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MEDICAL AND SOCIAL FEATURES OF THE FORMATION OF INFECTIOUS MORBIDITY OF CHILDREN OF THE METROPOLIS

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ABSTRACT. The study of the features of infectious morbidity, especially during the spread of a new coronavirus infection, is of particular relevance in the organization of medical care to the population and ensuring anti-epidemic safety. A comprehensive study of the infectious morbidity of children aged 0-17 years in St. Petersburg in 2016–2020 was conducted. The indicators of infectious morbidity of the child population by groups of infectious diseases and individual nosologies, by different ages, living conditions and clusters of city districts were assessed. Differences in the sanitary state of the external environment in the districts of St. Petersburg were revealed, such as chemical contamination of surface waters in industrial and central areas, an increase in unsatisfactory samples of bacterial contamination, especially in the historical center, an unsatisfactory situation of chemical contamination of soils in industrial and residential areas. During the observation period, there was a decrease in the general infectious morbidity among children in the city, only in 2018 and 2019 an increase in this indicator was recorded in suburban areas. The highest incidence of intestinal infections was observed in residential areas, the lowest in suburban areas. While maintaining the general trend of reducing the incidence of acute viral hepatitis, an increase in industrial and suburban areas in 2017 and 2018 was noted. The highest flu incidence rates were in residential areas, the lowest — in the historical center. In all groups of districts of the city in 2020 compared to 2019 an increase in the incidence of viral pneumonia was recorded, the most significant in industrial and suburban areas. The incidence of mainly sexually transmitted infections in 2020 decreased in the city as a whole, but in residential, industrial and central areas there was an increase in the incidence of gonococcal infection. The study of the features of the formation of infectious morbidity will contribute to the optimization of organizational and anti-epidemic measures.

KEY WORDS: infectious morbidity; new coronavirus infection; children 0–17 years old; sanitary condition.

МЕДИКО-СОЦИАЛЬНЫЕ ОСОБЕННОСТИ ФОРМИРОВАНИЯ ИНФЕКЦИОННОЙ ЗАБОЛЕВАЕМОСТИ ДЕТЕЙ МЕГАПОЛИСА

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РЕЗЮМЕ. Изучение особенностей инфекционной заболеваемости, особенно в период распространения новой коронавирусной инфекции, приобретает особую актуальность при организации медицинской помощи населению и обеспечении противоэпидемической безопасности. Проведено сплошное исследование инфекционной заболеваемости детей 0–17 лет в Санкт-Петербурге в 2016–2020 годах. Оценке подлежали показатели инфекционной заболеваемости детского населения по группам инфекционных болезней и отдельным нозологиям, по различным возрастам, условиям проживания и группам районов города. Выявлены различия в санитарном состоянии внешней среды в районах Санкт-Петербурга, такие как химическая загрязненность поверхностных вод в промышленных и центральных районах, увеличение неудовлетворительных проб по бактериальной загрязненности, особенно в историческом центре, неудовлетворительная ситуация по химической загрязненности почв в промышленных и спальных районах. За период наблюдения отмечалось снижение общей инфекционной заболеваемости среди детей в городе, только в 2018 и 2019 годах зафиксирован подъем данного показателя в пригородных районах. Наибольший уровень заболеваемости кишечными инфекциями отмечен в спальных районах, наименьший — в пригородных. При сохранении общего тренда на уменьшение заболеваемости острым вирусным гепатитом отмечалось ее увеличение в промышленных и пригородных районах в 2017 и 2018 годах. Наибольшие показатели заболеваемости гриппом были в спальных районах, наименьшие — в историческом центре. Во всех группах районов города в 2020 году по сравнению с 2019 годом зафиксирован рост заболеваемости вирусной пневмонией, наиболее значимый — в промышленных и пригородных районах. Общая заболеваемость инфекциями, передающимися преимущественно половым путем, в 2020 году в целом в городе уменьшилась, однако в спальных, промышленных и центральных районах отмечался рост заболеваемости гонококковой инфекцией. Изучение особенностей формирования инфекционной заболеваемости будет способствовать оптимизации организационных и противоэпидемических мероприятий.

КЛЮЧЕВЫЕ СЛОВА: инфекционная заболеваемость; новая коронавирусная инфекция; дети 0–17 лет; санитарное состояние.

INTRODUCTION

Infectious disease morbidity is an indicator of national security. It is one of the main causes of temporary disability of the working population, including care for a sick family member (child).

It is a well-known fact that the incidence of infectious diseases in the general population and individual socio-age groups is characterized by irregularity over time. Long-term dynamics is characterized by epidemic tendency, cyclicity and irregular (episodic) rises and (or) falls of morbidity. Epidemics develop during wars, after natural disasters, in case of neglect in highly effective anti-epidemic measures [1, 4, 5].

The year 2020 is notable for the epidemic spread of new coronavirus infection (NCVI),

which has reached a near-pandemic scale in all parts of the globe [6, 11].

Pandemic (Greek Πανδημία — the whole nation) is an unusually severe epidemic spread across countries and continents; the highest degree of development of the epidemic process. Pandemic is the most dangerous form of a new disease spreading on a worldwide scale. According to the criteria of the World Health Organization (WHO), a pandemic is the spread of a new disease worldwide [2, 10]. 5 million people became victims of the new Coronavirus infection (NCVI) in two years; more than 250 million (about 3% of the world's population) suffered from the disease in various forms. The pandemic led to an economic crisis, widespread quarantines, use of protective masks and, since the beginning of 2021, mass vaccination.

The incidence of acute respiratory infections and other infectious diseases continues to be recorded during the NCVI pandemic. The quarantine closure of a large number of preschool educational organizations (PEOs) and the switch to a distance learning mode in 2020 had a significant impact on the infectious disease incidence among the child population of St. Petersburg. At the same time, there are significant differences in infectious morbidity in general and by individual nosologies in different districts of the city.

AIM

To analyze the infectious morbidity of children 0–17 years old, to estimate the prevalence of infectious morbidity among the child population of St. Petersburg in 2016–2020, to evaluate the distribution of various nosologies of some infectious and parasitic diseases which depend on the medico-economic and medico-social characteristics of the districts in St. Petersburg, to assess the state of infectious morbidity of the child population in the analyzed groups.

MATERIALS AND METHODS

The research was conducted to retrospectively study the infectious morbidity of children 0–17 years old in St. Petersburg in 2016–2020, according to the conditions of residence and districts of the city. Following statistical observation forms have been analyzed: form No. 1 "Information about infectious and parasitic diseases", form No. 2 "Information about infectious and parasitic diseases", form No. 23–17 "Information about outbreaks of infectious diseases", form No. 18 "Information about the sanitary condition of the subject of the Russian Federation" [9]. The study was conducted by a continuous method. It covered the indicators of infectious morbidity of the child population in the period from 2016 to 2020. Various groups of the research included infectious diseases and individual nosologies in different ages and districts.

The principles of grouping neighborhoods of residence in St. Petersburg are presented. The neighborhoods of St. Petersburg are conditionally divided into 4 groups.

The 1st group is "Dormitory districts". This is the largest group in terms of adult and child population (the child population is more than 478 thousand children 0–17 years old). The group includes Vyborgsky, Kalininsky, Krasnoselsky, Primorsky, Frunzensky districts. These are the districts with the largest development and formation of housing stock.

The 2nd group — "Industrial districts". It is formed by Kirovsky, Krasnogvardeysky, Moskovsky and Nevsky districts. The average annual child population is more than 295 thousand children. The group is characterized by the highest level of industrial production.

The 3rd group includes the districts of the historical center: Admiralteysky, Vasileostrovsky, Petrogradsky, Tsentralny, with a child population of more than 112 thousand. The group is characterized, on the one hand, by the presence of a large number of communal (shared) apartments, and hence migration flows, and on the other hand, by a large volume of elite housing, transport flows, and an extended network of restaurants and cafes. This group is also characterized by the presence of a great number of medical and educational organizations in adapted buildings and premises built in the XVIII–XIX centuries, and in some cases these premises do not meet sanitary requirements.

Group 4 — "Suburban districts". This group includes Kolpinsky, Kronstadt, Kurortny, Petrodvortsovy, Pushkinsky districts of St. Petersburg. The group is characterized by the lowest population density and satisfactory environmental and hygienic indicators.

RESULTS AND DISCUSSION

St. Petersburg is located on 42 islands of the Neva River delta on the eastern coast of the

Gulf of Finland. St. Petersburg is currently divided into 18 administrative districts. In recent years, residential areas have been developing in all directions from the historical center of the city. The area of the city is more than 606 km^2. The nearest suburbs are located on the lowlands of the Neva River, they stretch along the bay — 1439 km^2 [3]. Population density in 2020 — 3837.73 people/km^2.

The quality of the environment in the region is determined by air and water pollution, land, waste accumulation, the state of green spaces and many other factors. Air basin pollution is determined by the mass of pollutant emissions from stationary and mobile sources. The main polluters of the city's atmosphere are enterprises of fuel and energy complex, metallurgy, metal processing and motor transport. A significant contribution to the air pollution of the city is made by transit transport, which is not recorded, however, its increase is noticeable. In general, the level of air pollution in the city is below the average in Russia. It is one of the lowest among the cities with more than 1 million of inhabitants (Table 1) [3].

The current research assesses the city districts in 2016 and 2020 by separate spheres of life: socio-demographic; health care (development of the network of medical organizations (MOs) and organization of medical support for children and adolescents); socio-economic; environmental and hygienic.

The presented data indicate the improvement of air quality in the city districts during the research.

The main source of water supply in St. Petersburg and its nearest suburbs is the Neva River. A number of suburban areas are supplied with water from underground sources (Krasnoselsky, Kurortny, Petrodvortsky, Pushkinsky districts). The quality of surface waters of St. Petersburg is mainly determined by the quality of natural waters flowing into the city as well as wastewater discharged [3].

The survey of underground water supply sources in Krasnoselsky district (classified as a group of dormitory districts) performed in 2016 showed both chemical and bacterial contamination in 85.7 and 3.6% of samples according to the Form No. 18 "Information on the sanitary condition of the subject of the Russian Federation". In 2020, bacterial contamination was not registered, and chemical contamination almost halved to 43.8% of samples. In three districts categorized as suburban (Kurortny, Pushkinsky and Petrodvortsovy), both chemical and bacterial contamination of underground water supply sources was also detected. In 2016, it amounted to 52.08 and 2.08%, respectively. In 2020, chemical contamination in suburban areas decreased

Table 1

Air quality in 2016 and 2020 (according to Form No. 18 "Information on the sanitary condition of the subject of the Russian Federation")

Таблица 1

Качество воздушной среды в 2016 и 2020 гг. (по данным формы № 18 «Сведения о санитарном состоянии субъекта Российской Федерации»)

Groups of districts / Группы районов /	2016			2020		
	Total research / Всего исследований	Number of unsatisfactory samples / Количество неудовлетворительных проб	% of unsatisfactory samples / % неудовлетворительных проб	Total research / Всего исследований	Number of unsatisfactory samples / Количество неудовлетворительных проб	% of unsatisfactory samples / % неудовлетворительных проб
Group 1 / 1-я группа	12 914	10	0,39	6500	0	0
Group 2 / 2-я группа	11 506	7	0,24	7450	0	0
Group 3 / 3-я группа	5615	30	2,14	3700	0	0
Group 4 / 4-я группа	6544	0	0	3350	0	0

more than 2-fold (to 24.14%), while bacterial contamination was not registered. These areas are characterized by the presence of private households, centralized and personal water supply systems.

In 2016 surface water supply sources have been examined for chemical, bacteriological and parasitic contamination. In 2016, as well as in 2020, 100% of surface water samples in dormitory districts were unsatisfactory in relation to bacterial contamination. The bacterial contamination in industrial districts increased from 75% of samples to 100%, in 2020 100% of samples were unsatisfactory concerning chemical contamination. Water samples in the historical center districts showed a significant increase in unsatisfactory results. The quality of water supply from surface sources in 2020 cannot be called satisfactory both by chemical and bacteriological components in all groups of districts (Table 2).

The condition of soils in different districts was analyzed as well. The main sources of pollution in St. Petersburg are industrial emissions, dust from construction sites and roads, waste disposal sites, garbage dumps, groundwater, and atmospheric precipitation. During the entire research, the unsatisfactory situation with regard to soil contamination by chemical pollutants (copper, lead, zinc, tin, tungsten, nickel, chromium) was recorded in industrial areas. The soil contamination in dormitory districts increased more than 2 times during the research period. Suburban areas and the historical center of the city were characterized by more favorable indicators of soil pollution (Table 3).

There have been performed the analysis of housing provision of the population in different districts of the city over a ten-year period (in 2010 and 2020).

In 2010, the highest housing provision (in m^2 per 1 inhabitant) is in the 2nd and 3rd groups (industrial districts and the historical center). The lowest is in suburban areas (Group 4). The highest population density is in industrial districts and the historical center, the lowest — in suburban areas (Table 4) [12].

In 2020, in all groups of districts except for the historical center, an increased provision of housing per 1 inhabitant from 18.4 to 19.9 m^2 is registered. At the same time there is a decrease in this indicator from 15.8 to 10.3 m^2 in group 3 (historical center). It should be noted that population density in group 3 increased (from 5692.9 in 2010 to 5796.8 in 2020) whereas the housing stock decreased, presumably due to the

Table 2

Surface water quality in 2016 and 2020 (according to Form No. 18 "Information on the sanitary condition of the subject of the Russian Federation")

Таблица 2

Качество поверхностных вод в 2016 и 2020 годах (по данным формы № 18 «Сведения о санитарном состоянии субъекта Российской Федерации»)

Groups of districts / Группы районов	2016						2020					
	Total chemical samples / Всего химических проб	% of unsatisfactory / % неудовлетворительных	Total bacteriological samples / Всего бактериологических проб	% of unsatisfactory / % неудовлетворительных	Total parasitological samples / Всего паразитологических проб	% of unsatisfactory / % неудовлетворительных	Total chemical samples / Всего химических проб	% of unsatisfactory% / неудовлетворительных	Total bacteriological samples / Всего бактериологических проб	% of unsatisfactory / % неудовлетворительных	Total parasitological samples / Всего паразитологических проб	% of unsatisfactory / % неудовлетворительных
Group 1 / 1-я группа	13	0	12	100	12	8,3	12	0	12	100	12	0
Group 2 / 2-я группа	24	0	24	75	24	0	24	100	24	83,3	24	0
Group 3 / 3-я группа	12	0	12	0	12	0	12	100	12	91,7	12	0
Group 4 / 4-я группа	24	0	24	83,3	23	50	24	8,3	24	100	24	0

Table 3

Soil quality in groups of districts in 2016 and 2020
(according to Form No. 18 "Information on the sanitary condition of the subject of the Russian Federation")

Таблица 3

Качество почвы в группах районов в 2016 и 2020 годах
(по данным формы № 18 «Сведения о санитарном состоянии субъекта Российской Федерации»)

Groups of districts / Группы районов	2016				2020			
	Total chemical samples / Всего химических проб	% of unsatisfactory / % неудовлетворительных	Total bacteriological samples / Всего бактериологических проб	% of unsatisfactory / % неудовлетворительных	Total chemical samples / Всего химических проб	% of unsatisfactory / % неудовлетворительных	Total bacteriological samples / Всего бактериологических проб	% of unsatisfactory / % неудовлетворительных
Group 1 / 1-я группа	1871	1,44	1871	0	588	3,23	588	0
Group 2 / 2-я группа	1360	1,32	1360	0	324	1,50	324	0
Group 3 / 3-я группа	1230	1,14	1230	0	290	0,02	290	0
Group 4 / 4-я группа	1101	0	702	0	359	0,01	359	0

Table 4

Provision of housing for the population of groups of districts of St. Petersburg in 2010 (m^2)

Таблица 4

Обеспеченность жильем населения групп районов Санкт-Петербурга в 2010 году ($м^2$)

Groups of districts / Группы районов	Total population / Все население	Children's population / Детское население	Living area (m^2) / Жилая площадь ($м^2$)	Population density (km^2) / Плотность населения ($км^2$)	Housing provision for 1 resident (m^2) / Обеспеченность жильем 1 жителя ($м^2$)	Number of rooms per 1 resident / Число комнат на 1 жителя
Group 1 / 1-я группа	2 191 766	295 114	27759,1	4796,8	12,7	0,8
Group 2 / 2-я группа	1 424 249	207 834	19 210	6015,4	13,5	0,9
Group 3 / 3-я группа	706 035	98 671	11 186,8	5692,9	15,8	0,9
Group 4 / 4-я группа	555 171	88050	6486,8	1100,4	11,7	0,8
St. Petersburg / Санкт-Петербург	4 877 221	705 910	64642,7	3467,4	13,3	0,9

transfer of housing stock into non-residential, a large number of shared apartments and an increase in population due to external migration, which affects the increase in population density (Table 5) [12].

Primary health care (PHC) for children in St. Petersburg, including primary specialized care, is provided at 1,170 pediatric areas in 79 children's outpatient polyclinics, among them 16 are children's city outpatient clinics and 63 are children's outpatient departments. In addition, primary health care for children is provided in 20 offices of general medical practice, and primary specialized medical care is provided in

Table 5

Provision of housing for the population of groups of districts of St. Petersburg in 2020 (m^2)

Таблица 5

Обеспеченность жильем населения групп районов Санкт-Петербурга в 2020 году ($м^2$)

Groups of districts / Группы районов	Total population / Все население	Children's population / Детское население	Living area (m^2) / Жилая площадь ($м^2$)	Population density (km^2) / Плотность населения ($км^2$)	Housing provision for 1 resident (m^2) / Обеспеченность жильем 1 жителя ($м^2$)	Number of rooms per 1 resident / Число комнат на 1 жителя
Group 1 / 1-я группа	2 413 403	478 459	47815, 6	5281,9	19,8	1,2
Group 2 / 2-я группа	1 576 132	295 313	31 307,6	6656,9	19,9	1,3
Group 3 / 3-я группа	718 919	112 292	7 429,6	5796,8	10,3	0,6
Group 4 / 4-я группа	675 436	140 149	12 773,3	1338,8	18,9	1,3
St. Petersburg / Санкт-Петербург	5 398 100	1 026 213	99 326,1	3837,7	18,4	1,3

Table 6

Provision of primary health care for children aged 0–17 from groups of districts of St. Petersburg in 2020 (%)

Таблица 6

Обеспеченность первичной медико-санитарной помощью детей 0–17 лет из групп районов Санкт-Петербурга в 2020 году (%)

Groups of districts / Группы районов	The number of children aged 0–17 years (abs. h.) / Численность детского населения 0-17 лет (абс. ч.)	The number of pediatric sites / Число педиатрических участков	Staffing with district pediatricians (%) / Укомплектованность врачами-педиатрами участковыми (%)	Provision with district pediatricians (per 10,000 population) / Обеспеченность врачами-педиатрами участковыми (на 10 000 населения)
Group 1 / 1-я группа	478 459	554	94,4	13,25
Group 2 / 2-я группа	295 313	328	94,1	12,16
Group 3 / 3-я группа	112 292	131	91,7	11,31
Group 4 / 4-я группа	140 149	157	91,4	11,0
St. Petersburg / Санкт-Петербург	1 026 213	1170	93,7	12,38

consultative and diagnostic centers, including medical organizations of federal subordination, specialized early treatment and prevention center, outpatient and consultative departments of city hospitals, and dental clinics [7, 8].

There have been performed an analysis of medical organizations providing primary health care to children, namely their staffing with district pediatricians and the availability of district pediatricians. In relation to the number of district pediatricians, the first and second ranks belong to the 1st and 2nd groups of districts: 13.25 and 12.16 per 10,000 children, respectively. The staffing level of district pediatricians is over 90% in all groups of districts (Table 6) [8].

The highest level of availability of district pediatricians is noted in the districts where the construction of new housing is accompanied by

the development of health care infrastructure, commissioning of new polyclinics and general practitioners' centers.

The minimum level of provision is noted in the group of suburban areas, where the development of medical infrastructure lags behind the growing demand of the population. At the same time, taking into account the lowest density of children's population, this group has the greatest "elbow of access" to children's polyclinics. The peculiarity of the 3rd group of districts (the historical center) is high population density, low provision with housing per 1 inhabitant and the 3rd place in terms of staffing with pediatricians.

Analyzing the growth/decline of the child population, a decrease in the number of children 0–17 years old in the 3rd group of districts by 1.85% was noted. The maximum increase in the number of children aged 0–17 years was observed in dormitory and suburban districts (16.4% and 21.6% growth in dynamics, respectively).

Thus, our conditional mapping of St. Petersburg districts and their grouping according to the studied qualitative criteria confirmed the assumptions about significant differences in the levels of infectious morbidity of children in all groups of districts during the research. It is worth noting that the overall infectious morbidity of children for 2016–2020 decreased by 32.9%, the largest decrease was recorded in the group of sleeping areas (35.3%), in the group of the historical center (37.0%), industrial areas (36.0%), and the smallest — in suburban areas (13.5%) (Fig. 1).

At the same time, while the general trend towards a decrease in overall infectious morbidity for all groups of districts was preserved, a significant decrease in the indicator was noted precisely in 2020 (–22.1% compared to 2019). The peculiarity of 2020 was the epidemic spread of a new coronavirus infection. The introduction of restrictive measures, including full distance learning and shutdown of public catering enterprises had a significant impact on the reduction of infectious morbidity.

An analysis of infectious morbidity was carried out by following groups of infections in the

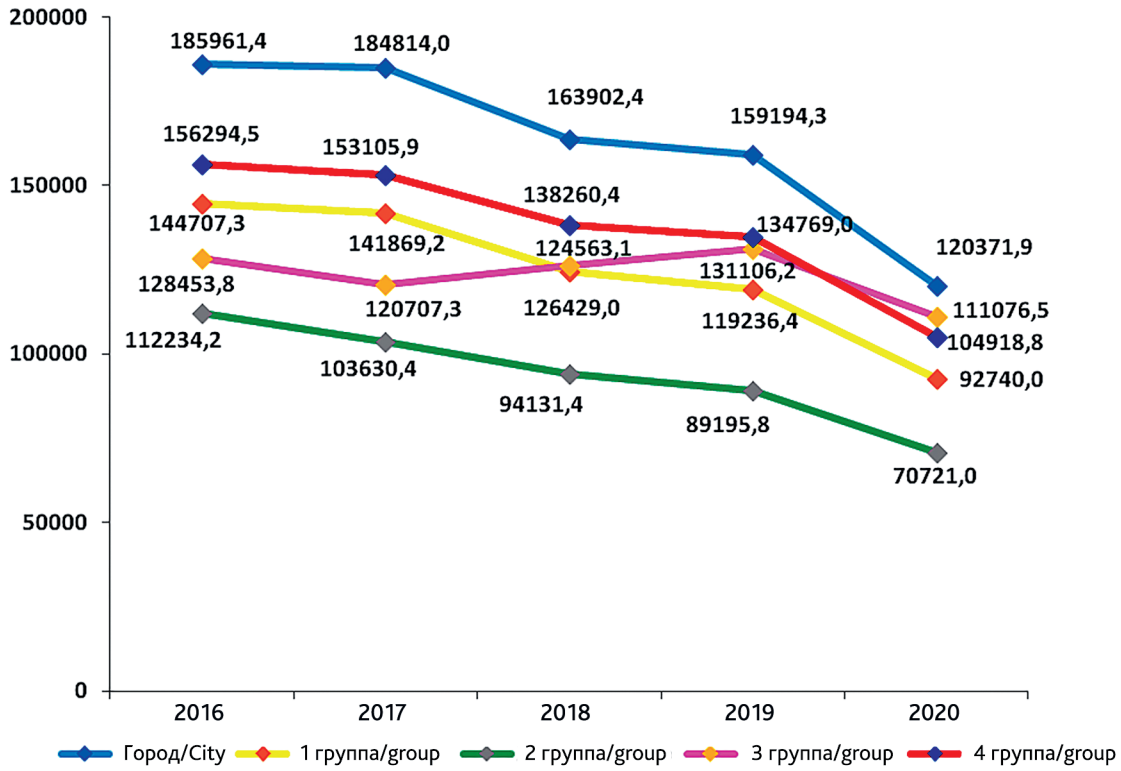

Fig. 1. Total infectious morbidity of children aged 0–17 years in 2016–2020 in groups of districts and in St. Petersburg as a whole (per 100,000 children)

Рис. 1. Общая инфекционная заболеваемость детей 0–17 лет в 2016–2020 годах в группах районов и в целом по Санкт-Петербургу (на 100 000 детей)

districts: incidence of intestinal infections (including bacterial dysentery), acute viral hepatitis, respiratory tract infections (acute respiratory infections, influenza, viral pneumonia), gonococcal infection, active tuberculosis.

The conducted analysis showed a similar trend to the decrease in general infectious morbidity — a decrease in the incidence of intestinal infections in 2020 in all groups of districts compared to 2016: by 45.0% in Group 1, 41.0% in Group 2, 40.1% in Group 3 and 35.0% in Group 4. At the same time, the highest incidence of intestinal infections was observed in the group of sleeping areas, the lowest — in suburban areas, with no significant differences between the groups of districts (Fig. 2).

Estimating the age structure of morbidity with intestinal infections, it was noted that the most prevalent group was the age of 3–6 years, 27.4% — on 7–14 years, 20% — on 1–2 years (Table 7).

Two infections from the group of intestinal infections — bacterial dysentery and viral hepatitis A were selected for the analysis as they were the most significant in epidemiological terms.

In 2019, the highest incidence of bacterial dysentery was recorded in the 2nd and 3rd groups of districts, however, in 2020, the incidence of bacterial dysentery was maximally reduced by 80% in these groups. At the same time, the morbidity in the suburban areas was lower than in other groups throughout the analyzed period (Fig. 3).

Analyzing the incidence of bacterial dysentery in children, data were obtained indicating significant differences in the prevalence of bacterial dysentery in all groups of districts. Thus, all groups of districts showed an increase in incidence in 2018, but the highest rate of was recorded in industrial districts (260.1%). In 2019, the outbreak was recorded in the central districts, where the incidence increased by 54.5% compared to 2018.

Over the five-year period, the city as a whole showed a decrease in the incidence of acute

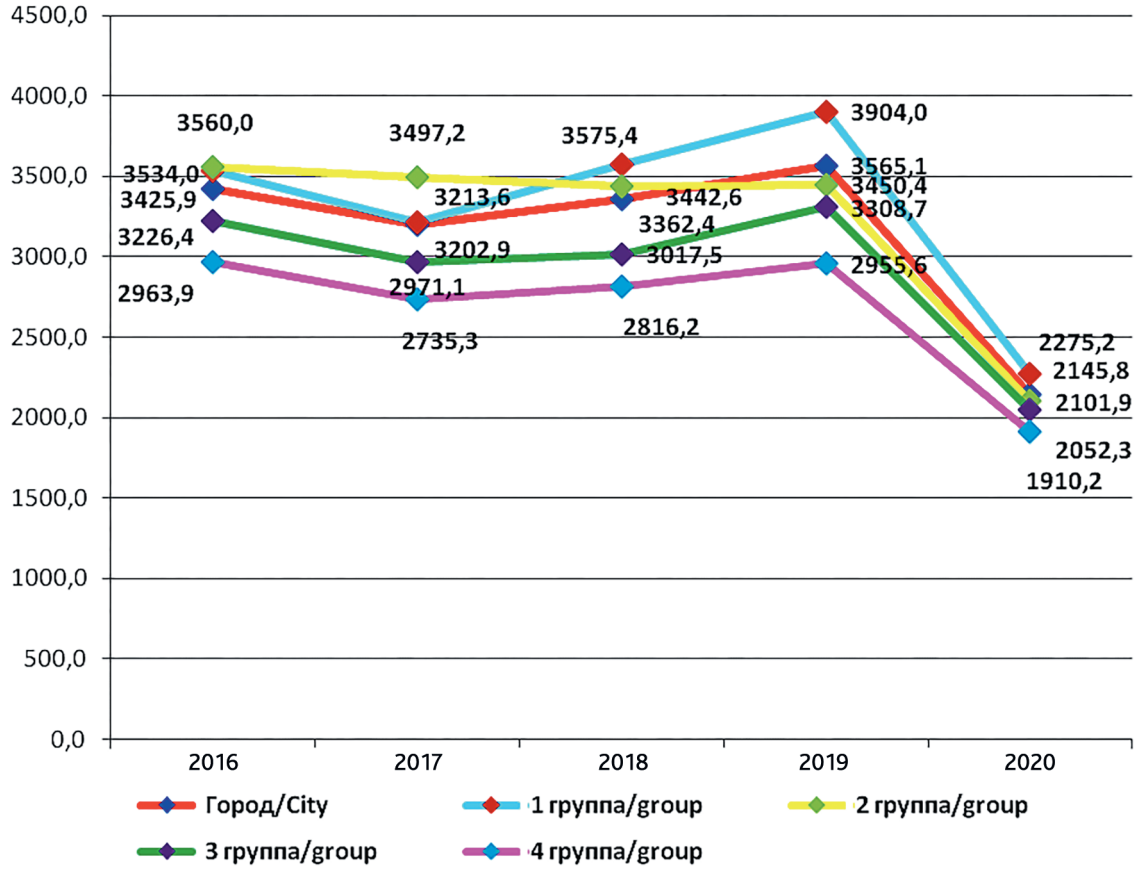

Fig. 2. Incidence of intestinal infections in children aged 0–17 years in 2016–2020 in St. Petersburg (per 100,000 children)

Рис. 2. Заболеваемость детей 0–17 лет кишечными инфекциями в 2016–2020 годах в Санкт-Петербурге (на 100 000 детей)

Table 7

The average annual age structure of the incidence of certain infectious diseases of children 0–17 years old in St. Petersburg in 2016–2020 (summary data for five years,%)

Таблица 7

Среднегодовая возрастная структура заболеваемости некоторыми инфекционными болезнями детей 0–17 лет в Санкт-Петербурге в 2016–2020 году (сводные данные за пять лет,%)

Nosology / Нозология	Up to 1 year / До 1 года	1–2 years / 1–2 года	3–6 years / 3–6 лет	7–14 years / 7–14 лет	15–17 years / 15–17 лет	Total% / Итого%
General infectious morbidity / Общая инфекционная заболеваемость	8,8	20,0	36,4	27,6	7,2	100
Group of intestinal infections / Группа кишечных инфекций	13,7	27,7	29,6	22,5	6,5	100
Dysentery / Дизентерия	2,8	17,0	33,8	32,8	13,6	100
Acute viral hepatitis / Острый вирусный гепатит	5,4	16,7	28,0	36,6	13,3	100
Respiratory tract infections / Инфекции дыхательных путей	8,8	19,9	36,6	27,4	7,3	100
Acute respiratory infections / ОРЗ	11,8	24,6	33,8	22,4	7,4	100
Flu / Грипп	8,2	22,4	35,2	26,1	8,1	100
Viral pneumonia / Вирусная пневмония	7,0	24,3	31,3	22,3	15,1	100
Parasitic infections / Паразитарные инфекции	0,2	3,6	28,8	64,0	3,4	100
Gonococcal infection / Гонококковая инфекция	0	0	5,0	10,2	84,8	100
Active tuberculosis / Активный туберкулез	1,7	11,0	27,3	43,6	16,4	100

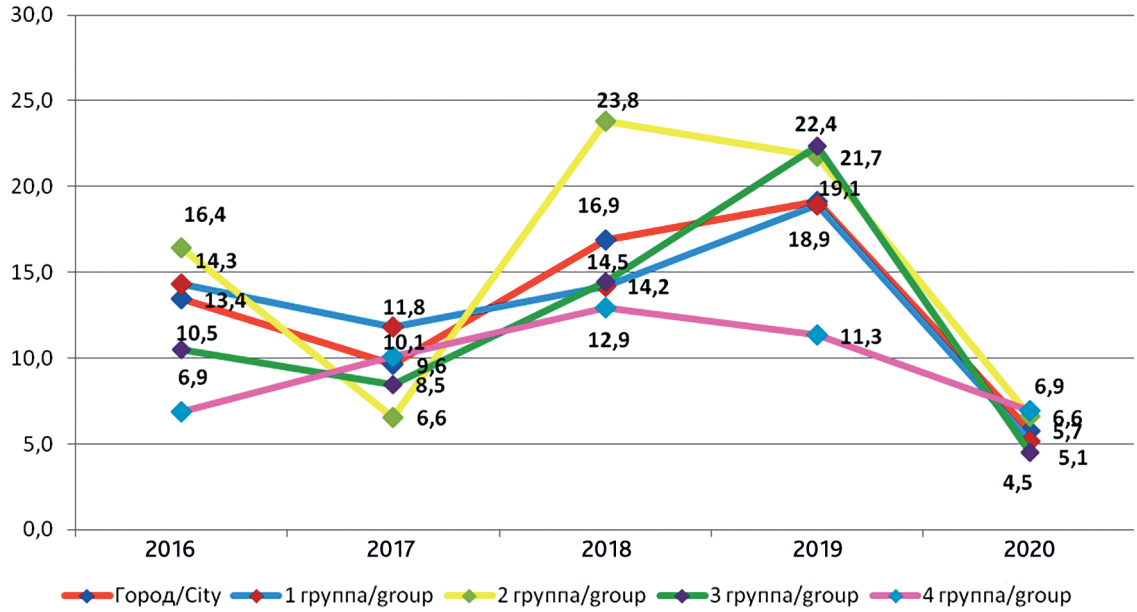

Рис. 3. Заболеваемость детей 0–17 лет бактериальной дизентерией в 2016–2020 годах в Санкт-Петербурге (на 100 000 детей)

Fig. 3. Incidence of bacterial dysentery in children aged 0–17 in 2016–2020 in St. Petersburg (per 100,000 children)

viral hepatitis by 86.9%. While maintaining the general trend on decreasing, there was an increase in incidence compared to 2016 in the group of industrial areas (in 2017 by 58.2%) and suburban areas (in 2018 by 2 times). These groups of districts had the highest percentage of unsatisfactory bacteriologic samples of soil and surface water. At the same time, single cases

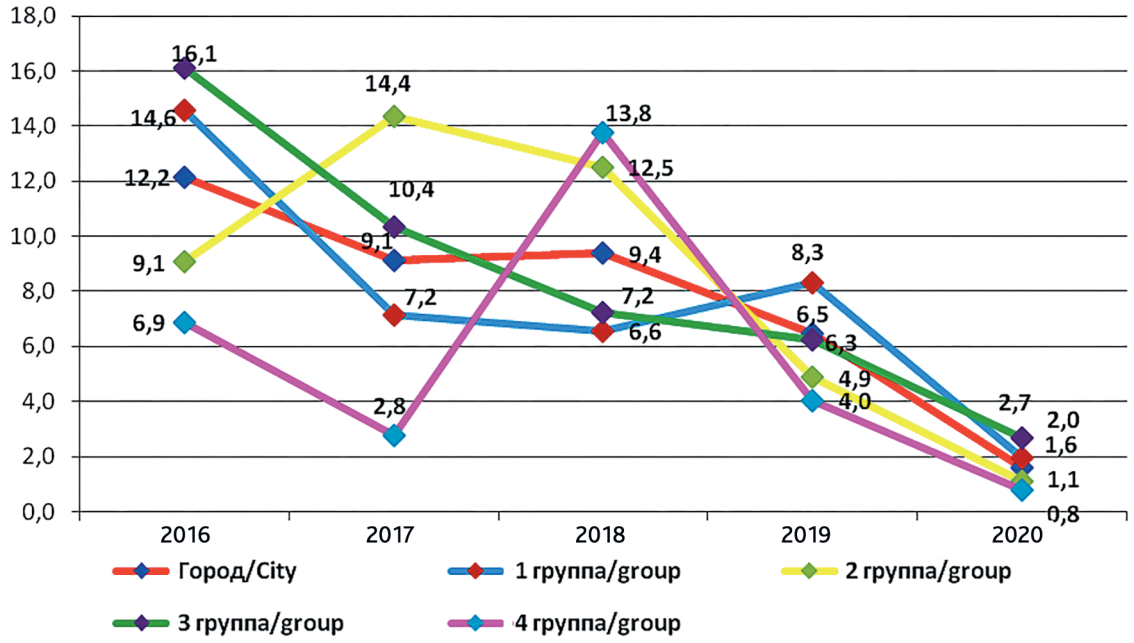

Fig. 4. Incidence of acute viral hepatitis in children 0–17 years old in 2016–2020 in St. Petersburg (per 100,000 children)

Рис. 4. Заболеваемость острым вирусным гепатитом детей 0–17 лет в 2016–2020 годах в Санкт-Петербурге (на 100 000 детей)

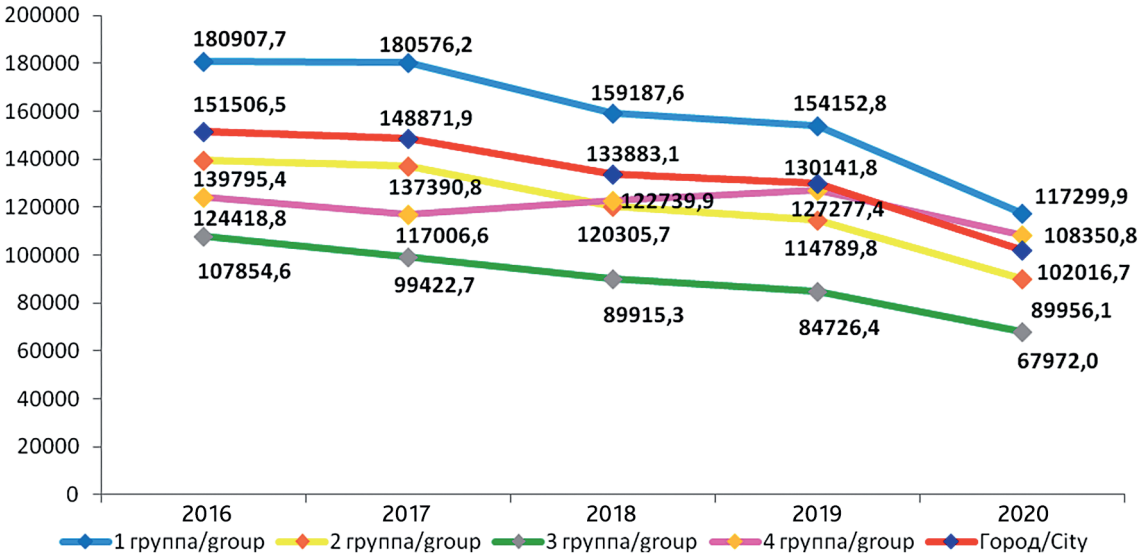

Fig. 5. Incidence of respiratory tract infections in children aged 0–17 in 2016–2020 in St. Petersburg (per 100,000 children)

Рис. 5. Заболеваемость детей 0–17 лет инфекциями дыхательных путей в 2016–2020 годах в Санкт-Петербурге (на 100 000 детей)

are recorded in all groups of districts in 2020 (Fig. 4).

The most common group of infections is respiratory tract infections. This group takes the leading place among the total infectious morbidity. Over the five-year period, the share of respiratory tract infections in St. Petersburg decreased by 32.7%. While the general trend towards a decrease in infectious morbidity in 2020 was maintained, there was an increase in the specific weight of respiratory tract infections in the group of suburban areas during 2018–2019: in 2019 compared to 2017, the increase amounted to 8.8%. A significant difference in the incidence of respiratory tract infections between the groups of districts was revealed, in particular,

the incidence in group 1 in 2020 was 1.7 times higher than in group 3 (Fig. 5).

Several individual nosological forms that play the most significant role in the morbidity of respiratory tract infections have been identified. Influenza and other acute respiratory viral infections account for 91.2% in the structure of all infectious diseases.

It was noted that the increase in influenza incidence among children has been risen in all groups of the districts since 2017, while the incidence of respiratory tract infections decreased. It was established that the highest rates of influenza morbidity were observed in the central districts, and the lowest — in suburban districts. Analyzing influenza incidence in 2020 compared to 2019, a pronounced increase in incidence was observed in all groups of neighborhoods, from 24.8% in suburban areas to 73.2% in industrial areas. At the same time, the highest incidence in 2020 was registered in the group of the historical center (215.5 per 100,000 children 0–17 years old), the lowest in the group of suburban areas (83.9) (Fig. 6).

Due to the COVID-19 epidemic, a significant increase in viral pneumonias among children was observed in 2020 compared to 2019 (20.7 times). The same trend was observed in all groups of city neighborhoods. Within the period from 2016 to 2019 no cases of viral pneumonias were recorded in suburban, central and industrial districts. In 2020 there was a sharp rise of the pathology in all groups of districts: in group 1 by 21.5 times, in group 2 by 26.7 times, in group 3 by 31.9 times, in group 4 by 10.6 times (Fig. 7).

Among predominantly sexually transmitted infections (PSTIs), gonococcal infection manifested in St. Petersburg in 2020, with an increase of 32%. The greatest increase in the incidence of the infection occurred in industrial (17.3 times), dormitory (24 times) and central

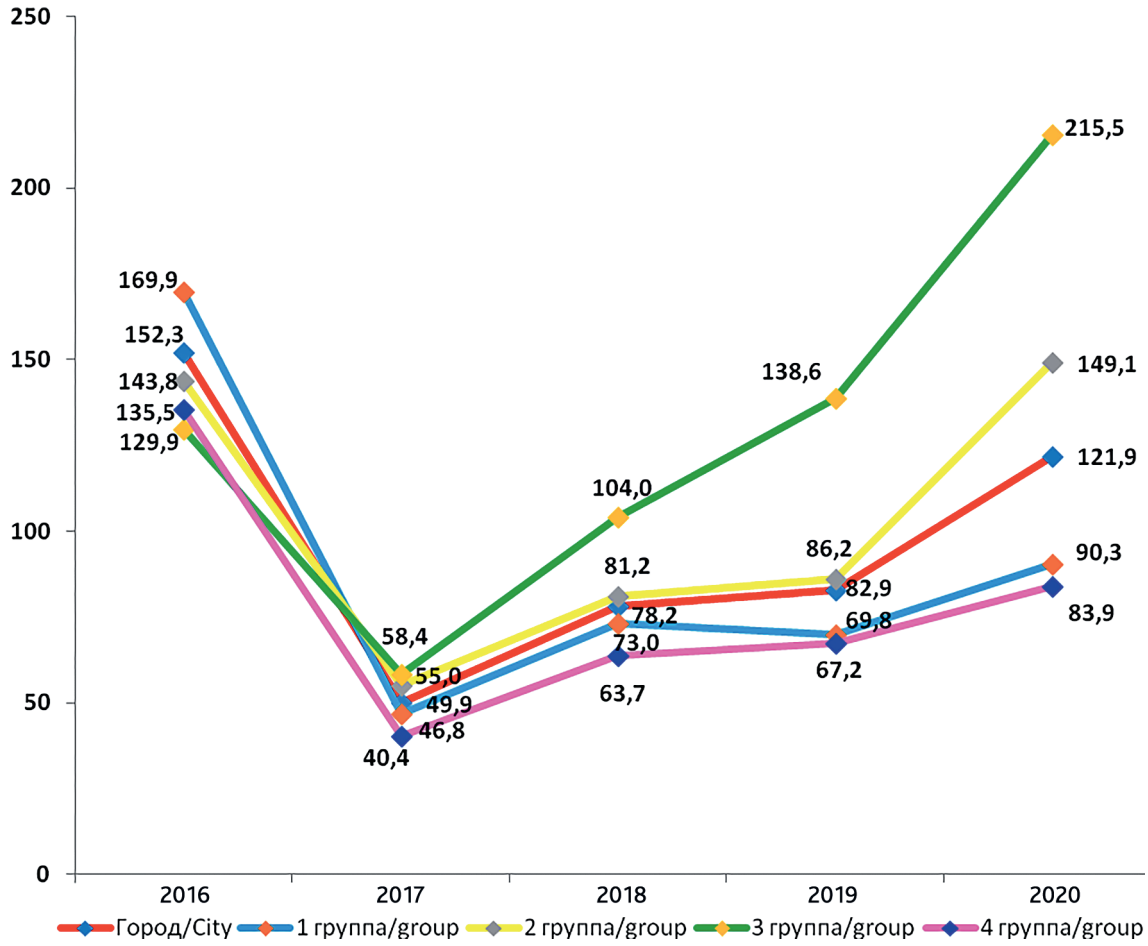

Fig. 6. Incidence of influenza in children 0–17 years old in 2016–2020 in St. Petersburg (per 100,000 children)

Рис. 6. Заболеваемость гриппом детей 0–17 лет в 2016–2020 годах в Санкт-Петербурге (на 100 000 детей)

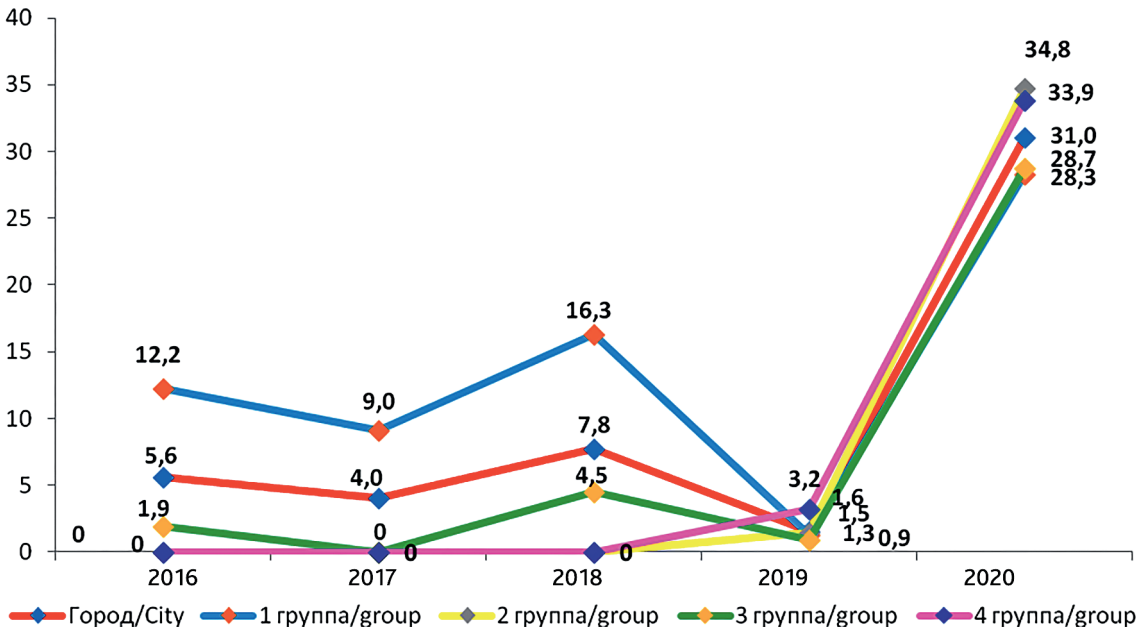

Fig. 7. Incidence of viral pneumonia in children 0–17 years old in 2016–2020 in St. Petersburg (per 100,000 children)

Рис. 7. Заболеваемость вирусной пневмонией детей 0–17 лет в 2016–2020 годах в Санкт-Петербурге (на 100 000 детей)

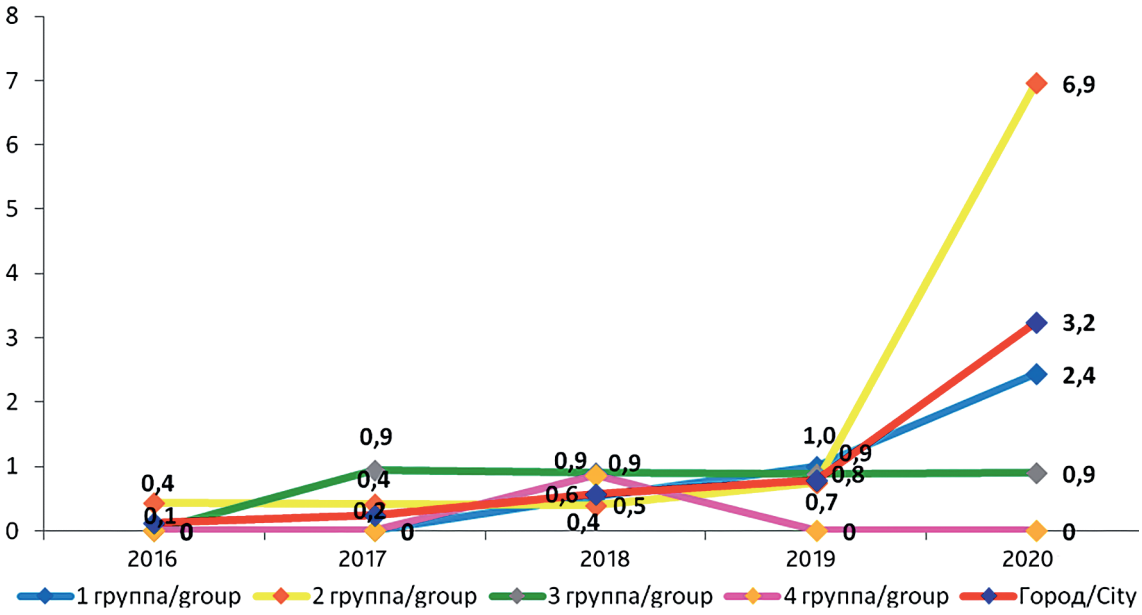

Fig. 8. Incidence of gonococcal infection in children aged 0–17 years in 2016–2020 in St. Petersburg (per 100,000 children)

Рис. 8. Заболеваемость гонококковой инфекцией детей 0–17 лет в 2016–2020 годах в Санкт-Петербурге (на 100 000 детей)

(9 times) districts. It should be noted that gonococcal infection was not registered in suburban areas during the entire observation period (Fig. 8).

The age of 15–17 years accounted for 85% of all cases of registered gonococcal infection, while the age group of 7–14 years accounted for 10.2%. Possible reasons for the increase in the incidence of gonococcal infection may be such factors as lack of full-time employment in the educational process (distance learning), inability to attend additional educational, sports and cultural events, and decreased parental supervision (parents continued to work), which led to

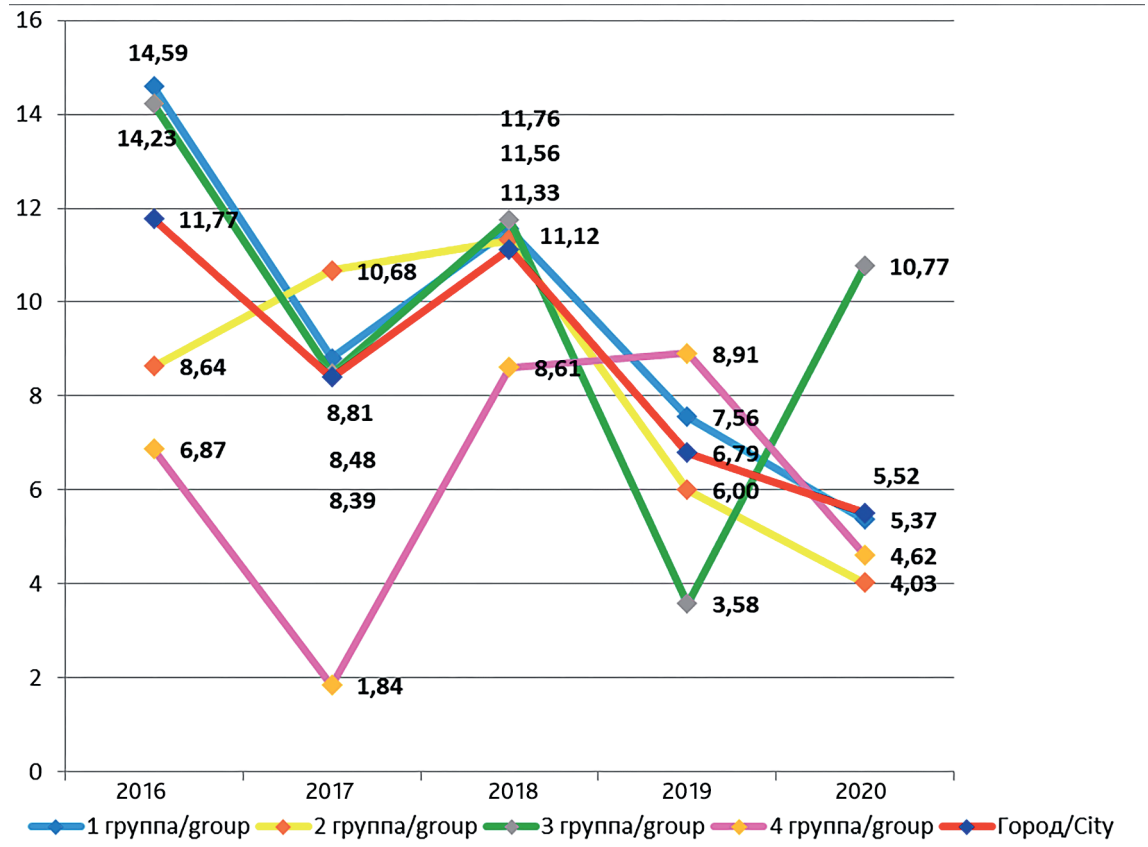

Fig. 9. Incidence of active tuberculosis in children aged 0–17 years in 2016–2020 in St. Petersburg (per 100,000 children)

Рис. 9. Заболеваемость активным туберкулезом детей 0–17 лет в 2016–2020 годах в Санкт-Петербурге (на 100 000 детей)

the emergence of uncontrolled free time among adolescents. Insufficient sexual and hygienic education of adolescents in families and educational organizations cannot be excluded.

Analyzing the incidence of active tuberculosis (TB) in children aged 0–17 years, there has been noted a wave-like course of the indicator both in the whole city and in the groups of districts with a tendency to decline. The highest rates of decline were recorded in dormitory (–63.3%) and industrial (–53.5%) districts. The decrease in the whole city amounted to 53.4%. The group of suburban areas showed a sharp rise (almost 5 times) in the incidence rate in 2018 and 2019, but by 2020 the rate fell below the city average. It occurred mainly due to the morbidity in Pushkinsky district, which is a part of the group. Migrants find this district attractive, therefore, the registered active tuberculosis may have imported nature. The incidence rate of active tuberculosis in the historical districts increased 3-fold in 2020 compared to 2019, up to 10.8 per 100,000 children aged 0–17 years. Although it did not reach the 2016 level (14.7 per 100,000 children), the central district has the highest incidence rate of active tuberculosis in children aged 0–17 years (2-times higher than the city rate) (Fig. 9).

Such a rise in morbidity in the central districts might be explained by the large number of shared apartments and low provision of living space (per 1 inhabitant) (Table 5).

Analysis of the average annual age structure of infectious morbidity has shown that children 1–2 years old and 3–6 years old with children 3–6 years old are more susceptible to intestinal infections (29.6%) than representatives from other age groups carrying intestinal infections. Among the most common infections are dysentery (33.8%) and respiratory tract infections (acute respiratory infections — 33.8%, influenza — 35.2%, viral pneumonia — 31.3%). Children in the age group 7–14 years are more likely to have dysentery (32.8%), acute viral hepatitis (36.6%), parasitic infections (64.0%), and tuberculosis (43.6%). Adolescents aged 15–17

have lower frequency of acute respiratory infections (7.4%), acute viral hepatitis (13.3%) and dysentery (13.6%), influenza is at the level of children under one year old (8.1%). However, adolescents are the leaders in the age structure of gonococcal infection incidence (84.8%) (see Table 7).

CONCLUSION

During the pandemic period total infectious morbidity in St. Petersburg tend to decrease to 39.2%, the nosological composition of the registered infectious morbidity preserved in children aged 0–17. At the same time, there was a significant increase in a number of individual nosologies: influenza (by 47.0%), viral pneumonia (by 20.7 times), and gonococcal infection (by 32.0%).

The state of infectious morbidity in the child population of the metropolis largely depends on the living conditions of families: environmental, hygienic, socio-demographic (housing), medical and organizational (state of primary health care) conditions:

1. Levels of infectious morbidity of the child population significantly differ depending on the medical-economic and medical-social characteristics of the districts of residence, with an increase in morbidity in some groups of districts and a significant decrease in others. The highest incidence of acute viral hepatitis was observed in industrial areas in 2017 and in suburban areas in 2018, since there was recorded the highest percentage of unsatisfactory bacteriological samples of soil and surface water. The leaders in the incidence of respiratory tract infections were dormitory areas with high population density, this rate was 1.2 times higher than in urban areas. In 2018–2019 the suburban areas showed a 5-fold rise in the incidence of tuberculosis due to the Pushkin district, which had an imported outbreak of active form of tuberculosis.

2. There have been revealed the peculiarities of infectious morbidity of children depending on their age. Children 3–6 years old are the most frequently affected by infectious diseases (36.4%), children 4–14 years old are in the second place (27.6%), children 1–2 years old are in the third place (20.0%), followed by children under 1 year old (8.8%) and adolescents 15–17 years old (7.2%). Moreover, children aged 3–6 years are leaders in morbidity in almost all nosological forms examined, except for acute viral hepatitis, parasitic infections, gonococcal infection and active tuberculosis. Among sexually transmitted infections, gonococcal infection in adolescents aged 15–17 years accounted for 85%.

3. Studying the peculiarities of infectious morbidity during the pandemic of a new coronavirus infection will make it possible to determine ways to optimize organizational and anti-epidemic measures in the work of medical organizations.

The solution of all of the above-mentioned problems will make it possible to improve the organization of primary health care during the pandemic as well as bring it to a proper level.

ADDITIONAL INFORMATION

Author contribution. Thereby, all authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

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Consent for publication. Written consent was obtained from the patient for publication of relevant medical information within the manuscript.

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Вклад авторов. Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

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