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First three months of COVID-19 in Croatia, Slovenia, Serbia and Federation of Bosnia and Herzegovina – comparative assessment of disease control measures

Prva tri mjeseca COVID-19 u Hrvatskoj, Sloveniji, Srbiji i Federaciji Bosne i Hercegovine – komparativna analiza mjera za suzbijanje bolesti

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Abstract

The uncertainty surrounding the emerging coronavirus threat prompted countries to adopt various disease control measures (DCMs). This study compares the DCMs and the epicurves in Croatia, Slovenia, Federation of Bosnia and Herzegovina and Serbia in the first three months of COVID-19 epidemic. The open-source data of COVID-19 confirmed case and the DCMs were analyzed. For comparison between countries, seven benchmark DCMs were used: closure of educational institutions, complete lockdown, borders closure, public transport ban, restriction of movement within the country, easing of the lockdown measure, and the borders re-opening. The time passed from the first detected and confirmed COVID-19 case and each DCM was recorded as well as the time between the epidemic declaration and each DCM. The results describe comparatively the time flow of the DCMs across the countries and relative to the number of confirmed cases.

Sažetak

Nesigurnost oko novonastale prijetnje od koronavirusa potaknula je pojedine zemlje na usvajanje raznih mjera za suzbijanje bolesti (engl. disease control measures, DCMs). Ovim istraživanjem usporedili smo mjere za suzbijanje bolesti i epidemijske krivulje u Hrvatskoj, Sloveniji, Federaciji Bosne i Hercegovine i Srbiji u prva tri mjeseca epidemije COVID-19. Analizirani su podaci iz otvorenih izvora o potvrđenim slučajevima COVID-19 i mjerama suzbijanja bolesti. Za usporedbu među zemljama korišteno je sedam referentnih mjera suzbijanja bolesti: zatvaranje obrazovnih institucija, potpuno zatvaranje zemlje (engl. lockdown), zatvaranje granica, zabrana javnog prijevoza, ograničenje kretanja unutar zemlje, ublažavanje mjere zatvaranja i ponovno otvaranje granica. Zabilježeno je proteklo vrijeme od prvog otkrivenog i potvrđenog slučaja bolesti COVID-19 do uvođenja svake mjere za suzbijanje bolesti, kao i vrijeme od proglašenja epidemije do uvođenja svake pojedine mjere. Rezultati usporedno opisuju vremenski tijek uvođenja mjera za suzbijanje bolesti u analiziranim zemljama u odnosu na broj potvrđenih slučajeva.

Introduction

On January 7, 2020 a novel coronavirus (severe acute respiratory syndrome coronavirus 2, SARS CoV-2) was discovered as a possible cause of respiratory infections clustering in Wuhan, China. Initially, twenty-seven patients with pneumonia had been reported, with an epidemiological link to a live animal market.^[1]

The first confirmed cases of COVID-19 (n=4) in China were reported on January 17, 2020.

The incubation period of COVID-19 ranges from 1 to 14 days, with an average of 5 to 6 days. SARS CoV-2 is transmitted mainly through droplets. COVID-19 exhibits a wide range of clinical symptoms from asymptomatic or mild symptoms such as fever, sore throat,

headache, and cough to severe cases of pneumonia with characteristic features on computed tomography (CT) scans.^[1]

Ever since the discovery of SARS CoV-2, a number of confirmed cases of COVID-19 has been rising, with the total number of confirmed cases on May 26, 2020 being 88 179 worldwide.^[2] In Europe, the first three detected cases were reported on January 24, 2020 in France, reaching a total of 16,629 confirmed cases on May 26, 2020 on the continent.^[2,3] In late February, Europe had become a new epicenter of the COVID-19 pandemic, with Italy reporting the highest incidence at the time. The specific context of that time of the year, with events like the Carnival of Venice and ski season in Italy, Austria, and other neighboring countries is thought to have facilitated the spread of SARS CoV-2 in the region.

The uncertainty surrounding this new virus and the disease itself, such as the way of transmission, the infectiousness of SARS CoV-2, the severity of the symptoms and other unknown variables prompted many countries to adopt very strict disease control measures (DCMs) in order to protect the health of their citizens and adjust health care system to the emergent situation.

This study aims to describe the DCMs implemented within the Republic of Croatia and the neighboring countries, Slovenia, Federation of Bosnia and Herzegovina, and the Republic of Serbia in the first three months of COVID-19 epidemic in those countries.

Methods

The open-source data of COVID-19 DCMs for Croatia, Slovenia, Serbia, and Federation of Bosnia and Herzegovina were analyzed. The sources of the analyzed data were specialized COVID-19 governmental web pages for each country. For Croatia, the source of DCMs was the web page of the Ministry of Internal Affairs^[6,7], for Slovenia it was the web page of the Slovenian government, where the 'coronavirus' search filter was used^[8]. The data source for Serbia was the web page of the Serbian government, COVID-19 news section^[9]. Due to the lack of reliable data for the entire Bosnia and Herzegovina, Republic of Srpska was excluded from further study, while for the Federation of Bosnia and Herzegovina the data source was the web page of the Ministry of Health^[10]. For each country, the timeline of DCMs compared with the epidemic curve was made. The data source of daily confirmed COVID-19 cases in the period from February 26 until May 26, 2020 for Slovenia and Serbia was the web page WORLDOMETER^[11,12], for Croatia it was the data found on the official government web page regarding all the information about novel coronavirus

in the country^[4], while for the Federation of Bosnia and Herzegovina (FB&H) the data used was found on the official web page of the Public Health Institute of FB&H^[5]. The case definition used for confirmed coronavirus disease 2019 (COVID-19) case was the case definition of the European Centre for Disease Control (ECDC) as of May 29, 2020 which states that the confirmed case is any person meeting the laboratory criteria, where the needed laboratory criterion is the detection of SARS CoV-2 nucleic acid in a clinical specimen.^[14]

The list of DCMs for each country was created and analyzed descriptively. For comparison between countries, seven benchmark DCMs were used: closure of educational institutions, complete lockdown, borders closure, public transport ban, restriction of movement within the country, easing of the lockdown measure, and the borders re-opening.

The time passed from first detected and confirmed COVID-19 case and each DCM was recorded as well as the time between the epidemic declaration and each DCM.

Results

COVID-19 and Disease Control Measures in the Republic of Croatia

The first confirmed cases in Croatia were detected on February 26, 2020, two imported cases from Italy^[4]. Due to the evolving situation in the region and around the world and the first confirmed cases in Croatia already detected, on March 9, the Republic of Croatia introduced a fourteen-day quarantine for all who enter Croatia from or who have visited in the last 14 days Italy, continental China, South Korea, and Iran. In Croatia, the COVID-19 epidemic was declared on March 11. On March 16, 20 days after the detection of the first confirmed cases of COVID-19 and only five days after the declaration of COVID-19 epidemic in Croatia, the educational institutions (such as kindergartens, schools, and universities) were closed. Twenty-three days after the first detected COVID-19 confirmed cases, a complete lockdown was imposed, with the exception on pharmacies and grocery stores that continued to work under strict disease control measures and shorter office hours. On March 22, a strong earthquake hit Zagreb, the capital of Croatia, just one week after the complete lockdown was imposed. All public transport, with the exception of taxis, stopped operating, twenty-six days after the first confirmed cases. The restriction of movement within the country (ban on traveling from one to another county) was introduced twenty-seven days after the first confirmed COVID-19 cases. Traveling from one to another coun-

ty was enabled from April 6, 2020, but only with special e-passes given to individuals meeting certain criteria. Easter holidays in Croatia were on the weekend of April 12, 2020 and the supermarkets and open green markets started operating longer hours three days before Easter until Easter holidays. The supermarkets finally started operating normal working hours, but with a one-hour break for disinfection since April 24, 2020. Public transport within the cities started oper-

ating again from April 27, 2020. On May 3, the easing of complete lockdown measures began (for example with the re-opening of outdoor playgrounds, shops other than grocery stores (that were open under strict conditions all the time), hairdresser salons, etc.). Croatian border re-opened seventy-four days after the first detected confirmed COVID-19 case, on May 9, 2020. For benchmark DCMs and relevant epidemiological measures for Croatia see Table 1.

TABLE 1. BENCHMARK DCMs AND RELEVANT EPIDEMIOLOGICAL MEASURES FOR THE REPUBLIC OF CROATIA
 TABLICA 1. OSNOVNE MJERE SUZBIJANJA BOLESTI I RELEVANTNE EPIDEMIOLOŠKE MJERE U REPUBLICI HRVATSKOJ

Croatia	Date	Total number of COVID-19 cases	Number of new COVID-19 cases (on that date)	Number of days since the first detected confirmed COVID-19 case in the country	Number of days since the declaration of epidemic
<i>First confirmed COVID-19 case</i>	February 26, 2020	2	2	0	-14
<i>Declaration of epidemic</i>	March 11, 2020	16	3	14	0
<i>Closure of educational institutions</i>	March 16, 2020	57	8	20	5
<i>Complete lockdown</i>	March 19, 2020	105	16	23	8
<i>Borders closure</i>	March 19, 2020	105	16	23	8
<i>Public transport ban</i>	March 22, 2020	254	48	26	11
<i>Restriction of movement within the country</i>	March 23, 2020	315	61	27	12
<i>Easing the lockdown measures</i>	May 3, 2020	2096	8	68	53
<i>Re-opening of the borders</i>	May 9, 2020	2176	15	74	59

COVID-19 and Disease Control Measures in the Republic of Slovenia

Slovenia reported the first confirmed COVID-19 case on March 4, 2020, followed by a ban on public gatherings of more than 500 people at public events in indoor public places three days later. All travelers crossing the Slovenian border as of March 9 received an SMS notification of the disease control measures in the Republic of Slovenia, while every household received a leaflet containing coronavirus actions. Further reduction in the number of people allowed to gather in indoor public areas was introduced on March 10, limiting the number of people to 100. Only six days after the first detected COVID-19 case, Slovenia banned landing of planes coming from Italy, China, South Korea, and Iran as well as introducing the obligatory 14-day quarantine upon return from the People's Republic of China (PRC). On March 11, 2020, Slovenia re-introduced border control checks for all travellers on the Italian border for all non-Slovenian nationals and people without permanent or temporary residence in Slovenia – checking for negative SARS CoV-2 PCR test certificate not older than three days, while Slovenian citizens had no such restrictions. Eight days

after the detection of the first COVID-19 case, Slovenia declared an epidemic. On March 14, Slovenia decided not to use the number of people who tested positive on SARS CoV-2, but the number of severely ill persons requiring hospital care as a data used to calculate the number of infected people. Those people with a respiratory infection were asked to stay at home for 14 days without determining whether they have novel coronavirus infection or not. Slovenia also decided to check for SARS CoV-2 if a person requires hospitalization. Eleven days after the first detected case, Slovenia introduced complete lockdown and banned public transport with the exception of taxis with strict disease control measures. On the following day, March 16, 2020, the educational institutions were closed. On March 17, Slovenia banned all international air transport. Eight days after the declaration of the epidemic and 16 days after the first detected case, Slovenia prohibited public gatherings and public events in all public places and it also suspended all dental services and preventive health services. Grocery stores introduced shorter working hours on March 21. Since March 25, Slovenia required either negative PCR test results on SARS CoV-2 not older than three days for all foreign-

ers or absence of signs of an upper respiratory tract infection and body temperature below 37.5°C upon entrance. On April 12, Slovenia introduced a seven-day quarantine on all entering the country with a mandatory PCR testing on SARS CoV-2 on the last day of the quarantine. As of April 30, Slovenian citizens were re-allowed to move outside the municipality of either permanent or temporary residence. After sixty-four

days of the epidemic, on May 15, Slovenia declared the end of the epidemic and re-allowed EU citizens to enter Slovenia without the need for quarantine upon arrival. On May 18, Slovenia re-opened kindergartens and schools and completely eased lockdown measures. For benchmark DCMs and relevant epidemiological measures for Slovenia see Table 2.

TABLE 2. BENCHMARK DCMs AND RELEVANT CHOSEN EPIDEMIOLOGICAL MEASURES FOR THE REPUBLIC OF SLOVENIA
 TABLICA 2. OSNOVNE MJERE SUZBIJANJA BOLESTI I RELEVANTNE ODABRANE EPIDEMIOLOŠKE MJERE U REPUBLICI SLOVENIJI

Slovenia	Date	Total number of COVID-19 cases	Number of new COVID-19 cases (on that date)	Number of days since the first detected confirmed COVID-19 case in the country	Number of days since the declaration of epidemic
<i>First confirmed COVID-19 case</i>	March 4, 2020	1	1	0	-8
<i>Declaration of epidemic</i>	March 12, 2020	99	39	8	0
<i>Closure of educational institutions</i>	March 16, 2020	256	34	12	4
<i>Complete lockdown</i>	March 15, 2020	222	38	11	3
<i>Borders closure</i>	x	x	x	x	x
<i>Public transport ban</i>	March 15, 2020	222	38	11	3
<i>Restriction of movement within the country</i>	March 15, 2020 ^a	222	38	11	3
<i>Easing the lockdown measures</i>	March 18, 2020	1469	0	75	67
<i>Re-opening of the borders</i>	X (May 15, 2020) ^b	(1468)	(1)	(72)	(64)

^a Restriction was never separately communicated, but on April 30, Slovenia lifted the prohibition of movement outside the municipality of permanent or temporary residence

^b Entrance into the Republic of Slovenia allowed without any disease control measure

COVID-19 and Disease Control Measures in the Republic of Serbia

Serbia reported the first COVID-19 case on March 6.^[9] Four days later, on March 10, Serbia banned entrance into to country for all foreigners coming from Italy, Hubei Province of the PRC, the city of Daegu, and the North Gyeongsang Province of the Republic of Korea, Iran and the Canton of Ticino of Switzerland. Six days after the first detected case of COVID-19, Serbia banned indoor public gatherings of more than 100 people and closed 44 border crossings for road, rail, and river traffic to Hungary, Romania, Bulgaria, Montenegro, Croatia, Northern Macedonia, and Bosnia and Herzegovina. On the following day, on March 13, Serbia banned all gatherings at outdoor sports facilities and prohibited entrance into the country for all foreigners coming from Romania. On March 14, Serbia extended the list of countries from where coming foreigners would be prohibited the entrance and the countries were as follows: the Republic of France, the Federal Republic of Germany, the Republic of Slo-

venia, the Republic of Austria, the Kingdom of Spain, the Republic of Greece and the Swiss Confederation. On March 15, Serbia closed its borders with the exception of Serbian citizens and those with permanent residence. Nevertheless, they were obliged to remain in home quarantine for 14- or 28-days if returning from the countries listed above, and, in case of violation, would be punished with up to three years of imprisonment. On that same day, Serbia declared the state of emergency, which is used in this study as the day of the declaration of the epidemic. On the following day, on March 16, the complete lockdown was introduced and all educational institutions were closed. On March 18, Serbia banned movement of all citizens between 8 pm and 5 am. The international border crossing on Nikola Tesla Airport in Belgrade was closed on March 19, followed by the total border closure for all the passengers on March 20. Serbian public transport stopped operating on March 22, sixteen days since the first detected case and on the same day, the curfew hours were extended from 8 pm to 5 pm until 5 am with exception

of Sundays when citizens aged 65 and older were allowed to leave their homes from 3 am until 8 am to go grocery shopping. The gatherings of more than five people in closed areas were prohibited as of March 22. From March 28, the curfew hours on weekends were extended from 3 pm until 5 am. On April 8, 2020 the curfew hours included the whole weekend starting on Friday from 5 pm until Monday at 5 am. On April 21, reopening of the shops and green markets started and six days later, Serbia reopened hairdresser's shops, beauty parlors, fitness centres and gyms. Interurban

bus and rail traffic started operating from May 4. On May 6, fifty-two days after the declaration of the state of the emergency, Serbia declared the end of the state of emergency. Two days later, on May 8, Serbia reopened its borders for all presenting negative PCR test on SARS CoV-2 not older than 72 hours or they would face a 14-day quarantine upon entrance. From May 22, Serbia completely opened its borders and lifted all the crossing measures introduced before. For benchmark DCMs and relevant epidemiological measures for Serbia see Table 3.

TABLE 3. BENCHMARK DCMs AND RELEVANT EPIDEMIOLOGICAL MEASURES FOR THE REPUBLIC OF SERBIA

TABLICA 3. OSNOVNE MJERE SUZBIJANJA BOLESTI I RELEVANTNE EPIDEMIOLOŠKE MJERE U REPUBLICI SRBIJI

Serbia	Date	Total number of COVID-19 cases	Number of new COVID-19 cases (on that date)	Number of days since the first detected confirmed COVID-19 case in the country	Number of days since the declaration of epidemic
<i>First confirmed COVID-19 case</i>	March 6, 2020	1	1	0	-9
<i>Declaration of the state of emergency (epidemic)</i>	March 15, 2020	41	0	9	0
<i>Closure of educational institutions</i>	March 16, 2020	50	9	10	1
<i>Complete lockdown</i>	March 16, 2020	50	9	10	1
<i>Borders closure</i>	March 15, 2020 ^a / March 20, 2020 ^b	50/128	9/32	9/14	0/5
<i>Public transport ban</i>	March 22, 2020	215	51	16	7
<i>Restriction of movement within the country</i>	x	x	x	x	x
<i>Easing the lockdown measures</i>	April 21, 2020	6883	260	46	37
<i>Re-opening of the borders</i>	May 22, 2020 ^c	11017	105	77	68

^a On March 15, Serbia closed its borders with the exception of Serbian citizens and those with permanent residence, nevertheless they were obliged to remain in home quarantine for 14 or 28 days if returning from the focal areas of the Republic of Italy, the Swiss Confederation, the Islamic Republic of Iran, Romania, the Kingdom of Spain, the Federal Republic of Germany, the French Republic, the Republic of Austria, Slovenia and the Republic of Greece

^b total border closure for all passengers on March 20

^c when there was no restrictions upon entrance

COVID-19 and Disease Control Measures in the Federation of Bosnia and Herzegovina

The Federation of Bosnia and Herzegovina (FB&H) reported the first confirmed COVID-19 case on February 29, 2020^[5], but even 5 days before, on February 24, FB&H introduced a fourteen-day quarantine for all travelling from or returning from PRC, Italy, South Korea and Iran and for everyone who was in those countries in the last 14 days before returning to FB&H. Six days after the first detected COVID-19 case, FB&H banned all visits to hospital patients and long-term care facilities and specialist examinations in hospitals were available only if necessary. Ten days after the first confirmed case, FB&H added Germany, France and

Spain to the list of countries with obligatory 14-day quarantine upon returning to FB&H, and on the same day, all foreigners entering the country had movement restrictions. Eleven days after the first detected COVID-19 case in FB&H, the educational institutions (kindergartens, schools and universities) were closed as well as all sports and cultural activities. On March 12, the citizens of FB&H were recommended not to leave the country, not to stay outdoors on public areas and to maintain social distance. COVID-19 epidemic in Federation of Bosnia and Herzegovina was declared on March 16, and on the same day, strict disease control measures were introduced for shops that would remain open during the complete lockdown intro-

duced two days later, on March 18. The public transport ban was introduced on March 21, twenty-one days after the first detected COVID-19 case and only five days since declaration of the epidemic. In the ob-

served period, until May 26, FB&H had not mitigated any disease control measure. For benchmark DCMs and relevant epidemiological measures for Federation of Bosnia and Herzegovina see Table 4.

TABLE 4. BENCHMARK DCMs AND RELEVANT EPIDEMIOLOGICAL MEASURES FOR FEDERATION OF BOSNIA AND HERZEGOVINA

TABLICA 4. OSNOVNE MJERE SUZBIJANJA BOLESTI I RELEVANTNE EPIDEMIOLOŠKE MJERE U FEDERACIJI BOSNE I HERCEGOVINE

Federation of Bosnia and Herzegovina	Date	Total number of COVID-19 cases	Number of new COVID-19 cases (on that date)	Number of days since the first detected confirmed COVID-19 case in the country	Number of days since the declaration of epidemic
<i>First confirmed COVID-19 case</i>	February 29, 2020	1	1	0	-16
<i>Declaration of epidemic</i>	March 16, 2020	62	10	16	0
<i>Closure of educational institutions</i>	March 11, 2020	31	8	11	-5
<i>Complete lockdown</i>	March 18, 2020	83	9	18	2
<i>Borders closure</i>	x	x	x	x	x
<i>Public transport ban</i>	March 22, 2020	197	23	22	6
<i>Restriction of movement within the country</i>	x	x	x	x	x
<i>Easing the lockdown measures</i>	x	x	x	x	x
<i>Re-opening of the borders</i>	x	x	x	x	x

Discussion

On January 30, 2020 the World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern (PHEIC)^[13], which raised attention and the level of concern in many countries. At that time, Europe had already detected several COVID-19 cases. Italy detected its first COVID-19 case on February 21, 2020 but only two days later Italy counted a total of 113 COVID-19 cases, the reason for concern in the region and neighbouring countries.^[14] The winter time and specific context of that time of the year with events like the Carnival of Venice and ski season in the Italian Alps prompted countries in the region to prepare for potential epidemic and adopt quite radical disease control measures rather early. The three DCMs imposed in all four observed countries were: closure of educational institutions, complete lockdown and public transport ban, with the specificity of being introduced in all four countries very early in the epidemic or even before the official declaration of the epidemic in Federation of Bosnia and Herzegovina. Croatia and Serbia closed their borders, while Slovenia and Federation of Bosnia and Herzegovina had a less radical approach and it was allowed to cross the border with either mandatory PCR test results or home quarantine. Slovenia and Croatia showed a similar pattern in low daily incidence while easing the lockdown measures and re-opening of the

borders or lifting any mandatory measures regarding border crossing. Serbia eased the lockdown measures and re-opened its borders, while the daily incidence of COVID-19 was the highest in the region. Nevertheless, Serbia is the regional leader in testing on SARS CoV-2 and that might be their reason for easing the lockdown and re-opening of the borders. In the observed period, only two countries declared the end of the epidemic, Slovenia and Serbia, while Croatia and FB&H kept the epidemic status further on, giving them the possibility to impose new DCMs if needed. The results show that the countries in the region acted quite similarly in this epidemic, with the early introduction of radical measures, when the number of COVID-19 cases in each country was quite low. The reason for that might be the cultural specificity of the region, daily migration, and working/living specificities of their residents. The evolving situation in Italy and a daily number of deaths due to COVID-19 spread the fear of the same scenario in the region. At that time, one of the factors contributing to such early radical measures was a lack of scientific data on the novel coronavirus and COVID-19 but also a lack of protective equipment for medical staff and shortage of disinfectants. It remains unclear as to what extent did the early adoption of radical DCMs affect the spread of the disease in the observed countries.

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