TUBERCULOSIS EPIDEMIOLOGY TRENDS IN THE SAKHA REPUBLIC (YAKUTIA) FOR 2004-2011

M.K. Vinokurova, V.L. Aleksandrov, L.P Yakovleva, N.M. Oshchepkova

Summary

Tensed epidemiologic situation for tuberculosis has been determined in Sakha Republic (Yakutia) for the study period from 2004 to 2011, based on key indicators. We observed growth in incidence of TB cases presenting with destructions in lung tissue and bacillary-positive state, persisting trend towards increase in TB cases caused by MDR MTB, high proportion of deaths during the first year of outpatient follow-up for TB, and low coverage of the population with fluorographic mass examinations. The quality of anti-TB measures conducted by local health institutions varies between different socio-geographical zones of the republic. The study proved the need for better organized control of TB that would take into account differences in socio-geographic conditions, medical economics, technical resources, and staff availability in the regions of the republic, within the ongoing context of modernization of anti-TB service.

Keywords: tuberculosis, epidemiologic indicators, monitoring, multidrug-resistance, tuberculosis control measures.

Introduction. Tuberculosis (TB) in the Sakha Republic (Yakutia) and overall in the Russian Federation is still an important socio-medical problem [3,6]. Starting in 2004, anti-TB care for the population of Russia has been provided in accordance with the renewed legal framework [1,2]. Moreover, in some of the regions of Russian Federation, including Sakha Republic (Yakutia), measures have been fulfilled, funded by federal and regional target programs, by the National Priority Project On Health, and by a number of international projects, which greatly helped to improve the material resources of anti-TB institutions, strengthen the laboratory service, train TB doctors, lab personnel and primary care workers [4].

The aim of this study was to establish the main trends in the epidemiological situation for the period from 2004 to 2011.

Material and methods. Information was retrieved from the results of epidemiological monitoring for TB in Sakha Republic for 2004–2011. We statistically analyzed key epidemiological indicators for TB and the outcomes of anti-TB service activity in the capital city (Yakutsk) and the

34 regions of the republic, as classified to 5 socio-geographic zones (the city of Yakutsk, Arctic zone, Industrial zone, Rural zone, and Mixed type zone) [5]. Data from state statistical reports pertaining to the study period were used for analysis.

Results and discussion. Trends in TB incidence among the population (Report Form #8) of Sakha Republic during the period from 2004 to 2011 were generally similar to those of Russia, although levels of incidence were 1.4–1.8 times lower compared to incidence in Far Eastern Federal District for the study period. For the study period, there was a 9.2% decrease of TB incidence in the population of Sakha-Yakutia: from 91.1 to 83.4, per 100.000 population. In 2011 TB incidence level raised by 4.1% compared to the previous year, and exceeded the incidence level in Russia by 12.5% (Fig. 1).

Analysis of the trends in incidence between different socio-geographic zones of the republic (Report Form #33) shows that incidence had been declining from 2004 to 2011 in all zones except the Arctic zone. Decline was maximum in the Rural zone (1.5 times lower), and minimum in the Industrial zone (5.4% lower). But compared to the previous year, in 2011 TB incidence had grown in the Arctic, Industrial, and Mixed zones. In 2011, TB incidence among the population of the republic varied from 45.5/100.000 in the Industrial zone to 122.5/100.000 in the Arctic zone (Fig. 2).

New patients with TB disease were mostly patients with respiratory TB (RTB): 94.1% of cases in 2011. It is known, that detection rate for RTB cases presenting with destructed lung tissue is an important indicator, pointing primarily at untimely detection of the disease. The proportion of cases with destructed lung tissue among newly identified patients with RTB had increased during 2004–2011 from 37.2 to 40.4% that is 8.6% higher. The city of Yakutsk where the proportion increased by 19.6%, from 36.2 to 43.3%, was largely responsible for this increase, in Rural zone the proportion of the above cases remained the same as in 2004, 35.5%, while in other socio-geographic zones the proportions had somewhat decreased.

In 2011, compared to preceding year, this indicator had declined in all socio-geographic zones, ranging from 33.0% in the Arctic and Mixed zones to 47.8% in the Industrial zone.

Proportion of bacillary-positive cases among newly identified patients with RTB in 2011 was 26.1% higher than in 2004, increasing from 44.1 to 55.6%. This can be related to improved microbiological diagnosis on the one hand, and to untimely case detection on the other. Compared to previous year, in 2011 there was an increase in proportion of these cases in Yakutsk and Industrial zone, where the proportions were highest recorded: 64.3 and 54.7%, respectfully. Minimum level was observed in Mixed zone, 37.7%.

TB incidence level in children aged 0-14 is one of the reliable indicators for assessment of trends in epidemiological situation for TB. In 2011 rates of pediatric TB incidence in Republic Sakha were 1.7 times higher than in Russia and 6.3% higher than in Far Eastern Federal District. Through the period from 2004 to 2011 pediatric TB incidence reduced almost twice, from 56.7 to 28.7 per 100.000 of pediatric population (Fig. 3). This significant decrease was due to improved quality of diagnosis following the introduction of contemporary technologies (computed tomography, highly-specific tuberculin tests) and due to strengthening of organizational and instructional measures.

Because pediatric TB incidence had been notably declining in all socio-geographic zones throughout the study period, the 1.3-fold growth of incidence for the last reported year is an alarming fact. The situation is most unfavorable in Arctic zone, where the incidence had grown 2.8 times higher, reaching 108.9/100.000 of pediatric population. High incidence levels of pediatric TB were recorded in Rural and Mixed zones, and in Yakutsk (34.6, 32.3 and 30.1 per 100.000 of pediatric population). Minimum incidence level was recorded in Industrial zone: 6.0/100.000 of pediatric population.

Prevalence of TB is an important indicator that characterizes the way the detection of TB patients and the formation of ambulatory dispensary follow-up groups are organized, and reflects the effectiveness of anti-TB measures and the quality of the work of anti-TB dispensary. TB prevalence rate in the republic had decreased by a factor of 1.3 from 2004 to 2011. In 2011 the prevalence was 195.6/100.000, which is 14.0% higher then the all-Russian rate, but 1.5 times lower than the same rate in the Far Eastern Federal District (Fig. 4).

Analysis of the trends in TB prevalence for 2004-2011 shows that it had declined in all socio-geographic zones except the city of Yakutsk. Maximum decline was observed in Rural zone where it decreased by a factor 1.6, and minimum decline was seen in Industrial zone, where it was 12.8% lower. But compared to 2010, the decrease in TB prevalence was observed only in Rural zone, while in Yakutsk prevalence level was the same as in the former year, and increased in the rest of the socio-geographic zones. In 2011 the highest prevalence rates were seen in Yakutsk and in Arctic zone – 317.6 and 250.3 per 100.000, respectfully.

TB mortality rate is one of the most significant and informative indicators used in the assessment of the epidemiological situation. In Sakha-Yakutia the mortality in 2011 compared to 2004 had grown by 14.1%, nevertheless, it was 1.5-2.7 times lower than the all-Russian rate throughout the study period. In 2011 mortality caused by TB reached 8.9/100.000, which was 1.6 times lower than in Russia and 2.7 times lower than in Far Eastern Federal District (Fig. 5).

For the period from 2004 to 2011, mortality level increased in 3 socio-geographic zones: Arctic, Industrial and Mixed, and decreased in Yakutsk and in Rural zone. In 2011 mortality rates in Yakutsk and in Industrial zone exceeded the all-republic mortality level (11.9 and 9.1 per 100.000, respectfully), while the lowest mortality was seen in Rural zone (5.0/100.000). Compared to the former year, mortality had increased in all socio-geographic zones, most of all in Industrial zone (2.3 times higher) and least of all in Arctic zone (7.6% higher).

Among the deaths caused by active TB, the percentage of patients who died during the first year of ambulatory dispensary follow-up indicates a poor level of management of TB case detection by the primary healthcare institutions. In Sakha-Yakutia from 2004 to 2011, this proportion had reduced by 9.8% but still remains high and is assessed as 26.8%, which is 1.6 times higher than the same proportion in Far Eastern Federal District. The highest proportion was registered in 2011 in Mixed zone (44.4%). The high percentages were observed also in Yakutsk (26.5%), Arctic zone (25.0%) and Industrial zone (21.7%).

One more sign that signalizes the lack of organization in detection of TB patients is the insufficient coverage of the population aged above 15 years with fluorographic mass examinations: in 2011 only 62.0% were covered in the republic. The lowest coverage rates were observed in Industrial, Arctic, and Mixed zones (52.3, 56.3 and 57.1%, respectfully).

The characteristics of bacterial population circulating in the region, including data on drug sensitivity of the causative agent, are currently the most informative indicators that characterize the epidemiological risk presented by TB patients and are helpful in analyzing bacillary-positive case rates.

In Sakha Republic, number of TB patients with mutidrug-resistance (MDR) tends to grow stably, still more complicating the general epidemiological situation and causing obstacles to organization of treatment. In 2004 primary MDR was documented in 9.6% of newly identified patients having bacillary-positive forms of RTB, but in 2011 the proportion of such cases increased by a factor of 2.4 (23.0%), 1.5 times higher than that in Russia and 1.4 times higher than in Far Eastern Federal District. The proportion of MDR cases among bacillary-positive patient populations had grown twice for 2004–2011, reaching 45.5%, 1.3 times higher than in Russia and 1.6 times higher than Far Eastern Federal District.

The main reasons for growth of MDR TB are mistakes in organizing the treatment of patients (incompliance with the standards, irregular chemotherapy, treatment default, problems with drug supply) on the one hand, and increased coverage of patients with drug sensitivity tests on the other hand. In 2011 the percentage of these tests performed in the republic was 89.4% which was

1.3 times more than in 2005 (66.2%).

For 2004-2011 the proportions of patients with MDR had increased in all socio-geographic zones of the republic. It should be noted that MDR detection rates among the patients with RTB widely varies, signalizing that differences exist in availability of microbiological diagnostics, especially in Arctic, Industrial and Mixed zones of the republic, and that patients are incompletely covered with culture tests, and those culture-positive are insufficiently covered with drug sensitivity tests. In 2011 the highest level of primary MDR was registered in Yakutsk (24.2%) and in Rural zone (20.9%), and the lowest levels were recorded in Industrial (5.2%) and Arctic (5.8%) zones (Fig. 6). Proportions of MDR cases among bacillary-positive patient populations are likewise high in Yakutsk (42.6%) and in Rural zone (30.8%), while the lowest proportions are seen in Arctic (16.3%) and Industrial (21.7%) zones. This points at the need for improvements in bacteriologic diagnosis.

All of the above factors – insufficient coverage of the population of the republic with preventive fluorographic examinations, significant proportion of new cases who have destructions in lung tissue and are bacillary-positive, growth of drug-resistant TB – have negative consequences on treatment effectiveness. In Sakha-Yakutia, rates of treatment effectiveness in newly identified patients had decreased in 2011 compared to 2004: rates of sputum conversion decreased by 10.8%, from 82.3 to 73.4% (Far Eastern Federal District – 62.1%), rates of cavity closure decreased by 2.2%, from 73.9 to 72.3% (Far Eastern Federal District – 52.6 %).

In 2011 rates of sputum conversion between different socio-geographic zones of Sakha-Yakutia ranged from 61.6% in Industrial zone to 84.7% in Mixed zone; rates of cavity closure varied from 48% in Industrial zone to 89.2% in Rural zone.

Treatment effectiveness in TB patients is significantly influenced by the use of surgical treatment methods. In Sakha Republic the percentage of surgically treated patients among the patients with RTB had increased from 10.4% in 2004 to 14.6% in 2011, which exceeds the same percentage in Far Eastern Federal District by a factor of 2.3 (6.2%). The highest increase was observed in Arctic (3.4 times higher) and in Rural (1.6 times higher) zones, the lowest increase was observed in Industrial zone (9.8% higher). In 2011 maximum proportion of surgically treated patients among those with RTB was recorded in Rural zone (25.7%) and the minimum proportion in Industrial zone (10.2%).

In Sakha Republic, rates of sputum conversion in patient populations with RTB had increased from 43.6% in 2004 to 46.4% in 2011, which was 1.3 times higher than that in Far Eastern Federal District (36.1%). The same positive trend in sputum conversion rates was observed

in all socio-geographical zones except Yakutsk, where the rates remained the same as in 2004. In 2011 rates of sputum conversion in patient populations with RTB were maximum in Rural zone (64.8%), and minimum in Industrial zone (31.3%).

Rates of clinical cure in patients with RTB had decreased for 2004–2011 from 49.1 to 39.6% (by a factor of 1.2), although still 1.2 times lower than the same rates in Far Eastern Federal District (32.3%). High rates were recorded in 2004 both in the republic and in Russia – an explanation for this is that new definitions of dispensary follow-up groups for TB patients were adopted later (Order #109). During the next years the rate of clinical cure had been tending to decline in all the socio-geographic zones in the republic. But in 2010–2011 these rates were reported to have grown in Yakutsk, Arctic and Industrial zones (by factors of 1.2, 1.3 and 1.2, respectfully). In 2011 the rates of clinical cure in TB patients was ranging from 30.5% in Yakutsk to 56.5% in Rural zone.

Conclusions:

Epidemiologic situation for TB in the Sakha Republic (Yakutia) remains intense, despite the overall trend towards decrease by key indicators for the period from 2004 to 2011; a growth in the overall population TB incidence, in pediatric TB incidence and in pediatric mortality caused by TB is observed for the last years.

Growing incidence of cases with TB of respiratory organs detected with destructions in lung tissue and bacillary-positive state, high proportion of deaths during the first year of ambulatory dispensary follow-up signalize a lack of organization in detecting TB patients at healthcare institutions of the republic.

There is a stable trend towards growing number of multidrug-resistant TB, which complicates even more the overall epidemiologic situation, causes significant difficulties to organization of treatment and patient rehabilitation, and leads to growth of infection reservoir that presents epidemiological risk.

Significant variance is observed in levels and trends of key epidemiological indicators and in treatment effectiveness indicators between the socio-geographic zones of the Sakha Republic, due to differences in quality of anti-TB measures conducted: organization of preventive work, case detection, bacteriological diagnosis, ambulatory dispensary follow-up for TB, controlled chemotherapy, and surgical patient treatment.

The above said calls for improvements in organizing TB control, paying attention to the specifics implied by socio-geographic, medical and economical differences, as well as differences in availability of material resources and staffing between the regions of the republic, within the ongoing context of modernization of anti-TB service.

References:

Russian Federation Ministry of Health order of 21 March 2003 no. 109 ["On improvement of tuberculosis-controlling measures in the Russian Federation"]. Moscow: n.p.; 2003. 168 p.

Russian Federation Ministry of Health order of 13 February 2004 no. 50 ["On implementing of TB recording/reporting documentation for tuberculosis monitoring"]. Moscow: n.p.; 2004. 51 p.

Vinokurova MK et al. Tendentsiya razvitiya mnozhestvennoy lekarstvennoy ustoychivosti u bolnykh tuberkulezom legkikh v Respublike Sakha (Yakutiya) [A trend in development of multidrug-resistance in patients with pulmonary tuberculosis in Sakha Republic (Yakutia)]. In: Tuberkulez v Sibirskom i Dalnevostochnom federalnykh okrugakh [Tuberculosis in Siberian and Far East Federal Districts]. Novosibirsk; 2011. 54 p.

Tyrylgin MA. Problema okhrany zdorovya naseleniya Kraynego Severa: na primere regiona Yakutiya [Health protection problems in the population of the Extreme North: the case of Yakutia]. Novosibirsk: "Nauka"; 2008. 304 p.

Yakovleva LP, Zorina SP, Kondratieva MN. Dinamika epidemiologicheskikh pokazateley po tuberkulezu v Respublike Sakha (Yakutiya) v period 2000-2010 gg. [Trends in epidemiologic indicators for tuberculosis in Republic Sakha (Yakutia) for the period from 2000 to 2010]. Tuberk Bolezn Legk. 2011;5:252.

Author information:

Vinokurova Maria Konstantinovna, Dr.Med.Sc., Deputy Director for Science, State Budgetary Institution of the Sakha Republic (Yakutia) "Research-Practice Center 'Phthisiatry'", Yakutsk, Republic Sakha (Yakutia),Russian Federation, e-mail: mkvin61@mail.ru

Aleksandrov Vyacheslav Lavrentievich, Dr.Med.Sc., Yakutsk, Republic Sakha (Yakutia), Russian Federation, e-mail: yniit@mail.ru

Yakovleva Lyudmila Petrovna, Cand.Med.Sc., Head of the Dispensary Department, State Budgetary Institution of the Sakha Republic (Yakutia) "Research-Practice Center 'Phthisiatry'", Yakutsk, Republic Sakha (Yakutia), Russian Federation, e-mail: rptd00@mail.ru

Oshchepkova Natalia Mikhailovna, Head of the Dispensary Department, State Budgetary Institution

of the Sakha Republic (Yakutia) "Research-Practice Center 'Phthisiatry'", Yakutsk, Republic Sakha (Yakutia), Russian Federation, e-mail: oschepkova.natalya.m@yandex.ru

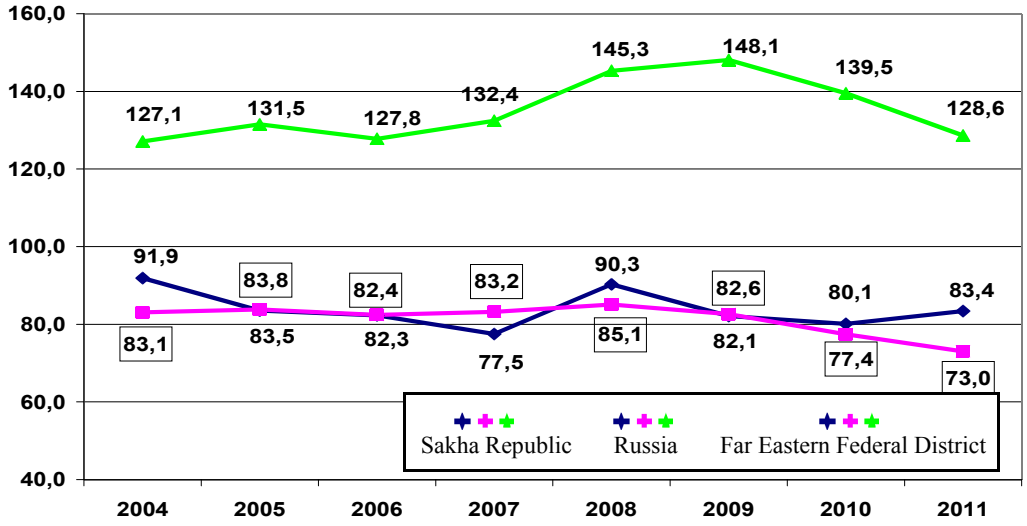

Fig. 1. Trends in population TB incidence (Form #8): Sakha Republic (Yakutia), Russian Federation, Far Eastern Federal District, 2004-2011 (per 100.000 population)

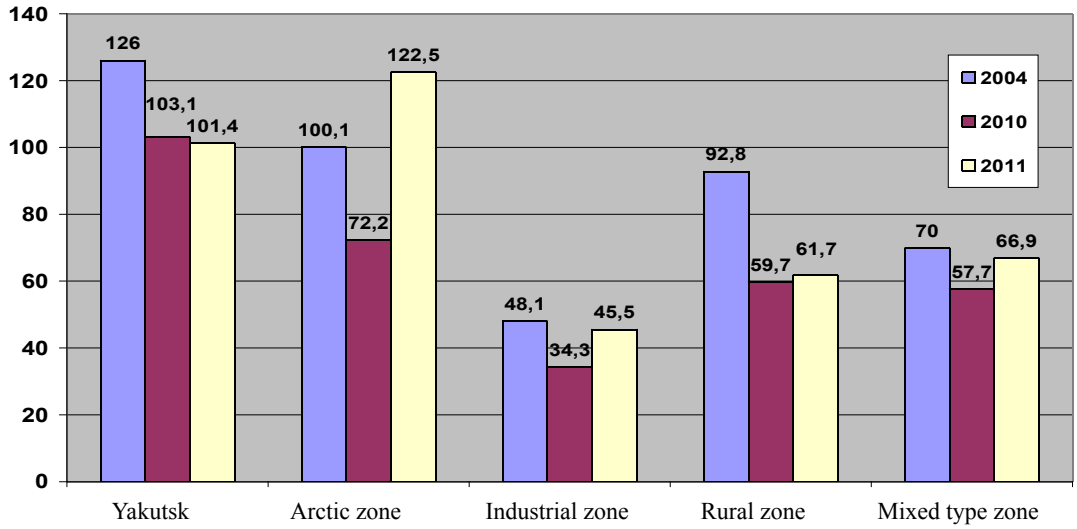

Fig. 2. Trends in population TB incidence: socio-geographic zones of Sakha Republic (Yakutia), 2004, 2010, 2011 (per 100.000 population)

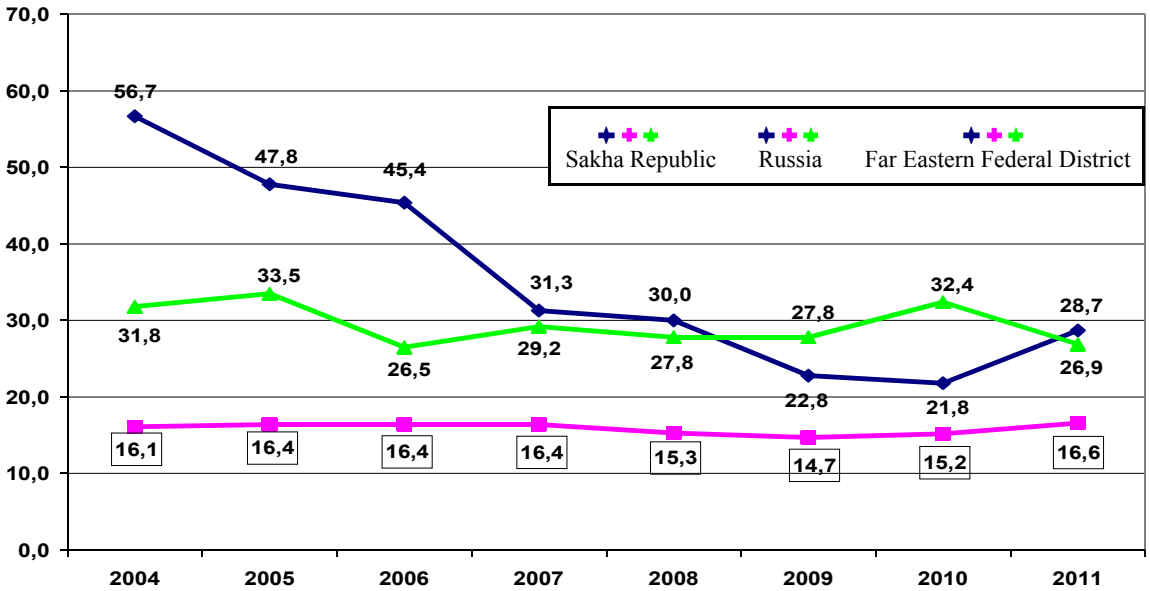

Fig. 3. Trends in pediatric TB incidence: Sakha Republic (Yakutia), Russian Federation, Far Eastern Federal District, 2004-2011 (per 100.000 population)

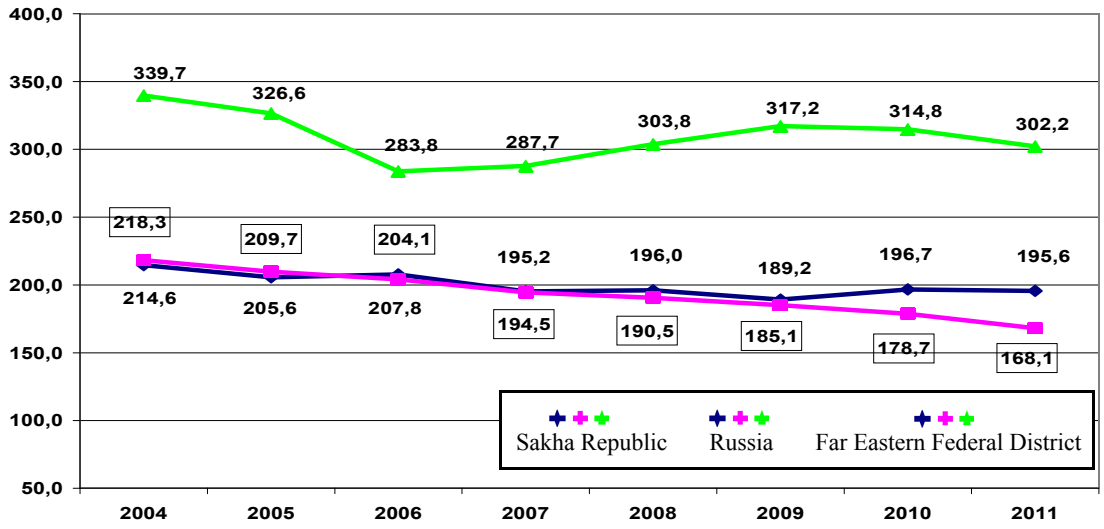

Fig. 4. Trends in TB prevalence: Sakha Republic (Yakutia), Russian Federation, Far Eastern Federal District, 2004-2011 (per 100.000 population)

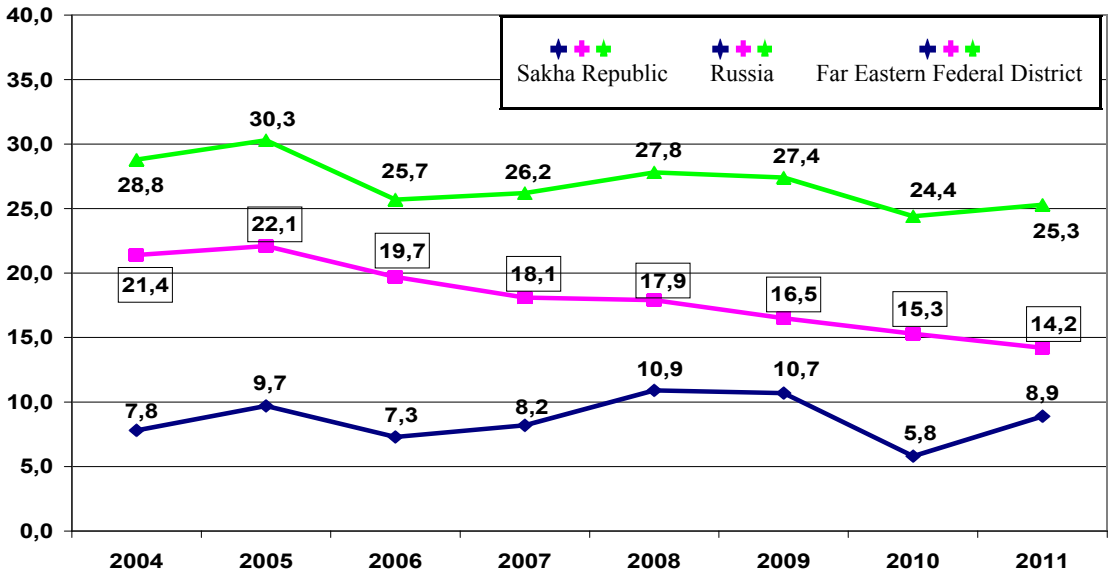

Fig 5. Trends in mortality caused by TB: Sakha Republic (Yakutia), Russian Federation, Far Eastern Federal District, 2004-2011 (per 100.000 population)

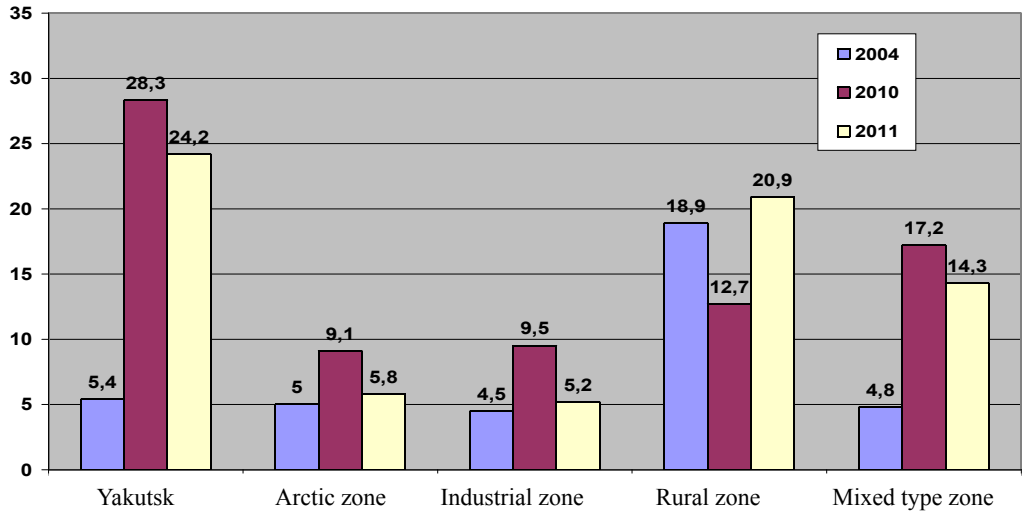

Fig. 6. Proportions of MDR cases among newly identified patients with bacillary-positive forms of respiratory TB: socio-geographic zones of Sakha Republic (Yakutia), 2004, 2010, 2011 (%)