

IMPACT OF TB PREVENTION MEASURES AND CAPACITY OF TB FACILITIES ON HIV/TB INCIDENCE IN THE RUSSIAN ARCTIC = ВЛИЯНИЕ МЕР ПО ПРОФИЛАКТИКЕ ТУБЕРКУЛЕЗА И ВОЗМОЖНОСТЕЙ ПРОТИВОТУБЕРКУЛЕЗНЫХ УЧРЕЖДЕНИЙ НА ЗАБОЛЕВАЕМОСТЬ ВИЧ/ТБ В РОССИЙСКОЙ АРКТИКЕ

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Рост миграции, высокая распространенность лекарственно-устойчивого туберкулеза (ТБ) и ВИЧ-инфекции в эпоху интенсивной индустриализации и глобализации в Арктике становятся актуальными проблемами для системы здравоохранения арктических территорий. **Цель** настоящего исследования – определение влияния мероприятий по профилактике ТБ, проводимых среди людей, живущих с ВИЧ-инфекцией, а также числа врачей-фтизиатров и износа зданий и сооружений медицинских противотуберкулезных организаций на заболеваемость ВИЧ/ТБ-коинфекцией в арктических регионах России. **Материалы и методы.** Оценивались показатели заболеваемости ВИЧ-инфекцией, ТБ и сочетанием ВИЧ/ТБ на 100 000 населения за период 2007–2019 годов, число врачей-фтизиатров и износ основного фонда противотуберкулезных учреждений, результаты мероприятий по профилактике туберкулеза среди людей, живущих с ВИЧ-инфекцией, в арктических регионах РФ. Статистические данные были получены из соответствующих форм федерального статистического наблюдения и ФГБУ «Научно-исследовательский институт организации здравоохранения и информатизации» Минздрава России. **Результаты.** Наихудшие показатели роста заболеваемости ВИЧ-инфекцией (315,8 %), ТБ (136,1 %) и ВИЧ/ТБ (150,0 %), а также самый высокий износ зданий и сооружений противотуберкулезных учреждений (100,0 %) выявлены в Чукотском автономном округе. Исследование показало, что заболеваемость ВИЧ-инфекцией, ТБ и сочетанием ВИЧ/ТБ в арктических регионах РФ неравномерна. Необходимо провести более детальные исследования

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по оценке распространения ВИЧ-инфекции, ТБ и ВИЧ/ТБ, потенциала системы здравоохранения в каждом арктическом регионе России.

Ключевые слова: ВИЧ-инфекция, туберкулез, ВИЧ/ТБ, арктические территории Российской Федерации, противотуберкулезные диспансеры.

Introduction. The Arctic, with its colossal mineral and raw material resources, has been subjected to intensive development, industrialization and globalization [1]. Nine entities of the Russian Federation are, partly or entirely, included in the country's Arctic zone: Arkhangelsk and Murmansk Oblasts; Republics of Karelia, Komi, and Sakha (Yakutia); Nenets, Yamalo-Nenets, and Chukotka Autonomous Okrugs, and Krasnoyarsk Krai.

Arkhangelsk Oblast is located in the north of the European part of Russia, occupying an area of 413.1 thousand km². Its predominant part (9 out of 21 municipal districts) lies in the Far North. The population density is about 2.0 people per km², urban dwellers comprising 77.8 %. In 2019, the population was estimated at 1144 thousand people. Arkhangelsk Oblast is one of Russia's industrially developed regions.

Murmansk Oblast is located in Northern Europe, bordering on Finland and Norway. It covers an area of 144.9 thousand km² and is in its entirety considered to be an Arctic territory, with the population density of 5.1 people per km². The population in 2019 was 748.1 thousand people, the share of urban residents amounting to 92.5 %. The fishing, mining, and chemical industries are well developed in the region.

The Republic of Karelia is located in Northwest Russia, bordering on Finland, and occupies an area of 180.5 thousand km², including the sea borders. Only 6 out of the Republic's 21 municipal districts are considered to be an Arctic territory. The population density is 3.5 people per km². In 2019, the estimated population was 618.1 thousand people, urban dwellers amounting to 80.2 %. The Republic's main industries are mining and forestry.

The Komi Republic is located in the northeast of the European part of Russia and covers an area

of 416.8 thousand km², with the population density of 2.0 people per km². The population in 2019 was estimated at 830.2 thousand people, the share of urban residents being 77.9 %. Four out of the region's 25 municipal districts are included in the Arctic zone of Russia. The Republic is one of the economically developed federal entities involved in oil production and processing.

The Republic of Sakha (Yakutia) is the largest entity of the Russian Federation, covering an area of 3,083,523 km² in the northeastern part of Siberia. More than 40.0 % of the region's territory is located beyond the Arctic Circle, and 13 out of its 35 municipal districts are included in the Russian Arctic zone. The Republic's population density is one of the lowest in the country, with only 0.32 people per km². The population number in 2019 was 967,009 people, the share of urban residents being 65.5 %. The oil, gas, coal, and diamond mining industries are the major focus of the region's economy.

Nenets Autonomous Okrug (NAO), with the exception of its extreme southwestern part, is located beyond the Arctic Circle and occupies an area of 176.8 thousand km². The population density is sparse, with only 0.25 people per km². In 2019, the population was estimated at 43,970 people, the proportion of urban residents being 72.5 %. The region's main economic branch is the fuel industry (96.5 %).

Yamalo-Nenets Autonomous Okrug (YaNAO) has an area of 769,250 km², more than half of which is located beyond the Arctic Circle. The population in 2019 was 541,479 people, with the density of 0.71 people per km² and urban dwellers amounting to 83.6 %. This is one of the leading regions in terms of natural gas and oil.

The whole of Chukotka Autonomous Okrug (Chukotka) is located in the Far North, bordering on the USA in the east and occupying an area of 721,481 km². The population in 2019 was estimated

at 497,000 people, with the density of 0.07 people per km² and urban residents comprising 72.6 %. The region's economy is based on the mining industry, including gold mining. The indigenous people are engaged in traditional types of fishing, hunting, and reindeer herding.

Krasnoyarsk Krai is part of the Siberian Federal District. Four out of Krai's 44 municipal districts are included in the Russian Arctic zone. Krasnoyarsk Krai has an area of 2,366,797 km², with the population density of 1.21 people per km². In 2019, the population was 2223 thousand people, with urban dwellers comprising 77.8 %. Non-ferrous and ferrous metallurgy, mechanical engineering and metalworking are among the region's main industries.

In 2010, there lived 82,481 indigenous people in the Russian Arctic, which accounted for 3.3 % of the total number of northerners [2].

Meanwhile, the invasion of civilization into the circumpolar territory disrupts its fragile ecosystem, worsening the environment of its residents, especially indigenous peoples, leading to irreversible changes in their demographic, social, as well as medical and biological characteristics [3, 4].

In the era of technogenic civilization, increased migration, and high prevalence of HIV and drug-resistant TB, in addition to climatic, economic, and social factors contributing to the spread of socially significant diseases, the role of the healthcare system that provides an adequate response to the climatic and other challenges of the Arctic becomes especially important [5–7].

According to S.Kh. Khaknazarov, residents of the Far North of Russia are faced with unsatisfactory health care, including such problems as remoteness of medical facilities, limited availability of modern diagnostic equipment, insufficient qualifications or lack of doctors in small settlements, and inability to pay for prescribed medication [8].

Today, the spread of socially significant infectious diseases among the residents of the Russian Arctic remains an urgent problem. TB, HIV, and their combination present a high social burden for the region's population [9–10].

In the United States, TB incidence among American Indians/Alaskan Natives in 2003–

2008 was 5 times higher than among the non-Hispanic population [11]. Indigenous women, predominantly living in the Arctic zone of Canada, get infected with HIV at twice the rate of women in the general population [12].

Meanwhile, current research regarding biomedical problems, including socially significant diseases, among northerners fails to meet the requirements of today, not fully taking into account the ongoing urbanization and the changed epidemics of socially significant diseases. Health protection programmes aimed at northerners are ineffective, as they remain based on outdated materials. A modern approach to healthcare services for the Far North residents can only be developed on the basis of interdisciplinary circumpolar studies, including an assessment of the adequacy of existing HIV, TB, and HIV/TB collaborative measures.

Thus, our study **aimed to:** 1) compare HIV, TB, and HIV/TB incidence in the regions of the Russian Arctic and in the country as a whole; 2) evaluate the impact of TB prevention measures among people living with HIV, the number of phthisiologists and the deterioration of the structures and buildings of TB facilities on HIV/TB coinfection incidence in the Arctic regions of the Russian Federation.

Materials and methods. The analytic observational study included all 9 regions of the Russian Arctic zone (see above) and evaluated HIV, TB, and HIV/TB coinfection incidence rates per 100,000 people/year from 2007 to 2019. Statistical data were obtained from the relevant forms of federal statistical observation (form no. 8 “Information on Incidence of Active Tuberculosis” and form no. 61 “Information on the Disease Caused by the Human Immunodeficiency Virus”). Additional data regarding the number of phthisiologists and the condition of the buildings and structures of TB facilities were obtained through the Federal Research Institute for Health Organization and Informatics of the Ministry of Health of the Russian Federation [13, 14].

Results. TB incidence in Russia over the last 13 years (2007–2019) has decreased dramatically from 83.3 to 41.2 per 100,000 population (Fig. 1).

The observed trend in HIV and HIV/TB coinfection incidence rates indicates their stabilization, at least during the last 5 years: in 2015–2019, HIV incidence decreased from 68.5 to 54.6 and HIV/TB incidence from 11.0 to 9.4 per 100,000 population/year, respectively.

Among Russia’s Arctic regions, the highest TB incidence in 2019 was recorded in Chukotka (136.1 per 100,000 population/year), while the highest HIV incidence (94.6) in Krasnoyarsk Krai (Fig. 2).

HIV/TB coinfection incidence was also high in Krasnoyarsk Krai and Chukotka, amounting to 8.0 and 6.0, respectively, with the national average being 9.4 per 100,000 population/year. In the Republic of Sakha (Yakutia), HIV/TB coinfection incidence was very low (0.8 per 100,000 population), according to the low HIV incidence (11.7). TB incidence there, however, remained high (50.2), classifying the Republic as an entity with high TB burden. Among other Arctic regions of Russia, the Republic of Karelia stands out with its high HIV

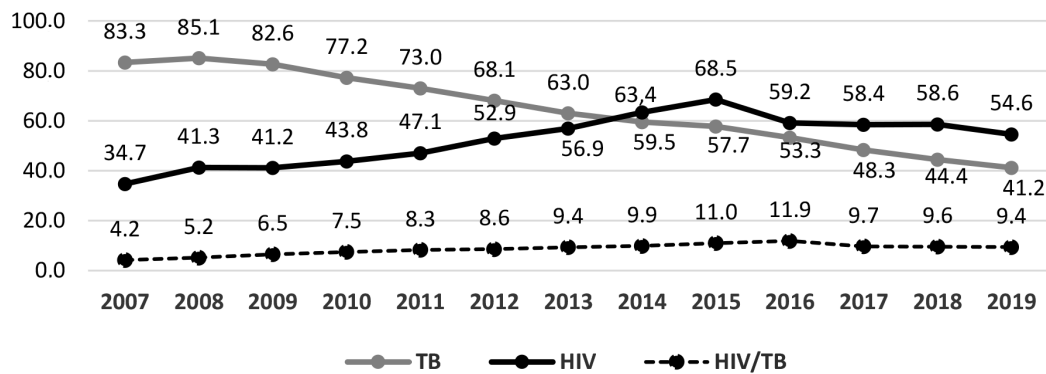


Fig. 1. HIV, TB, and HIV/TB coinfection incidence rates in the Arctic regions of the Russian Federation in 2007–2019 (per 100,000 population/year)

Рис. 1. Заболеваемость ВИЧ-инфекцией, ТБ и ВИЧ/ТБ в арктических регионах РФ в 2007–2019 годах (на 100 000 населения)

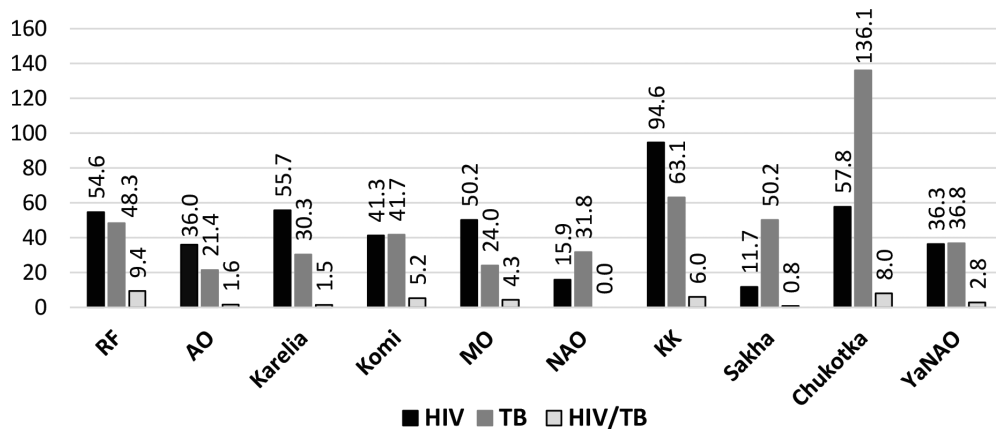


Fig. 2. HIV, TB, and HIV/TB incidence rates in the Arctic regions of the Russian Federation in 2019 (per 100,000 population/year): RF – Russian Federation, AO – Arkhangelsk Oblast, MO – Murmansk Oblast, NAO – Nenets Autonomous Okrug, KK – Krasnoyarsk Krai, YaNAO – Yamalo-Nenets Autonomous Okrug

Рис. 2. Заболеваемость ВИЧ-инфекцией, ТБ и ВИЧ/ТБ в арктических регионах РФ в 2019 году (на 100 000 населения)

incidence in 2019 (55.7 per 100,000 population/year). In YaNAO, HIV and TB incidence rates were practically identical (36.3 and 36.8, respectively) and HIV/TB coinfection incidence (2.8) was much lower than in Russia as a whole, while NAO had no reported HIV/TB cases at all.

The increase in HIV incidence during 2007–2019 was the highest in Arkhangelsk Oblast (592.3 %), followed by the Republic of Karelia (331.8 %) and Chukotka (315.8 %), the lowest rate being recorded in Murmansk Oblast (4.4 %) (Table 1).

TB incidence decreased over the last 13 years in all the Arctic regions of Russia, except for Chukotka, where it increased by 136.3 % and HIV/TB coinfection grew by 150.0 %. Chukotka is the only region where the epidemic situation with HIV, TB, and HIV/TB coinfection during the period under study has been deteriorating dramatically.

Despite the decline in TB incidence, there has been a large increase in the incidence rate of HIV/TB coinfection in Arkhangelsk Oblast (920.8 %) and Krasnoyarsk Krai (760.0 %), as well as in the

Republics of Sakha (Yakutia) (600.0 %) and Komi (320.9 %) over the last 13 years.

The deterioration of the buildings and structures of TB facilities in Russia's Arctic regions was uneven as well (Table 2). In Chukotka, the state of its TB facility deteriorated totally and needed a complete renovation. In the Komi Republic, YaNAO and Krasnoyarsk Krai, the regional TB facilities require renovation as well. At the same time, in Murmansk Oblast the deterioration of the buildings and structures of TB facilities was the lowest, followed by the Republic of Sakha (Yakutia). In Arkhangelsk Oblast, this parameter approached the indicator for the whole of Russia, while in NAO and the Republic of Karelia it slightly exceeded it. The data demonstrate the impact of the condition of TB facilities on the HIV/TB epidemic: regions with high level of deterioration of these buildings and structures have high HIV/TB incidence, which is particularly pronounced in Chukotka.

The number of phthisiologists in the Arctic zone of Russia in 2019 was quite high, meeting

Table 1

**DYNAMICS OF HIV, TB, AND HIV/TB COINFECTION INCIDENCE RATES
IN THE ARCTIC REGIONS OF THE RUSSIAN FEDERATION IN 2007–2019**
**ДИНАМИКА ЗАБОЛЕВАЕМОСТИ ВИЧ-ИНФЕКЦИЕЙ, ТБ И ВИЧ/ТБ
В АРКТИЧЕСКИХ РЕГИОНАХ РФ В 2007–2019 годах**

Region	HIV			TB			HIV/TB		
	Incidence per 100,000 population/year		Increase (%)	Incidence per 100,000 population/year		Increase (%)	Incidence per 100,000 population/year		Increase (%)
	2007	2019		2007	2019		2007	2019	
RF	31.4	54.6	73.9	83.3	48.3	-42.0	4.2	9.4	123.2
AO	5.2	36.0	592.3	59.2	21.4	-63.9	0.2	1.6	920.8
Karelia	12.9	55.7	331.8	71.0	30.3	-57.3	25.6	1.5	-94.1
Komi	16.1	41.3	156.5	95.3	41.7	-56.2	1.2	5.2	320.9
MO	48.1	50.2	4.4	58.2	24.0	-58.8	2.3	4.3	83.5
NAO	9.5	15.9	67.4	40.5	31.8	-21.5	0.0	0.0	0.0
KK	39.3	94.6	140.7	104.0	63.1	-39.3	2.5	21.5	760.0
Sakha	8.7	11.7	34.5	77.4	50.2	-35.1	0.3	2.1	600.0
Chukotka	13.9	57.8	315.8	57.6	136.1	136.3	4.0	10.0	150.0
YaNAO	21.3	36.3	70.4	74.0	36.8	-50.3	5.5	5.7	3.6

Note: RF – Russian Federation, AO – Arkhangelsk Oblast, MO – Murmansk Oblast, NAO – Nenets Autonomous Okrug, KK – Krasnoyarsk Krai, YaNAO – Yamalo-Nenets Autonomous Okrug.

Table 2

NUMBER OF PHTHISIOLOGISTS AND DETERIORATION OF THE BUILDINGS AND STRUCTURES OF TB FACILITIES IN THE ARCTIC REGIONS OF THE RUSSIAN FEDERATION IN 2019
ЧИСЛО ВРАЧЕЙ-ФТИЗИАТРОВ И ИЗНОС ЗДАНИЙ И СООРУЖЕНИЙ ПРОТИВОТУБЕРКУЛЕЗНЫХ УЧРЕЖДЕНИЙ В АРКТИЧЕСКИХ РЕГИОНАХ РФ В 2019 году

Region	Deterioration of buildings and structures (%) (permissible limit = 50.0 %)	Phthisiologists (per 10,000 population) (standard index = 0.50)
Russian Federation	40.9	0.47
Arkhangelsk Oblast	38.6	0.23
Republic of Karelia	44.2	0.41
Komi Republic	73.8	0.68
Murmansk Oblast	17.4	0.30
Nenets Autonomous Okrug	43.3	1.13
Krasnoyarsk Krai	57.7	0.50
Republic of Sakha (Yakutia)	26.9	1.38
Chukotka Autonomous Okrug	100.0	1.99
Yamalo-Nenets Autonomous Okrug	60.5	0.79

the accepted standard or exceeding it, especially in Chukotka, Republic of Sakha (Yakutia), NAO and YaNAO. A shortage of phthisiologists was observed in Arkhangelsk and Murmansk Oblasts and the Republic of Karelia. In Krasnoyarsk Krai, the number of phthisiologists corresponded to the required standard, while in the Komi Republic it slightly exceeded it.

Antiretroviral therapy (ART) coverage among HIV-infected patients registered at the AIDS Centres in all the Arctic regions of Russia in 2019 exceeded 60.0 %, the highest rate being observed in NAO (Table 3). The Republic of Sakha (Yakutia) and Komi, as well as Chukotka and YaNAO had a rate over 70.0 %. For the other entities (Krasnoyarsk Krai, Murmansk Oblast,

Table 3

TB PREVENTION COVERAGE AMONG PEOPLE LIVING WITH HIV IN THE ARCTIC REGIONS OF THE RUSSIAN FEDERATION IN 2019, people (%)
ОХВАТ МЕРАМИ ПО ПРОФИЛАКТИКЕ ТУБЕРКУЛЕЗА ЛЮДЕЙ, ЖИВУЩИХ С ВИЧ-ИНФЕКЦИЕЙ, В АРКТИЧЕСКИХ РЕГИОНАХ РФ В 2019 году, чел. (%)

Region	ART	TB chemoprophylaxis	TB screening
Russian Federation	789,613 (65.5)	124,087 (16.6)	580,767 (77.7)
Arkhangelsk Oblast	1116 (67.5)	212 (12.8)	1335 (80.8)
Republic of Karelia	1018 (65.2)	168 (10.8)	1211 (77.5)
Komi Republic	1897 (73.2)	657 (25.4)	2337 (90.2)
Murmansk Oblast	2476 (64.8)	986 (25.8)	3002 (78.5)
Nenets Autonomous Okrug	53 (82.8)	6 (9.4)	55 (85.9)
Krasnoyarsk Krai	12,644 (64.3)	2835 (14.4)	13,292 (67.6)
Republic of Sakha (Yakutia)	736 (72.3)	232 (22.8)	771 (75.7)
Chukotka Autonomous Okrug	132 (70.6)	29 (15.5)	152 (81.3)
Yamalo-Nenets Autonomous Okrug	1770 (73.9)	403 (16.8)	2086 (87.1)

Republic of Karelia, and Arkhangelsk Oblast), the data were close to the indicator for Russia as a whole (65.5 %) or slightly exceeded it.

The share of HIV-infected patients screened for TB who were registered at the AIDS Centres in the Arctic zone of the Russian Federation was quite high in 2019, exceeding 80.0 % in most entities: Arkhangelsk Oblast, Chukotka, NAO and YaNAO, the highest being in the Komi Republic (90.2 %). TB screening among HIV-infected patients was the lowest in Krasnoyarsk Krai (67.6 %). In Murmansk Oblast and the Republics of Sakha (Yakutia) and Karelia it was close to the federal indicator (77.7 %).

Among TB prevention measures for people living with HIV in 2019, the lowest rates were found in TB chemoprophylaxis, the national level being as low as 16.6 % of those who were registered at the AIDS Centres. The lowest percentage was identified in NAO, Republic of Karelia, and Arkhangelsk Oblast, while the highest, in Murmansk Oblast, Komi Republic and Republic of Sakha (Yakutia). In Krasnoyarsk Krai and YaNAO it was 14.4 and 15.5 %, respectively.

Discussion. The study found that the trend in the HIV, TB, and HIV/TB coinfection epidemics over the last 13 years in Russia's Arctic regions was uneven. The highest HIV incidence was recorded in Krasnoyarsk Krai, while the highest TB incidence, in Chukotka. This situation in Chukotka had been provoked by a long absence of a TB facility in the region, which had been closed during the Perestroika period and reopened only 4–5 years ago. Moreover, this Okrug ranks as one of the worst among the 9 Arctic regions in terms of HIV and HIV/TB incidence rates during 2007–2019. In addition, we noted a dramatic increase in HIV/TB incidence rates in Arkhangelsk Oblast as well as in the Republics of Karelia and Komi caused by an HIV outbreak, which is alarming.

The capacity of the TB control system in the Arctic regions of Russia, evaluated on the basis

of the state of the buildings and structures of TB facilities, is uneven as well, the worst being in Chukotka, which indicates the dependence of the HIV/TB epidemic on the condition of TB facilities.

Interestingly, there is a sufficient number of phthisiologists in the country's Arctic regions, as well as an adequate TB screening and ART coverage among people living with HIV. However, as in the whole of Russia, in the Arctic regions, TB chemoprophylaxis coverage among people living with HIV is unsatisfactory.

Meanwhile, our research presents only a preliminary assessment of the HIV, TB, and HIV/TB epidemics in Russia's Arctic regions. Another limitation of the study is that we evaluate the epidemiological data and other indicators for the Arctic regions in their entirety, although only 4 out of the 9 entities are fully considered to be Arctic territories (Murmansk Oblast, NAO, YaNAO and Chukotka), while in case of the other 5 entities only circumpolar districts are included in the Russian Arctic zone. Thus, to perform a more accurate assessment of the epidemic, economic and human resources data of the TB control system and results of TB prevention measures among people living with HIV, as well as to determine the main risk factors of the spread of these socially significant infections, especially among indigenous people, one needs to obtain information from each circumpolar district separately.

However, the study identified the main features of the HIV, TB, and HIV/TB coinfection epidemics, the impact of the number of phthisiologists as well as the state of buildings and structures of TB facilities on the effectiveness of TB prevention measures among people living with HIV in the Arctic regions of Russia and showed the necessity of more detailed studies.

Conflict of interest. Authors declare no conflict of interest.

Список литературы

1. The Development Strategy of the Arctic Zone of the Russian Federation. URL: <http://www.iecca.ru/en/legislation/strategies/item/99-the-development-strategy-of-the-arctic-zone-of-the-russian-federation> (дата обращения: 14.05.2021).
2. Тишков В.А., Коломиец О.П., Мартынова Е.П., Новикова Н.И., Пивнева Е.А., Терехина А.Н. Российская Арктика: коренные народы и промышленное освоение / под ред. В.А. Тишкова; Ин-т этнологии и антропологии им. Н.Н. Миклухо-Маклая РАН. М.; СПб.: Нестор-История, 2016. 272 с.
3. Revich B.A., Kharkova T.L., Kvasha E.A., Korolev I.B. Sociodemographic Limitations of the Sustainable Development of Murmansk Oblast // *Stud. Russ. Econ. Dev.* 2014. № 2. P. 201–206. DOI: [10.1134/S1075700714020087](https://doi.org/10.1134/S1075700714020087)
4. Сорочкина С.А., Загдын З.М. Социально-экономические, культурные и психологические факторы, влияющие на распространение туберкулеза и ВИЧ-инфекции среди коренных малочисленных народов России (обзор) // *Мед. альянс.* 2016. № 3. С. 24–29.
5. Revich B.A. Climate Change Impact on Public Health in the Russian Arctic. Moscow: UN in the Russian Federation, 2008. 24 p.
6. Brubaker M., Berner J., Chavan R., Warren J. Climate Change and Health Effects in Northwest Alaska // *Global Health Action.* 2011. Vol. 4. Art. № 8445. DOI: [10.3402/ghav4i0.8445](https://doi.org/10.3402/ghav4i0.8445)
7. Parkinson A.J., Bruce M.G., Zulz T. International Circumpolar Surveillance, an Arctic Network for Surveillance of Infectious Diseases // *Emerg. Infect. Dis.* 2008. Vol. 14, № 1. P. 18–24. DOI: [10.3201/eid1401.070717](https://doi.org/10.3201/eid1401.070717)
8. Хакназаров С.Х. Здоровье народов Севера в контексте социологических исследований // *Соц. аспекты здоровья населения.* 2013. № 3(31). URL: <http://vestnik.mednet.ru/content/view/486/30/lang.ru/> (дата обращения: 12.05.2021).
9. Козлов А.И., Козлова М.А., Вершубская Г.Г., Шилов А.Б. Здоровье коренного населения Севера РФ: на грани веков и культур: моногр. Пермь: ОТ и ДО, 2013. 205 с.
10. Волова Л.Ю., Родина Е.В. Эпидемиологическая ситуация по ВИЧ-инфекции среди представителей коренных малочисленных народов Севера // *Журн. инфектологии.* 2014. Т. 6, № 2. С. 76–82.
11. Bloss E., Holtz T.H., Jereb J., Redd J.T., Podewils L.J., Cheek J.E., McCray E. Tuberculosis in Indigenous Peoples in the U.S., 2003–2008 // *Public Health Rep.* 2011. Vol. 126, № 5. P. 677–689. DOI: [10.1177/003335491112600510](https://doi.org/10.1177/003335491112600510)
12. HIV/AIDS and Indigenous Peoples: Final Report of the 5th International Policy Dialogue. Ottawa: Health Canada, 2010.
13. Стерликов С.А., Нечаева О.Б., Галкин В.Б., Сон И.М., Тестов В.В., Попов С.А., Бурыхин В.С., Пономарёв С.Б., Русакова Л.И., Мезенцева Н.И., Кучерявая Д.А., Обухова О.В., Дергачёв А.В., Саенко С.С. Отраслевые и экономические показатели противотуберкулезной работы в 2018–2019 гг. Аналитический обзор основных показателей и статистические материалы / под ред. С.А. Стерликова. М.: РИО ЦНИИОИЗ, 2020. 92 с.
14. Нечаева О.Б., Гордина А.В., Стерликов С.А., Кучерявая Д.А., Дергачёв А.В., Пономарёв С.Б., Бурыхин В.С. Ресурсы и деятельность противотуберкулезных организаций Российской Федерации в 2018–2019 гг. (статистические материалы). М.: РИО ЦНИИОИЗ, 2020. 99 с.

References

1. *The Development Strategy of the Arctic Zone of the Russian Federation.* Available at: <http://www.iecca.ru/en/legislation/strategies/item/99-the-development-strategy-of-the-arctic-zone-of-the-russian-federation> (accessed: 14 May 2021).
2. Tishkov V.A., Kolomiets O.P., Martynova E.P., Novikova N.I., Pivneva E.A., Terekhina A.N. *Rossiyskaya Arktika: korennyye narody i promyshlennoe osvoenie* [The Russian Arctic: Indigenous Peoples and Industrial Development]. Moscow, 2016. 272 p.
3. Revich B.A., Kharkova T.L., Kvasha E.A., Korolev I.B. Sociodemographic Limitations of the Sustainable Development of Murmansk Oblast. *Stud. Russ. Econ. Dev.*, 2014, no. 2, pp. 201–206. DOI: [10.1134/S1075700714020087](https://doi.org/10.1134/S1075700714020087)
4. Sorokina S.A., Zagdyn Z.M. Sotsial'no-ekonomicheskie, kul'turnye i psikhologicheskie faktory, vliyayushchie na rasprostranenie tuberkuleza i VICH-infektsii sredi korennykh malochislennykh narodov Rossii (obzor) [Social-Economic, Cultural and Psychological Factors Affected the Tuberculosis and HIV-Infection Spread Among Indigenous Peoples in Russia (Review)]. *Meditinskiy al'yans*, 2016, no. 3, pp. 24–29.

5. Revich B.A. *Climate Change Impact on Public Health in the Russian Arctic*. Moscow, 2008. 24 p.
6. Brubaker M., Berner J., Chavan R., Warren J. Climate Change and Health Effects in Northwest Alaska. *Global Health Action*, 2011, vol. 4. Art. no. 8445. DOI: [10.3402/ghav4i0.8445](https://doi.org/10.3402/ghav4i0.8445)
7. Parkinson A.J., Bruce M.G., Zulz T. International Circumpolar Surveillance, an Arctic Network for Surveillance of Infectious Diseases. *Emerg. Infect. Dis.*, 2008, vol. 14, no. 1, pp. 18–24. DOI: [10.3201/eid1401.070717](https://doi.org/10.3201/eid1401.070717)
8. Khaknazarov S.Kh. Zdorov'ye narodov Severa v kontekste sotsiologicheskikh issledovaniy [Health of the People of the North in a Context of Sociological Researches]. *Sotsial'nye aspekty zdorov'ya naseleniya*, 2013, no. 3. Available at: <http://vestnik.mednet.ru/content/view/486/30/lang.ru/> (accessed: 12 May 2021).
9. Kozlov A.I., Kozlova M.A., Vershubskaya G.G., Shilov A.B. Zdorov'ye korennoy naseleniya Severa RF: na grani vekov i kul'tur [Health of the Indigenous Population of the North of the Russian Federation: On the Verge of Centuries and Cultures]. Perm, 2013. 205 p.
10. Volova L.Yu., Rodina E.V. Epidemiologicheskaya situatsiya po VICH-infektsii sredi predstaviteley korennykh malochislennykh narodov Severa [HIV Epidemic Situation Among Small Indigenous Populations of Northeast Russia]. *Zhurnal infektologii*, 2014, vol. 6, no. 2, pp. 76–82.
11. Bloss E., Holtz T.H., Jereb J., Redd J.T., Podewils L.J., Cheek J.E., McCray E. Tuberculosis in Indigenous Peoples in the U.S., 2003–2008. *Public Health Rep.*, 2011, vol. 126, no. 5, pp. 677–689. DOI: [10.1177/003335491112600510](https://doi.org/10.1177/003335491112600510)
12. *HIV/AIDS and Indigenous Peoples: Final Report of the 5th International Policy Dialogue*. Ottawa, 2010.
13. Sterlikov S.A., Nechaeva O.B., Galkin V.B., Son I.M., Testov V.V., Popov S.A., Burykhin V.S., Ponomarev S.B., Rusakova L.I., Mezentseva N.I., Kucheryavaya D.A., Obukhova O.V., Dergachev A.V., Saenko S.S. Otrasleye i ekonomicheskie pokazateli protivotuberkuleznoy raboty v 2018–2019 gg. Analiticheskiy obzor osnovnykh pokazateley i statisticheskie materialy [Sectoral and Economic Data of the TB Control System in 2018–2019. Analytical Review of the Main Data and Statistical Materials]. Moscow, 2020. 92 p.
14. Nechaeva O.B., Gordina A.V., Sterlikov S.A., Kucheryavaya D.A., Dergachev A.V., Ponomarev S.B., Burykhin V.S. Resursy i deyatelnost' protivotuberkuleznykh organizatsiy Rossiyskoy Federatsii v 2018–2019 gg. (statisticheskie materialy) [Resources and Work of TB Facilities of the Russian Federation in 2018–2019 (Statistical Materials)]. Moscow, 2020. 99 p.

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IMPACT OF TB PREVENTION MEASURES AND CAPACITY OF TB FACILITIES ON HIV/TB INCIDENCE IN THE RUSSIAN ARCTIC

Increased migration, high prevalence of HIV and drug-resistant tuberculosis (TB) in the era of intensive industrialization and globalization in the Arctic are becoming urgent problems for the healthcare system of Arctic territories. The **purpose** of this research was to determine the impact of TB prevention measures among people living with HIV, the number of phthisiologists and the condition of TB facilities on the incidence of HIV/TB coinfection in the Arctic regions of Russia. **Materials and methods.** We evaluated

HIV, TB, and HIV/TB coinfection incidence rates per 100,000 population for 2007–2019, the number of phthisiologists and deterioration of the buildings and structures of TB facilities, as well as the results of TB prevention measures among people living with HIV in the Arctic regions of the Russian Federation. The statistical data were obtained from the relevant forms of federal statistical observation and from the Federal Research Institute for Health Organization and Informatics of the Ministry of Health of the Russian Federation. **Results.** The highest HIV (315.8 %), TB (136.1 %) and HIV/TB (150.0 %) incidence rates as well as the worst deterioration level of the buildings and structures of TB facilities (100.0 %) were identified in Chukotka Autonomous Okrug. The research showed that HIV, TB, and HIV/TB incidence in the Arctic regions of Russia is uneven. More detailed studies are required assessing the prevalence of HIV, TB, and HIV/TB coinfection, as well as evaluating the capacity of the healthcare system in each Arctic region of the Russian Federation.

Keywords: HIV infection, tuberculosis, HIV/TB, Arctic territories of the Russian Federation, tuberculosis facilities.

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