

## ASSESSMENT OF THE CARDIOVASCULAR SYSTEM IN CHILDREN FROM POLESIE AND IVANKOV DISTRICTS

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In the first decades after the Chernobyl nuclear power plant accident, vast territories of Belarus, Ukraine and the Russian Federation were heavily contaminated with radioactive substances, primarily  $^{137}\text{Cs}$  and  $^{90}\text{Sr}$  [1, 2, 3]. Radionuclides were transferred from soil to the body of people living in these areas through food chains and were intensively incorporated by vital organs and systems, including the heart, leading to serious interference with metabolic and electrophysiological processes in cell structures [2, 4, 5]. A correlation between  $^{137}\text{Cs}$  radionuclide concentrations in the body and the occurrence of a disturbance in conduction of the electrical impulse in the heart muscle of children was found [2, 4]. In this regard, it is appropriate to examine on a regular basis the cardiovascular system in the entire child population residing in an area affected by the Chernobyl nuclear power plant accident.

*The aim of the paper* was to evaluate the cardiovascular system in children from Polesie and Ivankov districts of Kyiv region, Ukraine affected by the Chernobyl nuclear power plant accident.

**Materials and methods.** The results of the randomized instrumental examination of 1193 children (599 boys and 594 girls) from Polesie and Ivankov districts aged from 3 to 18 years carried out during scheduled health assessment in 2014-2015 were analysed. Furthermore, a whole body counter (WBC) (produced by NPP Atom Kompleks Prylad) was used to measure gamma emitting radionuclides in all children. Children's systolic and diastolic blood pressure and heart rate were measured automatically using a PM-9000 patient monitor (Penton Ltd). The heart rate recovery time after exercise (index of Rufe) was recorded with the help of Istoki Zdorovya hardware and software complex. Pulse pressure was also calculated, as well as 12-lead electrocardiograms (3 standard leads, 3 unipolar

limb leads and 6 unipolar precordial leads) recorded using a HCard Gold 3 electrocardiograph (Poland) were interpreted. The child's age at the time of examination was calculated and taken into account in each individual case.

In assessing the received results, all children examined by the above methods were divided into three age groups according to conventional classification [6]: 3-6 years - preschool age; 7-11 years - primary school age; 12-17 years - senior school age, each group was divided into subgroups of boys and girls (Table 1).

*Table 1*

Quantitative characteristics of children from Polesie and Ivankov districts who underwent scheduled medical examination in 2014-2015 and were included for the evaluation of the cardiovascular system.

Age groups, years	Number of children, persons		
	both sexes	boys	girls
3-6	153	78	75
7-11	533	264	269
12-17	507	257	250
Total:	1193	599	594

Systematization of the material and primary mathematical processing were performed using Microsoft Excel 2010 spreadsheets.

**Examination results.**  $^{137}\text{Cs}$  concentrations in the majority of children at the time of examination were detected at the minimum detection activity level of the counter (Table 2).

**Arterial blood pressure (ABP).** The distribution of the examined children by ABP levels is shown on Fig. 1. ABP readings within the age norm were recorded

in 783 of 1193 examined children (65,6 %), including 372 of 599 boys (62,1 %) and 411 of 594 girls (69,2 %).

*Table 2*

Distribution of the examined children aged 3-17 years from Polesie and Ivankov districts by radionuclide levels in the body

Number of children underwent measurement using a WBC	<sup>137</sup> Cs levels in the body, Bq/kg				
	< 4,99	5,0-19,9	20,0-39,9	40,0-59,9	> 60
Absolute number of cases	1081	62	25	11	14
% of cases from the total number of examined children	90,6	5,2	2,1	0,9	1,2

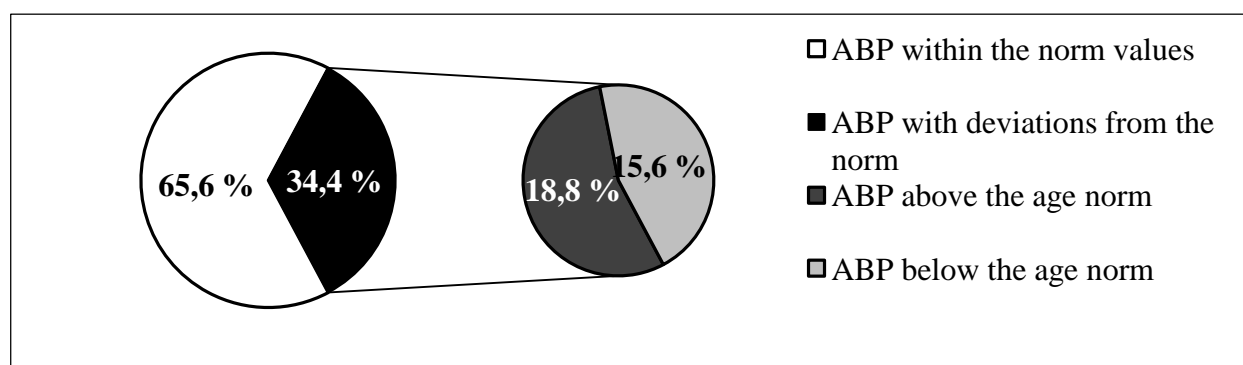


Fig. 1. Distribution of the examined children from Ivankov and Polesie districts by ABP levels, %.

As a result, 410 cases with ABP deviations from the age norm (34,4 % of the number of all examined children) were found. 64 cases with above deviations were recorded in the age group of 3-6 years (41,8 % of the number of children in the

group), 140 cases (26,23 %) - in the age group of 7-11 years, 206 cases (40,6 %) - in the age group of 12-17 years.

ABP deviations from the age norm were found in 227 cases (37,8 %) among all examined boys. ABP deviations from the established norm were found in 42 cases among boys aged 3-6 years (53,9 % of the number of boys in the subgroup), in 75 cases (28,4 % of the number of boys in the subgroup) among boys aged 7-11 years and in 110 cases (42,8 % of the number of boys in the subgroup) among boys aged 12-17 years.

ABP deviations from the norm were detected in 183 cases (30,8 %) among all examined girls. At the same time, 22 cases (29,3 % of the number of girls in the subgroup) were recorded among girls aged 3-6 years, 65 cases (24,2 %) among girls aged 7-11 years and 96 cases of ABP deviations from the age norm (38,4 %) were found among girls in the age group of 12-17 years.

ABP readings above established age norms were recorded in 224 cases (18,8 % of the number of all examined children), in particular, in 114 boys and 110 girls (19,0 % and 18,5 % of the number of examined boys and girls respectively).

An increase in ABP was recorded in 13 cases (8,5 % of the number of children in the group) in the age group of 3-6 year old children, in 42 cases (7,9 %) – in the group of 7-11 year old children and in 169 cases (33,3 %) – in the age group of 12-17 years.

ABP readings below established norms were recorded in 186 cases (15,6 % of the number of all examined children), including in 113 boys and 73 girls (18,9 % and 12,3 % of the number of examined boys and girls respectively).

A decrease in ABP was observed in 51 cases (33,3 % of the number of children in the group) in the group of 3-6 year old children, in 98 cases (18,4 %) -

in the group of children aged 7-11 years and in 37 cases (7,3 %) – in the group of children aged 12-17 years.

The largest number of cases of ABP within the age norm was recorded among boys and girls at the age of 7-11 - 71,7 % and 75,3 % (respectively of the number of children in each subgroup).

The largest number of cases of increased ABP was found among boys and girls aged 12-17 years - 32,6 % and 34,6 %, respectively of the number of children in each subgroup.

The largest number of cases of decreased ABP was observed among boys and girls aged 3-6 years - 42,3 % and 24,0 %, respectively of the number of children in each subgroup.

**Pulse pressure (PP).** PP limits exceeding (30-60 mm of mercury) was observed in 239 children (20,0 % of the number of all examined children), among which were 127 boys (21,2 % of the number of all examined boys) and 112 girls (18,9 % of the number of all examined girls).

21 cases of deviations from normal parameters (13,7 % of the number of children in the group) were recorded in the group of children aged 3-6 years, 64 cases (12,0 % of the number of children in the group) were observed in the group of 7-11 years, the largest number of cases of above deviations - 154 (30,4 % of the number of children in the group) was found in the group of 12-17 years. The number of deviations from the normal parameters of PP was 34,6 % in the subgroup of boys of this group, and 26,0 % - in the subgroup of girls.

Elevated PP was found in 208 children (17,4 % of the number of all examined children). 3 cases of increased PP (3,9 % of the number of boys in the group) were observed among boys aged 3-6 years, 17 cases (6,4 % of the number of boys in the group) - among boys aged 7-11 years, 89 cases (34,6 % of the

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number of boys in the group) - among boys aged 12-17 years. Among girls, there were similar dynamics corresponding to age groups, 1 case (1,3 % of the number of girls in the group) - in the group of 3-6 years, 33 cases (12,3 % of the number of girls in the group) – in the group of 7-11 years and 65 cases (26,0 % of the number of girls in the group) - in the group of 12-17 years.

Lowered PP was found in 31 children (2,6 % of the number of all examined children). The greatest number of cases of lowered PP was seen in children aged 3-6 years: 10 boys (12,8 % of the number of boys in the group) and 7 girls (9,3 % of the number of girls in the group). Cases of lowered PP were observed in 8 boys (3,0 % of the number of boys in the group) and 6 girls (2,2 % of the number of girls in the group) in the group of 7-11 years.

Cases of lowered PP in boys and girls in the age group of 12-17 years were not recorded. The age-specific incidence of elevated and lowered PP in examined children is shown on Fig. 2-4.

**Heart rate (HR).** The heart rate within physiological age norms was observed in 234 children (19,6 % of the number of all examined children).

The HR within physiological age norms was found in 13,7 % of cases in the group of children aged 3-6 years, in 20,5 % of cases - in the group of children aged 7-11 years, and in 20,5 % of cases - in the group of children aged 12-17 years. Among boys, the HR within physiological age norms was observed in 22,5 % of cases, and in 16,7 % of cases - among girls. The dynamics of incidence by age groups were not traced. Thus, the HR deviations from the age norms were observed in 959 children (80,4 % of the number of all examined children).

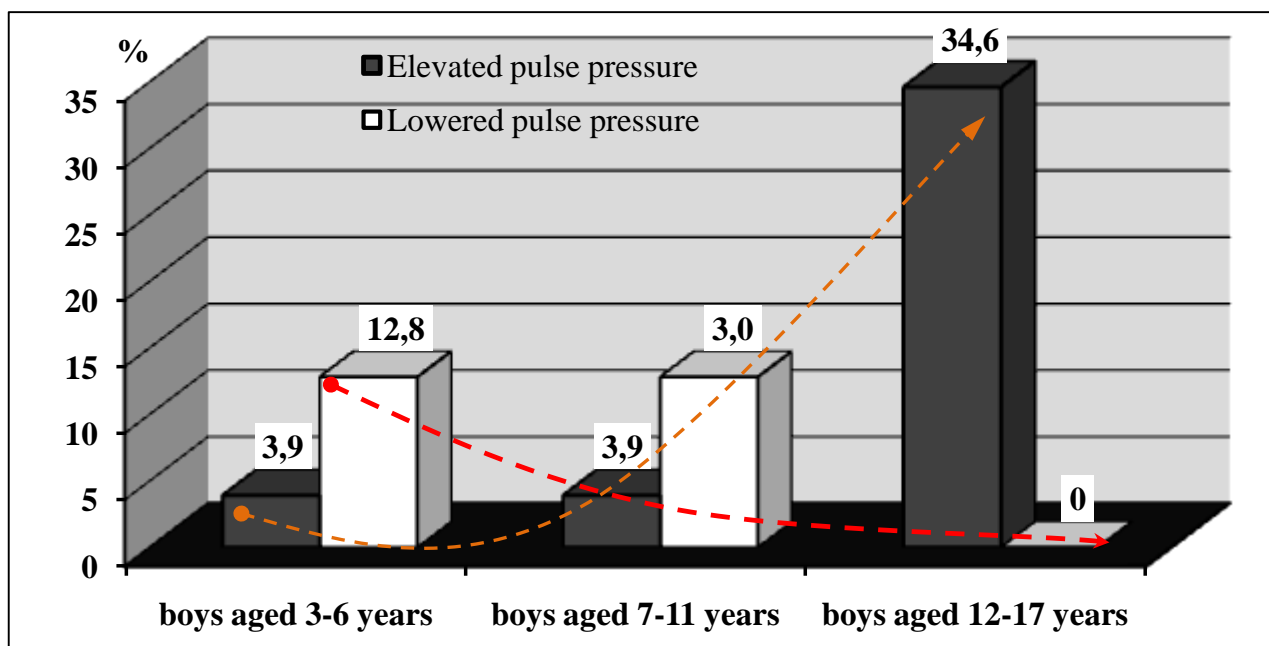


Fig. 2. The age distribution of detected cases of elevated and lowered pulse pressure in examined boys, %.

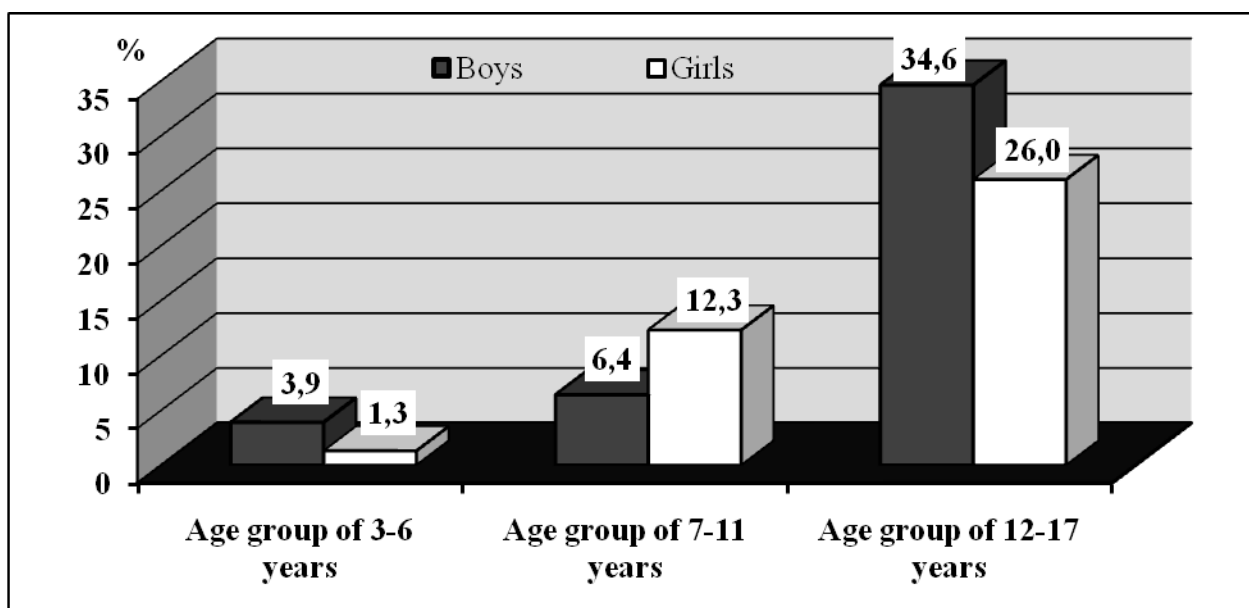


Fig. 3. The age distribution of cases of detected elevated pulse pressure in examined boys and girls, %.

**Index of Rufe.** The rate of heart rate recovery after the exercise (computer implementation of index of Rufe) in children was assessed according to the following criteria: at the rate value less than 0 – “excellent”, at 1-5 – “good”, at 6-10 – “satisfactory”, at 11-15 – “fair”, at the value above 15 – “poor”.

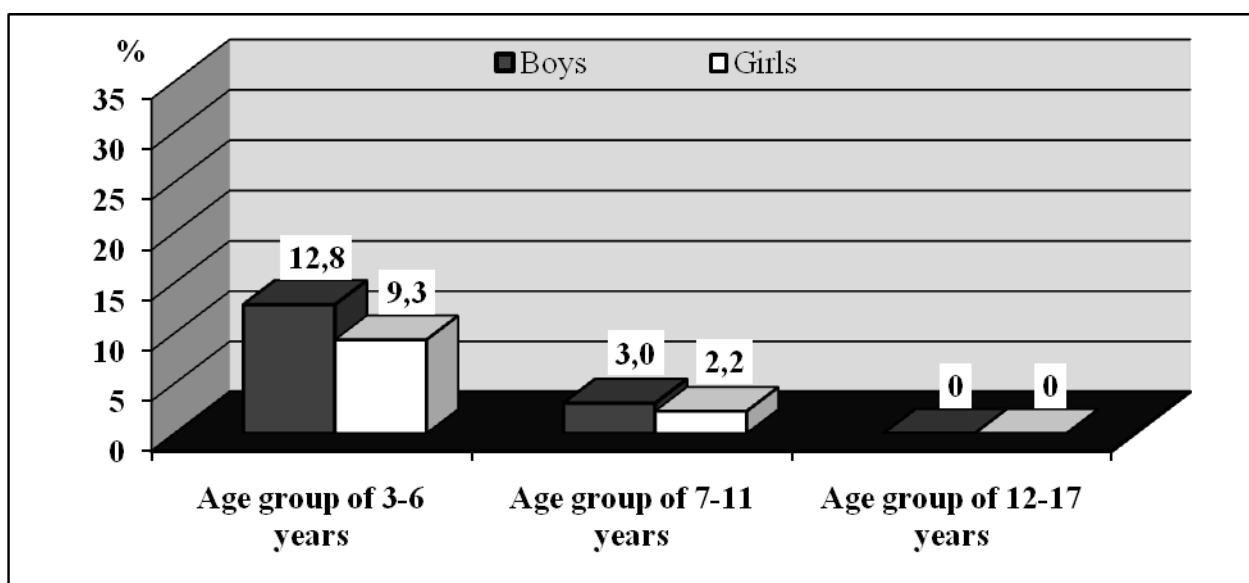


Fig. 4. The age distribution of cases of detected lowered pulse pressure in examined boys and girls, %.

A total of 919 children from two age groups of 7-11 years and 12-17 years were assessed. 63 children (6,9 % of the number of all children examined using this method) received “good” assessment, 288 children (31,3 %) were found to be “satisfactory”, 310 children (33,7 %) were rated “fair” and 258 children (28,1 %) as “poor”.

432 children (both sexes) were assessed in the age group of 7-11 years. 21 children (4,9 % of the number of all children in the group examined using this method) were rated “good”, 134 children (31,0 %) were found to be “satisfactory”, 145 children (33,6 %) were rated “fair” and 132 children (30,6 %) as “poor”.



487 children were assessed in the age group of 12-17 years. 42 children (8,6 % of the number of all children in the group examined using this method) were rated “good”, 154 children (31,6 %) were found to be “satisfactory”, 165 children (33,9 %) were rated “fair” and 126 children (25,9 %) as “poor”.

Among all examined boys (471 children), 47 children (9,9 % of the number of all boys examined using this method) were rated “good”, 188 children (39,9 %) were found to be “satisfactory”, 151 children (32,1 %) were rated “fair” and 85 children (18.1%) as “poor”.

Among all examined girls (448 children), 16 children (3,6 % of the number of all girls examined using this method) were rated “good”, 100 children (22,3 %) were found to be “satisfactory”, 159 children (35,5 %) were rated “fair” and 173 children (38,6 %) as “poor” (Fig. 5).

The dynamics of incidence of above assessment by age groups were not traced.

***Electrocardiographic examination (ECG).*** No cardiac disorders were observed in 216 cases (18,1 %) during an ECG study of 1193 children. 32 cases of “physiological” ECGs (20,9 % of the number of children in the group examined using this method) were detected in the group of children aged 3-6 years. The number of “physiological” ECGs in the group of children aged 7-11 years amounted to 107 cases (20,1 % of the number of children in the group examined using this method), in the group of children aged 12-17 years - 77 cases (15,2 % of the number of children in the group examined using this method).

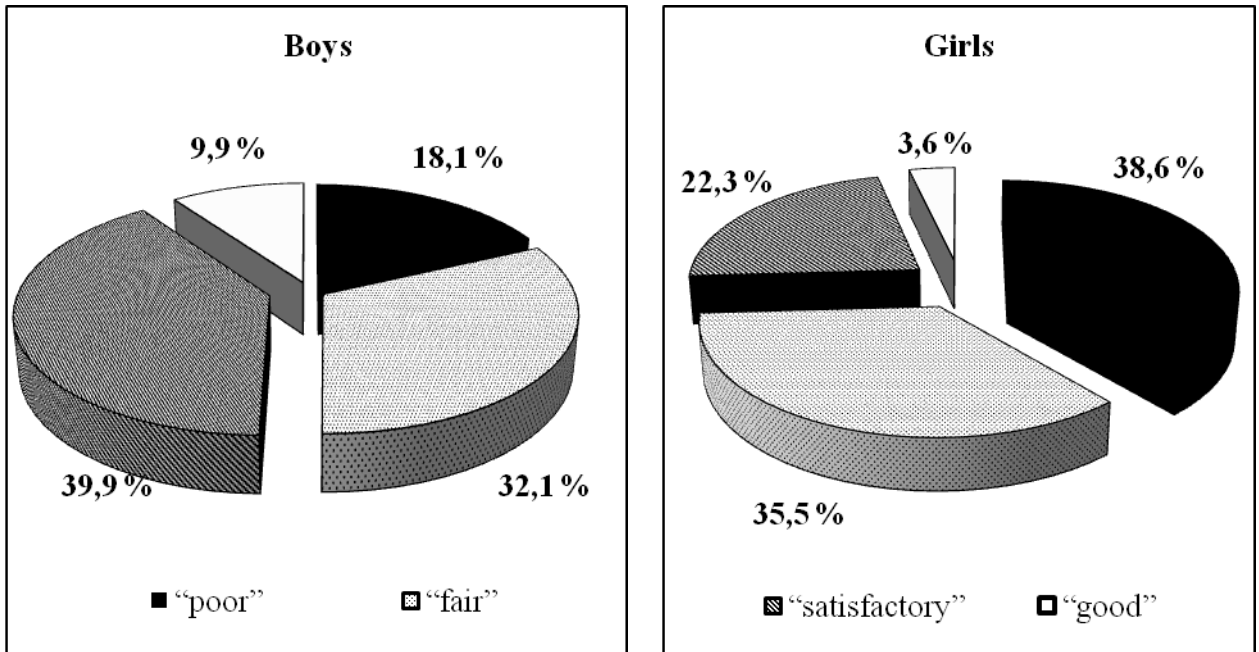


Fig. 5. The distribution of boys and girls by the index of Rufe testing results, %.

Among the boys from all groups, the number of “physiological” ECGs amounted to 90 cases (15,0 % of the number of all boys examined using this method). Among the girls from all groups, there were found 126 cases of “physiological” ECGs (21,2 % of the number of all girls examined using this method).

Among the boys aged 3-6 years, there were detected 15 cases of “physiological” ECGs or 19,2 % of the number of boys in the group; among the boys aged 7-11 years, there were 50 cases of “physiological” ECGs or 18,9 % of the number of boys in the group; among the boys aged 12-17 years, there were observed 25 cases of “physiological” ECGs or 9,7 % of the number of examined boys in the group. Among the girls aged 3-6 years, there were found 17 cases of

“physiological” ECGs or 22,7 % of the number of girls in the group; among the girls aged 7-11 years, there were detected 57 cases of “physiological” ECGs or 21,2 % of the number of girls in the group; among the girls aged 12-17 years, there were 52 cases of “physiological” ECGs or 20,8 % of the number of examined girls in the group.

Thus, the majority of examined children – 977 out of 1193 or 81,9 %, and boys aged 12-17 years, even more - in 90,3 % of cases (232 of 257) had cardiac abnormalities.

When interpreting the ECGs, the examined children most frequently demonstrated sinus bradycardia, sinus tachycardia, irregular sinus rhythm, early ventricular repolarization syndrome, ectopic atrial rhythm, incomplete right bundle branch block, wandering atrial pacemaker, moderate changes in the ventricular myocardium, short PQ syndrome.

*Sinus bradycardia* was found in 212 children - 17,8 % of the number of all examined children. Among the boys, it was observed in 23,4 % of cases (140 out of 599 examined boys), among the girls - in 12,1 % of cases (72 of 594 examined girls). Sinus bradycardia was detected in 12 cases (7,8 % of the number of all children in the group) in the group of children aged 3-6 years, in 79 cases (14,8 % of the number of all children in the group) in the group of children aged 7-11 years, in 121 cases (23,9 % of the number of all children in the group) in the group of children aged 12-17 years. Among the boys, there was a rise in the absolute and relative incidence of sinus bradycardia with increasing age of examined children, in particular, it was found in 7 cases (9,0 % of the number of boys in the group) in the group of 3-6 years, in 48 cases (18,2 %) – in the boys from the group of 7- 11 years, and in 85 cases (33,1 %) - in the boys from the group of 12-17 years. It was observed in 5 cases (6,7 % of the number of girls in the group) in the girls from the

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group of 3-6 years, in 31 cases (11,5 %) - in the girls from the group of 7-11 years, and in 36 cases (14,4 %) - in the girls from the group of 12-17 years (Fig. 6).

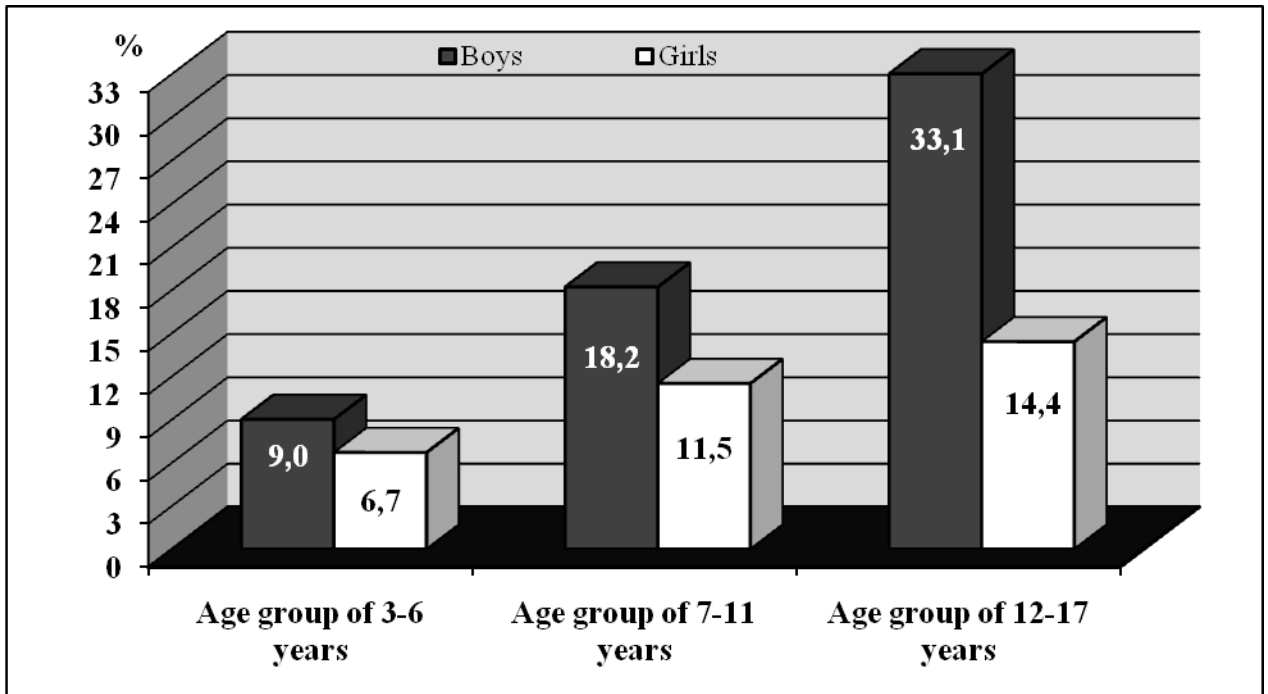


Fig. 6. The sex and age distribution of examined children from Polesie and Ivankov districts with diagnosed sinus bradycardia (in % to the number of children in the relevant age groups).

*Sinus tachycardia* was found in 230 children - 19,3 % of the number of all examined children (1193 children). Among the boys, it was observed in 14,7 % of cases (88 out of 599 examined boys), among the girls - in 23,9 % of cases (142 of 594 examined girls). It was detected in 48 cases (31,4 % of the number of all children in the group) in the group of children aged 3-6 years, in 102 cases (19,1 % of the number of all children in the group) in the group of children aged 7-11 years, in 80 cases (15,8 % of the number of all children in the group) in the group of children aged 12-17 years. Sinus tachycardia was observed in 27 cases (34,6 % of the number of boys in the group) among the boys aged 3-6 years, in 46 cases (17,4

%) - among the boys aged 7-11 years, and in 15 cases (5,8 %) - among the boys aged 12-17 years.

Sinus tachycardia was detected in 21 cases (28,0 % of the number of girls in the group) among the girls aged 3-6 years, in 56 cases (20,8 %) - in the age group of 7-11 years, and in 65 cases (26,0 %) - among 12-17 year old girls (Fig. 7).

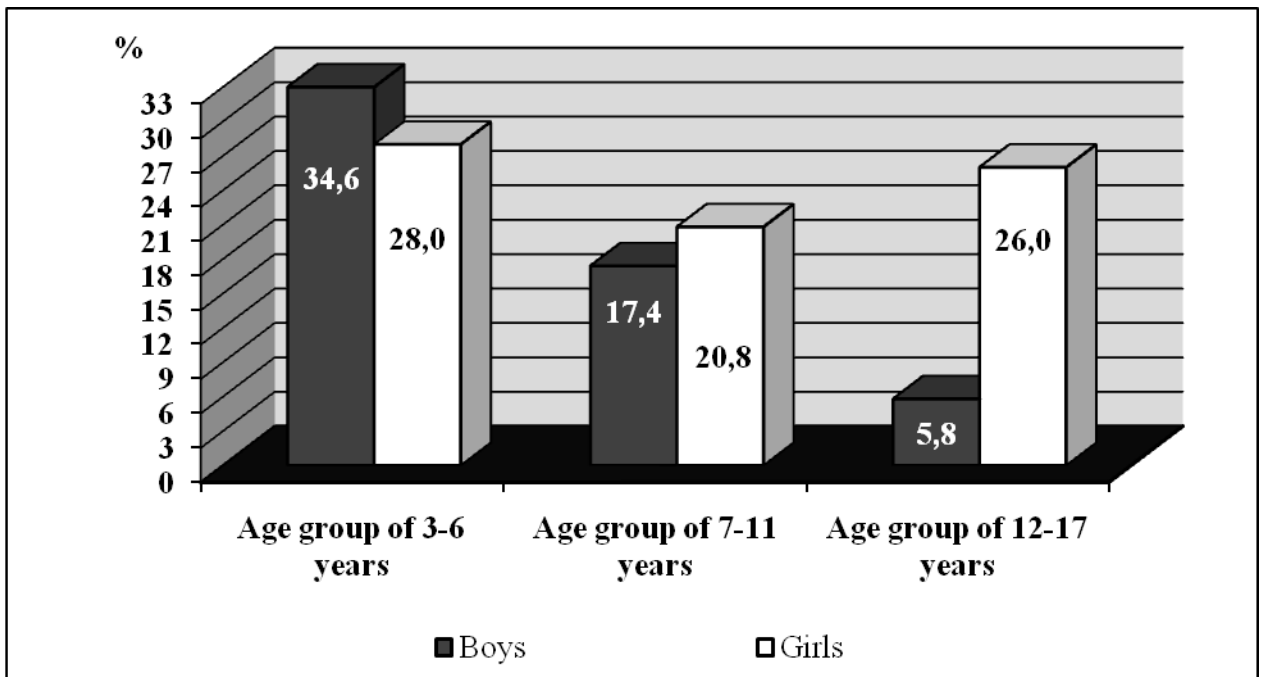


Fig. 7. The sex and age distribution of examined children from Polesie and Ivankov districts with diagnosed sinus tachycardia (in % to the number of children in the relevant age groups).

*Irregular sinus rhythm* was detected in 267 children - 22,4 % of the number of all examined children (1193 children) during ECG testing. Among the boys, irregular sinus rhythm was recorded in 21,7 % of cases (130 out of 599 examined boys), among the girls – in 23,1 % of cases (137 of 594 examined girls). This symptom was observed in 31 cases (20,3 % of the number of children in the group)

in the group of children aged 3-6 years, in 129 cases (24,2 %) - in the group of 7-11 years, and in 107 cases (21,1 %) - in the group of children aged 12-17 years.

*The early ventricular repolarization syndrome (EVRS)* was found in 169 children - 14,2 % of the number of all examined children during ECG testing. Among the boys, it was observed in 21,2 % of cases (127 out of 599 examined boys), among the girls - in 7,1 % of cases (42 of 594 examined girls). The EVRS was detected in 11 cases (7,2 % of the number of all children in the group) in the group of children aged 3-6 years, in 55 cases (10,3 % of the number of all children in the group) in the group of children aged 7-11 years, and in 111 cases (21,9 % of the number of all children in the group) in the group of children aged 12-17 years. At the same time, the number of boys with this syndrome in groups was significantly greater than the number of girls, particularly, there were 8 boys (10,3 % of the number of boys in the group) and 3 girls (4,0 % of the number of girls in the group) in the group of children aged 3-6 years; 38 boys (14,4 %) and 17 girls (6,3 %) in the group of 7-11 years; 89 boys (34,6 %) and 22 girls (8,8 %) in the group of 12-17 years. The highest rate of the EVRS was recorded among the boys aged 16-17 years - 20 cases or 50,0 % of the number of boys in the group (Fig. 8).

*Incomplete right bundle branch block* was diagnosed in 114 children (9,6 % of the number of all examined children). Among the boys, it was noted in 12,7 % of cases (76 out of 599 examined boys), among the girls - in 6,4 % of cases (38 of 594 examined girls). It was recorded in 7,8 % of cases (12 of 153 children) in the group of children aged 3-6 years, in 8,6 % of cases (46 of 533 children) in the group of children aged 7-11 years, and in 11,1 % of cases (56 of 507 children) in the group of children aged 12-17 years. Among the boys from these groups, there were clearer dynamics - 5 cases (6,4 % of the number of boys in the group) were observed in the group of children aged 3-6 years, 30 cases (11,4 %) - in the group

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of children aged 7-11 years and 41 cases (16,0 %) - in the group of children aged 12-17 years.

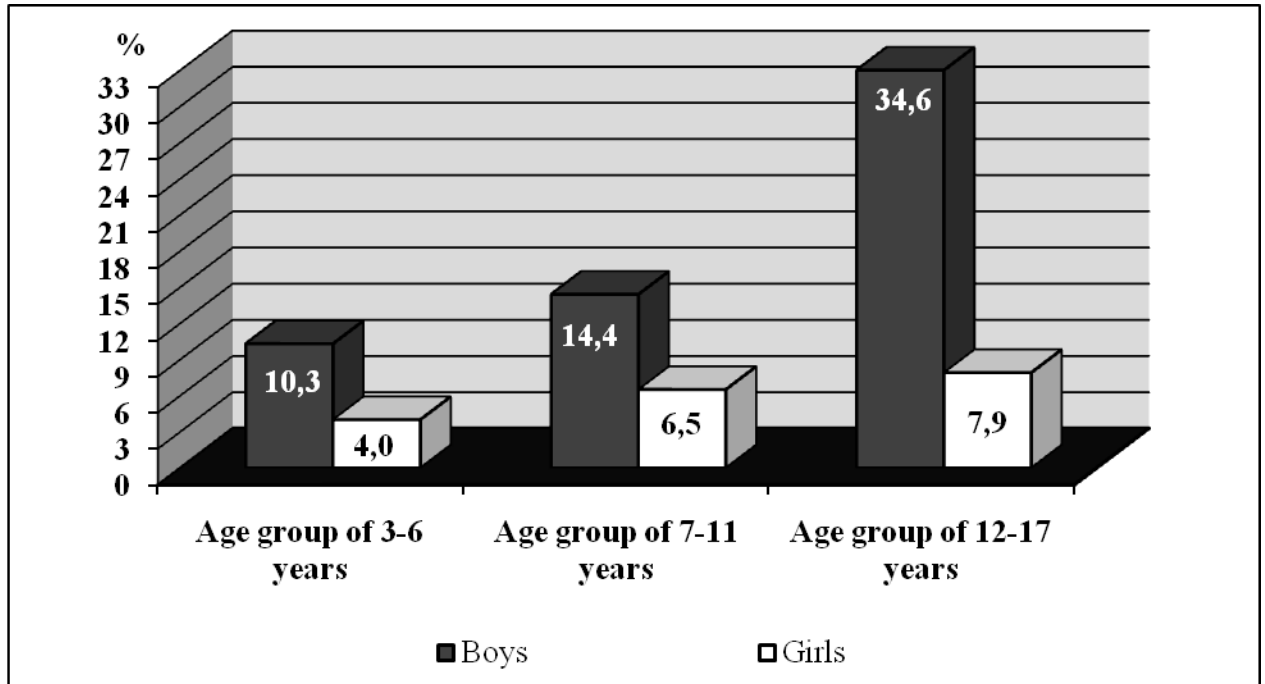


Fig. 8. The sex and age distribution of examined children from Polesie and Ivankov districts with diagnosed EVRS (in % to the number of children in the relevant age groups).

*Ectopic atrial rhythm* was detected in 89 children (7,5 % of the number of all examined children). Among the boys, it was recorded in 9,9 % of cases (59 out of 599 examined boys), among the girls – in 5,1 % of cases (30 of 594 examined girls). It was seen in 7 cases (4,6 % of the number of children in the group) in the group of children aged 3-6 years, in 43 cases (8,1 % of the number of children in the group) in the group of children aged 7-11 years, and in 39 cases (7,7 % of the number of children in the group) in the group of children aged 12-17 years.

*Wandering atrial pacemaker* was diagnosed in 56 children (4,7 % of the number of all examined children). Among the boys, it was present in 25 cases - 4,2 % of the number of examined boys, among the girls - in 31 cases – 5,2 % of the

number of examined girls. It was recorded in 3,3 % of cases (5 of 153 children) in the group of children aged 3-6 years, in 5,4 % of cases (29 of 533 children) in the group of children aged 7-11 years, and in 4,3 % of cases (22 of 507 children) in the group of children aged 12-17 years.

*The short PQ syndrome*, an important diagnostic sign detected during an ECG test, was observed in 29 cases (2,4 % of the number of all examined children). Among the boys, it was noted in 2,0 % of cases (12 out of 599 examined boys), among the girls - in 2,9 % of cases (17 of 594 examined girls). The dynamics of incidence by age groups were not traced.

*The moderate changes in the ventricular myocardium* were found in 41 children (3,4 % of the number of all examined children). Among the boys, they were observed in 19 cases (3,2 % of the number of all examined boys), among the girls - in 22 cases (3,7 % of the number of all examined girls). The dynamics of incidence by age groups were not traced.

In addition to the abovementioned disorders, in rare cases, using the ECG method there were detected: marked changes in the ventricular myocardium, left atrial enlargement, high electrical activity of the left ventricular myocardium, right atrial enlargement, second degree sinoatrial block, left ventricular enlargement, repolarization process abnormalities, first degree atrioventricular heart block, auricular extrasystole.

**Discussion.** The radiation situation on the territory of Polesie and Ivankov districts was quite complicated for decades after the Chernobyl nuclear power plant accident, and therefore, vast areas of land were not and are not used for agricultural purposes.

The radiometric examination carried out during a medical examination of children in 2014-2015, among 1193 children whose cardiovascular system was

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assessed confirmed only 9,4 % of cases when the  $^{137}\text{Cs}$  body content was significantly higher than the minimum detection activity level of the counter. However, this should not reassure the public, since there is a real risk of radionuclide intake by the children via food and their negative impact on vital organs and systems.

In analysing the instrumental examination results, there should be noted a considerable number of children with disturbance of vascular tone regulation - 34,4 % of the number of examined children, including 18,8 % of cases of elevated ABP and 15,6 % of cases of lowered ABP. Also among both boys and girls, we have discovered a phenomenon of “swing” – the passage from lowered ABP at the age of 3-6 years (33,3 % of the number of examined children in the group) to increased ABP at the age of 12-17 years (33,3 % of the number of examined children in the group) (Fig. 9).

In assessing hemodynamics in the child, it is important to determine such a parameter as PP - the difference between the systolic and diastolic ABP measurements. In the group under study, deviations from PP norm values were seen in 20 % of cases, largely due to elevated PP. Among the boys and girls, there was a direct proportion between increasing age and the number of cases of elevated PP, up to 34,6 % in the age group of 12-17 years.

Most of the examined children (80,4 %) demonstrated HR deviations from the age norms. The index of Rufe indicating the disturbance of regulatory processes of cardiac activity based on the assessment of heart rate recovery time after exercise revealed 33,7 % of children rated as “fair” and 28,1 % of children as “poor”.

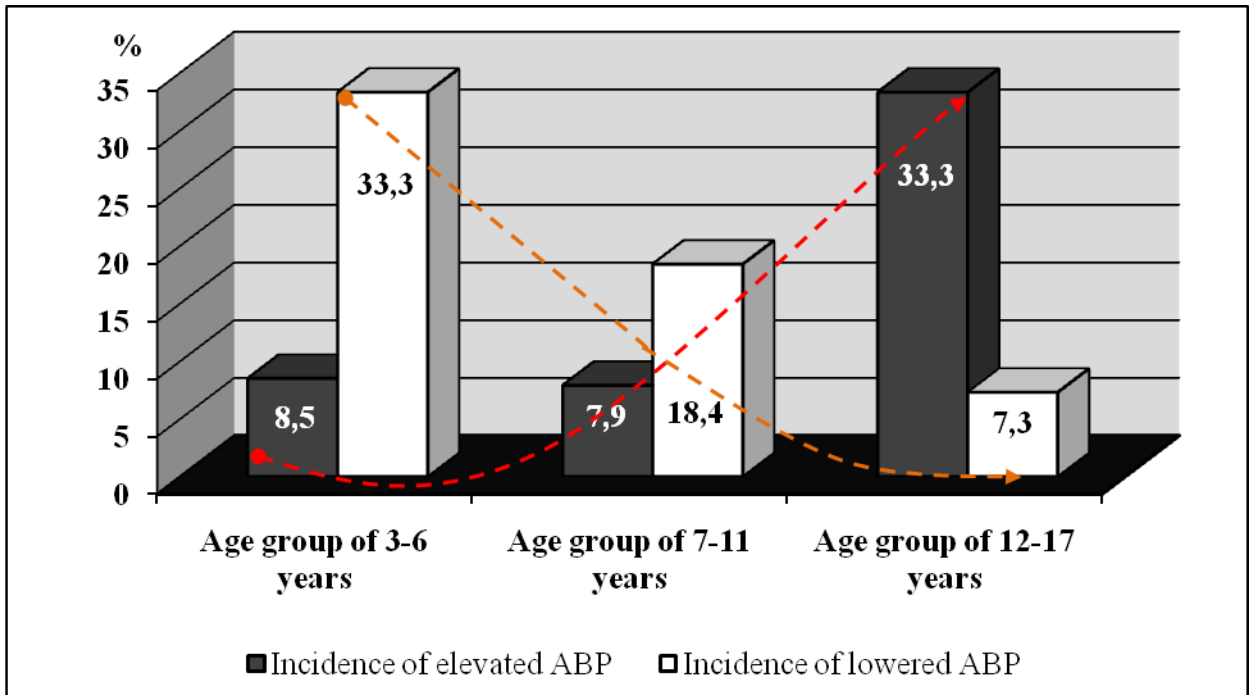


Fig. 9. The age distribution of examined children with elevated and lowered arterial blood pressure (in % of the total number of children in the age group).

During the medical examination, the ECG method was used to examine all children; the ECGs were interpreted by independent experts. The use of above instrumental method allowed to detect changes in the heart function other than normal ones in 81,9 % of examined children. In the group of boys aged 12-17 years, this rate was 90,3 %. These changes were mainly manifested in the form of arrhythmias, intracardiac conduction disturbances and metabolic changes in the myocardium. There were often combinations of different forms of the said abnormalities.

The increased incidence of sinus bradycardia (at a frequency of 17,8 % of cases among all examined children) was observed with increasing age of children, reaching 23,9 % of cases in the age group of 12-17 years, and 33,1 % - among the boys of this group. The frequency of sinus tachycardia also demonstrated age

dynamics but opposed to the one of sinus bradycardia. It amounted to 34,6 % of cases among 3-6 year old boys, and was recorded in 5,8 % of cases among boys aged 12-17 years (Fig. 10).

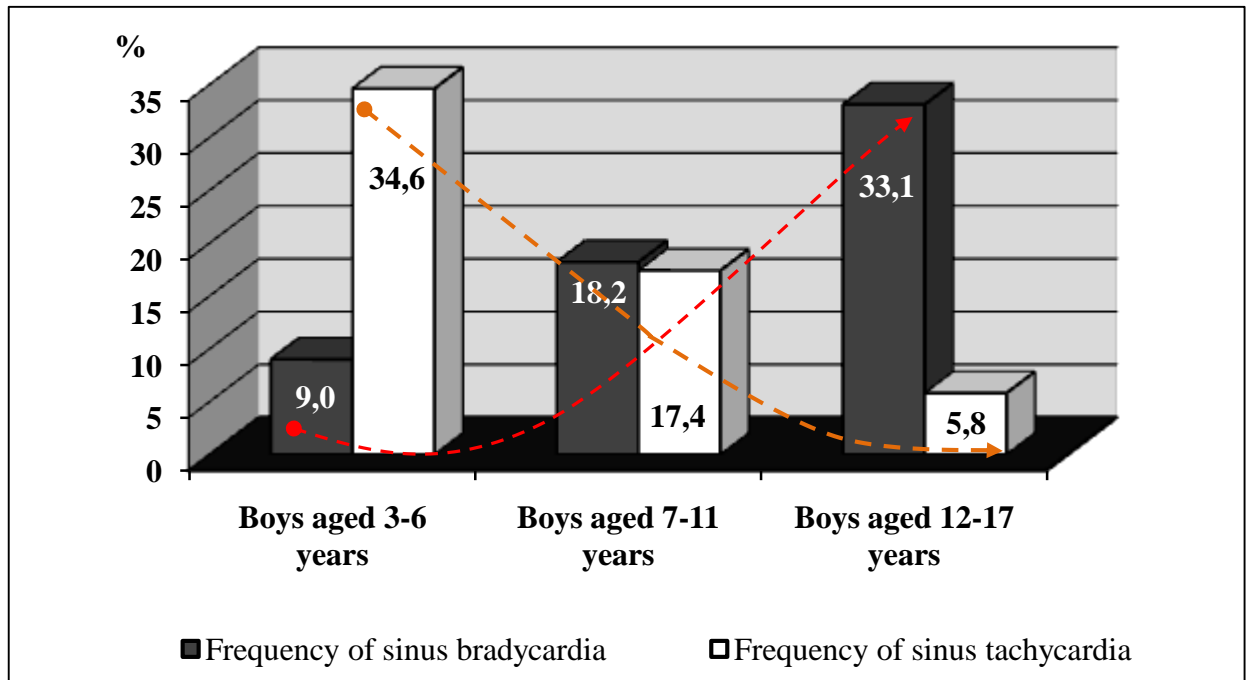


Fig. 10. The age distribution of boys with diagnosed sinus bradycardia and sinus tachycardia (in % of the number of boys in the relevant age groups).

It is also required to pay attention to irregular sinus rhythm which was seen in 22,4 % of examined children.

A significant number of children demonstrated abnormalities in the form of ectopic heart rhythm (7,5 % of cases) and wandering atrial pacemaker (4,7 %).

Incomplete right bundle branch block belonging to the group of abnormalities of impulse conduction in the heart was present in 9,6 % of cases, and there were dynamics of increasing frequency with increase in age of boys, reaching 16,0 % of cases in the group of 12-17 years.

The early ventricular repolarization syndrome relating to metabolic disorders in the myocardium was found in 14,2 % of cases of the number of all examined children, and in 21,2 % of cases among boys. There were dynamics of increasing incidence of the syndrome with increasing age of examined children, rising to 21,9 % of cases in the group of 12-17 years. Among boys in this group, the figure was much higher - 34,6 % of cases. The largest number of children with the EVRS was recorded among boys aged 16-17 years - 50 % of cases. Special vigilance with respect to the syndrome is associated with the fact that arrhythmias and acute coronary syndrome may occur on its basis, creating a danger for the life.

The moderate changes in the ventricular myocardium found in 3,4 % of cases also relate to metabolic changes.

### **Conclusions.**

1. The results of the instrumental examination give evidence of presence of functional changes in heart function in the majority of children from Polesie and Ivankov districts of Kiev region, Ukraine, detected during a routine medical examination in 2014-2015.

2. Particular attention should be paid to the health of boys aged 12-17 years, among whom in comparison with other age groups, there were most frequently cases of increased arterial and pulse pressure, abnormalities of heart beat rhythm in the form of bradycardia and early ventricular repolarization syndrome.

3. Clinical examination of the child population from areas affected by the Chernobyl nuclear power plant accident should include an assessment of the cardiovascular system with compulsory electrocardiographic examination and interpreting of electrocardiograms by a pediatric cardiologist.

### **References.**

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Bandazhevsky Yu.I., Dubovaya N.F., Bandazhevskaya G.S. et al. Assessment of the cardiovascular system in children from Polesie and Ivankov districts // Scientific and practical collection «Chernobyl: ecology and health» / General addition by prof. Yu.I. Bandazhevsky. – Ivankov: PI Coordination and Analytical Center «Ecology and health», - Dnipropetrovsk: Serednyak T.K., 2015. - Issue 2. – P. 22-35.

1. Nesterenko V.B. The extent and consequences of the Chernobyl nuclear accident for Belarus, Ukraine and Russia. - Minsk: Law and Economics, 1996. - 72 p.
2. Bandazhevsky Yu.I. Chernobyl 25 Years: Incorporated Cs-137 radionuclides and health of people / Yu.I. Bandazhevsky, N.F. Dubova, G.S. Bandazhevskaya and others; Ed. by Yu.I. Bandazhevsky, Prof. - Kyiv: Ecology and Health Coordination and Analytical Centre, 2011. – 156 p.
3. Structural and functional effects of radionuclides incorporated into the body / Under the editorship of Yu.I. Bandazhevsky, Prof. - Gomel, 1997. - 152 p.
4. Bandazhevsky Yu.I. Clinical and experimental aspects of the influence of incorporated radionuclides on the body / Yu.I. Bandazhevsky, V.V. Lelevich, V.V. Strelko and others; Ed. by Yu.I. Bandazhevsky, V.V. Lelevich. - Gomel, 1995. – 152 p.
5. Bandazhevsky Yu.I. Chronic Cs-137 incorporation in children's organs // Swiss. Med. Weekly 133: p. 488-490, 2003.
6. Vyalov S.S. Norms in pediatrics: Handbook / S.S. Vyalov. – M.: MEDpressinform, 2013. - 192 p.