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ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

Comparison of Delta and Omicron variant of COVID-19 infection cases in Montenegro

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SUMMARY

Introduction/Objective At the end of 2021, Omicron wave (B.1.1.529) SARS-CoV-2 variant superseded the Delta variant (B.1.617). The main goal of the research is to provide a detailed and comprehensive presentation of data related to people infected with the coronavirus in Montenegro. The specific goal of the research is to determine whether virus mutations influenced the course of the epidemic during its two-year duration.

Methods This is a retrospective study. We used data from the Institute of Public Health of Montenegro. Our sample consisted of 127,134 people who tested positive for Delta or Omicron infection aged 0–100 years, who had a positive PCR test for COVID-19 between August 17, 2021 and April 17, 2022.

Results The respondents aged 40–49 years were taken as a reference group for age. The results showed that the age group from 20 to 29 years old was affected 1.03 times more than the reference group – persons belonging to the age group of 30–39 years were affected 1.07 times more than the reference group. The Central region was taken as the reference group for the region. The results showed that people who live in southern region got sick 1.14 times more often and people who live in northern region got sick 1.20 times less than people from the central region.

Conclusion The biggest predictor that a person would get sick is the age group. Also, the predictor is the region, and in our research, it was southern region.

Keywords: COVID-19; SARS-CoV-2; age; Delta and Omicron strain; Montenegro

INTRODUCTION

At the end of 2020 the Delta variant (B.1.617.2) was discovered in India for the first time. In June 2021, the World Health Organization stated that the Delta would become the most prevalent strain in the world [1]. The SARS-CoV-2 Delta VOC is 40–60% more transmissible than the Alpha (B.1.1.7) [2].

The World Health Organization marked the variant B.1.1.529, commonly known as Omicron, on November 26, 2021 as variant of interest. The Omicron variant is the most divergent strain seen in significant numbers so far during the pandemic, raising concerns that it may be linked to greater transmissibility, lower vaccine efficiency, and an increased risk of reinfection. The Omicron SARS-CoV-2 variation is more transmissible than the Delta variant [3].

The World Health Organization also reported that the Omicron variant has a growth advantage with a doubling time of 2–3 days compared with the Delta variant, which may provide evidence that transmission capacity of the Omicron variant was stronger than Delta [4]. According to the available evidence, the incubation period is shorter for Omicron variant [5].

METHODS

We used data from the Institute of Public Health of Montenegro from the beginning of pandemic until April 17, 2022. Our sample consisted of 127,134 persons who tested positive for Delta or Omicron infection aged 0–100 years who had a positive PCR test for COVID-19 between August 17 and April 17 2022. Period of Delta variant was August 17 until December 21, 2021 and period for Omicron variant was December 22, 2021 until April 17, 2022. In accordance with the Emergency Care Data Set and World Health Organization protocols, a genome sequencing method was performed on samples that were suspicious for the presence of the Delta and Omicron variant, which confirmed the presence of each strain. In relation to the share of positive cases in the number of tested persons, an approximation was made of share of strains. Observation period was between August 17, and April 17, 2022.

In this paper, we used the χ^2 test of independence and logistic regression. The χ^2 test of independence provides information not only on the significance of observed differences, but also on detailed information on exactly which categories account for any differences found. Logistic regression was conducted to assess the impact of multiple factors on the likelihood of contracting COVID-19. The model contains

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three independent categorical variables sex, region, and age. The whole model with all predictors was statistically significant $p < 0.00$. A given set of variables explains 12–17% of the variance. The model correctly classifies 58.7% of all cases. Montenegro is divided into three regions: southern, central, and northern region. For purpose of this paper, we have chosen the central region as reference region. Also, the age group from 40 to 49 years was used as the reference age for the purposes of the paper.

The objective of the research is to determine, on the basis of the available data, how the epidemic in Montenegro moved in relation to virus mutations. In addition, specific goal is to determine how the epidemic moved in relation to Delta and Omicron mutations, which are disease rates in the population with special emphasis on age.

All data are properly named and paper represents analysis of datasets. We had approval from the Institute of Public Health of Montenegro to use the database. Also, corresponding author is a member of the Database team in Institute of Public Health of Montenegro. Thus, the research has been done in accord with the ethical standards of the institution.

RESULTS

During the period in which the Delta strain was dominant, a total of 373,813 cases were tested in Montenegro, with 54,402 new cases and 14.55% share of positive tests. In the period when the Omicron strain was dominant, the number of new cases was 72,732 (25.56%) out of total 284,540 tested (Table 1).

Table 1. Distribution of new cases, number of tested and percentage of positive cases in tested for the Delta/Omicron period

Period	New cases	Tested	%
Delta	54,402	373,813	14.55
Omicron	72,732	284,540	25.56

As shown in Tables 2 and 3, the highest number of new cases was found in the age category 30–39 in Delta strain 9746 (17.91%) as well as in Omicron strain 14,931 (20.53%).

As presented in Table 4, the χ^2 test of independence showed a link between sex and the incidence of Delta strain and Omicron strain. Men were statistically significantly more affected by the Delta strain, and women statistically significantly more by the Omicron strain, C^2 (n = 127,726) = 0.07, p = 0.01 p < 005; fi = 0.07 with a very small influence of sex on getting sick from Delta and Omicron strains.

Table 5 presents an analysis of the association of disease by Delta and Omicron strains by region in Montenegro. The χ^2 test of independence determined relation between regions and incidence of Delta and Omicron strains. The northern region was statistically significantly more affected by Delta strain compared to the central and southern regions, while the southern region was statistically significantly more affected by Omicron strain compared to the central and northern regions, with a very large influence of the region on the incidence of Delta and Omicron strains C^2 (n = 127,726) = 0.51; p = 0.00 p < 0.05, fi = 0.51 (Table 5).

Relation between the age groups and incidence of Delta and Omicron strains was also determined by the χ^2 test of independence. The age group from 20 to 29 years was statistically significantly more affected by the Delta strain compared to the other age groups, while the age group from 30 to 39 years was statistically significantly more

Table 2. Distribution of new cases in relation to age and sex – Delta

Age	Male	%	Female	%	Total	%
0–9	1250	4.98	1193	4.07	2443	4.49
10–19	3258	12.99	3286	11.21	6544	12.03
20–29	3296	13.14	3867	13.19	7163	13.17
30–39	4336	17.29	5410	18.45	9746	17.91
40–49	4033	16.08	5009	17.08	9042	16.62
50–59	3355	13.38	4030	13.74	7385	13.57
60–69	3059	12.20	3450	11.77	6509	11.96
70–79	1693	6.75	2023	6.90	3716	6.83
80–89	641	2.56	893	3.05	1534	2.82
90+	158	0.63	162	0.55	320	0.59
Total	25,079	100%	29,323	100%	54,402	100%

Table 3. Distribution of new cases in relation to age and sex – Omicron

Age	Male	%	Female	%	Total	%
0–9	1515	4.58	1248	3.15	2763	3.80%
10–19	2369	7.17	2427	6.12	4796	6.59%
20–29	4726	14.3	5791	14.6	10,517	14.46%
30–39	6629	20.05	8302	20.93	14,931	20.53%
40–49	5708	17.27	7135	17.98	12,843	17.66%
50–59	4594	13.9	5823	14.68	10,417	14.32%
60–69	4261	12.89	4973	12.53	9234	12.70%
70–79	2193	6.63	2545	6.41	4738	6.51%
80–89	814	2.46	1126	2.84	1940	2.67%
90+	251	0.76	305	0.77	556	0.76%
Total	33,060	100	39,675	100	72,735	100

Table 4. Characteristics of the Delta cohort and Omicron cohort among male and female patients; sex has been associated with both infection risk and severe outcomes of SARS-CoV-2 infections; men were statistically significantly more affected by the Delta strain, and women statistically significantly more by the Omicron strain with a very small influence of sex on getting sick from Delta and Omicron strains

Sex	Delta	Omicron	Total
Male	25,209 (46.14%)	33,235 (45.47%)	58,444 (45.76%)
Female	29,426 (53.86%)	39,856 (54.53%)	69,282 (54.24%)
Total	54,635 (42.77%)	73,091 (57.23%)	127,726 (100%)

p = 0.01, p < 0.05

Table 5. Characteristics of the Delta cohort and Omicron cohort among south, central and north region; the northern region was statistically significantly more affected by Delta strain compared to the central and southern regions, while the southern region was statistically significantly more affected by Omicron strain compared to the central and northern regions, with a very large influence of the region on the incidence of Delta and Omicron strains

Region	Delta	Omicron	Total
South	14,486 (26.71%)	22,123 (30.26%)	36,609 (28.76%)
Central	29,338 (54.11%)	39,345 (53.84%)	68,683 (53.95%)
North	10,395 (19.18%)	11,623 (15.90%)	22,018 (17.29%)
Total	54,219 (42.59%)	73,091 (57.41%)	127,310 (100%)

p = 0.01, p < 0.05

Table 6. Characteristics of the Delta cohort and Omicron cohort among age groups; the age group from 20 to 29 years was statistically significantly more affected by the Delta strain compared to other age groups, while the age group from 30 to 39 years was statistically significantly more affected by the Omicron strain, with a very small influence of sex on the incidence of Delta and Omicron strains Distribution of strains by age

Age	Delta	Omicron	Total
0–9	2437 (4.47%)	2777 (3.82%)	5214 (4.09%)
10–19	6580 (12.08%)	4829 (6.64%)	11,409 (8.97%)
20–29	7228 (13.27%)	10,588 (14.55%)	17,816 (14%)
30–39	9795 (17.98%)	14,992 (20.61%)	24,787 (19.49%)
40–49	9062 (16.63%)	12,971 (17.82%)	21,975 (17.28%)
50–59	7405 (13.6%)	10,464 (14.37%)	17,869 (14.04%)
60–69	6546 (12.01%)	9263 (12.73%)	15,809 (12.44%)
70–79	3721 (6.83%)	4751 (6.52%)	8472 (6.66%)
80–89	1542 (2.83%)	1943 (2.67%)	3485 (2.74%)
90+	167 (0.3%)	200 (0.27%)	367 (0.29%)
Total	54,483 (42.83%)	72,724 (57.17%)	127,203 (100%)

$p = 0.01$, $p < 0.05$

affected by the Omicron strain, with a very small influence of sex on the incidence of Delta and Omicron strains C^2 (n = 127,726) = 0.10; p = 0.00 p < 0.05 f = 0.10 (Table 6).

As a reference group for age, the age of respondents from 40 to 49 years was taken. The results showed that:

- people belonging to the age group from 0 to 9 years old got sick 1.25 times less compared to the reference group,
- people between the ages of 10 and 19 were 1.94 times less likely to get sick compared to the reference group,
- persons belonging to the age group from 20 to 29 years old got sick 1.03 times more than the reference group,
- people who belong to the age group of 30 to 39 years got sick 1.07 times more than the reference group,
- persons belonging to the age group of 60 to 69 years got sick 1.09 times less compared to the reference group,
- persons belonging to the age group of 70 to 79 years got sick 1.10 times less compared to the reference group.

The Central region was taken as the reference group for the region. The results showed that people who belong to the southern region got sick 1.14 times more often than people who belong to the reference group, i.e., the central region and people who belong to the northern region got sick 1.20 times less than people who belong to the reference group, i.e., central region.

Only two independent variables made a unique statistically significant contribution to the model (age and region). Sex did not contribute significantly to the model (Table 7).

Table 7. Logistic regression models parameters of set of predictor variables for COVID-19; only two independent variables made a unique statistically significant contribution to the model (age and region); sex did not contribute significantly to the model

Category	B value	Standard error	Wald test	Degrees of freedom	Significant p	Exp (B)
Sex (1)	0.009	0.011	0.636	1	0.425	1.009
40–49			1221.867	9	0.000	
0–9	-0.223	0.031	51.634	1	0.000	0.800
10–19	-0.663	0.023	798.024	1	0.000	0.515
20–29	0.028	0.021	1.859	1	0.173	1.028
30–39	0.066	0.019	12.236	1	0.000	1.069
50–59	-0.001	0.021	0.004	1	0.947	0.999
60–69	0.009	0.021	0.160	1	0.689	1.009
70–79	-0.088	0.026	11.547	1	0.001	0.916
80–89	-0.101	0.037	7.431	1	0.006	0.904
90+	-0.165	0.106	20.413	1	0.120	0.848
Central region			330.840	2	0.000	
South region	0.133	0.013	100.909	1	0.000	1.143
North region	-0.182	0.016	134.295	1	0.000	0.833
Constant	0.347	0.016	470.842	1	0.000	1.415

Exp (B) – odds ratio

DISCUSION

In a study with 55,269 cases of COVID-19 in Sweden, the results of the logistic regression analysis indicated that the risk of severe disease remained high among unvaccinated, first-time infected patients of both sexes during the Omicron period in the age group 65+, as well as among men in the age group 40–64 years with two or more comorbidities [6]. Our research has shown that women were statistically significantly more affected by the Omicron strain. In retrospective cohort study in England, with laboratory-confirmed SARS-CoV-2 infection conducted between November and January 2022, showed that the adjusted hazard ratio estimates varied with age for all endpoints examined. The adjusted hazard ratio for hospital admission was 1.10 in those younger than 10 years, decreasing to 0.25 in 60–69-year-olds, and then increasing to 0.47 in those aged at least 80 years. From December 15, 2021 to January 17, 2022 outpatient-diagnosed cases with Omicron variant infection (n = 222,688) were concentrated among adults aged 20–39 years and had lower odds of being either very young or very old in comparison to contemporaneously identified individuals with Delta variant infection (n = 23,305). From February 3 to March 17, 2022, among individuals tested as outpatients, BA.2 Omicron sub variant cases (n = 1,905) did not differ from BA.1* sub variant cases (n = 12,756) in demographic or clinical attributes, with the exception that BA.1* detection was more concentrated among individuals aged 20–49 years than BA.2, which was comparatively more common among both children and older adults [7]. Individual-level data on laboratory-confirmed COVID-19 cases resident in England between November 29, 2021, and January 9, 2022, has shown that risk of severe outcomes is substantially lower for Omicron than for Delta, with higher reductions for more severe endpoints and significant variation with age [8]. Retrospective chart reviews with 13 adult emergency departments in academic hospitals in Paris area from November 29,

2021 to January 10, 2022 showed that the median age of analyzed population was 58 years and 49% were women. The proportion of Omicron increased from 1.3% in the first week of inclusion to 86% in the last week. Compared to the Delta variant, patients infected with Omicron were younger and more often female [9]. The observational cohort study in Denmark, with RT-PCR-confirmed cases of SARS-CoV-2 from November 21 and December 19, 2021 has shown significantly lower risk of hospitalization with Omicron infection compared with Delta infection among both vaccinated and unvaccinated individuals, suggesting an inherent reduced severity of Omicron [10]. In the general population infection, the rates are similar between males and females. In previous pandemics, male sex has been associated with worse clinical outcomes [11] In Montenegro, the age group from 20 to 29 years was statistically significantly more affected by the Delta strain compared to other age groups, while the age group from 30 to 39 years was statistically significantly more affected by the Omicron strain, with a very small impact of sex on the incidence of Delta and Omicron strains.

CONCLUSION

During the Delta strain period, the largest number of new cases was in the age category of 40 to 49 years for both sexes, followed by 30 to 39 years of age. In the period of the Omicron strain, the situation is similar, and the largest number of new cases was found in the age category from 30 to 39 followed by the age group 40 to 49 years for both sexes.

Men were statistically significantly more affected by the Delta strain, and women statistically significantly more by the Omicron strain, with a very small influence of sex on the incidence of the Delta and Omicron strains. The northern region was statistically significantly more affected by the Delta strain compared to the central and southern regions, while the southern region was statistically significantly more affected by the Omicron strain compared to the central and northern regions, with a very large influence of the region on the incidence of the Delta and Omicron strains. The age group from 20 to 29 years old was statistically significantly more affected by the Delta strain compared to other age groups, while the age group from 30 to 39 years old was statistically significantly more affected by the Omicron strain, with a very small influence of sex on the incidence of Delta and Omicron strains. The biggest predictor that a person will get sick is the age group. Research showed that related to reference group (40 to 49) age group from 20 to 29 and 30 to 39 years is predictor. Additionally, the predictor is region, and in our research, it was southern region.

Note: The paper is a part of a master thesis of the corresponding author.

Conflict of interest: None declared.

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Поређење случајева заразе сојевима делта и омикрон ковида 19 у Црној Гори

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САЖЕТАК

Увод/Циљ Крајем 2021. варијанта таласа омикрон (*B*.1.1.529) *SARS-CoV*-2 заменила је варијанту делта (*B*.1.617).
Основни циљ истраживања је да пружи детаљан и свеобухватан приказ података који се односе на особе заражене вирусом корона у Црној Гори. Специфични циљ истраживања је да се утврди да ли су мутације вируса утицале на ток епидемије током њеног двогодишњег трајања.

Методе Ово је ретроспективна студија. Користили смо податке Института за јавно здравље Црне Горе. Наш узорак се састојао од 127.134 особе старости од 0 до 100 година које су биле позитивне на делта или омикрон инфекцију и које су имале позитиван *PCR* тест на ковид 19 између 17. августа 2021. и 17. априла 2022.

Резултати Као референтну групу за узраст узети су испитаници старости од 40 до 49 година. Резултати су показали да је старосна група од 20 до 29 година оболела 1,03 пута више од референтне групе – особе које припадају старосној групи од 30 до 39 година оболеле су 1,07 пута више од референтне групе. Централни регион је узет као референтна група за регион. Резултати су показали да су људи који живе у јужном региону оболевали 1,14 пута чешће, а људи који живе у северном региону 1,20 пута мање него људи из централног региона.

Закључак Највећи предиктор да ће се човек разболети је старосна група. Такође, предиктор је регион, а у нашем истраживању јужни регион.

Кључне речи: ковид 19; *SARS-CoV*-2; старост; сојеви делта и омикрон; Црна Гора