COVID-19 MORTALITY IN BELGRADENataša Rosić1, Milena Šantrić Milićević2

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ABSTRACT

Introduction: Mortality data are the most reliable indicators of the number of lives that a community has lost due to COVID-19 and represent the minimum data necessary for public health decision-making.

Aim: The aim of the study is to describe the basic characteristics of population mortality from COVID-19 in Belgrade in 2020.

Methods: The unit of observation in this cross-sectional study for the description of mortality from COVID-19 in 2020 was the population of Belgrade (total, by sex, and by age intervals). COVID-19 was analyzed as the main cause of death (ICD-10: U071, U072). The number and the structure of deaths (%), the crude death rate (per 1,000 population) and the specific death rate (per 100,000 population) were analyzed. The data sources for the study were official statistics on vital events of the Statistical Office of the Republic of Serbia.

Results: In 2020, 10.5% of the total number of deaths were due to COVID-19, and the majority of deaths was from the male contingent of Belgrade residents. The mortality rate due to COVID-19 was 158.78 per 100,000 population (211.7 for males and 111.4 for females). COVID-19 was the second leading cause of death in Belgrade.

Conclusion: The results of this study indicate the existence of premature mortality in Belgrade. In 2020, COVID-19 was the second leading cause of death among the male residents of Belgrade, while in female residents, it was the third leading cause of mortality. This research provides evidence that can contribute to the international discussion about societal losses caused by the COVID-19 pandemic.

Key words: mortality rates, COVID-19, causes of death, Serbia
UVOD

Na brifingu za novinare, 11. marta 2020. godine, generalni direktor Svetske zdravstvene organizacije (SZO), dr Tedros Adhanom Gebrejesus\(^1\) istakao je da je broj slučajeva KOVID-19 bolesti izvan Kine rapидno i trinaestostruko porastao, te da se zbog trostrukog većeg broja ugroženih zemalja progleđavaju pandemija nove zarazne bolesti - KOVID-19 [1].

KOVID-19 je bolest koju uzrokuje nekoliko nedovoljno poznatih varijanti koronavirusa, što otežava kompletno opisivanje kliničkog toka i prognostičkih aspekta bolesti, kod odraslih i dece [2]. Nedovoljno se zna o inkubacionom periodu KOVID-19 infekcije [3], kao i o poretku, epidemiološkoj slici, dužini transmisije među stanovništvom, i spektetu kliničkih manifestacija [4-6].

U većini zemalja, uključujući i Srbiju, primenjuju se mere javnog zdravlja za prevenciju infekcije KOVID-19, koje su zasnovane na prethodnom iskustvu prenošenja respiratornih patogena sa čoveka na čoveka. Ove mere podrazumevaju izolaciju i karantin, policijski čas, zatvaranje preduzeća i škola, fizičko distanciranje, ograničene društvene interakcije, bolnica, respiratorni higijenu, nošenje zdravstvenih maski i rukavica (bez ograničavanja samo na medicinske), i upotrebu efikasnih i bezbednih vакcinа.

Do sada smo skoro svakodnevno dobijali informacije o različitim procenama o gubicima koje je KOVID-19 pandemija prouzrokovala od lokalnog do globalnog nivoа. Zdravstveni gubici se najčešće izražavaju pokazateljima mortaliteta. U Međunarodnoj statističkoj klasifikaciji bolesti i srodnih zdravstvenih problema, 10. reviziji (MKB-10) [7], prema međunarodnim smernicama za potvrđivanje i klasifikaciju (šifriranje) KOVID-19 kao nosavnog uzroka smrti [8], smrt usled oboljenja KOVID-19 definisao se kao smrt koja potiče od bolesti koja ima klinički odgovarajuće karakteristike, a u verovatnom ili potvrđenom slučaju oboljenja Kovid-19, osim u slučaju kada postoji jasan alternativni uzrok smrti koji ne može biti povezan sa bolešću Kovid-19 (npr. trauma). Važno je naglasiti da smernice jasno navode kako “ne bi trebalo da postoji period između potpunog oporavka od KOVID-19 bolesti i smrti”. Ove smernice izdate su 16. 04. 2020. godine, u svrhu nadzora za slučaj KOVID-19, koji je identifikovan ili pak nije identifikovan ali je kliničko-epidemiološki dijagnostikovan, ili za verovatan slučaj KOVID-19, odnosno za moguć slučaj/slučaj sumnje na KOVID-19. Na osnovu ovih smernica je u MKB-10 uključena nova XXII grupa, sa U00-U89 Šiframa za posebne namene, gde je bolest KOVID-19 šifrirana kao:

- U07.1 KOVID-19, identifikovan virus; i
- U07.2 KOVID-19, nije identifikovan virus.

INTRODUCTION

At the press briefing held on March 11, 2020, Dr Tedros Adhanom Ghebreyesus, Director-General of the World Health Organization (WHO) pointed out that the number of COVID-19 cases outside China had rapidly increased thirteen-fold, and that, due to the tripled number of affected countries, the WHO was declaring a pandemic of the new infectious disease - COVID-19 [1].

COVID-19 is a disease caused by several less-known variants of coronavirus, which makes the complete description of the clinical course and the prognostic aspects of the disease, in children and adults, more difficult [2]. Sufficient knowledge is also lacking as to the incubation period of COVID-19 [3], its origin, epidemiological presentation, length of transmission in the population, and spectrum of clinical manifestations [4-6].

In most countries, including Serbia, public healthcare measures for preventing the spread of COVID-19 are being implemented. These measures are based on previous experience of respiratory pathogen transmission from human to human, and include isolation and quarantine, curfew, the closing of businesses and schools, physical distancing, limited social interaction, improved respiratory hygiene, wearing face masks and gloves (not limited only to medical masks and gloves), and the application of efficient and safe vaccines. So far, we have almost daily been receiving updates on the different estimates of the losses that the COVID-19 has caused, from the local to the global level. Health losses are most frequently expressed in mortality indicators. In the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD - 10) [7], according to the International guidelines for certification and classification (coding) of COVID-19 as cause of death [8], death caused by COVID-19 is defined as “a death resulting from a clinically compatible illness, in a probable or confirmed COVID-19 case, unless there is a clear alternative cause of death that cannot be related to COVID disease (e.g., trauma). It is also important to note that the guidelines state that “there should be no period of complete recovery from COVID-19 between illness and death”.

These guidelines were published on April 16, 2020, for the purpose of the surveillance of identified or unidentified but clinically-epidemiologically diagnosed COVID-19 cases, or probable COVID-19 cases, i.e., possible/suspected cases of COVID-19. Based on these guidelines, a new chapter was added to the ICD-10 - Chapter XXII with U00-U89 Codes for special purposes, where COVID-19 is coded as:

- U07.1 COVID-19, virus identified; and
- U07.2 COVID-19, virus not identified.

\(^1\) Tedros Adhanom Ghebreyesus
It is important to emphasize that the Statistical Office of the Republic of Serbia data state that all registered deaths in Chapter XXII, in 2020 were only deaths caused by COVID-19, i.e., all deaths in the entire U00-U89 group were caused by COVID-19.

Mortality data are the most reliable indicators of the number of lives that a community has lost due to COVID-19, and they represent the minimum data necessary for public health decision-making. Analyses and comparisons of mortality indicators may inform decision makers and help them in formulating public health recommendations and measures for promoting the care for the health and lives of the population. Between January 3, 2020, and September 3, 2021, the World Health Organization [9] registered more than 218 million confirmed COVID-19 cases worldwide as well as 4.5 million COVID-19 deaths, while in Serbia, more than 769 thousand confirmed cases and 7,322 deaths were registered.

**AIM**

The aim of the study is to describe the basic characteristics of population mortality from COVID-19 as the main cause of death, in Belgrade, in 2020.

**METHODS**

In this paper, a descriptive cross-sectional study was applied for analyzing mortality from COVID-19 as the main cause of death, in the population of Belgrade, in 2020. The unit of observation in the study was the population of Belgrade, observed in total, by sex, and by age intervals. Overall mortality, as well as mortality from COVID-19 as the main cause of death was observed. In the ICD-10, Chapter XXII, Codes for special purposes (U00-U89), there were only deaths with the main cause of death – COVID-19 (U07.1, U07.2). The data sources for the study were the electronic databases on population of the Statistical Office of the Republic of Serbia [10]. Indicators such as the absolute number of deaths, the average age at death (mean value and measures of variability), the structure of deaths (%), the death rate (crude death rate per 1,000 population and specific death rate per 100,000 population) were used for descriptive analysis of mortality.

**RESULTS**

In Belgrade, in 2020, a total of 25,526 people died, of whom 51.1% female (13,063) and 48.9% male (12,463). The greatest number of deaths in the population of Belgrade was in the age group 85 years and older (6,582) of whom 38.8% (2,557) male and 61.2% (4,025) female individuals. In the same year, the number of deaths caused by COVID-19 (group U00-U89, i.e., U07.1 and U07.2) was 2,690 or 10.5% of the total number of deaths, i.e., 13%...
Različita je zastupljenost bolesti KOVID-19 u odnosu na druge grupe uzroka smrti po starosnim intervalima. Treba istaći da je u starosnim intervalima 20 - 24 godine i 25 - 29 godina samo KOVID-19, a u odnosu na sve ostale grupe uzroka smrti, odneo čak 33,3% muškaraca odnosno 28,6% žena. Kod muškog pola, u starosnim intervalima 70 - 74 godine i 45 - 49 godina, KOVID-19 je, u odnosu na sve ostale grupe uzroka smrti, bio zastupljen 16% odnosno 15,8% smrtnih slučajeva.

Kada se posmatraju samo lica umrla od KOVID-19 oboljenja (Grafikon 1), skoro dve trećine umrlih su bili muškog pola, odnosno 63% ili 1.693 umrlih osoba muškog pola i 37% ili 997 osoba ženskog pola. U 2020. godini, od bolesti KOVID-19 (MKB-10: U071, U072), najviše je umrlih bilo u doboj grupi od 70 - 74 godine starosti (ukupno 480 ili 17,8% umrlih od KOVID-19), zatim u doboj grupama 80 - 84 godine (17,3%), 85 i viša godina (16,8%) i 65 - 69 godina (14,4%). Najviše muškaraca umrlih zbog KOVID-19 oboljenja bilo je u doboj grupi 85 i više godina (20,4%), po tome grupi 80 - 84 godine (20,2%) i grupi 70 - 74 godine (17,5%).

U 2020. godini, opšta stope smrtnosti u Beogradu bila je 15,1 na 1.000 stanovnika, a trocifrena u starosnom intervalu 80 - 84 godine umrlih od bolesti KOVID-19 (ICD-10: U071, U072) je 15,1 na 1.000 stanovnika, a trocifrena u starosnom intervalu 80 - 84 godine umrlih od bolesti KOVID-19 (ICD-10: U071, U072) je 15,1 na 1.000 stanovnika.

Za većinu dece (od 0 - 29 godina) i starih (od 85 i više godina) manje je umrlih od bolesti KOVID-19, uspešno je bilježeno da je u doboj grupi 65 - 74 godine, u odnosu na sve ostale grupe uzroka smrti, bio najviši broj umrlih. Ovakva je situacija obično obična u drugim svetskim zemljama.

Spomenuto je da je u starosnim intervalima 20 - 24 godine, 25 - 29 godine i 30 - 39 godine, KOVID-19 bilo najčešće uzrok smrti. U starosnim grupama 40 - 49 godina, 50 - 59 godina i 60 - 64 godine, COVID-19 je bio u većoj mjeri uzrok smrti. Međutim, u starosnim grupama 70 - 84 godine, COVID-19 je bio u smanjenoj mjeri uzrok smrti.

Za neke starosne grupe, KOVID-19 nije bio uzrok smrti, a samo podstakao proces smrti. U starosnim grupama 85 i više godina, COVID-19 je bio uzrok smrti, a samo podstakao proces smrti. U starosnim grupama 70 - 84 godine, COVID-19 nije bio uzrok smrti, a samo podstakao proces smrti.

Herac (2021) je navedao da je u starosnim intervalima 70 - 74 godine, COVID-19 bilo u većoj mjeri uzrok smrti. U starosnim grupama 85 i više godine, COVID-19 nije bio uzrok smrti, a samo podstakao proces smrti.

Treba istaći da je COVID-19 bio uzrok smrti za 24% od dece (od 0 - 29 godina) i 36% starih (od 85 i više godina). U starosnim grupama 30 - 59 godine, COVID-19 nije bio uzrok smrti, a samo podstakao proces smrti.

Specific death rates due to COVID-19 differ by sex: the frequency of the death rate due to COVID-19 is almost twice as high in men as compared to women (211.68 for men and 111.43 for women) (Grafikon 2). The crude mortality rates for both sexes were similar (16.33 for men and 13.93 for women).

When only individuals who had died from COVID-19 are observed (Figure 1), almost two thirds of the deceased persons were male, i.e., 63% or 1,693 deceased male individuals, while 37% or 997 were female individuals. In 2020, the greatest number of people dying from COVID-19 (ICD-10: U071, U072) was in the age group 70 – 74 years (480 or 17.8% persons deceased from COVID-19 in total), followed by the age groups 80 - 84 years (17.3%), 85 years and older (16.8%), and 65 - 69 years (14.4%). The greatest number of men deceased due to COVID-19 was in the age group 85 years and older (20.4%), followed by the age group 80 - 84 years (20.2%), and the age group 70 - 74 years (17.5%).

In Belgrade, in 2020, the crude mortality rate was 15.1 per 1,000 population, while the mortality rate due to COVID-19 was 15.785 per 100,000 population (Figure 2). The crude mortality rates for both sexes were similar (16.33 for men and 13.93 for women).

Specific death rates due to COVID-19 differ by sex: the frequency of the death rate due to COVID-19 is almost twice as high in men as compared to women (211.68 for men and 111.43 for women) (Figure 2). The crude death rate for both sexes enters the double digits in the age group 60 - 64 years (16.29 per 1,000 population) and triple digits in the age group 80 - 84 years (106.24 per 1,000 population) (Figure 3).

The distribution of the specific rate indicates that COVID-19 significantly affected younger adults. The specific death rate due to COVID-19 for both sexes enters the double digits in the age group 35 - 39 years (11.73 per 100,000 population), triple digits in the age group 55 - 59 years (111.43 per 100,000 population), and it becomes higher than 1,000 in the age group 80 - 84 years (1062.18 per 100,000 population) and older (Figure 3).

Crude death rates in male and female residents have similar distribution across age groups (Figure 4). The crude death rate in men enters the double digits in the age group 55 - 59 years (13.69 per 1,000 population), and the triple digits in the age group 80 – 84 years (125.99 per 1,000 population), while in women it is in the double digits in the age group 60 - 64 years (10.97 per 1,000 population), and in the triple digits in the age group 85 – 89 years (125.99 per 1,000 population).
Figure 2. Distribution by sex of the crude mortality rate (per 1,000 population) and the specific mortality rate due to COVID-19 (per 100,000) in Belgrade, 2020.

Figure 3. Age distribution of the crude mortality rate (per 1,000 population) and the specific mortality rate due to COVID-19 (per 100,000) in Belgrade, 2020.
Distribucija specifične stope ukazuje da je KOVID-19 značajno pogodio mlađe odrasle osobe. Specifična stopa smrtnosti od KOVID-19 oboljenja za oba pola postaje dvocifrena u starosnom intervalu 35 - 39 godina (11,73 na 100.000 stanovnika), trocifrena u starosnom intervalu 55 - 59 godina (111,43 na 100.000 stanovnika), i četvorocifrena od starosnog intervala 80 - 84 godine (1062,18 na 100.000 stanovnika) i na dalje (Grafikon 3).

Opšte stope smrtnosti kod stanovnika muškog i ženskog pola imaju sličnu distribuciju po starosnim intervalima (Grafikon 4). Opšta stopa smrtnosti kod muškaraca postaje dvocifrena u starosnom intervalu 35 - 39 godina (13,69 na 1.000 stanovnika), a trocifrena u starosnom intervalu 80 - 84 godine (125,99 na 1.000 stanovnika), dok je kod žena dvocifrena u starosnom intervalu 60 - 64 godine (10,97 na 1.000 stanovnika), a trocifrena u starosnom intervalu 85 i više godina (194,64 na 1.000 stanovnika) (Grafikon 4).

Specifične stope smrtnosti od KOVID-19 oboljenja kod stanovnika muškog i ženskog pola nemaju sličnu distribuciju po starosnim intervalima (Grafikon 4). Specific death rates due to COVID-19 in male and female residents do not have similar distribution across age groups (Figure 4). The specific death rate due to COVID-19 in men enters the double digits in the age group 35 - 39 years (19.61 per 100,000 population), the triple digits in the age group 50 - 54 years (111.52 per 100,000 population), and exceeds 1,000 in the age group 75 - 79 years (1108.91 per 100,000 population) and older, while in women it is in the double digits in the age group 25 - 29 years (11.11 per 100,000 population), and enters the triple digits in the age group 60 - 64 years (116.14 per 100,000 population) and older (Figure 4).

In Belgrade, in 2020, the ICD-10 group U00-U89, where deaths were registered only due to COVID-19 (U07.1, U07.2) represents the third leading cause of death, with a rate of 158.75 per 100,000 population, after ‘Diseases of the circulatory system’ (I00-I99), which are in the lead, with a rate of 672.42 per 100,000 population, and ‘Tumors’ (C00-D48), which are the second leading cause of death, with a rate of 314.85 per
Rangiранje pet vodećih dijagnoza kao osnovnih uzroka smrti stanovnika Beograda u 2020. godini (Tabela 1), razlikuje se po polu: COVID-19 (U07.1, U07.2) je drugi vodeći uzrok smrti za oba pola (158,75 na 100.000), i jedini uzrok smrti za žene (111,43 na 100.000). Međutim, dok su „Bolesti krvnih sudova mozga“ (I60-I69) na trećem mestu kod muškaraca, one su na drugom mestu kod žena, a „Specifična stopa smrtnosti od KOVID-19 oboljenja kod muškaraca postaje dvocifrena u starosnom intervalu 35 - 39 godina (19,61 na 100.000), trocifrena u starosnom intervalu 50 - 54 godine (111,52 na 100.000), i četvorocifrena od starosnog intervala 75 - 79 godina (1108,91 na 100.000 stanovnika) i na dalje, dok je kod žena dvocifrena u starosnom intervalu 25 - 29 godina (11,11 na 100.000 stanovnika), a postaje trocifrena od starosnog intervala 60 - 64 godine (116,14 na 100.000 stanovnika) i na dalje (Grafikon 4).

U Beogradu, u 2020. godini, MKB-10 grupa U00-U89, u kojoj su smrti registrovane samo zbog KOVID-19 oboljenja (U07.1, U07.2) predstavlja treći uzrok smrti, sa stopom od 158,75 na 100.000 iza „Bolesti sistema krvotoka“ (I00-I99), koje su na prvom mestu sa stopom od 672,42 na 100.000, i „Tumora“ (C00-D48), koji su na drugom mestu sa stopom od 314,85 na 100.000. Uzroci smrti na prvom mestu kod muškaraca i žena su „Druge bolesti srca“ (I26-I51). Međutim, dok su „Bolesti krvnih sudova mozga“ (I60-I69) na trećem mestu kod muškaraca, one su na drugom mestu kod žena, a „Ishemične bolesti srca“ (I20-I25) i „Maligni tumori dušnika, dušnice i pluća“ (C33-C34) su na četvrtom i petom mestu kod oba pola.
DISKUSIJA

Prema podacima Republičkog zavoda za statistiku, u Beogradu je, u 2020. godini, živelo oko 1,7 miliona stanovnika. Iste godine, od bolesti KOVID-19 umrlo je 2.690 građana Beograda, a većinu umrlih činio je muški kontingent stanovnika. Pandemija KOVID-19 postala je fatalna za muškarce od 35 godina i više, i za žene starije od 50 godine.

Do sličnih rezultata došlo se i u istraživanjima u svetu i Evropi [11,12]. Iako na globalnom nivou [13] još uvek nema preciznih evaluacija efekata KOVID-19 oboljenja na rangiranje uzroka mortaliteta u 2020. godini, takve procene postoje za pojedine zemlje. Procenjuje se da je, u 2020. godini, KOVID-19 bio treći uzrok smrti u Beogradu (180,9 na 100.000 stanovnika), Škotskoj (150,7 na 100.000 stanovnika), Portugalju (131,57 na 100.000 stanovnika), Španiji (127,7 na 100.000 stanovnika), Sjedinjenim Američkim Državama (122,7 na 100.000 stanovnika), Švedskoj (118,8 na 100.000 stanovnika), Holandijski (81,7 na 100.000 stanovnika), i Nemačkoj (68,4 na 100.000 stanovnika) [11,12]. Kao i u našem istraživanju, procenjeno je da je KOVID-19 bio drugi uzrok smrti u nekim evropskim zemljama [12], na primer u Engleskoj i Velsu (124,9/100.000) i Francuskoj (94,3/100.000), ali na petom mestu u Danskoj (37,6/100.000), te na devetom u Norveškoj (10,7/100.000). Na svibnju Srbije, u 2020. godini, od bolesti koje mogu da se dovedu u vezu sa infekcijom KOVID-19 umrlo je 10.356 lica (8,9% od svih umrlih, odnosno 6.629 muškaraca i 3.727 žena), te se nalaze na trećem mestu posle „Bolesti sistema krvotoka“ (na prvom mestu sa 47,3% svih umrlih) i „Tumora“ (na drugom mestu sa 18,3% svih umrlih) [14].

U 2020. godini, prosečno očekivano trajanje života živorođenih u Beogradu, prema skraćenim aproksimativnim tablicama mortaliteta, procenjeno je da je 72,31 godine, a od bolesti koje mogu da se dovedu u vezu sa infekcijom KOVID-19 umrlo je 10.356 lica (8,9% od svih umrlih, odnosno 6.629 muškaraca i 3.727 žena), te se nalaze na trećem mestu posle „Bolesti sistema krvotoka“ (na prvom mestu sa 47,3% svih umrlih) i „Tumora“ (na drugom mestu sa 18,3% svih umrlih) [14].

In Beograd, according to the percentual proportion in overall mortality for both sexes, COVID-19 was the second leading cause of death. In the previous two years, the official data on vital events of the Statistical Office of the Republic of Serbia show that, in Beograd, ‘All other forms of heart disease’ were in the first place as the leading cause of death; ‘Cerebrovascular diseases’ were in the second place; ‘Ischemic heart diseases’ were in the third place, while ‘Malignant neoplasms of the trachea, bronchus and lung’ were the fourth leading cause of death. In 2018, ‘Respiratory diseases’ were the fifth leading cause of death, while in 2019, ‘Hypertensive diseases’ were in the fifth place [10]. In 2020, COVID-19 disrupted the ranking of these diseases and inserted itself in the second place.

Our research, performed on the example of a number of European countries, including Serbia, has confirmed previous estimates of the vulnerability of older residents with comorbidities [15]. Relatedly, it is assumed that COVID-19 has prematurely taken the lives of persons who would probably have died during the year...
Naše istraživanje, rađeno na primjeru više zemalja u Evropi, uključujući i Srbiju, potvrdilo je prethodne procene o vulnerabilnosti starijih stanovnika sa komorbiditetima [15]. S tim u vezi, pretpostavlja se da je KOVID-19 prevremeno odneo i živote osoba koje bi najverovatnije (ali kasnije) u toku godine umrli [16]. VID-19 prevremeno odneo je živote osoba koje bi najverovatnije umrle [15]. S tim u vezi, pretpostavlja se da je KOVID-19 prevremeno odneo i živote osoba koje bi najverovatnije umrle [16]. VID-19 prevremeno odneo je živote osoba koje bi najverovatnije umrle [15].

Prema kliničkim dokazima [4], pacijenti sa najtežim oblikom bolesti KOVID-19 bili su najčešće ljudi starije dobi i sa komorbiditetima, od kojih se najviše pominju hronične bolesti kao što su bolesti srca, dijabetes, plućne bolesti, i bubrežna insuficijencija, kao i gojaznost, od faktora rizika. Najverovatnije su to razlozi zašto je KOVID-19 potisnuo neke uzroke smrti sa liste vodećih pet uzorka smrti u Beogradu. Osim toga, i drugi, ne-klinički faktori mogu da doprinose krajnjim efektima KOVID-19 oboljenja. Tu spadaju mobilnost [36-38], stepen pripravnosti i spremnosti zdravstvenog sistema da odgovori na zahteve za uslugama u pandemiji [39], način praćenja kontakata u epidemiji [40], behavioralni i društveni faktori koji podržavaju široko rasprostranjeno testiranje stanovništva [41,42], pridržavanje mera socijalnog distanciranja [43], i ostalo. U ove faktore treba uključiti i postojanje jakih porodičnih veza i mreža podrške [44], koje najverovatnije objašnjavaju tzv. Mortalitetni paradoks kod Latinamerikana [45].

Naše istraživanje, sa socijalno-medicinskog aspekta, razmatra jedan vitalni događaj - smrtnost tokom jednog perioda pandemije i u jednoj zajednici. Rezultati istraživanja ukazuju na pojavu prevremenih smrtnosti od bolesti KOVID-19 tokom 2020. godine i porod primene preventivnih mera. Adekvatna, dosledna i pravovremena primena kombinacije javnozdravstvenih i kliničkih mera može prevenirati pojavu bolesti i prevremenih smrtnih smrtnost primene svih gorepomenutih mera u Beogradu, i koja bi doprinela donošenju zaključaka o tome koliko je njihova primena doprinela sprečavanju oboljevanja i prevremenih smrtnih smrtnosti u nekim zemljama [17-35].

Osim bazičnih i kliničkih istraživanja, potrebna su javnozdravstvena istraživanja koja bi pokazala efikasnost primene svih gorepomenutih mera u Beogradu, i koja bi doprinela donošenju zaključaka o tome koliko je njihova primena doprinela sprečavanju oboljevanja i prevremenih smrtnih smrtnosti u Beogradu. (but at a later time) [16]. Bearing this in mind, it would be of value to perform research according to the Burden of Disease methodology at the national and subnational levels (in Serbia and in Belgrade, for instance), as has already been done in some countries [17-35].

According to clinical evidence [4], patients with the most severe form of COVID-19 were most frequently older people with comorbidities, among which the ones most frequently mentioned were chronic diseases, such as heart diseases, diabetes, pulmonary diseases and renal insufficiency, as well as obesity as a risk factor. These are probably the reasons why COVID-19 has displaced some causes of death from the list of five leading causes of death in Belgrade. Also, other, non-clinical factors may contribute to the ultimate effects of COVID-19. Amongst them are mobility [36-38], the level of preparedness and readiness of the healthcare system to respond to service demands during the pandemic [39], the method of the surveillance of contacts during the epidemic [40], behavioral and social factors which support wide population testing [41,42] adherence to measures of social distancing [43], etc. The existence of strong family bonds and support networks should be included amongst these factors [44], as they most probably explain the Latin American Mortality Paradox in [45].

From the socio-medical aspect our study analyzes a vital event – mortality during a specific period in one community. The results of the study indicate the occurrence of premature mortality from COVID-19 during 2020, despite the implementation of preventive measures. Adequate, consistent and timely implementation of a combination of public health and clinical measures may prevent the occurrence of the disease and mitigate the effects of the COVID-19 pandemic on the population. Many studies have already demonstrated the benefits from health promotion and from applying protective and preventive measures, as well as disease control measures, such as wearing masks and protective gloves, adhering to the recommended physical distance, isolation, social distancing, curfew, boosting immunity, providing healthcare, observing healthcare recommendations, and vaccination [45-48].

In addition to baseline and clinical research, public health studies are also necessary in order to demonstrate the efficiency of the application of all the above-mentioned measures in Belgrade and contribute to the conclusions on how much the application of these measures has contributed to the prevention of disease and premature deaths in Belgrade.

For more efficient decision-making, in addition to research on mortality, it is also necessary to carry out socio-medical studies which would assess how well healthcare institutions are staffed and equipped with...
Osim istraživanja o mortalitetu, za efikasnije odlučivanje, potrebna su socijalno-medicinska istraživanja koja procenjuju obezbeđenost ustanova zdravstvenim radnicima i drugim resursima za prevenciju, lečenje, i rehabilitaciju oboljelih od KOVID-19 infekcije, kao i ona koja evaluiraju dostupnost, korišćenje, i kvalitet pružanja zdravstvenih usluga oboljelima od KOVID-19 oboljenja, i drugim osobama sa sumnjom na infekciju KOVID-19. U nedostatku takvih istraživanja tokom pandemije, kao i profesionalnih procena o incidenciji, prevalenciji i preživljavanju KOVID-19 infekcije, posmatranih kroz distribuciju starosti i pola stanovnika, tumačenje ukupnog opterećenja stanovništva bolešću KOVID-19 ostaje izazov za zajednicu, a mortaliteti podaci najvažniji za profesionalna razmatranja.

Zbog ograničenja istraživanja, kao što su mali broj posmatranih varijabli, nije moguće izvući šire zaključke o mortalitetu. Za dobijanje šire slike mortalitetu usled KOVID-19 oboljenja i sa sumnjom na KOVID-19 oboljenje, potrebne su dodatne informacije, koje bi omogućavale, na primer, analizu smrtnih slučajeva u odnosu na mesto smrti (zdravstvene ustanove i van njih), po tipu naselja (gradska i ostala), prema stepenu obrazovanja, zaposlenosti, etničkoj pripadnosti, zdravstvenom statusu, tipu osiguranja, kao i prema korišćenju zdravstvenih usluga, odnosno opremljenosti zdravstvenih ustanova u kojima su umrli. Druga ograničenja se odnose na posebno podatke. U istraživanju su korišćeni zvanični podaci samo o U07.1 i U07.2 kao osnovnom uzroku smrti, a ne neposredni, prethodni i drugi uzroci smrti povezani sa bolešću KOVID-19 [7,8]. S obzirom da obdukcije tokom KOVID-19 pandemije nisu u istoj meri rađene kao i pre pandemije, sa tog stanovišta ne može se sa sigurnošću reći kolika je podregistacija U07.1 i U07.2 slučajeva smrti. Potrebno je analizirati u kojoj meri su lekari, a posebno oni koji su registrovali smrt, bili upoznati sa smernicama za korišćenje U07.1 i U07.2 šifara za osnovni uzrok smrti, koliko prepoznaju značaj pravilnog klasifikovanja uzroka smrti, a da li uspešno prave razliku između osnovnog, prethodnog, neposrednog i ostalih uzroka smrti. Takođe, izvorni podaci se odnose samo na umrle stanovnike Beograda i rezultati istraživanja se ne mogu generalizovati na druge zajednice.

Prednosti ovog istraživanja su što pokazuje obuđene podatke koji izvorno potiču iz potvrde o smrti u Dem-2 orascu, i koji su prošli sistem kontrole mortaliteta u područnim jedinicama Republičkog zavoda za statistiku, u institutima/zavodima za javno zdravlje i Republičkom zavodu za statistiku. Rezultati istraživanja mogu biti korisni da se u narednom periodu posebna pažnja usmeri na vulnerabilne grupe, kako bi se održalo i unapredilo njihovo očekivano trajanje života. Ostaje da se u studijama koje koriste metodologiju other resources necessary for the prevention, treatment, and rehabilitation of COVID-19 patients, as well as studies that would evaluate the accessibility, use, and quality of health services offered to COVID-19 patients and other persons with suspected COVID-19 infection. With the lack of such research during the pandemic, as well as the lack of professional assessments of the incidence, prevalence and survival of COVID-19, observed through the age and sex distribution in the population, the interpretation of the overall burden of COVID-19 in the population remains a challenge for the community, while mortality data remain the most relevant data for professional consideration.

Due to the limitations of the study, such as the small number of analyzed variables, it is not possible to draw wider conclusions on mortality. In order to gain a broader understanding of COVID-19 mortality and suspected COVID-19 mortality, additional information is necessary, which would enable, for instance, the analysis of deaths in relation to the location of death (at healthcare facilities or outside healthcare facilities), in relation to the type of community (urban or other), in relation to the level of education of the patient, their employment status, ethnicity, health status, type of healthcare coverage, as well as in relation to the use of health services, i.e., the level of equipment of the healthcare facilities where they had died. Other limitations are related to the data themselves. Official data was used in the study only on U07.1 and U07.2 as the main cause of death, and not on immediate, previous or other causes of death related to COVID-19 [7,8]. Since, during the COVID-19 pandemic, postmortems have not been performed to the same extent as before the pandemic, it is not possible to determine with certainty the extent of the underregistration of U07.1 and U07.2 death cases. It is necessary to analyze to which extent were doctors, especially those registering the deaths, familiar with the guidelines on the use of U07.1 and U07.2 codes for the main cause of death, and how well do they understand the significance of the proper classification of the cause of death, and whether they are able to successfully distinguish among the main, previous, immediate and other causes of death. Also, original data refer only to deceased citizens of Belgrade and the results of the study cannot be generalized to refer to other communities.

The advantages of this study lie in the fact that it shows processed data originating from death certificates in the Dem-2 form, which have gone through the system of mortality control at the regional offices of the Statistical Office of the Republic of Serbia, at institutes of public health, and at the statistical Office of the Republic of Serbia. Results of the study may be useful in order to focus special attention, in the coming period,
Opterećenja društva boleću utvrdi koliko je stanovništvo Beograda izgubilo godina života zbog prevremene smrtnosti u vezi sa KOVID-19 oboljenjem (engl. years of life lost due to COVID-19), kao i koliko je godina života provelo u nesposobnosti zbog KOVID-19 bolesti (engl. years lived with disability due to COVID-19) [17-34].

ZAKLJUČAK

Rezultati istraživanja ukazuju na postojanje prevremene smrtnosti stanovnika Beograda zbog KOVID-19 oboljenja. U 2020. godini, prema specifičnim stopama mortaliteta, KOVID-19 je bio drugi vodeći uzrok smrti kod stanovnika Beograda muškog pola a treći kod stanovnika ženskog pola. Ovo istraživanje pruža dokaze kojima se može obogatiti diskusija koja se na međunarodnom nivou vodi o gubicima društva zbog pandemije KOVID-19 infekcije.

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CONCLUSION

The results of the study indicate the existence of premature death of Belgrade residents from COVID-19. In 2020., according to specific mortality rates, COVID-19 was the second leading cause of death in Belgrade male residents and the third leading cause of death in female residents. This research provides evidence that can contribute to the international discussion about societal losses caused by the COVID-19 pandemic.

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LITERATURA / REFERENCES

1. WHO Director-General’s opening remarks at the media briefing on COVID-19 - March 2020. [Internet]. [Accessed on 8 August 2021]. Available on: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020

2. Kupferschmidt K, Cohen J. Will novel virus go pandemic or be contained? Science. 2020;367(6478):610-611. doi: 10.1126/science.367.6478.610.

3. Linton NM, Kobayashi T, Yang Y, Hayashi K, Akhmetzhanov AR, Jung SM, et al. Incubation Period and Other Epidemiological Characteristics of 2019 Novel Coronavirus Infections with Right Truncation: A Statistical Analysis of Publicly Available Case Data. J Clin Med. 2020 Feb 17;9(2):538. doi:10.3390/jcm9020538.

4. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. [Erratum in: Lancet. 2020 Jan 30]. Lancet. 2020;395(10223):497-506. doi:10.1016/S1470-2153(20)30183-5.

5. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. N Engl J Med 2020;382:1199-207. doi: 10.1056/NEJMoa2001366.

6. Chan JF, Yuan S, Kok KH, To KKW, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020;395:514-523. doi:10.1016/S1470-2153(20)30154-9.

7. Institut za javno zdravlje Srbije „Dr Milan Jovanović Batut“, World Health Organization. Međunarodna statistička klasifikacija bolesti i srodnih zdravstvenih problema, 10. Redakt. Knjiga 2. Priručnik za upotrebu. Beograd: institut za javno zdravlje Srbije „Dr Milan Jovanović Batut“, 2010.

8. Međunarodne smernice za potvrđivanje i klasiﬁkaciju (ijuriranje) Kovid-19 kao uzroka smrti. [Internet]. [Accessed on 9 August 2021]. Available on: https://www.batut.org.rs/download/Uputstvo_Uzrok_Smrti_COVID-19%202020.pdf

9. WHO Coronavirus (COVID-19) Dashboard. [Internet]. [Accessed on 4 September 2021]. Available on: https://covid19.who.int/

10. Republika Srbija. Republički zavod za statistiku Srbije. Stanovništvo. Elektronska baza podataka. [Internet]. https://www.stat.gov.rs/.

11. Woolf SH, Chapman DA, Lee JH. COVID-19 as the leading cause of death in the United States. JAMA. 2021;325(6):123-4.

12. Sonjic S, Beltrán-Sánchez H, Yang JW, Mann C. Population-level mortality burden from novel coronavirus (COVID-19) in Europe and North America. Gens. 2021;77:7. https://doi.org/10.1186/s41118-021-00115-9.

13. WHO. The top 10 causes of death. Dostupno na: https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death. [Pristupljeno 09.08.2021].

14. Republika Srbija, Republički zavod za statistiku. Vitalni događaji 2020. Saopštění SN 40 2021;180. [Internet]. [Accessed on 4 September 2021]. Available on: https://publikacije.stat.gov.rs/G2021/pdf/G20211180.pdf

15. Wyper GMA, Assunção R, Cuschieri S, Devleesschauwer B, Fletcher E, Haagsma JA, et al. Population vulnerability to COVID-19 in Europe: a burden of disease analysis. Arch Public Health. 2020;78,47 . https://doi.org/10.1186/s13690-020-00433-y.

16. The Institute for Health Metrics and Evaluation. Estimation of the excess mortality due to COVID-19. [Internet]. http://www.healthdata.org/node/8660. Objavljen 13. 5. 2021.

17. Gémes K, Talbäck M, Modig K, Ahlbom A, Berglund A, Feychting M, et al. Burden and prevalence of prognostic factors for severe COVID-19 in Sweden. Eur J Epidemiol. 2020;35(5):401-409. doi: 10.1007/s10654-020-00646-z.

18. John D, Narassima MS, Menon J, Jammr GR, Banerjee A. Estimation of economic burden of COVID-19 using disability-adjusted life years (DALYs) and Productivity Losses in Kerala, India: a model-based analysis. BMJ Open. 2021;11:e049619. doi: 10.1136/bmjopen-2021-049619.
19. Salinas-Escudero G, Toledano-Toledano F, García-Peña C, Parra-Rodríguez L, Granados-García V, Carrillo-Vega MF. Disability-adjusted life years for the COVID-19 pandemic in the Mexican population. Front Public Health. 2021;9:686700. doi: 10.3389/fpubh.2021.686700
20. Fan CY, Fann JC, Yang MC, Lin TY, Chen HH, Liu JT, et al. Estimating global burden of COVID-19 with disability-adjusted life years and value of statistical life metrics. J Formos Med Assoc. 2021;110(1):160-165. doi: 10.1016/j.jfma.2021.05.019
21. He M, Li X, Tan Q, Kong Y, You J, et al. Disease burden from COVID-19 symptoms among inpatients at the temporary military hospitals in Wuhan: a retrospective multicentre cross-sectional study. BMJ Open. 2021;11(5):e048822. doi: 10.1136/bmjopen-2021-048822
22. Quast T, Andel R, Gregory S, Storch EA. Years of life lost associated with COVID-19 deaths in the USA during the first year of the pandemic. J Public Health. 2021; 10.1093/pubmed/fdab123
23. Vasishtha G, Mohanty SK, Mishra US, Dubey M, Sahoo U. Impact of COVID-19 infection on life expectancy, premature mortality, and DALY in Maharashtra, India. BMC Infect Dis. 2021;21:343. doi: 10.1186/s12879-021-06026-6
24. Lagerweij G, Schimmer B, Mooij S, Raven S, Schoffelen A, de Gier B, et al. Disseminated COVID-19 with disability-adjusted life years and value of statistical life metrics. J Formos Med Assoc. 2021;110(1):160-165. doi: 10.1016/j.jfma.2021.05.019
25. Rommel A, von der Lippe E, Lass D, Zierke T, You J, et al. The COVID-19 disease burden in Germany in 2020—years of life lost to death and disease over the course of the pandemic. Dtsch Arztebl Int. 2021;118:arztebl.m31.2021.0147. doi: 10.3238/arztebl.2021.0147
26. Zhao J, Jin H, Li X, Jia J, Zhang C, Zhao H, et al. Disease burden attributable to the first wave of COVID-19 in China and the effect of timing on the cost-effectiveness of movement restriction policies. Value Health. 2021; 10.1016/j.val.2020.12.009
27. Pifaré i Arolas H, Acosta E, López-Casasnovas G, Lo A, Nicodemo C, Rifffe T, et al. Years of life lost to COVID-19 in 81 countries. PLoS Med. 2020;17(12):e1003304. doi: 10.1103/s1548-8958(20)00403-7
28. Ortiz-Prado E, Simbaña-Rivera K, Barreno LG, Díaz AM, Barreto A, Moyano C, et al. Epidemiological, socio-demographic and clinical features of the early phase of the COVID-19 epidemic in Ecuador. PLOS Negl Trop Dis. 2020;15(1):e0008958. doi: 10.1371/journal.pntd.0008958
29. Mitra AK, Payton M, Kabir N, Whitehead KN, Brown A. Potential Years of Life Lost due to COVID-19 in the United States, Italy, and Germany: an old formula with newer ideas. Int J Environ Res Public Health. 2020;17(12):4392. doi: 10.3390/ijerph17124392
30. Oh H, Ock M, Jang SY, Go DS, Kim YE, Jung YS, et al. Years of Life Lost attributable to COVID-19 in high-incidence countries. J Korean Med Sci. 2020;35(32):e300. doi: 10.3346/jkms.2020.35.e300
31. Bell D, Schultz Hansen K, Kiragga AN, Kambugu A, Kissa J, Mbonye AK. Predicting the impact of COVID-19 and the potential impact of the public health response on disease burden in Uganda. Am J Trop Med Hyg. 2020; 10.1016/j.ajtmh.2020.05-0456
32. Tchole AIM, Li ZW, Wei JT, Ye RZ, Wang WJ, Du WY, et al.; Cheeloo EcoHealth Consortium (CLEC). Epidemic and control of COVID-19 in Niger: quantitative analyses in a least developed country. J Glob Health. 2020;10(2):020513. doi: 10.7189/jogh.10.020513
33. Nurchis MC, Pascucci D, Sapienza M, Villani L, D’Ambrosio F, Castrini F, et al. Impact of the burden of COVID-19 in Italy: Results of Disability-Adjusted Life Years (DALYs) and productivity loss. Int J Environ Res Public Health. 2020;17:4233. doi: 10.3390/ijerph17124233
34. Jo MW, Go DS, Kim R, Lee SW, Ock M, Kim YE, et al. The burden of disease due to COVID-19 in Korea using Disability-Adjusted Life Years. J Korean Med Sci. 2020;35(21):e199. doi: 10.3346/jkms.2020.35.e199
35. Yi-Huan C, Chi-Tai F, Yu-Ling H. Effect of Non-lockdown Social Distancing and Testing-Contact Tracing During a COVID-19 Outbreak in Daegu, South Korea, February to April 2020: A Modeling Study. Int J Infect Dis. 2021;110:213-221. doi: 10.1016/j.ijid.2021.07.058.
36. Adam K. Second wave of COVID-19 in Europe leads to new restrictions but no national lockdowns. [Internet]. Washington Post. https://www.washingtonpost.com/world/europe/covid-europe-second-wave/2020/10/12/8a8f6c-0c66-11eb-b404-8d1675ec701_story.html. [Published 12 October 2020]. [Accessed on 9 August 2021].
37. Wright A, Salazar A, Mirica M, Volk LA, Schiff GD. The invisible epidemic: neglected chronic disease management during COVID-19. J Gen Intern Med. 2020;35(9):2816-2817. doi: 10.1007/s11606-020-06025-4.
38. Bennhold KA. German exception? Why the country’s coronavirus death rate is low. [Internet]. The New York Times. https://www.nytimes.com/2020/04/04/world/europe/germany-coronavirus-death-rate.html. [Published 4 April 2020]. [Accessed on 9 August 2021].
39. Beaumont P. Coronavirus testing: How some countries got ahead of the rest. [Internet]. The Guardian. https://www.theguardian.com/world/2020/apr/02/coronavirus-testing-how-some-countries-germany-south-korea-got-ahead-of-the-rest. [Published 2 April 2020]. [Accessed on 9 August 2021].
40. Barone E. Why some people are waiting weeks for their COVID-19 test results. [Internet]. Time. https://time.com/5878732/covid-19-testing-delays/. [Published 12 October 2020]. [Accessed on 9 August 2021].
41. Ruiz JM, Steffen P, Smith TB. Hispanic mortality paradox: a systematic review and meta-analysis of the longitudinal literature. Am J Public Health. 2013;103(3):e52-e60. doi: 10.2105/ajph.2012.301103
42. Abraído-Lanza AF, Dohrenwend BP, Ng-Mak DS, Turner JB. The Latino mortality paradox: a test of the “salmon bias” and healthy migrant hypotheses. Am J Public Health. 1999;89(10):1543-1548. doi: 10.2105/AJPH.89.10.1543.
43. European Centre for Disease Prevention and Control. Prevention and control of COVID-19. [Internet]. [Accessed on 9 August 2021]. Available on: https://www.ecdc.europa.eu/en/all-topics-z/coronavirus/threats-and-outbreaks/covid-19/prevention-and-control-covid-19
44. Covid-19 Prevention Network. [Internet]. [Accessed on 9 August 2021]. Available on: https://www.coronaviruspreventionnetwork.org/
45. Doroshenko A. The Combined Effect of Vaccination and Nonpharmaceutical Public Health Interventions—Ending the COVID-19 Pandemic. JAMA Netw Open. 2021;4(6):e2111675. doi: 10.21203/rs.3.rs-287183/v1. [Preprint].
46. Mishra D, Maurya RR, Kumar K, Munjal NS, Bahadur V, Sharma S, et al. Structured modified compounds of hydroxychloroquine, remdesivir and tetra-hydrocannabinol against main protease of SARS-CoV-2, a possible hope for the COVID-19: Docking and molecular dynamics simulation studies. J Mol Liq. 2021;335:116185. doi:10.1016/j.molliq.2021.116185.
47. Brooks JT, Butler JC. Effectiveness of mask wearing to control community spread of SARS-CoV-2.JAMA. 2021;325(10):998-9. doi: 10.1001/jama.2021.1505.
48. Maria N, Rapičavioli RV, Alaimo S, Bischof E, Stasuzzo A, Broek J, et al. Rapid Identification of Druggable Targets and the Power of the PhENoM type SIMulator for Effective Drug Repurposing in COVID-19. Res Sq. 2021 Apr.3.rs.3.rs-287183/v1. [Preprint].