THE COVID-19 PANDEMIC IN DIFFERENT COUNTRIES: RUSSIA, BRAZIL AND INDIA

Rocha Ferreira SS[1] ✉, Koreshkova KYu[1], Guduru Y[1], Rocha LS[2], Perminova LA[1]

[1] Immanuel Kant Baltic Federal University, Kaliningrad

[2] State University of Rio de Janeiro (UERJ), Río de Janeiro, Brazil

At the end of December 2019, cases of pneumonia of unknown etiology were registered in China. The cause represented by the novel coronavirus SARS-CoV-2 was established later. The infection has spread rapidly around the world. According to the latest official data, over 531,959,093 cases of the infection and over 6,299,068 confirmed COVID-19-related mortality cases were reported in 215 countries. The study aimed to examine characteristic features of the novel coronavirus pandemic in Russia, Brazil, and India from April 2020 to March 2022. Official statistical data on COVID-19-related morbidity, mortality, and vaccination from the websites of the Russian Federal State Agency for Health and Consumer Rights and Johns Hopkins Institute were collected for every country from April 01, 2020, to March 01, 2022. Out of the three examined countries, the highest incidence and mortality for COVID-19 per one million people were found in Brazil, followed by Russia and India respectively. The level of vaccination was the highest in Brazil (73%). It was followed by India (53%) and Russia (50%). The *Delta* variant of the virus was first identified in India in October 2020. In June of the next year, it accounted for the majority of COVID-19 cases registered in three countries. The same was true for the Omicron variant. Despite the efforts taken within the last two years to contain COVID-19 (development of vaccines, use of other anti-epidemic agents), the coronavirus infection is still of cyclical patterns along with increased morbidity. Based on the obtained data, massive vaccination effectively reduced mortality due to COVID-19 though many new variants occurred.

Keywords: COVID-19, global impact, vaccination, incidence, mortality

✉ **Correspondence should be addressed:** Samantha Dos Santos Rocha Ferreira
ul. A. Nevskogo, 14, г. Kaliningrad, 236016, Russia; samantharocha.ssr@gmail.com

ПАНДЕМИЯ COVID-19 В РАЗНЫХ СТРАНАХ: РОССИИ, БРАЗИЛИИ И ИНДИИ

С. С. Роша Феррейра[1] ✉, К. Ю. Корешкова[1], Я. Гудуру[1], Л. С. Роша[2], Л. А. Перминова[1]

[1] Балтийский федеральный университет им. Иммануила Канта, Калининград

[2] Государственный университет Рио-де-Жанейро (UERJ), Рио-де-Жанейро, Бразилия

В конце декабря 2019 г. в Китае были зарегистрированы случаи пневмонии неизвестной этиологии, позже была установлена причина — новый коронавирус (SARS-CoV-2). Инфекция быстро распространилась по всему миру, по последним официальным данным, зарегистрировано более 531 959 093 случаев инфекции и более 6 299 068 подтвержденных смертей от COVID-19 в 215 странах. Цель исследования — изучить особенности пандемии новой коронавирусной инфекции в России, Бразилии и Индии с апреля 2020 г. по март 2022 г. Собраны официальные статистические данные из веб-сайтов: Роспотребнадзора и Johns Hopkins Institute по числу заболеваемости, летальности и вакцинации от COVID-19 по каждой стране с 01.04.2020 по 01.03.2022. Из трех исследованных стран в Бразилии был самый высокий уровень заболеваемости и самая высокая летальность от COVID-19 на миллион жителей, затем следуют Россия и Индия, соответственно. Уровень вакцинации также был самым высоким в Бразилии — 73%, за ней следует Индия — 53% и Россия — 50%. Вариант *Delta* появился в Индии в октябре 2020 г., а в июне следующего года он уже представлял большинство случаев заражения от COVID-19, зарегистрированных в трех странах. То же самое наблюдалось со штаммом омикрон. Несмотря на усилия, предпринятые в течение последних двух лет для сдерживания пандемии COVID-19: разработки вакцин, использования других противоэпидемических средств, коронавирусная инфекция продолжает демонстрировать свой циклический характер с увеличением заболеваемости. Согласно полученным данным, массовая вакцинация оказалась эффективной в снижении летальности от COVID-19, несмотря на появление новых штаммов.

Ключевые слова: COVID-19, глобальное воздействие, вакцинация, заболеваемость, летальность

✉ **Для корреспонденции:** Саманта дос Сантос Роша Феррейра
ул. А. Невского, д. 14, г. Калининград, 236016, Россия; samantharocha.ssr@gmail.com

At the end of December 2019, the World Health Organization (WHO) was informed about pneumonia cases of unknown etiology, detected in Wuhan City, China. On the 7th of January 2020, a novel coronavirus (temporarily called 2019-nCoV) was identified as the cause of the new infection by the Chinese government. In March 2020, Europe became the epicenter of the rapidly spreading global coronavirus pandemic. By the beginning of April 2022, SARS-CoV-2 infected 531,959,093 people and was the cause of mortality of 6,299,068 people in 215 countries [1].

Coronavirus is a large family of single-stranded enveloped RNA viruses of the *Coronaviridae* family that can cause both a mild respiratory illness and severe pulmonary involvement.

The pandemic launched a global race aimed at virus mapping and vaccine development. In the middle of December 2020, Russia started to vaccinate its people; Brazil and India did the same in January 2021. However, mutation of the virus and formation of new variants have been an important part of the pandemic development for over two years. Thus, a novel Delta variant was identified in India in October 2020 [1–4].

Despite global efforts associated with anti-epidemic activities and massive vaccination campaigns, novel variants of the virus continued to evolve. Omicron was one of the last variants first identified in South Africa in December 2021, rapidly spreading over all the continents [1–2]. The variant had high virulence and involved the pediatric population being less lethal among vaccinated people.

Since the novel coronavirus outbreak, specifics of the epidemic process in various countries were associated with geographical position, climate, social, economic, and demographic factors, and public health system resources [5].

The purpose of this study was to compare COVID-19 morbidity and mortality dynamics from the beginning of the pandemic to the present days taking into account new virus variants (delta and omicron) in the countries located in various world regions such as Russia, Brazil, and India, and analyze vaccination coverage in these countries and its influence on the novel coronavirus infection-associated morbidity and mortality.

MATERIALS AND METHODS

1) Collection of official statistical data on novel coronavirus morbidity and mortality, and COVID-19 vaccination coverage for every country from April 01, 2020, to March 01, 2022, using official data of the Russian Federal State Agency for Health and Consumer Rights and Johns Hopkins Institute.
2) Calculation of COVID-19-related morbidity and mortality values. Statistical processing of the obtained data in *Windows Microsoft Excel 10.*

STUDY RESULTS

The Russian Federation is located in Eastern Europe and Northern Asia. Being the largest country in the world, it is inhabited by 144,1 million people. Brazil with 212.6 million people is a country located in South America. India is a huge country in South Asia inhabited by 1.38 billion people.

In Russia, the first cases of COVID-19 were registered in two citizens of China on January 31, 2020. In Brazil, the first case was reported in a Brazilian citizen who came back from Italy on January 26, 2020. In India, the first case was noted in a girl who came back from Wuhan, China, on January 27, 2020.

The obtained data show that, in the absolute values, the total number of confirmed COVID-19 cases amounted to 16,260,000 people in Russia, with 28,820,000 and 42,940,00 cases found in Brazil and India respectively from April 01, 2020, to March 01, 2022. COVID-19 morbidity data per one million people were calculated for every country. It has been shown that Brazil occupied the first place with the morbidity of 134,671 confirmed cases per one million people followed by Russia and India with 111,421 and 30,815 cases per one million respectively.

Analyzing the morbidity dynamics during the pandemic caused by the novel coronavirus, its cyclicity can be traced (fig. 1). Five main rises have been registered in Russia. They occurred from May to June 2020, from November 2020 to January 2021, from June to August 2021, from October to November 2021, and from January to February 2022. Though Brazil and India are located in different hemispheres, they have similar cyclic forms. Four and three morbidity rises are found in Brazil and India respectively.

In Brazil, the first rise was registered from July to September 2020, during a Brazilian winter. The second rise was noted from January to February 2021 (in summer). The third rise was reported from April to July 2021 (autumn and winter). The fourth rise was from February to March 2022 (in the summer). In India, the first peak of incidence was in the middle of September 2020 (monsoon season), the second peak was from March to June 2021, and the third peak was in February, at the beginning of 2022 (spring).
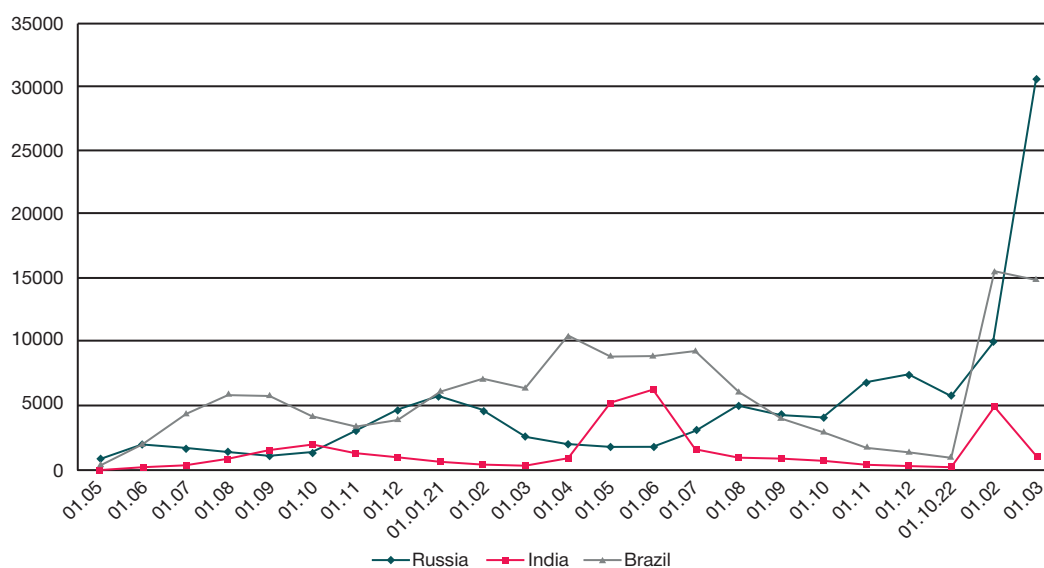

Fig. 1. Analyzing the dynamics of COVID-19 morbidity in Russia (A), Brazil (B) and India (C)
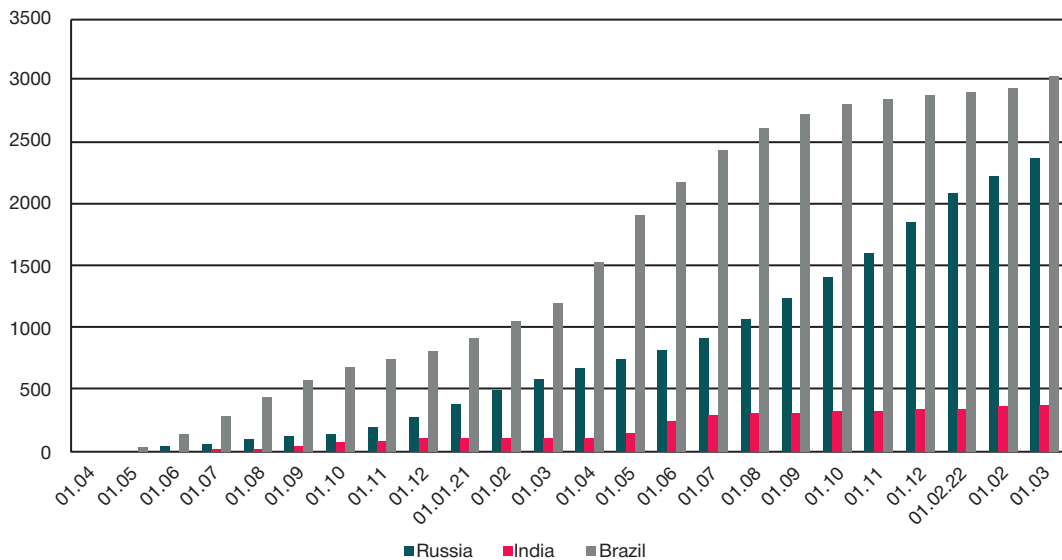
Fig. 2. COVID-19-related mortality in Russia, India, and Brazil from April 01, 2020, to March 01, 2022 (per million people)
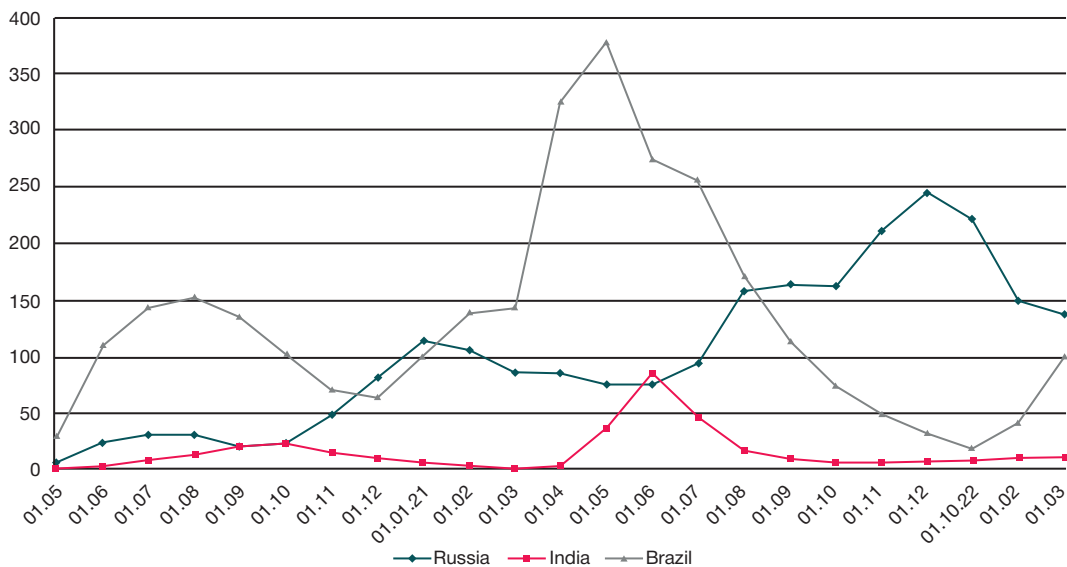

Fig. 3. Analyzing the dynamics of COVID-9-related mortality in Russia, Brazil and India from May 01, 2020, to March 01, 2022

A comparative analysis of the confirmed mortality rate due to the novel coronavirus was performed for the analyzed period. According to the obtained absolute values, India occupies the leading position among the analyzed countries with 514,246 COVID-19-related cases of death being confirmed, whereas in Brazil and Russia they amounted to 649,922 and 345,427 cases respectively. However, analysis of relative mortality rates per one million people has shown that the highest mortality value was reported in Brazil (3,037 cases per 1 million) followed by Russia and India (with 2,367 and 369 respectively) (fig. 2). Within the examined period, the highest percentage of lethal COVID-19-related outcomes (2.32%) was recorded in Brazil and followed by the Russian Federation (2.12%) and India (1.2%).

In Brazil, the mortality rate for people with novel coronavirus has two peaks: from July to September 2020 (first peak) and from April to May 2021 (second peak). In Russia, we have several periods of COVID-19-related mortality rise: in May-June 2020 (first peak), from December 2020 to January 2021 (second peak), from July to September 2021 (third peak), and from October to December 2021 (fourth peak) (fig. 3).

In India, the first mortality rise was in October 2020, the second one occurred from May to July 2021(fig. 3).

A reduced mortality rate was also found in Brazil from June 2021. In January 2022, the most minimal values were reported. Similar data were observed in India with decreased mortality rate from July 2021 and the lowest values in October 2021 (fig. 3).

To protect people from COVID-19, the studied countries used vaccines with different mechanisms of action. They used *Covaxin* (inactivated vaccine) in India and Sputnik V and Sputnik Light (vector vaccine) in Russia. In Brazil, Coronavac (inactivated vaccine); AstraZeneca and Johnson & Johnson (vector vaccines), and BioNTech Pfizer (mRNA vaccines) were utilized. Vaccination coverage was the highest in Brazil (73%), followed by India (53%) and Russia (50%).

Vaccination in Russia started at the beginning of December 2020. In the majority of cases, they used Sputnik V and EpiVacCorona vaccines. After the start of the vaccination campaign, military men, doctors, teachers, and social workers were given Sputnik V. Small lots of CoviVac vaccine were distributed from April 2021. Sputnik Light went into circulation on June 25, 2021 (fig. 4A).
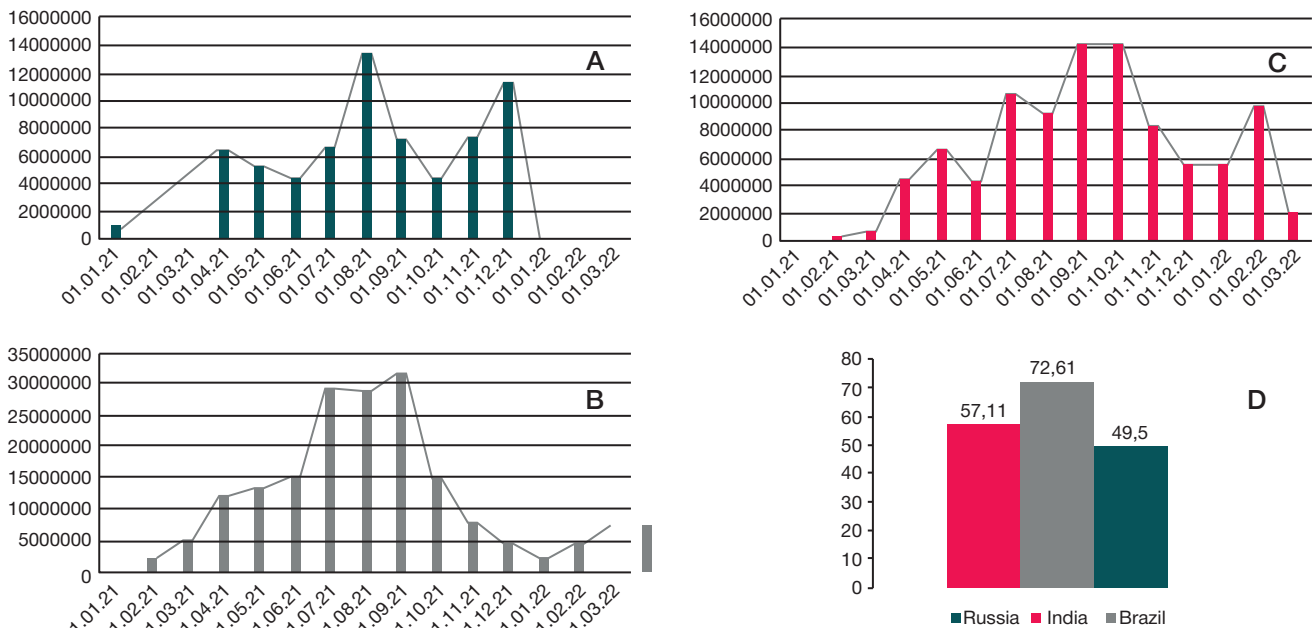
Fig. 4. Dynamics of COVID-19 vaccination from January 2021 to March 2022 in Russia (A), Brazil (B) and India (C).
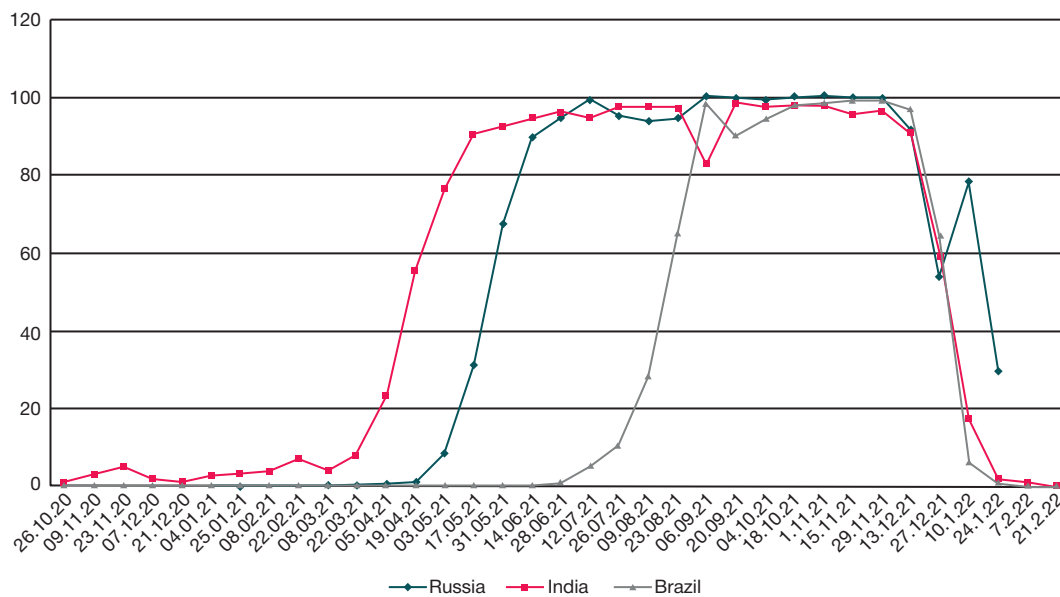Percentage of the population vaccinated with at least one dose of COVID-19 vaccine available in the country (D)

Fig. 5. The share of Delta variant among all the confirmed COVID cases in Russia, India and Brazil from October 26, 2020, to February 21, 2022

In Brazil, they started vaccination with *Coronavac* in January 2021. During the first months, only medical professionals and elderly people were vaccinated. As soon as the Brazilian government obtained more vaccine doses from other manufacturers, the rest part of the population was vaccinated by the age groups (from the eldest to the youngest ones). The vaccination peak is from July to September 2021. Currently, the population is being revaccinated already (third dose) and the main vaccines used for now are *Pfizer, AstraZeneca, and Johnson and Johnson* (fig. 4B).

In India, the vaccination campaign started in February 2021. Medical professionals, public officers, and frontline employees were the first ones vaccinated in India. The majority of the population was vaccinated in September and October 2021. The first vaccines used in India were *CoviShield* and *Covaxin*. It is lately recommended to obtain a booster vaccine dose there (fig. 4C).

In Brazil and India, the dynamics of vaccination have a similar pattern. This emphasizes gradually increased vaccination coverage with the highest peak of the obtained doses in the middle of 2021 when vaccination with the second dose has already begun and when widespread vaccination has already been available to the entire population, and not just to the groups of risk. When assessing vaccination development in Russia, variation in the number of applied doses with their rise in April, August, and December 2021 has been observed (fig. 4D).

The first cases of the Delta variant infection were first identified in India. It all began in October 2020 with the peak being reached by April 2021. Decreased incidence of the Delta variant was for the first time reported in December 2021, whereas the lowest values were registered in February 2022.

In Russia, the first cases of the Delta variant were reported in the middle of April 2021 (fig. 5). The maximum incidence was
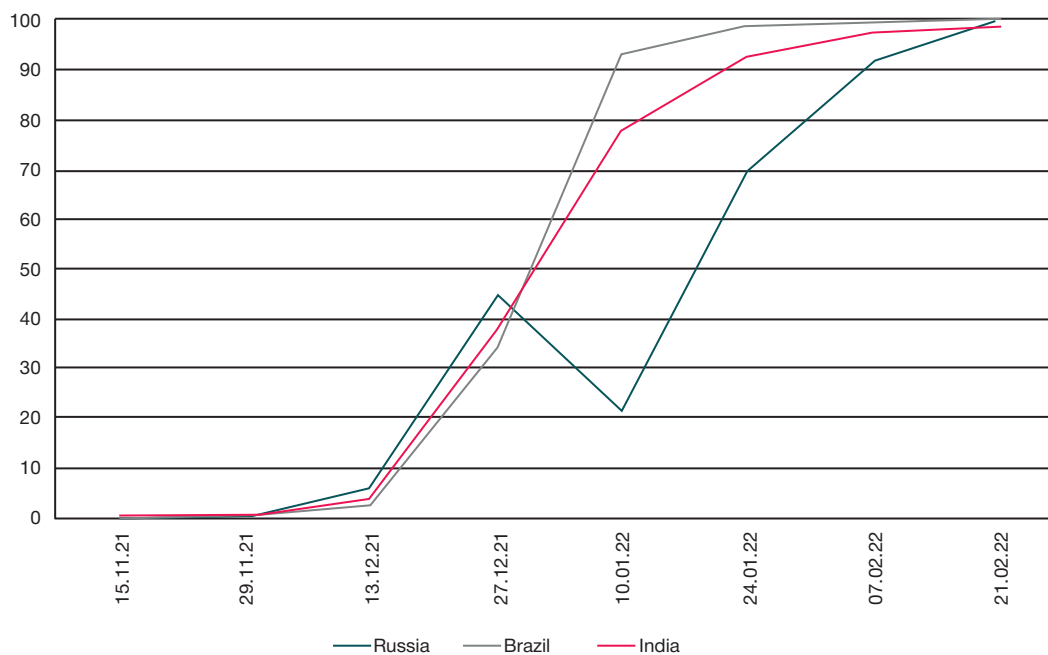
Fig. 6. The share of the Omicron variant among all confirmed cases of COVID in the studied countries from November 15, 2021, to February 21, 2022

reached at the end of June 2021, with a higher peak being found in Russia than in Brazil and India. A steep decline in cases of the Delta infection was seen from the end of November. Another rise was reported at the beginning of January, but by the end of the month, the morbidity reduced. The lowest values were found in February 2022.

In Brazil, the first cases of the COVID-19 delta variant infection were observed at the end of June 2021. It reached the maximum in September 2021 and accounted for the largest share of all COVID-19 cases in the country. In December 2021, the number of cases dropped with the level of infection being the lowest in January 2022 (fig. 5).

The Omicron variant was first detected in South Africa in November 2021. During this month, the highest incidence rates were identified in Russia as compared with other countries. The new peak was found at the end of January 2022. In India, the first cases of the Omicron variant were first registered in November 2021. The infection rate with the Omicron variant reached its maximum in January-February 2022 (fig. 6).

In December 2021, the lowest infection level was found in Brazil. However, in January 2022 Brazil came in first place by several new cases associated with the Omicron variant.

Almost 100% of the registered cases in the studied countries are represented by this variant, as shown in March 2022 (fig. 6).

DISCUSSION OF RESULTS

The COVID-19 pandemic is a global healthcare concern with certain differences in the dynamics of the epidemic process for different countries. The BRICS club is a political and economic group of countries (Brazil, Russia, India, China, and South Africa) with rapidly growing economies amounting to almost half of the world population. As of April 30, the number of SARS-CoV-2-infected in the BRICS countries reached 39.77 million, accounting for over a quarter (26.3%) of the worldwide total [6].

The greatest level of the relative incidence of the novel coronavirus infection is registered in Brazil. Based on the obtained data, we differentiated between four cycles of

rise in the number of registered COVID-19 cases in Brazil (July-September 20; January-February 21; April-July 21; February-March 22). Russia with five cycles of rise in the incidence of COVID-19 (May-June 20; November-January 21; June-August 21; October-November 21; January-February 22) is in the second place by a relative number of incidences; the third place is occupied by India with three peaks of incidence (September 20; March-June 21; February-March 22). Similar cyclic processes were observed in India and Brazil. It was quite opposite for Russia. This can be explained by a similar climate in India and Brazil.

Zhu et al. [6] estimated the COVID-19 pandemic in the BRICS countries and showed that the population density correlates with the daily gain of new COVID-19 cases. This is how our data are confirmed. Moreover, social, economic, and demographic factors, health and resource vulnerability, and demographic and political measures were associated with the development of the COVID-19 pandemic.

Rocha et al. [7] have found that the initial spread of COVID-19 in the country was more influenced by the models of social and economic vulnerability than by the age structure of the population and the incidence of available chronic diseases. This is confirmed by data obtained during our research where India and Brazil had higher morbidity and mortality as compared to Russia.

During the first wave, the basic increase in the COVID-19 incidence in Brazil and India was reported in the summer and autumn of 2020. A maximum number of new COVID-19 cases was observed at the end of July in Brazil and in September in India [5]. In Russia, the first maximum incidence figures were registered in May 2020. The second maximum rise was reported in December 2020 [8], when the incidence rate in Brazil and India began to decline [5]. The presented data correlated with the results obtained in our research work (fig. 1).

The greatest level of COVID-9-related morbidity was registered in Brazil (July-September 20; April-March 21), the second position was occupied by Russia (May-June 20; December 20-January 21; July — September 21; October — November 21), the third position was occupied by India (October 20; May-July 21). According to the obtained results, it can be

noted that Brazil and India have two peaks of mortality rise with the second peak being higher. The fact can be possibly related to occurrence of new variants of coronavirus, which are more contagious and highly virulent. This is also supported by the disease dynamics, which increased in the both countries during the same period.

Tavilani A. et al. [9] demonstrated that Asians, Latinos, and Africans are more subjected to the risk for COVID-19 infection as compared with the Europeans, with the COVID-19 mortality rate being 4.2 times higher among black men and women.

The novel coronavirus mortality dynamics in Russia have four peaks. Every peak was higher than the previous one, which can be associated with the novel variants of coronavirus and lower levels of vaccination as compared with other countries.

Thus, we can conclude the protective effect of the vaccination. Though new variants emerged, the vaccination reduces mortality, just like it was in Brazil and India, where a number of lethal outcomes dropped below the values at the beginning of the pandemic. The conclusions can be confirmed during the analysis of vaccination development in the countries, as a significant decrease in mortality was demonstrated within several months following the highest vaccination level in Brazil and India.

Boguslansky DV et al. interviewed 5,822 Russian citizens from 85 regions of Russia and demonstrated that 42.15% of them had doubts the vaccination. Only 37.82% of them had concerns about quality, whereas all the others were more worried about the social aspect, conspiracy theory, and policy of QR-code checking [10]. In fig. 4, which shows the dynamics of vaccination development in Russia, the variations that demonstrate the low level of population compliance and the importance of state measures aimed at the rise in awareness can be observed. This could be the reason for the growing level of vaccination observed during some periods.

In the global study, Sallam Malik et al. [11] assessed the COVID-19 vaccine and showed that the percentage of those willing to be vaccinated in India varied from 78.6 to 83.6% in the period from June 2020 to March 2021 in various studies. The same study shows that the acceptance value in Russia amounted to 30.4% from November to December 2020. Later studies confirmed the result. Urrunaga-Pastor et al. assessed vaccination in Latin America and showed that the level of vaccine acceptance was 83% among 162,763 Brazilian subjects [12].

The study recently published by Shkoda AS et al. in June 2022 suggests that Sputnik V and Sputnik Light effectively reduced the risk of COVID-19 hospitalization when infected with the Omicron variant. A reduction in COVID-19 severity was observed as well [13].

In the attempt to explain the possible successful vaccination in Brazil, we can single out its success story with the national plan of vaccination, where 75% of the used vaccines are manufactured in Brazil and can be obtained by everyone. According to the Ministry of Health of Brazil, 38,000 vaccination rooms were opened in 5,500 municipalities, whereas during the COVID-19 vaccination campaign, there were 50,000 rooms with 114,101 medical professionals being involved [14].

Moreover, it should be noted that Brazil concluded a contract for vaccine purchase with COVAX as a self-financing agent and that the Federal Government of Brazil supplied its population with an access to vaccines within a shorter period of time, and that vaccination campaigns were widely advertised in mass media [14].

At the same time, the study by Briko NI et al. [15] has shown that the level of vaccination among Russian medical professionals was 35%, being higher among doctors than among nurses. The largest concerns were associated with the safety of vaccines and the scarcity of studies. The vaccination advertising rate among professionals was 29.4%. It again confirms the importance of the involvement of medical professionals in the vaccination campaign in order to make it successful.

The conducted studies had certain limitations, such as difficulty in obtaining similar data from three studied countries to perform an objective comparison. Moreover, some data for certain periods were not available on the visited websites, justifying the lack of data in some figures. We would like to emphasize again that it is important to collect statistical data, especially in medicine, making it possible to analyze the taken measures along with the effectiveness of the used prevention and plan the future measures.

CONCLUSIONS

In spite of the efforts taken within the last two years to contain the COVID-19 pandemic, developments, and the use of vaccines against the novel coronavirus infection, COVID-19 is still showing cyclical patterns along with increased morbidity. According to the obtained data, massive vaccination effectively reduced mortality due to COVID-19 in spite of the occurrence of many new variants leading to the increased number of infected people in the examined countries.

Subsequent monitoring of the dynamics of the epidemic process is required taking into account novel variants of coronavirus to improve anti-epidemic activities and resolve the issue of the necessary development of novel vaccines to prevent new variants of SARS-CoV-2 and reduce the related mortality. Moreover, longer studies have to be conducted to detect the effectiveness of the existing vaccines against the newest variants.

References

1. Resursnyy tsentr po koronavirusu Dzhona Khopkinsa. Available from URL: https://coronavirus.jhu.edu/map.html Russian.
2. Our World in Data — Nekommercheskiy elektronnyy proyekt, publikuyushchiy v otkrytom dostupe dannyye o global'nykh problemakh chelovechestva. Available from URL: https://ourworldindata.org/coronavirus Russian.
3. Federal'naya sluzhba po nadzoru v sfere zashchity prav potrebiteley i blagopoluchiya cheloveka. Available from URL: https://rospotrebnadzor.ru/ Russian.
4. Ofitsial'nyy sayt Vsemirnoy organizatsii zdravookhraneniya. Razdel informatsii i rekomendatsiy VOZ o koronavirusnoy infektsii COVID-19.Available from URL: https://www.who.int/ Russian.
5. Bavrina AP, Saperkin NV, Drugova OV, et al. Sravnitel'naya kharakteristika ocherednogo pod"yema zabolevayemosti COVID-19 v razlichnykh regionakh mira. Epidemiologiya i vaktsinoprofilaktika. 2021; 20 (4): 89–102. https://doi:10.31631/2073–3046–2021–20–4–89–102. Russian.
6. Zhu J, Yan W, Zhu L, Liu J. COVID-19 pandemic in BRICS countries and its association with socio-economic and demographic characteristics, health vulnerability, resources, and policy response. Infect Dis Poverty. 2021 Jul 8; 10 (1): 97. DOI: 10.1186/s40249–021–00881-w.
7. Rocha R, Atun R, Massuda A, Rache B, Spinola P, Nunes L, et al. Effect of socioeconomic inequalities and vulnerabilities on health-system preparedness and response to COVID-19 in Brazil: a

comprehensive analysis. Lancet Glob Health. 2021 DOI: 10.1016/S2214–109X(21)00081–4.

8. Karpova LS, Stolyarov KA, Popovtseva NM, et al. Sravneniye pervykh trekh voln pandemii COVID-19 v Rossii (2020–2021 gg.). Epidemiologiya i vaktsinoprofilaktika. 2022; 21 (2): 4–16. https://doi.org/10.31631/2073–3046–2022–21–2–4–16 Russian.

9. Tavilani A, Abbasi E, Kian Ara F, Darini A, Asefy Z. COVID-19 vaccines: Current evidence and considerations. Metabol Open. 2021 Dec; 12: 100124. doi: 10.1016/j.metop.2021.100124. Epub 2021 Sep 11. PMID: 34541483; PMCID: PMC8433053.

10. Boguslavsky DV, Sharova NP, Sharov KS. Public Policy Measures to Increase Anti-SARS-CoV-2 Vaccination Rate in Russia. Int J Environ Res Public Health. 2022 Mar 13; 19 (6): 3387. doi: 10.3390/ijerph19063387. PMID: 35329076; PMCID: PMC8955973.

11. Sallam M, Al-Sanafi M, Sallam M. A Global Map of COVID-19 Vaccine Acceptance Rates per Country: An Updated Concise Narrative Review. J Multidiscip Healthc. 2022 Jan 11; 15: 21–45. DOI: 10.2147/JMDH.S347669. PMID: 35046661; PMCID: PMC8760993.

12. Urrunaga-Pastor D, Bendezu-Quispe G, Herrera-Añazco P, et al. Cross-sectional analysis of COVID-19 vaccine intention, perceptions and hesitancy across Latin America and the Caribbean. Travel Med Infect Dis. 2021; 41: 102059. DOI: 10.1016/j.tmaid.2021.102059.

13. Shkoda AS, Gushchin VA, Ogarkova DA, Stavitskaya SV, Orlova OE, Kuznetsova NA, Keruntu EN, Pochtovyi AA, Pukhov AV, Kleymenov DA, Krzhanovsky VG, Vasina DV, Shkuratova NV, Shidlovskaya EV, Gorbunov AL, Kustova DD, Mazurina EA, Kozlova SR, Soboleva AV, Grigoriev IV, Pankratyeva LL, Odintsova AS, Belyaeva ED, Bessonova AA, Vasilchenko LA, Lupu IP, Adgamov RR, Tkachuk AP, Tokarskaya EA, Logunov DY, Gintsburg AL. Sputnik V Effectiveness against Hospitalization with COVID-19 during Omicron Dominance. Vaccines (Basel). 2022 Jun 13; 10 (6): 938. DOI: 10.3390/vaccines10060938. PMID: 35746546; PMCID: PMC9227631.

14. Fonseca EMD, Shadlen KC, Bastos FI. The politics of COVID-19 vaccination in middle-income countries: Lessons from Brazil. Soc Sci Med. 2021 Jul; 281: 114093. DOI: 10.1016/j.socscimed.2021.114093. Epub 2021 Jun 2. PMID: 34144480; PMCID: PMC9188662.

15. Briko NI, Korshunov VA, Mindlina AY, Polibin RV, Antipov MO, Brazhnikov AI, Vyazovichenko YE, Glushkova EV, Lomonosov KS, Lomonosova AV, Lopukhov PD, Pozdnyakov AA, Saltykova TS, Torchinsky NV, Tsapkova NN, Chernyavskaya OP, Shamis AV. Healthcare Workers' Acceptance of COVID-19 Vaccination in Russia. Int J Environ Res Public Health. 2022 Mar 31; 19 (7): 4136. DOI: 10.3390/ijerph19074136. PMID: 35409818; PMCID: PMC8998926.

Литература

1. Ресурсный центр по коронавирусу Джона Хопкинса. Режим доступа: [Электронный ресурс]. URL: https://coronavirus.jhu.edu/map.html

2. Our World in Data — Некоммерческий электронный проект, публикующий в открытом доступе данные о глобальных проблемах человечества. Режим доступа: [Электронный ресурс]. URL: https://ourworldindata.org/coronavirus

3. Федеральная служба по надзору в сфере защиты прав потребителей и благополучия человека. Режим доступа: [Электронный ресурс]. URL: https://rospotrebnadzor.ru/

4. Официальный сайт Всемирной организации здравоохранения. Раздел информации и рекомендаций ВОЗ о коронавирусной инфекции COVID-19. Режим доступа: [Электронный ресурс]. URL: https://www.who.int/

5. Баврина А. П., Саперкин Н. В., Другова О. В. и др. Сравнительная характеристика очередного подъема заболеваемости COVID-19 в различных регионах мира. Эпидемиология и вакцинопрофилактика. 2021; 20 (4): 89–102. https:// doi:10.31631/2073–3046–2021–20–4–89–102.

6. Zhu J, Yan W, Zhu L, Liu J. COVID-19 pandemic in BRICS countries and its association with socio-economic and demographic characteristics, health vulnerability, resources, and policy response. Infect Dis Poverty. 2021 Jul 8; 10 (1): 97. DOI: 10.1186/s40249–021–00881-w.

7. Rocha R, Atun R, Massuda A, Rache B, Spinola P, Nunes L, et al. Effect of socioeconomic inequalities and vulnerabilities on health-system preparedness and response to COVID-19 in Brazil: a comprehensive analysis. Lancet Glob Health. 2021 DOI: 10.1016/S2214–109X(21)00081–4.

8. Карпова Л. С., Столяров К. А., Поповцева Н. М. и др. Сравнение первых трех волн пандемии COVID-19 в России (2020–2021 гг.). Эпидемиология и вакцинопрофилактика. 2022; 21 (2): 4–16. https://doi.org/10.31631/2073–3046–2022–21–2–4–16

9. Tavilani A, Abbasi E, Kian Ara F, Darini A, Asefy Z. COVID-19 vaccines: Current evidence and considerations. Metabol Open. 2021 Dec; 12: 100124. DOI: 10.1016/j.metop.2021.100124. Epub 2021 Sep 11. PMID: 34541483; PMCID: PMC8433053.

10. Boguslavsky DV, Sharova NP, Sharov KS. Public Policy Measures to Increase Anti-SARS-CoV-2 Vaccination Rate in Russia. Int J Environ Res Public Health. 2022 Mar 13; 19 (6): 3387. DOI: 10.3390/ijerph19063387. PMID: 35329076; PMCID: PMC8955973.

11. Sallam M, Al-Sanafi M, Sallam M. A Global Map of COVID-19 Vaccine Acceptance Rates per Country: An Updated Concise Narrative Review. J Multidiscip Healthc. 2022 Jan 11; 15: 21–45. DOI: 10.2147/JMDH.S347669. PMID: 35046661; PMCID: PMC8760993.

12. Urrunaga-Pastor D, Bendezu-Quispe G, Herrera-Añazco P, et al. Cross-sectional analysis of COVID-19 vaccine intention, perceptions and hesitancy across Latin America and the Caribbean. Travel Med Infect Dis. 2021; 41: 102059. DOI: 10.1016/j.tmaid.2021.102059.

13. Shkoda AS, Gushchin VA, Ogarkova DA, Stavitskaya SV, Orlova OE, Kuznetsova NA, Keruntu EN, Pochtovyi AA, Pukhov AV, Kleymenov DA, Krzhanovsky VG, Vasina DV, Shkuratova NV, Shidlovskaya EV, Gorbunov AL, Kustova DD, Mazurina EA, Kozlova SR, Soboleva AV, Grigoriev IV, Pankratyeva LL, Odintsova AS, Belyaeva ED, Bessonova AA, Vasilchenko LA, Lupu IP, Adgamov RR, Tkachuk AP, Tokarskaya EA, Logunov DY, Gintsburg AL. Sputnik V Effectiveness against Hospitalization with COVID-19 during Omicron Dominance. Vaccines (Basel). 2022 Jun 13; 10 (6): 938. DOI: 10.3390/vaccines10060938. PMID: 35746546; PMCID: PMC9227631.

14. Fonseca EMD, Shadlen KC, Bastos FI. The politics of COVID-19 vaccination in middle-income countries: Lessons from Brazil. Soc Sci Med. 2021 Jul; 281: 114093. DOI: 10.1016/j.socscimed.2021.114093. Epub 2021 Jun 2. PMID: 34144480; PMCID: PMC9188662.

15. Briko NI, Korshunov VA, Mindlina AY, Polibin RV, Antipov MO, Brazhnikov AI, Vyazovichenko YE, Glushkova EV, Lomonosov KS, Lomonosova AV, Lopukhov PD, Pozdnyakov AA, Saltykova TS, Torchinsky NV, Tsapkova NN, Chernyavskaya OP, Shamis AV. Healthcare Workers' Acceptance of COVID-19 Vaccination in Russia. Int J Environ Res Public Health. 2022 Mar 31; 19 (7): 4136. DOI: 10.3390/ijerph19074136. PMID: 35409818; PMCID: PMC8998926.