



## Assessment of Individual Health of Russian Students from Different Social Groups

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### Authors' contributions

This work was carried out in collaboration between all authors. Authors SVM, SNP and KAV designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors LMZ and SIV managed the literature searches, analyses of the study performed the spectroscopy analysis and author NVB managed the experimental process. All authors read and approved the final manuscript.

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### ABSTRACT

The assessment of individual health with the use of various techniques allows to obtain more complete information on the functioning of the body. For productive studying and professional development students need to have good health, which, under the current socio-economic environment, is under a lot of stress. The purpose of the study is a comparative analysis of students health assessments obtained by different methods and among different social groups of young people. For the analysis, we use the results of comprehensive medical examinations of 633 students (18-22 years) of Nizhny Novgorod state University, Arzamas branch (231 boys and 402 girls) on the basis of Arzamas Health Centre. The survey included questionnaires, anthropometry, bioimpedance analysis, cardiointervalography. Comparative analysis of students from different social groups shows that the factor "place of residence" has a greater impact on health than family structure. Urban students have better indicators of physical health, caloric intake and body componential structure, than rural ones, but at the same time, they have higher tension of

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regulatory systems of the body. Despite the high self-assessment of health, the students have serious health problems. Complex medical examinations on the basis of the Health Center give the possibility to reveal all disorders and start the necessary treatment immediately.

*Keywords: Students; self-assessment of health; morbidity structure; family structure; place of residence; AIRS; caloric intake; body structure.*

## 1. INTRODUCTION

The leading indicator of individual health of students is the ability to adapt to changing internal and external environment [1,2]. Good individual health is a prerequisite for activity and self-affirmation, which are necessary for life program implementation and the achievement of personal well-being and happiness. A close correlation between health and education has been noted: the stronger students' health is, the more productive the studying will be [3,4].

Russian students do not consider their health as a kind of capital, which has to be preserved and increased, in order to bring its dividends in the future. According to sociological studies, young people put health on the first place in the hierarchy of life values and priorities, but do not take necessary measures for the preservation and increment of this capital. Among young people there is a low level of concern about health and no commitment to the strengthening and use of treatments of methods health resumption. The lack of medical and hygienic knowledge, the high level of study load, lack of free time and financial difficulties are considered to be the reasons [5]. It is especially noticeable among students from single-parent families and nonresident students. At the same time there is quite a high level of healthy lifestyle motivation. Among the surveyed students of Arzamas branch UNN, 24.7% of boys and 23.4% of girls from single-parent families have been identified; in most cases these are families with single mothers. It has been determined that 37.2% of boys and 32.7% of girls are nonresident students. According to the analysis of the number of students from single-parent families, depending on place of residence, urban students have 13.1% more such students than the young people from rural areas. As a state institution, this University, allows most students to study for free; this makes it affordable for those with social and economic difficulties [6,7].

In the practice of medical care of students most frequently used diagnostic methods are: self-assessment of health; assessment of health

according to the results of medical examinations; diagnosis of health by the indicators of functional reserves of a body [3].

Self-assessment of health may serve as an important indicator of state and dynamics of students' health in addition to objective medical research. It also reflects the subjective characteristics of a person, his satisfaction with life conditions and the certain quality result of social policy [3,8].

A number of researchers agree that it is necessary to carry out the work on overcoming negative tendencies in dynamics of a state of health and student youth's way of life, mainly at a stage of primary prevention which is focused on early identification of persons with risky behavior, and take measures to improve their way of life that can be made in the Health Centers [9,10].

A new program "Healthy Russia" devoted to the formation of a healthy lifestyle of adults has been realized since 2009 in our country. The Health Center is one of the first steps of implementation of the program. Doctors of the Health Centers make recommendations on a way of life of the person for the purpose of correction and recovery of the health. Measurement of human scale and weight, testing of psychophysiological and somatic health, functional and adaptive reserves of a body, study of cardiac performance, screening of blood vessels and calculation of an ankle-brachial index, determination of level of the general cholesterol and glucose in blood, an assessment of function of external breath, definition of a component of structure of a body taken by method of bioimpedansmetriya are held in the Health Center [11,12].

Health Centers are important and necessary as they help to prevent diseases and reveal them at an early stage. The educational institutions cooperating with the Health Centers to preserve and promote health of the students are recognized as optimum adaptive models of the educational organization regarding health protection of schoolchildren and students [13].

Diagnostics of health with the application of various techniques allows receiving more informative assessment about it, and also to reveal the social factors having the modulating impact on a state of health of students in the conditions of intensification of modern educational process.

**Aim of the research is** to conduct a comparative analysis of students' health assessments obtained by different methods and among different social groups of young people.

## 2. METHODS AND MATERIALS

The research was held after obtaining a positive decision of the local ethical committee of Lobachevsky University of Nizhni Novgorod and written informed consent of 633 students (231 young men and 402 girls) of 18-22 years of age. The participants of the research are students of 1-4 courses of Arzamas Branch of Lobachevsky University of Nizhni Novgorod where more than three thousand people are studied. The health level was determined by the results of the preventive medical examination in the Health Center. It included the following methods:

### 1. Questionnaire

- The subjective assessment of health was made by means of the standard questionnaire "Health Subjective Assessment" including 29 questions. The state of health was estimated in points: "excellent" 0-3 points, "good" 4-8 points, "satisfactory" 9-12 points, "bad" – more than 12 points. Value 6,01 points was accepted as a normal average value [3];
- To reveal the features of a students' diet "The Questionnaire of the Analysis of Food Consumption Frequency" has been used. The method allows defining how often the concrete product is often consumed for a certain period, and calculating the provision of a body with nutrients and calorific capacity of a diet [14].

**2. Anthropometry** (weight and length of the body, chest circumference, systolic and diastolic blood pressure, heart rate, lung capacity, dynamometry) [15].

**3. Bioelectrical impedance analysis (BIA)** (determination of absolute and percentage of fat, lean and active cell mass of a body, water, basal metabolism); [16,17].

**4. Cardiointervalography** (determination of indicators of variability of a rhythm of heart using the computer program of health level assessment "Rhythm-express" included in the list of the standard and certified equipment of the Health Center). Diagnostics of a functional condition of cardiovascular system was performed with the use of the change in vegetative balance in accordance with the level of activation of the sympathetic link which is a non-specific component of the adaptive reaction in response to a variety of stress stimulations through the calculations of the activity index of regulatory systems (IARS).

The technique of definition of the index of activity of the regulatory systems (IARS) is developed by R.M. Bayevsky and has no analogs in foreign researches. It is calculated in points from 1 to 10 and focuses on static indicators, the indicators of the histogram and the data of spectral analysis [1,18]. In accordance with the analysis of AIRS values, following functional states have been diagnosed (for clarity, presented in the form of a "traffic light"):

Green means, that everything is all right; no special measures for prevention/treatment are necessary (Norm, AIRS=0-3).

Yellow shows the necessity of high attention towards health. Here prevention/treatment measures are necessary (AIRS=4-7).

Red color shows that serious measures are to be taken. First of all, proper diagnostics, after which – required treatment is necessary (AIRS=8-10).

Quantitative assessment of physical health level was calculated using the methods of G.L. Apanasenko. The method considers such characteristics of a human body as body weight, length of a body, lung capacity, heart rate, blood pressure, hand dynamometry. Indexes are calculated on the basis of these indicators and the number of points is counted. By the number of the gained points each individual can be referred to one of the groups with various health level – low, below an average, average, above an average and high [19].

Measurements are made on the certified and regularly calibrated equipment with observance of accurate criteria of an exception, namely: availability at the time of inspection of sharp diseases or an exacerbation of chronic diseases, pregnancies, and also refusal from inspection.

In accordance with the results of the study, a personalized database, statistical analysis using "EXCEL v8.00" and "BIOSTAT" office programs, has been created. To perform the objectives of the study, methods of variation statistics, methods of estimation of authenticity of results (Student criteria (t-test) and  $\chi^2$ ) have been applied, with the confidence interval of  $p < 0.05-0.001$  [20].

### 3. RESULTS OF THE RESEARCH

The results of the "Subjective health assessment" test showed that in most cases students give a positive assessment of their health: 42,0% of students assessed their health as "good", 58,0% - "satisfactory"; "bad health" evaluations were not received. The average health assessment rate ( $M \pm \sigma$ ) by the "HEALTHY-UNHEALTHY" scale (0-29 points) was  $5.5 \pm 2.79$  among boys and  $6.2 \pm 3.22$  among girls. The most frequent complaints were the following:

- Sometimes there is sleep loss because of excitement (63,1%);
- Vision has become lower during recent years (46,4%);
- Changes in the weather also have an impact on health (34,8%);
- Sometimes dizziness happens (33,7%).

It was revealed that city young men give the best assessment to the health, than young men from

rural areas. There is an opposite tendency with the city girls. Girls and young men from full families estimate the health more positively, than students from lonely families (Table 1).

Assessment of the students' health state, done in accordance with the results of medical examinations, lets us analyze the prevalence of morbidity among students (Table 2). In Arzamas branch of Nizhny Novgorod state University monitoring of the morbidity among students is done in the context of the teachers and students' research work.

During the period of the study, the most common are eye diseases. Up to this moment, the reduction in circulatory and the digestive system diseases. However, the level of musculoskeletal and respiratory diseases has become higher. An increase in numbers of students with no diseases or physical defects has also been revealed.

Measurement of anthropometrical indicators of physical development is taken in the Health Center during medical examinations of students. The results of measurements with factors "place of residence" and "structure of a family" are presented in Table 3. To make a comparative analysis, indicators of students of 18 years of age were used as this group is the most numerous group among the participants taken part in the checkup (103 young men and 216 girls).

**Table 1. Students' health self-assessment indicators ( $M \pm \sigma$ )**

Place of residence				Family structure			
Male		Female		Male		Female	
Urban students	Rural students	Urban students	Rural students	Two-parent family	Single-parent family	Two-parent family	Single-parent family
5,2±3,01	5,7±2,57	6,3±3,25	6,0±3,20	5,3±3,02	5,5±2,38	6,0±3,06	6,5±3,56
P = 0,048		P = 0,188		P = 0,430		P = 0,033	

**Table 2. Analysis of morbidity structure among students, 2009-2016 (%)**

Functional defect, disease	2009	2011	2014	2016
Endocrine diseases	4,1	3,5	1,5	2,4
Diseases of the nervous system	5,7	14,1	11,9	14,1
Eye diseases	25,1	33,4	28,6	31,1
Ear diseases	-	0,8	0,3	1,1
Circulatory system diseases	15,3	14,7	5,1	2,2
Respiratory diseases	2,5	2,1	12,4	14,8
Diseases of the digestive system	18,4	22,7	4,7	3,9
Musculoskeletal diseases	13,6	14,2	23,6	24,1
Genitourinary diseases	-	1,3	1,9	1,1
No diseases or functional defects	15,3	12,1	20,7	18,8

**Table 3. Anthropometrical indicators of physical development of students of 18 years of age, M±σ**

Indicators physical development	Male		Female	
	Family structure			
	Two-parent family	Single-parent family	Two-parent family	Single-parent family
length of the body (cm)	177,3±5,16	178,2±4,32	165,7±5,82	163,2±4,63*
Weight of the body (kg)	70,3±6,44	71,9±5,96	59,4±4,38	58,8±4,14
Chest circumference (cm)	91,4±7,46	95,4±6,97*	83,3±5,52	82,2±4,87
Vital capacity of lungs (l)	4,4±0,69	4,1±0,75*	2,96±0,47	2,82±0,51
Dynamometry (kg)	35,1±6,02	36,0±6,35	18,9±4,95	17,7±5,14*
Means heart rate	74,1±4,77	75,6±8,34	78,4±5,11	77,7±5,43
Systolic blood pressure (mm Hg)	121,9±5,67	121,1±5,95	113,1±5,99	114,8±4,21*
Diastolic blood pressure (mm Hg)	74,4±6,22	74,3±6,57	71,4±4,05	72,5±3,70

  

Indicators physical development	Place of residence			
	Urban students	Rural students	Urban students	Rural students
	Length of the body (cm)	178,8±4,11	177,1±4,23*	166,6±5,21
Weight of the body (kg)	73,3±5,91	70,8±5,88*	57,8±5,49	60,4±5,55*
Chest circumference (cm)	94,7±6,62	92,2±6,50	81,3±6,03	85,0±4,24*
Vital capacity of lungs (l)	4,4±0,71	4,11±0,68*	2,87±0,47	3,12±0,54*
Dynamometry (kg)	36,6±5,08	34,5±5,13*	18,2±5,15	19,2±4,14*
Means heart rate	75,4±4,26	74,8±5,29	78,7±7,11	77,1±8,43
Systolic blood pressure (mm Hg)	122,5±4,75	120,1±4,77*	116,0±4,81	114,4±4,66*
Diastolic blood pressure (mm Hg)	75,2±6,48	73,8±6,75	74,5±4,28	74,7±4,08

Note: \* - differences between paired groups are valid for  $p < 0.05$

During the research the reliable distinctions between the students living in city and rural areas almost on all anthropometrical indicators are revealed except heart rate and diastolic blood pressure. The distinctions caused by a family membership aren't so considerable.

The assessment of students' health by the method of G. L. Apanasenko has revealed that

more than half of young men and women (82.5%) have average and high levels of physical cal health (Table 4).

For identifying the functional state and degree of tension of regulatory systems, activity index of regulatory systems (AIRS) study has been conducted among girls and boys of different social groups (Table 5).

**Table 4. Distribution of students by physical health level (acc. to G.L. Apanasenko), %**

Health level	All students	Place of residence		Family structure	
		Urban students	Rural students	Two-parent family	Single-parent family
Low	7,6	8,1	6,4	7,5	7,0
Below average	11,1	7,2	13,0	11,0	8,4
Average	34,4	29,8	41,9	34,9	33,3
Above average	35,3	45,4	27,0	35,3	39,4
High	11,6	11,5	11,7	11,3	11,8
Statistics:		$\chi^2 = 9,65$ $p = 0,0127$		$\chi^2 = 0,50$ $p = 0,9735$	

**Table 5. Student distributing according to AIRS (%)**

AIRS indicators	All students	Place of residence		Family structure	
		Urban students	Rural students	Two-parent family	Single-parent family
AIRS =0-3	44,4	36,1	48,2	54,9	33,7
AIRS =4-7	44,5	47,4	41,0	41,0	51,5
AIRS =8-10	11,1	16,5	6,8	4,1	14,8
Statistics:		$\chi^2 = 19,86$ $p = 0,0109$		$\chi^2 = 31,96$ $p = 0,0001$	

**Table 6. Body component structure and caloric intake indicators, (M±σ)**

	All students		Place of residence				Family structure			
	Male	Female	Male		Female		Male		Female	
			Urban students	Rural students	Two-parent family	Single-parent family	Two-parent family	Single-parent family	Two-parent family	Single-parent family
KCAL, per day	2622,4± 927,89	2303,6 ± 836,53*	2658,8± 911,97	2577,5± 973,18	2202,3± 843,59	2452,9± 809,82*	2586,8± 938,29	2690,9± 941,06	2227,2± 740,04	2462,5± 818,14*
FM, %	19,2± 3,35	26,5± 2,71*	18,9± 3,23	19,5 ± 3,58	26,5± 2,51	26,3±1,99	19,6± 3,05	17,9± 4,48*	26,4± 2,35	26,7± 2,33
BCM, %	53,4± 2,53	48,5± 2,24*	53,2± 2,65	53,6± 2,52	48,5± 3,02	48,5± 1,38	53,2± 2,34	54,2± 2,55*	48,7± 1,44	47,9± 2,97*
BasMet, kcal	1829,8± 229,27	1467,4± 156,21*	1888,8± 238,68	1770,8± 207,44*	1448,0± 148,91	1495,7± 163,32	1818,7± 227,39	1847,5± 237,07	1467,4± 155,89	1467,2± 158,48

Note: KCAL – Caloric content of daily ration, FM – Fat mass,

BCM– Body cell mass, BasMet – Basal metabolism

\* - differences between paired groups are valid for  $p < 0.05$

Using the information from the "Feeding frequency questionnaire" and the Bioelectrical impedance analysis data, a comparative analysis of the average values of caloric content of daily ration, basal metabolism and the percentage of fat and active cell mass among students of different social groups, has been conducted (Table 6).

Statistically the basal metabolism of urban young men is 118 kcal higher than of the rural ones. Urban girls and girls from full families have 235-250 kcal lower than rural girls and girls from single-parent families. Male students with two parents, have a high content of fat mass (1.7%) and a smaller fraction of active cell mass (1.0%). The indicators of active cell mass of the girls from full families is also higher (0.8%). Differences in all parameters between male and female students are statistically different.

#### 4. DISCUSSION

Researches devoted to the study of students' health demonstrates that the problem is the most urgent for society and the country. In this connection the state support of health and formation of a healthy lifestyle, including development and realization of system of health protection of students is necessary.

In Novak's researches [4] it is revealed that shortcomings of the organization of educational activity of students in the conditions of essential growth of professional information affect the way of life of the students. In particular, Novak showed that more than a third of students have various violations of hygienic requirements to a healthy lifestyle. It includes both inobservance of regular hours, balanced diet, rest, and existence of addictions. Violation of a dietary regime is most often shown in lack of breakfast and reduction of a number of meals a day. The decrease in the general daily caloric content of food connected with a lack of proteins and carbohydrates, decrease concerning standard of the contents of phosphorus and iron, deficiency of vitamins C and B is revealed.

According to Malkova (1992) and Emelyanenko's researches (2003) it is proved that the probability of successful adaptation to training conditions in the university is higher while observing the following conditions:

1) Regular physical culture trainings;

- 2) Compliance of the organization of work and day regimen to hygienic requirements;
- 3) Psychological comfort in relationship in a group and a family;
- 4) Observance of the principles of a balanced diet.

The correct organization of work and rest considerably reduces tension of students' adaptation, 51,6% from them pass into group of the adapting students. In 45,7% of cases such transition is promoted by optimization of the mode and quality of food, in 44,0% – increase in level of physical activity is observed [5].

One of the most objective criteria for evaluation of a state of health of the person is the level of his physical development. The first standards of physical development of students developed in 1964 by the laboratory staff on scientific control of physical development at the State central institute of physical culture showed that the number of students with the average level of physical development decreases at graduation, more than two thirds have disharmonious physical development. Higher incidence with temporary disability is found [5].

The data of modern researches confirm these tendencies. In Uskov's [9] researches it is shown that 17,4% of young men and 11,6% of young girls do physical culture and sport systematically besides obligatory lessons at the university. There are significant differences in a way of life and high incidence of disease high incidence of disease of students depending on the level of physical activity. Among students with the low level of physical activity the number of smokers from 34,5% on the 1<sup>st</sup> course increases up to 48,5% on the 5th course, among those doing sports the number of smokers decreases from 14,5% to 10,2%. Catarrhal diseases met with the students who did not do sports more often: 49,3% were ill once; 31,5% were ill twice and 19,2% were ill three times. With the students doing sports, this indicator makes respectively 14,7%; 7,1%; 5,3%. 40% of students have the expressed violations of the musculoskeletal device, including 20,7% of those who have scoliosis. The growth of violations of the musculoskeletal device is noted with the senior students. Mostly, this pathology is inherent in male students. Increase in dynamics of initial physiometric indicators within the first two years of training at the university is characteristic, further the tendency to decrease in sizes of vital capacity of lungs with female students, the

dynamometer force of muscles of a brush and a back with students of both sexes is observed.

In recent years the increase of activity of preventive work among students in Russia is noted. Many higher education institutions have intra- and interuniversity polyclinics with a necessary set of experts and corresponding diagnostic and therapeutic equipment. The system of high school preventative clinic revives in the country. Medical check-up of students is becoming obligatory.

"Passports of professional psychophysical readiness of future specialists", "passports of health" and other standard indicators allowing to raise health reserves of the students have been developed for the last 10-15 years in a number of higher educational institutions of Russia. For example, the department of physical training of Russian state university of oil and gas in Moscow has been carrying out monitoring of health level for a row of years and has been studying the influence of various means and methods of physical training on "somatic health" of students [5].

A monitoring of physical health of students with application of specially developed "Students' Health Journals" including total estimates of the social status, physical development and a state of health of the student while training at the university is carried out in Arzamas branch of Lobachevsky University. "Students' Health Journals" contains advisory information on the formation of a healthy lifestyle taking into account individual indicators and features of student's development. Annually students of the university have complex preventive inspections in the Health Center. In medical care practice of physical training and research of students at the university various methods of diagnostics of health of young men and girls are used:

- Health self-assessment;
- An assessment of health state by the results of medical examinations;
- An assessment of health state on integrated biological age;
- Diagnostics of health on indicators of functional reserves of a body.

1. **The self-assessment of health** is rather an objective method as the answer to a question of health reflects an objective condition of a body to a greater or lesser

extent. Almost equally students have estimated their health as "good" and "satisfactory".

2. **Assessment of a health state of students by the results of medical check-ups** which has allowed revealing the greatest prevalence among students of violations of sight and diseases of eyes, diseases of nervous system, bone and muscular system and respiratory organs.

According to Rajevski and Kanishevsky [3], mostly wide-spread diseases among students are the diseases of locomotion system, cardiovascular and diseases of eyes. Recently among young people studied at the higher education institution an increase in various mental disorders promoted by poor quality of life, considerable psychoemotional loadings, stressful situations which appear during students' study and activity is noted.

3. **Health level assessment by means of definition of biological age.** It is calculated on the basis of the data of a self-assessment of the health, indicators of arterial pressure, static balancing, a breath delay (for young men), body weights (for girls). The biological age on which makes it possible to judge about the rate of aging and worn physiological functions of the human body of the surveyed is a very informative indicator of young people health. According to the researches done earlier it is revealed that 48,4% of young men and 41,7% of young girls have accelerated aging, and respectively, poor health. At the same time there are 5,0% more representatives among young men among young men with sharply accelerated aging in comparison with that among young girls. Young girls with a slow rate of aging are 7,2% more, than the young men [21].

4. **Diagnostics of health according to the indicators of functional reserves of a body** is carried out on the basis of indicators of activity of regulatory systems assessment according to Bayevsky and the level of manifestation of functions of a body according to Apanasenko. Following the results of the last method revealed that there are more than a half of young men and girls have average and high levels of physical health [21]. Statistically significant differences of physical health of students living in different localities have been revealed. Among rural students there are



4.1% more students with "low" and "below average" levels of health; among urban students - 18.2% more with "high" and "above average" levels. Gender differences and differences in health between students with one or two parents, are minor and not significant.

It has been revealed that 44.5% of the students are in a state of moderate and significant tension of regulatory systems, while for adaptation to environmental conditions the organism requires additional functional reserves. Such conditions occur in the process of adaptation to labor activity, during emotional stress or under the influence of unfavorable environmental factors (AIRS=4-7). Students need to pay more attention to their health, curative and preventive measures are recommended. 11.1% of the diagnosed are in the state of overstrain of regulatory systems, which is characterized by insufficiency of protective and adaptive mechanisms, their inability to provide adequate reaction of the organism to the influence of environmental factors. Here the excessive activation of the regulatory systems as not underpinned by an appropriate functional reserves (AIRS=8-10). Students need serious measures towards their health, which means a comprehensive diagnosis and treatment of possible diseases.

44.4% of the students have good health, not requiring any additional interventions, i.e., the optimal tension of regulatory systems, necessary to maintain an active balance of organism with the environment (AIRS=0-3).

Significant differences, caused by social factors have been revealed: students from rural areas, as well young people from two-parent families have the highest indicators of functional status and degree of tension of regulatory systems of the body (Table 5).

## 5. CONCLUSION

1. The indicators of health self-assessment among students are high, which is typical for young people. They do not worry much about strengthening their health, neither pay attention to first symptoms, which warn about possible disorders.
2. Eye, musculoskeletal and respiratory diseases are the most frequent among students.
3. Physical health assessment shows that more than half of the students have

average and high indicators of functional abilities.

5. According to AIRS data, 11.1% of the students need thorough diagnostics for revealing functional disorders and preventing potential diseases.
6. The comparative analysis of students from different social groups shows that such factor as "place of living" is more significant for health state, than "family structure". Urban students have higher physical health indicators, caloric intake and body componential structure, than rural ones.

Thus, despite the high self-assessment of health, students have serious health problems. Complex medical examinations on the basis of the Health Center give the possibility to reveal all disorders and start the necessary treatment immediately.

The analysis of references and our own researches convincingly show that the solution of the problem of students' health in Russia has important social value.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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