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INTERREGIONAL ANALYSIS OF CERVICAL CANCER INCIDENCE AND MORTALITY IN THE SIBERIAN PART OF RUSSIA (2008-2019)

DOI 10.25789/YMJ.2021.74.18

The study presents the differences in cervical cancer incidence and mortality in the period from 2008 to 2019 among the state entities, including national state entities, located in Siberia and Russia as a whole. Taking into account the study results, the entities, which are characterized by a multiethnic population – Kemerovskaya oblast, Buryatia and Zabaikalski Krai are acutely, but Tyva is in critical need of cervical cancer preventive measures, including HPV vaccination.

Keywords: human papillomavirus, vaccination, health, ethnic, minorities, disparities.

Introduction. Cervical cancer (CC) is the fourth most common cancer among women worldwide, and currently more than 300,000 women die from it every year. The highest burden of CC is in low- and middle-income countries where access to public health services is limited [1].

In the Russian Federation, which belongs to countries with a middle income level [2], in the structure of the cancer incidence and mortality in 2020, the indicators of CC took the 4th place of women's cancers [3]. For example, in countries with a high income level, such as the United States and Canada, in 2020, CC incidence took the 13th place, CC mortality - the 10th and the 12th respectively [3].

Along with routine screenings HPV vaccination is important to prevent CC. The vaccination targets the types of HPV that are the most important CC risk factors [1].

In the United States the HPV vaccination are covered by health insurance plans [4]. In Canada all jurisdictions offer the HPV vaccination through government-funded programs [5].

In Russia the HPV vaccination has not yet been included in the national routine immunization schedule, named "The Russian national preventive vaccinations and the vaccinations by epidemic indications calendar" approved by the Order of the Ministry of Health of the Russian Federation, March 21, 2014, N 125n, and therefore is not free for the population of Russia's state entities.

Meanwhile, the HPV vaccination has been highlighted in the WHO strategy for the period 2020-2030 [1]. Therefore, there is a hope that HPV vaccines will be included in the Russian national vaccinations calendar and will become available to all Russia's citizens in the foreseeable future. When these vaccines will be free, their supplies at the start of vaccination would be limited. In the period between the inclusion of vaccines in the Russian national vaccinations calendar and their widespread distribution, it is necessary to develop a plan that figures out which people, including the territories of their residence, should get vaccines first. Accordingly, the studies highlighted the disparities in the CC incidence and mortality depending on the territories of residence, ethnicity / race, gender, etc., are of undoubted relevance [6,7].

Our previous study was devoted to the analysis of CC incidence and mortality in the national-state entities located in Siberia, in which the indigenous population and national minorities live - the republics Altai, Buryatia, Tyva, Khakassia and Sakha (Yakutia) in the period from 2007 to 2019. Taking into account its results we concluded that in Tyva and Buryatia the urgent need for HPV vaccination is.

To confirm the results of our previous study and compare them with foreign studies, which also noted an unfavorable CC situation in multiethnic territories [8,9,10], we have expanded the number of state entities in the comparison group and have included in it other state entities located in the Siberian part of Russia. The retrospective year at the beginning of this study is 2008 since the Zabaikalski Krai was formed in 2008 by the unification of the Chitinskaya Oblast and the Agin-Buryat Autonomous Okrug [11], and when its data on the CC incidence and mortality appeared. The retrospective final year of the study remained 2019, its data on cancer were marginal for access on the portal for medical and pharmaceutical workers "ONCOLOGY.ru". In this study we have also introduced analysis for other indicators - the annual changes of the CC incidence and mortality for every year of the period 2009- 2019 from 2008, which was chosen as baseline. Accordingly, the purpose of this study was to compare the CC incidence and mortality in the period from 2008 to 2019 among state entities, located in Siberia, as well as Russia as a whole.

The following tasks were set: to compare the CC incidence and mortality among these state entities, and also compare them to the all-Russian analogous indicators; to determine state entities with maximum and minimum rates of

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CC incidence and mortality; to establish the disparities among state entities in the CC incidence and mortality annual baseline changes; to highlight state entities with the highest baseline increase in the CC incidence and mortality; to identify state entities with the correlation between CC incidence and mortality baseline changes.

Materials and methods. To establish the disparities in CC incidence (CCI) and mortality (CCM), the data of state medical statistics on cancer from 2008 to 2019 were used. The data that published annually in the books of the Moscow Oncological Research Institute named after P.A. Herzen - a branch of the Federal State Budgetary Institution "National Medical Research Center of Radiology" of the Ministry of Health of Russia on the portal for medical and pharmaceutical workers "ONCOLOGY.ru", from 2008 to 2020 were extracted [12].

The CCI and CCM were estimated by the age-standardized CCI rates (ASIR) and CCM rates (ASMR) per 100 thousand populations. To standardize by the age in the data sources, mentioned above, the world standard for the population distribution by the age was used. The time period was from 2008 to 2019. State entities (SEs) – Altaiski Krai (AK), Krasnoyarski Krai (KK), Irkutskaya Oblast (IO), Kemerovsraya Oblast (KO), Novosibirskaya Oblast (NO), Omskaya Oblast (OO), Tomskaya Oblast (TO), Zabaikalski Krai (ZK), and the republics – Buryatia (RB), Altai (RA), Tyva (RT), Khakassia (RKh) and Sakha (Yakutia) (RSY) were included in the comparison group. There were 13 SEs in total and Russia as a whole (RF). The retrospective time period is from 2008 to 2019. The cancer site is the cervix (C53).

Because the annual values of CC ASIR and ASMR did not have a normal distribution the Friedman's test was used for finding differences across multiple attempts. To identify paired differences the Wilcoxon's test was used.

The values of the CCI and CCM annual baseline changes (ABC) were calculated as the ratio of the difference between the current annual value of ASIRi and ASMRi (where i - [2009, 2019]) and the value of the CCI and CCM in 2008 (ASIRo, ASMRo) to the value of ASIRo, ASMRo.

CCI ABC = (ASIRi – ASIRo) / ASIRo;

CCM ABC = (ASMRi – ASMRo) / ASMRo.

To identify the correlation between the CCI ABC and CCM ABC, the Spearman correlation coefficient (r) was calculated, using the formula for small sample sizes. Chan's scale was used to assess the connection strength [13].

Differences and r were considered significant at $p \leq 0.05$.

Results and discussion. *Research on the cervical cancer incidence.*

The annual values of the CC ASIR from 2008 to 2019 in the SEs located in Siberia and in Russia as a whole are presented in Table 1. The null hypothesis of Friedman's test is rejected, so Friedman's test revealed their unevenness ($p = 0.000$).

The average ranks of the annual values of the CC ASIR from 2008 to 2019 in the SEs and in Russia as a whole are shown graphically in Figure 1. Based on them, the lowest CCI in this period of time was in the NO. The paired differences in the NO's average rank with the all-Russian and with the rest of the SEs' average ranks reached the level of the chosen significance ($p < 0.05$). The CCI average ranks in the KO and in the OO did not differ from the all-Russian ones ($p = 0.979$). In the remaining ten SEs, the CCI average rank significantly exceeded the all-Russian ($p < 0.05$) while ZK and Tyva had the highest CCI average ranks, which exceeded the all-Russian by more than 4 times. There were no differences between the ZK's and RT's CCI average ranks ($p = 0.638$), and they both significantly exceeded the ranks of all other eleven SEs ($p < 0.05$).

Our previous study on the CCI differences in the period 2007-2019 among the republics located in Siberia also showed that the highest CCI rates was observed in Tyva [14].

The all-Russian CCI baseline change rates increased steadily from year to year in the period 2009-2019 and have the character of a steady trend towards the further increase. The rates of the all-Russian CCI ABCs, as well as the CCI ABCs in SEs located in Siberia, are graphically presented in Figure 2. An increase of CCI ABCs that are close to the above-described characteristics of the all-Russian one and confirmed by the strong correlation on the Chan scale [6], was observed in the KK ($r = 0.945$, $p = 0.000$), in the IO ($r = 0.855$, $p = 0.001$), in the KO ($r = 0.873$, $p = 0.000$), in Buryatia ($r = 0.845$, $p = 0.001$) and in Tyva ($r = 0.882$, $p = 0.000$).

The increase in the CCI ABCs close to the all-Russian, but confirmed by a moderately strong correlation, was observed in the RSY ($r = 0.755$, $p = 0.007$). The CCI ABCs in the OO, the NO, the TO, the ZK and the RKh in 2009-2019 varied and did not correlate with the all-Russian, but at the same time always showed an increase or no change in rare years (1-2 years out of the selected 12 years). The absence of the CCI ABCs in these SE is shown in Figure 2 as a decrease in the CCI ABCs in certain years. The absence because when we calculated the differences between the CC ASIR values in these SEs in 2008 and in the years in which, according to our calculations, the CCI ABCs had negative values, the significance did not reach the chosen level ($p > 0.05$).

The CCI ABCs in the AK as well as in the RA were in opposite directions, and have the fair and poor negative correlation coefficient with the all-Russian ones, but the p values did not reach the required level ($r = -0.205$, $p = 0.545$; $r = -0.336$, $p = 0.312$, respectively). In the AK the CCI ABCs' increase was noted in 2012 and 2013, in other years the baseline CCI decreased or did not change. In the RA the CCI ABCs' increase was observed in 2009, 2013 and 2015, in other years the baseline CCI decreased or did not change. In our opinion in the AK and the RA there is a tendency towards a decrease of the CCI baseline changes but so far without the formation of a stable trend.

In addition our previous study showed that despite the fact that in the RA, with a 1.55-fold decrease of the CC ASIR value in 2019 compared to 2007, the difference between them still did not reach the required level of significance ($p=0.108$) [14].

When we carried out the multiple rank analysis of the CCI ABCs in the period 2009-2019, we found that their distribution is also heterogeneous ($p = 0.000$). These rank rates are graphically presented in Figure 3. Despite the fact that the CCI ABCs average ranks in the KK, the IO, the KO, the NO, the TO, Buryatia, ZK, Tyva and RKh graphically exceed the all-Russian ones, the average ranks were distributed unevenly ($p = 0.049$). Therefore, we had begun to form comparison groups among these SEs by the descending order of their average ranks, to identify a group of SEs or a single SE, which had the maximum rates of CCI ABCs. We had formed such a group, that included the KK, the KO, the ZK, and the RKh, among which the distribution of the CCI ABCs was the same ($p = 0.664$) and the median of the CCI ABCs' differences between in these SEs and the all-Russian reached the significance ($p < 0.02$).

Research on cervical cancer mortality. The annual values of the CC ASMR from 2008 to 2019 in SEs located in Siberia and in Russia as a whole are presented in Table 1. Analysis of their distribution

Table 1

Annual values of CC ASIRs and CC ASMRs in the SEs located in Siberia and RF

	2008				2009				2010				2011			
	ASIR		ASMR		ASIR		ASMR		ASIR		ASMR		ASIR		ASMR	
	M	m	M	m	M	m	M	m	M	m	M	m	M	m	M	m
RF	12.84	0.11	4.99	0.07	13.40	0.12	5.13	0.07	13.71	0.12	5.12	0.07	13.70	0.12	5.27	0.07
AK	16.27	0.99	5.40	0.54	15.04	0.94	4.99	0.52	15.81	0.97	5.67	0.56	16.25	1.01	4.81	0.54
KK	14.25	0.85	6.60	0.56	13.76	0.83	6.73	0.56	15.13	0.87	7.06	0.59	14.94	0.88	6.93	0.58
IO	19.00	1.06	8.36	0.70	17.68	1.02	8.26	0.69	19.72	1.09	7.45	0.66	21.18	1.16	7.61	0.68
KO	10.78	0.73	3.96	0.43	12.77	0.81	4.18	0.45	12.06	0.78	4.36	0.45	12.90	0.83	6.18	0.56
HO	11.40	0.78	4.99	0.50	13.08	0.85	4.27	0.46	12.24	0.82	4.23	0.46	12.15	0.84	4.48	0.49
OO	12.84	0.96	5.55	0.61	14.63	1.05	5.93	0.64	12.61	0.95	5.57	0.61	14.13	1.02	4.71	0.57
TO	16.61	1.56	7.09	1.01	19.13	1.68	6.41	0.92	20.40	1.73	6.44	0.91	15.85	1.49	6.43	0.92
ZK	24.92	1.93	5.43	0.87	30.74	2.12	9.08	1.13	28.06	2.04	7.90	1.04	30.38	2.11	8.39	1.11
RB	22.90	1.98	11.69	1.42	18.66	1.75	11.60	1.38	15.57	1.62	8.71	1.17	21.09	1.86	11.13	1.33
RA	18.60	3.77	10.28	2.96	27.03	4.83	12.91	3.28	14.15	3.45	10.98	3.00	18.56	3.88	6.18	2.21
RT	27.54	3.98	6.24	1.90	17.45	3.12	9.20	2.33	20.66	3.54	10.44	2.48	27.94	4.11	13.46	2.85
RKh	14.04	1.99	8.39	1.45	16.36	2.09	6.60	1.27	16.97	2.11	4.31	1.02	22.00	2.47	5.77	1.23
PSY	17.21	1.74	6.77	1.09	17.44	1.72	5.29	0.96	13.36	1.52	3.82	0.79	16.68	1.70	4.91	0.93
	2012				2013				2014				2015			
	СПЗ		СПСм		СПЗ		СПСм		СПЗ		СПСм		СПЗ		СПСм	
	M	m	M	m	M	m	M	m	M	m	M	m	M	m	M	m
RF	13.90	0.12	5.23	0.07	14.17	0.12	5.35	0.07	14.47	0.12	5.18	0.07	15.01	0.12	5.39	0.07
AK	17.78	1.05	5.25	0.55	17.19	1.01	5.92	0.58	15.56	0.96	5.66	0.56	16.38	0.99	6.32	0.59
KK	16.10	0.91	6.09	0.54	17.29	0.94	6.12	0.56	19.73	1.00	6.70	0.56	20.62	1.03	7.26	0.60
IO	22.39	1.18	8.82	0.72	22.21	1.17	8.51	0.72	22.63	1.19	7.93	0.68	22.45	1.19	9.31	0.76
KO	14.51	0.88	6.77	0.59	14.29	0.86	7.12	0.60	14.72	0.89	5.80	0.54	16.53	0.94	7.30	0.61
HO	14.23	0.89	5.28	0.54	15.13	0.90	5.14	0.51	12.62	0.82	5.09	0.51	15.19	0.89	4.74	0.49
OO	12.61	0.97	5.26	0.59	14.20	1.02	5.91	0.62	13.54	1.00	5.58	0.61	16.39	1.09	5.79	0.64
TO	19.81	1.66	7.26	1.00	19.56	1.64	7.06	0.97	26.86	1.92	7.84	0.98	25.74	1.90	7.66	0.99
ZK	25.15	1.96	8.95	1.12	29.23	2.10	8.57	1.13	32.77	2.23	8.73	1.13	35.58	2.36	10.69	1.24
RB	18.86	1.76	10.57	1.31	31.27	2.27	12.47	1.42	27.83	2.10	12.48	1.39	29.91	2.20	11.46	1.36
RA	18.97	3.87	6.93	2.21	22.43	4.16	11.19	2.82	16.46	3.35	8.95	2.54	21.86	4.04	8.21	2.37
RT	20.20	3.43	9.04	2.29	24.07	3.66	12.00	2.59	30.97	4.15	9.38	2.22	35.40	4.48	12.21	2.64
RKh	20.15	2.34	8.08	1.43	20.55	2.37	10.55	1.72	26.57	2.69	7.46	1.42	17.20	2.12	8.50	1.50
PSY	16.58	1.69	5.58	0.99	20.30	1.84	6.95	1.06	19.59	1.83	6.47	1.03	19.20	1.79	6.21	0.97
	2016				2017				2018				2019			
	ASIR		ASMR		ASIR		ASMR		ASIR		ASMR		ASIR		ASMR	
	M	m	M	m	M	m	M	m	M	m	M	m	M	m	M	m
RF	15.45	0.12	5.26	0.07	15.76	0.13	5.18	0.07	15.80	0.12	5.07	0.07	15.38	0.12	5.01	0.07
AK	14.92	0.97	4.73	0.51	16.38	1.02	5.83	0.60	14.96	0.96	4.28	0.50	16.24	1.02	5.01	0.54
KK	18.90	0.99	6.61	0.56	21.06	1.03	6.80	0.57	21.49	1.03	6.40	0.55	21.03	1.04	6.21	0.54
IO	26.43	1.31	9.24	0.75	23.56	1.21	8.34	0.71	25.18	1.26	8.87	0.74	21.83	1.17	7.94	0.69
KO	16.22	0.94	6.38	0.57	16.97	0.97	7.27	0.61	15.65	0.92	6.67	0.57	15.24	0.91	6.94	0.59
HO	13.75	0.84	4.01	0.44	14.28	0.86	4.37	0.45	13.05	0.81	5.89	0.54	12.60	0.80	4.99	0.48
OO	13.80	1.01	5.49	0.62	15.61	1.08	5.07	0.6ц0	17.33	1.14	5.83	0.65	16.73	1.11	4.91	0.57
TO	23.44	1.82	6.92	0.95	19.20	1.62	7.11	0.97	17.26	1.52	5.74	0.85	19.49	1.58	5.74	0.83
ZK	44.75	2.64	8.85	1.12	41.54	2.59	7.17	0.99	40.64	2.54	9.55	1.15	22.85	1.86	7.30	1.00
RB	30.03	2.25	11.39	1.36	42.55	2.67	13.09	1.47	35.64	2.43	11.41	1.30	39.92	2.56	14.32	1.53
RA	16.75	3.71	9.18	2.68	17.08	3.60	7.61	2.12	18.19	3.59	2.14	1.07	14.50	3.14	5.12	1.86
RT	43.88	4.96	9.11	2.23	44.98	4.92	9.41	2.17	49.01	5.09	12.62	2.62	51.37	5.33	13.60	2.81
RKh	17.26	2.10	8.78	1.53	20.29	2.30	8.55	1.45	19.48	2.33	6.21	1.18	22.10	2.44	7.93	1.40
PSY	22.85	1.94	6.84	1.07	20.20	1.82	6.11	1.01	21.57	1.89	4.61	0.84	18.38	1.75	5.49	0.93

Note: See the explanation of abbreviations in Tables 1-3 and Fig.1-4 in the text

revealed the heterogeneity (p = 0.000) also as the ASIR and the CCI ABCs distributions.

The average ranks of the annual CC ASMR values from 2008 to 2019 in the selected SEs and in Russia as a whole are shown graphically in Figure 1. Based on the average ranks, the lowest CCM was, also as the CCI, in the NO (p <0.05 in comparison with the all-Russian rank and with the remaining SEs' ranks). The CC mortality average rank not different from the all-Russian one was observed only in the AK (p = 0.328). In the remaining eleven SEs, the CC mortality average ranks significantly exceeded the all-Russian level (p <0.05). The highest CCM average ranks during this period were in Buryatia and Tyva, which exceeded all-Russian by more than 4 times. There were no differences between the values of these ranks (p = 0.158) and they both significantly exceeded the ones of all other eleven SEs (p <0.05).

Our previous study also showed that the highest CCM in the period 2007-2019 among the republics located in Siberia was observed in Buryatia and Tyva [14].

In contrast of the all-Russian CCI ABCs, its CCM ABCs in the period 2009-2019 did not have the stable increase. The CCM ABCs in SEs located in Siberia and in Russia as a whole are shown in Figure 4. A steadily increase in the CCM ABCs can be seen in the KO; but in Tyva and in the ZK the increase is accompanied by peaks. Such increasing rates of CCM ABCs can even be called critical in comparison with all-Russian and with the rates in the remaining ten SEs, in which their CCM ABCs had a downward and upward direction. The largest number of years in which a decrease of the CCM ABCs was observed was in the RSY; there were 9 years of them in total (2009-2012, 2014-2015, 2017-2019).

When we carried out the multiple rank analysis of the CCM ABCs rates among all SEs and Russia as a whole, it was found that their distribution is also heterogeneous (p = 0.000). The rates of the average ranks of the CCM ABCs in SEs located in Siberia as well as all-Russian ones are graphically presented in Figure 3. Based on the rates, the KO, the ZK and Tyva have the most increase in the CCM ABCs, which is about 1.5 times higher than the all-Russian ones (the paired differences between each of them and all-Russian have p = 0.002). The rates of the CCM ABCs average ranks in these SEs had no difference (p> 0.05). The CCM ABCs average ranks in the AK, the KK, the IO and Buryatia did not differ from the all-Russian ones (p> 0.05).

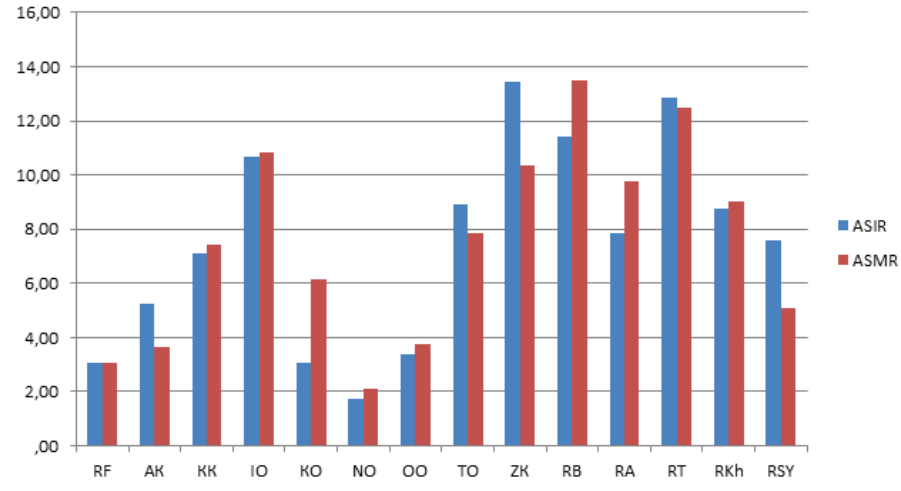

Fig 1. Average ranks of the CC ASIRs and ASMRs in the SEs (2008-2019)

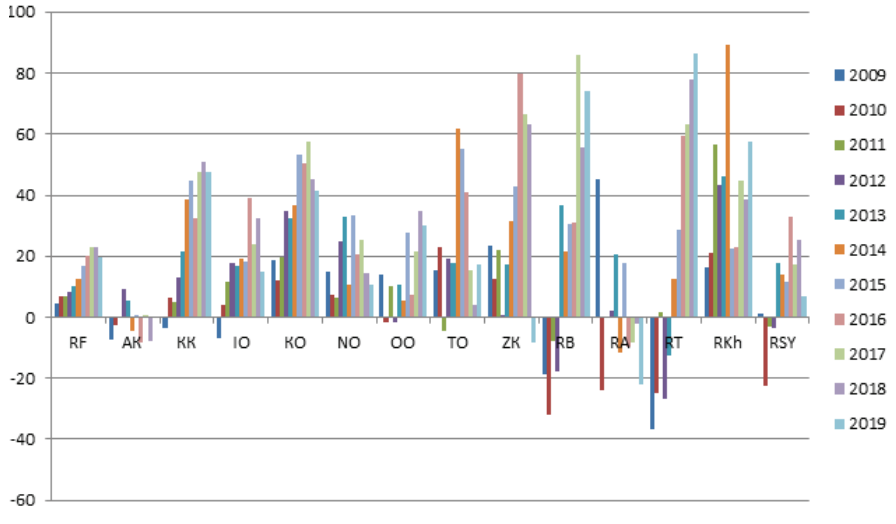

Fig 2. The rates of the CCI ABCs in the SEs

Fig 3. The average ranks of the CCI ABCs and the CCM ABCs in the SEs (2008 – 2019)

Significantly lower ranks than of all-Russian were in the NO (paired differences p = 0.034), the OO (p = 0.034), the TO (p = 0.015), the RA (p = 0.0340), the RKh (p = 0.028) and in the RSY (p = 0.003); in the RSY, as we wrote above, a decrease in the CCM baseline changes was revealed in most annual periods. When we were performing the rank analysis of the CCM ABCs of these six

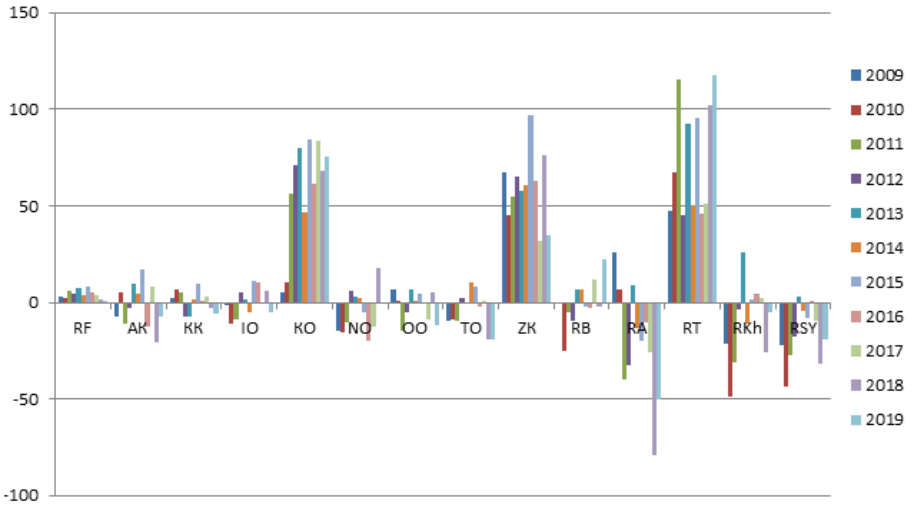

Fig 4. The rates of the CCM ABCs in the SEs

SEs it was found that their distribution is uniform, that is, no significant differences were found between them (p = 0.075).

In our opinion, only in relation to the RA we can talk about the beginning of the stable decreasing CCI baseline changes trend predominantly at the period 2014-2019.

Presented in our previous study the analysis of differences in CCM in 2019-2007 in the republics located in Siberia, also showed that Tyva had the most significant increase and the RA had most significant decrease [14].

Analysis of the correlation between cervical cancer incidence and mortality.

Analysis of the correlation between CCI ABCs and CCM ABCs, the results of which are presented in Table 2, showed the presence of a moderately strong correlation in the AK, the IO, the KO, the TO and Buryatia. Of these SEs, only in the AK there was a relatively favorable picture in relation to CC.

In Global Strategy the WHO recommends to achieve the CCI rate less than 4 cases per 100,000 women per year for accelerating the CC elimination as a public health problem [1]. According to the 2019 data in all SEs included in this study, there is a significant excess of this rate (see Table 1).

Nevertheless, according to the results of our study, it is important to choose SEs that are in highly need of CC prophylaxis including the HPV vaccination. So, finally, we assigned ranks to the indicators calculated by us. The ranking results are presented in Table 3, in which 1 point is the presence of the indicator, 0 is its absence. The indicator "Maximum values of ASMR" was assigned 2 points, since currently a maximum reduction of CCM is the first goal.

As a result, the maximum final rank was assigned to Tyva, which characterizes the burden of CC in this SE as critical that is also shown in our previous study [1]. Further, in descending order the KO, and having a common border Buryatia and the ZK followed. Their ranks indicate the need for urgent CC prevention.

Tyva, the KO, Butyatia and the ZK are the SEs characterized by a significant share of the indigenous population and ethnic minorities. These data consist with other third-party international research, which established an unfavorable situation in relation to CC in multiethnic areas [8,9,10].

Conclusion. Our research shows that the HPV vaccination among the population of the SEs located in Siberia is a very urgent task.

In all SEs selected for the study, as well as in Russia as a whole, the CCI in 2019 exceeded the WHO-established 4 cases per 100,000 women per year.

The lowest CCI and CCM in 2008-2019 detected in the NO, where the rates were lower than the all-Russian ones. In most of the selected SEs, the CCI (10 SEs) and the CCM (11 SEs) significantly exceeded the all-Russian ones. The

Table 2

Spearman correlation coefficient (r) between the annual values of CC ASIRs and ASMRs (2008-2019)

	RF	AK	KK	IO	KO	NO	OO	TO	ZK	RB	RA	RT	RKh	RSY
r	-0.182	0.683*	-0.145	0.645*	0.709*	0.164	0.155	0.724*	0.291	0.682*	0.264	0.518	0.136	0.573
p	0.574	0.020	0.670	0.032	0.015	0.631	0.649	0.012	0.385	0.021	0.433	0.102	0.689	0.066

Note: * - the r has the required significant p-value

Table 3

The sum of the calculated CCI and the CCM indicator ranks

	AK	KK	IO	KO	NO	OO	TO	ZK	RB	RA	RT	RKh	RSY
Max ASIR								1			1		
The increase of CCI ABCs		1	1	1					1		1		
Max increase of CCI ABCs		1		1				1				1	
Max ASMR									2		2		
The increase of CCM ABCs				1				1			1		
Max increase of CCM ABCs				1				1			1		
Correlation between CCI ABCs and CCM ABCs			1	1			1		1				
The sum		**2**	**2**	**5**			**1**	**4**	**4**		**6**	**1**	

highest CCI was observed in the ZK and Tyva, the highest CCM was in Buryatia and Tyva.

Based on the changes in the CCI from baseline it have showed an increase of the CCI in Russia as a whole and in all SE selected for the study, except for the AK and the RA. But in Russia as a whole, in the KK, the IO, the KO, Buryatia and in Tyva the CCI increased steadily. The maximum increase was noted in the KK, the KO, the ZK and the RKh.

The changes in the CCM from baseline in most SEs (10 SEs) had two direction - downward and upward. A critically increase of CCM based on the changes in the CCM from baseline was found in the KO, the ZK and Tyva. The correlation between the CCI ABCs and the CCM ABCs reflecting an unfavorable CC situation found in the IO, the KO, the TO and Buryatia.

Thus, taking into account the results of our study in total, among SEs located in Siberia the most acute CCI and CCM situation has developed in the SEs of Russia, which have significant proportion of the indigenous population and ethnic minorities, such as Tyva, Kemerovskaya Oblast, Buryatia and Zabaikalski Krai. These SEs, especially Tyva, highly need to carry out CC preventive measures, including HPV vaccination.

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