



Acute intestinal infections in the Omsk region in 2013–2015

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ABSTRACT

Prevalence of acute intestinal infections motivated this research. Cases of intestinal infection at a stationary stage of treatment were analysed in unit of intestinal infection in Infectious Clinical Hospital No. 1 n.a. D.M. Dalmatov in Omsk during the period from 2013 to 2015.

Clinical implications of gastroenterocolitis were registered at every second patient with acute intestinal infection, some patients asked for a medical care in late terms. 10.6% of patients have had the virus etiology of gastroenterocolitis, bacteriological etiology was revealed in 2.6% of patients (*Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Proteus*).

The rotavirus infection was more often registered in young people (35.4 ± 8.7 years) with implications of gastroenteritis (37.3%), mainly of moderate severity (82.6%).

Salmonellosis appeared in 9.1% of cases with bacteriological verification of *Salmonella enteritidis* in 86.7% of patients, *Salmonella typhimurium* — in 8.3%, *Salmonella infantis* — in 0.8%. More often implications of salmonellosis were registered among the men with a syndrome of gastroenterocolitis of moderate severity who got sick after the use of crude eggs.

Acute dysentery and alimentary toxic infection was registered seldom.

Every second patient left in-patient department willfully upon application. Thus, the intense situation on a disease of salmonellosis and rotavirus infection remained unchanged in the Omsk region in 2013–2015, however diagnostics of acute intestinal infections was complicated seeing acute inpatient stay in unit that did not allow conducting full examination.

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Introduction

Nowadays intestinal infections take one of the leading position in structure of infectious pathology [1, 2]. The steady tendency towards excess incidence of acute intestinal infections (AInI) is observed in the Russian Federation. If there was a case rate of 70.57 per 100.000 population in 2012, then in 2015 — case rate of 85.45. Rate of growth for three years was 21.1% [3], at the same time more than a half of cases was accounted for by AInI of unknown etiology (in 2015 — 63.44%). The virus etiology among intestinal infection prevails [4–12].

Differential diagnostics is rather difficult as very often similar clinical symptomatology occurs in patients with surgical pathology [13]. Identification of AInI etiological structure in some cases sometimes is impossible [14], and drug resistance to antimicrobial drugs is sometimes registered that leads to development of bacterial disease carrier [15–17].

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10 261 cases of AInI were registered in the Omsk region in 2015 (in 2014 – 9961; in 2013 – 11 925), there was the case rate of 518.7 per 100.000 population (in 2014 – 504.6; in 2013 – 603.6). In structure of AInI case rate in 2015 salmonellosis accounted for 2.7% of cases (in 2014 – 3.73%; in 2013 – 3.70%) [18], acute dysentery accounted for 0.3% (in 2014 – 0.3%; in 2013 – 1.08%), AInI of the known etiology accounted for 44.9% (39.5 and 40.7% in 2014 and in 2013 respectively), AInI of unknown etiology accounted for 52.1% of cases (in 2014 – 56.42%, in 2013 – 54.5%) [19, 20].

Aim of the Research

The analysis of AInI cases during in-patient treatment in Infectious Clinical Hospital No. 1 n.a. D. M. Dalmatov for the period of 2013 to 2015.

Materials and Methods

Data of patient records (“In-patient case history”, F 003/U) of patients who were on treatment with AInI manifestation in Infectious Clinical Hospital No. 1 n.a. D. M. Dalmatov for the period of 2013 to 2015 are analysed.

1867 patients who were in a hospital for 10 426 days were discharged from AInI unit in 2015. 1913 patients (10 674 days) were discharged in 2014; in 2013 – 2091 patients (11 477 days). During 2013–2015 the number of the patients who are on treatment in unit decreases that is connected with depression of the plan and reduction of fixed bed fund. Among all infectious in-patient hospital the largest number of patients undergoes treatment in AInI unit: in 2015 it was 33% of all patients of the hospital (in 2013 – 36.3%; in 2014 – 35.0%) and 22.75% per bed-days. Duration of in-patient stay of the patient on bed remained stable within 2012–2015 and in 2015 it was 5.6 per bed-days (in 2013 – 5.5; in 2014 – 5.6).

Statistical processing of data is carried out by means of methods of variation statistics. Quantitative data are presented in the form of $M \pm \sigma$ where M is an arithmetic average, σ is a standard deviation.

Results and Discussion

In 2015 acute gastroenterocolitis (58.7% on indicators of bed-days) dominated in of 64.5% of all AInI that practically didn't differ from 2013 and 2014 (in 2014 – 65.3% of all AInI, in 2013 – 65.7%). Average bed-days in this group of patients were 4.2 ± 1.2 in 2015 (4.0 ± 1.8 in 2014; 4.7 ± 1.7 in 2013), in such terms it is difficult to conduct profound examination.

The accurate tendency towards decrease of severe forms of not otherwise specified acute gastroenterocolitis was outlined in 2013–2015. So, in 2015 the severe disease is registered only in 0.7%

of cases (in 2014 – in 0.8% of cases, in 2013 – in 0.5% of cases). Mild disease in 2015 is registered in 20.8% of cases (22.1% of cases – in 2014; 17.8% of cases – in 2013). The syndrome of gastritis is registered in 2015 in 2.9% of cases (in 2014 in 0.2% of cases); gastroenteritis in 48.1% (in 2014 – in 48.5% of cases); gastroenterocolitis in 19.6% (in 2014 – in 23.1% of cases); enteritis in 17.6% (in 2014 – in 15.8% of cases); enterocolitis in 11.8% of cases (in 2014 – in 12.5% of cases). It was also revealed in the analysis of case histories that 5.1% of patients (51 people) with not otherwise specified acute gastroenterocolitis (in 2014 – 8.0%; in 2013 – 6.6%) were admitted to the hospital in late terms of a disease (later than the 5th day of illness). Obviously most of these patients were treated on outpatient basis. In particular, 3.4% (35) patients independently have performed autolavage (in 2014 – 2.1%; in 2013 – 3.3%). A small part of patients, 5.5% (56 people), have taken antibacterial drugs at a pre-hospital stage (in 2014 – 8.0%; in 2013 – 7.7%).

It is noteworthy that bacteriological research of washing of patients' stomach was prescribed for only 1.1% of patients (10 people) (in 2014 – 0.8%; in 2013 – 1.2%) in 2015 in hospital admissions unit. Authors consider that if the usage of this manipulation is dilated, laboratory indicators of the specified acute gastroenterocolitis will raise a little.

Etiotropic treatment in 2015 is carried out by 33.7% of patients that less than in 2014 (39.3%) and 2013 (42.2%). Fluoroquinolones were mainly prescribed – 86.7% (in 2014 – 90.8%; in 2013 – 89.6%).

144 patients with acute diarrheal syndrome were made the diagnosis of “Viral intestinal infection of not otherwise specified etiology” in 2015. These are 10.6% of all cases of AInI (in 2014 – 10.6%, in 2013 – 7.2%). The diagnosis was made when the patient had syndromes of gastritis and enteritis, leukopenia (54.9%) or lymphomonocytosis (63.2%) of peripheric blood, in the presence of negative results of serological, bacteriological and immunologic researches. The study of coprofiltrate on existence of rotaviruses antigen is conducted at 58.3% of patients of this group. Besides, contact with patients with acute diarrheal syndrome shortly before the disease was revealed in 32.3% of patients.

Nearly half of patients with the diagnosis “Not otherwise specified acute gastroenterocolitis”, 50.2% (511 people), left hospital willfully that considerably exceeded this indicator in comparison with 2014 – 38.0% and 2013 – 43.6%, and more than half of patients (57.5%) of this group were in a hospital no more than 2 days (1 bed-day – 30.7% and 2 bed-days – 26.8%) that also complicated possibility of carrying out full examination. Unauthorized hospital leaves of

patients with acute gastroenterocolitis were registered much less often in 2014 – 38% (from them 1 bed-day – 13%; 2 bed-days – 11%).

In 2015 the quantity of the specified acute gastroenterocolitis has slightly decreased in comparison with 2014 (2.9%) and 2013 (5.4%) and was 2.6% of all AInI. The major etiological factor in development of the specified nosology in 2015, as well as in 2013–2014, was *Klebsiella pneumoniae* species of 54.3% (in 2014 – 51.1%; in 2013 – 58.8%). In 14.3% of cases *Pseudomonas aeruginosa* was the reason of acute diarrheas (in 2014 – 14.0%; in 2013 – 7.0%). A little more often than in 2014 *Proteus* species were the cause of acute gastroenterocolitis in 31.4% of cases (in 2014 – 32.5%; in 2013 – 25.9%). *Citrobacter* species were not marked out in 2015 in patients with AInI during bacteriological research (in 2013 it was exposed in 4.7% of cases; in 2014 – 2.3%).

For the first time “the second place” among patients with AInI in 2015 was taken by patients with rotavirus infection, 161 people (11.9%). These patients were in a hospital for 846 bed-days (in 2014 – 126 patients (11.8%); in 2013 – 187 (11.8%)). Average bed-day in this group of patients in 2015 was 5.3 ± 1.9 (in 2014 – 5.3 ± 0.9 ; in 2013 – 5.5 ± 1.4).

Mixed infection in 2015 (salmonellosis + rotavirus infection) was verified in 3 patients (in 2014 – in 9 patients; in 2013 – in 5 patients).

Women more often suffered from rotavirus infection – 56.5% (in 2014 – 64.3%; in 2013 – 69.6%). Young people under 30 years were 38.5% (62 people) of all patients with rotavirus infection (in 2014 – 39.5%; in 2013 – 31.9%); persons are older than 60 years were 21.7% (35 people) (in 2014 – 23.8%; in 2013 – 27.0%), the oldest patient was 88 years old. Average age of patients with rotavirus infection who treated in a hospital was 35.4 ± 8.7 years (37.1 ± 7.4 and 36.4 ± 4.3 in 2014 and in 2013 respectively).

Peak in disease incidence of rotavirus infection fell on cold season 2015 from December to May (62.1%), and the most large number of patients with the diagnosis of rotavirus infection was in April and May. In winter months 26.7% of patients suffered from rotavirus infection, in spring months – 35.4%, in summer of – 16.1% and in autumn – 21.8% of patients.

Rotavirus infection associated with gastroenteritis syndrome proceeded in 37.3% of cases (in 2014 – 53.2%; in 2013 – 43.6%), rotavirus infection associated with enteritis proceeded in 15.5% of cases (in 2014 – 21.8%; in 2013 – in 23.5%). The gastroenterocolitis was registered in 34.8% of patients (in 2014 – 16.1%; in 2013 – 21.6%) and enterocolitis was registered in 11.2% (in 2014 – 8.1%; in 2013 – 10.8%). The syndrome of gastritis was registered only in two patients (in 2014 – 0.8%; in 2013 – 0.5%).

The disease proceeded in moderate severity in 82.6% of cases in 2015. More often than in 2013–2014, the mild progress of the rotavirus infection is registered in 28 patients (17.4%) (in 2014 – 11.1%; in 2013 – 10.8%). The severe disease was not registered in 2015 as well as in 2013 (in 2014 – 0.8%). 56.5% of patients (91 people) had comorbidity, and 32.3% (52 people) have had associated pathology. Rotavirus infection proceeded in the course of pregnancy in 6 (3.7%) patients. The detailed epidemiological interview often relieved establishment of correct diagnosis, as contact with patients with acute diarrheal syndrome shortly before the disease was registered by 37.3% of patients with rotavirus infection (in 2014 – 32.2%; in 2013 – 29.4%).

There were far less patients with the diagnosis of salmonellosis in 2015, than in 2013, 2014. So, 124 patients within 731 bed-days were treated in a hospital with the within-named diagnosis (in 2014 – 189 patients per 1212 bed-days). These were 9.1% of all patients with AInI (in 2014 – 13.5%). The average duration of inpatient stay in hospital of this category of patients in 2015 decreased in comparison with 2013, 2014 and showed 5.9 ± 2.4 bed-days (in 2014 – 6.4 ± 2.2 ; in 2013 – 6.3 ± 1.3).

One large outbreak of salmonellosis was registered in October 2015 when 11 people got sick after the banquet at one of restaurants of the city. Also 9 family outbreak with 2–3 patients were registered within a year.

The percent of bacteriological confirmation of salmonellosis in 2015 did not change in comparison with 2013, 2014 and was equal to 96.8% (in 2014 – 98.4%; in 2013 – 97.7%). Salmonellosis was established in 3.2% of cases according to clinical epidemiological implications (in 2014 – 0.5%, in 2013 – 0.6%). Relative share of *Salmonella enteritidis* among bacteriologically confirmed forms equaled 86.7% that differed from indicators in 2014 (87.6%) and 2013 (85.1%) a little. Salmonellas of other groups were registered rather seldom in 2015.

The species of *Salmonella typhimurium* was exposed in 8.3% of patients in 2015 (in 2014 – 4.8%; in 2013 – 5.9%). The species of *Salmonella newport* were not exposed in patients in 2015 (in 2014 – 1.1%; in 2013 – 4.2%). The species of *Salmonella infantis* was exposed in 0.8% of patients during environmental analysis of feces (in 2014 – 1.0%; in 2013 – 0.6%). The species of *Salmonella muenchen* (1.7%) was exposed in 2 patients in 2015. Salmonellas of C group are allocated during environmental research in 2.5% of patients (in 2014 – 5.4%).

In 2015 the disease proceeded in 3 patients in the form of a mixed infection: salmonellosis + rotavirus infection (in 2014 – in 9 patients; in 2013 – in 8 patients).

In 2015 men suffered from salmonellosis more often – 51.6%, unlike 2013 and 2014 (in 2014 – 49.3%; in 2013 – 49.2%). The share of women was 48.4% (in 2014 – 50.7%; in 2013 – 50.8%). Among age groups as well as in 2014, 2013, young people of under 30 years old suffered from salmonellosis more often – 33.1% (in 2014 – 35.6%; in 2013 – 36.2%) and patients of 30–49 years equaled 40.3%, persons older than 60 years equaled 13.7% (in 2014 – 12.6%; in 2013 – 15.7%), and the oldest patient was 80 years old. Average age of the patients who had salmonellosis was 34.2 ± 12.2 years (33.1 ± 1.2 and 33.7 ± 1.2 in 2014 and 2013 respectively).

Clinically moderate forms of disease prevailed in 92.2% of patients (114 patients) (in 2013 – 98.4%; in 2014 – 89.9%). Severe forms in 2015 were exposed in 4.4% of cases – in 5 patients (in 2013 – 1.1%; in 2014 – 4.5%). The mild course of a disease is registered also in 4.4% of cases (in 2013 – 0.5%; in 2014 – 2.4%). Generalized forms of salmonellosis were not registered within the experimental years.

The disease proceeded with gastroenterocolitis syndrome slightly more often in 2015, than in 2013 and 2014. Complications during a disease were registered in 44 patients (35.5%). It was metabolic ketosis in 20 patients (16.1%), nephropathy – in 13 patients (10.5%), reactive pancreatitis – in 9 patients (7.3%), convalescent bacterial excretion – in 2 patients (1.6%), mesoadenitis being the reason of the transferring patient to surgical unit – in 1 patient (0.8%).

In 2015 relatively “healthy” people suffered from salmonellosis only in 40.3% of cases. The comorbidity was registered in 59.7% (74) of patients. In 22.6% of cases the associated pathology was exposed more often in the form of chronic diseases of alimentary tract and cardiovascular system. Salmonellosis proceeded in 4 patients in the course of pregnancy (in 2014 – in 3 patients).

In patients’ opinion, the suppositional etiology was the following: raw chicken eggs – in 30.6% of cases, raw quail eggs – in 2.4% of cases, fried eggs – in 30.6% of cases and roast chicken – in 5.6% of cases.

More competent approach to assign etiotropic treatment of salmonellosis was registered in 2015. Only pathogenetic treatment was prescribed in 22.6% of patients (in 2014 – 19.6%; in 2013 – 16.2%). Patients with salmonellosis left a hospital willfully much less often (than patients with others AInI 23.4%).

High qualification of doctors of hospital admissions unit is noteworthy: the diagnosis of salmonellosis was established on attendance at seeking medical care in 30.6% of cases (38 people) (in 2014 – 36.7%; in 2013 – 36.8%). The syndromal diagnosis was established in hospital admissions unit in 69.4% of cases (in 2014 – 66.3%; in 2013 – 61.6%).

The percent of the acute dysentery in structure of AInI in 2013–2015 was small. In 2015 there were 6 patients with the diagnosis of acute dysentery that equaled 0.4% of all treated patients with AInI

(in 2014 – 0.7%; in 2013 – 2.1%). The average duration of inpatient stay in bed of patients with the diagnosis of acute dysentery in 2015 was less than in 2013 and 2014, and equaled 5.2 ± 0.9 bed-days (6.2 ± 1.1 – in 2014; 5.6 ± 1.2 – in 2013).

The percent of men suffered from acute dysentery, prevailed and equaled 66.6% in 2015 (in 2014 – 60.2%; in 2013 – 61.2%). Features of seasonality concerning dysentery in 2015 were the following: there was one patient in January, February, December, November and there were two patients in October (it was July, August, September and December in 2014).

The moderate course of acute dysentery in 2015 was registered in all 6 patients. Bacteriological confirmation of dysentery equaled 83.3% (5 people) (in 2014 – 90.4%; in 2013 – 100%). The species of *Shigella flexneri* (60.0%) prevailed in microbial transit as well as in 2014 (88.9%). *Shigella sonnei* was the reason in development of disease in 1 patient – 20.0% (in 2014 – 11.1%; in 2013 – 73.5%). At environmental analysis of feces revealed the species of *Shigella dysenteriae* (20.0%) in one more patient. The diagnosis of dysentery is established on the basis of clinical and epidemiological data in one more patient.

60% of patients had enterocolitic scenario of the disease and 40% of patients had gastroenterocolitic one in 2014. Unfortunately, the diagnosis of acute dysentery was not established during the attendance as well as in 2013 and 2014.

Indicators of diagnostics of food toxicoinfection worsened in 2015, the number of patients with this diagnosis decreases annually. In 2014 there were 9 patients in the unit with the diagnosis of food toxicoinfection (0.6% of all AInI), and in 2013 – 13 people (0.8%). In 2015 the diagnosis of food toxicoinfection was established only in 4 patients (0.3%) who were in hospital for only 9 bed-days. Average bed-day equaled 2.3 ± 0.8 in 2015 (in 2014 – 3.5 ± 1.1 ; in 2013 – 2.3 ± 1.4). Practically as well as in 2013 and 2014, in 2015 the species of *Staphylococcus aureus* was the main reason for development of food toxicoinfection in 50.0% of patients (in 2014 – 100%; 2013 – 69.2%). The species of *Proteus vulgaris* was revealed during bacteriological research of stomach washing in one patient and species of *Pseudomonas aeruginosa* was revealed in one patient. All patients were admitted to the hospital in the first three days of the disease. Moderate forms are registered in all patients (in 2014 – 66.7%; in 2013 – 69.3%), a severe form of the disease was not revealed as well as in 2013 and 2014. 50.0% of patients left the hospital willfully in 2015 (in 2014 – 44.4%; in 2013 – 53.8%).

It is noteworthy that diagnostics of intestinal infection has been improved in 2015. The PCR method for RNA identification of noroviruses and astroviruses in coprofiltrate was more widely used, the method of identification of norovirus Ag in feces was used with polarization fluoroimmunoassay.

Thus, the unit of intestinal infection in Infectious Clinical Hospital No. 1 n.a. D. M. Dalmatov remains one of the main subdivisions with difficult medical and diagnostic process, larger variety of nosological forms, appreciable relative share of patients with the serious associated pathology. Intensity of work is annually enlarged as evidenced by the accruing indicators of bed turnover and the largest number of the patients treated in a hospital. Due to the polymorphism of AInI clinic their classical clinical course is lost therefore syndromal approach prevails in the diagnosis. The purpose of AInI antibacterial therapy was more justified in 2015.

Among all AInI, treated in a hospital, the acute gastroenterocolitis (64.5%) clinically prevailed (the etiologial factor was revealed only in 2.6% of cases). 10.6% of cases with prevalence of rotavirus infection mainly among women of young age fell to the share of viral infection among the adults.

In structure of AInI 9.1% of cases fell to the share of a salmonellosis, bacteriological confirmation equaled 96.8% of cases (*Salmonella enteritidis* – in 86.7%). Salmonellosis was registered more often in men of young age (51.6% of cases). The etiology was raw chicken eggs in every third case (chicken eggs – 30.6%, quail eggs – 2.4%).

The share of acute dysentery was 0.4% of number of all patients with AInI who were on treatment in infectious hospital, bacteriological confirmation equaled 83.3%. In 2015 considerably depression of the incidence of acute dysentery weakened alertness of doctors concerning this infection over the last years. A share of food toxicoinfection equaled 0.6%, *Staphylococcus aureus* was the cause more often.

Conclusion

The tendency to decrease of severe cases of acute intestinal infections and significant increase in number of patients who sought for medical advice of infectiologists with the mild course of infectious pathology in 2013–2015 is revealed. Despite the usage of modern approaches in assessment of clinical implications and various methods of laboratory diagnostics, in a large number of cases the establishment of the final clinical diagnosis at acute intestinal infections can be difficult resulting from short duration of inpatient stay in hospital in the unit that doesn't allow conducting full examination of the patient.

References

1. Haljavina A.A., Savinyh M.V. (2009). Jependiologija ostryh kishechnyh infekcij. *Vyatskiy Meditsinskiy Vestnik*, 1, 62.
2. Krasnova E.I. (2015). Acute intestinal infections: modern aspects of atipathogenesis, place of probiotics in the treatment. *Consilium Medicum. Pediatrics*, 3, 80–84.
3. *National report on health and disease control situation in Russian Federation in 2015*. (2016). Federal Hygienic and Epidemiological Center of Federal Service on

Surveillance for Consumer Rights Protection and Human Well-being. Moscow. 200.

4. Pechenik A.S. (2011). Regional'nye osobennosti jepidemiologicheskogo processa ostryh kishechnyh infekcij. *Medical Almanac*, 5, 18, 195–198.
5. Asilova M.U., Musabaev Je.I., Ubajdullaeva G.B. (2011). Viral diarrhea in structure of acute intestinal infections in children. *Jurnal Infektologii*, 3, 3, 56–59.
6. Ljubeznova O.N., Utenkova E.O. (2017). Rotavirus and norovirus infection in adult. *Medical News of the North Caucasus*, 12, 1, 32–35.
7. Poljanskaja N.A. (2011). Features a rotavirus and norovirus infections in children of early age. *Omsk Scientific Bulletin*, 1, 104, 44–47.
8. Krasnova E.I. (2017). Bocavirus infection in children with acute gastroenteritis. *Almanac of Clinical Medicine*, 45, 1, 40–48.
9. Kapustin D.V. (2016). Virus diarrheas in structure of acute intestinal infections at adult residents of Novosibirsk. *Journal of Siberian Medical Sciences. Special issue*. From http://ngmu.ru/cozo/mos/article/text_full.php?id=2048.
10. Chen S.Y. (2017). Intestinal microbiome in children with severe and complicated acute viral gastroenteritis. *Sci Rep*, Apr 11, 7, doi: 10.1038/srep46130.
11. Martinez A.O. (2017). Acute gastroenteritis and enteric viruses: Impact on the detection of norovirus. *An Pediatr (Barc)*, 86, 3, 143–147.
12. Parisi A. (2017). Protein-losing enteropathy in an infant with rotavirus infection. *Paediatr Int Child Health*, 6, 1–4.
13. Bondarenko A.L. (2011). Differencial'naja diagnostika ostryh kishechnyh infekcij. *Vyatskiy Meditsinskiy Vestnik*, 2, 22–25.
14. Gritchina A.V., Mishhuk V.I. (2005). Jetiologicheskaja struktura ostryh kishechnyh infekcij v Lipeckoj oblasti. *Russian Clinical Laboratory Diagnostics*, 9, 58.
15. Wotzka S.Y., Nguyen B.D., Hardt W.D. (2017). Salmonella Typhimurium diarrhea reveals basic principles of enteropathogen infection and disease-promoted DNA exchange. *Cell Host Microbe*, 21, 4, 443–454.
16. Shitova O.I., Kaz'janin A.V., Zaharova Ju.A. (2011). Jependiologicheskie osobennosti, biologicheskaja harakteristika i chuvstvitel'nost' k antimikrobnym preparatam sal'monell, cirkulirujushhiih v Permskoj oblasti. *Sibirskij medicinskij zhurnal (Tomsk)*, 26, 2–2, 116–120.
17. Majowicz S.E. (2010). The global burden of non typhoidal Salmonella gastroenteritis. *Clinical infectious diseases*, 50, 882–889.
18. Minina Ju.A., Puzyreva L.V. (2017). Salmonellosis and bacteriocarrier of typhys in the Omsk Region from 2003 to 2015. *Sanitary Doctor*, 4, 43–48.
19. *The Omsk region National report on health and disease control population welfare in 2015*. (2016). Directorate of the Federal Service for Supervision in the Sphere of Consumer Right Protection and Human Welfare for the Omsk region.
20. *The Omsk region National report on health and disease control population welfare in 2014*. (2015). Directorate of the Federal Service for Supervision in the Sphere of Consumer Right Protection and Human Welfare for the Omsk Region.