 60 years and over, so this did not have a significant impact on the estimate of the final excess deaths. On the other hand, for the time series of deaths of people aged 60–79 years and 80 years and over, the regression model with trend and seasonality described by zero-one variables was most often used, which in this case tended to have the smallest error and had a statistically significant trend and a large proportion of seasonality indicators. The fit to the empirical data was at a satisfactory level – the average percentage error was at the level of a few percent of the mean value of the explanatory variable (it was generally smaller for countries with larger populations, for which the law of large numbers worked better).

Excess deaths can only be calculated based on accurate, high-frequency mortality data from previous years. Unfortunately, few countries have statistical offices with the capacity to report the number of people who died in each month or week, and even fewer by age and sex of the deceased. Therefore, only 28 European countries for which data on the weekly structure of deaths by sex and age were available from at least 2015 were selected for the study (for Germany, data were available without sex breakdown). The study used data in the Eurostat database on weekly deaths by sex and age and population. The data were grouped into weeks according to ISO8601, which provides a standard definition of a 'week' (Eurostat, 2023). The collected data were grouped into weekly time series of deaths of women or men by sex and 20-year age groups, i.e. 0–19, 20–39, 40–59, 60–79 and 80 years and over. On their basis, an attempt was made, using time series modelling methods, to estimate the magnitude of excess deaths in 2022–2022, which provided a starting point for further analyses, i.e. assessing the impact of the COVID-19 epidemic on population ageing.

4. EMPIRICAL RESULTS

The study found that nearly 1.5 million excess deaths occurred in the 28 countries studied between 2020 and 2022 (see Table 1), with the highest number in Italy (nearly 240 000), Germany (nearly 190 000) and Poland (nearly 180 0002). Nevertheless, other studies show that the highest number of excess deaths in Europe occurred in Russia, whereby the end of 2021 alone it could be as high as around 1.1 million (Murkowski, 2022). In addition, the distribution of excess deaths over time was not uniform and developed with different severity at different times in all countries studied, i.e. successive 'coronavirus epidemic waves' affected European countries with different severity. In 2020, the highest number of excess deaths was recorded in Italy (around 100 000) and Spain (close to 70 000), in 2021 in Poland (close to 97 000) and Romania (over 72 000), while in 2022 in Germany (close to 98 000) (see Figure 1). As we know, it was Italy that was the first country in Europe to face the Covid-19 outbreak, where, via tourists from China, the virus spread throughout the country in early March 2020. The initial response to the development of the outbreak in many European countries was the so-called lockdowns, i.e. restrictions on the movement of people and the functioning of the economy across Europe, which somewhat delayed the development of the outbreak, but which immediately returned when restrictions were relaxed in subsequent periods.

Gender was a significant factor in the risk and eventual fatal response to Covid-19 infection, and in light of the findings, men appeared to be at higher risk of acute COVID-19 and death from the disease. In most of the countries studied, more excess deaths occurred in men than in women (but not in all), and in some cases (such as Sweden, Austria, the Czech Republic and Switzerland) it was even above 60% of all deaths. This was despite the fact that women clearly dominate in numbers among the elderly population most affected by the COVID-19 epidemic. Similar results are corroborated by the results of other studies, e.g. in relation to mortality rates in a normal situation during the COVID-19 pandemic in Poland in 2020, mortality rates for men increased more than mortality rates for women (Czerwiński, 2021). This is because, presumably due to differences in immune response, men are more likely to experience an acute course of COVID-19 and to die from the disease (Scully et al., 2020).

[2] In the author's earlier estimates, the number of excess deaths in Poland in 2020 was estimated at about 70,000 (Murkowski, 2021) (in the current model it is 61,000), and in 2021 at about 107,000 (in the current model it is 97,000) (Murkowski, 2022). The lowering of the estimates in relation to the author's earlier publications is due, firstly, to the use of not one, as before, but several methods of time series analysis and the selection of the method characterised by the best fit to the empirical data and, secondly, to the analysis of the time series of deaths for women and men by 20-year age groups and not, as before, for the total data.

Table 1. Number of excess deaths by sex and age in 2020–2022 (T – total, M – males, F – females)

Description		Total	per 100 000	Error (%)	0–19	20–39	40–59	60–79	80+
Austria	T	19 743	220	6,44	-93	197	-269	4 513	15 396
	M	12 587	284	6,27	-92	156	115	3 493	8 916
	F	7 156	157	7,49	-1	41	-384	1 020	6 480
Belgium	T	27 413	236	6,09	-229	-242	2 581	12 065	13 238
	M	14 646	255	5,68	-180	-189	1 860	7 791	5 364
	F	12 767	217	7,11	-49	-53	721	4 274	7 874
Bulgaria	T	66 754	976	5,97	-414	106	6 276	38 424	22 362
	M	35 066	1 059	6,01	-288	59	3 540	21 387	10 368
	F	31 688	898	6,57	-126	47	2 736	17 037	11 994
Croatia	T	20 983	543	7,08	-62	-87	-493	11 417	10 207
	M	10 370	557	7,09	-46	-64	-318	6 591	4 206
	F	10 613	531	8,18	-16	-23	-175	4 826	6 001
Cyprus	T	2 103	232	10,63	44	38	247	756	1 018
	M	1 030	234	12,80	22	18	138	349	503
	F	1 073	231	15,07	22	20	109	407	515
Czechia	T	42 303	402	6,47	-173	-98	3 660	21 815	17 099
	M	25 543	493	6,40	-97	-133	2 491	14 816	8 466
	F	16 760	314	7,23	-76	35	1 169	6 999	8 633
Denmark	T	4 183	71	4,08	-80	27	341	1 044	2 851
	M	1 809	62	4,89	-73	16	112	300	1 454
	F	2 374	80	4,89	-7	11	229	744	1 397
Estonia	T	3 377	254	7,00	-39	-98	41	1 522	1 951
	M	1 643	259	8,48	-19	-87	46	973	730
	F	1 734	248	8,30	-20	-11	-5	549	1 221
Finland	T	9 434	170	4,58	-36	-23	-585	3 384	6 694
	M	4 276	156	5,51	0	-48	-409	2 189	2 544
	F	5 158	184	5,49	-36	25	-176	1 195	4 150
France	T	138 532	204	4,83	-878	102	8 666	55 025	62 305
	M	81 697	249	4,31	-504	26	8 322	34 773	30 957
	F	56 835	162	5,56	-374	76	344	20 252	31 348
Germany	T	189 561	228	5,64	-582	1 345	9 754	42 509	136 535
	M	99 632	243	5,01	NA	NA	NA	NA	NA
	F	89 961	213	6,34	NA	NA	NA	NA	NA
Greece	T	37 473	358	6,40	-337	-314	2 854	18 539	16 710
	M	19 456	380	5,97	-184	-190	1 881	10 687	7 244
	F	18 017	337	7,45	-153	-124	973	7 852	9 466
Hungary	T	41 087	424	6,61	-212	245	7 973	19 978	13 044
	M	21 303	459	6,19	-103	108	4 975	9 658	6 615
	F	19 784	392	7,52	-109	137	2 998	10 320	6 429
Italy	T	236 153	400	5,72	-1 629	-1 265	9 728	80 303	149 016
	M	121 082	420	5,10	- 1 006	-705	6 936	52 028	63 829
	F	115 071	381	6,48	-623	-560	2 792	28 275	85 187
Latvia	T	7 408	395	5,66	-133	-230	118	3 560	4 060
	M	2 531	291	6,87	-81	-195	238	1 577	964
	F	4 876	484	6,83	-52	-35	-120	1 983	3 096

Table 1 (cont.). Number of excess deaths by sex and age in 2020–2022 (T – total, M – males, F – females)

Description		Total	per 100 000	Error (%)	0–19	20–39	40–59	60–79	80+
Lithuania	T	20 989	748	5,41	-219	-523	3 180	10 296	8 255
	M	11 131	852	5,99	-130	-439	3 011	6 083	2 606
	F	9 858	657	6,75	-89	-84	169	4 213	5 649
Montenegro	T	3 320	537	11,06	23	39	120	2 129	1 009
	M	1 799	589	13,79	14	20	110	1 226	429
	F	1 521	487	14,04	9	19	10	903	580
Netherlands	T	38 363	218	4,64	-15	507	-324	17 282	20 913
	M	22 255	254	4,41	-21	294	346	11 506	10 130
	F	16 108	182	5,42	6	213	-670	5 776	10 783
Norway	T	5 218	96	4,66	-57	-95	-232	1 265	4 337
	M	2 917	107	5,54	-23	-81	-107	966	2 162
	F	2 301	86	5,96	-34	-14	-125	299	2 175
Poland	T	178 363	474	5,00	-960	1 788	19 557	86 264	71 714
	M	97 010	533	4,44	-641	1 000	14 456	52 575	29 620
	F	81 353	418	5,89	-319	788	5 101	33 689	42 094
Portugal	T	27 618	267	6,93	-163	-50	7	11 313	16 464
	M	11 937	242	6,55	-127	-23	-126	6 310	5 861
	F	15 681	289	7,91	-36	-27	133	5 003	10 603
Romania	T	114 370	601	5,31	138	1 339	10 992	62 237	39 664
	M	60 109	651	5,10	125	883	6 433	33 576	19 092
	F	54 261	554	5,82	13	456	4 559	28 661	20 572
Serbia	T	51 689	760	8,25	-218	303	2 812	37 328	11 289
	M	28 114	850	7,80	-112	266	2 173	20 153	5 510
	F	23 575	676	9,31	-106	37	639	17 175	5 779
Slovakia	T	28 027	516	6,57	-46	46	1 425	14 967	11 635
	M	13 929	524	6,39	-26	49	951	8 415	4 540
	F	14 098	508	7,82	-20	-3	474	6 552	7 095
Slovenia	T	5 095	242	6,98	-43	-85	-145	1 539	3 829
	M	2 623	248	8,55	-24	-66	-73	1 128	1 658
	F	2 472	236	8,52	-19	-19	-72	411	2 171
Spain	T	136 493	288	5,37	-431	88	6 662	57 582	68 332
	M	70 279	302	4,66	-258	121	4 369	36 529	27 248
	F	66 219	274	6,33	-188	-61	2 290	21 050	41 090
Sweden	T	15 135	145	4,45	-55	-362	677	4 632	10 243
	M	10 049	191	4,64	26	-337	1 031	3 126	6 203
	F	5 086	98	5,48	-81	-25	-354	1 506	4 040
Switzerland	T	14 661	168	6,26	17	64	-523	4 532	10 571
	M	8 827	203	6,18	29	72	-245	3 217	5 754
	F	5 834	133	7,43	-12	-8	-278	1 315	4 817

Source: Own compilation based on Eurostat data. Explanations: Error $= \frac{S_y}{\bar{y}} * 100\%$ – residual coefficient of variation – model error in the determination of the expected number of total deaths calculated for the years 2015–2019, where: $S_y = \sqrt{\frac{\sum_{i=1}^{N}(y_i - \hat{y}_i)^2}{N}}$

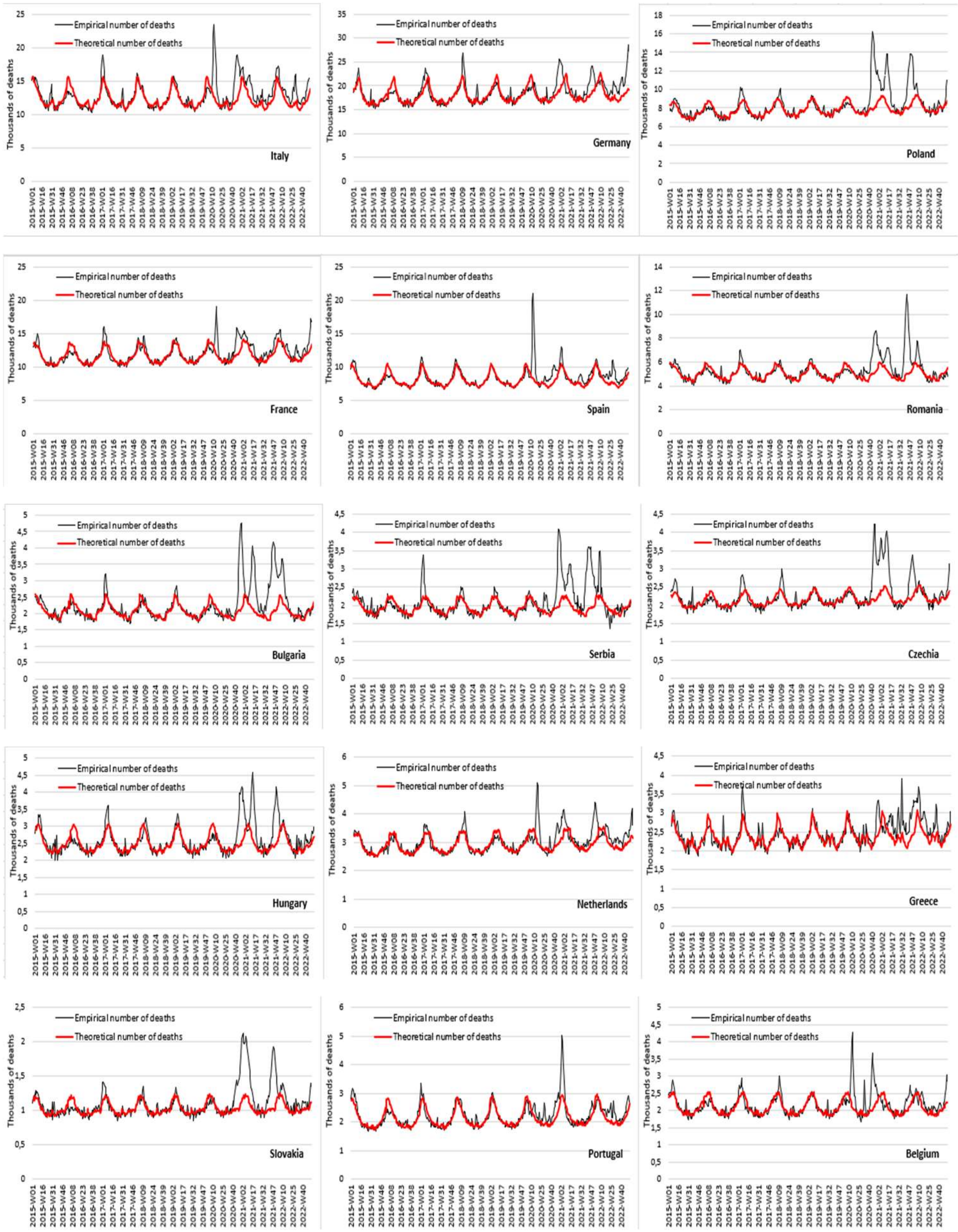

Figure 1. Time series of weekly empirical and theoretical number of deaths in selected European countries from 2015 to 2022

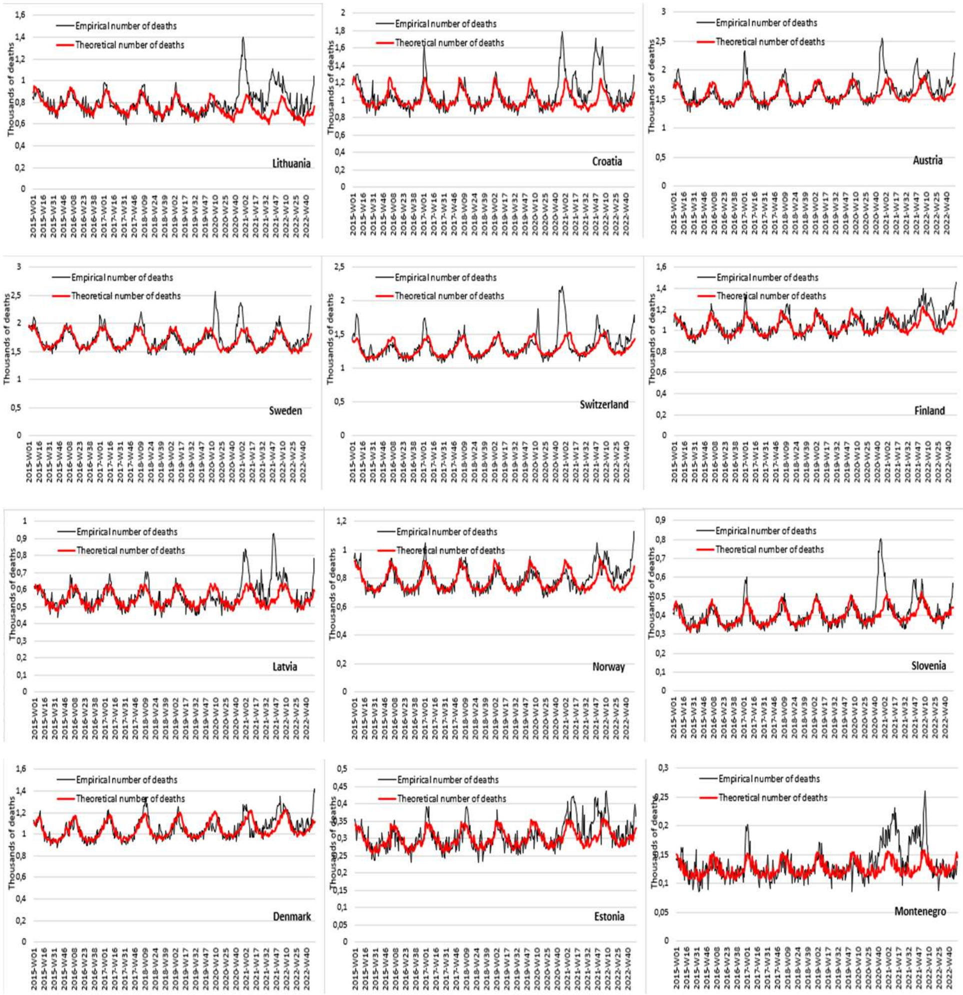

Figure 1 (cont.). Time series of weekly empirical and theoretical number of deaths in selected European countries from 2015 to 2022

Source: Own elaboration based on Eurostat data.

The best measure of the extent of the consequences of the COVID-19 epidemic for society is the number of excess deaths in relation to population. The study found that, among the 28 countries surveyed, Bulgaria was the country most affected by the COVID-19 epidemic, with as many as 976 excess deaths per 100,000 population – an average of 1059 men and 898 women. Among other countries, other Eastern European countries such as Serbia, Lithuania and Romania were also disproportionately affected by the COVID-19 epidemic (see Figure 2 and Table 1). In contrast, the countries least affected by the epidemic were mainly Northern European countries like Denmark, Norway, Sweden or Finland – these are countries with a fairly low population density (and thus less potential for the virus to spread) and with good health care, which could also probably have contributed to their relatively small number of excess deaths relative to their populations. The study found that there were only about 71 excess deaths per 100,000 people in Denmark between 2020 and 2022.

The distribution of excess deaths in relation to population has also varied over time. The study found that in 2020, the highest number of excess deaths per 100 000 people was recorded in Bulgaria (around 225), Serbia (around 225) and Lithuania (around 190). In contrast, in 2021, the peak year of the COVID-19 outbreak, the highest number of excess deaths was recorded in Bulgaria, where, on average, as many as 600 more people per 100,000 people died than normal. Equally unfavourable results were then also recorded in Serbia (around 500 excess deaths per 100,000 people) and in countries such as Montenegro, Romania, Lithuania, Slovakia and Latvia (between 300 and 400 excess deaths). In 2022, on the other hand, excess deaths per 100 000 people were already much lower, although still high in some countries such as Bulgaria (around 150) and Lithuania (around 200).

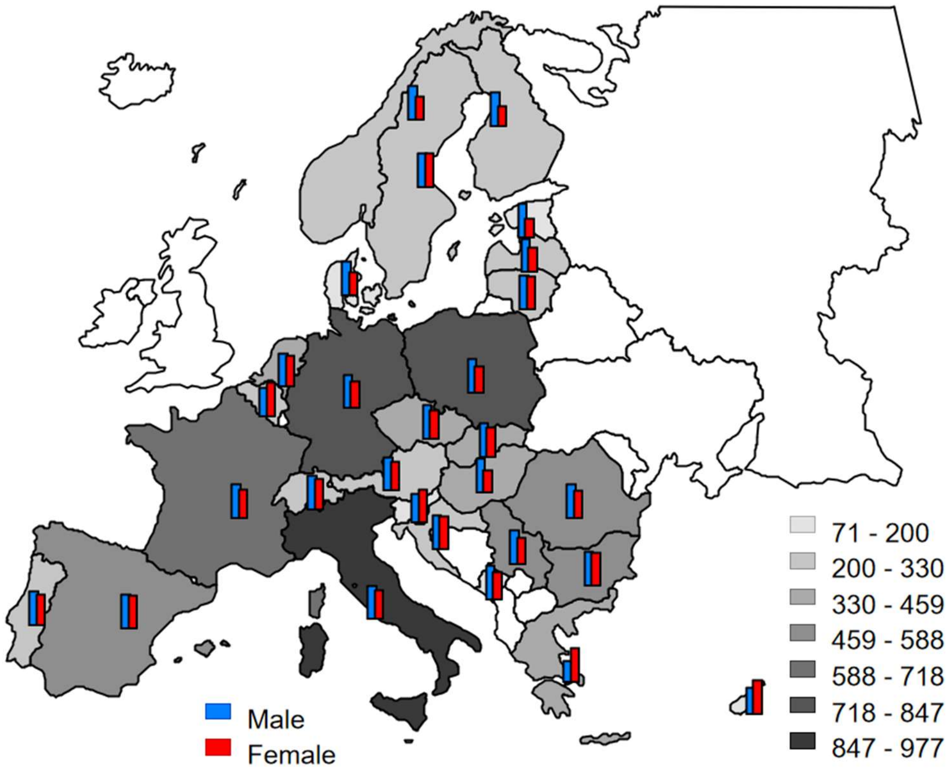

Figure 2. Number of excess deaths in the period 2020–2022 per 100,000 people

Source: Own elaboration based on Eurostat data.

For the purpose of analysing excess deaths by age group, we divided the population into five age groups, i.e. those aged 0–19, 20–39, 40–59, 60–79, 80 years and over. In light of the available data from many countries, it appears that it is the elderly population that has the highest risk of severe COVID-19 and death (Elbeddini et al., 2020; Kemenesi et al., 2020). The study found no evidence of elevated mortality in the younger population between 2020 and 2022. In the 0–19 and 20–39 year old age groups, excess deaths were even negative in most of the countries studied (see Table 1), i.e. fewer deaths were recorded than would be expected with the average weekly deaths from 2015 to 2019.

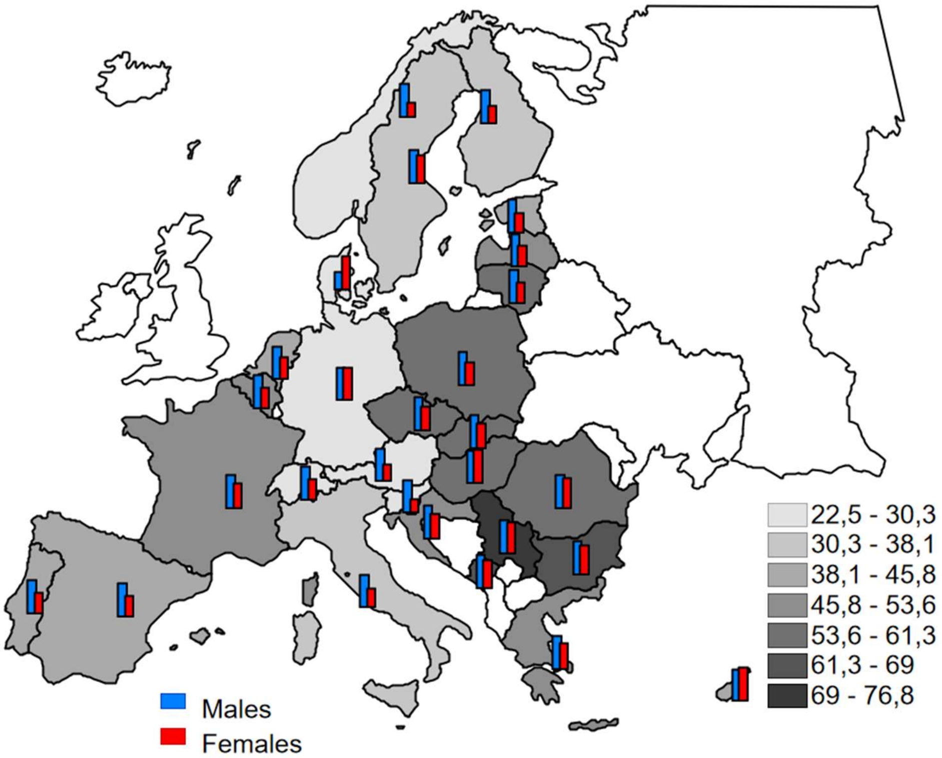

Figure 3. Percentage of excess deaths of people aged 60–79 among excess deaths of people aged 60 and over

Source: Own elaboration based on Eurostat data.

The study found that, of the nearly 1.5 million excess deaths observed between 2020 and 2022 in the 28 European countries analysed, almost 93% of them involved people aged 60 years and over. As is well known, it is in richer countries that the age structure of the population tends to be older than in poorer countries, which may help to explain why it is the economically more developed countries that have suffered more from the pandemic (Economist, 2020). The study observed that a statistically clearly higher mortality rate during the COVID-19 epidemic could only be observed for those aged 40 years and older, although there was some territorial variation in this in Europe, with a higher proportion of deaths among those aged 40 to 59 years recorded in Eastern Europe than in Western Europe (see Table 1). This is confirmed by the structure of excess deaths by age, i.e. among all excess deaths, the proportion of deaths among people aged 40–59 tended to be higher on average in central and eastern European countries (e.g. 19.4% in Hungary, 15.2% in Lithuania, 11% in Poland, 9.6% in Romania) than in western Europe. In some Western and Northern European countries such as Austria, Finland, Norway, Switzerland or Slovenia, no statistically significant increased mortality was observed for people of this age during the study period. It could even be hypothesised that deaths of these people in eastern European countries could be largely avoided with better quality health services.

As already mentioned, the majority of excess deaths that occurred during the COVID-19 epidemic in the countries studied were deaths of people aged 60 years and over. The study found that the magnitude of excess deaths of the different age groups of the population was evidently influenced by the very structure of the population by age. Western European countries are countries where, in the structure of the population by age, the oldest age group, i.e. those aged 80 and over, account for a relatively large proportion of excess deaths among those aged 60 and over (see Figure 3). For example, in Norway, Austria and Germany, about 77% of excess deaths among people aged 60 and over were deaths of the oldest people, i.e. those aged 80 and over, and this percentage was more often slightly higher for women than for men. In Central and Eastern European countries, on the other hand, it was the other way around, i.e. most excess deaths among people aged 60 and over were deaths of people aged 60 to 79 (in the case of Serbia, this was as high as 77% of excess deaths among people aged 60 and over, and for Montenegro, Bulgaria, Romania and Hungary the percentage was over 60% – being more often slightly higher for men than for women.

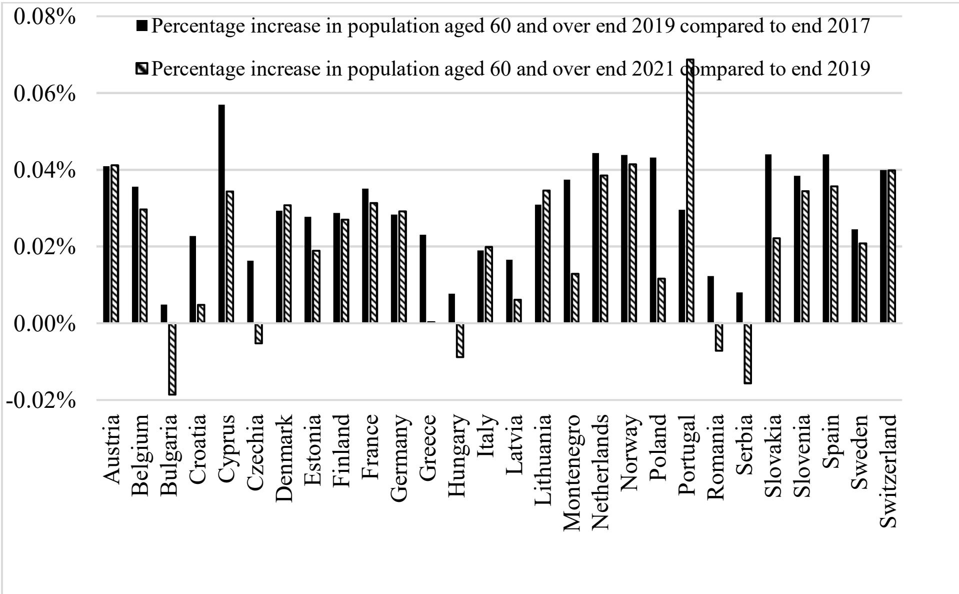

Figure 4. Percentage increase in population aged 60 and over at the end of 2019 compared to the end of 2017 compared to the end of 2021 compared to the end of 2019

Source: Own elaboration based on Eurostat data.

All these changes had an impact on the advancement of population ageing in the countries studied. The dynamics of population ageing because of the COVID-19 epidemic decreased in practically most European countries (see Figure 4). In some countries, even the sheer number of people aged 60 and over has decreased between the end of 2019 and the end of 2021 (see in Figure 4 countries such as Bulgaria, the Czech Republic, Hungary, Romania and Serbia). Consequently, in some mainly central and eastern European countries, the number of people aged 60 and over as a proportion of the total population has stopped growing between 2020 and 2022, which means that the ageing of their population has stopped.

There is a clear negative correlation between the number of excess deaths per 100,000 people and the growth of the population aged 60 and over during the COVID-19 epidemic. The more excess deaths, the lower the growth of the population aged 60 and over – every 100 excess deaths more means on average 0.69 percentage points less aging of people aged 60+ (see Figure 5). All this supports the hypothesis that the pandemic has had a negative impact on the rate of ageing by slowing or reversing the rate of ageing. However, it seems that these changes are only incidental and after the end of the COVID-19 epidemic, everything will return to previous trends, i.e. the rate of population ageing will continue to increase along with the process of human life expectancy.

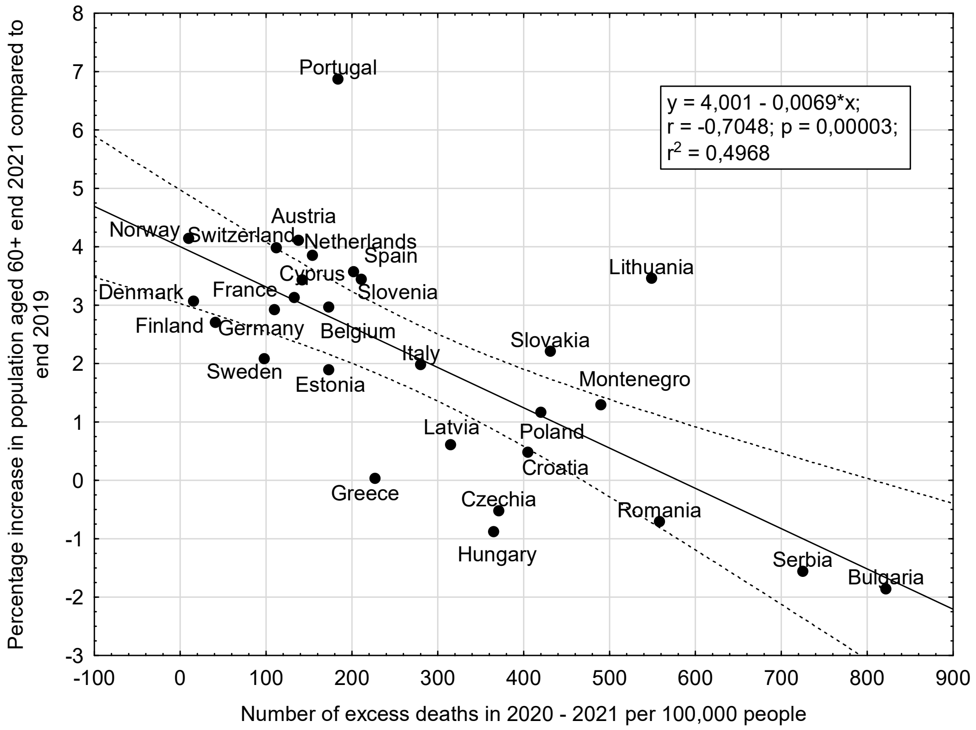

Figure 5. Relationship between the number of excess deaths per 100,000 people and the increase in the population aged 60 and over – end 2021 versus end 2019

Source: Own elaboration based on Eurostat data.

5. CONCLUSIONS

The COVID-19 pandemic caused widespread disruptions in economies and societies around the world, including reduced economic growth, increased public debt, reduced tourism, paralysed the functioning of health services or partly education systems. The enormous impact of the COVID-19 pandemic on the course of various demographic processes cannot be overlooked either; mortality has increased in many countries, international migration and mobility have been significantly reduced, and rising unemployment and job insecurity have lowered fertility rates. As a consequence, long-term demographic trends have changed or been adjusted to some extent, including the population ageing process analysed here, which is mainly driven by long-term trends in fertility and mortality. The study ignores the impact of the COVID-19 epidemic on the decline in birth rates, which in addition may have further accelerated the ageing of the population, and which should be considered in further research. Nevertheless, a number of other studies, indicate that the pandemic clearly influenced the decline in birth rates in Europe or the USA, with a large proportion of young women deciding to postpone pregnancy because of the pandemic (Harper, 2021).

The impact of the epidemic appears to be greatest in densely populated areas, especially in those countries where the aging of the population is most advanced. As we know from many studies, it is the elderly who are most at risk of severe illness and death from COVID-19. Since death rates from COVID-19 are highest among the oldest people, the impact of the current pandemic on a given society depends largely on the proportion of the elderly among the total population and their living conditions. As we know, the total number of deaths can depend on both the structure of the population and the mortality rate by age group. The results of this study also confirm this, as of the nearly 1.5 million excess deaths observed in the 28 European countries studied, as many as 93% of them involved people aged 60 and older. Therefore, the pandemic has reduced the rate of aging, increasing the number of deaths among the elderly. The study also observed a reduction over time in many countries in the percentage of deaths among those aged 80 and over among all excess deaths in favour of lower age groups. Perhaps the positive impact of the COVID-19 vaccination program should be seen here.

On the basis of the analysis carried out, it can be concluded that the hypothesis posed at the beginning of the study, that the COVID-19 pandemic had a negative impact on the rate of population ageing by increasing the number of deaths among the elderly, which consequently reduced the rate of population ageing, has been confirmed. The results of the study indicate that the pandemic did indeed have a significant impact on the demographic structure, particularly through excess deaths in older age groups, which temporarily reduced the rate of population ageing in the countries analysed. In summary, the fact that a large number of excess deaths involved the elderly resulted in a decline in the dynamics of population aging in practically most of the European countries studied. In some Central and Eastern European countries, the process of population aging, as measured by the percentage of people aged 60 and over among the total population, has even stopped. However, these changes appear to be purely incidental, and once the COVID-19 epidemic is over, the population aging process will return to its long-term negative trends.

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