– 131 p. http://www.ceap.br/material/MAT17032011184632.pdf

9. Prenatal Hemoglobin Levels and Early Cognitive and Motor Functions of One-Year-Old Children / M.O. Mireku, L.L. Davidson, G.K. Koura [et al.] // Pediatrics. – 2015. – Vol. 136, Is. 1: e76-83. doi: 10.1542/peds.2015-0491.

10. Fetal umbilical artery Doppler pulsatility index and childhood neurocognitive outcome at 12 years / F. Mone, B. McConnell, A. Thompson [et al.] // BMJ Open. – 2016. – Vol. 6, Is. 6: e008916. doi: 10.1136/bmjopen-2015-008916.

11. Moore V.C. Spirometry: step by step / V.C. Moore // Breathe. – 2012. – Is. 8. – P. 232-240. doi: 10.1183/20734735.0021711

12. Muscle Strength Procedures Manual. – National Health and Nutrition Examination Survey, 2011. – 55 p. https://wwwn.cdc.gov/nchs/data/nhanes/2011-2012/manuals/muscle_strength_proc_manual.pdf

13. An exploratory study of the associations between maternal iron status in pregnancy and childhood wheeze and atopy / B.I. Nwaru, H. Hayes, L. Gambling et. al. // British Journal of Nutrition. – 2014. – Vol. 112, Is. 12. – P. 2018-2027. doi: 10.1017/S0007114514003122.

14. Paauw N.D. Pregnancy as a critical window for blood pressure regulation in mother and child: programming and reprogramming / N.D. Paauw, B.B. van Rijn, A.T. Lely, J.A. Joles // Acta physiologica (Oxford, England). – 2017. – Vol. 219, Is. 1. – P. 241-259. doi: 10.1111/apha.12702. Epub 2016 May 26.

15. Pulse and Blood Pressure Procedures for Household Interviewers. – National Health and Nutrition Examination Survey 1993. – 50 p. https://wwwn.cdc.gov/nchs/data/nhanes3/manuals/pressure.pdf

16. Pregnancy-Associated Hypertension and Offspring Cardiometabolic Health / M.M. Rice, M.B. Landon, M.W. Varner [et al.] // Obstetrics & Gynecology. – 2018. – Vol. 131, Is. 2. – P. 313-321. doi: 10.1097/AOG.0000000000002433.

17. Seppä S. Markers of Insulin Sensitivity in 12-Year-Old Children Born from Preeclamptic Pregnancies / S. Seppä, R. Voutilainen, S. Tenhola // Pediatrics. – 2015. – Vol. 167, Is. 1. – P. 125-130. doi: 10.1016/j.jpeds.2015.04.015.

18. Shaheen S.O. Haemoglobin concentrations in pregnancy and respiratory and allergic outcomes in childhood: Birth cohort study / S.O. Shaheen, C. Macdonald-Wallis, D.A. Lawlor, A.J. Henderson // Clinical and Experimental Allergy. – 2017. – Vol. 47, Is. 12. – P. 1615-1624. doi: 10.1111/cea.13034. Epub 2017 Oct 16.

19. Blood pressure, serum lipids, fasting insulin, and adrenal hormones in 12-year-old children born with maternal preeclampsia / S. Tenhola, E. Rahiala, A. Martikainen [et al.] // Journal of Clinical Endocrinology & Metabolism. – 2003. – Vol. 88. Is. 3. - P. 1217–1222. https://doi.org/10.1210/jc.2002-020903

20. Association between placental morphology and childhood systolic blood pressure / X. Wen, E.W. Triche, J.W. Hogan [et al.] // Hypertension. – 2011. – Vol. 57, Is. 1. – P.48-55. doi: 10.1161/HYPERTENSIONAHA.110.162792.

21. Maternal haemoglobin concentrations before and during pregnancy as determinants of the concentrations of children at 3-5 years of age: A large follow-up study / Y. Zhang, L. Jin, J.M. Liu [et al.] // European Journal of Clinical Nutrition. – 2018. – Aug 17. doi: 10.1038/s41430-018-0284-x. [Epub ahead of print].

22. Maternal Blood Pressure Rise During Pregnancy and Offspring Obesity Risk at 4 to 7 Years Old: The Jiaxing Birth Cohort / J.S. Zheng, H. Liu, K.K. Ong [et al]. // Journal of Clinical Endocrinology & Metabolism. – 2017. – Vol. 102, Is. 11. – P. 4315-4322. doi: 10.1210/jc.2017-01500.

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OPINION OF YOUNG PEOPLE ON THE POTENTIAL RISK OF THE BIRTH OF DEAF CHILD

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ABSTRACT

In Yakutia, the contribution of *GJB2* mutations to the etiology of hereditary deafness is 48.8% and is one of the highest in Asia, due to a significant accumulation of the mutation of the splice site c.-23+1G>A in the *GJB2* gene due to the founder effect in the Yakut population ("age" of mutation ~ 800 years). The results of scientific research in the field of genetic forms of deafness are actively introduced into practice in the form of various test systems of routine DNA diagnostics. However, the bioethical, social and psychological problems arising from the application of these genetic technologies are less well understood than the molecular genetic aspects of deafness. We conducted a questionnaire and a selection of buccal epithelium of 241 people, whose mean age is 21, in order to analyze their opinion on the potential risk of a deaf child's birth and conduct genetic testing for the presence of the mutation c.-23+1G>A in the *GJB2* gene. The frequency of heterozygous carriage of the mutation c.-23+1G>A of the *GJB2* gene among hearing young people (n = 241) in the Yakut population was 10.8%, which is comparable to the previously obtained data. Analysis of data from the questionnaire with genotypes shows that there are no statistically significant differences in the respondents' responses ($p>0.05$). As a result of the questionnaire, it is shown that most young hearing people think that deafness can be a hereditary disease (62.6%). Most young people assume the possibility of birth of a deaf child from hearing parents (81.33%), but only 2.49% of respondents agree with this risk. Such an answer can be explained by the protective internals of the psyche, when a person assumes the existence of the same risk of the birth of a deaf child in all people, but denies such a possibility in himself.

Keywords: opinion of young people, *GJB2* gene, c.-23+1G>A mutation, frequency of heterozygous carrier.

Introduction. In recent years, in connection with the expansion of the possibilities of DNA testing, much attention has been paid to the molecular genetic causes of hereditary forms of deafness. However, at the same time, in many regions of the world, the bioethical and social aspects of this disease remain insufficiently studied. At present, genetic technologies are ahead of the informa-

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tion space, as a result of which there is no formed opinion in Russian society in relation to the heavy moral and ethical issues that entail genetic technologies. Work in this direction was carried out in the United States and a number of European countries [5,6,9], in Russia such studies are practically absent.

Earlier in the Republic of Sakha (Yakutia), the main cause of congenital deafness was identified, which is caused by the mutation c.-23+1G>A in the gene *GJB2* [3]. In the Yakut population, this mutation occurs with an extremely high incidence of heterozygous carriage (10%) [3]. In Yakutia, the contribution of *GJB2* mutations to the etiology of hereditary deafness is 48.8% and is one of the highest in Asia, due to a significant accumulation of the mutation of the splice site c.-23+1G>A in the *GJB2* gene due to the founder effect in the Yakut population ("age" of mutation ~ 800 years) [3,4,11]. The results of scientific research in the field of genetic forms of deafness are actively introduced into practice in the form of various test systems of routine DNA diagnostics. However, the bioethical, social and psychological problems arising from the application of these genetic technologies are less well understood than the molecular genetic aspects of deafness.

In clinical practice, 90% to 95% of deaf children are born in hearing families [7,10]. An analysis of the voices of hearing parents about the possible causes of hearing loss in their child indicates that the majority of hearing respondents in Yakutia (86.1%), Tuva (73.8%) and Bashkortostan (76.2%) do not consider hearing loss in a child hereditary [1, 8]. If we take into account this opinion of the parents, then the hearing loss in their children in 73.8-86.1% of cases is due either to environmental factors or the cause remains unknown [1.8]. At the same time among respondents who participated in the survey, there is a tendency to deny the hereditary nature of the disease in the absence of deaf relatives in the family [1,8]. In this context, the analysis of the opinion of young people about the hypothetical risk of the birth of a deaf child is important from the point of view of forming a reference group of individuals, who for the most part did not face similar moral and ethical problems [1].

The aim of this work is to analyze the opinion of young people about the hypothetical risk of a deaf child's birth.

Materials and methods. We conducted a questionnaire and a selection of buccal epithelium in students of the Federal State Autonomous Educational Institution of Higher Education "North-Eastern Federal University named after M.K. Ammosov ". A total of 241 people took part in the questionnaires, who were students. Of these, 44% were men and 56% women, the average age of participants was 21 years. The urban population was 24%, rural - 74%, did not specify the place of residence / birth - 2%. All the respondents were Yakuts (Table 1).

Questions in the questionnaires were closed alternatives with a choice of one answer option. By completeness of coverage, the questionnaire is selective, conducted among hearing people. By type of contact with respondents - full-time. According to the number of respondents, there is an auditor, that is, the simultaneous filling in of questionnaires by a group of people gathered in the same room in accordance with the rules of a selective procedure. Surveys foreseen by the scope of this research work were carried out after informed written consent of the participants or their parents. The research work was approved by the local committee on biomedical ethics under the YSC of the Commission in 2014 (Yakutsk, minutes No. 41 of November 12, 2014).

Isolation of DNA from the buccal epithelium was carried out by phenol-chloroform extraction. Amplification of fragments of the *GJB2* gene, including exon 1 with 5'-CCGGGAAGCTCTGAGGAC-3 'and 5'-GCAACCGCTCTGGGTCTC-3' primers and exon 2 with 5'-TCGGCCCCAGTGGTACAG-3 'and 5'-CTGGGCAATGCGTTAAACTGG-3' primers of the *GJB2* gene with flanking regions was performed by PCR. The verification of the amplificate on electrophoresis was carried out in a 2.5% agarose gel and stained with ethidium bromide for 25 minutes. When detecting the mutation of c.-23+1G>A in the *GJB2* gene, we amplified exon 1 of this gene with an intron portion containing a polymorphic restriction site (restriction site - GGTGA (N) 8/7). To do this, the amified sample with restriction enzyme and buffer was placed in a thermostat for 12 hours at 37 □ and the next day electrophoresis of the amplifications was performed.

Results and discussion

In this paper, we consider three questions related to the purpose of the study. The first question: "Do you think deafness is a hereditary disease?" Respondents answer: "Yes" or "No". The second question: "Do you think there is a chance of giving birth to a deaf child from hearing parents?". Respondents answer: "Yes" or "No". The third question: "Do you have a chance to give birth to a deaf child?". Respondents answer: "Yes", "No" or "I do not know."

Table 1

Data of interviewed young hearing respondents

Young hearing people (n=241)	Number	%
Gender		
Male	106	43.98
Female	135	56.02
Place of residence		
Urban	57	23.65
Rural	178	73.86
No response	6	2.49
Nationality		
Yakut	241	100
Average age – 21		

We correlated the respondents' answers about the hypothetical risk of a deaf child's birth with their real risks, by testing their presence of the mutation c.-23+1G>A of the *GJB2* gene, since this mutation among the Yakuts is the most common [11]. The frequency of heterozygous carrier mutation c.-23+1G>A of the *GJB2* gene among hearing young people (n = 241) in the Yakut population was 10.8% (Table 2).

To the question "What do you think, deafness is a hereditary disease?" More than half of the respondents (62.66%) answered "Yes" and 37.34% do not agree with this (Fig. 1 - A). When comparing responses to genotyping data, there were no significant differences in respondents' answers. Thus, heterozygous carriers of the mutation c.-23+1G>A of the *GJB2* gene are larger (76.92%) in the group of respondents who agree that deafness is a hereditary disease, and in a group of those who disagree with this heterozygous carriers of this mutation, 23.08% (Fig. 1-B).

To the question "Do you think there is a probability of giving birth to a deaf child from hearing parents?" The majority (81.33%) consider that hearing parents have such a probability, 17.43% exclude such a possibility and 1.24% did not respond to this question (Fig. 2 - A). In the group of respondents who agree with this probability, heterozygous carriers are larger (88.46%) than in the opposite group (7.69%) (Fig. 2 - B).

To the question "Is there a probability of

Table 2

The frequency of heterozygous carriers of mutation c.-23+1G>A in the gene *GJB2*

	Number (n=241)	%
[wt]; c.[-23+1G>A]	26	10.79
[wt];[wt]	215	89.21

a deaf child's birth?" More than half of the respondents (66.8%) do not know what to answer, they exclude this probability of 29.88% and only 2.49% of respondents agree with this (Fig. 3 - A). When correlating responses with genotypes, it turns out that heterozygous carriers are larger in the group of respondents who do not know whether they have a probability of giving birth to a deaf child (80.77%), less in a group that do not agree with such a probability (19.23%) and in a group, which agreed with this heterozygous carriers was not (Fig. 3 - B).

The carrier frequency of the mutation c.-23+1G>A of the *GJB2* gene among hearing young people (n = 241) in the Yakut population was 10.8% (Table 2), which is comparable to earlier data. Earlier in Yakutia, the carrier frequency of mutation c.-23+1G>A, in a population sample of Yakuts of 350 people, was 10.2% [3, 11].

Most young hearing people think that deafness can be a hereditary disease (62.6%) (Fig. 1). In a study conducted among deaf adults and hearing parents of deaf children [1,8], it is shown that these groups think the opposite. That is, most deaf adults (84%) and hearing parents of deaf children (78%) think that their deafness or deafness of their child is a non-hereditary disease [1,8]. The general tendency in denying the hereditary nature of the disease in the study groups is attributed to the respondents' low awareness of the genetic causes of deafness and psycho-emotional reasons - "unwillingness to be guilty of deafness of the child" [1,8]. Consent that deafness can be a hereditary disease among young hearing people may indicate that this group of respondents underestimates the importance of this issue, and is ready to agree with such an abstract statement (that deafness is a hereditary disease). On the contrary, people with hearing loss or having a deaf child / deaf relatives (faced with this problem) are more likely to deny the hereditary nature of hearing loss (78-84%) [8].

It is interesting that most of the young respondents interviewed believe that hearing parents may have a deaf child (81.33%) (Fig. 2), but only 2.49% (Fig. 3) of the respondents agree with this risk. Such a response can also be explained by the protective internals of the psyche, when a person assumes the existence of the same risk of the birth of a deaf child in all people, but denies such a possibility in himself.

Analysis of the data from the questionnaire with *GJB2* genotypes shows that

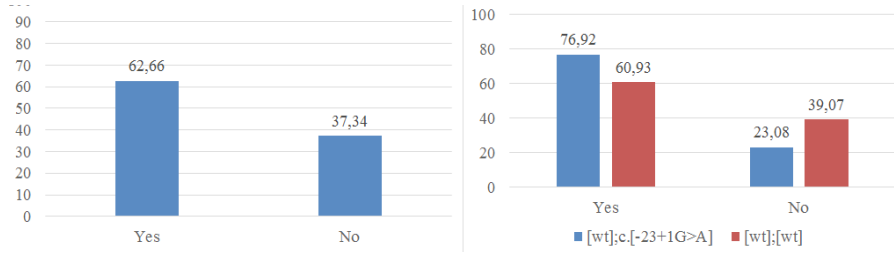

Fig.1. Answers to the question: «What do you think, deafness is a hereditary disease?»: A - the general distribution of answers; B - the answers of young people in relation to their genotypes.

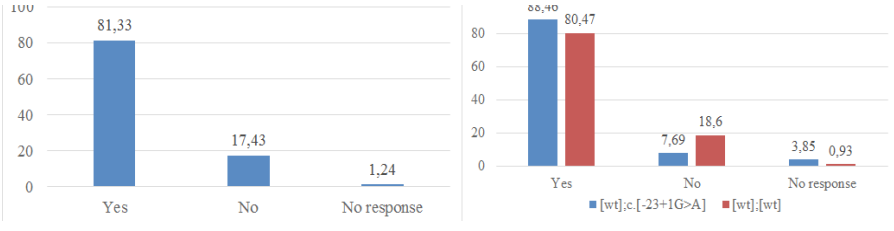

Fig.2. Answers to the question: «Is it possible to give birth to a deaf child from hearing parents?»: A - the general distribution of answers; B - the answers of young people in relation to their genotypes.

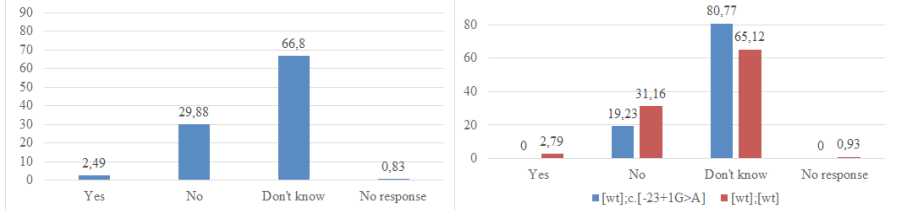

Fig.3. Answers to the question: «Do you have a chance to give birth to a deaf child?»: A - the general distribution of answers; B - the answers of young people in relation to their genotypes.

there are no statistically significant differences in the respondents' responses ($p>0.05$). However, heterozygous carriers of the mutation c.-23+1G>A in the *GJB2* gene are more likely (79%) than people without this mutation (60%), agree that deafness is a hereditary disease (Fig. 1-B). To question number 2, "Do you think there is a probability of giving birth to a deaf child from hearing parents?" Heterozygous carriers of mutation c.-23+1G>A are half as rare (7.6%) than people without this mutation (18, 6%) answer "no" (Fig. 2-B). In addition, heterozygous carriers of the mutation c.-23+1G>A are uncertain in answering the question about the probability of producing a deaf child in themselves (Fig. 3-B). Such an answer can be explained by the presence of close or distant deaf / hard-of-hearing relatives, and thus carriers of the mutation c.-23+1G>A in the gene *GJB2* assume these risks in themselves. Perhaps, statistical results can be achieved by increasing the sample, and then this trend can be statistically confirmed.

Conclusion. Most young people think that a deaf child may be born to hearing parents (81.33%), but only 2.49% of respondents agree with this risk. In heterozygous carriers of the mutation c.-23+1G>A in the gene *GJB2*, there is a tendency to assume the hereditary nature of deafness more often than in people without this mutation.

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References

1. Barashkov N.A., Dzhemileva L.U., Posukh O.L., Solov'yev A.V., Bady-Hoo M.S., Pshennikova V.G., Terjutin F.M., Lobov S.L., Neustroyeva A.B., Kurtanov H.A., Vasil'yeva L.M., Fedotova Je. E., Rafailov A.M., Solov'yeva N.A., Kononova S.K., Alekseyev A.N., Fedorova S.A., Khusnutdinova Je.K. Analiz anketirovaniya roditeley detey-invalidov po

slukhu v Yakutii, Tyve i Bashkortostane: mneniye slyshashchikh roditeley o prichinakh poteri slukha u rebonka s posleduyushchim sravneniyem s rezul'tatami DNK-testirovaniya gena GJB2 (Sh26) [Analysis of the survey of parents of hearing-impaired children in Yakutia, Tuva and Bashkortostan: the opinion of hearing parents about the causes of hearing loss in the child, followed by a comparison with the results of DNA testing of the gene *GJB2* (Cx 26)] Meditsinskaya genetika [Medical genetics]. Moscow, 2014, V.13, №1, p.8-17 https://www.medgenjournal.ru/jour/issue/viewIssue/13/13

2. Barashkov N.A., Teryutin F.M., Pshennikova V.G., Solov'yev A.V., Fedorova S.A. Molekulyarno-geneticheskiye metody izucheniya nasledstvennykh bolezney na primere autosomno-retsessivnoy glukhoty 1 A tipa [Molecular genetic methods for studying hereditary diseases on the example of autosomal recessive deafness type 1 A] Izdatel'skiy dom SVFU [SVFU Publishing house]. Yakutsk, 2017.

3. Autosomal recessive deafness 1A (DFNB1A) in Yakut population isolate in Eastern Siberia: extensive accumulation of the splice site mutation IVS1+1G>A in *GJB2* gene as a result of founder effect / N.A. Barashkov [et al.] // Journal of Human Genetics. – 2011. – V.56. – N-8. – P. 631-639. DOI: 10.1038/jhg.2011.72

4. Associated with GJB2 Single Mutation IVS1+1G>A in the Yakut Population Isolate in Eastern Siberia / N.A. Barashkov [et al.] / PLoS One. - 2014. - Vol. 9(6). - e100848 DOI: 10.1371/journal.pone.0100848

5. Effect of Pre-test Genetic Counseling for Deaf Adults on Knowledge of Genetic Testing / Baldwin E.E [et al.] // J Genet Counsel. - 2012. - Vol. 21, №2. - P.256-272. DOI: 10.1007/s10897-011-9398-1

6. Middleton A. Prenatal diagnosis for inherited deafness: what is the potential demand? / A Middleton, J Hewison, R. Mueller // J Genet Couns 2001; 10: 121–131. https://www.ncbi.nlm.nih.gov/pubmed/11767801

7. Mitchel R.E. When parents are deaf versus hard of hearing: patterns of sign use and school placement of deaf and hard-of-hearing children / R.E. Mitchel, M.A. Karchmer. // J Deaf Stud Deaf Educ. - 2004; 9(2):133–152. DOI: 10.1093/deafed/enh017

8. Opinions of hearing parents about the causes of hearing impairment of their children with biallelic *GJB2* mutations / Solovyev A.V. [et al.] // Journal of Community Genetics. 2017. Jul;8(3):167-171. DOI: 10.1007/s12687-017-0299-3

9. A Prospective, Longitudinal Study of the Impact of GJB2/GJB6 Genetic Testing on the Beliefs and Attitudes of Parents of Deaf and Hard-of-Hearing Infants / C.G. Palmer, A. Martinez, M. Fox [et al.] // Am J Med Genet A. - 2009 - Vol. 149A, №6. - P.1169-1182 DOI: 10.1002/ajmg.a.32853

10. Schein JD. The deaf population of the United States / J.D. Schein, M.T. Delk // National Association of the deaf: 1–336 https://eric.ed.gov/?id=ED101517

11. Spectrum and Frequency of the *GJB2* Gene Pathogenic Variants in a Large Cohort of Patients with Hearing Impairment Living in a Subarctic Region of Russia (the Sakha Republic) / N.A. Barashkov, [et al.] // PLoS One. - 2016. - Vol. 11(5):e0156300. DOI: 10.1371/journal.pone.0156300

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ORGANIZATION OF HEALTH, MEDICAL SCIENCE AND EDUCATION

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ANALYSIS OF THE INFECTIOUS SERVICE IN THE REPUBLIC OF SAKHA (YAKUTIA)

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ABSTRACT

The main results of the infectious service were analyzed for the study of its state in the Republic of Sakha (Yakutia) during 2000-2017. Also there were given comparative characteristics with analogical indicators in the Russian Federation. According to results of 2017, the growth of morbidity in 12 infections was recorded in the Republic. Due to persisting unfavorable situation, the problem of realization of medical service to infectious patients demands to take system arrangements on deficit reduction of infectious diseases' specialists and infectious beds in hospitals; to increase financing of current medical care in the Republic of Sakha (Yakutia).

Keywords: infectious service, morbidity, infectious diseases, personnel, the death rate from infectious diseases.

Introduction

The epidemiological situation is intensive in the Republic of Sakha (Yakutia). The spread of the human immunodeficiency virus among the population and an increase in the cumulative number of infected and sick people are continuing; tuberculosis indicators have a steady downward trend. However, comparing with the average of Russian indicators, they continue to keep a sufficiently high level. The incidence of acute respiratory viral infections in the Republic of Sakha (Yakutia) is higher than the incidence rate in the Russian Federation by 45%, in the Far Eastern Federal District by 50%. Last two years expansion of the incidence of whooping cough and enterovirus infection is noted in the Republic, which is connected with contiguous cyclical rise in the incidence rate. In 2017, the incidence