

Excess Mortality Associated with the Covid-19 Pandemic in Romania

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Abstract

The aim of the paper is to determine if there was an excess mortality in Romania in the 2020-2021 interval and to establish if this excess is explained only by increasing mortality directly resulting from Covid19 disease or/and by collateral deaths from various causes. Due to the fact that a simple international comparison of data directly associated with deaths caused by COVID-19 appears more and more debatable, the new approach of European Official Statistics (Eurostat), but also of other international statistical bodies by calculating an indicator of excess mortality over a period compared to a reference period (2016-2019), appears as a valid general measure of the health crisis real impact on the total mortality in a region/country. Based on these new statistics our findings reveal that Romania's excess mortality was caused by Covid19 disease but also in same proportion by collateral deaths.

Key words: mortality, Covid19 Pandemic, excess mortality, Romania

J.E.L. classification: I10, I18, J11

1. Introduction

Basically, collection and analysis of statistical data regarding mortality in the EU belong to population and demography issues and account at national level. These mortality specific data also break down on groups of sex, age, education levels and nationalities and all these for each year. However, how could such a new accounting, be it accurate and detailed in itself, be ever able to reflect the proper size of the pandemic, since not related to the whole population of a country, a multi-country region and so on? Moreover, how to properly compare the current pandemic years situation to the one of the previous years in such circumstances, be it just on the mortality data side? Besides, obvious inter-State differentiations on healthcare systems and specific policies, caused by the ones of economic development (and not only), were producing in their turn differentiated effects, as the case of measures taken about the pandemic and about corresponding data reporting. International comparison on data so was all over suffering.

2. Literature review

Never neglecting the basic historical data on mortality collected, the year 2020 brought in the need of renewing the assessment method for mortality, together with the pandemic. World Health Organisation (WHO, 2022) representatives here argue for the concept of *excess mortality, related to Covid-19* that they find as closer to a proper evaluation of direct and indirect results of the pandemic (Table no. 1).

Table no. 1 Excess mortality. Definitions given in the literature

Author/Organisation	Definitions
Checchi, F. and Roberts, L. (2005)	Number of deaths during a specific health crisis, as compared to corresponding expectations for non-crisis (i.e. normal) periods. This term belongs to the public healthcare sector.
Eurostat (2022)	An unusual mortality level arising for a limited period on an also limited population/region.
University of Oxford Our World in Data (2022)	The simple difference between total number of deaths in a specific period/raw deaths and the same in non-specific periods / "normal" deaths or/and number of deaths just expected to happen.
OECD(2020)	Comparison between total deaths from all causes in a certain (specific) period (e.g. 2020, 2021) and annual average number of deaths of the previous periods. OECD here has opted for the five-year interval previous to the Covid-19 pandemic triggered. A period during which population's adjustments on age and sex groups were made concomitantly with and according to deaths reported.
UK Health Foundation(2020)	The most accurate way to make international comparisons of deaths caused by Covid19
ECDC (2020)	The difference between number of deaths officially reported for a period done and previously expected deaths for the same length of period.

Source: Eurostat, OECD, ECDC

Actually, this equals the difference between total number of deaths attributed to a unit of territory (country, region or territorial district) for a given time period and expectable number of deaths in the absence of the pandemic in the same time and on the same territory.

Eurostat (European Commission's statistical body), on the European continent, took another initiative in April 2020: an exceptional weekly data collection on deaths for the help of political authorities and of research units to better and more closely approaching all about the pandemic content. The result did consist in a more mobile and adaptive statistic done for equally more rapid situation changes on the mortality side. In context, Eurostat itself does find the same *excess mortality* indicator as percentages comparing total current deaths (i.e. of all causes) with those expected previously, in the reference times with no pandemic – e.g. for 2020 and 2021 the reference period was considered the 2016-2019 time interval. The higher this index, the more current deaths as compared to the ones of the reference period; when negative, on the contrary, the current deaths get less numerous than those of the reference period (Eurostat,2022). It is finally this index expected as able to approach the true dimension of the recent health crisis and to offer a valid measure for the same crisis impact on mortality— i.e. it includes all existing and reportable deaths irrespective of their causes.

Our below analysis does base on this new statistic on Romania. Eurostat, again, here helps by offering data on *excess mortality in Romania*, as part of the EU region, here including by breaking it down on groups of sex and ages, as well as on interior regions and territorial districts.

Then, the excess mortality evaluation became an intense preoccupation for both epidemiologists and statisticians since the beginning of pandemic for better relate current happenings to the ones of the previous periods, taken as normal, i.e. off pandemics. There are to be mentioned international organisms and institutions of statistics working on excess mortality estimations: Office for National Statistics (ONS) for England and for Wales, U.S.-National Centre for Health Statistics (NCHS), Euro-MOMO's. Besides, important media entities provided their own statistics and estimations, once more, for countries that made their own data as such collectable: The Economist (2022), The New York Times, The Financial Times, The Washington Post and, BBC. In April 2020 Eurostat, laid the groundwork for calculating a mortality rate based on data collection on deaths caused by Covid 19 and its specific procedure and methodology included deaths recorded weekly.

In another view the excess mortality came to be seen as the monthly percentage of the mortality surplus of 2020 and 2021, as related to the same month's mortality average in the 2016-2019 years interval. And this last basing on the assumption that the Covid-19 pandemic was the factor causing these both directly and indirectly.

Last, but not least, the 2016-2019 years interval equals the normality basis in the view of the statistics' publishing department of the European Commission, i.e. Eurostat.

3. Methodology and data

Once more, the *excess mortality* will be here below taken as the difference between the number of deaths – i.e. weekly or monthly – officially reported within the 2020-2022 period and an estimation of mortality for this same period previously made in no pandemic moments (Ritchie et al, 2020). Such a methodology is equally used by Eurostat for evaluating the mortality done by the Covid-19 pandemic for both the EU and EFTA member countries, but with no country-pandemic profile here coming out. The Eurostat data estimate the number of deaths throughout the region by its averages on the four years preceding the pandemic, i.e. weekly averages on the 2016-2019 years interval. Then, these average numbers get compared to the equally weekly deaths reported by the authorities along the pandemic years when these deaths came. In context, it is well understood that no methodology implemented by Eurostat would be possible in the absence of huge efforts on data collecting in the EU member States and the other States involved in this project. Moreover, data were permanently updated so that our study here came to benefit also from the early 2022 data even in a moment where the pandemic wasn't yet done.

It is basing on this Eurostat's working model that our data were collected for just Romania – i.e. weekly data on the four years previous to the pandemic for corresponding averages to be computed as such. Then, there comes the turn of extreme – i.e. minimum and maximum – deaths reported in each of the 52-53 weeks of the year and then calculating standard deviations and upper & lower bound of numbers expected at 95% confidence level. Bogos at all (2021) previously applied this method on the Hungary's case, with a regard on the Eastern European region as well.

See the calculating formula for the weekly excess mortality of 2020 and 2021—i.e. this is for both Eurostat regarding the EU and EFTA member countries and for Oxford University on its web-site called "Our World in Data".

$$\begin{aligned} EXM_{2020} &= M_{e_2020} - M_{e_2016_2019} \\ EXM_{2021} &= M_{e_2021} - M_{e_2016_2019} \end{aligned} \quad (1)$$

In which:

- EXM = *Excess mortality*. This results first in number of deaths (see the M_e), so rather no comparability between countries and between regions on such a basis. This is why this number will be related to 100,000 persons in the alternative of the $EXM\%$ calculated by either *Eurostat*, or University of Oxford.

- M_e = *Crude mortality*, i.e. weekly official data.

- M_e = *Mortality estimated*, i.e. its weekly average of previous 4 years (2016-2019).

Finally, EXM results as the percentage difference between total deaths of all causes and estimated deaths on the basis of the previous years' averages, as in the following formula (other studies do call EXM (%) the "*P-score*"):

$$EXM (\%) = (M_c - M_e) / M_e * 100 \quad (2)$$

Naturally, when $EXM > M_e$ there are more deaths in the current – i.e. pandemic, 2020-2021 – period, as compared to the reference period – i.e. just previous and taken as normal, 2016-2019. And, on the contrary, when $EXM < M_e$ there are less deaths in the current period as compared the reference period and EXM itself is negative.

4. Findings

4.1 Crude mortality (M_c) in Romania, 2016-2021 (weekly data)

It is to be noticed in Romania a certain pattern of mortality evolving without obvious ups and downs for the 2016-2019 years interval, unless in cold seasons. Then, the 2020-2021 new situations appear obviously distinct from the previous years' ones (Table no. 2).

Table no.2. Mortality in Romania, 2016-2021

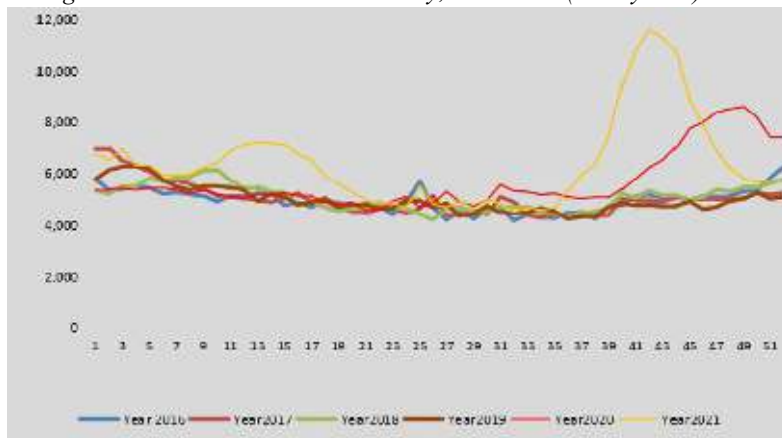
Year	Crude mortality	Males	Females	Crude mortality rate* (number/ 1000 pop.)
2016	258404	135251	123153	13.10
2017	262321	136725	125596	13.40
2018	263911	138224	125687	13.60
2019	259889	136245	123644	13.40
2020	301427	160672	140755	15.61
2021	332483	173059	159424	17.22

Source: countryeconomy.com, 2021

On the 11 March of 2020 the World Health Organization (WHO) declared the Sars-CoV-2 disease a pandemic. But actually during the first half of this first year of pandemic the country's mortality data yet looked similar to the ones of the precedent years. It was the month of July 2020 – i.e. more precisely the 31st week of the year -- when all changed and mortality started growing higher than the one corresponding to the previous years' trend. Overall, crude mortality increased in Romania from 13.4 deaths per 1,000 inhabitants in 2019 to 15.61 deaths per 1,000 inhabitants in 2020 (table 2). But then, in 2021 pandemic grew much higher, i.e. to 17.22 deaths per 1,000 inhabitants.

The following graph of crude mortality is supposed to accurately reflect the size of pandemic. This latest's impact on mortality was both direct and indirect, i.e. collateral deaths, as to be detailed about in the next below paragraph. Each of the years 2020 and 2021 included two pandemic waves brought in as assumed to be in infectious agent pandemic cases.

Figure no. 1. Romania: crude mortality, 2016-2021 (weekly data)

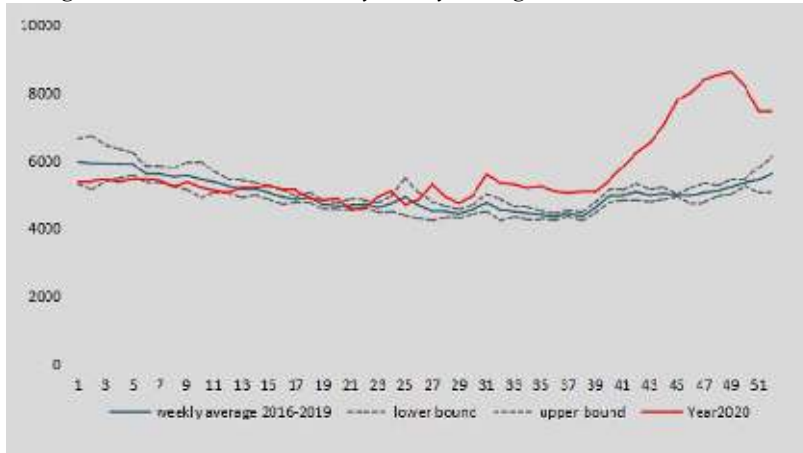


Source: calculations based on Eurostat, 2022

4.2. Mortality estimated(M_e) and excess mortality(EXM) in Romania

In our research order crude mortality (M_c) of the 2020-2021 pandemic period to be compared to the previous 2016-2019 one (M_e) required the statistic calculus on weekly averages for the latter, here including their maximal and minimal numbers expected at 95% significance level.

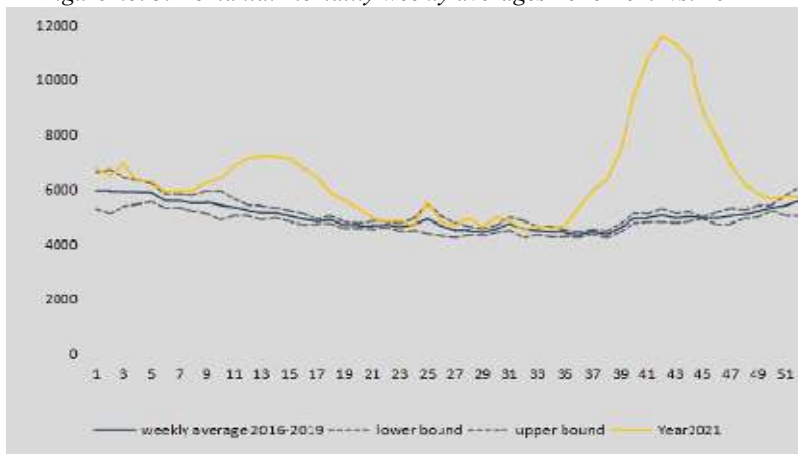
Figure no. 2. Romania: mortality weekly averages 2016-2019 vs. 2020



Source: calculations based on Eurostat, 2022

In Figure 2 these minimal and maximal numbers come on the dotted line that drags in its middle the previous years' specific averages. The 2020 crude mortality numbers here come on the red line – i.e. see the primary 27 weeks of the year (up to the week between the 29 June and 5 July) in which the accounted numbers stayed underneath the up estimation limit (17.51%) made in the reference period. Then, a second pandemic wave came up in September and got obvious after the 41st week of the year (11-20 October) to reach its maximum in the 48th week (23-29 November) together with as high as 67.4% rise as compared to the reference period.

Figure no. 3. Romania: mortality weekly averages 2016-2019 vs. 2021

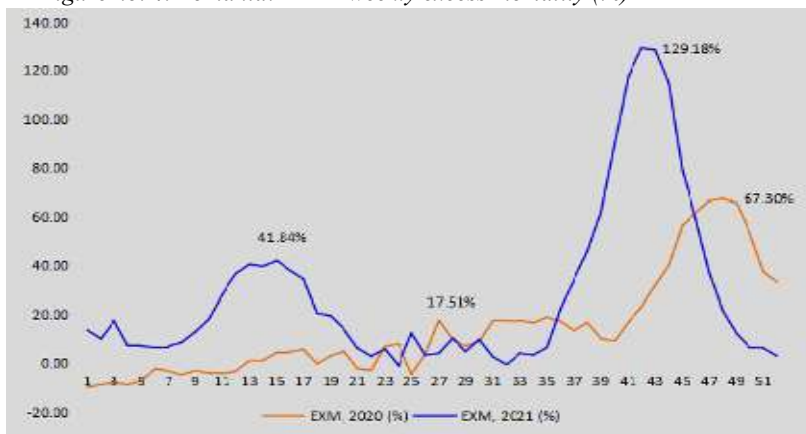


Source: calculations based on Eurostat, 2022

Then in 2021 a new mortality peak came up in early April – i.e. see the 15th week case with 36 deaths per 100,000 inhabitants and a 41.8% excess mortality as compared to the same weeks of the years 2016-2019 averages, with 26 deaths per 100,000 inhabitants.

Total number of deaths in Romania lowered between April and August of 2021, but this turned into a new rise in September (the 38th week of the year) that went on in October and November. The maximum here reached in the 42nd week brought in a 129.18% excess mortality related to its estimation (Figure 4) -- i.e. actually, more than 100% excess mortality means more than double than estimated for that week. Equation 2 was applied for these growth percentages.

Figure no. 4. Romania: EXM- weekly excess mortality (%)



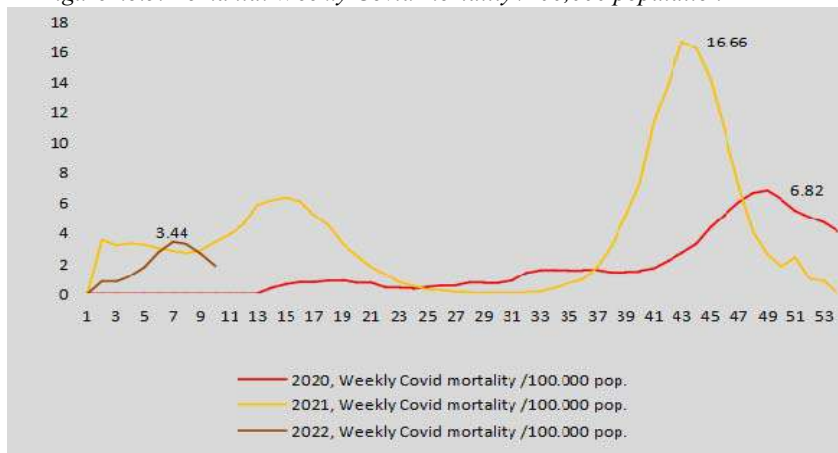
Source: calculations based on Eurostat ,2022

The per 100,000 inhabitants excess mortality cumulated for the successive years 2020 and 2021 places Romania on the 7th position world-wide, according to publication “*The Economist (2022)*” – i.e. more exactly, it was about 561.95 deaths as excess mortality per 100,000 inhabitants.

4.3. Romania: Covid-19 related deaths and excess mortality data – an analysis

At the end of 2020 the Covid-19 related deaths in this country were 17,428, meaning 90.16 deaths per 100,000 inhabitants. At the end of the next 2021 there were 39,606 total deaths, so 204.9 deaths per 100,000 inhabitants. Figure 5 sees the four pandemic waves as a whole and equally shared between the two respective years and the year’s maximums in the 48th week of 2020 with 6.82 deaths per 100,000 inhabitants and in the 42nd week of 2021 with 16.66 deaths per 100,000 inhabitants.

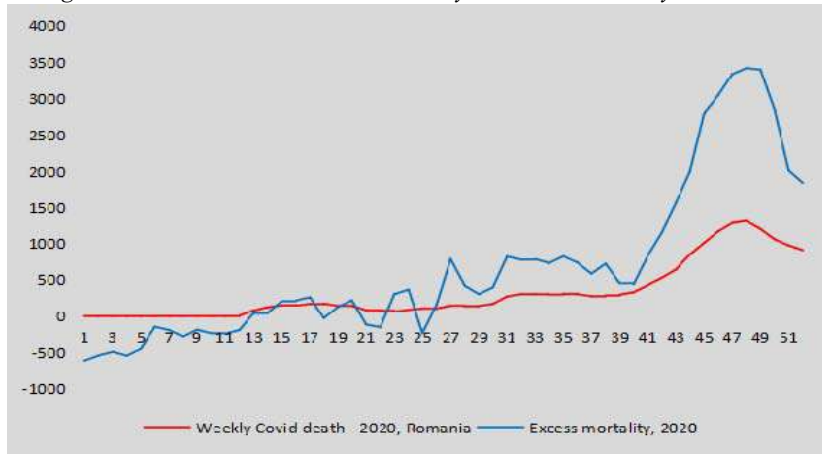
Figure no.5. Romania: Weekly Covid mortality /100,000 population



Source: calculation based on ECDC data, 2022

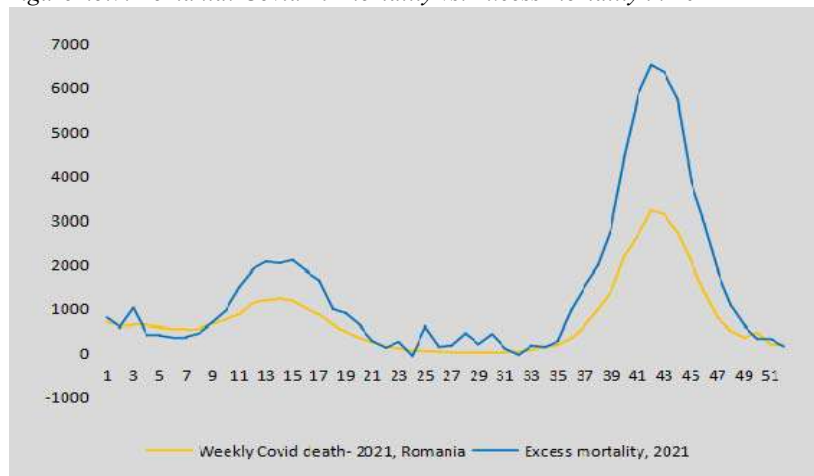
The next following 6th and 7th graph-figures underline the officially declared Covid-19 related deaths and excess mortality – i.e. here computed on the basis of the difference between the general mortality and the four pre-pandemic years average found by Eurostat.

Figure no.6. Romania: Covid-19 mortality vs. Excess mortality in 2020



Source: calculation based on ECDC data, 2022

Figure no.7. Romania: Covid-19 mortality vs. Excess mortality in 2021



Source: calculation based on ECDC data, 2022

To be here noted that the Covid-19 related deaths do reflect the above defined excess mortality only partly – i.e. 48%, the rest of 52% being due to collateral deaths. In spring 2020 most chronicle disease hospitals in Romania were turned into exclusive Covid-19 treating patients hospitals by Government decision. And this would be suspected as decisively causing the significant fall in hospitalizations of all causes. The *Romanian Health Observatory (RHO, 2021)* reports in context in 2020 that one of the obvious pandemic impacts did consist in the people's lowered access to healthcare services – i.e. there were 70% less hospitalizations between April and the 2020 year end than in the same period of the previous 2019. See the most affected hospitals from this point of view: the "Matei Bals" Institute of Bucharest, as a Covid-19 hospital (mentioned with as high as 90% activity reduction in the March-August interval, as compared to the same period of 2019) and "Colentina" hospital, equally in Bucharest and as a Covid-19 one (Cosac, 2022). Besides, the other non-Covid-19 hospitals rather similarly suffered: the "Fundeni" Clinical Institute with 35-79% activity reduction, here including the fall of surgery for patients with cancer, the Cluj District Emergency Hospital with 21-68% activity reduction, the Iasi District Emergency Hospital with 56-79% activity reduction (Cosac, 2022). RHO (2021) here adds that public hospitals suffered

more than the private ones. Moreover, during the March-August time interval hospitalizations fell by 80% for HIV patients, by 67% for diabetes patients, by 57% for multiple sclerosis, by 50% for tuberculosis and by 46% for cancer.

October 2021 brought in the peak of the 4th Covid-19 wave and the highest mortality rate in Romania in peacetime according to INSSE – i.e. 110%, as 10,700 Covid-19 related deaths reported by the authorities, more than double than the same month average along the 2016-2019 years interval. The ability of hospitals to receive Corona virus-infected patients has got exceeded, and non-urgent procedures were stopped. The Eurostat data place Romania of this period (month) on the top position in the EU for its excess mortality – i.e. also the only three-digit value excess mortality country since the beginning of the pandemic and so far in the whole EU region.

There also might be mentioned another study published in August 2021 by the research specialized company called *Ipsos* (one of the largest market research companies in the world). This last argues that the second pandemic year did not reveal any much better situation than previously, in 2020 – e.g. about half of the urban population saw less or not at all the family physician (43%) or specialist doctor (50%). A quarter of the Romanian population didn't take any blood test and one of three Romanians did not resort to investigations, follow-up or ultrasound monitoring or prevention. *Ipsos* (2021) believes that such a behaviour might be due to the general fear against the Covid-19 infection wherever, including or even especially in hospitals and clinics. Then, in spring 2021 54% of family physicians and 68% of specialist doctors interviewed noticed chronicle disease emergencies rising in connection with the idea that those patients were becoming collateral victims of the pandemic.

Many patients diagnosed with cancer have discontinued treatment for several reasons, such as delays in scheduling and the focus of medical resources over these years on just reducing the risk of Covid-19 spreading. Or, the patients with cancer certainly were those collateral victims of pandemic, says the *Federation of the Patients with Cancer of Romania (FPC, 2021)*, since hospitals stayed open just for emergencies and nowhere for speciality medical care. In the meantime cancer diagnosis has dropped by 40% in Romania, according to FPC here cited by *Ipsos*.

The same study then reveals that the new *Telemedicine* in Romania stays in a "gray area" – i.e. this is much less developed on specific platforms than by *WhatsApp* and by the classical phone(calls). All the less, it seems that only under 44 years old individuals do actually use it.

5. Conclusions

In Romania, as in the rest of the world, *Covid-19* made victims directly by the actual infection with the virus Sars-Cov-2, but collateral victims at the same by the indirect action on the increase of mortality (FPC,2021).

The indicator of excess mortality – i.e. the reported number of deaths from all causes exceeding the expected number of deaths based on the reference value of previous years -- provides a broader measure of direct and indirect deaths caused by Covid-19 and appears less affected by problems related to testing and registration of death causes (OCDE/European Observatory on Health Systems and Policies, 2021). Our above paper searches for such an excess mortality in Romania during the 2020-2021 period, compared to its four previous years by using the Eurostat methodology.

Deaths from all causes in Romania had been even lower in early 2020 than the average of the four previous years of the pandemic and social distance specific measures – e.g. closing non-essential stores, restricting free movement, suspending hospitalizations for non-acute conditions -- were coming to be taken a little later, on 22-23 March 2020. In the year end general (crude) mortality in Romania went as high as 301,427 deaths with an excess mortality of 35,797, as compared to the 2016-2019 reference period, of which only 17,428 deaths (i.e. 48%) were directly due to Covid-19, the rest (52%) being collateral deaths of the pandemic. Then, the highest numbers of deaths as weekly reported were coming up in the 48th and 49th weeks of the same year, i.e. between 23 November and 6 December, 1,319 (ECDC,2020). And in the excess mortality of late 2020 the role of the more aggressive new Covid-19 variants isn't to be excluded (Hu et al, 2021).

In the end of 2021 in Romania the general (crude) mortality was as high as 332,483 with the excess mortality of 72,437 related to the reference 2016-2019 period, of which just 39,606 directly due to Covid-19. There were obviously more deaths in Romania in the 2021 year end than previously, in 2020, despite that the collateral ones dropped by 8% -- i.e. possibly, due to the meanwhile advance of the experience in the management of chronic diseases.

The excess mortality cumulated for 2020 and 2021 -- i.e. simply, for the number of deaths cumulated -- might make 108,234, of which only 57,037 officially declared as Covid-19 related. In this order, 51,197 deaths result as collateral for these two years as about 47% of the also cumulative excess mortality. As related to the officially declared Romanian population, 19,328,842 inhabitants, the same excess mortality so would be as high as 560 deaths to 100,000 inhabitants (i.e. our calculation).

Concomitantly, this part of the excess mortality not Covid-19 related could be attributed to causes similarly coming up in other countries: limited testing capacity for those diseases (OCDE/European Observatory on Health Systems and Policies, 2021, p5) then scarcity of treatment in needed time due to hospitals turned into Covid-19 exclusive treatment, the patients' reticence to meet their physicians in medical offices during pandemic, under reporting of cases and implicitly of deaths, scarcity of hospital treatment spaces, here including the ones of intensive therapy, scarcity again of personnel skilled in these specialities, all these might have lead to such excess mortality (Rocks and Idriss, 2020). Last, but not least there might be about inconsistent measures taken by the Romanian authorities.

Last but not least, mental diseases, actually the whole mental state of the people in pandemic were affected as additionally: i.e. the emotional stress, which led to depression and anxiety among the population. Negative effects will remain even after the end of the medical crisis (Neagu. 2022).

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