

Prevention of Healthcare Associated Infections in the Tuberculosis Health Center

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Abstract

Prevention of healthcare-associated infections associated (HAI) is an important part of the activities of a medical organization (MO), focused on the quality and safety of medical services. Epidemiological safety of the profile infectious MO requires strict adherence to the sanitary and anti-epidemic regime. An example of such a MO is the State Budgetary Institution of the Republic of Mari El, Republican Tuberculosis Health Center (RATHC). The analysis of sanitary and epidemiological well-being on the example of the RATHC used the methods of retrospective and operative epidemiological analysis of cases among staff and patients, as well as data of microbiological monitoring. Based on the results of the analysis for the period of 2002-2016, there were 7 cases of HAI among the staff, which are tuberculosis processes, 116 cases of HAI were found among the patients, not associated with tuberculosis. According to the microbiological monitoring (MBM) of the RATHC, there has been a decrease in studies aimed at detecting coliform bacteria (CB) (1.5 times), *S. aureus* from the surfaces of the RATHC objects (1.5 times), pathogenic flora (1.5 times), and working solutions of disinfectants for the activity of the active substance (ASA) (1.2 times). At the same time, there has been an increase in research aimed at determining microbial contamination of air (a total microbial number by 8.6 times, *S. aureus* by 8.6 times), a degree of sterility of medical products (MP) by 2.4 times and the pre-sterilization quality control of medical products (MPPSQC) by 1.5 times. Epidemiologically significant structural subdivisions (children's department, surgical and therapeutic departments, clinical diagnostic and bacteriological laboratories) have been established. The obtained results indicate the need for staff motivation to comply with the established instructions and protocols to ensure the sanitary and epidemiological well-being of the medical organization.

Keywords: Healthcare-Associated Infections; Tuberculosis; Microbiological Monitoring; Sanitary and Epidemiological Well-Being.

Introduction

HAI occupy an actual place in the modern healthcare system in terms of hygiene and epidemiology, the quality management system in medical organizations, since epidemiological safety is one of the tools for targeting to the consumer of medical services with the involvement of medical personnel to achieve this goal [1,2,3,4,5,6].

The Russian Federation in 2011 enacted "The National Concept for the Prevention of Healthcare-Associated Infections", approved by the Chief State Sanitary Doctor of the Russian Federation on November 6, 2011, which fully identifies the demographic, economic, medical aspects of this issue and ways to solve this problem. Economic analysis according to the national concept is one of the criteria for assessing the prevention of HAI [7,8,9,10].

Prevention of HAI in medical organizations is the main activity of the departmental epidemiological service, which requires close monitoring in surgical hospitals, perinatal centers, and in specialized health centers. A tuberculosis health center is an example of a medical organization, where the risk of developing nosocomial tuberculosis is great both among patients and its employees due to the peculiarities of the transmission mechanism of this pathogen [11].

Despite the fact that in the Russian Federation there is a tendency to reduce the incidence of tuberculosis, this nosology remains one of the most socially significant infectious diseases, including in the structure of occupational diseases, which indicates the existing risk of tuberculosis development as HAI among medical staff. In 2016, in the territory of the Russian Federation, the dominant in the structure of occupational diseases and poisonings (with the biological factor of the production environment as the key factor in the pathogenesis of the development of occupational disease) among medical personnel and other employees of organizations classified as "Healthcare" in accordance with the all-Russian classifier of economic activities, are respiratory tuberculosis - 85.5% (2015 - 88.7%), and tuberculosis of other organs - 8.6% (2015 - 4.1%). The investigations of occupational diseases have revealed the following main factors and conditions for the emergence of pathologies: contact with the

infectious agent during labor activity - 42.7% of cases, imperfect workplace arrangement - 13.1%, improper use of personal protective equipment (PPE) - 12.6 %, and imperfect technological processes - 8.0% [12].

In 2016, the Republic of Mari El (RME) had no cases of nosocomial tuberculosis registered in the structure of the HAI of the RATHC, which is explained by strict observance of the sanitary legislation in the field of epidemiological safety, and the understanding by the medical personnel of the internal instructions for compliance with the sanitary and anti-epidemic regime. This study analyzes the results of implementing risk management from the standpoint of ensuring sanitary and epidemiological well-being in the conditions of the RATHC [13,14, 15].

Materials and Methods

The HAI log (infectious diseases log No.60), production control MBM log of the RATHC for the period of 2002-2016 were analyzed. Methods of retrospective and operative epidemiological analysis, data of the form of the federal state statistical observation No. 30 "Information on the medical organization" were used.

Results and Discussion

The RATHC is located in Yoshkar-Ola, the village of Kuyar, Medvedevsky district (about 9 km from the city of Yoshkar-Ola) and in the village of Krasnogorsky, Zvenigovsky district (about 60 km from the city of Yoshkar-Ola). The structure of the MO is presented in Table. 1.

Table 1. Structure of the TB Health Center of the Republic of Mari El

Number of structural departments	Location	Name of the structural department
1.	Yoshkar-Ola	Administrative and economic part
2.		Health center department
3.		Department of extra pulmonary forms of tuberculosis (40 round - the - clock beds, 5 - day hospital)
4.		Pulmonary and surgical department (43 round-the-clock beds, 2-day hospital), incl. Chambers where multidrug-resistant patients are located)
5.		Children's department (35 round-the-clock beds, 5-day hospital)
6.		Bacteriological laboratory
7.		Clinical and diagnostic laboratory (part of the health center department)
8.		X-ray department (part of the health center department)
9.		Catering unit
10.	A residential area of Kuyar, Medvedevsky District	Therapeutic department №1 (50 round-the-clock beds)
11.		Therapeutic department №2 (30 round-the-clock beds), where there are patients with multiple drug resistance)
12.		Catering unit
13.	Kransnogorsk village, Zvenigovo district	Children's sanatorium (50 round-the-clock beds)
14.		Catering unit

The epidemiologically significant departments of the RATHC are all the departments equipped with beds, rooms for medical procedures and examinations conducted by specialists, and laboratories. Less epidemiologically significant structural department

is the catering unit, since it is used for cooking only, and the patients are fed directly in the departments. No epidemiological danger is detected in the administrative and economic divisions.

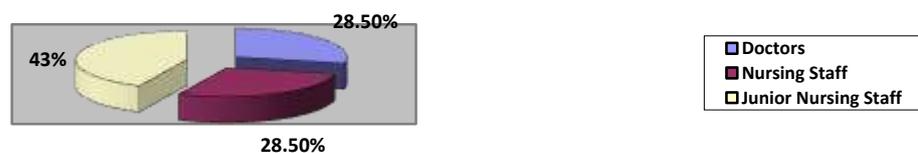
Table 2.Cases of Healthcare Associated Infections among Staff TB Health Center of the Republic of Mari El

Year	Sex / Age / Position	Diagnosis	Source of Infection	Department of the health center, where the case of the HAI was registered
2002	Female, 27 years, nurse	Focal tuberculosis S2 of the right lung in the phase of infiltration, Bacillus Kocha (BK) Newly discovered case	Case of nosocomial infection	Therapeutic department
2003	Female, 22, Paramedic assistant	Focal tuberculosis S2 of the right lung in the phase of infiltration, BK- Newly discovered case	Case of nosocomial infection	Clinical and diagnostic laboratory
2004	Man, 60 years, Radiologist	Disseminated pulmonary tuberculosis with decay, BC + Relapse	Case of nosocomial infection	Health center department
	Female, 26 years, Junior nurse	Infiltrative tuberculosis with decay and seeding, BK + Newly discovered case	Case of nosocomial infection	Pulmonary and surgical department
2006	Female, 45 years, Junior nurse	Focal tuberculosis of the upper lobe of S2 of the left lung in the phase of decay Newly discovered case	Case of nosocomial infection	Pulmonary and surgical department
2009	Female, 36 years, Phthisiatrician	Focal tuberculosis of the upper lobe S2 of the right lung in the infiltration phase, BK- Newly discovered case	Case of nosocomial infection	Children's department
2012	Female, 27 years, Junior nurse	Multiple tuberculosis, BK + Newly discovered case	Case of nosocomial infection	Pulmonary and surgical department
2013		Not registered		
2014		Not registered		
2015		Not registered		
2016		Not registered		

For the period of 2002-2016, among the staff of the RATHC, 7 cases of HAI were registered. It is worth noting that from 2013 to 2016 no cases of HAI were registered in this cohort. Analysis of the cases of HAI among the staff of the RATHC indicates that the pulmonary-surgical department is leading among the structural departments in the development of nosocomial infections (43% or 3 cases). The therapeutic, health center, children departments, as well as the clinical diagnostic laboratory had one

case each registered (14.25%, respectively). All cases of occupational infection are classified as tuberculosis (ICD-10 A15-A19). Causes of HAI among the staff are the established cases of non-compliance with sanitary and anti-epidemic instructions in the RATHC (Table 2). In the professional structure of the HAI the share of junior medical staff (43% or 3 cases) prevails, while doctors and nursing staff account for 28.5% or 2 cases respectively (Fig.1).

Figure 1.The Professional Structure of Healthcare Associated Infections for 2002-2016 Years among Staff of the TB Health Center of the Republic of Mari El



The results of the MBM data of the RATHC are presented in Table 3. Compliance/noncompliance of the results obtained is regulated by sanitary rules and norms SanPiN 2.1.2630-10 "Sanitary and epidemiological requirements for organizations engaged in medical activities", sanitary rules SP 1.1.1058-01 "Organization and implementation of industrial control over compliance with sanitary regulations and implementation of sanitary and anti-epidemic (prophylactic) measures", methodical guidelines MUK 4.2.2942-11 "Methods of sanitary-bacteriological studies of environmental objects, air and sterility control in medical organizations".

Table 3. Results of Microbiological Studies

Name of Instrumental and Laboratory Study		2002	2016
1.	Research on CGB	688	463
	Including inappropriate	4	0
2.	Studies on <i>S. aureus</i>	688	463
	Including inappropriate	0	0
3.	Research on pathogenic flora	688	463
	Including inappropriate	0	0
4.	Air to the total microbial number	16	138
	Including inappropriate	0	0
5.	Air on <i>S. aureus</i>	16	138
	Including inappropriate	0	0
6.	Sterility of medical devices	340	808
	Including inappropriate	0	1
7.	Working solutions of disinfectants for the activity of the active substance	344	299
	Including inappropriate	0	0
8.	Quality control of pre-sterilization treatment of medical devices	11348	16463
	Including inappropriate	0	0

For the period of 2002-2016, there was a decrease in the total number of studies of the objects of the RATHC within the framework of production control (due to the cancellation of the order of the Ministry of Health of the USSR No. 720 of July 31, 1978). There has been a decrease in studies aimed at detecting coliform bacteria (1.5 times), *S. aureus* from the surfaces of the RATHC objects (1.5 times), pathogenic flora (1.5 times), and working solutions of disinfectants for the activity of the active substance (ASA) (1.2 times). At the same time, there has been an increase in research aimed at

determining microbial contamination of air (total microbial number by 8.6 times, *S. aureus* by 8.6 times), a degree of sterility of medical products by 2.4 times and the pre-sterilization quality control of medical products (MPPSQC) by 1.5 times.

As a result of the MBM analysis, there is a decrease in inadequate indicators among the results of the CB tests (2002 - 4 inadequate results, 2016 - 0 similar indicators, respectively). During the period studied, there was a slight increase in inadequate indicators among the sterility tests (2002 – 0, 2016 – 1).

Table 4. Cases of Healthcare Associated Infections among patients TB health center of the Republic of Mari El

Year	Diagnosis	Sex	Source of infection	Department
2002	5 cases of ARVI	3 boys, 2 girls	Source not detected	Children's department
	7 cases of Chicken Pox	5 boys, 2 girls	1 case from outside 6 case - by contact	
2003	2 cases of ARVI	2 girls	Source not detected	Children's department
2004	6 cases of ARVI	2 boys, 4 girls	Source not detected	Children's department
2005	9 cases of ARVI	5 boys, 4 girls	Source not detected	Children's department
2006	2 cases of ARVI	2 girls	Source not detected	Children's department
2007	7 cases of Chicken Pox	3 boys, 4 girls	1 case from outside 6 cases - by contact	Children's department

2008	6 cases of ARVI	3 boys, 3 girls	Source not detected	Children's department
2009	22 cases of ARVI	10 boys, 12 girls	Source not detected	Children's department
	22 cases of chicken pox	12 boys, 10 girls	1 case from outside 21 cases - by contact	
2010	4 cases of ARVI	3 boys, 1 girl	Source not detected	Children's department
	1 case of lacunar angina	1 male	Source not detected	Pulmonary and surgical department
2011	8 cases of chicken pox	4 boys, 4 girls	1 case from outside 7 cases - by contact	Children's department
	1 case of chicken pox	1 male	By contact	Department of extrapulmonary forms of tuberculosis
	2 cases of ARVI	1 boy, 1 girl	Source not detected	Children's department
2012	1 case of chicken pox	1 male	By contact	Department of extrapulmonary forms of tuberculosis
	1 case of ARVI	1 girl	Source not detected	Children's department
2013	1 case of ARVI	1 girl	Source not detected	Children's department
	2 cases of ARVI with complications	2 boys	Source not detected	Children's department
2014	Not registered			
2015	1 case of ARVI	1 girl	Source not detected	Children's department
2016	5 cases of chicken pox	1 boy, 4 girls	1 case – of outside 4 cases - by contact	Children's department
	1 case of ARVI with complications	1 girl	Source not detected	

During 2002-2016, 116 cases of nosocomial infections were detected among patients. The dominant in the structure of HAI are ARVI (52.6% or 61 cases), a smaller proportion is occupied by cases of chicken pox (44% or 51 cases) and acute respiratory viral infection with complications (2.6% or 3 cases). Lacunar angina was diagnosed once (0.8%) in 2010. Among the structural subdivisions, the largest number of HAI cases was diagnosed in the children's department (97.4% or 113 cases), which is explained by the lack of mechanisms of child immdepartmenty, the large crowding of children and the absence of strong habits of personal hygiene [16].

Conclusion

There has been a decrease in the incidence of HAI among the RATHC employees and patients, which indicates compliance with the sanitary and anti-epidemic regime in the MO, and also reflects the quality of medical care provided to the population.

The MBM serves as a tool that allows for timely response to various violations of internal instructions and protocols for ensuring sanitary and epidemiological well-being by medical personnel. At the same time, despite the fact that the number of studies has decreased, this has not affected the quality of compliance with the sanitary and anti-epidemic regime, as evidenced by the absence of nosocomial cases of tuberculosis since 2012, as well as a decrease in the number of other HAI in the organization.

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