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Prevalence of gastroesophageal reflux disease symptoms in school-age children

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ABSTRACT. ***Introduction.*** The Montreal Consensus Meeting defined gastroesophageal reflux disease as a condition that develops when reflux of gastric contents causes bothersome symptoms and/or complications. The global prevalence of gastroesophageal reflux disease is 13.3% and continues to increase. Data on the prevalence of gastroesophageal reflux disease in the pediatric population are significantly scarcer. Study. ***Aim*** – to study the prevalence of gastroesophageal reflux disease symptoms in school-aged children using the Gerd-Q questionnaire. ***Materials and methods.*** A study was conducted to assess the prevalence of gastroesophageal reflux disease symptoms among schoolchildren in Barnaul. The study included 291 schoolchildren, including 131 boys (45.0%) and 160 girls (55.0%), studying in grades 7–11 of comprehensive schools. The validated Gerd-Q questionnaire was used to quantitatively assess the prevalence of gastroesophageal reflux disease symptoms in the pediatric population. The statistical significance of differences in qualitative characteristics was assessed using the Pearson χ^2 goodness-of-fit test. Differences at $p < 0.05$ were considered significant. ***Results.*** According to a study of gastroesophageal reflux disease symptoms conducted using the Gerd-Q questionnaire, the prevalence of gastroesophageal reflux disease in school-aged children was 8.2%. Heartburn and regurgitation, with a frequency of at least once a week, were reported by 19.6% and 35.7% of schoolchildren, respectively. Nocturnal gastroesophageal reflux disease symptoms were observed in 2.7% of schoolchildren. Periodic self-administration of antacids to relieve symptoms was used by 4.1% of those surveyed. ***Conclusion.*** The use of the Gerd-Q questionnaire allows to improve the frequency of detection of gastroesophageal reflux disease symptoms, and the most frequent, among school-age children, is determined by heartburn, which bothers boys predominantly.

KEYWORDS: *gastroesophageal reflux disease, children, Gerd-Q questionnaire*

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Распространенность симптомов гастроэзофагеальной рефлюксной болезни у детей школьного возраста

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РЕЗЮМЕ. ***Введение.*** Монреальское консенсусное совещание определило гастроэзофагеальную рефлюксную болезнь как состояние, развивающееся, когда рефлюкс содержимого желудка вызывает беспокоящие симптомы и/или осложнения. Общемировая распространенность гастроэзофагеальной рефлюксной болезни составляет 13,3% и продолжает расти. Данных о распространенности гастроэзофагеальной рефлюксной болезни в педиатрической популяции значительно меньше. ***Цель исследования*** – установить распространенность симптомов гастроэзофагеальной рефлюксной болезни у детей школьного возраста с помощью опросника Gerd-Q. ***Материалы и методы.*** Проведено исследование распространенности симптомов гастроэзофагеальной рефлюксной болезни среди школьников города Барнаула. В исследование включен 291 школьник, из них 131 мальчик (45,0%) и 160 девочек (55,0%), учащиеся 7–11 классов общеобразовательных учреждений. Для количественной оценки распространенности симптомов гастроэзофагеальной рефлюксной болезни в детской популяции применяли валидированный опросник Gerd-Q. Статистическая значимость различий качественных признаков оценивалась с использованием критерия согласия χ^2 Пирсона. Различия при $p < 0,05$ расценивали как значимые. ***Результаты.*** По данным исследования симптомов гастроэзофагеальной рефлюксной болезни, проведенного с применением анкеты Gerd-Q, распространенность гастроэзофагеальной рефлюксной болезни у детей школьного возраста составила 8,2%. Жалобы на изжогу и регургитацию с частотой не менее 1 раза в неделю предъявляли 19,6 и 35,7% школьников. Ночные симптомы гастроэзофагеальной рефлюксной болезни отмечались у 2,7% школьников. К периодическому самостоятельному приему антацидов для купирования симптомов прибегали 4,1% обследованных. ***Заключение.*** Использование анкеты Gerd-Q позволяет увеличить частоту выявления симптомов гастроэзофагеальной рефлюксной болезни, причем наиболее частым среди симптомов определяется изжога, которая беспокоит преимущественно мальчиков.

КЛЮЧЕВЫЕ СЛОВА: *гастроэзофагеальная рефлюксная болезнь, дети, анкета Gerd-Q*

Источник финансирования. Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

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INTRODUCTION

The Montreal Consensus Meeting defined gastroesophageal reflux disease (GERD) as a condition that develops when reflux of stomach contents causes bothersome symptoms and/or complications. Common esophageal signs and symptoms include peptic stricture, esophageal ulcer, Barrett's esophagus, esophageal adenocarcinoma, retrosternal pain, heartburn, regurgitation, and dysphagia [1, 2]. The prevalence of GERD among the adult population is high and continues to rise. The highest prevalence of GERD symptoms was observed in a single study in Central America (19.6%), while the lowest was in Asia (10.0%; 23 studies), particularly in Southeast Asia (7.4%; 18 studies) [3]. The global prevalence of GERD is 13.3% (95% CI 12.0–14.6) [3]. The prevalence is higher among individuals over 50 years of age (OR 1.32; 95% CI 1.12–1.54) [4].

There is significantly less data on the prevalence of GERD in the pediatric population [5]. According to the results of some studies, the prevalence of GERD symptoms among school-aged children and adolescents may be comparable to that in adults. For example, the prevalence of heartburn in the "weekly" category among adolescents, according to data from Novosibirsk authors for 2009, was 6.9% among boys, 4.4% among girls, and 5.5% overall [6]. The prevalence of troublesome heartburn in the school-age population of Krasnoyarsk was reported as 10.4% in one study; other GERD symptoms—a sensation of acidity and/or bitterness in the throat, regurgitation, and difficulty swallowing — were observed less frequently and were associated with heartburn in most patients; heartburn was reported 1.4 times more often in boys than in girls, and 1.6 times more often in older schoolchildren than in younger schoolchildren [7]. According to other data, 21.3% of schoolchildren experienced heartburn at least once in the past year. Heartburn was significantly more common among boys than among girls. The prevalence of heartburn was 26.2% among older school-aged children and 14.3% among younger school-aged children. Weekly heartburn was reported in 2.7% of children [8]. In a survey of older children and adolescents, the frequency of typical subjective manifestations of GERD was 19.4% (95% CI 17.7–21.1%); sour belching was the most common symptom (in 8.2% (95% CI 7.0–9.4) of the examined children and adolescents, heartburn (in 7.4% (95% CI 6.3–8.6) of respondents), and regurgitation (in 7.3% (95% CI 6.2–8.4) [9]. In a survey of 55 adolescents in the Republic of Belarus, clinical symptoms of GERD of varying duration were identified in 65% (95% CI 51.4–77.8) of the 17-year-old adolescents surveyed. Based on diagnostic clinical criteria, GERD was diagnosed in 3.6% of cases (95% CI 0.4–12.5) [10].

When planning a survey, the choice of questionnaire is crucial. One of the tools used to diagnose GERD is the GERD-Q questionnaire. In adult patients, the GERD-Q questionnaire has a sensitivity of 65.4% and a specificity of 91.7% [11]. Another study showed that the most satisfactory results for detecting erosive esophagitis in school-aged children were obtained using the GERD-Q questionnaire with a cutoff score of 8; in this case, sensitivity and specificity were 64.1% and 82.9%, respectively [12]. The prevalence of GERD can also be studied based on endoscopic findings. In 2008, a large-scale study was conducted involving 7,188 children and adolescents under the age of 17 (mean age 12.7±4.9 years); erosive esophagitis was detected in 12.4% of them. Its prevalence increased with age, reaching 19.6% by age 17 [13]. In another study, during fibrogastroscopy of 2,935 children with symptoms of dyspepsia aged 7 to 18 years, changes consistent with epithelialized esophageal erosions were detected in 20.2%, and non-epithelialized erosions in an additional 7.6% of children. Among patients with erosive esophagitis across all age groups, stage A according to the Los Angeles classification was predominant — 67.1% of children, stage B — 28.4%, stage C in only 3.5% of those examined; erosive changes in the esophagus were more common in boys, and the proportion of children with erosive esophagitis was similar across all age groups from 7 to 18 years [14].

Thus, the data on the prevalence of GERD in children are inconclusive and require further research in this area.

AIM

To investigate the prevalence of symptoms of gastroesophageal reflux disease in school-aged children using the GERD-Q questionnaire.

MATERIALS AND METHODS

A study was conducted on the prevalence of GERD symptoms among schoolchildren in Barnaul. Surveys

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were conducted in each of the four administrative districts. In each district, a school and a class were selected by random draw. A total of 400 questionnaires were distributed; of these, 109 were incomplete or incorrectly filled out and were therefore excluded from the study. Thus, the analysis included data from 291 schoolchildren, of whom 131 were boys (45.0%) and 160 were girls (55.0%), students in grades 7–11 of general education institutions. The mean age of the surveyed children was 15.3±1.25 years. The inclusion criteria for the study were:

- school-age;
- enrollment in a general education school;
- the presence of informed voluntary consent for children's participation in the study.

To quantitatively assess the prevalence of GERD symptoms in the pediatric population, the validated GERD-Q questionnaire (Russian-language version) was used. It is based on six indicators: "heartburn," "regurgitation," "pain," "nausea," "nocturnal GERD symptoms," and "use of medications to relieve heartburn." A score of 8 points or more serves as the basis for a diagnosis of GERD. The statistical significance of differences in qualitative characteristics was assessed using Pearson's χ^2 test. Differences at $p < 0.05$ were considered significant.

RESULTS

According to international consensus and Russian clinical guidelines, the main clinical manifestations of GERD are heartburn and regurgitation. When evaluating the survey results, 57 out of 291 (19.6%) school-aged children experienced heartburn, with an equal frequency among boys—24 out of 131 (18.3%) — and girls — 33 out of 160 (20.6%), p=0.623. Heartburn occurring at least once a week was reported by 43 out of 291 (14.8%) respondents, with 17 out of 131 (13.0%) boys and 26 out of 160 (16.3%) girls, p=0.434. Complaints of heartburn occurring 2–3 times a week were reported by a significantly smaller number of children: 13/291 (4.5%), 6/131 (4.6%) among boys, and 7/160 (4.4%) among girls, p=0.933. Frequent heartburn 4–7 times a week was observed in only one boy — 1/291 (0.3%). The data are presented in Table 1.

Complaints of regurgitation were reported by 104/291 (35.7%) of the examined schoolchildren, which is nearly twice as common as heartburn. Boys reported this symptom slightly more often — 54/131 (41.2%) — than girls — 50/160 (31.3%), p=0.078. Regurgitation at least once a week was experienced by 76/291 (26.1%) children; boys also reported it slightly more often — 40/131 (30.5%) — than girls — 36/160 (22.5%), p=0.121. Regurgitation 2–3 times a week was reported by 21/291 (7.2%) schoolchildren, with boys accounting for 12/131 (9.2%) and girls for 9/160 (5.6%), p=0.247. Complaints of frequent regurgitation were reported by 7/291 (2.4%) children, girls — 5/160 (3.1%), boys — 2/131 (1.5%), p=0.376. The results are presented in Table 2.

Less prominent symptoms of GERD include abdominal pain and nausea, as reflected in the GERD-Q questionnaire scoring. The total number of children reporting abdominal pain was 98/291 (33.7%); girls reported it significantly more often — 68/160 (42.5%) — than boys — 30/131 (22.9%), p <0.001. At least once a week, 66 out of 291 (22.7%) children experienced abdominal pain, with girls accounting

Table 1. Proportion of schoolchildren complaining of heartburn

Таблица 1. Доля школьников, предъявляющих жалобы на изжогу

Пациенты Patients	Проявление симптома Symptom manifestation			
	симптом отсутствует there is no symptom	1 раз в неделю once a week	2–3 раза в неделю 2–3 times a week	4–7 раз в неделю 4–7 times a week
Мальчики Boys (n=131)	107/131 (81,7%)	17/131 (13,0%)	6/131 (4,6%)	1/131 (0,8%)
Девочки Girls (n=160)	127/160 (79,4%)	26/160 (16,3%)	7/160 (4,4%)	0/160 (0,0%)
Всего Total	234/291 (80,4%)	43/291 (14,8%)	13/291 (4,5%)	1/291 (0,3%)
p_{1-2}	0,623	0,434	0,933	0,269

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ISSN 3034-6312 (Print) ISSN 3034-6320 (Online)

Table 2. Proportion of schoolchildren complaining about regurgitation

Таблица 2. Доля школьников, предъявляющих жалобы на регургитацию

Пациенты Patients	Проявление симптома Symptom manifestation			
	симптом отсутствует there is no symptom	1 раз в неделю once a week	2–3 раза в неделю 2–3 times a week	4–7 раз в неделю 4–7 times a week
Мальчики Boys (n=131)	77/131 (58,8%)	40/131 (30,5%)	12/131 (9,2%)	2/131 (1,5%)
Девочки Girls (n=160)	110/160 (68,8%)	36/160 (22,5%)	9/160 (5,6%)	5/160 (3,1%)
Всего Total (n=291)	187/291 (64,3%)	76/291 (26,1%)	21/291 (7,2%)	7/291 (2,4%)
p_{1-2}	0,078	0,121	0,247	0,376

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Table 3. Frequency of abdominal pain syndrome in school-age children

Таблица 3. Частота абдоминального болевого синдрома у детей школьного возраста

Пациенты Patients	Проявление симптома Symptom manifestation			
	симптом отсутствует there is no symptom	1 раз в неделю once a week	2–3 раза в неделю 2–3 times a week	4–7 раз в неделю 4–7 times a week
Мальчики Boys (n=130)	101/131 (77,1%)	21/131 (16,0%)	7/131 (5,3%)	2/131 (1,5%)
Девочки Girls (n=160)	92/160 (57,5%)	45/160 (28,1%)	18/160 (11,3%)	5/160 (3,1%)
Всего Total	193/291 (66,3%)	66/291 (22,7%)	25/291 (8,6%)	7/291 (2,4%)
p_{1-2}	<0,001	0,015	p=0,074	0,376

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Table 4. Proportion of schoolchildren complaining of nausea

Таблица 4. Доля школьников, предъявляющих жалобы на тошноту

Пациенты Patients	Проявление симптома Symptom manifestation			
	симптом отсутствует there is no symptom	1 раз в неделю once a week	2–3 раза в неделю 2–3 times a week	4–7 раз в неделю 4–7 times a week
Мальчики Boys (n=130)	98/131 (74,8%)	25/131 (19,1%)	6/131 (4,6%)	2/131 (1,5%)
Девочки Girls (n=160)	86/160 (53,8%)	39/160 (24,4%)	28/160 (17,5%)	8/160 (5,0%)
Всего Total	184/291 (63,2%)	64/291 (22,0%)	34/291 (11,7%)	10/291 (3,4%)
p_{1-2}	<0,001	0,279	<0,001	0,123

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for 45 out of 160 (28.1%), which was also significantly more common than in boys – 21 out of 131 (16.0%), p=0.015. Abdominal pain was observed in 25/291 (8.6%) children 2–3 times a week; it was also slightly more common in girls – 18/160 (11.3%) – than in boys – 7/131 (5.3%), p=0.074. Frequent abdominal pain was noted in only 7/291 (2.4%) of those examined, with equal frequency among boys – 2/131 (1.5%) – and girls – 5/160 (3.1%), p=0.376. The results are presented in Table 3.

The total number of children who reported nausea was 107 out of 291 (36.8%), with a higher proportion of girls – 74 out of 160 (46.3%) – than boys – 33 out of 131 (25.2%) – p <0.001. At least once a week, 64 out of 291 (22.0%) schoolchildren reported nausea, with an equal frequency among boys – 25 out of 131 (19.1%) – and girls – 39 out of 160 (24.4%), p=0.279. More frequent episodes of nausea (2–3 times a week) were reported by 34/291 (11.7%) respondents, with girls reporting it significantly more often – 28/160 (17.5%) – than boys – 6/131 (4.6%), p <0.001. A small number of schoolchildren – 10/291 (3.4%) – reported frequent episodes of nausea, occurring 4–7 times a week; among girls – 8/160 (5.0%), among boys – 2/131 (1.5%), p=0.123. The data are presented in Table 4.

In addition, to more accurately assess the likelihood of gastroesophageal reflux disease, the GERD-Q questionnaire includes an assessment of nocturnal symptoms of the disease and the frequency of self-administration of antacids and other medications to relieve heartburn. Nocturnal GERD symptoms in children were noted in only 8/291 (2.7%) children, with equal frequency among boys – 4/131 (3.1%) – and girls – 4/160 (2.5%), p=0.774. At least once a week, 5 out of 291 (1.7%)

Table 5. Frequency of nocturnal symptoms of gastroesophageal reflux disease in school-age children

Таблица 5. Частота ночных симптомов гастроэзофагеальной рефлюксной болезни у детей школьного возраста

Пациенты Patients	Проявление симптома Symptom manifestation			
	симптом отсутствует there is no symptom	1 раз в неделю once a week	2–3 раза в неделю 2–3 times a week	4–7 раз в неделю 4–7 times a week
Мальчики Boys (n=131)	127/131 (96,9%)	3/131 (2,3%)	0/131 (0,0%)	1/131 (0,8%)
Девочки Girls (n=160)	156/160 (97,5%)	3/160 (1,9%)	2/160 (1,3%)	0/160 (0,0%)
Всего Total	283/291 (97,3%)	5/291 (1,7%)	2/291 (0,7%)	1/291 (0,3%)
p_{1-2}	0,774	0,805	0,200	0,269

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Table 6. Proportion of schoolchildren with heartburn taking antacid medication

Таблица 6. Доля школьников с изжогой, принимающих антацидные препараты

Пациенты Patients	Проявление симптома Symptom manifestation			
	нет no	1 раз в неделю once a week	2–3 раза в неделю 2–3 times a week	4–7 раз в неделю 4–7 times a week
Мальчики Boys (n=131)	127/131 (96,9%)	2/131 (1,5%)	1/131 (0,8%)	1/131 (0,8%)
Девочки Girls (n=160)	152/160 (95%)	3/160 (1,9%)	4/160 (2,5%)	1/160 (0,6%)
Всего Total	279/291 (95,9%)	5/291 (1,7%)	5/291 (1,7%)	2/291 (0,7%)
p_{1-2}	0,407	0,821	0,257	0,887

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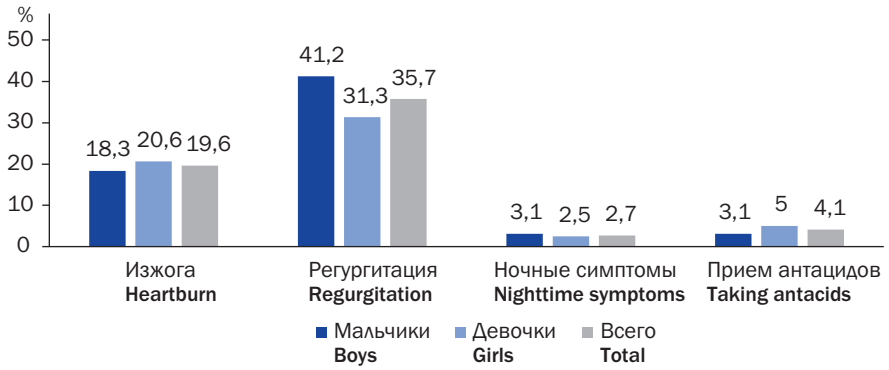

Fig. 1. Symptoms of gastroesophageal reflux disease in school-age children (%) (the figure is prepared by the authors)

Рис. 1. Симптомы гастроэзофагеальной рефлюксной болезни у детей школьного возраста (%) (рисунок подготовлен авторами)

Table 7. The proportion of children who scored eight or more points according to the Gerd-Q

Таблица 7. Доля детей, набравших по данным анкеты Gerd-Q 8 баллов и более

Показатель Indicator	<8 баллов <8 points	≥8 баллов ≥8 points
Мальчики Boys (n=131)	117/131 (89,3%)	14/131 (10,7%)
Девочки Girls (n=160)	150/160 (93,5%)	10/160 (6,5%)
Всего Total	267/291 (91,8%)	24/291 (8,2%)
p_{1-2}	0,172	

The table is prepared by the authors using their own data

Таблица составлена авторами по собственным данным

schoolchildren experienced nighttime symptoms. Periodic nighttime symptoms 2–3 times a week were reported in 2 out of 291 (0.7%) of the surveyed children. Frequent nocturnal symptoms 4–7 times a week were observed in only 1/291 (0.3%) child. No gender differences were found. The results are presented in Table 5.

The total number of children who occasionally took antacids was 12 out of 291 (4.1%), with an equal frequency among girls (8 out of 160, 5%) and boys (4 out of 131, 3.1%); p=0.407 (Fig. 1). Among the surveyed schoolchildren who took the medications at least once a week, there were 5/291 (1.7%) children, 2/131 (1.5%) boys, and 3/160 (1.9%) girls, p=0.821. Periodic use of antacids 2–3 times a week was reported by 5/291 (1.7%) of the respondents, 4/160 (2.5%) of whom were girls and 1/131 (0.8%) of whom were boys, p=0.257. Frequent use of antacids was observed in only 2/291 (0.7%) of respondents. The data are presented in Table 6.

A total score of 8 or higher on the questionnaire indicates a high probability of GERD. The proportion of schoolchildren who scored 8 points or more was 24/291 (8.2%), with 14/131 (10.7%) boys and 10/160 (6.59%) girls, p=0.172. The data are presented in Table 7.

DISCUSSION

The study found that 8.2% of school-aged children scored 8 points or higher on the GERD-Q questionnaire; 10.7% of boys and 6.5% of girls. This is slightly lower than in the adult population [1, 2], but higher than in one pediatric study [10]. The prevalence of individual GERD symptoms among schoolchildren was higher. Thus, 19.6% of those examined reported heartburn, 14.8% experienced heartburn episodes once a week, and in the remaining 4.8% of cases, 2 to 7 times a week. This is somewhat more frequent than in other studies, where the prevalence of weekly or troublesome heartburn among adolescents ranged from 2.7% to 10% [6, 7, 9]. At the same time, up to 21.3% of schoolchildren may experience less frequent

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episodes of heartburn (less than once a week) [8]. Unlike other pediatric studies, heartburn was reported with equal frequency among boys and girls. Regurgitation was observed significantly more frequently than heartburn—in 35.7% of those examined (also with equal frequency among boys and girls) — which is significantly more common than in other studies [9, 10]. As with heartburn, episodes of regurgitation occurring no more than once a week were most common, observed in 26.1% of the children examined. Nocturnal GERD symptoms, indicative of a more severe course of the disease, were observed in 2.7% of schoolchildren. 4.1% of the examined children resorted to periodically taking antacids on their own to relieve GERD symptoms.

CONCLUSION

Thus, the use of the GERD-Q questionnaire improves the detection rate of GERD symptoms, with heartburn being the most common symptom among school-aged children, affecting boys in particular.

ADDITIONAL INFORMATION

Authors'contribution. D.Yu. Latyshev, M.D. Lider, N.A. Tekutyeva — literature search, writing the draft of the article, descriptive part, data collection, correspondence with the editorial board; Yu.F. Lobanov, E.V. Skudarnov — scientific supervision, making comments on the draft version of the article, approval of the final version; V.S. Ponomaryov, I.Yu. Boldenkova — formal analysis, concept and conceptualization.

All authors made a substantial contribution to the acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

Competing interests. The authors declare that there have no competing interests.

Consent for publication. Written consent was obtained from legal representatives of the respondents for publication of relevant medical information within the manuscript.

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Вклад авторов. Д.Ю. Латышев, М.Д. Лидер, Н.А. Текутьева — поиск литературы, написание черновика статьи, описательная часть, набор данных, переписка с редакцией журнала; Ю.Ф. Лобанов, Е.В. Скударнов — научное руководство, внесение замечаний в черновой вариант статьи, утверждение итоговой версии; В.С. Пономарёв, И.Ю. Болденкова — формальный анализ, концепция и концептуализация.

Все авторы внесли существенный вклад в проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

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