sciendo

DOI: 10.2478/fv-2022-0012

FOLIA VETERINARIA, 66, 2: 9—16, 2022

RETROSPECTIVE OVERVIEW OF COVID-19 IN EUROPE

Ondrejková, A.[1], Süli, J.[2], Zemanová, S.[1], Tomčová, J.[1], Korytár, Ľ.[1]

[1]Department of Epizootiology, Parasitology and Protection of One's Health

[2]Department of Chemistry, Biology and Biophysics

University of Veterinary Medicine and Pharmacy in Košice, Komenského 73, 041 81 Košice

Slovakia

lubos.korytar@uvlf.sk

ABSTRACT

A disease of unknown origin connected with severe pneumonia was identified in Wuhan (China) in December 2019. It was named coronavirus disease 2019 (COVID-19). The disease had rapidly spread all over the world, including Europe. The World Health organization (WHO) declared the disease a pandemic. The aim of this study is to summarize and to compare objectively the epidemiological situation of COVID-19 in European countries from 15 February 2020 to 31 December 2021. Due to the significant difference in the population of individual states, all data were calculated per 1 million people (parameter/1M). Cases/1M, number of death/1 M, and % of death (case fatality rate) were compared. The actual situation on 31 December 2021 was quantified by comparing the active cases/1 M in each European country. The situation in Europe has been compared also with those on the other continents of the world, respectively on 31 December 2021. In order to monitor the development of the disease spread on the national level, the European countries were compared after division into six regions: South, West, North, Middle, Balkan and East. These data were recorded daily from 15 February to 31 December 2021.

Key words: COVID-19; Coronavirus; Europe; spread of disease

INTRODUCTION

A respiratory disease of unknown origin was identified in Wuhan (China) in December 2019 [5, 22]. A novel coronavirus named "Severe acute respiratory syndrome coronavirus 2" (SARS-CoV-2) was isolated from the clustered cases. The disease caused by SARS-CoV-2 has been named Coronavirus Disease 2019 (COVID-19) [12]. The first identified case in Europe was detected by the National Reference Centre for Respiratory Viruses at the Institute Pasteur in Paris (France) on 24 January 2020 [3]. During February 2020, there were COVID-19 cases in 35 countries, with 67,120 confirmed infections and 1,526 deaths. China accounted for 99.22 % of infections and 99.87 % of

deaths [1]. After the first confirmed cases imported into Europe, model studies assumed a high risk of COVID-19 widespread for Europe, especially in countries with important international airports [10]. However, the reality exceeded the assumptions. Due to a global travelling of people the virus had rapidly spread all over the world and the outbreak is now widespread. On 11 March 2020 the disease was reported in 114 countries and the Director General of the World Health Organization (WHO) declared a pandemic [6]. Currently, the COVID-19 is present in all 48 European countries; Montenegro (17 March) and Isle of Man (19 March) were the last affected countries [15].

The attack rate or transmissibility of a virus is indicated by its reproductive number (R0), which represents the average number of people to which a single infected person will transmit the virus. The R0 is calculated by a mathematic model based on epidemiological data. WHO estimated that the transmission rate of SARS-CoV-2 virus varied between 1.4 and 2.5 [11, 14]. But according to other models the R0 can be 2.24 to 3.58 [8, 21]. Preliminary studies had estimated R0 to be between 1.4 and 3.5 [9, 11]. The measure of disease severity is represented by the case fatality rate (CFR) expressed as a percentage of death from the disease for a particular period. In March 2020, the CFR was expected to be at around 2—3 %, but it may vary by country [13]. Data dealing total and current numbers of cases or mortality can be found on various national and global sites. Uniformly processed data are accessible from the website Worldometer (https://www.worldometers.info/coronavirus/), which is a reference website that provides counters and real-time statistics for diverse topics. It is currently also dealing with the situation in COVID-19 based on data provided by individual countries from all continents of the world [20].

The aim of this study is to objectively summarize the epidemiological situation in COVID-19 in each European country from 15 February 2020 to 31 December 2021. The individual countries emphasize the information dealing the total number of infected patients, the total number of deaths and the total number of active cases, which characterizes the epidemiological situation at a given time. Given the markedly different population sizes in different countries, it is more objective from an epidemiological point of view to report prevalence values, i. e. the number of cases, the number of deaths or the number of active cases per million inhabitants [2].

COVID-19 situation in Europe and on the other continents on 31 December 2021

The European situation in comparison with that on the other continents is described in Figure 1. All data about COVID-19 cases, death, mortality rate (percentage of death) and active cases were recorded on 31 December 2021 and have been calculated per million of the population of individual continents of the world, respectively (cases/1 M, death/1 M, active cases/1 M). The number of population has been recorded based on the Worldometer population data also on 31 December 2021. Only the population of countries with registered COVID-19 occurrence has been counted.

In Europe, North America including the Caribbean and in South America, all countries are registered. In Asia, there are no available data from North Korea. In Africa, the data from Saint Helena are inaccessible and in Oceania data were registered only in 6 countries from 23 (Australia, New Zealand, French Polynesia, Papua New Guinea, Fiji and New Caledonia). It can be assumed that the number of total cases can be significantly higher worldwide, because the disease can occur with mild atypical symptoms, or, even asymptomatic [16].

From the Figure 1 it is evident that while in the number of cases and deaths per million of the population, the results were the worst in South America, the actual situation (active cases/1 M) was the hardest in North America. The CFR was the highest in South America (2.99 %). The average CFR value in the world (1.89 %). For Europe, this value has a declining trend over time, but the rate of decrease in % of death varies from country to country (details not shown). The number of all cases/1 M in Europe was highest, up to 120 thousand.

Epidemiological situation in European countries on 31 December 2022

In order to monitor the development of the disease spread on the national level, the European countries were compared after division into regions. This division does not follow exactly the political division of European countries, but is based on the geographical position of the given country. In this article Europe was divided into 6 regions:

South: Italy and Vatican City (Italy & V), Spain, Portugal, Malta, Andorra, San Marino, Gibraltar;

West: Germany, France, United Kingdom (UK), Ireland, Switzerland, Belgium, Netherlands, Luxembourg, Liechtenstein, Monaco, Channel Islands, Isle of Man;

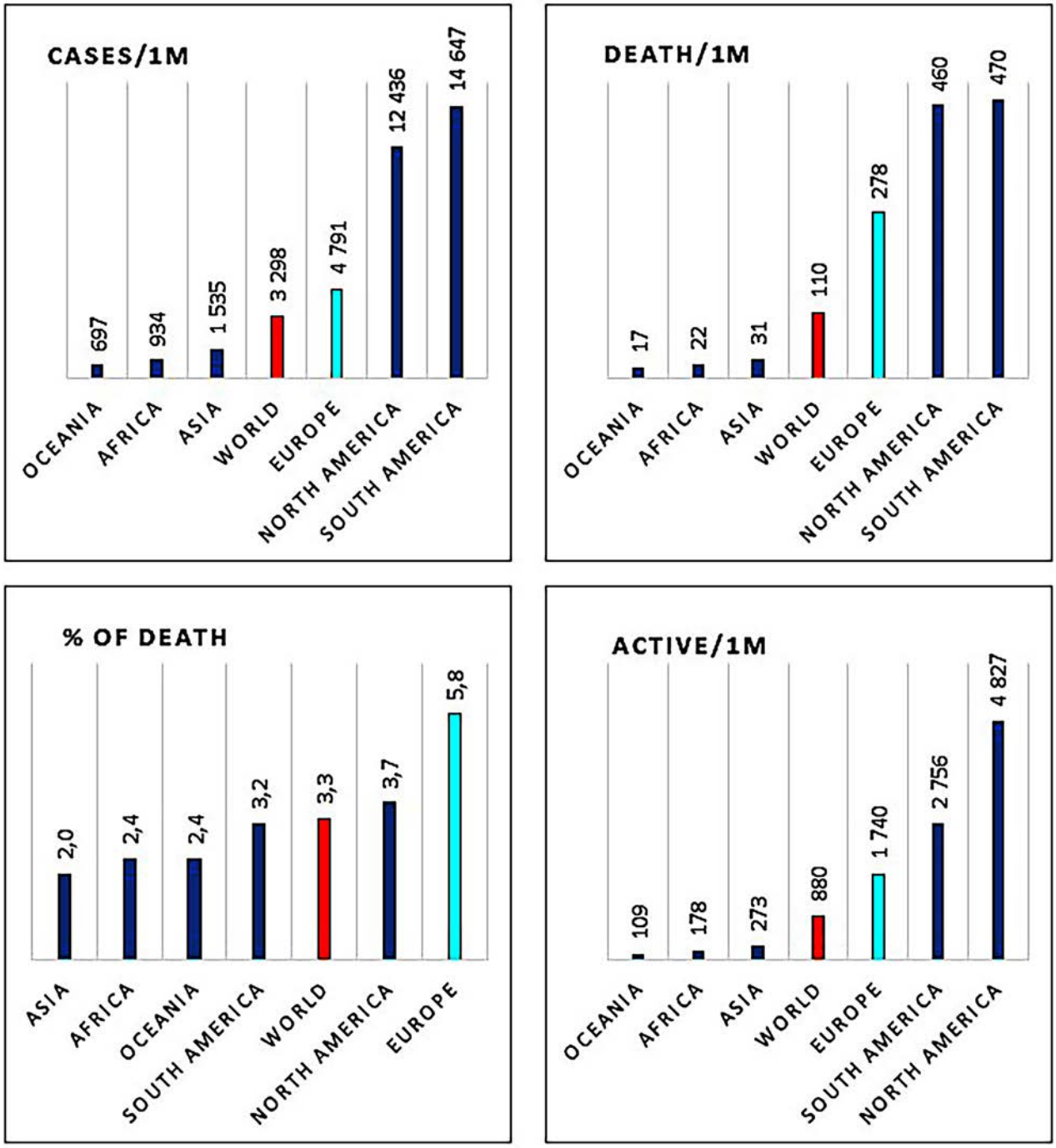


Fig. 1. Number of cases per million, number of deaths per million, % of deaths and active cases per million worldwide as of 31 December 2021. Data from Worldometer as of 31. 12. 2021

North: Sweden, Finland, Norway, Denmark, Iceland, Faroe Islands;

Middle: Austria, Czech Republic, Poland, Slovakia, Hungary, Slovenia;

Balkan: Croatia, Serbia, Bosnia and Herzegovina, Montenegro, North Macedonia, Albania, Bulgaria, Greece;

East: Russia, Belarus, Ukraine, Latvia, Lithuania, Estonia, Moldova, Romania.

Cases/1 M in individual countries

As described in Table 1, most cases/1 M were recorded especially in the southern countries. However, the prevalence of the disease is often significantly higher in the smaller countries with a smaller area and lower populations. The population of San Marino at 31 December 2021 was 33,943/240,966 cases in total, in Andorra the population was 77,286 persons/306,520 cases in total. It should

Table 1. Southern European countries

State	Active cases/1 M	Cases/1 M	Death/1 M	% of death
Italy + Vatican	14 934	101 539	2 278	2.24
Spain	26 378	136 547	1 912	1.40
Portugal	17 603	136 881	1 867	1.36
Malta	26 738	118 368	1 076	0.91
Andorra	39 212	306 520	1 808	0.59
San Marino	29 967	240 966	2 938	1.22
Gibraltar	26 013	258 374	2 969	1.15
Europe	15 145	117 115	2 041	1.74

Data from Worldometer as of 31. 12. 2021

Table 2. Western European countries

State	Active cases/1 M	Cases/1 M	Death/1 M	% of death
Germany	8 086	85 246	1 339	1.57
France	26 840	152 280	1 889	1.24
UK	36 167	189 095	2 172	1.15
Ireland	42 757	157 073	1 178	0.75
Switzerland	36 275	152 525	1 408	0,92
Belgium	29 159	179 137	2 427	1.35
Netherlands	27 398	182 225	1 217	0.67
Luxembourg	12 497	161 828	1 427	0.88
Liechtenstein	8 461	159 511	1 802	1.13
Monaco	12 431	130 289	958	0.74
Channel Islands	26 410	156 058	641	0.41
Isle of Man	3 827	159 159	782	0.49
Europe	15 145	117 115	2 041	1.74

Data from Worldometer as of 31. 12. 2021

be borne in mind that in these countries the infrastructure is being built for a given population, and a sudden increase in the number of infected people poses as serious a problem for the health service as in larger countries with larger populations.

From epidemiological data, it is known that the virus spreads most rapidly in places with high urbanization and population density [4]. Therefore, it is understandable that in the city-state of San Marino, the case/1M in COVID-19 was so high. Of the other countries, the situation was quite serious in Spain, Moldova or Sweden. The prevalence of COVID-19 as of 31 December 2021 was generally lowest in Central European countries. WHO highlighted the risks in cities and urban environments and the need to put measures in place, in particular the benefit of using masks [18, 19].

Death/1 M and the percentage of death in individual countries

Although WHO has issued guidelines for surveillance and certification of COVID-19 as a cause of death, coun-

Table 3. Northern European countries

State	Active cases/1 M	Cases/1 M	Death/1 M	% of death
Sweden	10 528	128 982	1 498	1.16
Finland	38 304	46 869	282	0.60
Norway	55 427	71 884	238	0.33
Denmark	32 097	135 223	561	0.41
Iceland	18 482	84 839	107	0.13
Faroe Islands	14 753	117 295	285	0.24
Europe	15 145	117 115	2 041	1.74

Data from Worldometer as of 31. 12. 2021

Table 4. Middle European countries

State	Active cases/1 M	Cases/1 M	Death/1 M	% of death
Austria	3 322	140 765	1 512	1.07
Czech Republic	10 479	230 543	3 367	1.46
Poland	10 085	108 727	2 569	2.36
Slovak Republic	7 876	154 062	3 045	1.98
Hungary	10 968	130 555	4 072	3.12
Slovenia	8 431	223 169	2 688	1.20
Europe	15 145	117 115	2 041	1.74

Data from Worldometer as of 31. 12. 2021

tries have not followed uniform rules for reporting the total number of deaths due to this disease [17, 18]. A distinction should be made between deaths caused directly by COVID-19 and deaths related to COVID-19 [18]. Data for this parameter (Table 1—6) are difficult to compare because we do not know the key for assigning cause of death to each condition. Overall, the highest number of deaths occurred in Hungary (4,072/1 M) and the Czech Republic (3,367/1 M), the number of deaths in Europe (2,041/1 M) was compared.

Data from some countries are interesting: e. g. in the Czech Republic 2.51 times more death/1 M has been reported compared to Germany but the % of death was higher in Germany (1.57) than in the Czech Republic (1.46). In Hungary, death/1 M was 2.7 times higher than in Austria while the % of death was 2.9 times higher. For comparison, in Slovakia the mortality rate/1 M was 1.5 times higher than in Europe, the % mortality was 1.13 times higher.

Active cases/1 M in individual countries on 31 December 2021 and the current trend

On 31 December 2021, the highest number of active cases/1M in Europe was reported from Norway (55,427 cases). The value was also high in Ireland (42,757 cases). In the other countries in the ranking, the values were at least more than 2,000/1 M lower. Unfortunately, after the summer period, the number of active cases/1 M increased rapidly in many European countries (Table 1—6). In Denmark and Hungary, the number of active cases increased more than 10-fold in one month, in the Czech Republic and Iceland more than 5-fold, and in 15 European countries the number of new cases more than doubled. In many European countries, the highest number of new cases per day since the COVID-19 outbreak was recorded after 31 August.

Table 5. Balkan countries

State	Active cases/1 M	Cases/1 M	Death/1 M	% of death
Croatia	6 775	175 850	3 083	1.75
Serbia	2 775	149 613	1 464	0.98
Bosnia & Herzegovina	26 353	89 628	4 136	4.61
Montenegro	13 912	270 675	3 838	1.42
North Macedonia	2 517	108 028	3 821	3.54
Albania	2 175	73 170	1 120	1.53
Bulgaria	15 103	108 748	4 506	4.14
Greece	17 078	117 027	2 009	1.72
Europe	15 145	117 115	2 041	1.74

Data from Worldometer as of 31. 12. 2021

Table 6. Eastern European countries

State	Active cases/1 M	Cases/1 M	Death/1 M	% of death
Russia	4 980	71 904	2 115	2.94
Belarus	132	74 022	591	0.80
Ukraine	2 374	84 625	2 213	2.61
Lithuania	9 827	194 999	2 773	1.42
Latvia	6 231	149 154	2 464	1.65
Estonia	11 893	181 799	1 455	0.80
Moldova	858	93 573	2 556	2.73
Romania	585	94 977	3 085	3.25
Europe	15 145	117 115	2 041	1.74

Data from Worldometer as of 31. 12. 2021

The COVID-19 spread in the European regions from 15 February to 31 December 2021

The first cases of COVID-19 in individual European countries were confirmed from 24 January (France, Bordeaux) to 19 March (Isle of Man) [3, 7]. However, the rate of spread varied from region to region (Table 1—6). In the southern and western countries, the virus started to spread very soon after its first outbreak (Table 1, 2). Since mid-March, there has been a rapid increase in cases almost in all southern (Table 5), western (Table 2) and northern (Table 3) countries. The spread rate was lower in the Central European countries (Table 4). In the eastern countries (Table 5), the spread has intensified about mid-April. From mid-April, the disease started to spread also in the Balkans (Table 6). The situation was similar in the Eastern European countries, with the exception of the Baltic States, where the spread of COVID-19 was smaller and slower.

In terms of deaths within the regions of the Balkan countries, Bulgaria had the highest number of deaths/1 M throughout the reporting period; its number significantly exceeded that of Bosnia and Herzegovina. Among the Western countries, the situation was worst in Belgium, the United Kingdom and France (Table 2). The data from Sweden (1,498 deaths/1 M) significantly exceeded those from the other Nordic countries (Table 3). In Central European countries, the number of deaths more or less slowed

down at the end of May, with the exception of Poland. During the whole period under review, the highest number of deaths/1 M was in Hungary (4, 072 deaths/1 M) and the Czech Republic (3,367 deaths/1 M) (Table 4).

In the Balkan countries, the highest number of deaths/1 M was in Bulgaria (4,506 deaths/1 M) and Bosnia and Herzegovina (4,136 deaths/1 M). In the other Balkan countries, a similar situation started to change in mid-July, with data from Bulgaria currently the worst (Table 5). Among the eastern countries, despite the high number of total deaths in Romania (3,085 deaths/1M), the highest figures were in Lithuania and Moldova. The number of deaths/1 M in Belarus was lower than in the Baltic States (Table 6).

In each region, there were countries with both worse and better situations, but on 31 December 2021 the number of active cases/1 M was the lowest in Eastern European region (Table 6). It is questionable how strongly they will be affected by the second wave of the epidemic. It is already clear that the position of individual countries may change completely during the next wave of COVID-19.

COVID-19 appeared in Europe on 24 January 2020 (France) and by 19 March (Isle of Man) the infection was confirmed in all European countries. The total number of people infected was naturally higher in countries with large populations, but the prevalence (number of cases per million) in smaller countries was even higher than in large countries. The ranking of countries with a high number of all cases is not the same as the ranking of countries by COVID-19 prevalence. The virus spreading is not equally fast in different European regions. The virus started to spread first in the southern and western countries, soon in the northern region and, to a lesser extent, in the countries of Central Europe.

The number of deaths/1M was generally highest in the southern and western regions of Europe as of 31 December 2021, but these figures may be influenced by the method of certifying COVID-19 as the cause of death. It can be assumed that individual European countries are not uniform in their assessment of this parameter. The mortality rate for new coronaviruses from all continents was highest in Europe, although this value is gradually decreasing over time.

The current epidemic situation characterized by the number of active cases, more objectively expressed as the number of active cases/1M, was worst in Norway (55,427 active cases/1 M) and Ireland (42,757 active cases/1 M) as of 31 December 2021. In many countries, however, the new wave of COVID-19 has started with a record number of new cases per day. According to epidemiologists, mortality rates may vary because the virus can mutate. By comparison, approximately 290,000 to 650,000 people die each year worldwide as a result of complications from seasonal influenza viruses. The R0 for the common influenza is 1.3. The mortality rate for SARS in 2002—2003 was 10 %; for MERS in 2012, the mortality rate was 34 %. Both coronavirus epidemics were considerably less widespread: 8,096 people were infected with SARS-CoV and 2,494 with MERS-CoV.

ACKNOWLEDGEMENTS

This publication is the result of the project implementation: "Open scientific community for modern interdisciplinary research in medicine (OPENMED)", ITMS2014+: funded by the ERDF; this work was also supported by the project KEGA No. 005UVLF-4/2022 granted by The Ministry of Education, Science, Research and Sport of the Slovak Republic.

REFERENCES

1. **Cao, Y., Cai, K., Xiong, L., 2020:** Coronavirus disease 2019: A new severe acute respiratory syndrome from Wuhan in China. *Acta Virol.*, 64, 2, 245—250. DOI: 10.4149/av_2020_201.
2. **European Centre for Disease Prevention and Control. Population-wide Testing of SARS-CoV-2, 2020:** country experiences and potential approaches in the EU/EEA and the UK Stockholm, ECDC, 2020. https://www.ecdc.europa.eu/sites/default/files/documents/covid-19-population-wide-testing-country-experiences.pdf. Accessed January 8, 2021.
3. **Gámbaro, F., Behillil, S., Baidaliuk, A., Donati, F., Albert, M., Alexandru, A., et al., 2020:** Introductions and early spread of SARS-CoV-2 in France, 24 January to 23 March. *Euro Surveill.*, 25, 26, 2001200. DOI: 10.2807/1560-7917.ES.2020.25.26.2001200.
4. **Hassell, J. M., Begon, M., Ward, M. J., Fèvre, E. M., 2017:** Urbanization and disease emergence: Dynamics at the wildlife-livestock-human interface. *Trends Ecol. Evol.*, 32, 1, 55—67. DOI: 10.1016/j.tree.2016.09.012.

5. **Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., et al., 2020:** Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*, 395, 497—506. DOI: 10.1016/S0140-6736(20)30183-5.
6. **Kinross, P., Suetens, C., Gomes Dias, J., Alexakis, L., Wijermans, A., Colzani, E. et al., ECDC Public Health Emergency Team, 2020:** Rapidly increasing cumulative incidence of coronavirus disease (COVID-19) in the European Union/European Economic Area and the United Kingdom, 1 January to 15 March 2020. *Euro Surveill.*, 25, 11, 2000285. DOI: 10.2807/1560-7917.ES.2020.25.11.2000285.
7. **Lescure, F.X., Bouadma, L., Nguyen, D., Parisey, M., Wicky, P.H., Behillil, S., et al., 2020:** Clinical and virological data of the first cases of COVID-19 in Europe: a case series. *Lancet Infect. Dis.*, 20, 6, 697 706. DOI: 10.1016/S1473-3099(20)30200-0.
8. **Liu, Y., Gayle, A.A., Wilder-Smith, A., Rocklöv, J., 2020:** The reproductive number of COVID-19 is higher compared to SARS coronavirus. *J. Travel Med.*, 27, 2, taaa021. DOI: 10.1093/jtm/taaa021.
9. **Majumder, M.S., Mandl, K.D., 2020:** Early Transmissibility Assessment of a Novel Coronavirus in Wuhan, China. *SSRN* [Preprint], 3524675. DOI: 10.2139/ssrn.3524675.
10. **Pullano, G., Pinotti, F., Valdano, E., Boëlle, P.Y., Poletto, C., Colizza, V., 2020:** Novel coronavirus (2019-nCoV) early-stage importation risk to Europe, January 2020. *Euro Surveill.*, 25, 4, 2000057. DOI: 10.2807/1560-7917.ES.2020.25.4.2000057.
11. **Read, J.M., Bridgen, J.R.E., Cummings, D.A.T., Ho, A., Jewell, C.P., 2020:** Novel coronavirus 2019-nCoV: early estimation of epidemiological parameters and epidemic predictions. medRxiv 2020.01.23.20018549, preprint. DOI: 10.1101/2020.01.23.20018549.
12. **Spiteri, G., Fielding, J., Diercke, M., Campese, C., Enouf, V., Gaymard, A., et al., 2020:** First cases of coronavirus disease 2019 (COVID-19) in the WHO European Region, 24 January to 21 February 2020. *Euro Surveill.*, 25, 9, 2000178. DOI: 10.2807/1560-7917.ES.2020.25.9.2000178.
13. **Wang, C., Horby, P.W., Hayden, F.G., Gao, G.F., 2020:** A novel coronavirus outbreak of global health concern. *Lancet*, 395, 10223, 470—473. DOI: 10.1016/S0140-6736(20)30185-9.
14. **World Health Organization, 2019:** *Statement on the Meeting of the International Health Regulations (2005) Emergency Committee Regarding the Outbreak of Novel Coronavirus (2019-nCoV)*. Jan 2020. https://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)/. Accessed January 5, 2022.
15. **World Health Organization, 2020:** *Director-General's Opening Remarks at the Media Briefing on COVID-19*. 11 March 2020. https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020/. Accessed January 23, 2021.
16. **World Health Organization, 2020a:** *Advice on the Use of Masks in the Context of COVID-19*. Interim Guidance. 5 June 2020. https://apps.who.int/iris/handle/10665/332293/. Accessed January 5, 2022.
17. **World Health Organization, 2020b:** *Global Surveillance for COVID-19 Caused by Human Infection with COVID-19 Virus*. Interim Guidance. 20 March 2020. https://apps.who.int/iris/handle/10665/331506/. Accessed January 5, 2022.
18. **World Health Organization, 2020c:** *Medical Certification, ICD Mortality Coding, and Reporting Mortality Associated with COVID-19*. Technical note. 7 June 2020. https://apps.who.int/iris/handle/10665/332297/. Accessed January 8, 2022.
19. **World Health Organization, 2020d:** *Strengthening Preparedness for COVID-19 in Cities and Urban Settings. Interim guidance for local authorities*. 28 April 2020. https://www.who.int/publications/i/item/strengthening-preparedness-for-covid-19-in-cities-and-urban-settings/. Accessed January 5, 2022.
20. **Worldometer:** https://www.worldometers.info/coronavirus/. Accessed January 5, 2022.
21. **Zhao, S., Lin, Q., Ran, J., Musa, S.S., Yang, G., Wang, W., et al., 2020:** Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. *Int. J. Infect. Dis.*, 92, 214—217. DOI: 10.1016/j.ijid.2020.01.050.
22. **Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., et al., 2020:** A novel coronavirus from patients with pneumonia in China, 2019. *Engl. J. Med.*, 382, 8, 727—733. DOI: 10.1056/NEJMoa2001017.

Received March 14, 2022
Accepted April 14, 2022