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Health groups as an integral indicator of the state of health of the offspring of the first generation of inhabitants of radioactively contaminated areas, from birth to the age of 18

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Abstract

An analysis of the distribution of first-generation offspring born to residents of radiation-contaminated areas of Ukraine by health groups, assessment of the organization of medical examinations, identification of risk factors that are factors of loss of health, to improve medical care.

The observation period from 1987 to 2016. The total cohort was 35893 individuals, among whom male offspring constituted 18138 individuals, while female offspring constituted 17755 individuals. There were created four groups to study offspring up to 3 years old, depending on the time of birth of offspring after an accident – years of birth:(first –

01.03.1987– 28.02.1990, second – 01.03.1990– 28.02.1993, third – 01.03.1993– 28.02.1996, fourth – 01.03.1996– 28.02.1999), with a three-year observation period.

The groups under clinical examination have been entered as follows: the first group – healthy; the second group – practically healthy; the third group – diseased, whilst the disease has a compensated or subcompensated course. A separate fourth group includes individuals with persistent pathological disorders that lead to permanent disability (disability)

During the observation period, there were detected, that the offspring of the general cohort in the first years of life were mostly healthy and only 5% had the third health group. At the age of 16-18, the health condition gradually deteriorated, as evidenced by a 27% decrease in the proportion of healthy and practically healthy offspring (first and second health groups) and a simultaneous increase by 30% of the number of people in the third health group. Significant deterioration in the health of offspring occurred at 5-7 and 16-18 years. The health condition of the male offspring is worse than of the female offspring. During the entire study period, in all of the groups under study, the proportion of offspring with disabilities was about 1-2%.

Key words: First-generation offspring; radioactively contaminated territories; health groups

Studies by many scientists, namely V. Bebeshko, E. Stepanova, O. Savisko, O. Kopylova, have proved that one of the most unfavorable consequences of the Chernobyl accident was the deterioration of the health of the affected population, especially of children in the post-accident period. The children born to irradiated parents have high morbidity rates, early infant mortality due to birth defects and developmental abnormalities [1-3].

The Purpose of the Study is to analyse the state of health of the offspring of the first generation (OFG), born by residents of the radioactively contaminated areas (RCA) in Ukraine, in the period of 18 years of lifetime by health groups; to assess the organization of clinical examination; to identify risk factors that may have caused health loss, – all in order to improve health-care delivery.

The Materials and Methods Used Provide as Follows. The total OFG cohort under the age of 18 of the RCA residents comprised 35893 individuals, including 18138 persons as offspring of males and 17755 persons as offspring of females, with individual doses of ionizing radiation coming from 10 districts of four regions in Ukraine, namely: Kyiv (Ivankivsky), Zhytomyr (Narodytsky, Ovrutsky, Olevsky, Korostensky), Rivne (Rokytnivsky, Dubrovytsky, Sarnensky), Chernihiv (Ripkynsky, Kozeletsky). Subject to the time of birth, the offspring are divided into four groups, taking into account the frequency of birth every three years from 1987 to 1999. The observation period lasted from 1987 to 2016, from birth to the age of 18. The state of health of the offspring was assessed based on the information from the Ukraine State Register (USR).

The number of OFG registered with the USR from birth to the age of 18 ranges from 0.32 to 100%. The findings of screening-assessment of the groups under clinical examination have been entered into the USR as follows: the first group – healthy; the second group – practically healthy; the third group – diseased, whilst the disease has a compensated or subcompensated course. A separate fourth group includes individuals with persistent pathological disorders that lead to permanent disability (disability) [4].

Findings

1. Health groups of the offspring of the general cohort under the age of 18 who are registered with the USR by three-year observation periods are provided in Figure 1.



Figure 1. Health groups of the OFG of the general cohort born by the RCA residents during the lifetime period of 18 years, %

At the age of up to two, FGO had mainly the first health group and a small percentage of the second and third health groups. At the age of three, there was a redistribution by health groups: the number of offspring with the second group increased significantly, the offspring with the third group increased slightly, and there was a small number of offspring with the fourth health group. At the age of four, the number of offspring with the first health group decreases, whilst the offspring with the second, third and fourth health groups increases. From 5 to 8 years, there was an increase in offspring with the third health group, while there was a decrease with the first and second health groups, and the proportion of offspring with the fourth group is insignificant. During the period from 9 to 14 years, the largest proportion of

offspring applies to the one in the second health group, which along with the first health group comprised about 75%, while there was practically no change with the third health group, and there was a slight increase with the fourth health group. From the age of 15 to 18, there increased a number of offspring by 32% in the third health group and up to 2% in the fourth health group.

During the period of epidemiological observation, no significant differences between male and female offspring were found. At the same time, the health condition of the male offspring is worse than of the female offspring, as evidenced by 12.8% of male offspring in the third health group under 3 years of age against 6.37% of the female offspring. There is also being observed a higher proportion of the male offspring with a disabilities ranging from 0.36% to 1.48%, and for the female offspring – from 0.14% to 1.27%, respectively.

The main diseases for which the OFG aged up to three years had the second and third health groups established, included acute respiratory infections of the upper respiratory tract, and iron deficiency anemia. A single case of the fourth health group was found in relation to intellectual disability. In the following years of observation (up to 6 years), the health of the offspring deteriorated due to thyroid diseases associated with iodine deficiency (E02), refractive errors and accommodation (H52.0-52.7), chronic tonsillitis and adenoids. Certain single cases of the fourth health group were established for: cerebral palsy, congenital anomalies of the cleft lip and palate, congenital anomalies of the circulatory system. The FGO aged up to 9 years in the third health group were found to have the following: deforming dorsopathies – scoliosis and kyphosis, lordosis; diseases of the gallbladder and biliary tract, gastritis and duodenitis, hernias; heart failure, cardiomyopathy; acute bronchitis and bronchiolitis, chronic tonsillitis. There occurred a redistribution by health groups. The proportion of almost healthy offspring insignificantly (by 0.3%) exceeded the offspring in the first group. The FGO's fourth group is established by diseases of the endocrine system (including obesity), mental and behavioral disorders (intellectual disability), nervous system diseases (cerebral palsy), eye and appendages diseases (refractive errors and accommodation), respiratory diseases (asthma), digestive organs, congenital anomalies of the circulatory system, cleft lip and palate, congenital malformations and deformities of the musculoskeletal system.

The FGO aged 10-12 years had the proportion of individuals in the second health group increased by 4.65% and by 0.15% – of individuals in the fourth health group. During this age, the offspring suffered from thyroid disease associated with iodine deficiency, hypothyroidism, other forms of non-toxic goiter, hyperthyroidism, disorders of the autonomic

nervous system, bronchitis, SARS, flu and pneumonia, gastritis and duodenitis, biliary tract disease, valve damage. The fourth group was exposed to diseases of the eye endocrine system (including obesity), nervous system, eye diseases (strabismus, refractive errors and accommodation), ear diseases, congenital anomalies of the nervous system and congenital anomalies of the eye, ear, face and neck.

Among the FGO aged 13–15, the percentage of individuals in the third health group increased sharply. As the offspring of the general cohort reached the age of 18, the share of the first health group decreased by 30.88% compared to the period from birth to three years.

The study of the health of the offspring depending on the date of birth after the Chernobyl accident (the first, second, third, fourth groups under study) made it possible to analyze the changes in health groups during their lifetime.

The main number of offspring of the first study group aged up to 2 years had the first health group, while the insignificant number had the second and third groups (Figure 2).



Figure 2. – Health groups of the FGO of the first study group during the lifetime period of 18 years, %

From three to ten years inclusive, there was a redistribution by health groups, namely: the percentage decreased with the first group and increased with the second group, which together ranged from 96% to 70%, and increased with the third group from 3% to 30%. There was a slight increase in the fourth group. From the age of eleven, the FGO are redistributed to the first and third health groups by reducing the number of the second group. At the age of 16-18, there is observed the largest number of offspring in the first health group, a third of the offspring – in the third group, a slightly smaller number – in the second group, and about one percent in the fourth. It should be noted that after reaching the age of 18, the number of

offspring in the first and second health groups together did not exceed the number in the period of up to 11 years.

The offspring of the second group under study aged up to two years were mostly healthy, a small proportion was observed in the second and third health groups (Figure 3).



Figure 3 – Health groups of the OFG of the second study group during the lifetime period of 18 years, %

At the age of three, there began redistribution of offspring from the first health group to the second and third ones. At the age of 4–5 years, the number of offspring with the second group increased significantly due to a decrease in the proportion of the first group, but together they amounted to about 90%. A small number of offspring belonged to the third health group, and the smallest number – to the fourth group. From 6 to 16 years, the redistribution of offspring by health groups continued, namely the number increased with the second and third groups due to the decrease of the first group. At the same time, it should be noted that about 75% of children and adolescents aged under 16 were healthy and practically healthy. Between the ages of 16 and 18, there was a significant redistribution of the first and second health groups into the third group. Thus, one third of the offspring of the second study group after reaching 18 years of age had chronic diseases of varying degrees. The proportion of offspring with disabilities was insignificant throughout the observation period with the highest percentages applicable to the ones aged 12–14 years.

The offspring of the third study group aged up to two years were mostly healthy, a small proportion – almost healthy, the third and fourth health groups were not determined (Fig. 4).



Figure 4 – Health groups of the OFG of the third study group, during the lifetime period of 18 years, %

In 3-4 years, the distribution of the first and second groups of health is almost the same, for the third - a small share, the fourth - was not exposed.

From 5 to 9 years, the share of healthy and almost healthy offspring is almost the same and was about 80%, a smaller share in the third group of health, the smallest - in the fourth.

From the age of 10 to 16 the percentage of healthy people gradually decreases and the percentage of offspring with chronic diseases and disabilities increases. After reaching the age of 18, the share of healthy FGOs decreased by half compared to the first years of life, the share of the third group of health was a third of the total.

In the first three years of life, NPP of the fourth study group were divided into the first and second health groups with a slight advantage over the first group (Figure 5).



Figure 5. – Health groups of the OFG of the fourth study group during the lifetime period of 18 years, %

The third and fourth health groups are missing. At 4-6 years of age, the ratio of the first and second health groups was maintained, but there appeared OFG with the third and fourth health groups due to redistribution from the first and second health groups.

At the age of 7-9 years, the OFG redistribution continues by health groups between the first and second groups, namely: a decrease in the first health group and an increase in the second group. In case of the OFG aged 10-12 years, there is a significant proportion of the second health group by means of the first group. The number increased with the third and fourth groups compared to previous years of life. In case of the OFG aged 13-15 years, the following feature of the distribution by health groups was manifested: the first two health groups decreased sharply and the third and the fourth groups sharply increased compared to the previous years of 16-18 years, the proportion of healthy and virtually healthy offspring decreases significantly and the number increases significantly with the third health group. About one percent of the offspring had a fourth group.

The conducted analysis of the obtained findings on the number of the OFG, which was used to establish the health groups also showed that in different years of clinical examination (from birth to 18 years) the number of individuals covered by clinical examinations does not correspond to the number of the general cohort of offspring and ranges from 0.16 to 36%.

Conclusions

1. The offspring of the general cohort in the first years of life were mostly healthy and only 5% had the third health group. At the age of 16-18, the health condition gradually deteriorated, as evidenced by a 27% decrease in the proportion of healthy and practically healthy offspring (first and second health groups) and a simultaneous increase by 30% of the number of people in the third health group.

2. Significant deterioration in the health of offspring occurred at 5-7 and 16-18 years. At the same time, the offspring born 11-13 years after the accident have the largest share among the third health group of the studied individuals.

3. The health condition of the male offspring is worse than of the female offspring, as evidenced by 12.8% of male offspring in the third health group under 3 years of age against 6.37% of the female offspring; ranging from 0.36% to 1.48% with the established fourth health group against 0.14% to 1.27% for the female offspring, respectively.

4. During the entire study period, in all of the groups under study, the proportion of offspring with disabilities was about 1-2%.

5. The obtained findings of changes in the health condition according to the integrated indicator (health groups) are preliminary, as they are based on the data of the

information base of the USR, where the completeness of clinical examinations of offspring does not correspond to the total cohort. This may be due to the lack of 100% coverage of clinical examinations of studied individuals or incomplete transmission of the findings of dispensary examinations.

It is known that negative environmental factors often have a stronger impact on children than on adults [5, 6]. The child's body from birth to adulthood (18 years) is characterized by rapid changes in physiological, social and psychological development. Parallel changes determine the nature and complexity of children's environments in infancy, early childhood, middle age and adolescence. Each change is related to their growing competence, social engagement and independence.

Thus, measures to improve children's health and well-being should be aimed at modifying or improving the physical, social and psychological environment of the younger generation.

The most powerful medical and social factor in preventing the development of chronic diseases at an early age and maintaining the children's health would be the conduct of annual clinical examinations by primary care physicians, namely family physicians or paediatricians.

One of the important social factors in the formation of health is the involvement of children in a healthy lifestyle. Physical education classes should become popular, with interesting content and outdoor games. It is important, especially in radioactively contaminated areas, to provide children with a balanced diet and clean drinking water.

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