

## Long-Term Analysis of Polio Epidemiological Situation in Russian Federation and The Republic of Tatars Tan

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### Abstract

Poliomyelitis is a highly contagious infectious disease of the viral etiology. The causative agent of this infection is poliovirus. The target system of poliovirus is the nervous system when it penetrates a human body. According to official data of the World Health Organization, in most cases children under the age of 5 are exposed to poliomyelitis. The studied infectious nosology refers to immunocontrolled pathologies, which helps to minimize risks for public health. In Russian Federation (RF) vaccination against poliomyelitis is included in the National calendar of preventive vaccinations. However, there are risks associated with migration processes. In this study, they used the data from state reports of the Federal Service for the Supervision of Consumer Rights and Human Welfare Protection (Rospotrebnadzor) "On the state of sanitary and epidemiological welfare of RF population" to analyze the epidemiological situation of poliomyelitis in Russian Federation and in the Republic of Tatarstan (RT) and the following report data from Rospotrebnadzor Department in RT: "On the state of sanitary and epidemiological welfare of the population in the Republic of Tatarstan" in 2012-2016. They analyzed the forms of the federal statistical observations № 1, 2 "Information on infectious and parasitic diseases" for the same period with the use of statistical processing methods. It has been established that during the period under study, the cases of poliomyelitis caused by wild poliovirus strain have not been recorded on the territories of Russian Federation and RT. A similar situation with vaccine-associated polio is recorded in RT during 2012-2016. In general, the cases of vaccine-associated poliomyelitis were registered in Russian Federation during 2013 (6 cases), 2014 (5 cases) and 2016 (1 case). The immunization of the population against poliovirus in RF and RT is characterized as stably high. Thus, the vaccination / revaccination rates are at 95% or higher from the planned number. This measure is regarded as an effective management decision during the prevention of poliomyelitis. Such factors as migration processes with poliomyelitis endemic countries, the emergence of vaccine-producing poliomyelitis viruses are identified as epidemiological risks that can adversely affect the sanitary and epidemiological situation of poliomyelitis in Russian Federation.

**Keywords:** Poliomyelitis; Epidemiology; Prevention; Morbidity.



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### 1. Introduction

The World Health Organization (WHO) is implementing the Strategic Plan for the Eradication of Poliomyelitis and the implementation of the final phase in 2013-2018. The goal of this strategy is to save mankind from poliomyelitis caused by wild poliovirus and circulating poliovirus of vaccine genesis. Poliomyelitis is the infection with severe clinical manifestations, most often it affects children under the age of 5 years. Poliomyelitis is characterized by a fecal-oral transmission mechanism, which, as it would seem, allows to attribute this nosology to the group of intestinal infections, however, the target cells of the poliovirus in a human body are the neurons of the anterior horn gray matter in the spinal cord. The impact of the polio virus on the human central nervous system can lead to paralysis, which leads to a patient's disability, and to a lethal outcome during the involvement of respiratory muscles or vasomotor nuclei of the cranial nerves into the pathological process caused by the poliovirus. Poliomyelitis can be caused by wild poliovirus and can be characterized as vaccine-associated one. Vaccine-associated poliomyelitis is the complication after immunization activities, during which a live oral attenuated vaccine is introduced into a human body. This feature should be taken into account during the vaccination against poliomyelitis according to the National calendar of preventive vaccinations. For example, if a child is not vaccinated against this infectious disease, then he must not be admitted to a team of children, where the remaining children are vaccinated with live oral attenuated vaccine within 60 days after the last inoculation of the oral poliomyelitis vaccine.

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According to the official statistics of WHO and Rospotrebnadzor, the samples of wild poliovirus of type 1 were isolated from sewage in 2013 as the part of routine epidemiological surveillance in southern Israel and Egypt. Also, in 2013, they registered the outbreak of poliomyelitis in the Horn of Africa with 6 confirmed cases of a real infectious disease caused by type 1 poliovirus. In the same year, the Chief State Sanitary Doctor of RF issued the Resolution No. 11 "On the Action Plan for the Maintenance of Russian Federation Poliomyelitis Free Status for 2013-2015" (Patel *et al.*, 2015). The above-mentioned facts made it possible to characterize the epidemiological situation as an international distribution of poliovirus with a special involvement in the epidemiological process of those countries where the level of immunization against poliovirus was low (Korotkova, 2015).

The obtained data make it possible to characterize poliomyelitis as a significant infectious pathology, which has certain risks. Taking into account a high migration activity of the population, including the countries with a low coverage with preventive vaccinations, this infection may be considered as a potential threat to the international sanitary and epidemiological situation. However, it should not be forgotten that the infection under study belongs to a controlled one by preventable vaccine, which plays an important role in poliomyelitis prevention. The authors of this research work have set the following goal: to assess the epidemiological situation of poliomyelitis in Russian Federation and the Republic of Tatarstan. The tasks assigned to the authors of the study were the description of poliomyelitis incidence rate in Russian Federation and RT, the determination of external epidemiological risks for RF, taking into account the international sanitary and epidemiological situation for the infectious disease under study and the determination of population immunization level (vaccination, revaccination) against the poliovirus (Antúnez, 2018; Arita, 2017).

## 2. Materials and Methods

In this paper we used the data from the State Reports of Rospotrebnadzor "On the state of population sanitary and epidemiological welfare in Russian Federation" and Rospotrebnadzor Department in RT "on the state of population sanitary and epidemiological welfare in the Republic of Tatarstan" for 2012-2016, the forms of federal state statistical supervision No. 1, 2 "The information on infectious and parasitic diseases" for the same period. In this paper they used the methods of epidemiological analysis and generally accepted methods of variational statistics (Razavi, 2016).

## 3. Results

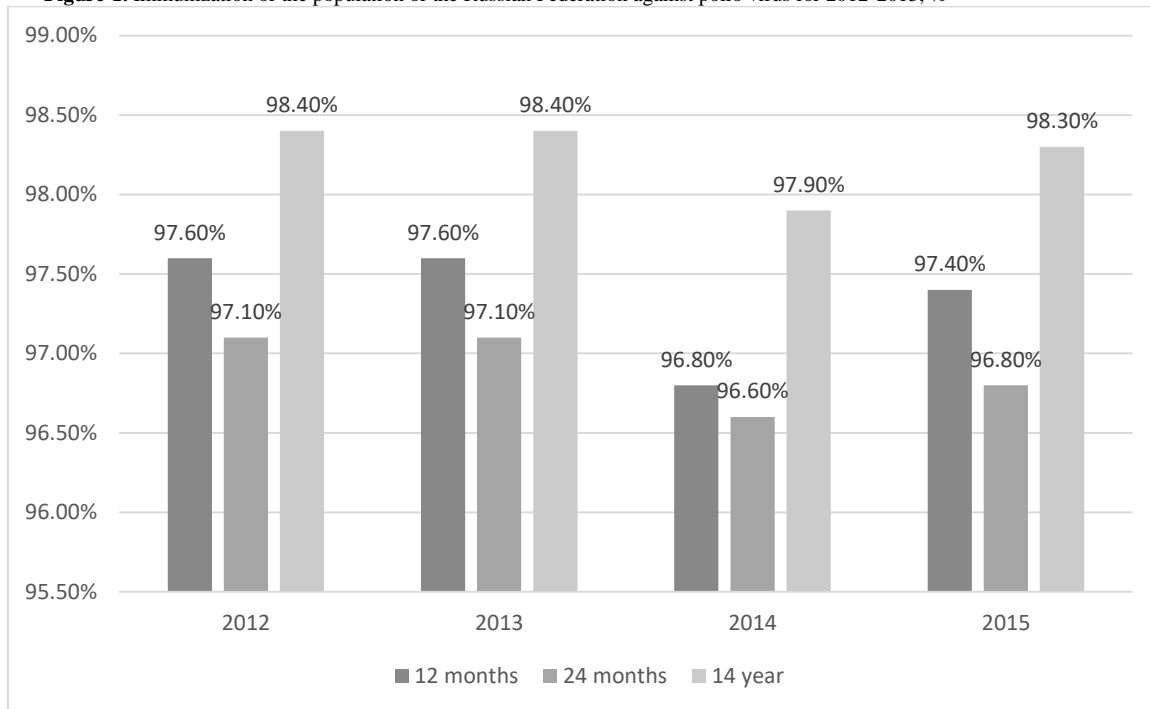
During the period 2012-2016, they did not record the cases of poliomyelitis caused by a wild strain of polio virus on the territory of Russian Federation. Accordingly, a similar picture is observed on RT territory. This epidemiological situation makes it possible to characterize RF as the territory free from poliomyelitis. A different picture is observed with vaccine-associated poliomyelitis. So, in 2013, 2014 and 2016 the cases of the studied infectious disease of vaccine genesis were registered on the territory of RF. In 2012 and 2015, the cases of vaccine-associated poliomyelitis were absent in RF. During the period of 2012-2016 the cases of poliomyelitis of vaccine origin were not recorded in RT (Table 1). So, the last such case was registered in 2004 on RT territory, and the incidence rate of poliomyelitis caused by wild poliovirus strain has not been registered in RT since 1994. This fact makes it possible to characterize the epidemiological situation on poliomyelitis caused by a wild strain of poliovirus and vaccine-associated strain in RT as a satisfactory one (Müller, 2016).

**Table-1.** Cases of incidence of vaccine associated polio and polio caused by wild poliovirus strain in the Russian Federation and the Republic of Tatarstan for 2012-2016, the absolute value

Year Cases	2012	2013	2014	2015	2016
The wild strain of the virus, RF	0	0	0	0	0
A wild strain of the virus, RT	0	0	0	0	0
vaccine-associated poliomyelitis, RF	0	6	5	0	1
vaccine-associated poliomyelitis, RT	0	0	0	0	0

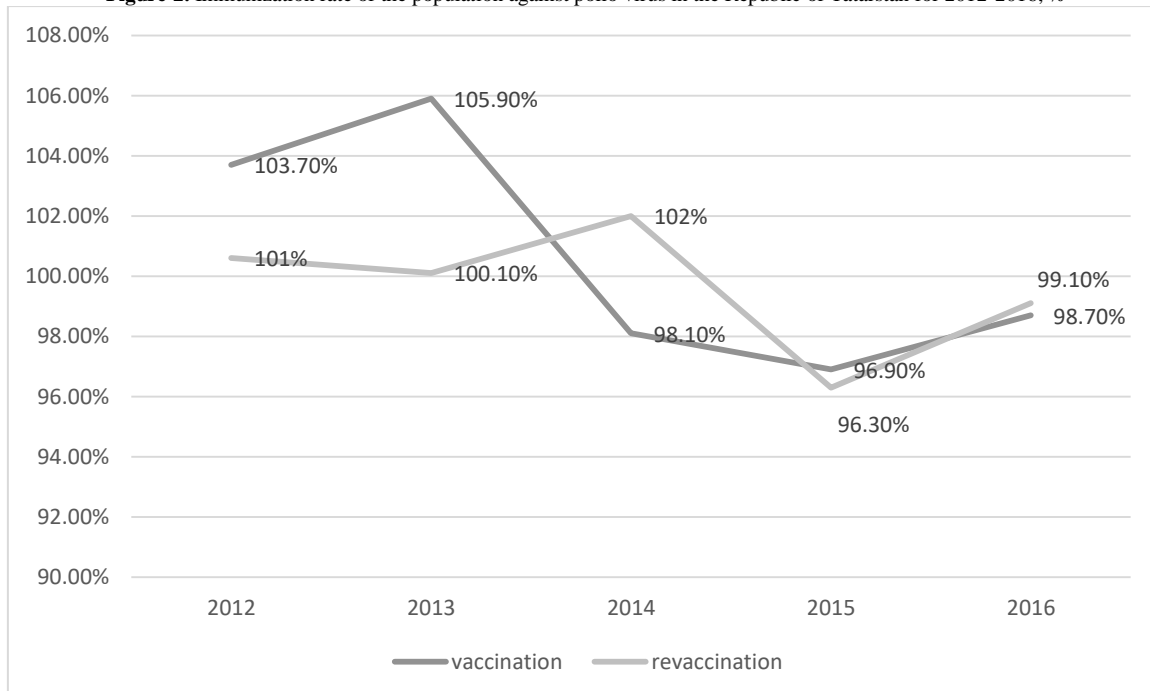
According to the National calendar of preventive vaccinations in RF, the immunization of an inactivated poliomyelitis vaccine against the poliovirus virus is carried out at the age of 3 months and 4.5 months. The next stage of vaccination is carried out at the age of 6 months with an oral polio vaccine. The first revaccination of by oral poliomyelitis vaccine against poliovirus is carried out at the age of 18 months, the second revaccination - at the age of 20 months. The third, final revaccination with an oral poliomyelitis vaccine is carried out at the age of 14 years. This preventive measure is considered as one of the tools of preventive measures, which allows to provide a stable epidemiological situation on poliomyelitis within RF territory. During the period of 2012-2016 the immunization against the poliomyelitis virus in RF is characterized as a stably high (above 95% from the number of subjects to be vaccinated/revaccinated). So, in 2012, the vaccination among 1 year old children was 97.6%, the revaccination of 2 year old children made 97.1%, the revaccination at 14 year old children made 98.4% (Figure 1). The rate of vaccination / revaccination was at a consistently high level (above 95% from the number of subjects to be immunized) for similar age categories in RF during 2016 (Moulsdale *et al.*, 2014).

**Figure-1.** Immunization of the population of the Russian Federation against polio virus for 2012-2015, %



In RT, as in RF, the immunization coverage against the poliovirus is characterized as a consistently high. Thus, in 2012, the vaccination rate against poliovirus in the RT was 103.7%, and revaccination coverage rate was 100.6%. In 2016, the vaccination rate against the infectious disease under study was 98.7%, revaccination coverage rate made 99.1% (Figure 2). The exceeding of 100% in 2012, 2013 and 2014 can be explained by the overfulfilment of the immunization plan in these cohorts, which may be explained by many reasons. For example, the increase of the birth rate, the arrival in the region and the obtaining a temporary / a permanent registration. All these factors can occur after immunization planning for any reporting period.

**Figure-2.** Immunization rate of the population against polio virus in the Republic of Tatarstan for 2012-2016, %



During the determination of the epidemiological risks that can negatively affect the epidemiological situation of poliomyelitis in Russian Federation and biological safety, the following factors can be determined. So, migratory processes can worsen the epidemiological situation of poliomyelitis. For example, such polio-endemic countries as Afghanistan, Pakistan and Nigeria can be considered as unsafe regions for this infectious disease both for Russian tourists and for the coming population from these countries to RF territory. Also, 2 cases of the studied infectious disease caused by vaccine-producing poliomyelitis viruses were recorded on the territory of Ukraine in 2015. It should be noted that the appearance of vaccine-related polioviruses during the world transition from trivalent oral poliovirus vaccine to bivalent oral poliovirus vaccine plays a negative role in polio-free region support.

## 4. Conclusions

The obtained results of the present study indicate a favorable epidemiological situation on poliomyelitis within the territories of Russian Federation and the Republic of Tatarstan. In 2012-2016, polio cases caused by wild poliovirus strain were not recorded in the study areas. Vaccine-associated poliomyelitis was not recorded during in RT during the study period, which is not the case for Russian Federation as a whole, where 6 cases were registered in 2013, 5 cases were recorded in 2014 and 1 case in 2016. The immunization of the population against the poliomyelitis virus on the territory of Russian Federation is characterized by consistently high rates (above 95% from the number of subjects). In terms of vaccination / revaccination RT is characterized by overfulfilment of the plan in 2012 (vaccination exceeded the plan by 3.7%, revaccination - by 0.6%), in 2013 (vaccination rate was exceeded by 5.9%, revaccination rate - by 0.1%), and in 2014 (the actual rate of revaccination was exceeded by 2%). The migration processes with poliomyelitis endemic countries can serve as the tool to import wild strains of poliovirus in the territory of Russian Federation, which should be taken into account during making managerial decisions during the sanitary protection of the territory. A separate factor that can adversely affect the sanitary and epidemiological situation of poliomyelitis in RF can be such a phenomenon as the emergence of vaccine-related polioviruses. This study clearly demonstrates a successful epidemiological situation on poliomyelitis in Russian Federation, which indicates the effectiveness of preventive measures, which help to preserve RF population health (Metlenkov, 2018).

## Acknowledgements

The authors are grateful to the Kazan Federal University for their assistance in this study.

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