

# Health of HIV Infected Children and Social Living Conditions



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**Abstract:** *The article considers the statistical and cause-effect relationship between social conditions and two groups of features characterizing the psychophysical development and incidence in HIV infected children from residential institutions in comparison with a group of HIV infected children from families. The authors have obtained data on the adverse influence of social living conditions (residential institutions) on the health of HIV infected children. HIV infected children without parental care, living in residential institutions, are more vulnerable in terms of a number of factors and need enhanced integrated medical and social support to correct the existing defects and improve the quality of life.*

**Keywords :** *HIV infection, children, incidence, psychophysical development, health status, social living conditions, systematic multifactorial analysis.*

## I. INTRODUCTION

HIV infection is an indolent infectious disease caused by retroviruses affecting the immune and central nervous systems and developing an immunodeficiency state leading to the death of a patient from opportunistic infections and tumors [1].

In 2017, the number of registered HIV infected persons in the Russian Federation exceeded one million people. The federal state statistical observation of form No. 61 "Information on the disease caused by the human immunodeficiency virus" as of January 1, 2017 registered 11,007 children with HIV infection aged 0 to 17 years in the Russian Federation, of which 1,281 children were diagnosed with HIV infection for the first time, including 762 children aged 0 to 17 years, 189 children aged 8 to 14 years and 330 children aged 1 to 17 years [2]. During the years of the study in the Samara region, HIV infected women gave birth to 11,106 children (650 children were born during 11 months of 2017). Five hundred and twenty children were diagnosed with HIV infection [3]. Despite the fact that today mothers are less likely to abandon a child, the problem of orphans born by women with HIV infection is still relevant.

The probability of child abandonment is increased by an unwanted pregnancy,

lack of family support, drug and alcohol use, fear of a child with birth defects or a disabled child, as well as belonging to the most vulnerable social and economic group of the population [4]. Due to the above problems, there is a need for an in-depth study of health characteristics and the course of HIV infection process in children from residential institutions to optimize comprehensive medical and social support.

The aim of the study is to analyze the relationship between the health of HIV infected children and social living conditions.

## II. PROPOSED METHODOLOGY

### A. General description

We conducted a real-time study (2013-2018) on the basis of the state public healthcare institutions of the Samara region "Specialized Children's Home "Solnyshko", "Child's Home "Malysh" (chief physician N.V. Shibanova) and "Correctional Center for Helping Children without Parental Care "Ivolga" of the Samara City District" (chief physician A.V. Mironova), as well as the state budgetary healthcare institution "Samara Regional Clinical Center for AIDS and Infectious Diseases" (chief physician Candidate of Medical Sciences O.E. Chernova).

According to the analysis of medical documents, 180 children aged 7 months to 14 years were selected. A comprehensive examination was conducted in three groups: the first group – 50 children with a confirmed diagnosis of HIV infection from residential institutions of the Samara region, the second group – 60 children with a confirmed diagnosis of HIV infection from families, the third group – 70 children not HIV infected brought up in residential institutions of the Samara region.

The study is prospective, randomized, open and relatively controlled in parallel groups (Figure 1).

The research was carried out in 2013-2017. The compliance with ethical standards is confirmed by the bioethics committee at Samara State Medical University (protocol No. 35 of November 6, 2013). The legal representatives of all children participating in the study gave their informed consent to participate.

### B. Algorithm

The hypothesis of a statistical connection between a pair of qualitative features (in our study, this is health of HIV infected children and social living conditions) was proved by analyzing 2x2 cross tables with calculation of the connection statistics (chi-square test ( $\chi^2$ ) and the achieved significance level (p) with Yates continuity correction).

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In addition, there were evaluated connection statistics, such as odds ratios, relative risk and boundaries of 95% confidence intervals for them. Next, mathematical models were obtained using systematic multifactorial analysis (MFA) of quantitative characteristics that passed statistical processing and were grouped into logical systems [5].

During the MFA, multidimensional quantitative characteristics were transferred into relatively comparable ones by calculating the relative difference  $X_i$  of each of the parameters (arithmetic mean values), groups and parameters accepted as the norm ( $X_o$ ). Due to the fact that the significance level of some obtained parameters in providing the studied processes was not equivalent, calculated

influence coefficient ( $P_i$ ) of each of the obtained parameters was calculated in all groups.  $\sigma_i$ -mean squared deviations  $X_i$  were calculated as well.

Based on the obtained data, a weighted mean value for each group was calculated – a value that characterizes the whole group ( $X_{bi}$ ) in relative units.

Based on the results, graphical dependences of weighted mean values of time process, stages or other given factors were built. They showed the integrated time dependence or a mathematical model of the studied process, reflecting their nature, direction and dynamics. The health of HIV infected children was estimated according to two groups of features: psychophysical development and incidence (Table 1).

**Table 1: Basic distinctive features of the analysis of the relationship and construction of multifactorial models of the health of HIV infected children, depending on the social living conditions (brought up in a social institution or in the family) (contingency tables).**

Feature	Value	Groups						$\chi^2$	p
		HIV, residential institutions		HIV, families		Without a diagnosis, residential institutions			
		Abs.	%	Abs.	%	Abs.	%		
<b>DEVELOPMENT</b>									
Low physical development	Yes	21	42.00	12	20.00	23	32.86	23.612(a)	0.003
Body mass deficiency of the second degree	Yes	25	50.00	14	23.33	32	45.71	20.709(a)	0.008
Teething time	norm	33	66.00	60	100.00	39	97.50	40.892(a)	0
Period of closing of the anterior fontanel	norm	31	62.00	60	100.00	40	100.00	43.511(a)	0
Delayed motor development	Yes	31	62.00	16	26.67	17	42.50	13.919(a)	0.001
Delayed mental development	Yes	48	96.00	27	45.00	36	90.00	44.127(a)	0
<b>INCIDENCE</b>									
Anemia	Yes	19	38.00	22	36.67	5	12.50	8.489(a)	0.014
Recurrent infections	Yes	50	100.00	39	66.10	39	97.50	31.756(a)	0
Chronic ENT diseases	Yes	21	42.00	13	21.67	8	20.00	7.325(a)	0.026
Chronic hepatitis C infection	Yes	6	12.00	2	3.33			7.130(a)	0.028
Had pneumonia	Yes	12	24.00	7	11.67	1	2.50	9.130(a)	0.01
Fourth health group	Yes	40	80.00	37	61.67	5	12.50	75.375(a)	0

### III. RESULT ANALYSIS

The MFA showed a significant deviation of the integrated development index (MV development=0.66) of children in residential institutions from the development of children in families accepted as 0.0, which shows the influence of social living conditions on the psychophysical development of children in general. The obtained data coincided with the resulting trend of the development analysis according to contingency tables. The most significant deviations were shown by the features “Delayed motor development” and “Delayed mental development”. The same indexes had the

highest influence coefficients (weight coefficients) in terms of the development process of children in general.

The results of the MFA showed that, in general, the incidence of HIV infected children brought up in residential institutions was higher than that of children from families. The deviation of the integrated incidence index for children of the main group (incidence MV=0.61) is shown compared with another group where the integrated index=0.0.

Influence coefficients or weight coefficients ( $P_i$ ) were calculated, showing the contribution of each index to the weighted mean value (Figure 1).

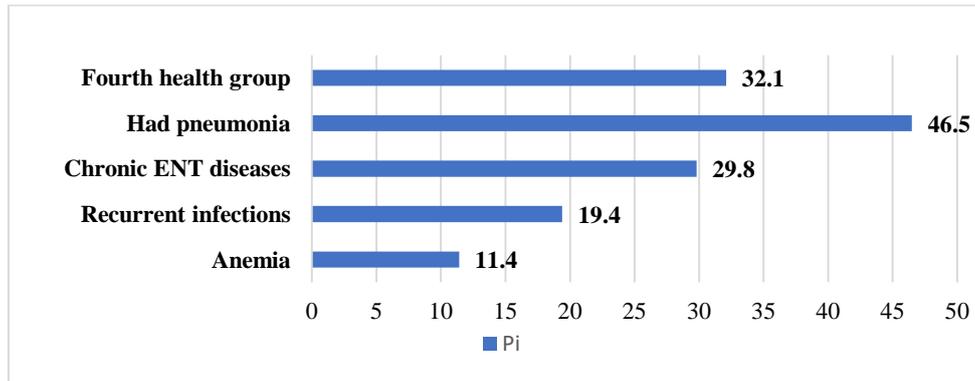


Fig. 1. Values of feature influence coefficients (Pi) affecting the incidence of HIV infected children in residential institutions.

The analysis of contingency tables revealed a direct cause-effect relationship with social living conditions of such features of children’s development as “Low physical development”, “Delayed motor development” and “Delayed mental development” (Table 2).

Table 2: Summary of the distribution of relationship types between the factor of social living conditions and health indicators of HIV infected children in residential institutions.

Direct cause-effect relationship	Indirect cause-effect relationship	Lack of cause-effect relationship
DEVELOPMENT		
Low physical development Delayed motor development Delayed mental development	Deficit of body weight of the second degree	Teething time Period of closing of the anterior fontanel
INCIDENCE		
-	Recurrent infections Chronic diseases of ENT organs Had pneumonia	Anemia Fourth health group

A statistical relationship was established between the main features characterizing the incidence of HIV infected children and the factor of social living conditions (the exception was “Anemia”, which is not statistically related to the social factor). However, the statistical relationship does not entail a cause-effect relationship (Table 2).

The MFA of the health of HIV infected children was carried out (Table 3).

Table 3: The results of the MFA of the health of infected children in residential institutions.

Feature group	Integrated index
Development	0.66
Incidence	0.61
Health status	0.66

The MFA showed a significant deviation of the integrated index of the development of children in residential institutions from the development of children in families where the index=0.

The incidence of HIV infected children from residential institutions is higher than that of children living in families. The mathematical model of incidence showed a deviation of the integrated index in the first group towards the increase in the second group.

As a result of the MFA, we obtained data on the adverse influence of social living conditions (residential institutions)

on the health of HIV infected children. The integrated index of health status was obtained, which showed a deviation from the index of children’s health in families.

IV. CONCLUSION

Thus, HIV infected children left without parental care and living in residential institutions are more vulnerable in terms of a number of factors and need enhanced integrated medical and social support to correct the existing defects and improve the quality of life. The development and testing of preventive individual programs for HIV infected children living in residential institutions and families are promising and comply with the principles of the P4 medicine concept (Order of the Ministry of Health of the Russian Federation of April 24, 2018 No. 186 “On approval of the concept of predictive, preventive and personalized medicine”).

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