

Hidden Trends in Modern Sickness Rate Dynamics in Children

Yuri Arkadievich Tyukov¹, Eduard Aikovich Kosymov²

¹. *Public Health and Healthcare Department, South Ural State Medical University, Russia.*

². *Public Health Department, South Ural State Medical University Federal State Budgetary Educational Institution of Higher Education 'South Ural State Medical University' the Ministry of Health, 64 Vorovskogo Str., 454092, Chelyabinsk, Russia.*

Abstract

The health state of children in Russia has a number of unfavorable trends, i.e. chronic diseases increase, and infectious diseases increase. *Objective:* To obtain an objective characteristic of the overall sick rate in children of the regional center and the role of urgent pathology in its level and dynamics. *Methods:* The study base was 'Children's City Clinical Hospital #8', serving the entire child population of the Metallurgical District, Chelyabinsk. The number of children for the period from 2008 to 2017 raised from 23.4 thousand to 26.5 thousand children. *Results:* The total disease appealability decreased from 2195.0 per 1,000 children to 1,733.2 in 2017. At the same time, the total urgent morbidity, according to the emergency department, ambulance and hospital wards increased to 1,025.3 cases per 1 000 children. *Conclusion:* A disease appeal ability decrease is counterbalanced by an increase in urgent morbidity, which means the absence of a real improvement in children's health indicators.

Keywords: *Sick rate, Child population, Urgent morbidity, Disease appeal ability, State of health.*

Introduction

The first decades of the current century saw many unfavorable health tendencies in children of both Russia and the world. The proportion of children born with injuries and pathology of the central nervous system has increased. For instance, this group of pathologies takes the second place, i.e. 225.4 cases per 1,000 children in Chelyabinsk; the frequency rate of congenital and hereditary diseases has increased as well. The prevalence of chronic diseases has increased by 2.8 times, i.e. from 128.5 to 359.7 cases per 1,000 children. There is a progressive increase in viral and parasitic diseases up to 1,678.9 cases per 1,000 children (like measles, chickenpox and scarlet fever) [1, 4].

This is because the children's body has a high degree of susceptibility to the effects of adverse environmental factors, under their influence the children's biological and psychological maturation slows down, which leads to impaired social adaptation [5, 7]. Educational regime violation, increased educational study load, poor organization of physical culture and health-improving work, a low level of hygienic knowledge among

students, as well as the information volume increase, passive rest leads to an increase in morbidity, disability, mortality, and social maladaptation of children [8]. All the negative trends in the state of children's health have caused vigilant attention from the Government of the Russian Federation, which is systematically forming various preventive programs to improve children's health. The implementation of the 'Children of Russia' federal program and the 'Health' national project has led to a decrease in child mortality by 1.7 times, infant mortality by 1.9 times, primary morbidity by 17% and overall morbidity by 6.2% compared with 2007.

The sick rate decrease has occurred in five classes of ICD-10. The most significant successes (a 40% decrease) have been noted in the 16th class, i.e. 'Individual conditions that arise in the perinatal period', which was facilitated by the opening of 25 perinatal centers in various regions of Russia. The struggle to preserve children's health has taken on a systemic character [9, 10]. As a result, a long-term tendency towards a

disease appealability decrease has been marked out in certain territories. At the same time, life-threatening situations, according to WHO began to occur in children, this is 25% of cases [11].

Consequently, pediatricians noted a sharp increase in ambulance demand and emergency medical services, which led to a logical conclusion that the frequency of urgent morbidity in children has increased [12, 13, 14]. To decipher the indicated imbalance, in this study we carried out an objective characteristic of the overall sick rate of children in an urban area fully provided with a system of medical child care; focusing on the assessment, characteristics and trends of urgent pathology.

Objective: To obtain a characteristic overall sick rate of children in an urban area and the place of urgent pathology in its characteristics and main trends.

Methods

The study was based on the Children's City Clinical Hospital #8, which serves the entire child population of the Metallurgical region of Chelyabinsk. The child population and socio-economic indicators of Chelyabinsk do not differ from other areas of the regional center. However, this district is the only one in Chelyabinsk, where there are all the necessary pediatric services, i.e. somatic and infectious hospitals, emergency room, emergency substation, etc. Children in other areas of the regional center are forced to apply for certain types of medical care to medical organizations in neighboring areas. As a result, official medical reports in particular form #12 do not reflect the true sick rate in the corresponding area.

In order to eliminate this, the Metallurgical region was chosen. The number of children aged 0 to 17 years for a ten-year period changed slightly from 23.4 thousand to 26.5 thousand. The information was obtained by copying from the 'Patient Admission and Hospital Denial Logs', 'Emergency Medical Call Cards' and Report Form #12 from 2008 to 2017. The primary sick rate and disease appealability per 1000 children and the frequency of urgent conditions per 1000 children is the result of the cases number ratio of urgent conditions to the average annual number of children from zero to 17 years multiplied by 1000.

To determine the randomness or significance of indicator levels changes (of sick rate, etc.) in dynamics, an iteration criterion (Z) was applied. If $Z \geq Z_{05}$, then changes in the level of the phenomenon are recognized as statistically insignificant. If $Z < Z_{05}$, then the differences recognize the presence of certain dynamics of indicators. To determine the statistical significance of differences or similarities in the indices of the compared groups, we used the calculation of the nonparametric Wilcoxon-White criterion for unrelated populations (T).

If $T_{\text{calc}} \geq T_{05}$, the null hypothesis is accepted. There are no differences between the compared sets. If $T_{\text{calc}} < T_{05}$, differences between populations are and are considered statistically significant [15]. A value of $p < 0.05$ was considered statistically significant. The analysis of the statistical regularity was carried out using the statistical software package Microsoft Office Excel 2003, the average and relative values and their representative errors were calculated.

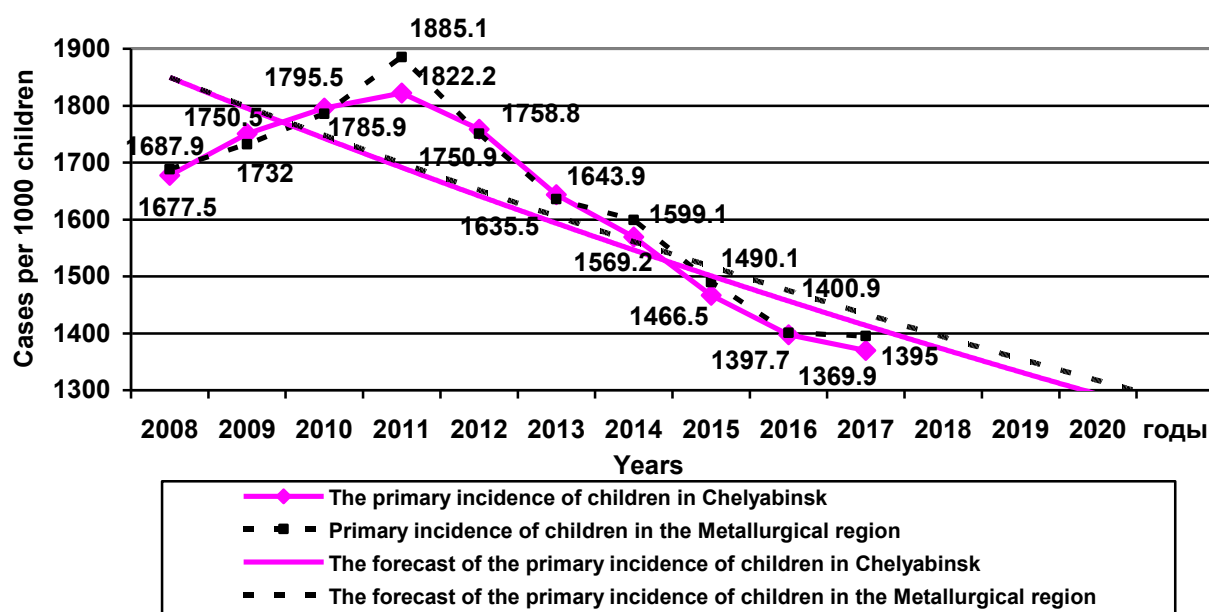
Results

It has been found that in the whole city of Chelyabinsk, the primary sick rate of children from zero to 17 years in 2008–2017 had different dynamics. At the first stage from 2008 to 2011 it is at an unequal rate, but constantly growing ($Z < Z_{05}$; $p < 0.05$), reaching a maximum in 2011, 1,822.2 cases per 1,000 children. The growth rate is 108.6%. The second stage, from 2012 to 2017, was followed by its significant ($Z < Z_{05}$; $p < 0.05$) decline in 2017; the primary sick rate reached a minimum in ten years under consideration, 1,369, 9 cases per 1,000 children.

As a result, over 2008–2017, it significantly ($Z < Z_{05}$; $p < 0.05$) decreased with a decrease rate of 18.3%, which indicates the presence of positive dynamics in the primary children morbidity in Chelyabinsk. The forecast of primary disease appealability for both compared territories (picture 1) shows that the identified trends will remain constant in the future, i.e. the sick rate will continue to decrease both in Chelyabinsk and in the Metallurgical region and in 2020 will reach the levels of 1, 180.4 and 1291.8 cases per 1,000 children, respectively. The primary morbidity obviously dominates in childhood, accounting for more than 80.0% in total.

However, it cannot be the only subject of the research, since in this case it will be difficult to see objectively the degree of the child's

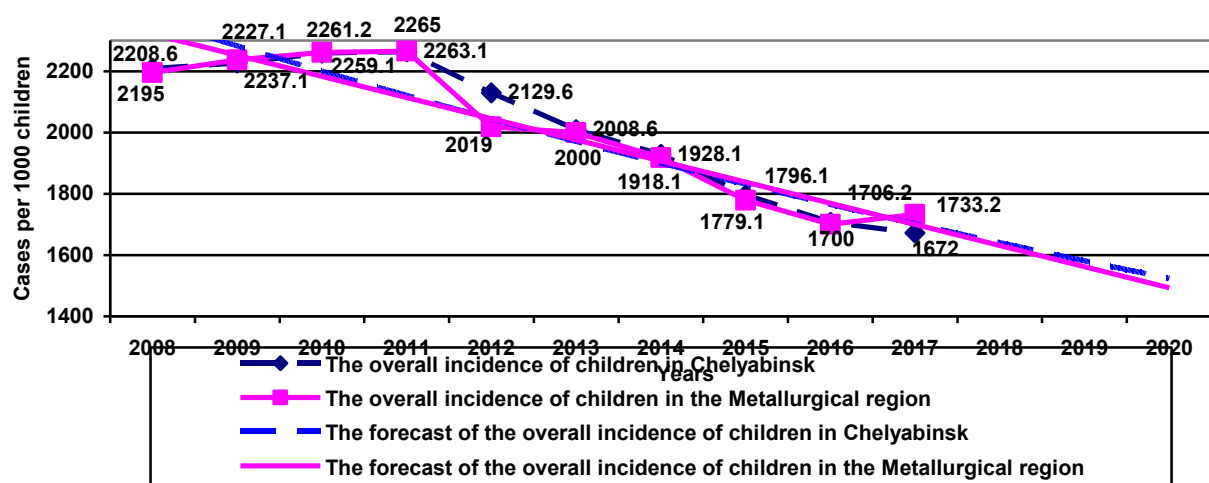
body reactivity and the pathogenicity of an acute disease. For a full picture, a study of the overall morbidity is needed [9].



Picture 1: The primary incidence prognosis of children in Chelyabinsk and Metallurgical region up to 2020 (per 1,000 children)

The analysis showed that there is a direct correlation between the dynamics of primary and general morbidity in Chelyabinsk and the Metallurgical District +0.97 and +0.93, respectively. As a result, from 2008 to 2017, the total incidence in both populations varied in the same way as the primary; first, it significantly increased ($Z < Z_{05}$; $p < 0.05$), reaching a maximum by 2011, and then decreased intensively ($Z < Z_{05}$; $p < 0.05$). At the same time, over the past ten years, the rate of decline in the overall incidence rate (24.0% and 21.0%) exceeded this indicator for the primary incidence rate (18.3 and 17.3%), which is the result of a decrease in the number of visits from exacerbations of

previously known chronic diseases. Significantly higher ($T < T_{05}$; $p < 0.05$) similar indicators of primary incidence and levels of general incidence both in Chelyabinsk and in the Metallurgical region, while among themselves they do not have reliable ($T > T_{05}$) differences, and their dynamics shows a strong direct correlation ($r = +0.98 \pm 0.009$). The general disease appeal ability for both compared territories (picture 2) shows that the existing trends will continue in the future, i.e. the incidence will continue to decrease both in Chelyabinsk and in the Metallurgical region, and in 2020 will reach the levels of 1,523.7 and 1,593.2 cases per 1,000 children, respectively.



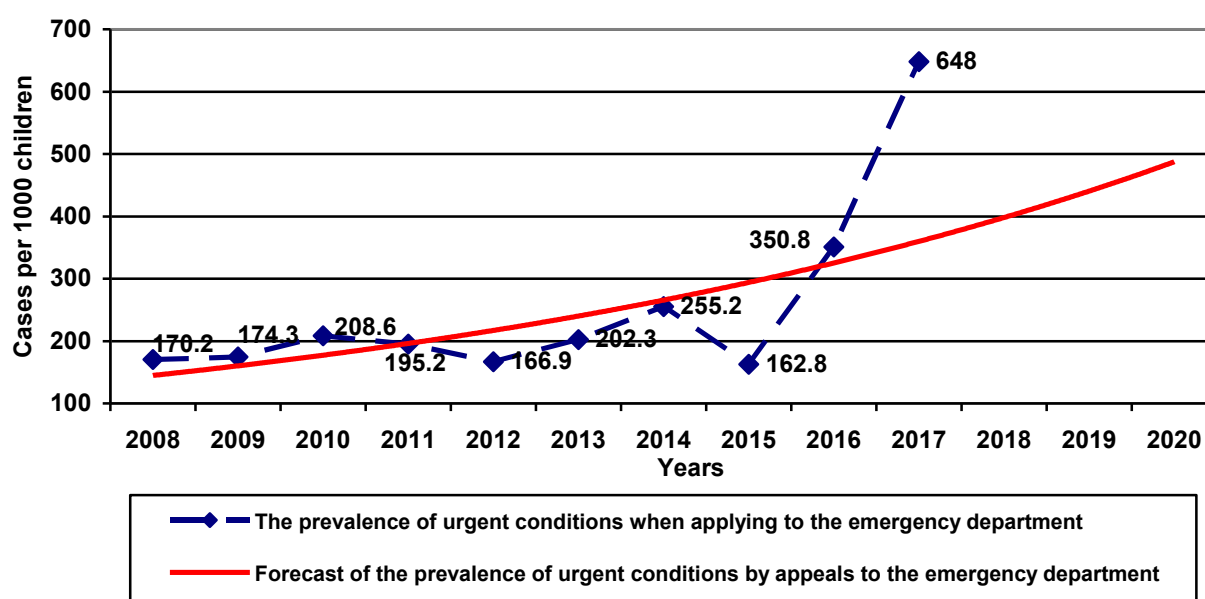
Picture 2: The prognosis of the overall incidence rate of children in Chelyabinsk and Metallurgical region up to 2020 (per 1,000 children)

It should be noted that the reduction in the overall morbidity rate of children of the Metallurgical District was accompanied by an increase in urgent conditions recorded when applying to the emergency department, emergency medical service and the in-patient department of the hospital. There is no single state reporting form for registering urgent conditions.

All this pathology without an additional designation is included along with other diseases in the forms # 12, # 14, etc. It became possible to obtain the necessary information only by copying from the accounting forms of the respective units. Therefore, according to the emergency room in the period of 2008–2017, the frequency of urgent conditions in children has more than tripled, i.e. from 170.2 cases per 1,000 children in 2008 to 648.0 cases in 2017. In other words, at the beginning and at the end

of the period every 13 and every third disease were recorded, respectively, of the total number of those that were recorded in the clinic (picture 3). The forecast urgent conditions prevalence in children registered by appeals to the emergency room shows that the existing trend will not continue in the future, i.e. the incidence rate will decrease significantly, and as a result, by 2020 its level will be 487.1 cases per 1,000 children.

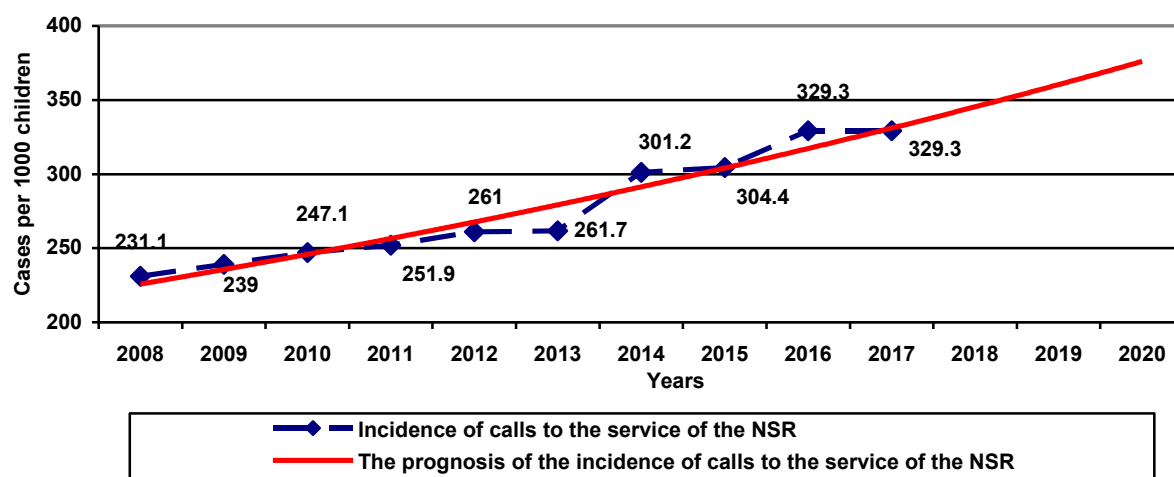
According to emergency medical service calls, a decrease in the overall disease appealability of the Metallurgical District clinic is accompanied by an increase in urgent conditions recorded by emergency medical service. In 2008–2017, the prevalence of these conditions increased significantly ($Z < Z_{05}$; $p < 0.05$): from 231.1 cases per 1,000 children's population in 2008 to 329.3 cases in 2017. The growth rate is 142.5%.



Picture 3: Urgent conditions prevalence forecast in children of the Metallurgical District according to the emergency department up to 2020 (per 1,000 children)

The average level for ten years of observation is 275.6 cases per 1,000 children. That is, at the beginning of the period, 10.5% of diseases cases were not recorded by the clinic, then at the end of this period it almost doubled and equaled 19.0% of cases. The forecast urgent conditions prevalence recorded by calls to emergency medical services shows that the current trend will continue in the future, i.e. the sick rate will increase and in 2020 will reach 376.2 cases per 1,000 children (picture 4). When analyzing form 001 / u (Journal of Patient Admission and Hospitalization Denial), filled out in the admission

department of children's hospitals, it turned out that over the ten years under review, this unit became very popular as a source of urgent care, especially among parents whose sick children did not need hospitalization. Parents brought them to the hospital on their own in the evening and at night, usually without calling an emergency medical service or emergency care team. After medical assistance was provided, the children returned home. From 2008 to 2017, the share of such cases increased by more than 15 times, i.e. from 0.6 to 9.4%, respectively.

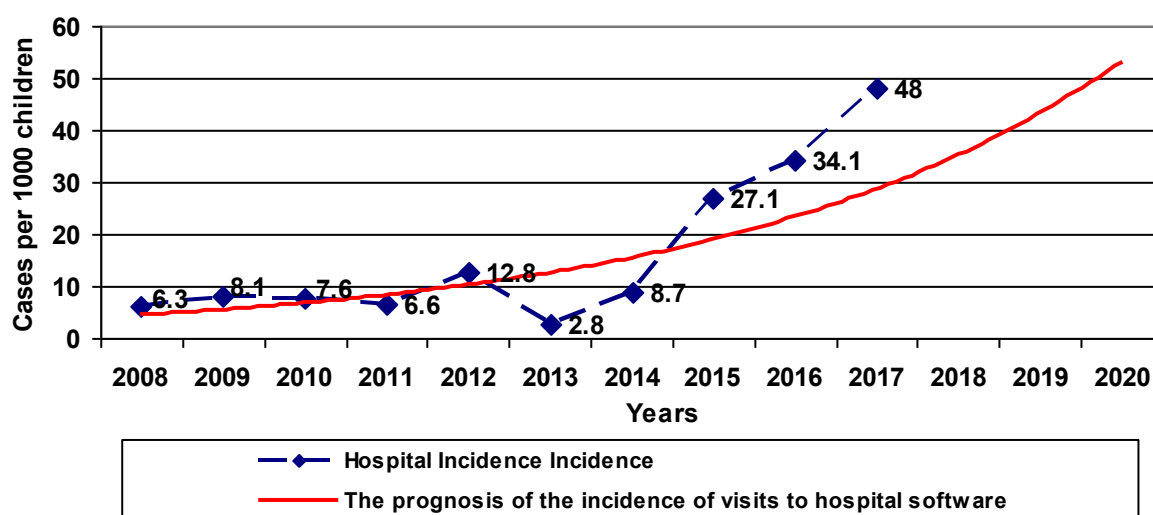


Picture 4: Forecast of urgent conditions prevalence in children of the Metallurgical District, according to the ambulance service up to 2020 (per 1,000 children)

Overall, from 2008 to 2017, the prevalence of urgent conditions recorded by appeals to the admitting office grew eight times, i.e. from 6.3 to 48.0 cases per 1,000 children. The last four years show the maximum increase in this incidence. Therefore, from the end of 2014 to the end of 2017, it increased by more than five times, i.e. from 8.7 to 48.0 cases per 1,000 children. The forecast of urgent conditions prevalence in children, according to the admitting office, shows that the current trend will continue, i.e. the incidence will increase and in 2020 will reach 53.3 cases per 1,000 children (picture 5).

Discussion

The study of primary and general incidence, and urgent conditions prevalence of children of the Metallurgical region, resulted in two opposing trends that have been observed in recent years. On the one hand, both the primary and the general incidence of medical visits to the clinic demonstrate a decrease. So, the last of them significantly ($Z < Z_{05}$; $p < 0.05$) decreased from 2 019 cases per 1,000 children in 2012 to 1,733 cases in 2017. The decline rate is 14.2%.



Picture 5: Forecast of urgent conditions prevalence in children of the Metallurgical District, according to the admission department of the Children's Hospital up to 2020 (per 1,000 children)

On the other hand, the cumulative prevalence of urgent conditions according to emergency department, emergency medical service, and admitting office of the children's hospital increased significantly ($Z < Z_{05}$; $p < 0.05$): from 440 cases per 1,000 children in 2012 to 1,025 cases in 2017, i.e. almost 2.3 times.

Thus, the decrease in the overall morbidity is not about children's health indicators improvement, but as it turns out, hides the health deterioration in children living in the Metallurgical District. If we take into account that the sick rate of children in the Metallurgical region and in Chelyabinsk, as a whole, is not significantly different in level,

structure and dynamics; then a similar situation should be assumed in the regional center as well. The question naturally arises about the structure of urgent morbidity. The existing allocation of urgent diseases for pediatrics has purely theoretical significance. It is more correct to talk about urgent conditions (these are conditions requiring urgent medical intervention, the failure of which can lead to serious complications or death for the patient), which in children, due to the different reactivity of their body, can occur with common diseases.

For example, respiratory infections, insect bites, etc. The parents' reaction to increasing symptoms is the leading one here, i.e. 'aggravation' of a child. And not a single service called upon in order to provide urgent assistance shall refuse. The urgent conditions increase in children is often the result of a decrease in the availability and adequacy of primary health care provided by district pediatricians in clinics. The existing practice is as follows, after visiting a pediatrician, the blood test is taken only next day, then a week

later, for example, there is an ultrasound scan, and only after that the appointment is set, this leads to the fact that diseases in children can acquire aggravated forms that force parents to seek urgent help.

Conclusion

A disease appeal ability decrease was observed in the Metallurgical region, and in the regional center; it cannot indicate a health status improvement in children, due to a simultaneous increase in the prevalence of urgent conditions in children. As a result, urgent conditions often lead to disease complications and its transition to a chronic form, it is necessary to note the health status deterioration in children of the Metallurgical region of Chelyabinsk. Reducing the urgent conditions prevalence in children requires increasing the availability and adequacy of diagnostics in children's clinics, and for effective control of this pathology, it is necessary to improve the accounting system of urgent conditions, stopped by various services.

References

1. Matveev EN (2017) Features of incidence in adolescents aged from 15 to 17 years in the Russian Federation in the period from 2000 to 2015 / Matveev E.N., Manoshkina E.M., Bantieva M.N. et al. // Management in healthcare.-2017.-#6.-2017.
2. Matveeva, ES (2017) The place and role of pediatricians and teachers in the formation of health-preserving behavior of schoolchildren / Matveeva E.S., Tyukov Y. A. // Modern science successes. - #4. 9: 215-217.
3. Fernandez A (2017) Is this child sick? Usefulness of the Pediatric Assessment Triangle in emergency settings /A. Fernandez, J. Benito, S. Mintegi// J. Pediatr., 5: 1-8.
4. Zaver F (2016) Blog and Podcast Watch: Pediatric Emergency Medicine /F. Zaver, M. Hansen, E. Leibner et al. // Western Journal of Emergency Medicine, XVII (5): 513-518.
5. Brown NM (2014) Need and Unmet. Need for Care Coordination Among Children with Mental Health Conditions/ N.M. Brown, J.C. Green, M.M. Desai et al.// Pediatrics, 133 (3): 530-537.
6. Burokienė S (2017) Factors Determining Parents' Decisions to Bring Their Children to the Pediatric Emergency Department for a Minor Illness/S. Burokienė, J. Raistenskis, E. Burokaitė et al. // Med. Sci. Monit., 23: 4141-4148.
7. Gnani S (2016) Healthcare use among preschool children attending GP-led urgent care centres: a descriptive, observational study/S Gnani, S Morton, F Ramzan et al.//BMJ Open. – 6: 1-7.
8. Bogdanska, A (2005) The evaluation of secondary school student's knowledge about risk factors of cardiovascular disease / A. Bogdanska, I. Maniecka-Bryla, A. Szpak // Rocz. Akad. Med. Białymst., 50: 213-215 1.
9. Baranov AA (2012) Trends in sick rate and health status of children of the Russian Federation / Baranov A.A., Albitsky V.Y., Ivanova A.A. et al. // Russian Pediatric Journal, 6: 4-9.
10. Baranov AA (2012) Health state features of children of the Russian Federation, trends of its changes / Baranov A.A., Albitsky V.Y., Farrakhov A.Z. et al. // Public Health and Health Care, 4: 18-24.

11. Zhdanova LA (2015) Organization of the emergency department in a children's clinic / Zhdanova L.A., Rusanova O.S., Postol I.I. et al. // Deputy Chief Physician, 6 (109):26-37.
12. Luzyanina GA (2015) Emergency conditions for vegetovascular dysfunction in emergency pediatrician practice/Luzyanina G.A., Kolesnikova S.M. // Healthcare of the Far East, 4(66): 53-57.
13. Zook HG (2016) Racial Differences in Pediatric Emergency Department Triage Scores/ H.G. Zook, A.B. Kharbanda, A. Flood et al. //J. Emerg. Med., 50(5): 720-727.
14. Mohamed K (2017) Improving access for Urgent patients in Paediatric Neurology/K. Mohamed, B. Al Hour, K. Ibrahim et al. // BMJ Quality Improvement Reports, 6 (1): 4.
15. Sidorenko EV (2000) Methods of mathematical processing in psychology / E.V. Sidorenko //-SPb, Speech., 350.