



Canton Sarajevo journey through COVID-19 pandemic

Anes Jogunčić^{1*}, Aida Pilav¹, Anisa Bajramović¹, Snežana Bursač-Aranđelović¹, Aida Pošković-Bajraktarević¹, Emina Kurtagić-Pepić¹, Aida Pitić¹, Zimka Šeremet¹, Denis Đurović¹, Suada Branković²

¹Public Health Institute of Canton of Sarajevo, Sarajevo, Bosnia and Herzegovina, ²Department of Nursing, Faculty of Health Studies, University of Sarajevo, Sarajevo, Bosnia and Herzegovina

ABSTRACT

Introduction: Sarajevo is the capital city of Bosnia and Herzegovina, with the population in Canton Sarajevo of 438,443 people. The first cases of COVID-19 in Canton Sarajevo were on 20th March. On that day, we had three positive cases. These days at the beginning of the COVID-19 epidemic in Canton of Sarajevo around 2500 citizens were in self-isolation at home. The aim of this paper is to show the journey of Canton Sarajevo in the fight against COVID-19 infection, the impact of measurements that were taken to stop the infection spreading and to compare pre- and post-lockdown stats.

Methods: During the period March-July 2020, we have analyzed daily newly cases and followed them through the period of at least 14 days. All data were analyzed using SPSS 25.0 (IBM Corp. Released in 2019. IBM SPSS Statistics for Windows, NY: IBM Corp.) and MS Office 2019 suite (Excel). For comparison, we have used the Chi-square test.

Results: In the period of 10 weeks from the beginning of March to the 25th of May in Canton of Sarajevo, we had a total of 113 cases of COVID-19 infection. The number of conducted tests was 7515. In total, with positive retests, we had only 161 positive tests, which is 2.14% of all analyzed tests. From that number of patients, 58 (51.3%) were male and 55 (48.7%) were female. Regarding age distribution, under 65 years were 91.1% of patients.

Conclusion: Choosing the best method to fight against COVID-19 is hard to determine. Staying at home would decrease the infection rate, but in the long term, it is not sustainable. Perhaps the mix of methods that we had in Sarajevo is the best option. Fighting against one epidemic cannot be the source for other epidemics.

Keywords: Coronavirus; public health; measures; infection control; lockdown

INTRODUCTION

Pneumonia of unknown cause was detected in China, Wuhan, in December 2019 and it was reported to

the WHO office on 31st December 2019 (1,2). On 30th January 2020 outbreak was declared as a Public Health Emergency of International Concern (3). WHO announced a name for the new coronavirus disease, COVID-19, on 11th February 2020 (4).

Canton Sarajevo is part of the Federation of Bosnia and Herzegovina, one of two entities of Bosnia and Herzegovina. Sarajevo is the capital city of Bosnia and Herzegovina, with the population in Canton Sarajevo of 438,443 people. The city consists of four

Corresponding author: Anes Jogunčić, Public Health Institute of Canton of Sarajevo, Dr. Mustafe Pintola 1/3, 71000 Sarajevo, Bosnia and Herzegovina. E-mail: anesjoguncic@outlook.com

Submitted: 29 July 2020/Accepted: 21 September 2020

DOI: <https://doi.org/10.17532/jhsci.2020.1031>



municipalities but has close connections with five other municipalities. Sarajevo area is densely populated for Bosnia and Herzegovina – on average, 2470 citizens per square kilometer (range from 742.5 citizens/sq kilometer in Municipality of Old city up to the 7524.5 citizens/sq kilometer in Municipality of New Sarajevo). Around 70% of the population is in the age range from 15 to 64 years and 13.8% of people are older than 65 (5). Sarajevo is a capital city, but also the administrative center and biggest tourist destination in the country. A large number of tourists in December 2019 and January 2020 were from Asia, mostly Japan, Korea, and China. From the beginning, there was a risk of infection from imported cases.

At the beginning of February 2020, in the Canton of Sarajevo, first plans and guidelines for preventing COVID-19 infections were made. As the infection spread globally in the Federation of Bosnia and Herzegovina on 12th March, schools started with online classes, and large public gatherings (>100 people) were banned from 17th March. On March 21st, younger than 18 and older than 65 were under restrictions of going out, with police hours from 6 PM to 5 AM every day. On the country level, on March 25th, foreign citizens were forbidden to enter the country as prevention against imported cases.

In Canton of Sarajevo, Public Health Institute started from the second part of February to follow all foreign citizens with special emphasis on citizens of China, South Korea, Iran. Citizens from these counties would go in self-isolation for 14 days if they were staying longer or through the period of stay. As infection increased in Italy, Spain, and other European countries, all foreign citizens and Bosnian citizens returning from these counties went to the self-isolation and were passively followed with telephone communication for the onset of symptoms of COVID-19. If the symptoms were present, person would be tested on COVID-19 using the RT-PCR method.

The first cases of COVID-19 in Canton Sarajevo were on 20th March. On that day, we had three positive cases. All of them were connected with earlier known Cluster from the southern city of Konjic. On March 11th, in Konjic was a celebration of one

company with a bigger number of guests. These days at the beginning of the COVID-19 epidemic in Canton of Sarajevo around 2500 citizens were in self-isolation at home.

According to earlier orders, anyone who was on the celebration in Konjic or who had contact with the infected persons in Konjic had to report to the Department of Epidemiology at the Public Health Institute of Canton Sarajevo. Self-isolation for these patients was at home, and in the case of braking, self-isolation police would take that person in forced isolation in one of the centers. During the epidemic, food and liquor stores, baby stores, pharmacies, drugstores, garden centers, and construction places were all open and working. Shops were working online and delivering at the address. Cafe bars, hotels, and restaurants are closed.

In the following period, testing capacities in Canton of Sarajevo were increased and identification of COVID-19 patients' strong campaign of finding their contacts was conducted. At the peak of the first wave of epidemic, around 4200 were in self-isolation.

The aim of this paper is to show the journey of Canton Sarajevo in the fight against COVID-19 infection, the impact of measurements that were taken to stop the infection spreading and to compare pre- and post-lockdown stats.

METHODS

During the period March-July 2020, we have analyzed daily newly cases and followed them through the period of at least 14 days. Furthermore, we have tracked contacts and isolated them to cut virus transmission chains. In total, 2100 infected patients were followed with 6753 contacts.

For presenting the results of our journey through the COVID-19 epidemic in Canton of Sarajevo, we used descriptive methods. The number of patients is presented as a frequency and percentage. Furthermore, for comparison with other cities, we used a number of tested people per 100,000 citizens and a number of positive patients were also compared on the scale of 100,000 citizens. For predictions and testing trends, we used minimal reproductive number R and growth rate.

All data were analyzed using SPSS 25.0 (IBM Corp. Released in 2019. IBM SPSS Statistics for Windows, NY: IBM Corp.) and MS Office 2019 suite (Excel). For comparison, we have used the Chi-square test.

RESULTS

In the period of 10 weeks from the beginning of March to the 25th of May in Canton of Sarajevo, we had a total of 113 cases of COVID-19 infection. The number of conducted tests was 7515. In total, with positive retests, we had only 161 positive tests, which is 2.14% of all analyzed tests.

From that number of patients, 58 (51.3%) were male and 55 (48.7%) were female. Regarding age distribution, under 65 years were 91.1% of patients. There was not any significant difference in the sex distribution of patients, but a significantly larger number of infected people were younger than 65 years in comparison with a number of older people ($p < 0.001$).

In the same period, we had six death outcomes and furthermore. Analyzing patients who died and were positive on SARS-CoV-2, 2/6 were female and 4/6 were male. The average age of these patients is 59.5 years. Only one patient was older than 70 years. Through these 2 months, around 30 patients were hospitalized, and capacities were always mostly empty.

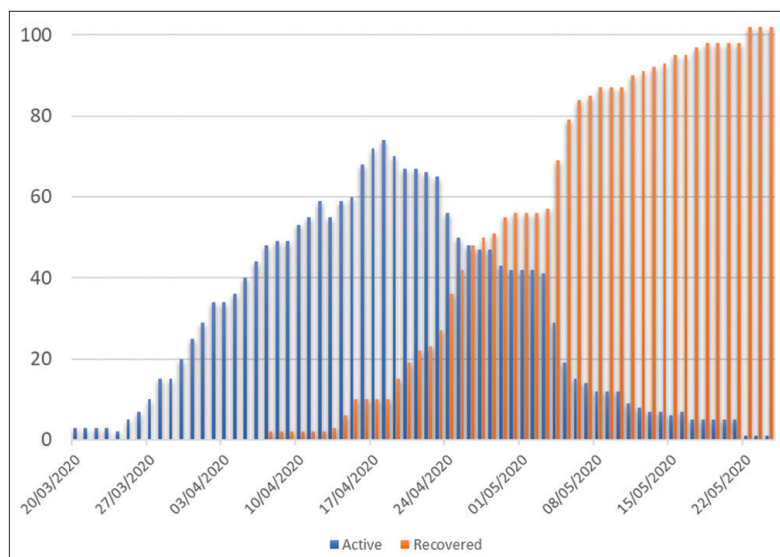
On 7th April, we had the first two patients that were recovered from COVID-19 infection by the protocol of having two negative swabs on RT-PCR analysis. On the 30th of May, the number of recovered people in the Canton of Sarajevo is 104, and we had 0 active case (Graph 1).

Of these 104 patients, 52% were female and 48% were male. The largest number of recovered cases is between 51 and 65 years (40% of cases); furthermore, 34% was in the age group between 35 and 50 years. Furthermore, 8% of cases were older than 65 years.

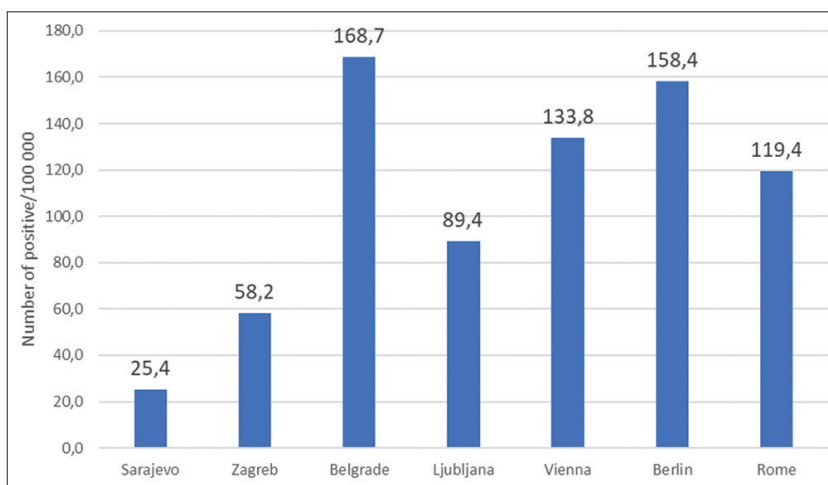
During the period of 2 months, the percentage of patients older than 60 years was under 25%. In the last month, there is a severe decline of cases; on the 1st May, 42 cases were active, 11% of patients were under the age of 18, and 72% were in age groups from 18 to 60 years; furthermore, 11% of active cases were in the age group 61-70 years. Furthermore, 2% of active cases are in the age group of 71-80 years and 4% older than 80 years.

For comparison with other cities, we took a number of positive cases per 100,000 citizens. Sarajevo had significantly lower numbers in comparison with other cities (Graph 2).

In Sarajevo, 25/100,000 was positive on COVID-19, while in Zagreb, which is second best,



GRAPH 1. Number of active and recovered patients in Canton of Sarajevo



GRAPH 2. Number of positive citizens on COVID-19 per 100,000 citizens.

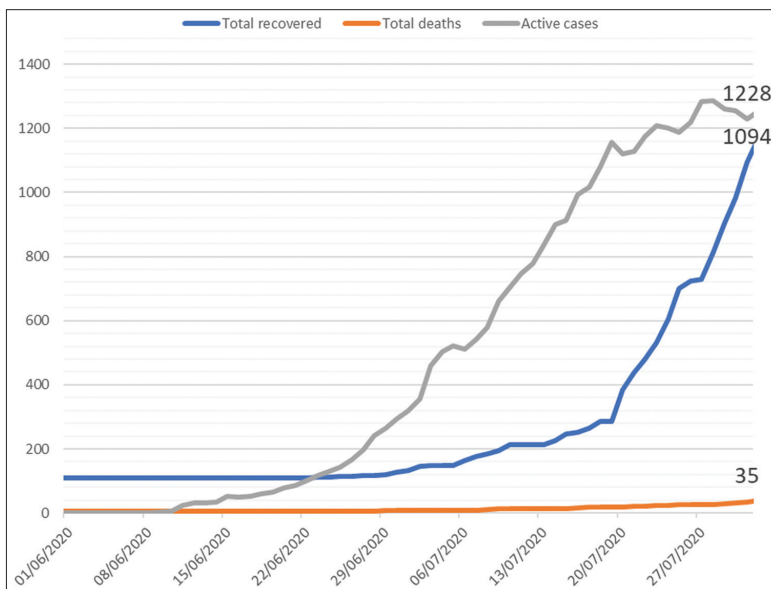
that ratio is 58/100,000 citizens (6). Zagreb has a population more than twice larger than Canton of Sarajevo. Ljubljana is in size as Sarajevo and they had 89/100,000 patients in the same period (7). Belgrade is the biggest city in the Balkan region and has 169 cases per 100,000 citizens (8).

Austria is well recorded and in Vienna, the number of positive patients is 134/100,000, but they have a small number of active cases at this moment. Italy is one of the countries most affected by COVID-19 and the majority of these cases are in the north. Milano has a population of 1.352 million and 1047 cases per 100,000 citizens. Sweden has a different approach and they still have open bars, restaurants, public transport, etc., and the biggest number of cases is in Stockholm, but even they have a smaller number than Milano 864/100,000 citizens (9). When comparing Sarajevo infected rate with an even average rate of three capital cities of countries around Bosnia (Zagreb, Belgrade, and Ljubljana), in Sarajevo had a significantly lower number of infected ($p < 0.001$).

Then came the second wave of the epidemic. On the 8th of June, we had 2 cases, a day later 3 newly infected persons, but on the 10th of June, there were 17 of them. Mostly, they were imported cases from other cities in Bosnia and Herzegovina but also from Region of Sandzak in the Republic of Serbia. The number of infected people increased significantly in the week from 22nd June to 28th July, when 175 people get confirmed as newly infected. In the

same period, the minimal reproductive number in Canton of Sarajevo was between 2.2 and 3.14 daily (Graph 3). One week later, in Canton of Sarajevo was the highest number of infected people per day, 107 patients. The biggest number of cases was imported cases from the Region of Sandzak and their contacts. Large family clusters were an issue but because it mostly included two or three generations, including elderly people.

In the period between the second part of June and to the 18th July in Sarajevo, the reproductive number was above 1.3 and with that we had weekly growth of around 30%. The highest growth was in the 1st week of July, with an increase of 65% of new cases. Crisis headquarters of Cantonal Ministry of Health issued an order to reduce the number of people that are allowed to gather in public to 100 with masks if they cannot keep a distance of 2 meters and to 50 people inside with masks and keeping the distance. On that day was $R_0 = 1.6$. Furthermore, reminding the population to follow epidemiological rules: Wearing masks and keeping distance produced that on the day of 25th July, minimal reproductive number is $R = 1.08$. The second wave of epidemic mostly hit the younger population, with 88.9% of infected being under 65 years old. Under the age of 18 were 11% of patients. Unfortunately, with this increase in the number of cases, also number of death outcomes had increased. With 25th July, in Canton of Sarajevo were 25 death outcomes, with $CFR = 1.27\%$. From



GRAPH 3. Movement of active and recovered cases in period of June and July.

that number, 72% were male and 68% of all death outcomes were in groups above age 65. For further predictions and possible implementation of new measures, we look on daily growth, minimal reproductive number, and number of days that are needed to double the number of cases. Doubling time on 25th July is 24.69 days, with the potential to increase even more. The daily growth rate has decreased from around 10% before the last Order by Crisis Headquarters to the level of around 3% on 25th July (Graph 4).

In the last 2 weeks, with additional education of the population and with messages that were send through the mass media, in general, population masks are used widely and even younger people are recognizing that they could be infected with the severe clinical picture.

DISCUSSION

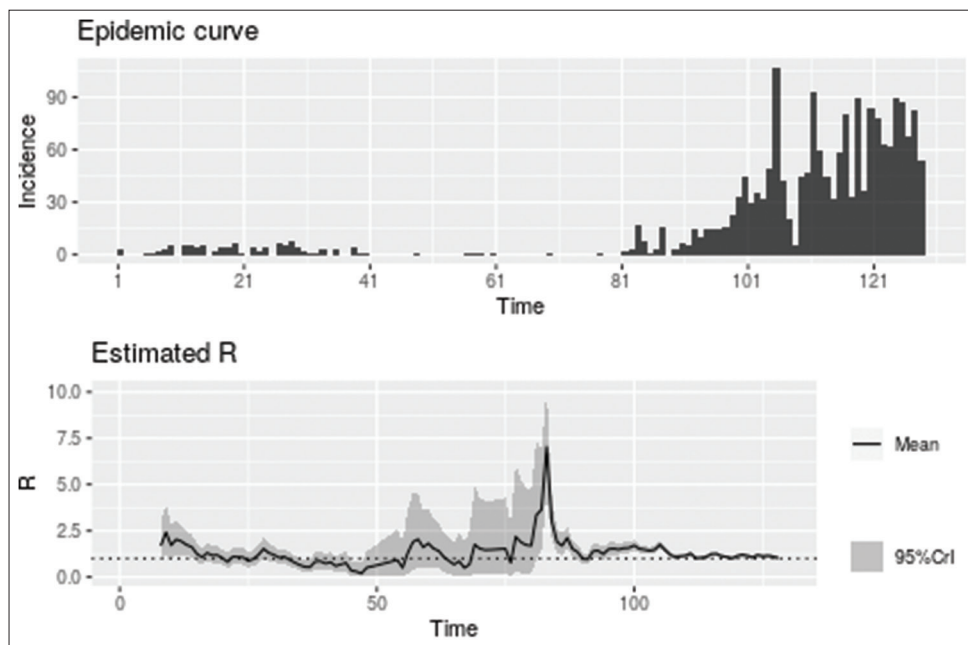
No country knows the total number of people infected with COVID-19. All we know is the infection status of those who have been tested. All those who have a lab-confirmed infection are counted as confirmed cases (10).

This means that the counts of confirmed cases depend on how much a country actually tests. Without testing, there are no data.

Testing is our window onto the pandemic and how it is spreading. Without data on who is infected by the virus, we have no way of understanding the pandemic. Without this data, we cannot know which countries are doing well, and which are just underreporting cases and deaths. Here in Canton of Sarajevo, with available capacities in hospitals and without active cases in the hospital, we could be sure that our measures and testing have provided the results. To interpret any data on confirmed cases, we need to know how much testing for COVID-19 the country actually does.

The rapid spread of COVID-19 with pandemic potential poses one of the most significant global challenges in recent years. With more than 300 scientific reports and articles on this topic published in the past 2 months, it is crucial to disseminate the main findings through a comprehensive review of the existing evidence. In this review, we extracted and synthesized key epidemiological, demographic, and clinical features of COVID-19 from the published literature and preprints available to date (11).

Control measures such as quarantine, travel restrictions, and airport screening for travelers have been widely implemented to contain the spread of infections. The effectiveness of these containment



GRAPH 4. Impact of Minimal Reproductive Number of Newly infected number in Canton of Sarajevo.

measures in controlling the outbreak, however, remains inconclusive.

Due to the small number of cases, case fatality rate in Sarajevo was 5.3% in the first wave. After 2 months into second wave, CFR = 1.27%. From the total number of closed cases, the fatality rate was 3.3%. The average mortality rate in China was 4.0% (3276/81 601) (12). Until 25th July, globally were 16,376,159 cases of COVID-19 infection, with 651,162 deaths (9). From that number, 10,653,951 are closed cases, with a fatality rate of 6.11%.

Perhaps the best predictions we will have after conducting serological analyses in population. Until now, a couple of countries are starting these studies. WHO is suggesting that only 2–7% of the population globally have antibodies (around 200 million worldwide). This number is still 60 times bigger than those numbers of confirmed cases (13). The study from California, at Stanford University, had the conclusion that the virus is 50–85 times more common than official figures indicated (14). Serological studies from Italy showed even higher numbers, with at least 20% of people having antibodies.

Soon, we are going to conduct a serological study in the Canton of Sarajevo to find citizens with

antibodies. With that, we will have a better picture of infection spread in the population.

CONCLUSION

Choosing the best method to fight against COVID-19 is hard to determine. Staying at home would decrease the infection rate, but in the long term, it is not sustainable. Perhaps the mix of methods that we had in Sarajevo is the best option. Fighting against one epidemic cannot be the source of other epidemics. Contact tracing is a crucial part of controlling the COVID pandemic. No country knows the total number of people infected with COVID-19, all we know is the infection status of those who have been tested.

REFERENCES

1. European Centre for Disease Prevention and Control. COVID-19 pandemic. Available from: <https://www.ecdc.europa.eu/en/covid-19-pandemic>. (last accessed date: 24th July 2020)
2. World Health Organization. Coronavirus Disease (COVID-19) Outbreak; 2019. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>, (last accessed date: 24th July 2020)
3. World Health Organization. Statement on the Second Meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). Geneva: World Health Organization; 2020. Available from: <https://www.who.int/news-room/>

- detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov). (last accessed date: 24th July 2020)
4. World Health Organization. WHO Director-general's Opening Remarks at the Media Briefing on COVID-19. Geneva: World Health Organization; 2020. Available from: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>. (last accessed date: 23rd July 2020) <https://doi.org/10.1093/ww/9780199540884.013.u23682>
 5. Official Site of Sarajevo City. Available from: <https://www.sarajevo.ba/bs/article/5822/stanovnistvo> (Last accessed date: 23rd July 2020).
 6. GIS COVID-19 Data Croatia. Available from: <http://www.gdi-online.maps.arcgis.com/apps/opsdashboard/index.html#/47451c9cab8649c49ebfad8db4f64aec> (Last accessed date: 21st July 2020)
 7. GIS Data Slovenia. Available form: <https://www.gdi ljubljana.maps.arcgis.com/apps/opsdashboard/index.html#/1cf4f90e05984ae5a365f4838f746138> (Last accessed date: 21st July 2020).
 8. GIS Data Serbia. Available from: <https://www.covid-19-srbija-gdisr.hub.arcgis.com> (Last accessed date: 21st July 2020).
 9. Available from: <https://www.worldometers.info/coronavirus/#countries> (Last accessed date: 21st July 2020).
 10. Coronavirus Pandemic Statistics and Research Available from: https://www.ourworldindata.org/coronavirus?fbclid=IwAR0N-V37byOhETU6x-OCYGVkHJPasWZQ_OGeLaOORis1AZPRhTaktWDo6fIU#testing-for-covid-19z (Last accessed date: 21st July 2020).
 11. Park M, Cook AR, Lim JT, Sun Y, Dickens BL. A systematic review of COVID-19 epidemiology based on current evidence. *J Clin Med* 2020;9(4):967. <https://doi.org/10.3390/jcm9040967>.
 12. Ye Q, Wang B, Mao J, Fu J, Shang S, Shu Q, et al. Epidemiological analysis of COVID-19 and practical experience from China. *J Med Virol* 2020;92(7):755-69.
 13. World Health Organization. Serology, Diagnostics and Testing Coronavirus (Covid-19) Update No. 23. Geneva: World Health Organization; 2020
 14. Stanford University Serology. Available from: <https://www.bioengineering.stanford.edu/serologic-testing-sars-cov-2-immunity>. (Last accessed date: 20th July 2020)