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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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FEATURES OF THE CLINICAL COURSE OF CORONAVIRUS INFECTION IN NEWBORN CHILDREN

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Abstract.

The article analyzes the prevalence of coronavirus infection in newborns in the Republic of Kazakhstan from the pandemic outbreak till April 2022. The article provides the dynamics of the number of newborns with positive SARS-CoV-2 tests in the reporting period, describes the specifics of the course of coronavirus infection in newborns depending on the neonatal gestational age, and reports the immediate outcomes.

Key words. Newborn, coronavirus infection, COVID-19 pandemic, SARS-CoV-2 RNA, neonatal period.

Introduction.

An outbreak of coronavirus infectious disease in 2019 (COVID-19) was declared by the World Health Organization a health emergency with possible negative consequences for pregnant women and their newborns [1]. Currently, there are an increasing number of publications and systematic reviews about neonatal and pediatric patients with SARS-CoV-2 [2,3]. Several studies have shown that a severe course of the disease in pregnant women increases the risk of complications such as premature birth, fetal malformations, intrauterine fetal development delay, and stillbirth [4-6]. Considering the coagulopathy observed in patients with COVID-19, these complications may result from impaired fetoplacental perfusion and thrombotic changes [5,7]. Dong Y. et al. note that newborns and children in the first year of life have a higher likelihood of severe SARS-CoV-2 disease than elder children [8]. In their studies, Malik S. et al. (2021) demonstrate a higher risk of adverse outcomes, such as neonatal sepsis and mortality, in infected newborns with SARS-CoV-2 than in uninfected newborns. The authors also claim the risk of SARS-CoV-2 infection in 6.3% of infants born to mothers with COVID-19 [9].

However, other researchers argue that, in most cases, COVID-19 during pregnancy does not affect the newborn's health [10,11]. Current literature data suggest that children are less exposed to coronavirus infection than adults [12,13]. In addition, it was noted that children had a milder course of the disease and were much less likely to suffer complications and adverse outcomes than adults [14-18]. In newborns, the likelihood of vertical (intrauterine) transmission is still assumed [19,20], but the available evidence to support this hypothesis is insufficient [21,22]. Thus, our review of the world literature shows the inconsistency of data regarding the impact of coronavirus infection on the health of newborns and young children. This paper analyzes the monitoring data for coronavirus infection in newborns in Kazakhstan since the outbreak of the COVID-19 pandemic.

The purpose was to study the prevalence of coronavirus infection in newborns in the Republic of Kazakhstan (RK) and the specifics of its clinical course.

Materials and Methods.

We conducted a retrospective analysis of the medical records of 565 newborn children (form 097u, form 003u) who were in the isolation wards of maternity institutions and in infectious hospitals in 17 regions of Kazakhstan with positive results of PCR studies for SARS-CoV-2 (smear from the nasopharyngeal or oropharyngeal mucosa). The management of newborns with suspected or confirmed COVID-19 was carried out in accordance with the algorithm of actions at the birth of a newborn from a mother with suspected or confirmed COVID-19 (clinical protocol No. 117 of October 16, 2020, approved by the Joint Commission on the Quality of Medical Services of the Ministry of Health of the Republic of Kazakhstan). In accordance with this algorithm, newborns born in maternity hospitals of the republic from mothers with suspected or confirmed COVID-19 underwent mandatory PCR testing for SARS-CoV-2 virus RNA (smear from the nasopharyngeal or oropharyngeal mucosa) immediately after birth.

Newborns admitted from home to an infectious hospital with suspected COVID-19 were given a PCR test for SARS-Cov-2 RNA (smear from the nasopharyngeal or oropharyngeal mucosa) on the day of hospitalization.

The statistical processing was made using a Pentium IV PC with MS Excel 2013 and IBM SPSS Statistics 23 software package. The arithmetic mean and standard deviation were used to describe the normal population. The student's criterion was used to test the mean difference for two groups (main and control). The error control was ensured by data collection.

Standard methods of variation statistics used included the calculation of mean values (M), mean errors for absolute and relative values (m), and statistical significance in comparison between groups (p).

Results.

Overall, coronavirus was confirmed in 565 newborns from March 2020 to April 2022 (Table 1).

Table 1 shows an upward tendency in coronavirus incidence in newborns.

Table 2 provides the gender structure of SARS-Cov-2 infected newborns.

No statistically significant gender differences in SARS-CoV-2 infected newborns were noted from March 2020 to April 2022 (Table 2). In 2020, 426,824 children were born in Kazakhstan.

Table 1. *Number of newborns with coronavirus infection registered from March 2020 to April 2022.*

Years	Abs.	M±m%
2020	135	24.0±1.8
2021	268	47.4±2.1
2022 (January-April)	162	28.7±1.9
Total	565	100.0

Table 2. *Gender distribution of newborns with coronavirus infection.*

Years/gender	Males (n=306)		Females (n=258)		p-value
	Abs.	M±m%	Abs.	M±m%	
2020	72	23.5±2.8	63	24.4±2.7	>0.05
2021	148	48.5±2.8	120	46.5±3.1	>0.05
2022 (January-April)	87	28.4±1.9	75	29.1±2.8	>0.05
Note: p >0.05 – no statistical significance between the indicators of compared groups was registered					

Table 3. *Distribution of newborns with SARS-CoV-2, by gestational age.*

Years/ gestational age	Full-term newborns (n=538)		Preterm newborns (n=27)		Total	p
	Abs.	M±m%	Abs.	M±m%		
2020	133	98.5±8.4	2	1.5±0.01	135	<0.01
2021	248	92.5±5.6	20	7.5±0.19	268	<0.01
2022	157	96.9±5.7	5	3.1±0.04	162	<0.01
Note: p < 0,01 – the significance of differences between the indicators of compared groups from the beginning of the pandemic till today						

All infants born from mothers with confirmed COVID-19 underwent PCR examination for SARS-Cov-2 RNA by nasopharyngeal or oropharyngeal swab during Day 1 of life. The newborns suspected of COVID-19 and admitted to an infectious hospital from home underwent PCR examination on admission (Figure 1).

Figure 1 shows the COVID-19 prevalence in newborns by regions of the RK in 2020-2021. In 2020, the number of newborns registered with SARS-CoV-2 was the highest in the North Kazakhstan Region – 33 (24.4%), followed by the city of Nur-Sultan – 24 (17.8%). The prevalence of SARS-CoV-2 infection was low in Almaty Region – 10 (7.4%) and Karaganda Region -10 (7.4%), as well as in Almaty city, East Kazakhstan, and Pavlodar Regions – 8 patients each (6%), Turkestan and Kyzylorda Regions – 7 (5.2%), West Kazakhstan Region – 6 (4.4%), Qostanay Region – 3 (2.2%), and Mangystau and Aktobe Regions – 2 cases each (1.6%). The SARS-CoV-2 prevalence was the lowest in the city of Shymkent, Akmola, and Zhambyl Regions – 1 case each (0.74%).

The picture slightly changed in 2021 (figure 2). The SARS-CoV-2 prevalence in newborns was the highest in the cities of Almaty – 68 (25.4%), Nur-Sultan – 73 (18.2%), and Shymkent – 22 (8.2%). Low prevalence of SARS-CoV-2 infection among newborns was registered in Karaganda – 21 (7.8%), Pavlodar – 16 (6%), North Kazakhstan – 16 (6%), Aktobe – 11 (4.1%), Zhambyl – 11 (4.1%), Qostanay – 7 (2.6%), Akmola – 6 (2.2%), and Kyzylorda – 6 (2.2%) Regions. SARS-CoV-2 was very rare in newborns of West Kazakhstan – 5 (1.9%), Mangystau – 4 (1.5%), and Turkestan – 3 (1.1%) Regions. Only one newborn with COVID (0.4%) was registered in Almaty, East Kazakhstan, and Atyrau Regions each.

Figure 3 shows the number of newborns with positive SARS-Cov-2 PCR by regions of Kazakhstan in January-April 2022.

As shown in Figure 3, in 2022, most newborns with a positive SARS-CoV-2 PCR test were registered in the cities of Nur-Sultan – 37 (23%) and Almaty – 26 (16.1%), and Pavlodar Region – 22 (13.7%), followed by Karaganda Region – 18 (11.2%). Fewer children with SARS-CoV-2 were registered in Kyzylorda – 13 (8.1%), Zhambyl – 10 (6.2%), Qostanay – 10 (6.2%), Aktobe – 6 (3.7%), Atyrau – 4 (2.5%), and North Kazakhstan – 3 (1.9%) Regions, and the city of Shymkent – 3 (1.9%). Only 2 (1.2%) patients with SARS-CoV-2 were recorded in Turkestan, West Kazakhstan, Almaty, and Mangystau Regions each. Only 1 (0.62%) newborn with COVID was registered in the Akmola Region, and no cases in the East Kazakhstan Region.

According to our data, more newborns with COVID were registered in big cities (Almaty and Nur-Sultan). The number of newborns with a positive SARS-CoV-2 PCR was twice higher in 2021 compared to 2020. From January to April 2022, the COVID incidence in newborns has also increased.

The SARS-CoV-2 incidence by month in the study period is presented in Figures 4-6.

In 2020, most COVID cases in newborns were recorded in July (34%), less – in June (26%), and November (16%).

A similar pattern was observed in 2021. In newborns, the highest COVID incidence was recorded in summer, in July (27.2%) and August (26.1%).

During four months of 2022, COVID frequency was high in wintertime (January-February), possibly due to a high prevalence of the Omicron strain in Kazakhstan.

The number of infected newborns depending on gestational age is shown in Table 3.

According to Table 3, the number of full-term infants with COVID (95.2%) in the study period significantly exceeded the number of preterm births (4.8%). However, the differences in the groups of full-term and premature babies ($p<0.01$) were statistically significant over the entire pandemic period. Notably, the share of premature births was growing in 2021 and 2022. Our study is consistent with H. Zhu et al. (2020), who reported a predominance of premature births with COVID [23].

It should be noted that 65% of newborns were born by self-delivery, and 35% of children were born by Caesarean section.

The Clinical Protocol of the Ministry of Health RK "COVID in children" (No.117 of October 16, 2020) establishes the clinical forms reflecting the severity of child conditions with SARS-CoV-2 (Table 4).

Table 4 demonstrates that the asymptomatic and extremely severe forms of COVID in newborns ($p<0.05$ and $p<0.01$, respectively) were significantly more often in 2020 than in 2021. At that, in 2021, 42.2±3.0% of newborns had a severe COVID condition, which was more than in 2020 ($p<0.01$).

Comparing the severity of the COVID condition in newborns in 2020 and 2022 (January-April), we found more newborns with a moderate condition in 2022 (January to April) than in 2020 ($p<0.01$). The moderate condition in 2022 was also more common compared to 2021 ($p<0.05$). On the contrary, severe and extremely severe clinical conditions were more common in 2021 than in 2022 ($p<0.001$ and $p<0.05$, respectively). Thus, during 4 months of 2022, coronavirus infection proceeded in

Table 4. *COVID clinical forms in newborns.*

Severity of condition	2020 (n=135)		2021 (n=268)		P_1	2022 (n=162)		P_2	P_3
	Abs.	M±m%	Abs.	M±m%		Abs.	M±m%		
Asymptomatic	6	4.5±1.8	2	0.8±0.6	<0.05	20	12.4±2.6	<0.05	<0.01
Mild severity	64	47.4±4.3	66	24.6±2.6	<0.01	58	26.0±3.5	<0.001	>0.05
Moderate severity	39	28.9±3.9	80	29.9±2.8	>0.05	73	45.0±3.9	<0.01	<0.05
Severe condition	25	18.5±3.3	113	42.2±3.0	<0.01	11	6.8±2.5	<0.05	<0.001
Extremely/critically severe condition	1	19.3±3.4	7	2.6±1.0	<0.01	0	0±0.02	<0.01	<0.05

P_1 – the significance of differences between the severity of conditions in 2020 and 2021
P_2 – the significance of differences between the severity of conditions in 2020 and 2022 (January-April)
P_3 – the significance of differences between the severity of conditions in 2021 and 2022 (January-April)

Table 5. *Concomitant pathologies in newborns with COVID.*

Concomitant pathology	2020 (n=135)		2021 (n=268)		P_1	2022 (n=162)		P_2	P_3
	Abs	M±m%	Abs	M±m%		Abs	M±m%		
Respiratory distress syndrome (RDS)	10	7.4±2.3	20	7.5±1.6	>0.05	3	1.9±0.8	<0.05	<0.05
Intrauterine pneumonia	10	7.4±2.3	10	3.7±0.2	>0.05	1	0.6±0.5	<0.05	<0.05
Neonatal jaundice	16	11.9±2.8	31	11.6±1.9	>0.05	10	6.2±1.5	<0.05	<0.05
Hypoxic-ischemic brain changes (CNS injury)	10	7.4±2.3	34	12.7±2.0	>0.05	8	4.9±1.3	>0.05	>0.05
Intraventricular hemorrhages	3	2.2±1.3	4	1.5±0.8	>0.05	1	0.6±0.5	>0.05	>0.05
Congenital heart disorder	3	2.2±1.3	6	2.2±0.9	>0.05	0	0±0	<0.05	<0.05

P_1 – the significance of differences between the severity of conditions in 2020 and 2021
P_2 – the significance of differences between the severity of conditions in 2020 and 2022 (January-April)
P_3 – the significance of differences between the severity of conditions in 2021 and 2022 (January-April)

Table 6. *Types of feeding of newborns for the period 2020-2022.*

Types of feeding	qty for 2020	qty for 2021	qty for 2022
cohabitation with mother	115	255	156
separate feeding	20	10	0
feeding with expressed breast milk	5	3	6
Total	140	268	162

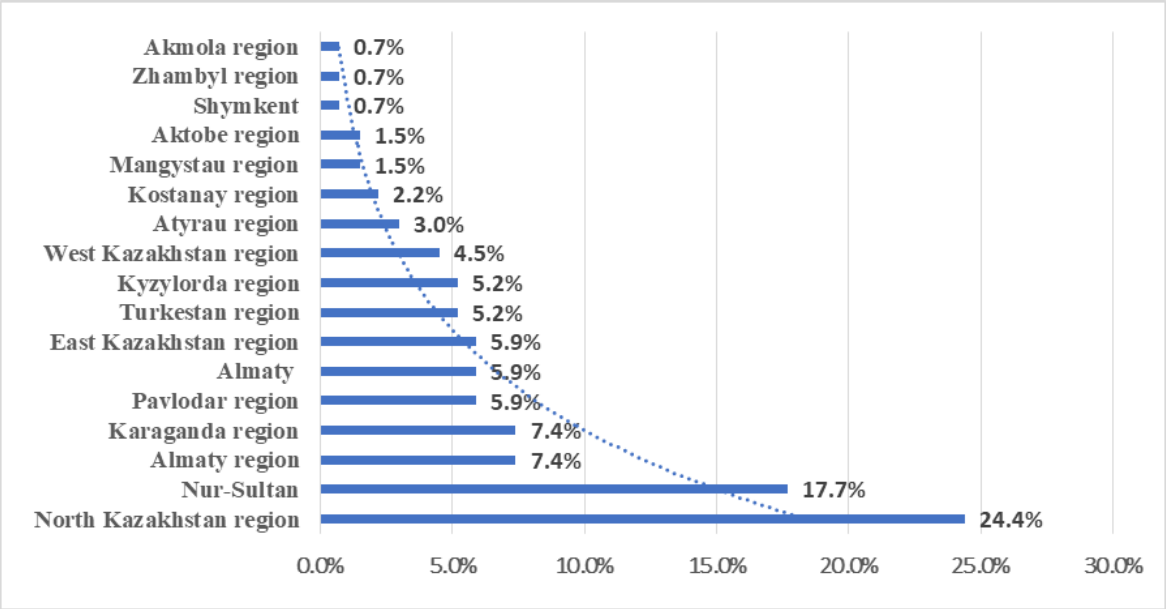

Figure 1. *Number of SARS-Cov-2 infected newborns, by regions of Kazakhstan, 2020, abs.*

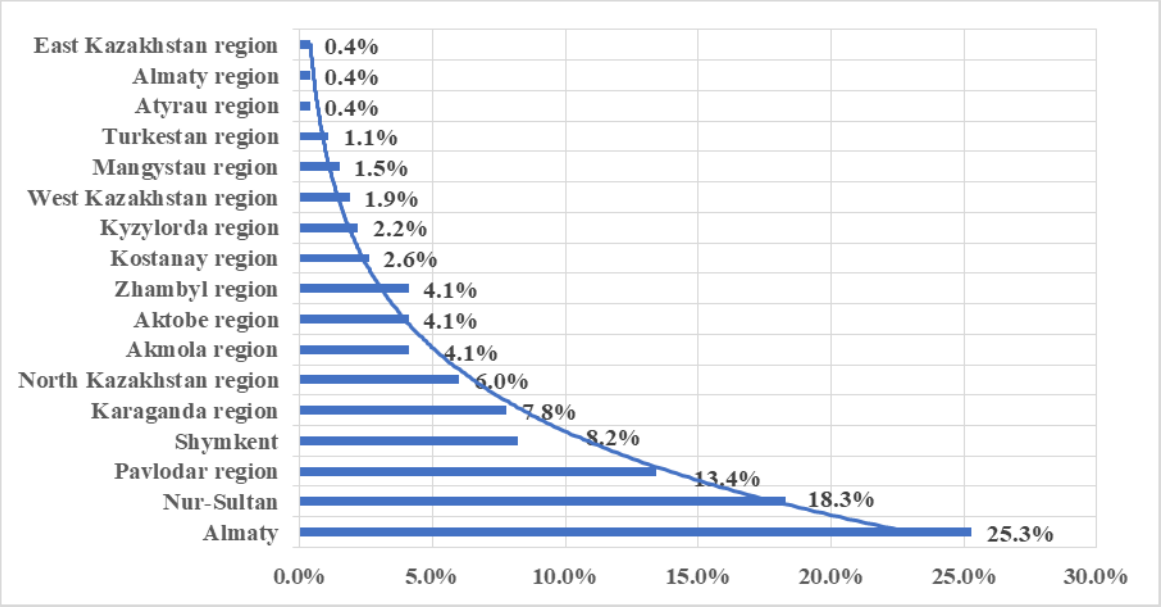

Figure 2. *Number of SARS-Cov-2 infected newborns, by regions of Kazakhstan, 2021, abs.*

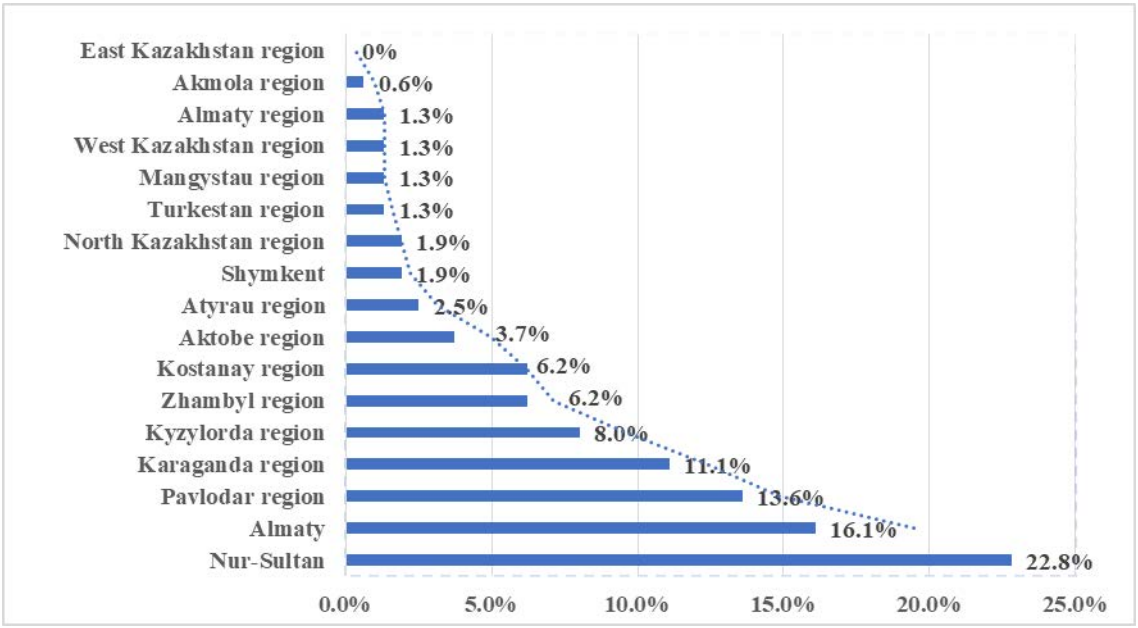

Figure 3. *Number of SARS-Cov-2 infected newborns by regions of the RK, January-April 2022.*

Figure 4. *COVID incidence in newborns in 2020, by month.*

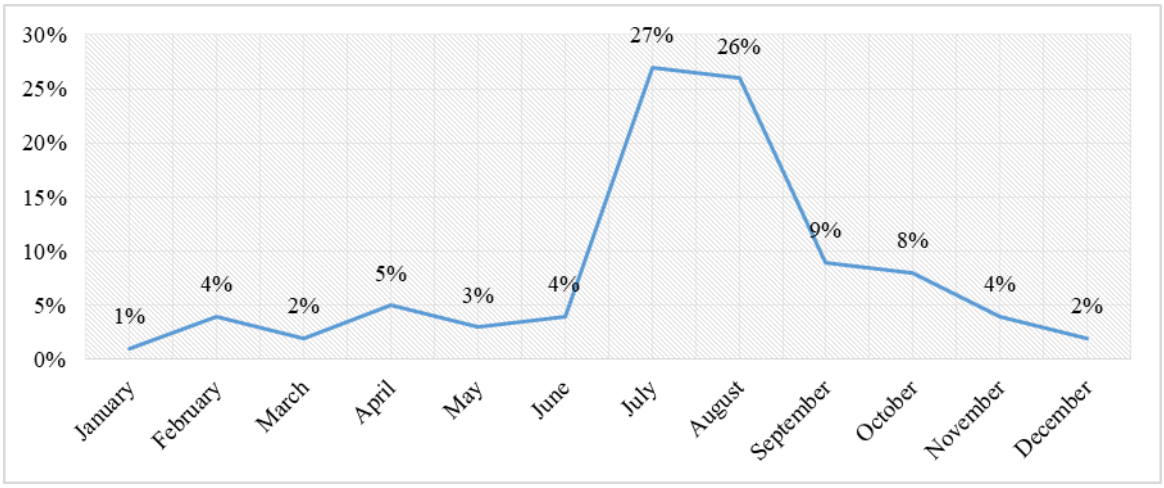

Figure 5. *COVID incidence in newborns in 2021, by month.*

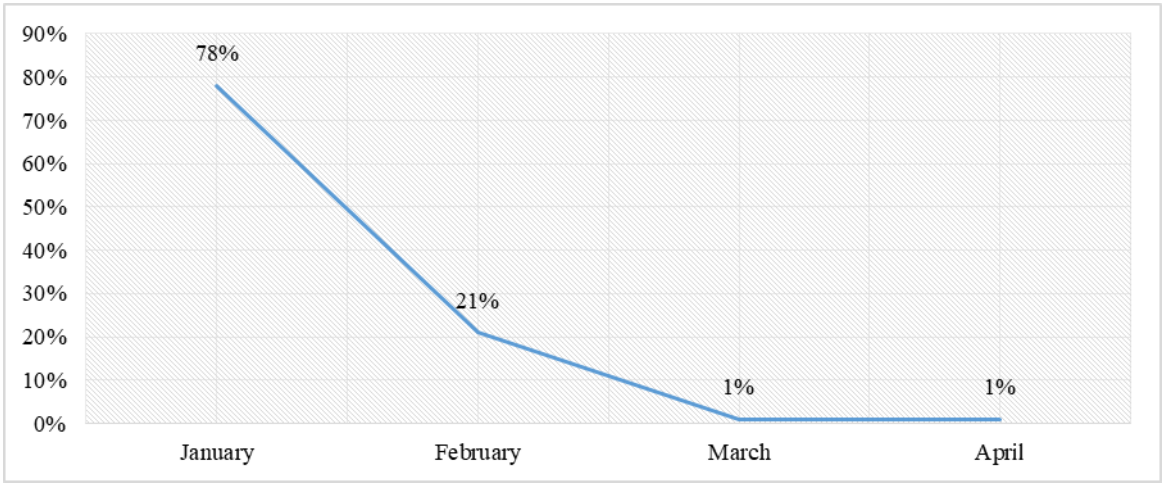

Figure 6. *COVID incidence in newborns in January-April 2022, by month.*

an asymptomatic and moderate form. Thus, the severity of this disease is declining year to year; its asymptomatic and moderately severe forms have become more common.

Table 5 shows the concomitant pathologies in newborns with SARS-CoV-2.

As per Table 5, more newborns with SARS-CoV-2 had respiratory distress syndrome, intrauterine pneumonia, neonatal jaundice, and congenital heart disorders in 2020-2021 compared to 2022 (January-April) ($p<0.05$). The vast majority (70%) of newborns with comorbidities were premature by gestational age.

As shown in Table 5, in full-term newborns with early SARS-Cov-2 infection, respiratory disorders syndrome, intrauterine pneumonia, hypoxic-ischemic brain changes were significantly more often detected ($p<0.05$). In premature infants with late coronavirus infection, respiratory disorders syndrome, neonatal jaundice, hypoxic-ischemic brain changes ($p<0.05$) were significantly frequent concomitant pathologies. The average number of hospital beds in infected newborns in 2020 was 12 days, in 2021 the number of bed days was reduced to 4 days. This is due to the fact that according to the algorithm of newborn management, updated in October 2020, the children were discharged home without a control PCR, which was carried out after discharge at the place of residence in the polyclinic according to the decree of the chief sanitary doctor. After the discharge of newborns with COVID-19, a mobile COVID-19 group was observed, which was formed from doctors and nurses of the polyclinic.

The vast majority (90.5%) of the children were breastfed together with their mother. During breastfeeding, all possible precautions were taken to avoid infection with the virus, including thorough hand washing and wearing a face mask. All children who stayed with their mother from birth were discharged home in satisfactory condition (Table 6).

25 (18.5%) children were separated from their mother in 2020, 13 (4.8%) children - in 2021, 6 (2.5%) - in 2022 due to the severity of the condition of mothers or their children. Mothers were asked to breastfeed their babies or express breast milk to establish and maintain a supply of milk. In 88% of the discharged children, the elimination of the causative agent of coronavirus infection was noted already on the 7th day of infection (SARS-Cov-2 was not identified in repeated PCR-RNA analyses), and in the remaining (12%) newborns, the control PCR was negative only after 14 days.

Deaths were noted in 2021 in 5 children, 4 (80%) of whom were admitted to an infectious hospital from home (postnatal COVID-19) in the late neonatal period. The average age at the time of admission was 17 days of life. The average duration of stay in the ICU of newborns in serious condition was 13 days.

In 5 deceased full-term infants with coronavirus pneumonia, the results of PCR testing were positive on the first day after birth in only one child, in the remaining 4 newborns, the SARS-Cov-2 RNA virus was identified in the late neonatal period (after 7 days of life). These children came from a home where there was contact with infected family members. Only 1 child from the moment of birth was in a serious condition due to congenital pneumonia and was separated from his mother in the intensive care unit. Later (on the 16th day of life) this child died. All newborns were prescribed antibacterial, post-syndrome therapy from the first day of hospitalization in the hospital. The peak mortality of newborns was noted in July-August 2021, which is most likely due to the delta strain of coronavirus, which causes a severe course of coronavirus infection. In 2022 (from January to April inclusive), no deaths were reported in any child. An analysis of the epidemiological situation in the country shows that during this period the strain of coronavirus infection "Omicron" was spread, occurring mainly in mild and moderate form. Unfortunately, laboratory data on SARS-Cov-2 types were not available in verified patients.

Discussion.

Our presented work is the result of summarizing the results of monitoring newborns with coronavirus infection throughout the republic since the beginning of the pandemic. We have not identified similar studies on the prevalence of coronavirus infection among newborns at the country level. According to our data, in 2021, compared with 2020, there is an almost 2-fold increase in the number of newborns with positive results for SARS-CoV-2 in Kazakhstan, while deaths were observed in 5 newborns (1.9%). The largest number of newborns with CVI was registered in 2020, 2021 in large megacities of Kazakhstan (Nursultan, Almaty, Shymkent). In 2022, regions with a high frequency of COVID-19 newborns- Pavlodar, Karaganda regions. Thus, the results of our work show an unfavorable epidemiological situation of an increase in the incidence of newborns in megacities, while with a decrease in the detection of COVID-19 in the regions.

The peak incidence of COVID-19 in newborns occurred in the summer period (July, August) 2020,2021. In 2022, a high frequency of COVID-19 was observed in January and February. Among the infected SARS-CoV-2 newborns, the vast majority were full-term (94.5%), less often premature (5.5%). Our research contradicts the research of H. Zhu et al., in which there is a prevalence of premature infants with COVID-19 than full-term [23,24]. Lower rates of premature birth were found in the works of Malik et al. (4.78%) and Kumar et al. (6.21%), compared with higher rates in Anand et al. (4%), Gupta et al. (29.25%) and Singh et al. (28.93%).

In most studies, the prevalence of low-birth-weight newborns (LBW) was almost 30%, whereas the prevalence of LBW in Kumar et al. and Charki et al. it was 19.89% and 50%, respectively. According to a study by Gupta et al. mothers infected with SARS-CoV-2 (28.3%) had more premature babies compared to uninfected mothers (14.6%) [25]. Anand et al. the highest percentage of preterm births was reported, as well as the highest percentage of symptomatic mothers in this meta-analysis [15]. In a systematic review, premature birth was an unfavorable outcome in pregnant women infected with SARS-CoV-2 [9]. In the work of Azimenia Angelidou, MD, PhD1,2; Catherine Sullivan, MD3 (2021), 24.3% of children with CVI were born either at low birth weight or prematurely. Our studies also show a trend towards an increase in prematurity among infected newborns with COVID-19 in 2021 and 2022.

According to our data, 65% of newborns were born by self-delivery, and 35% of children were born by cesarean section. According to the literature, the caesarean section rate was higher in the studies of Kumari et al. (71.43%), Nambiar et al. (72.33%), Charki et al. (73.08%) [14,17,26] compared with the majority of vaginal births in Kumar et al. (caesarean section 31.63%) [13] and Anand et al. (cesarean section 38.24%). In the work of Gupta et al., the caesarean section rate was twice as high in SARS-CoV-2 positive compared to SARS-CoV-2 negative mothers [24]. The detection of concomitant pathology in newborns infected with COVID-19 once again confirms the literature data that coronavirus infection has an indirect effect on the course of pregnancy and contributes to intrauterine hypoxia, intrauterine development delay, premature birth, the birth of a premature baby with the development of respiratory disorders syndrome [24].

The issue of breastfeeding was especially important and controversial for us, because at the beginning of the pandemic, relying on the few data from foreign researchers on the management of newborns with COVID-19 and fearing the spread of COVID-19 among medical personnel, we developed an algorithm for the management of newborns with COVID-19 in the maternity hospital. In this algorithm, we proposed to isolate newborns born to mothers with suspected and confirmed COVID-19. At the same time, we were in favor of breastfeeding and recommended feeding with expressed breast milk. Breastfeeding practice was common in 67.8% of India, while 73% of hospitals from Europe and 66.9% from the USA practiced breastfeeding during the COVID-19 pandemic [24]. About 30% of newborns were breastfed in studies by Sehra et al. [25] compared to 100% breastfeeding practice in the work of Kalamdani et al. [26]. In the work of Azimenia Angelidou, MD, PhD1,2; Catherine Sullivan, MD3 (2021), among newborns, 49 (19.2%) needed resuscitation at birth, 88 (34.5%) were separated from their mothers, and 152 (59.6%) were directly breastfed.

Also, in the algorithm, we obliged newborns born to mothers with suspected and confirmed COVID-19 to conduct PCR studies from the nasopharynx or oropharynx twice for SARS-CoV-2 RNA in the maternity hospital (the first study on the first day after birth, the second (control) study – on the 7th day of life). However, we have seen the negative consequences of this recommendation, as the length of stay of newborns in the maternity hospital has increased and created crowding and the risk of nosocomial infection.

Over time, the recommendations of WHO and other countries appeared, in which the joint stay of mother and child was proposed. Based on the literature data and our small clinical

experience, we updated the algorithm according to which the mother and child were allowed to stay together if the condition of the mother and child allows (updated algorithm Protocol No. 117 of October 16, 2020). We also gave permission to discharge newborns from the maternity hospital with an asymptomatic course of the disease as early as possible so as not to create crowding of children. At the same time, we ordered the control PCR to be carried out in the polyclinic at the place of residence on the 14th day of the disease. The condition of the newborn at home was monitored by a mobile group, which consisted of polyclinic doctors. According to our data, the joint stay of mother and child had a beneficial effect on the course of coronavirus infection in newborns, which is confirmed by the rapid elimination of the virus already on the 7th day of the disease. All reported studies, including newborns infected with SARS-CoV-2, show favorable clinical outcomes with exceptional breastfeeding practices, as reported by Nambiar et al. and Kalamdani et al. [24,27].

Newborns with COVID-19 received from home are of great concern, since newborns after discharge from the maternity hospital come into contact with family members who may be infected with COVID-19 (late postnatal coronavirus infection). These newborns with clinical symptoms of COVID-19 were hospitalized in an infectious hospital. Deaths occurred in 5 full-term newborns, among whom 4 children were admitted to an infectious hospital in the late neonatal period (postnatal coronavirus infection). Our data obtained are consistent with the data of Chamseddine R.S. (2020), in the sample of which 5 (2.5%) deaths were also registered, which is significantly higher than the average (2 cases of stillbirth, 3 more died shortly after birth due to progressive multiple organ failure against the background of infectious and toxic shock), despite the fact that that all newborns received antibacterial therapy [24].

In the work of Kumari et al., the neonatal mortality rate was 12.64 (5.40-22.06) per 1,000 live births in 12 studies, and higher neonatal mortality was recorded (71.43 per 1,000 live births). In studies by Malik et al. It was noted that the risk of neonatal sepsis, poor nutrition, respiratory support, and death in newborns with positive SARS-CoV-2 is increased compared to negative groups in [24]. At the same time, in a multicenter study, newborns infected with SARS-CoV-2 need more resuscitation, symptomatic and respiratory support, but the authors found no effect on mortality compared with uninfected [24].

According to our data, postnatal COVID-19 in July-August 2021 proceeded in a severe form complicated by pneumonia. Thus, in our article, we divide newborns with COVID-19 into early and late coronavirus infection and indicate that late coronavirus infection can be severe with adverse outcomes. The strengths of our publication are that the presented article is presented as the first work in the domestic information space to study the prevalence of COVID-19 among newborns and the features of the clinical course of early and late coronavirus infection in newborns. The topic of the publication is relevant today and is of interest to a wide range of specialists.

The limitation of this study is that the vertical mechanism of transmission of infection is not excluded. To verify the mechanism of transmission of infection, PCR studies of the placenta, amniotic fluid, breast milk and stool in a child are necessary. The disadvantage of this work is that the course of pregnancy and childbirth in women with confirmed coronavirus infection has not been studied in detail. We agree with the opinions of Santosh K Panda et al., in which it is noted that the only policy of early testing may not predict the true time of infectious activity when the practice of exclusively breastfeeding is used. It also requires further study of the catamnesis of infected children born to mothers with SARS-CoV-2 and newborns with postnatal COVID-19. Data on neonatal follow-up after discharge from the hospital were available in several studies: Charki et al. observed for up to two months, Sehra et al. observed up to two weeks after discharge, Anand et al. up to four weeks of life, and Kalamdani et al. newborns infected with SARS-CoV-2 were monitored for two months.

Conclusions.

The results of this study provide unique information on the prevalence of COVID-19 among newborns in Kazakhstan for the period from the beginning of the pandemic to the present. From year to year, there is a tendency to an increase in premature babies among those infected with COVID-19. Breastfeeding has a beneficial effect on the health of newborns, since there is an asymptomatic course of the disease and the elimination of the pathogen in a short time. Lethality occurred in only one child with an early infection. For general practitioners and pediatricians, newborns discharged from a maternity hospital where there are infected family members should be more alert. There were 4 cases of mortality among these children.

We believe that monitoring of the health of newborns should be carried out after discharge from the maternity hospital in case of infection from the mother, as well as after discharge from the infectious hospital in case of late infection as a result of contact with infected patients. Future research is needed to study the health status of children who have had a coronavirus infection in the first year of life. Future studies of serum antibodies to the S and N antigen of coronavirus infection are also needed to differentiate the transmitted coronavirus infection or vaccinate women during the present pregnancy. It is especially important to know at this stage how vaccination and the transferred coronavirus infection may have had an impact on the course of pregnancy, childbirth, and the birth of a child.

Authors' Contributions.

All authors participated equally in the writing of this article.

Conflicts of interest.

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