DOI: https://doi.org/10.17816/PTORS623155

Original Study Article

Comparative analysis of the detection of diseases of the muscular system in minors of Saint Petersburg

Dmitriy N. Kokushin[1], Vera V. Sokolova[2], Vadim V. Kirilenko[2], Natalya A. Guryeva[2], Lyubov L. Sharafutdinova[2]

[1] H. Turner National Medical Research Center for Children's Orthopedics and Trauma Surgery, Saint Petersburg, Russia;
[2] Saint Petersburg State Pediatric Medical University, Saint Petersburg, Russia

ABSTRACT

BACKGROUND: Diseases of the musculoskeletal system in children and their dynamics and structure are urgent health problems and have important scientific and practical significance. The epidemiological features of the detectability of pathology in different regions are of interest for detailed consideration.

AIM: This study aimed to conduct a comparative characterization of the primary morbidity of children with diseases of the musculoskeletal system in St. Petersburg in the 2017–2022 period.

MATERIALS AND METHODS: Official collections of statistical reports of the Central Research Institute of Organization and Informatization of Healthcare from 2017 to 2022 were analyzed. Indicators of diseases of the musculoskeletal system and connective tissue in children were analyzed, and a comparative assessment of the ratio of the probabilities of detecting pathologies in general and for individual nosologies presented in the collections in St. Petersburg and the Russian Federation was performed. Digital analysis was performed in Microsoft Office 2010 programs (Word and Excel).

RESULTS: The indicators of primary morbidity in St. Petersburg from 2017 to 2022 exceeded the national and regional averages and had a negative upward trend. In all age groups, over 6 years, the odds ratio in favor of St. Petersburg increased with arthropathies in general and deforming dorsopathies and decreased with spondylopathies and systemic connective tissue lesions. Moreover, in children aged 0–14 years, the chances of detection in St. Petersburg increased with respect to reactive arthropathies and fell with juvenile arthritis, whereas in adolescents the increase concerned juvenile arthritis and the decrease in reactive arthropathies. In rheumatoid arthritis, a transition was noted – the probabilities of detection have become lower in favor of the regions in Russia.

CONCLUSIONS: In St. Petersburg, an unfavorable trend in the probabilities of detecting diseases of the musculoskeletal system and connective tissue was registered among children. A two-stage increase in indicators was found in 2017–2019 and 2020–2022, and the rate of increase in the detectability of most nosologies during the COVID-19 pandemic exceeded the prepandemic values, indicating the conjugacy of the studied group of diseases with organizational limitations in the outpatient unit, quality and specificity of differential diagnosis, and viral component. The identified features indicate the need for a reassessment of organizational measures and management decisions.

Keywords: detection of diseases of the musculoskeletal system; primary morbidity; detection of musculoskeletal disorders in children; monitoring; odds ratio; dynamics of primary and general morbidity.

To cite this article
Kokushin DN, Sokolova VV, Kirilenko VV, Guryeva NA, Sharafutdinova LL. Comparative analysis of the detection of diseases of the muscular system in minors of Saint Petersburg. *Pediatric Traumatology, Orthopaedics and Reconstructive Surgery.* 2024;12(2):205–216. DOI: https://doi.org/10.17816/PTORS623155

Received: 10.11.2023 **Accepted:** 30.05.2024 **Published online:** 24.06.2024

УДК 616.71/.74-053.2/.7(470.23)-036.4
DOI: https://doi.org/10.17816/PTORS623155

Оригинальное исследование

Сравнительный анализ выявляемости болезней костно-мышечной системы у несовершеннолетних Санкт-Петербурга

Д.Н. Кокушин[1], В.В. Соколова[2], В.В. Кириленко[2], Н.А. Гурьева[2], Л.Л. Шарафутдинова[2]

[1] Национальный медицинский исследовательский центр детской травматологии и ортопедии имени Г.И. Турнера, Санкт-Петербург, Россия;
[2] Санкт-Петербургский государственный педиатрический медицинский университет, Санкт-Петербург, Россия

АННОТАЦИЯ

Обоснование. Уровень заболеваемости детей болезнями костно-мышечной системы, ее динамика и структура являются актуальной проблемой здравоохранения и имеют большое научное и практическое значение. Эпидемиологические особенности выявляемости патологии в разных регионах представляют интерес для детального рассмотрения.

Цель — дать сравнительную характеристику первичной заболеваемости детей болезнями костно-мышечной системы в Санкт-Петербурге в период 2017–2022 гг.

Материалы и методы. Изучены официальные сборники статистических отчетов ФГБУ «Центральный научно-исследовательский институт организации и информатизации здравоохранения» Минздрава России с 2017 по 2022 г. Проанализирован уровень показателей болезней костно-мышечной системы и соединительной ткани у детей, выполнена сравнительная оценка отношения шансов выявляемости патологии в целом и по отдельным нозологическим формам, представленным в сборнике, по Санкт-Петербургу и Российской Федерации. Цифровой анализ проводили в программах Microsoft Office-2010 (Word, Excel).

Результаты. Показатели первичной заболеваемости в Санкт-Петербурге с 2017 по 2022 г. кратно превысили среднероссийские и среднеокружные значения, знаменуя негативный восходящий тренд. Во всех возрастных группах за 6 лет отношение шансов в пользу Санкт-Петербурга значимо увеличилось при артропатиях в целом и деформирующих дорсопатиях в частности, а снизилось при спондилопатиях и системных поражениях соединительной ткани. При этом у детей 0–14 лет дополнительно шансы выявляемости в Санкт-Петербурге увеличивались в отношении реактивных артропатий и снижались при ювенильных артритах, а у подростков увеличение касалось ювенильных артритов и снижение — реактивных артропатий. При ревматоидных артритах произошел переход — шансы выявляемости стали ниже в пользу регионов России.

Заключение. В Сант-Петербурге среди детского населения наблюдается неблагоприятная тенденция по шансам выявляемости болезней костно-мышечной системы и соединительной ткани. Отмечен двухэтапный рост показателей в течение 2017–2019 и 2020–2022 гг., причем темпы прироста в выявляемости большинства нозологий в период пандемии COVID-19 превышали допандемийные значения, указывая на сопряженность исследуемой группы заболеваний с организационными ограничениями в работе амбулаторного звена, качеством и спецификой дифференциальной диагностики, вирусным компонентом. Обнаруженные особенности необходимо в дальнейшем детально изучать и переоценить процесс оказания травматолого-ортопедической помощи детям в регионах.

Ключевые слова: выявляемость болезней костно-мышечной системы; первичная заболеваемость; выявляемость опорно-двигательных нарушений у детей; мониторинг; отношение шансов; динамика первичной и общей заболеваемости.

Как цитировать

Кокушин Д.Н., Соколова В.В., Кириленко В.В., Гурьева Н.А., Шарафутдинова Л.Л. Сравнительный анализ выявляемости болезней костно-мышечной системы у несовершеннолетних Санкт-Петербурга // Ортопедия, травматология и восстановительная хирургия детского возраста. 2024. Т. 12. № 2. С. 205–216. DOI: https://doi.org/10.17816/PTORS623155

Рукопись получена: 10.11.2023 **Рукопись одобрена:** 30.05.2024 **Опубликована online:** 24.06.2024

BACKGROUND

Geographical variations significantly impact morbidity both in the medical and social contexts, reflecting the influence of socio-economic conditions, climate, level of medical care, and social needs of citizens, as well as the availability of medical services in various regions of the Russian Federation, on the general health of the population [12].

Risk factors that affect bone and connective tissue formation are of key importance in developing acquired disorders of the musculoskeletal system in children [3, 4]. Musculoskeletal diseases are prevalent among 80% of the Russian population, according to data from the World Health Organization.

The increase in musculoskeletal disease incidence causes several problems for the state and society as a whole, such as long-term illness and disability of the population, a decline in the labor force in the country and the associated loss of gross domestic product, an increase in state budget expenditures on social security for people with disabilities, as well as a decrease in the country's mobilization potential and a deterioration in the quality of life of citizens [5–7].

Traumatological and orthopedic disorders constitute one of the important causes of disability. From 2012 to 2022, this pathology was consistently ranked fifth among the main causes during the initial medical and social examination of children, according to official statistics. Upon subsequent examinations, a rotation was noted, as the increase in cases of this condition in recent years led to a transition from sixth to fourth place.

The prevalence of this group of diseases in the population is significantly influenced by external circumstances [8–10]. In St. Petersburg, the specifics of providing pediatric medical care, diagnostics, and morbidity recording are influenced by the metropolis's specific characteristics, including the inflow of migrants, high population density, and the concentration of medical institutions with an extensive diagnostic and treatment base [11–13].

The SARS-CoV-2 (2019-nCoV) virus pandemic in 2020–2022 severely impacted the entire healthcare system. An increasing number of studies indicate direct and indirect virus-mediated effects [14–16]. A comprehensive examination of the characteristics of the incidence of musculoskeletal disorders in children of varying ages in St. Petersburg before and during the pandemic is of both scientific and practical significance.

The work aimed to perform a comparative analysis of the primary incidence of musculoskeletal disorders in children in St. Petersburg during the period 2017–2022.

MATERIALS AND METHODS

The study used data from the official statistical collections of the Central Research Institute for Healthcare Organization and Information of the Ministry of Health of Russia "Morbidity of the Russian pediatric population with a diagnosis established for the first time in life" for 0–14 and 15–17 year olds in St. Petersburg and the Russian Federation from 2017 to 2022 [17, 18]. The level and dynamics of primary morbidity per 1000 population of individuals of the corresponding age were analyzed. A quantitative evaluation was conducted to determine the odds ratio (OR) in the detection patterns of musculoskelatal in children. This analysis focused on the overall prevalence of these diseases as primary morbidities and also examined specific conditions such as reactive arthropathy, juvenile and rheumatoid arthritis, arthropathy in general, deforming dorsopathies and spondylopathies, as well as systemic connective tissue lesions. Two groups were selected for analysis: those who became ill and those who did not, in St. Petersburg, and the constituent entities of the Russian Federation (in absolute values). Those who were not sick represented the difference between the total number of children in the region and the number of sick children (for each group 0–14 and 15–17 years old separately) in St. Petersburg and throughout the Russian Federation (excluding St. Petersburg). The OR was calculated as the ratio of the number of children with the disease to the number of children of the same age category without the disease in St. Petersburg or in regions of the Russian Federation. If the OR for St. Petersburg to the Russian Federation exceeded 1, then the chances of detecting the disease were higher in St. Petersburg. Thus, the location of a child's domicile was directly related to the detection of musculoskeletal diseases. If the OR was less than 1, then the chances of identifying the pathology under discussion were higher in other regions of the Russian Federation. To assess the statistical significance of the ORs, the boundaries of the 95% confidence interval were examined, which were required to be either greater than or less than 1, specifically, not include 1 ($p < 0.05$).

To generate databases, statistical processing, analysis, and visualization of the results obtained, a set of MS Office 2016 application programs was used, including Word and Excel.

RESULTS

In St. Petersburg in 2022, the prevalence of diseases of the musculoskeletal system and connective tissue was seventh among children who presented to the outpatient clinic with a newly established diagnosis. This was immediately followed by respiratory and digestive disorders, injuries, poisoning, and other external causes, certain infectious and parasitic diseases, as well as diseases of the skin and subcutaneous tissue.

There was a high primary incidence of musculoskeletal system and connective tissue diseases in children aged 0 to 14 years in St. Petersburg in 2022, with a total of 84.8 cases per 1000 children of this age group. This value exceeded

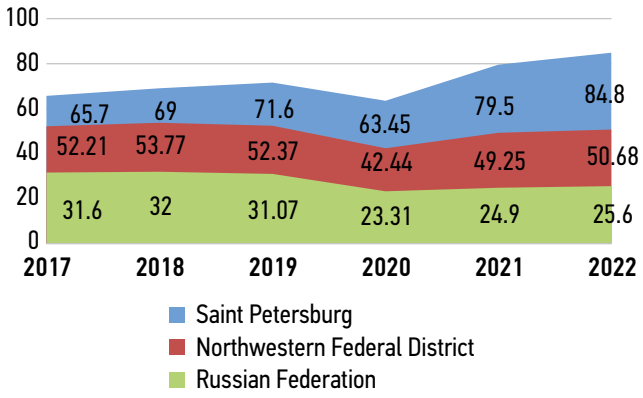

Fig. 1. Changes in the incidence of new cases of diseases of the musculoskeletal system and connective tissue in children 0–14 years old in St. Petersburg, the Northwestern Federal District, and throughout Russia in 2017–2022 (per 1000 children of this age group)

the average values for the Russian Federation (by 69.8%, $p \leqslant 0.001$) and the Northwestern Federal District (by 40.2%, $p \leqslant 0.001$) (Fig. 1).

St. Petersburg experienced a 22.5% increase in primary incidence during the study period, whereas the NWFD and the Russian Federation as a whole experienced a 2.9% and 19.0% decrease, respectively ($p \leqslant 0.05$). In St. Petersburg, there were two distinct waves of increased incidence: the growth rate was 8.2% from 2017 to 2019, and it was 6.3% from 2021 to 2022. In 2020, a significant decline in the registration of new cases was noted in all regions (minimum by 11.4% in St. Petersburg, maximum by 19.0% in the NWFD, and by 25.0% in the Russian Federation; $p \leqslant 0.05$). The decrease in visits throughout the entire COVID-19 pandemic (2020–2022) led to a higher growth rate (25.2%) than previously observed.

In the period between 2017 and 2022 in St. Petersburg, there was a 24.1% increase in reactive arthropathy, 26.8% in juvenile arthritis, 29.1% in arthropathy in general, and 14.7% in deforming dorsopathies ($p < 0.05$) (Table 1). Furthermore, the rate of primary cases of systemic connective tissue lesions and spondylopathies was 23.0% and 39.1% lower, respectively.

In the RF, the incidence of most of the diseases under consideration decreased. Reactive arthropathy experienced a 19.4% decrease, arthropathy in general experienced a 12.6% decrease, deforming dorsopathies experienced a 15.3% decrease, spondylopathy experienced a 33.3% decrease, while others decreased by 29.6%. For juvenile and rheumatoid arthritis, conversely, there was an increase in the number of new cases by 30.0% and 40.0%, respectively ($p \leqslant 0.05$).

We calculated the ORs for the RF for 2017–2022 to estimate the likelihood of new cases of musculoskeletal system diseases in children in St. Petersburg (Table 1).

The OR's significance in the analysis of all musculoskeletal system disorders was consistent, with the exception of rheumatoid arthritis, where the 95% confidence interval did not include unity. Compared to the regions of the RF, the odds of identifying diseases of the musculoskeletal system in children in St. Petersburg were 3.5 times higher in 2022. In addition, reactive arthropathy was increased by 1.9 times, juvenile arthritis by 2.0 times, arthropathy in general by 4.0 times, deforming dorsopathies by 2.9 times, spondylopathies by 3.3 times, and systemic connective tissue lesions by 6.8 times ($p < 0.05$).

Over the past six years, the odds of detecting diseases of the musculoskeletal system in general (an increase of 36.1%), reactive arthropathy (36.5%), arthropathy in general (36.5%), and deforming dorsopathies (23.6%) have gradually increased. Additionally, the probability of detecting juvenile arthritis, spondylopathies, and systemic connective tissue lesions decreased (rates of decrease of 9.4%, 15.7%, and 36.6%, respectively).

The unfavorable global situation, specifically the COVID-19 pandemic, was a significant factor in the overall indicator's increase during the study period. Thus, from 2020 to 2022, compared to 2017–2019, there was an increase in the odds of detecting musculoskeletal disorders in general (by 15.2% versus 11.0%), arthropathy in general (by 20.8% versus 11.2%), and reactive arthropathy (by 6.8% versus 5.4%) increased in St. Petersburg children aged 0 to 14 years. Furthermore, a decrease in the odds was recorded for juvenile arthritis (0 versus 8.2%), spondylopathies (2.3% versus 50.3%), and systemic connective tissue disorders (–16.4% versus –30.8%).

The dynamics of rheumatoid arthritis are noteworthy, as in the pre-pandemic period, the odds of detection in adolescents, despite the low significance, were higher in St. Petersburg (the growth rate of the OR was 50.5%). However, after the pandemic, the ratio shifted toward the regions of the RF (the rate of decline in the OR was 14.0%).

Diseases of the musculoskeletal system and connective tissue among adolescents in St. Petersburg were ranked fourth in the structure of causes of morbidity with a diagnosis established for the first time in life in 2022 (fourth place in 2020 and 2021). In 2022, the primary incidence of these disorders in St. Petersburg was 140.3 per 1000 children of the corresponding age (Fig. 2).

The indicators for musculoskeletal disorders in adolescents aged 15–17 years in St. Petersburg was significantly higher than that of the Northwestern Federal District and the RF by 37.9% and 62.6% ($p \leqslant 0.05$), respectively, in analogy with the child population of the younger age group. Although the incidence of new cases of the disease increased in St. Petersburg and the Northwestern Federal District (growth rates of 29.4% and 5.3%, respectively), the average number of new cases in the RF decreased (7.3%) ($p < 0.05$).

Table 1. Difference in the primary incidence of diseases of the musculoskeletal system and connective tissue in children 0–14 years old and the odds ratio (OR) of their detection along with 95% confidence interval (CI) in St. Petersburg (SPb) and the Russian Federation (RF) in the period 2017–2022 (absolute values per 1000 children of the corresponding age)

Disease classification (according to ICD-10)	Values by region with OR and CI	Incidence rates (absolute/relative values) and OR by year						Rate of increase/ decrease in incidence, %
		2017	2018	2019	2020	2021	2022	
Musculoskeletal system as a whole (M00–M99)	SPb	50542/65.7	54102/69.0	58348/71.6	52309/63.5	65068/79.5	67575/84.8	22.5
	RF	811074/31.6	826428/32.0	805971/31.1	604672/32.3	644181/24.9	659984/25.6	–23.4
	OR SPb to RF	2.27	2.33	2.55	3.01	3.55	3.55	36.1*
	Left boundary of CI	2.25	2.31	2.53	2.98	3.52	3.52	–
	Right boundary of CI	2.29	2.35	2.57	3.04	3.58	3.58	–
Reactive arthropathy (M02)	SPb	335/0.44	367/0.47	346/0.43	408/0.50	328/0.40	463/0.58	24.1
	RF	9328/0.36	9842/0.38	8708/0.34	7356/0.28	7259/0.28	7529/0.29	–19.4
	OR SPb to RF	1.22	1.24	1.29	1.79	1.41	1.92	36.5*
	Left boundary of CI	1.10	1.11	1.16	1.62	1.26	1.75	–
	Right boundary of CI	1.36	1.37	1.44	1.98	1.58	2.11	–
Juvenile arthritis (M08–M09)	SPb	229/0.30	277/0.35	279/0.34	213/0.26	231/0.28	329/0.29	26.8*
	RF	3581/0.14	3929/0.15	3853/0.15	3408/0.13	3560/0.14	5084/0.2	30.0*
	OR SPb to RF	2.24	2.42	2.44	2.03	2.07	2.03	–9.4
	Left boundary of CI	1.96	2.14	2.16	1.77	1.81	1.82	–
	Right boundary of CI	2.57	2.73	2.75	2.33	2.37	2.27	–
Rheumatoid arthritis (M06)	SPb	28/0.04	21/0.03	71/0.09	26 /0.03	27/0.03	29/0.4	0
	RF	680/0.03	615/0.02	848/0.03	945/0.04	608/0.02	1173/0.05	40.0*
	OR SPb to RF	1.41	1.13	2.85	0.86	1.39	0.74	–47.5*
	Left boundary of CI	0.97	0.73	2.24	0.58	0.94	0.51	–
	Right boundary of CI	2.06	1.74	3.64	1.27	2.04	1.08	–
Arthropathy in general (M00–M25)	SPb	22209/28.86	21854/27.85	23929/29.37	23059/27.97	30242/36.96	32394/40.64	29.1*
	RF	318533/12.4	334664/12.96	330001/12.72	251586/9.71	272585/10.54	279891/10.84	–12.6
	OR SPb to RF	2.51	2.26	2.48	3.13	3.83	3.95	36.5*
	Left boundary of CI	2.47	2.23	2.45	3.09	3.78	3.91	–
	Right boundary of CI	2.54	2.30	2.52	3.18	3.87	4.00	–
Deforming dorsopathies (M40–M43)	SPb	11689/15.19	12262/15.63	14505/17.8	11284/13.67	13305/16.26	14193/17.81	14.7
	RF	188064/7.32	186916/7.24	191471/7.38	143498/5.53	155584/6.02	160114/6.20	–15.3
	OR SPb to RF	2.20	2.26	2.59	2.62	2.82	2.88	23.6*
	Left boundary of CI	2.15	2.22	2.54	2.57	2.77	2.84	–
	Right boundary of CI	2.24	2.30	2.63	2.67	2.87	2.94	–
Spondylopathies (M45–M49)	SPb	173/0.23	167/0.21	225/0.28	106/0.13	121/0.15	112/0.14	–39.1*
	RF	1607/0.06	1817/0.07	1106/0.04	1051/0.04	1217/0.05	1096/0.04	–33.3*
	OR SPb to RF	3.96	3.23	7.97	3.42	3.30	3.34	–15.7
	Left boundary of CI	3.39	2.75	6.89	2.80	2.73	2.75	–
	Right boundary of CI	4.64	3.79	9.23	4.18	3.98	4.06	–
Systemic connective tissue lesions (M30–M36)	SPb	572/0.74	353/0.45	465/0.57	471/0.57	477/0.58	455/0.57	–23.0
	RF	2333/0.09	2562/0.10	2431/0.09	2242/0.09	2660/0.1	2429/0.09	0
	OR SPb to RF	10.68	5.10	7.39	8.10	6.52	6.77	–36.6*
	Left boundary of CI	9.72	4.56	6.68	7.32	5.91	6.11	–
	Right boundary of CI	11.73	5.71	8.17	8.97	7.20	7.49	–

*$p \leq 0.05$.

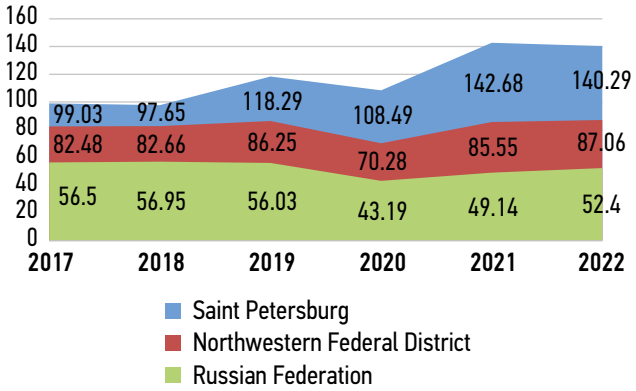

Fig. 2. Trend in the detection of new cases of diseases of the musculoskeletal system and connective tissue in adolescents aged 15–17 years in St. Petersburg, the Northwestern Federal District, and throughout Russia in 2017–2022 (per 1000 children of this age group)

A 16.3% increase in the indicator was observed in the period prior to the pandemic, and a 22.7% increase was observed during the pandemic (considering the decline in visits in 2020).

The dynamics of indicators of individual musculoskeletal disorders in adolescents in St. Petersburg and RF were extremely variable over a six-year period. In St. Petersburg, a decreasing trend was observed in cases of reactive arthropathy (decline rate 46.8%), spondylopathies (42.9%), and systemic connective tissue lesions (25.0%) (all $p \leqslant 0.05$). Simultaneously, there was an increase in juvenile arthritis by 18.7%, arthropathies in general by 44.3%, and deforming dorsopathies by 29.0% (Table 2).

In the regions of the RF, an opposite trend was noted, as the frequency of new cases of rheumatoid arthritis increased by 28.6%, that of reactive arthritis increased by 17.2%, the rate of juvenile arthritis increased by 17.9%, the rate of arthropathy in general increased by 9.5%, and that of systemic lesions of the connective tissue increased by 11.1%. The frequency of new cases of spondylopathies was 26.4% lower ($p \leqslant 0.05$).

A consistent pattern of significance in the detection of musculoskeletal disorders under consideration among adolescents in St. Petersburg was established as a consequence of the OR analysis. In 2022, the overall likelihood of diagnosing diseases of the musculoskeletal system was 3.5 times higher in St. Petersburg than in RF regions. The probability of detecting juvenile arthritis was 3.5 times higher; that of arthropathy in general and deforming dorsopathies was 3.4 times higher; and that of spondylopathies was 2.4 times higher ($p < 0.05$).

The probability of detecting adolescent diseases of the musculoskeletal system in general, juvenile arthritis, arthropathy in general and deforming dorsopathies increased by 45.2%, 14.4%, 46.8%, and 38.4%, respectively, in St. Petersburg from 2018 to 2022. Conversely, the frequency of registration of primary cases of reactive arthropathy, rheumatoid arthritis, spondylopathies and systemic connective tissue lesions decreased (decrease rate by 53.8%, 28.2%, 11.5%, and 25.7%).

At the start of the COVID-19 pandemic (2020–2021), the OR of pathology detection in St. Petersburg was significant for all musculoskeletal disorders considered ($p < 0.05$). Moreover, compared to the pre-pandemic period in St. Petersburg, the OR for identifying juvenile arthritis increased by 38.0% versus 48.8%, deforming dorsopathies increased by 22.95% versus 21.9%, and spondylopathies increased by 12.2% versus 10.0%. Furthermore, the OR for detection of systemic connective tissue lesions, reactive arthropathy, and rheumatoid arthritis decreased by –70.1% versus –50.9%, –72.1% versus 16.2%, and –70.6% versus 32.7%, respectively.

If, in the pre-pandemic period, the odds of diagnosing reactive arthropathy and rheumatoid arthritis were higher in St. Petersburg, although with insufficient significance, then the probability of their detection began to increase in the regions of the RF in 2022.

DISCUSSION

Official data on morbidity among children, which are derived from reports on visits to medical institutions, are not comprehensive and necessitate additional specialized epidemiological studies. Additionally, the nature of the musculoskeletal system's pathology necessitates regular outpatient monitoring to evaluate the structure and trends of morbidity and plan outpatient treatment, routing, and preventive measures.

The study results indicate a high rate of primary incidence of musculoskeletal pathology in children in St. Petersburg, which is significantly higher than the regional average and Russian averages. This high rate may be attributed to the epidemiological characteristics of the metropolis as well as the varying levels of accessibility to medical care in the regions.

Although the primary incidence rates increased progressively in St. Petersburg, it decreased in the NWFD (0–14 years) and in Russia as a whole. This trend continued steadily both in the period preceding the COVID-19 pandemic and during it. In children 0–14 years of age, the odds of diagnosing primary cases of reactive arthropathies, arthropathies in general, and deforming dorsopathies increased, and systemic lesions of connective tissue, spondylopathies, juvenile arthritis, and rheumatoid arthritis decreased. In adolescents aged 15–17 years, there was an increase in the odds of detecting juvenile arthropathy, arthropathy in general and deforming dorsopathies, while the odds of detecting reactive arthropathy, rheumatoid arthritis, spondylopathies and systemic connective tissue

Table 2. Difference in the primary incidence of diseases of the musculoskeletal system and connective tissue in adolescents aged 15–17 years and the odds ratio (OR) of their detection rates along with 95% confidence interval (CI) in St. Petersburg (SPb) and the Russian Federation (RF) in general in 2017–2022 (absolute values per 1000 children of the corresponding age)

Disease classification (according to ICD-10)	Values by region with OR and CI	Incidence rates (absolute/relative values) and OR by year						Rate of increase/ decrease in incidence rate, %
		2017	2018	2019	2020	2021	2022	
Musculoskeletal system as a whole (M00–M99)	SPb	11042/99.3	11164/97.65	14277/118.29	13298/108.49	18374/142.68	18745/140.29	29.4*
	RF	231316/56.5	237104/56.95	243911/56.03	191501/43.19	220923/49.14	235674/52.4	–7.3
	OR SPb to RF	1.9	1.83	2.33	2.82	3.58	3.47	45.2*
	Left boundary of CI	1.86	1.79	2.29	2.77	3.52	3.41	–
	Right boundary of CI	1.94	1.87	2.38	2.88	3.64	3.52	–
Reactive arthropathy (M02)	SPb	69/0.62	98/0.86	83/0.69	127/1.04	127/0.99	44/0.33	–46.8*
	RF	2164/0.53	2384/0.57	2134/0.49	2394/0.54	3387/0.75	2896/0.64	–25.5*
	OR SPb to RF	1.19	1.52	1.42	1.97	1.37	**0.55**	–53.8*
	Left boundary of CI	**0.93**	1.24	1.14	1.65	1.15	**0.41**	–
	Right boundary of CI	1.51	1.86	1.76	2.36	1.64	**0.74**	–
Juvenile arthritis (M08–M09)	SPb	101/0.91	59/0.52	64/0.53	75/0.61	71/0.55	150/1.12	18.7
	RF	1326/0.32	1418/0.34	1532/0.35	1300/0.29	1698/0.38	1699/0.39	17.9
	OR SPb to RF	2.97	1.54	1.52	2.15	1.54	3.47	14.4
	Left boundary of CI	2.43	1.18	1.19	1.71	1.21	2.93	–
	Right boundary of CI	3.64	2.00	1.96	2.72	1.95	4.10	–
Rheumatoid arthritis (M06)	SPb	6/0.05	9/0.08	14/0.12	16/0.13	16/0.12	6/0.05	0
	RF	215/0.05	184/0.04	333/0.08	239/0.05	285/0.06	296/0.07	28.6*
	OR SPb to RF	1.03	1.82	1.53	2.52	2.10	**0.74**	–28.2*
	Left boundary of CI	**0.46**	**0.93**	**0.90**	1.52	1.27	**0.33**	–
	Right boundary of CI	2.33	3.56	2.62	4.19	3.47	1.66	–
Arthropathy in general (M00–M25)	SPb	3067/27.51	3594/31.44	4286/35.51	4440/36.22	6145/47.72	6599/49.39	44.3*
	RF	64310/15.71	70004/16.82	73947/16.99	59565/13.44	71248/15.85	78017/17.35	9.5
	OR SPb to RF	1.83	1.95	2.19	2.90	3.45	3.44	46.8*
	Left boundary of CI	1.76	1.88	2.13	2.81	3.36	3.35	–
	Right boundary of CI	1.90	2.01	2.26	2.99	3.54	3.53	–
Deforming dorsopathies (M40–M43)	SPb	4302/38.58	3823/33.44	5872/48.65	4566/37.25	6246/48.5	7262/54.35	29.0*
	RF	79687/19.46	81380/19.55	84544/19.42	67001/15.11	80595/17.93	86744/19.29	–0.9
	OR SPb to RF	2.10	1.77	2.69	2.63	3.07	3.41	38.4*
	Left boundary of CI	2.04	1.71	2.62	2.55	2.99	3.33	–
	Right boundary of CI	2.17	1.83	2.77	2.71	3.15	3.50	–
Spondylopathies (M45–M49)	SPb	55/0.49	37/0.32	88/0.73	54/0.44	36/0.28	38/0.28	–42.9*
	RF	791/0.19	946/0.23	1118/0.26	962/0.22	565/0.13	609/0.14	–26.3*
	OR SPb to RF	2.69	1.44	2.99	2.09	2.40	2.38	–11.5
	Left boundary of CI	2.05	1.04	2.40	1.59	1.71	1.71	–
	Right boundary of CI	3.54	2.00	3.72	2.75	3.37	3.31	–
Systemic connective tissue lesions (M30–M36)	SPb	18/0.16	18/0.16	52/0.43	56/0.46	54/0.42	16/0.12	–25.0*
	RF	339/0.08	508/0.12	494/0.11	449/0.1	463/0.1	398/0.09	11.1
	OR SPb to RF	2.02	1.30	4.11	5.01	4.66	1.50	–25.7*
	Left boundary of CI	1.26	**0.81**	3.09	3.79	3.51	**0.91**	–
	Right boundary of CI	3.25	2.08	5.48	6.63	6.19	2.47	–

*$p \leq 0.05$

lesions decreased. The described multifaceted dynamics of musculoskeletal disorders, including arthropathy in general, and certain types of arthritis, is due to the uneven distribution of identified cases of diseases in the groups under consideration and the specifics of registration.

Based on the analysis of the OR of incidence of diseases of the musculoskeletal system in children of all age categories, it was determined that despite fluctuations in the rate of the examined musculoskeletal disorders, the frequency of their occurrence at each time point during the entire monitoring period, or partially in most cases in St. Petersburg, was significantly higher than in the RF as a whole (95% CI did not include unity, $p < 0.05$). Notably, the severity and incidence of rheumatoid arthritis in children aged 0–14, as well as rheumatoid arthritis and reactive arthropathy in adolescents, significantly decreased in the RF regions.

Additionally, the dynamic of the difference in values (morbidity rates and OR) in favor of St. Petersburg was linked to the increased availability and quality of consultative and diagnostic care in the metropolis, the growing shortage of medical personnel and diagnostic capabilities in the regions of the RF, and the specifics of differentiating diagnoses by group [1, 8]. The private healthcare sector data was not used to estimate the incidence of children's morbidity in the analyzed data. It is possible that the scope of medical services in private clinics is not as extensive as in public ones (including against expanding public-private partnerships and compulsory health insurance). However, in regions with a shortage of medical personnel, this factor can play a significant role in interpreting the level of morbidity [19, 20].

Furthermore, it is crucial to take into account the medical practices of the local population in each region. In the event of a child's illness, the medical and social characteristics of families can significantly influence the timeliness of seeking medical attention and, as a result, the efficacy and outcome of treatment measures. Thus, risk factors for low medical activity included multi-child families (5 children or more), financially disadvantaged families, and parents with low levels of education [21, 22].

St. Petersburg is a federally significant city, with many medical centers that offer a high level of treatment, diagnostic, and rehabilitation resources (including high-tech medical care), and are staffed with specialists in the fields of traumatology and orthopedics. In addition to the residents of the metropolis, children living in the Northwestern Federal District and other regions of the country also visit St. Petersburg for examination and treatment, which makes a significant contribution to the diagnostics, treatment, and rehabilitation of patients with musculoskeletal diseases [1, 5].

The high prevalence of musculoskeletal diseases is also associated with regional risk factors, as St. Petersburg is characterized by an unstable humid and cold climate, leading to decreased immune defense reactions and increased inflammatory processes in the body. Furthermore, the formation of the skeleton and the progression of diseases are adversely affected by chronic vitamin D deficiency and minimal insolation in children [23].

Numerous researchers have studied the role of vitamin D in bone mineralization, and its deficiency in rickets in children and adolescents is widely recognized [24, 25]. In the northern latitudes of Russia, where the number of sunny days is limited and the daylight hours are brief, residents of St. Petersburg and NWFD frequently experience insufficient ultraviolet exposure, which leads to a predisposition to its deficiency. T.L. Karonova observed vitamin D deficiency in 93.0% of children aged 7 to 14 years in St. Petersburg [26]. In addition, 85.0% of pregnant women are deficient in cholecalciferol, despite taking prophylactic dosages of 500 IU due to the effects of seasonality. This indicates that there is a risk of intrauterine development of the skeletal system and congenital deficiency [27].

The COVID pandemic 2020–2022 was accompanied by the destructive effect of the new coronavirus infection on the immune system, as well as multiple organs and tissues of the body, leading to decline in health and an increase in mortality. In particular, the virus triggered the development of inflammatory arthritis associated with COVID-19 [28, 29].

The Russian government has implemented quarantine restrictions and lockdown periods for the population to reduce the spread of infection and social contacts since the onset of the COVID-19 pandemic. Consequently, the volume of scheduled medical care and clinic attendance has decreased. This led to deterioration in work with patients with chronic diseases and aggravation of acute conditions due to treatment delays. The study results do not clarify the etiology of the registered musculoskeletal diseases, but the identified specificities in the dynamics of indicators should be considered. It is important to observe that the most sluggish and chronic processes, such as deforming dorsopathies and spondylopathies, exhibited the highest rate of decline in application rate. The increase in incidence of various arthropathies in the next two years (2021–2022) can be interpreted, to a certain extent, as a compensatory "response" to the removal of restrictions on visiting outpatient medical institutions, which is partially linked to viral exposure[13, 14, 30].

Many authors also draw attention to the indirect consequences of the COVID-19 pandemic on the musculoskeletal system, caused by a lack of physical activity, especially in schoolchildren. An increase in morbidity in the musculoskeletal system, including pathology of the spine and joints, was also influenced by immunity, decreased physical activity, and distance learning [15, 31, 32].

CONCLUSION

The primary incidence of children with diseases of the musculoskeletal system and connective tissue in St. Petersburg was at an exceptionally high level throughout the entire period under review, and the OR of detection was higher than in the regions of the Russian Federation. The significant disparity between the indicators of St. Petersburg, NWFD, and the average in Russia indicates greater accessibility and quality of medical care in a metropolis and an increasing shortage of medical personnel in the regions. The largest increase in OR in St. Petersburg was noted in arthropathy and deforming dorsopathies, and the greatest decrease was registered in spondylopathies and systemic connective tissue lesions. A two-stage growth was observed in the dynamics of morbidity among children in St. Petersburg, specifically before the pandemic (2017–2019) and during the pandemic (2020–2022). During quarantine measures in 2020, there was a sharp decrease in indicators for most causes of musculoskeletal diseases. Meanwhile, with the lifting of restrictions and the further spread of the pandemic (2021–2022), a repeated increase in the detection of pathology was noted, except for reactive arthropathy and rheumatoid arthritis, which OR began to prevail in the regions of Russia. The identified features may be required for the re-evaluation of organizational measures and management decisions.

ADDITIONAL INFORMATION

Funding source. The study had no external funding.

Competing interests. The authors declare that they have no competing interests.

Author contributions. All authors made significant contributions to the study and preparation of the article and read and approved the final version before its publication.

The largest contribution was distributed as follows: *D.N. Kokushin* created the study concept and design; *N.A. Guryeva* edited the article; *V.V. Sokolova* wrote the article; *V.V. Kirilenko, L.L. Sharafutdinova* selected and processed the data.

REFERENCES

1. Baindurashvili AG, Vissarionov SV, Zaletina AV, et al. Incidence of the musculoskeletal system diseases in children and the organization of specialized care in Saint Petersburg. *Pediatric Traumatology, Orthopaedics and Reconstructive Surgery*. 2024;12(1):43–52. doi: 10.17816/PTORS626498

2. Kokushin DN. Analysis of the dynamics of primary morbidity of minors 0-14 years old with diseases of the musculoskeletal system in St. Petersburg during the COVID-19 pandemic. *International Journal of Applied and Basic Research.* 2024;(1):17–21. EDN: NDNJRF doi: 10.17513/mjpfi.13605

3. Sokolovskaya TA, Armashevskaya OV, Sachek OI. Main trends in morbidity among children in the first year of life in the Russian Federation. *Russian Bulletin of perinatology and pediatrics.* 2021;66(6):39–45. EDN: XXGPMM doi: 10.21508/1027-4065-2021-66-6-39-45

4. Proia P., Amato A., Drid P., et al. The impact of diet and physical activity on bone health in children and adolescents. *Front Endocrinol (Lausanne).* 2021;12. doi: 10.3389/fendo.2021.704647

5. Akulin IM, Sokolova VV. Satisfaction of parents with the availability of preferential drug provision for minors. *Menedzher zdravookhraneniya.* 2022;(6):47–52. EDN: ZDMDEA doi: 10.21045/1811-0185-2022-6-47-52

6. Kokushin DN, Khardikov MA, Vissarionov SV, et al. Comparative analysis of the quality of life of children with congenital scoliosis after surgical treatment: extirpation of a hemivertebra from the dorsal and combined approaches. *Pediatric Traumatology, Orthopaedics and Reconstructive Surgery*. 2021;9(2):153–162. EDN: HBOCOD doi: 10.17816/PTORS60339

7. Lila AM, Lila VA. Social significance and economic consequences of rheumatic diseases. *Hygiene and Sanitation, Russian journal*. 2017;96(4):387–392. EDN: YKUQOF doi: 10.18821/0016-9900-2017-96-4-387-392

8. Kirilenko VV. Problems of development of medical and preventive healthcare institutions in Russia. In: Collection of scientific works "Research and Educational Center "Technologies of Commodity, Customs and Forensic Expertise". Saint Petersburg; 2015. P. 301–303. EDN: VUKMTR

9. Mansurova GSh, Ryabchikov IV, Maltsev SV, et al. Violations of the musculoskeletal system in school-age children. *Russian Bulletin of Perinatology and Pediatric*. 2017;62(5):187–191. EDN: ZRPYUN doi: 10.21508/1027-4065-2017-62-5-187-191

10. Kokushin DN. Features of primary morbidity of adolescents aged 15-17 years diseases of the musculoskeletal system and connective tissue in St. Petersburg during the COVID-19 pandemic. *International Journal of Applied and Basic Research.* 2023;(12):24–28. EDN: RQHDNL doi: 10.17513/mjpfi.13600

11. Grigoryeva NN, Airapetov GA. Mechanisms of musculoskeletal consequences of COVID-19. *Orthopaedic Genius.* 2024;30(1):153–162. EDN: DAZQKU doi: 10.18019/1028-4427-2024-30-1-153-162

12. Ganuzin VM, Maskova GS, Storozheva IV, et al. Analysis of the dynamics of the health status of children and adolescents based on the results of clinical examinations. *Russian bulletin of hygiene.* 2021;(3):9–12. EDN: LJMPKY doi: 10.24075/rbh.2021.019.

13. Bogormistrova VA, Svoboda PN, Shestakova VN, et al. The structure of lesions of the musculoskeletal system in adolescent children, considering the somatic pathology and living environment. *Pediatric Traumatology, Orthopaedics and Reconstructive Surgery.* 2022;10(1):5–12. EDN: ORERAQ doi: 10.17816/PTORS96525

14. Musina AA, Amirseitova FT, Ismailova AA. Impact of the COVID-19 pandemic on injury rates in the world and in Kazakhstan. *Traumatology and Orthopaedics of Kazakhstan*. 2021;(1):48–52. EDN: UZXXVX doi: 10.52889/1684-9280-2021-1-56-48-52

15. Rossi L, Behme N, Breuer C. Physical activity of children and adolescents during the COVID-19 pandemic – a scoping review. *Int J Environ Res Public Health*. 2021;18(21):11440. doi: 10.3390/ijerph182111440

16. Polyakova YuV, Papichev EV, Akhverdyan YuR, et al. New coronavirus infection – direct and indirect impact on patients with diseases of the musculoskeletal system and connective tissue. *Sovre-*

mennye problemy nauki i obrazovaniya. 2021;6. (In Russ.) Available from: https://science-education.ru/ru/article/view?id=31342 Accessed: 1 Jun, 2024.

17. *Morbidity of the Russian child population (0–14 years old) with a diagnosis established for the first time in life in 2018–2022: statistical collection, Part V.* Moscow: FGBU "TsNIIOIZ" Minzdrava Rossii; 2023. (In Russ.)

18. *Morbidity of the Russian child population (15–17 years old) with a diagnosis established for the first time in life in 2018-2022: statistical collection, Part V.* Moscow. FGBU "TsNIIOIZ" Minzdrava Rossii; 2023. (In Russ.)

19. Skvirskaya G. P., Volnukhin A. V., Reze A. G. The state and private sector of health care system of the Russian Federation: From competition to integration and partnership. *Problems of Social Hygiene, Public Health and History of Medicine.* 2022;30(2):275–280 EDN: SKNJCD doi: 10.32687/0869-866X-2022-30-2-275-280

20. Miloserdov MA, Maslov NE, Erochina AS, et al. Prevalence of acute disorders of cerebral circulation in the Smolensk region in terms of the role of socio-economic factors and the state of the health care system. *Health care of the Russian Federation*. 2022;66(4):275–281. EDN: CJXCST doi: 10.47470/0044-197X-2022-66-4-275-281

21. Yur'ev VK, Mezhidov KS, Moiseeva KE. Children's appeal to medical organizations as a criterion for parents' medical activity. *Healthcare Manager*. 2023;(9):71–79. EDN: WVQCBO doi: 10.21045/1811-0185-2023-9-71-79

22. Goroshko NV, Emel'yanova EK, Patsala SV. The problem of medical activity of the Russian population in the era of COVID-19. *Social Aspects of Population Health.* 2022;68(3):15. EDN: QTYSRX doi: 10.21045/2071-5021-2022-68-3-15

23. Borisenko EP, Romantsova EB, Babtseva AF. Vitamin D provision among children and adults in the Amur Region. *Bulletin of physiology and pathology of respiration*. 2016;(60):57–61. EDN: WDMVVP doi: 10.12737/20121

24. Sharawat IK, Dawman L. Bone mineral density and its correlation with vitamin D status in healthy school-going children of Western India. *Arch Osteoporos*. 2019;14(1):13. doi: 10.1007/s11657-019-0568-3

25. Davies JH, Reed JM, Blake E, et al. Epidemiology of vitamin D deficiency in children presenting to a pediatric orthopaedic service in the UK. *J Pediatr Orthop*. 2011;31(7):798–802. doi: 10.1097/BPO.0b013e31822f1af1

26. Karonova TL, Mikheeva EP, Nikitina IL, et al. Level of vitamin D provision among residents of the North-Western region of the Russian Federation and the importance of vitamin D deficiency for health. *Osteoporosis and Bone Diseases*. 2016;19(2):45–46. EDN: XSCNOT doi: 10.14341/osteo2016245-46

27. Khazova EL, Shirinyan LV, Zazerskaya IE, et al. Seasonal fluctuations in the level of 25-hydroxycholecalciferol in pregnant women living in St. Petersburg. *Ginekologiya*. 2015;17(4):38–42. EDN: ULUHQZ

28. Taradin GG, Kugler TE, Malovichko IS, et al. Acute arthritis associated with COVID-19. *Almanac of Clinical Medicine.* 2022;50(2):139–148. EDN: BENHBH doi: 10.18786/2072-0505-2022-50-015

29. Mobasheri L, Nasirpour MH, Masoumi E, et al. SARS-CoV-2 triggering autoimmune diseases. *Cytokine*. 2022;154. doi: 10.1016/j.cyto.2022.155873

30. Yur'ev VK, Mezhidov KS, Sokolova VV. Features of the incidence of diseases of the musculoskeletal system and connective tissue in children in the Chechen Republic. *Healthcare Manager*. 2024;(1):32–40. EDN: JVADUT doi: 10.21045/1811-0185-2024-1-32-40

31. Kontsevaya AV, Myrzamatova AO, Mukaneeva DK, et al. Physical activity of school-age children during the COVID-19 pandemic: results of the Russian part of an international study involving 9 European countries. *Human Ecology.* 2022;(10):729–738. EDN: EMLCZN doi: 10.17816/humeco109524

32. Sibiryakova NV. Physiological risk factors caused by low physical activity. *Ulyanovsk Medico-biological Journal*. 2023;(2):132–144. EDN: CROCGT doi: 10.34014/2227-1848-2023-2-132-144

СПИСОК ЛИТЕРАТУРЫ

1. Баиндурашвили А.Г., Виссарионов С.В., Залетина А.В., и др. Анализ заболеваемости костно-мышечной системы у детей и организация специализированной помощи в Санкт-Петербурге // Ортопедия, травматология и восстановительная хирургия детского возраста. 2024. Т. 12, № 1. С. 43–52. doi: 10.17816/PTORS626498

2. Кокушин Д.Н. Анализ динамики первичной заболеваемости несовершеннолетних 0–14 лет болезнями костно-мышечной системы в Санкт-Петербурге в период пандемии COVID-19 // Международный журнал прикладных и фундаментальных исследований. 2024. № 1. С. 17–21. EDN: NDNJRF doi: 10.17513/mjpfi.13605

3. Соколовская Т.А., Армашевская О.В., Сачек О.И. Основные тенденции заболеваемости детей первого года жизни в Российской Федерации // Российский вестник перинатологии и педиатрии. 2021. Т. 66, № 6. С. 39–45. EDN: XXGPMM doi: 10.21508/1027-4065-2021-66-6-39-45

4. Proia P., Amato A., Drid P., et al. The impact of diet and physical activity on bone health in children and adolescents // Front Endocrinol (Lausanne). 2021. Vol. 12. doi: 10.3389/fendo.2021.704647

5. Акулин И.М., Соколова В.В. Удовлетворенность родителей доступностью льготного лекарственного обеспечения несовершеннолетних // Менеджер здравоохранения. 2022. № 6. С. 47–52. EDN: ZDMDEA doi: 10.21045/1811-0185-2022-6-47-52

6. Кокушин Д.Н., Хардиков М.А., Виссарионов С.В., и др. Сравнительный анализ качества жизни детей с врожденным сколиозом после хирургического лечения: экстирпация полупозвонка из дорсального и комбинированного доступов // Ортопедия, травматология и восстановительная хирургия детского возраста. 2021. Т. 9, № 2. С. 153–162. EDN: HBOCOD doi: 10.17816/PTORS60339

7. Лила А.М., Лила В.А. Социальная значимость и экономические последствия ревматических заболеваний // Гигиена и санитария. 2017. Т. 96, № 4. С. 387–392. EDN: YKUQOF doi: 10.18821/0016-9900-2017-96-4-387-392

8. Кириленко В.В. Проблемы развития лечебно-профилактических учреждений здравоохранения в России. В кн.: Сборник научных работ «Научно-образовательный центр «Технологии товароведческой, таможенной и криминалистической экспертизы». Санкт-Петербург, 2015. С. 301–303. EDN: VUKMTR

9. Мансурова Г.Ш., Рябчиков И.В., Мальцев С.В., и др. Нарушения опорно-двигательного аппарата у детей школьного возраста // Российский вестник перинатологии и педиатрии. 2017. Т. 62, № 5. С. 187–191. EDN: ZRPYUN doi: 10.21508/1027-4065-2017-62-5-187-191

10. Кокушин Д.Н. Особенности первичной заболеваемости подростков 15–17 лет болезнями костно-мышечной системы

и соединительной ткани в Санкт-Петербурге в период пандемии COVID-19 // Международный журнал прикладных и фундаментальных исследований. 2023. № 12. С. 24–28. EDN: RQHDNL doi: 10.17513/mjpfi.13600

11. Григорьева Н.Н., Айрапетов Г.А. Механизмы развития патологии опорно-двигательного аппарата после перенесенной инфекции COVID-19 // Гений ортопедии. 2024. Т. 30, № 1. С. 153–162. EDN: DAZQKU doi: 10.18019/1028-4427-2024-30-1-153-162

12. Ганузин В.М., Маскова Г.С., Сторожева И.В., и др. Анализ динамики состояния здоровья детей и подростков по результатам диспансерных осмотров // Российский вестник гигиены. 2021. № 3. С. 9–12. EDN: LJMPKY doi: 10.24075/rbh.2021.019

13. Богормистрова В.А., Свобода П.Н., Шестакова В.Н., и др. Структура поражений опорно-двигательного аппарата у детей подросткового возраста с учетом соматической патологии и среды проживания // Ортопедия, травматология и восстановительная хирургия детского возраста. 2022. Т. 10, № 1. С. 5–12. EDN: ORERAQ doi: 10.17816/PTORS96525

14. Мусина А.А., Амирсеитова Ф.Т., Исмаилова А.А. Влияние пандемии COVID-19 на показатели травматизма в мире и в Казахстане // Traumatology and Orthopaedics of Kazakhstan. 2021. № 1(56). С. 48–52. EDN: UZXXVX doi: 10.52889/1684-9280-2021-1-56-48-52

15. Rossi L., Behme N., Breuer C. Physical activity of children and adolescents during the COVID-19 pandemic – a scoping review // Int J Environ Res Public Health. 2021. Vol. 18, N. 21. P. 11440. doi: 10.3390/ijerph182111440

16. Полякова Ю.В., Папичев Е.В., Ахвердян Ю.Р., и др. Новая коронавирусная инфекция — прямое и косвенное влияние на пациентов с болезнями костно-мышечной системы и соединительной ткани // Современные проблемы науки и образования. 2021. № 6. Режим доступа: https://science-education.ru/ru/article/view?id=31342 Дата обращения: 01.06.2024

17. Заболеваемость детского населения России (0–14 лет) с диагнозом, установленным впервые в жизни в 2018–2022 году: статистический сборник. Ч. V. Москва: ФГБУ «ЦНИИОИЗ» Минздрава России, 2023.

18. Заболеваемость детского населения России (15–17 лет) с диагнозом, установленным впервые в жизни в 2018–2022 году: статистический сборник. Ч. V. Москва: ФГБУ «ЦНИИОИЗ» Минздрава России, 2023.

19. Сквирская Г.П., Волнухин А.В., Резе А.Г. Государственный и частный секторы системы здравоохранения Российской Федерации: от конкурентной борьбы к интеграции и партнерству // Проблемы социальной гигиены, здравоохранения и истории медицины. 2022. Т. 30, № 2. С. 275–280. EDN: SKNJCD doi: 10.32687/0869-866X-2022-30-2-275-280

20. Милосердов М.А., Маслов Н.Е., Ерохина А.С., и др. Заболеваемость населения Смоленской области острыми нарушениями мозгового кровообращения: роль социально-экономических факторов и состояния системы здравоохранения // Здравоохранение Российской Федерации. 2022. Т. 66, № 4. С. 275–281. EDN: CJXCST doi: 10.47470/0044-197X-2022-66-4-275-281

21. Юрьев В.К., Межидов К.С., Моисеева К.Е. Обращаемость детей в медицинские организации, как критерий медицинской активности родителей // Менеджер здравоохранения. 2023. № 9. С. 71–79. EDN: WVQCBO doi: 10.21045/1811-0185-2023-9-71-79

22. Горошко Н.В., Емельянова Е.К., Пацала С.В. Проблема медицинской активности населения России в эпоху COVID-19 // Социальные аспекты здоровья населения. 2022. Т. 68, № 3. С. 15. EDN: QTYSRX doi: 10.21045/2071-5021-2022-68-3-15

23. Борисенко Е.П., Романцова Е.Б., Бабцева А.Ф. Обеспеченность витамином D детского и взрослого населения Амурской области // Бюллетень физиологии и патологии дыхания. 2016. № 60. С. 57–61. EDN: WDMVVP doi: 10.12737/20121

24. Sharawat I.K., Dawman L. Bone mineral density and its correlation with vitamin D status in healthy school-going children of Western India // Arch Osteoporos. 2019. Vol. 14, N. 1. P. 13. doi: 10.1007/s11657-019-0568-3

25. Davies J.H., Reed J.M., Blake E., et al. Epidemiology of vitamin D deficiency in children presenting to a pediatric orthopaedic service in the UK // J Pediatr Orthop. 2011. Vol. 31, N. 7. P. 798–802. doi: 10.1097/BPO.0b013e31822f1af1

26. Каронова Т.Л., Михеева Е.П., Никитина И.Л., и др. Уровень обеспеченности витамином D у жителей Северо-Западного региона РФ и значение дефицита витамина D для здоровья // Остеопороз и остеопатии. 2016. Т. 19, № 2. С. 45–46. EDN: XSCNOT doi: 10.14341/osteo2016245-46

27. Хазова Е.Л., Ширинян Л.В., Зазерская И.Е., и др. Сезонные колебания уровня 25-гидроксихолекальциферола у беременных, проживающих в Санкт-Петербурге // Гинекология. 2015. Т. 17, № 4. С. 38–42. EDN: ULUHQZ

28. Тарадин Г.Г., Куглер Т.Е., Маловичко И.С., и др. Острый артрит, ассоциированный с COVID-19 // Альманах клинической медицины. 2022. Т. 50, № 2. С. 139–148. EDN: BENHBH doi: 10.18786/2072-0505-2022-50-015

29. Mobasheri L., Nasirpour M.H., Masoumi E., et al. SARS-CoV-2 triggering autoimmune diseases // Cytokine. 2022. Vol. 154. doi: 10.1016/j.cyto.2022.155873

30. Юрьев В.К., Межидов К.С., Соколова В.В. Особенности заболеваемости детей болезнями костно-мышечной системы и соединительной ткани в Чеченской Республике // Менеджер здравоохранения. 2024. № 1. С. 32–40. EDN: JVADUT doi: 10.21045/1811-0185-2024-1-32-40

31. Концевая А.В., Мырзаматова А.О., Муканеева Д.К., и др. Физическая активность детей школьного возраста в пандемию COVID-19: результаты российской части международного исследования с участием 9 стран Европы // Экология человека. 2022. № 10. С. 729–738. EDN: EMLCZN doi: 10.17816/humeco109524

32. Сибирякова Н.В. Физиологические аспекты рисков. Обусловленных низкой физической активностью // Ульяновский медико-биологический журнал. 2023. № 2. С. 132–144. EDN: CROCGT doi: 10.34014/2227-1848-2023-2-132-144

AUTHOR INFORMATION

Dmitriy N. Kokushin, MD, PhD, Cand. Sci. (Med.);
ORCID: 0000-0002-2510-7213;
eLibrary SPIN: 9071-4853;
e-mail: partgerm@yandex.ru

ОБ АВТОРАХ

Дмитрий Николаевич Кокушин, канд. мед. наук;
ORCID: 0000-0002-2510-7213;
eLibrary SPIN: 9071-4853;
e-mail: partgerm@yandex.ru

AUTHOR INFORMATION

*** Vera V. Sokolova**, MD, PhD, Cand. Sci. (Med.), Assistant Professor;
address: 2 Litovskaya str., Saint Petersburg, 194100, Russia;
ORCID: 0000-0001-7034-9281;
eLibrary SPIN: 9708-3639;
e-mail: vera-Sokol@inbox.ru

Vadim V. Kirilenko, ED, PhD, Cand. Sci. (Econ.), Assistant Professor;
ORCID: 0000-0001-7642-4561;
eLibrary SPIN: 4718-9184;
e-mail: vadimvlkir@bk.ru

Natalya A. Guryeva, MD, PhD, Cand. Sci. (Med.), Assistant Professor;
ORCID: 0000-0001-8827-3537;
e-mail: socp_ozz@mail.ru

Lyubov L. Sharafutdinova,
MD, PhD, Cand. Sci. (Med.), Assistant Professor;
ORCID: 0000-0002-3478-6043;
eLibrary SPIN: 2230-8341;
e-mail: socp_ozz@mail.ru

ОБ АВТОРАХ

*** Вера Васильевна Соколова**, канд. мед. наук, доцент;
адрес: Россия, 194100, Санкт-Петербург, ул. Литовская, д. 2;
ORCID: 0000-0001-7034-9281;
eLibrary SPIN: 9708-3639;
e-mail: vera-Sokol@inbox.ru

Вадим Владимирович Кириленко, канд. экон. наук, доцент;
ORCID: 0000-0001-7642-4561;
eLibrary SPIN: 4718-9184;
e-mail: vadimvlkir@bk.ru

Наталья Алексеевна Гурьева, канд. мед. наук, доцент;
ORCID: 0000-0001-8827-3537;
e-mail: socp_ozz@mail.ru

Любовь Леонидовна Шарафутдинова,
канд. мед. наук, доцент;
ORCID: 0000-0002-3478-6043;
eLibrary SPIN: 2230-8341;
e-mail: socp_ozz@mail.ru

* Corresponding author / Автор, ответственный за переписку