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Incidence of socially significant infectious diseases (HIV, TB and HIV/TB coinfection) in the Arctic regions of Russia)

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ABSTRACT

The study is aimed to evaluate the HIV, TB, and HIV/TB coinfection incidence per 100,000 population/year in Russian Arctic, based on official statistical data. The epidemics' incidence in Russian Arctic is uneven. The highest HIV incidence in 2019 was registered in Krasnoyarsk region (94,6), and the highest TB incidence in ChAD (136,1). ChAD was also identified as the region with the worst indicators, where the HIV incidence in 2007–2019 was evaluated at (315,8%), TB (136,1%), HIV/TB coinfection (150,0%). Despite the significant reduction in TB incidence in Arkhangelsk oblast (−63,9%), Karelia (−57,3%) and Komi (−56,2%) republics, it is alarming to observe dramatic increases in HIV incidence in the aforementioned regions (592,3%, 331,8%, 156,5% respectively). External factors influence HIV and TB incidence in most regions. Prevailing in men, HIV and TB incidence disparities between the general population and permanent residents occurred in all regions, except in ChAD and NAD, where the infections were diagnosed only among permanent residents. It is necessary to provide more detailed studies focusing on HIV, TB, and HIV/TB coinfection features in each circumpolar district in order to determine the main risk factors, especially among indigenous peoples as a vulnerable group, and to evaluate the HIV/TB collaborative services' capacity.

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Introduction

The Arctic, with its colossal mineral and raw material resources, occupies a special place in geopolitical space. Currently, there is intensive development of the Arctic territories, involving their rapid industrialisation and globalisation [1,2]. Meanwhile, the invasion of economic and social activities into the circumpolar zone disrupts its fragile ecosystem, worsening the environment of its residents, especially indigenous peoples, leading to irreversible changes in their demographic, social, and medical/biological characteristics [3–5]. In the era of technogenic civilisation, increased migration, and the high incidence of drug-resistant TB and HIV, the Arctic zone requires a healthcare system that adequately addresses these evolving phenomena, as well as the climatic, economic, and social factors that play a role in the spread of socially significant diseases [6–9].

In a study by S. Kh. Khaknazarov, the majority of respondents, who were residents of the Far North of Russia, noted the problems of a low level of medical care: the remoteness of medical organisations, low availability of modern diagnostic equipment, insufficient qualifications of doctors or their absence in small settlements, and lack of financial resources for medication [10].

Throughout all stages of the development of the Arctic territories, Russian researchers paid attention to the problems of maintaining the health of the area's inhabitants. Today, the spread of socially determined diseases among Russian Arctic inhabitants remains as relevant as it was during the Soviet period, specifically infectious diseases such as TB, HIV, and HIV/TB coinfection [11,12].

In Russia, most studies on the spread of TB among residents of the Far North were carried out in the 1980s-90s. These studies describe the epidemic situation and clinical features of the disease without focusing on the causes and factors of their occurrence or the disadvantages of the TB care system provided to the northern population [13–15].

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Unlike TB problems, the spread of HIV infection among the inhabitants of the Russian North is almost completely not studied. There is a limited number of publications devoted to the study of HIV among indigenous peoples. This topic is most fully explored by the work of L.Yu. Volova and E.V. Rodina [16]. The authors express concerns about the possibility of uncontrolled HIV spread in the case of its introduction into the communities of the nomadic tundra population due to the natural development of family relations and the inaccessibility of preventive measures.

In the USA, the TB incidence among American Indians/Alaskan Natives was 5 times higher than among the non-Hispanic population [17]. Among older residents of Alaska, access to health services was significantly lower than among those in the continental USA [18].

In Canada, 19% of TB cases are among residents of the Arctic zone [19]. Indigenous women, predominantly living in the Arctic zone of Canada, become infected with HIV 2 times more often than women in the general population [20,21]. The risk of contracting active TB among Greenlanders is 45 times higher than among the entire Danish population [22].

Thus, the study **is aimed** *at evaluating the HIV, TB and HIV/TB coinfection incidence in the Arctic zone of the Russian Federation throughout the last 13 years, during the era of the region's intensive development.*

Methods

Study design and areas

This is a descriptive epidemiological study with an analytical component and time series in the Arctic zone of the Russian Federation (RF). The Arctic zone of the RF includes the territories of 9 federal entities: Arkhangelsk (Arch) and Murmansk (Murm) oblasts; Karelia (Kar), Komi (Komi) and Sakha (Yakutia) republics (Sakha); Nenets, Yamalo-Nenets and Chukotka autonomous districts (NAD, YaNAD, ChAD) and Krasnoyarsk region (Kras). In fact, nearly half of the mentioned entities are fully considered as Arctic territories (Murmansk oblast, NAD, YaNaD and ChAD), and in the remaining 5 regions, only circumpolar municipal or city districts are included in the Russian Arctic zone: in Karelia Republic – 6 out of 21, in Komi Republic – 4 out of 25, in the Republic of Sakha (Yakutia) – 13 out of 35, in Krasnoyarsk region – 4 out of 44, and in Arkhangelsk oblast – 9 out of 21 municipal districts and cities. In our study, we assessed the epidemics in the Arctic entities as a whole, without separating the districts classified as purely Arctic territories.

Population and study period

We included in the study all new cases of HIV, TB and TB coinfected with HIV registered in Russia as a whole in the period from 2007 to 2019, as well as in the Arctic regions, excluding only those with diagnostic changes. In the Federal Districts (FD) of Russia, the incidence of epidemics in 2019 was analysed only.

Data sources

Data from HIV, TB and HIV/TB coinfection cases were annually disseminated among the Federal TB Research Institutions by the Federal Center of Monitoring of TB in the RF, which is a structural part of the State Central Research Institute of Public Health of the Ministry of Health of the RF. This is where all reporting and recorded data regarding health and related issues from all 85 federal entities of the RF are gathered, stored, and provided to the Ministry of Health. We extracted the needed data from the corresponding annual reporting forms of federal statistical observation (form # 8 "Information on the incidence of active tuberculosis" [23], form # 61 "Information on the disease caused by the human immunodeficiency virus" [24], form # 33 "Information on TB patients" [25]) transferred to the TBWeb and HIVWeb by the Federal Center of Monitoring of TB in the RF. These statistical forms at the end of each reporting year are filled out by the leading regional medical institutions on the basis of their constantly updated, personified patient database (form # 61-by the regional AIDS Centers, forms # 8 and # 33-by the regional TB dispensaries), and sent to the TB Monitoring Center mentioned above. In form # 8, only new cases of TB diagnosed during the reporting year among all regional populations, including foreigners, prisoners, migrants, and homeless people, are reflected. The data of TB and HIV/TB coinfection incidence as well as of prevalence among permanent residents only of the specific region during the reporting period are included in form # 33. The HIV incidence and prevalence information among the general population with highlighting of data from a certain category of the population (prisoners, foreigners + migrants, homeless people) are registered on form # 61. The population data of the whole Russia, as well as of the FDs' and Arctic regions' were obtained from the State Central Research Institute of Public Health of the Ministry of Health of the RF as well.

Analyses

To calculate the annual incidence rate, we considered the total annual reported number of new cases of HIV, TB and HIV/TB coinfection among the total population

and permanent residents per year separately, divided by the appropriate mid-year population and multiplied by 100,000, resulting in an incidence rate per 100,000 population/year. To quantitatively estimate the time trends of HIV, TB, and HIV/TB coinfection in the analysed period, and to calculate the differences between incidence data among the general population and permanent residents in 2019, we used the formula of annual percent change (APC). The gender disparity in HIV and TB incidence was simply calculated as a percentage proportion of males and females from the total number of new cases of HIV and TB. Spatial mapping was created in the R statistical analysis software using the base maps of the Russian Federation (map-of-Russia) and the ggplot2 package. Analytical comparison of obtained data between the Arctic regions, also between the regions and Russia as a whole, as well as with the FDs, was provided. In statistical analysis of epidemic trends in Russia as a whole, the 95% Confident Interval (95% CI) was used.

Ethical issues

Due to the use of only non-identifiable official data, the study did not require human subjects review.

Results

HIV, TB, HIV/TB coinfection incidence in the whole of Russia

According to the annually reported federal statistical forms # 61 and # 8, the TB incidence in the RF during the last 13 years (2007–2019) has dramatically decreased from 83,3 to 41,2 per 100,000 population/year, respectively (95% CI 0,80–1,62) (Figure 1). The tendency of HIV and HIV/TB coinfection incidence rates largely reflect stabilisation, at least in the last 5 years: HIV incidence decreased from 68,5 to 54,6 (95% CI 0,63–1,51) and HIV/TB coinfection incidence decreased from 11,0 to 9,4 per 100,000 population/year (95% CI 0,21–2,51), respectively in 2015–2019.

HIV, TB, HIV/TB coinfection incidence in the Federal Districts of the RF

Meanwhile, the HIV, TB, and HIV/TB coinfection incidence rates in the context of the FDs are uneven (Figure 2: A, B, C). The highest TB incidence rates in 2019 were in the Siberian FD (SFD) – 75,7 per 100,000 population/year, the Far East FD (FEFD) – 66,5 and the Ural FD (UFD) – 56,2, which also had the highest HIV and HIV/TB coinfection incidence rates, excluding the FEFD, where the HIV (40,7) and HIV/TB coinfection (6,2) incidence rates were less than in the whole of Russia. These three FDs include several Arctic regions: YanAD, ChAD, the Republic of Sakha (Yakutia), and Krasnoyarsk region.

The other 4 Arctic regions (Arkhangelsk and Murmansk regions, the Republic of Komi, and NAD) are part of the Northwestern FD where the HIV (43,8 per 100,000 population/year), TB (25,2) and HIV/TB coinfection (4,6) incidence rates in 2019 were much lower than in the previous three FDs, as well as in Russia as a whole.

HIV, TB, HIV/TB coinfection incidence in the Arctic zone of the RF

As we have noted already, the average TB and HIV incidence in Russia as a whole in 2019 was 41,2 and 54,6 per population/year respectively (Figure 3). In the Arctic regions of the RF, the highest TB incidence among the general population in 2019 was registered in ChAD – 136,1 per 100,000 population/year. The highest HIV incidence was in Krasnoyarsk region – 94,6. In

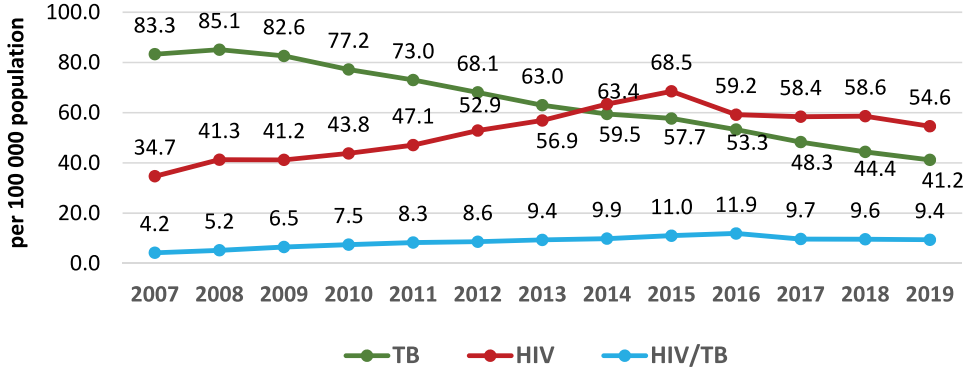


Figure 1. HIV, TB and HIV/TB coinfection incidence among general population of the Russian Federation, 2007–2019 (per 100,000 population/year, ff. 61, 8).

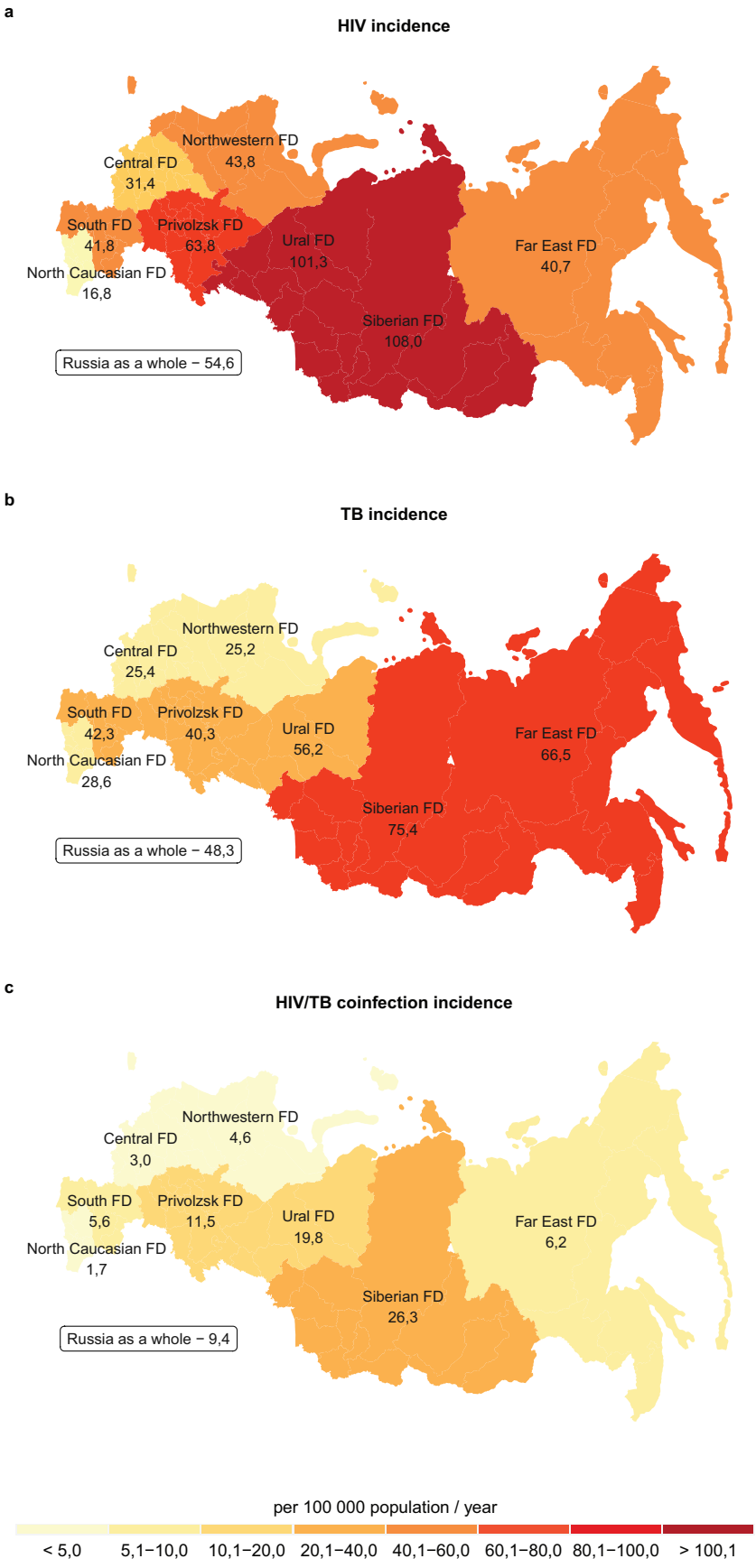
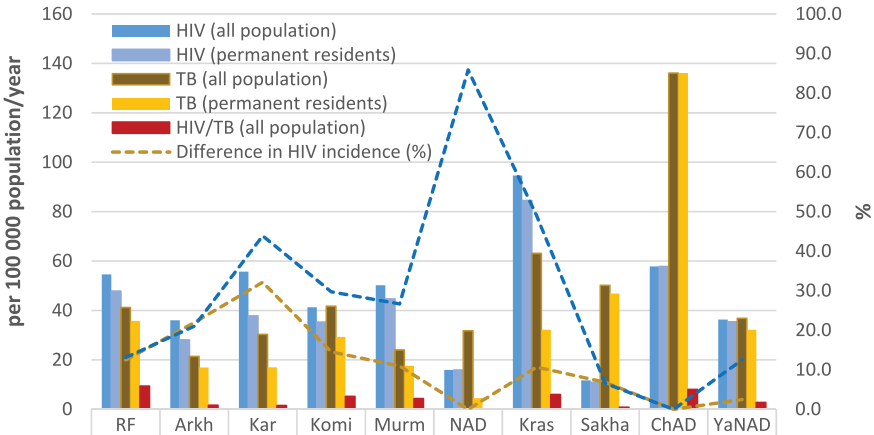


Figure 2. HIV (A), TB (B) and HIV/TB coinfection (C) incidence in the Federal Districts of the Russian Federation, 2019 (per 100,000 population/year, ff. № 61, 8).



	RF	Arkh	Kar	Komi	Murm	NAD	Kras	Sakha	ChAD	YaNAD
HIV (all population)	54.6	36.0	55.7	41.3	50.2	15.9	94.6	11.7	57.8	36.3
HIV (permanent residents)	47.8	28.1	37.8	35.3	44.7	15.9	84.5	10.9	57.8	35.4
TB (all population)	41.2	21.4	30.3	41.7	24	31.8	63.1	50.2	136.1	36.8
TB (permanent residents)	35.8	16.9	17.0	29.3	17.6	4.5	32.2	46.9	136.1	32.2
HIV/TB (all population)	9.4	1.6	1.5	5.2	4.3	0.0	6.0	0.8	8.0	2.8
Difference in HIV incidence (%)	12.5	21.9	32.1	14.5	11.0	0.0	10.7	6.8	0.0	2.5
Difference in TB incidence (%)	13.1	21.0	43.9	29.7	26.7	85.8	49.0	6.6	0.0	12.5

Figure 3. HIV, TB and HIV/TB coinfection incidence in the Arctic regions of the Russian Federation among general and permanent inhabitants, 2019 (per 100,000 population/year, %, ff. 61, 8 and 33).

these two regions, HIV/TB coinfection incidence, compared to that in other Arctic regions, was also high, amounting to 8,0 and 6,0, respectively, with an average rate in Russia of 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/year), which corresponds to the low HIV incidence (11,7), but TB incidence remains high (50,2), classifying the republic as a high TB burden entity of the RF. Out of the other Arctic regions, Karelia Republic is of note with a high HIV incidence in 2019 (55,7 per 100,000 population/year). In NAD, there were no HIV/TB coinfection cases registered in 2019. In YaNAD, HIV (36,3) and TB (36,8) incidence rates were equal, and HIV/TB coinfection incidence (2,8) was much lower than in Russia as a whole.

The incidence of HIV among the general population in 2019 prevailed over the rate among permanent residents of almost all Russian Arctic regions, except NAD and ChAD, where all new cases of HIV were diagnosed among permanent residents. The highest discrepancies in HIV incidence found in comparing the rate of the whole population to that of the permanent residents was discovered in the Republic of Karelia (32,1%), then in Arkhangelsk oblast (21,9%), a testament to a probable influence on the HIV incidence in these regions due to external factors. In Krasnoyarsk region, Murmansk oblast, and the Republic of Komi, the mentioned disparity was not over 15,0%: 10,7%, 11,0%, and 14,5%, respectively. The lowest prevailing of HIV incidence among the general population over one among the permanent inhabitants was indicated in YaNAD (2,5%) and in the Republic of Sakha (Yakutia) (6,8%), demonstrating the minimal probable external impact on the HIV incidence in the regions.

The probable external impact on the TB incidence among the permanent residents of the Russian Arctic territories is greater than its influence on the HIV incidence. Meanwhile, the general TB incidence prevails over the TB incidence among permanent residents in Russia as a whole (13,1%) and is almost equal to the HIV incidence (12,5%). In NAD, the difference between TB incidence in the whole population and permanent residents was the highest in the Russian Arctic regions (85,8%), i.e. nearly all of the new TB cases were diagnosed in "incomings". In Krasnoyarsk region, the indicator was 49,0%, i.e. almost half of all new cases of TB were also indicated in non-permanent residents of the region, and a similar situation is observed in the Republic of Karelia (43,9%). The indicator was not over 30,0% in Arkhangelsk oblast (21,0%), Murmansk oblast (26,7%), and the Republic of Komi (29,7%). The lowest indicators where TB incidence among the general population prevailed over the TB incidence among permanent residents, as did the HIV incidence, were observed in the Republic of Sakha (Yakutia) (6,6%) and YaNAD (12,5%). In ChaD there was not any influence of the "incomings" on the TB incidence in the region.

Table 1. HIV, TB and HIV/TB coinfection incidence rates in the Arctic regions of the Russian Federation, 2007–2019 (per 100,000 population/year, %, ff. № 61, 8).

	HIV			TB			HIV/TB		
	per 100,000		Rate	per 100,000		Rate	per 100,000		Rate
Regions	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
Arkh	5,2	36,0	592,3	59,2	21,4	−63,9	0,2	1,6	920,8
Kar	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
Murm	48,1	50,2	4,4	58,2	24,0	−58,8	2,3	4,3	83,5
NAD	9,5	15,9	67,4	40,5	31,8	−21,5	0,0	0,0	0,0
Kras	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
ChAD	13,9	57,8	315,8	57,6	136,1	136,3	4,0	10,0	150,0
YaNAD	21,3	36,3	70,4	74,0	36,8	−50,3	5,5	5,7	3,6

The increase in HIV incidence rate during 2007–2019 was highest in Arkhangelsk oblast (592,3%), Karelia Republic (331,8%), and ChAD (315,8%), the lowest incidence was in Murmansk oblast (4,4%) (Table 1).

TB incidence the last 13 years decreased in all Arctic regions, besides ChAD, where the TB incidence rate increased by 136,3%, and the HIV/TB coinfection incidence rate increased by 150,0%. The ChAD is the only region where the HIV, TB, and HIV/TB coinfection epidemics worsened critically throughout the period of analysis. Despite the decline in TB incidence rates, there is a high rate of increase in the incidence of HIV/TB coinfection in Arkhangelsk (920,8%) and Krasnoyarsk (760,0%) regions, as well as in the Republics of Sakha (Yakutia) (600,0%) and Komi (320,9%).

Gender disparity in HIV and TB incidence in the Arctic regions of the RF

In 2019, there were 80,124 new HIV cases among the whole population of Russia, where men disproportionately accounted for 63,7% of the total HIV incidence (Table 2). Similarly, in all of the Arctic territories of the RF, the share of new HIV cases was attributed to males, particularly in the Republic of Sakha (Yakutia), where almost all new HIV cases were diagnosed in men (93,6%). In NAD, Arkhangelsk oblast and the Republic of Komi, the share of newly HIV infected men was also high: 85,7%, 76,6%, and 72,5% respectively. The proportion of HIV incidence among women in Murmansk oblast, Krasnoyarsk region, and ChAD, accounted for approximately 1/3 of all new HIV cases: 31,8%, 34,2%, and 34,5%, respectively, also reflecting a larger male proportion. The ratio of men and women newly infected with HIV in YaNAD was almost equal, with a slight, but still predominant proportion of men (52,8%). In the Republic of Karelia (41,4%), the proportion of new HIV cases among women was higher than in all other regions, except the YaNAD. The gender structure of the TB incidence among the Russian Arctic inhabitants was similar to that of HIV incidence, with the share of men prevailing: in the whole Russia it was 68,2%. But in NAD, only 16,7% of new cases of TB were diagnosed in men. Meanwhile, the highest TB incidence in men was registered in Arkhangelsk oblast (82,7%), Murmansk oblast (76,0%,), and the Republic of Komi (73,2%). In the rest of the regions, the proportion of new TB cases in men varied from 58,8% to 68,4% in ChAD and the Republic of Karelia, respectively.

Discussion

Our study allowed for only a preliminary assessment of the HIV, TB, and HIV/TB coinfection epidemics' tendencies in the Russian Arctic regions. However, we found a dramatic decrease in the TB incidence in the period analysed in Russia as a whole and in all FDs, which shows an advanced change in the National TB Strategy in Russia, as well as in the world [9,26]. Nevertheless, regarding the HIV epidemic, despite the intensive implementation of antiretroviral therapy, improving diagnosis, and case finding of TB in people living with HIV, the high level of loss to follow up and death reflect the difficulties in effective treatment and early diagnosis of HIV/TB coinfection [27]. Epidemiological analysis of the Arctic zone of the RF allowed for identification of areas with high incidence of HIV, TB, and HIV/TB coinfection, which should be a priority for control interventions at the individual and population level. Some areas are even more

Table 2. The incidence of HIV and TB by sex among all inhabitants of the Arctic regions of Russia, 2019 (total number and percentage, ff. № 61, 8).

Regions/ characteristics		RF	Arkh	Kar	Komi	Murm	NAD	Kras	Sakha	ChAD	YaNAD
HIV	N	80,124	333	336	291	340	7	2432	109	29	197
	Male (%)	63,7	76,6	58,6	72,5	68,2	85,7	65,8	93,6	65,5	52,8
	Female (%)	36,3	23,4	41,4	27,5	31,8	14,3	34,2	6,4	34,5	47,2
TB	N	60,531	220	136	287	154	12	1811	487	68	200
	Male (%)	68,2	82,7	68,4	73,2	76,0	16,7	66,5	63,2	58,8	64,5
	Female (%)	31,8	17,3	31,6	26,8	24,0	83,3	33,5	36,8	41,2	35,5

affected by TB, HIV, and HIV/TB coinfection, and are especially essential in strengthening the health system capacity of the regions. The highest TB incidence in ChAD could have been provoked by a long absence of a TB dispensary, which was closed during the "Perestroyka" and reopened only 3 years ago [28]. Also, this region has one of the worst indicators for TB out of 85 federal entities of the RF [29]. The alarming rates of increase in HIV incidence are contradictory to a significant reduction in TB rates in Arkhangelsk oblast, as well as the Karelia and Komi republics, and require research the factors influencing the epidemic tendencies. The understanding of the dynamics of HIV/TB coinfection in relation to the HIV and TB epidemic trends is necessary in order to empower the health system capacity, especially in HIV and TB collaborative services [30], to achieve 90–90-90 HIV/ADS goals, as well as to attain the TB epidemic elimination worldwide Strategy [31,32]. Meanwhile, in the Arctic, with a high scattering of its settlements and a very low population density, the availability of medical services is too scarce [33,34]. In addition, the natural development of family relations, ethnic cultural features of the indigenous peoples, and the fact that more than half of them in Russia live in the Arctic territories [35], all contribute to the rapid spread of socially significant infectious diseases among the Arctic inhabitants [36,37]. Along with the acceleration of globalisation and industrialisation of the Arctic, the introduction of advanced medical technologies, such as telemedicine, mobile laboratories, is developing alongside [38]. However, access to HIV and TB preventive measures for Arctic inhabitants, including products of mass information, requires real, and not virtual, contact between inhabitants and medical or other types of specialists. We admit the assumption of underreported HIV and TB cases among the Arctic inhabitants, especially among indigenous peoples due to the factors described above. Our assumption is based on the fact that, so far in the RF, no one has properly studied how HIV testing and TB case finding in the Arctic territories is organised currently. Also, the high unevenness of TB, HIV, and HIV/TB coinfection incidence rates in the Arctic regions found in our study is a testament to their possible underreporting. We understand that the spread of socially significant diseases is influenced by many other natural and socio-economic factors, including climate change, the increase of pollution, etc [39,40]. Therefore, there is an urgent need to provide deeper, interdisciplinary research on this topic. In addition, our suggestion to conduct more detailed studies is supported by the disparities in HIV and TB incidence observed among the general population and the permanent residents of the Russian Arctic territories, which could be tied to differences in the level of impact of globalisation and migration processes on the epidemic situation in the regions. The high difference in HIV and TB incidence between the whole population and permanent residents in the Republics of Karelia and Komi, as well as in Arkhangelsk oblast, could be related to the epidemics in the penitentiary system [41], and the same assumption is eligible for Krasnoyarsk region [42]. The probable external impact on the HIV and TB incidence among permanent residents in Murmansk oblast and, interestingly, the huge prevailing of the TB incidence in the general population over the incidence among the permanent residents in NAD, are both phenomena that need clarification. Our findings suggest low probable outside impact on HIV and TB incidence among permanent inhabitants in far and more isolated Arctic regions such as ChAD, the Republic of Sakha (Yakutia) and YaNAD, despite the acceleration of industrial invasion in the regions, and prompt further study.

The results of the gender disparity in HIV incidence in the Arctic regions of the RF were unanticipated. The fact of the matter is that in Russia in the last decade, there has been a tendency for newly registered HIV infection to prevail in women, related to the increase of heterosexual transmission of human immunodeficiency virus in the country [43,44]. Meanwhile, in our study, we observe that HIV incidence in 2019 prevails in men not only in the Arctic regions, but also in Russia as a whole. The greater infection with HIV in men compared to women in the Russian Arctic territories is possibly due to the practice of shift work in the regions, where men are predominantly recruited [16]. On the other hand, in the Republic of Sakha (Yakutia), NAD, ChAD, and YaNAD, we have found that the outside impact on the HIV incidence among permanent residents was absent or was very low, but, nevertheless, the share of men infected with HIV in the regions was very high. This was true except for in YaNAD, where a nearly equal proportion of men and women newly infected with HIV can likely be related to the predominant heterosexual transmission of the infection.

The greater proportion of men newly diagnosed with TB in the Arctic regions of Russia, as well as in the whole country, is not cause for much discussion, since in Russia the male population has always been predominantly ill with tuberculosis [45,46]. Despite this, a very high share of men with newly diagnosed TB is observed in certain regions (Arkhangelsk oblast, Murmansk oblast, Republics of Komi and Karelia), which raises questions and needs to be studied more deeply.

In the study, we assessed the epidemics throughout the entire Arctic regions, though, as we mentioned above, only 4 of them are fully considered as the Arctic territories and in the remaining 5 regions, only circumpolar districts are included in the Russian Arctic zone. For a clearer assessment of the epidemics, it is better to obtain data from each circumpolar district separately. However, the study identified the main features of the HIV, TB and HIV/TB coinfection epidemics in the Arctic regions of the RF, showing the necessity of providing future studies.

Conclusion

The HIV, TB and HIV/TB coinfection incidence in the Russian Arctic regions are uneven. The highest HIV incidence in 2019 was in Krasnoyarsk region, the highest TB incidence – in ChAD. In general, the worst HIV, TB and HIV/TB coinfection epidemic situations are identified in ChAD. Despite the significant reduction in TB incidence in Arkhangelsk oblast and in the Karelia and Komi republics, it is alarming to observe the dramatic increase in HIV incidence rates in these regions. In the distant and more isolated regions (ChAD, Republic of Sakha (Yakutia) and YaNAD), the new cases of HIV and TB were mostly diagnosed in the permanent residents rather than in the general population. In all Russian Arctic regions, new HIV and TB cases were predominantly diagnosed in men, especially in Arkhangelsk oblast, the Republic of Komi, Murmansk oblast (TB-76,0%), NAD (HIV-85,7%), and the Republic of Sakha (Yakutia) (HIV-93,6%). It is necessary to provide more detailed studies to assess HIV, TB, and HIV/TB coinfection epidemic features in each district of the Arctic zone separately, to determine their main risk factors, including socio-economic, demographic, psychological, and other characteristics, especially among indigenous peoples, who belong to a vulnerable group in most countries, and to evaluate the health system capacity regarding HIV and TB collaborative services.

Disclosure statement

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References

[1] The development strategy of the Arctic zone of the Russian Federation. http://www.iecca.ru/en/legislation/strategies/item/99-the-development-strategy-of-the-arctic-zone-of-the-russian-federation
[2] US Arctic strategy. https://russiancouncil.ru/en/analytics-and-comments/analytics/u-s-arctic-strategy
[3] Sorokina SA, Zagdyn ZM. Social-economic, cultural and psychological factors affected the tuberculosis and HIV-infection spread among indigenous peoples in Russia (review). Med Alliance. 2016;3:24–29.
[4] Khasnulin V.I. 2009. Ethnic features of psychophysiology of the North indigenous peoples as the basis for survival in extreme natural environment. Problems of health preservation in North and Siberia environment: Proceedings on medical anthropology. http://www.national-mentalities.ru/diversity/nacionalnopsihologicheskie_osobennosti_etnosov_rossii/ural/hasnulin_vi_etnicheskie_osobennosti_psihofiziologii_korennyh_zhitelej_severa_kak_osnova_vyzhivaniya_v_ekstremalnyh_prirodnyh_usl/. Access date: 02/12/2021. (In Russian).
[5] Nadtochy LA. 2014. Solving the problems of the indigenous peoples' health preserving in certain regions of Russia (medical and social aspects). Krasnoyarsk 1-172. (In Russian)
[6] Brubaker M, Berner J, Warren RCJ. Climate change and health effects in Northwest Alaska. Glob Health Action. 2011;4(1):8445.
[7] Parkinson AJ, Bruce MJ, Zulz T, the International Circumpolar Surveillance Steering Committee. International Circumpolar Surveillance, an Arctic Network for Surveillance of Infectious Diseases. Emerg Infect Dis. 2008;14(1):18–24.
[8] Revich B. Determinants of public health in Arctic and Subarctic territories of Russia. Stud Russ Econ Dev. 2017;28(1):39–47. https://dx.doi.org/10.1134/S1075700717010099
[9] World Health Organization. Global Tuberculosis report; 2019. https://www.who.int/teams/global-tuberculosis-programme/tb-reports.
[10] Khaknazarov SK. The North peoples' health in sociological research context. Social aspects popul health. 2013;3(31):10. (In Russian).
[11] Vasilyeva IA, Belilovskiy EM, Borisov SE, et al. Tuberculosis with concurrent HIV-infection in the Russian Federation and the world. Tuberculosis Lung Dis. 2017;95(9): 8–18. (In Russin).
[12] Vladimirov AV. Dynamics of deaths and the structure of their causes in HIV-infected patients in the Khanty-Mansi Autonomous Okrug - Yugra. Bull SurSU Med. 2017;3:43–48.
[13] Tyrylgin MA. Mass TB screening in epidemiologically unfavorable regions of Far North. TB Probl 11: 10–14. (In Russian). 1989.
[14] Anisimov IV. The value of expeditionary research in TB epidemiology in the Yakutia (to the 70th anniversary of the first expedition). TB Probl. 1997;2:8–9.

[15] Nikolaev Y. Lung tuberculosis in the North. TB Probl. 1997;2:36 37.
[16] Volova LY, Rodina EV. HIV epidemiological situation among representatives of the indigenous peoples in the North. J Infectol. 2014;6(2):76–82. (In Russian).
[17] Bloss E, Holtz TH, Jereb J, et al. Tuberculosis in indigenous peoples in the U.S., 2003–2008. Public Health Rep. 2011;126(5):677–689.
[18] Fourtz JD, Cohen SA, Cook SK. Challenges and barriers to health care and overall health in older residents of Alaska: evidence from national survey. Int J Circumpolar Health. 2016;75(1):30348.
[19] Aboriginal people and HIV/AIDS. Canadian AIDS Society. cited 2007 July 27. http://www.cdnaids.ca/aboriginalpeopleandhivaids.HIV/AIDS and indigenous population in Canada and Sub-Saharan Africa.
[20] HIV/AIDS and indigenous peoples: final Report of the 5th International Policy Dialogue, October 21-23, 2009 Ottawa, Canada, International Affairs Directorate, Health Canada.
[21] Tuberculosis prevention and Control in Canada. www.publichealth.gc.ca.
[22] The health of indigenous peoples. Inter-agency support group on indigenous peoples' issues. Public Health Rep. 2011;126(5):677–689. PMCID: PMC3151185/.
[23] Form # 8 "Information on incidence of active tuberculosis" of federal statistical observation. http://www.consultant.ru/document/cons_doc_LAW_85720/c85cca7a9a19bb16bf153c9d541b4d1557c4eef3. (In Russian).
[24] Form # 61 "Information on HIV infection" of federal statistical observation. http://www.consultant.ru/document/cons_doc_LAW_344142/7ee4b13aae5c5c623ea254fbac617b1cc37c4e4c. (In Russian).
[25] Information on TB patients. Form # 33 of Federal Statistical Observation. http://www.consultant.ru/document/cons_doc_LAW_109766/e769e23cecbb9a423788443dff5efe74a5d526c4. (In Russian).
[26] Yablonskii PK, Vizel AA, Galkin VB, et al. Tuberculosis in Russia, its history and its status today. Am J Res Crit Care Med. 2015;191(4):372–376.
[27] Ngwenya N, Gumede D, Shahmanesh M, et al. Community perceptions of the socio-economic structural context influencing HIV and TB risk, prevention and treatment in a high prevalence area in the era of antiretroviral therapy. Afr J AIDS Res. 2018;17(1):72–81.PMID: 29504507
[28] The Russian National Front appealed to the Ministry of Health of the RF to take measures in Chukotka due to the extremely high TB incidence in the region. https://onf.ru/2017/10/13/onf-prosit-minzdrav-prinyat-mery-v-svyazi-s-krayne-vysokoy-zabolevaemostyu-tuberkulezom. (In Russian).
[29] Nechaeva OB. TB situation in Russia. Tuberculosis Lung Dis. 2018;96(8):1–10. (In Russian).
[30] WHO policy on collaborative TB/HIV activities. Guidelines for national programs and other stakeholders. Geneva: WHO; 2012. p. 36.
[31] UNAIDS 2016-2021 Strategy. UNAIDS/UNAIDS; 2015. URL: http://aidsinfo.unaids.org. Access date: 11/07/2020.
[32] WHO End TB Strategy. ttps://reliefweb.int/report/world/who-end-tb-strategy.
[33] Ruscio BA, Brubaker M, Glasser J, et al. One Health a strategy for resilience in achanging arctic. Int J Circumpolar Health. 2015;74(1):27913.
[34] Golnick C, Asay E, Provost E, et al. Innovative primary care delivery in rural Alaska: a review of patient encounters seen by community health aides. Int J Circumpolar Health. 2012;71(1):18543.
[35] Pavlenko VI, Petrov A, Kutsenko SY, et al. Indigenous peoples of the Russian Arctic (problems and development prospects). Hum Ecol. 2019;1:26–33. (In Russian)
[36] Burtseva TE, Uvarova TE, Tomsky MI, et al. The health of populations living in the indigenous minority settlements of northern Yakutia. Int J Circumpolar Health. 2014;73(1):25758.
[37] Negin J, Aspin C, Gadsden T, et al. HIV among indigenous peoples: a review of the literature on HIV-related behavior since the beginning of the epidemic. AIDS Behav. 2015;19(9):1720–1734.
[38] Woldaregay AZ, Walderhaug S, Hartvigsen G. Telemedicine services for the Arctic: a Systematic Review. JMIR Med Inform. 2017;5(2):e16.
[39] Parkinson AJ, Evangard B, Semenza JC, et al. Climate change and infectious diseases in the Arctic: establishment of a circumpolar working group. Int J Circumpolar Health. 2014;73(1):25163.
[40] Krümmel E-M, Andrew Gilman A. An update on risk communication in the Arctic. Int J Circumpolar Health. 2016;75(1):33822.
[41] Zagdyn ZM. The HIV and Tuberculosis tendency in penitentiary system of North-West Region of Russia. HIV infect Immunosuppressive Disord. 2019;11(2):67–74. (In Russian).
[42] Koretskaya NM, Elyart VF, Levina EB, et al. Newly diagnosed tuberculosis in penitentiary and civil health systems of Krasnoyrsk Region. Siberian Med J. 2014;5:89–92.
[43] Pokrovskaya AV, Kozyrina NV, Gushchina YS, et al. Patent's portrait Study Group. The sociodemographic portrait of a patient living with HIV and visiting AIDS centers in Russia. Ther Arch. 2016;11(11): 12–16. (In Russian).
[44] Grishina YY, Martynov YV, Kukhtevich YV. The significance of the sexual transmission rote in HIV epidemic development. HIV infect Immunosuppressive Dis. 2013;5 (2): 122–126. (In Russian).
[45] Perelman MI, Marchuk GI, Borisov SE, et al. Tuberculosis epidemiology in Russia: the mathematical model and data analysis. Russ J Numer Anal Math Modell. 2004;19(4):305–314.
[46] Koretskaya NM, Narkevich AA, Narkevich AN. Gender features of newly diagnosed infiltrative pulmonary tuberculosisю. Pulmonology. 2014;1(1):77–80.(In Russian)