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Improving the quality of medical care for patients with 5q spinal muscular atrophy through the implementation of continuing professional education programs

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Abstract

Aim – to evaluate the effectiveness of the continuing professional education program "Multidisciplinary approach to managing patients with a confirmed diagnosis of 5q spinal muscular atrophy" (36 hours; hereinafter referred to as the SMA5q CPE Program) as a tool for improving the level of competence of doctors within multidisciplinary teams providing medical care to SMA5q patients.

Material and methods. The study used the materials completed by course teachers and students who had completed training under the SMA5q CPE Program. These materials included entrance control forms, final certification forms, and certification reports, which were provided by the Institute of Higher and Continuing Professional Education of the N.P. Bochkov Medical Genetic Research Center.

Results. As of January 2025, 136 students from 39 administrative entities of the Russian Federation had completed the training. During the final certification of the training program, all students demonstrated a relatively high level of competence in completing test tasks: 70-80% correct answers were given by 96 students, 81-90% by 36, 91-100% by 4. At least one control question was answered by 42 students, two by 85, and all three questions, by 9 doctors.

Conclusions. The SMA5q CPE Program has proven effective in improving the competencies of doctors who make up a multidisciplinary team. The implementation of this SMA5q CPE Program can increase the availability and effectiveness of high-cost pathogenetic therapy for patients with SMA5q.

Keywords: additional education program, 5q spinal muscular atrophy, SMA5q.
Conflict of interest: nothing to disclose.

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Повышение уровня врачебных компетенций в области ведения пациентов со спинальной мышечной атрофией 5q с помощью внедрения программы дополнительного профессионального образования

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Аннотация

Цель – оценка эффективности дополнительной программы образования «Многопрофильный подход к ведению пациентов с подтвержденным диагнозом спинальная мышечная атрофия 5q» (36 часов) (далее – Программа ДПО по СМА5q) в качестве инструмента повышения уровня компетенций врачей, входящих в многопрофильную бригаду по оказанию медицинской помощи пациентам со СМА5q.

Материал и методы. Использованы материалы, заполненные преподавателями курса и обучающимися, прошедшими подготовку по Программе ДПО по СМА5q. Указанные материалы представляли собой бланки входного контроля, бланки итоговой аттестации и аттестационные ведомости, которые были предоставлены Институтом высшего и дополнительного профессионального образования ФГБНУ «Медико-генетический научный центр имени академика Н.П. Бочкова».

Результаты. По состоянию на январь 2025 года подготовку прошли 136 обучающихся из 39 субъектов РФ. В ходе итоговой аттестации по обучающей программе все обучающиеся показали сравнительно высокий уровень компетенций при выполнении тестовых заданий: 70–80% правильных ответов дали 96 обучающихся, 81–90% – 36, 91–100% – 4. Как минимум на один контрольный вопрос ответили 42 обучающихся, на два – 85 и на все три вопроса – 9 врачей.

Выводы. Программа ДПО по СМА5q показала эффективность в повышении компетенций врачей, составляющих многопрофильную бригаду. Внедрение данной Программы ДПО по СМА5q способно повысить доступность и эффективность использования высокозатратной патогенетической терапии пациентов со СМА5q.

Ключевые слова: дополнительная программа образования, спинальная мышечная атрофия 5q, СМА5q.

Конфликт интересов: не заявлен.

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INTRODUCTION

Spinal muscle atrophy 5q (SMA5q) is a severe hereditary orphan life-threatening disease the progresses mostly in the early age [1–4]. In compliance with the Clinical recommendations for SMA5q (2024), a multidisciplinary team should be involved in the management of SMA5q patients [5–7].

The multidisciplinary team providing medical care to SMA5q patients should be headed by a neurologist[1], and pediatricians, physicians, orthopedic traumatologists, anesthesiologists and reanimatologisits, nutritionists, physiotherapists, physical and rehabilitation medicine specialists, as well as palliative care specialists should be on the team [8, 9].

Contents of academic disciplines	Competences to be created			
	Genetic specialists	Neurologists, physicians, general practitioners, orthopedic traumatologists, anesthesiologists and reanimatologists, pulmonologists, gastroenterologists, nutritionists, physiotherapists and specialists in sports medicine	Pediatricians	Specialists in medical rehabilitation, specialists in palliative care
"Hereditary SMA5q: etiopathogenesis, classification, specifics of clinical manifestations, diagnostics"	PC-5. Diagnostic activities: competency in identifying patients' pathological conditions, symptoms, disease syndromes, and nosological entities in accordance with the International Statistical Classification of Diseases and Related Health Problems. PC-6. Clinical practice: competency in managing and treating patients with hereditary disorders.	GPC-5. Competence in prescribing treatments for diseases and/or medical conditions, while monitoring therapeutic efficacy and safety. GPC-6. Competence in implementing and monitoring the effectiveness of medical rehabilitation interventions for diseases and/or health conditions, including through individualized rehabilitation or habilitation programs for persons with disabilities.	GPC-4. Competence in using medical products stipulated by the procedures of provision of medical care, and perform patient check-ups for diagnostic purposes. GPC-5. Competence in assessment of morpho-functional, physiological and pathological processes in the body in order to perform professional tasks.	GPC-4. Competence in examining patients to identify activity limitations and impairments of body functions and structures. GPC-5. Competence in prescribing procedures for the medical rehabilitation of patients with activity limitations and impairments of body functions and structures, and monitoring therapeutic efficacy and safety.
"Implementation of a multidisciplinary approach in provision of medical care to SMA5q patients"	PC-6. Clinical practice: competency in managing and treating patients with hereditary disorders. PC-9. Rehabilitation activities: competence in administering pharmacological and non-pharmacological therapy and other methods in need of medical rehabilitation.	GPC-6. Competence in implementing and monitoring the effectiveness of medical rehabilitation interventions for diseases and/or health conditions, including through individualized rehabilitation or habilitation programs for persons with disabilities. GPC-8. Способен проводить и контролировать эффективность мероприятий по профилактике и формированию здорового образа жизни и санитарно-гигиеническому просвещению населения.	GPC-6. Competence in organizing patient care, delivering primary healthcare, and coordinating professional decision-making during prehospital emergencies, disaster situations, epidemics, and mass casualty incidents. GPC-7. Competence in prescribing treatment and monitoring its therapeutic efficacy and safety. GPC-8. Competence in monitoring the efficiency of medical rehabilitation of patients, including through implementation of individual programs of rehabilitation and habilitation of pediatric patients with disabilities, evaluation of the patients' ability to perform labor activities.	GPC-4. Competence in examining patients to identify activity limitations and impairments of body functions and structures. GPC-5. Competence in prescribing procedures for the medical rehabilitation of patients with activity limitations and impairments of body functions and structures, and monitoring therapeutic efficacy and safety.
"Legal, ethical and coordination aspects of the multidisciplinary approach provision of medical care to SMA5q patients"	PC-5. Diagnostic activities: competency in identifying patients' pathological conditions, symptoms, disease syndromes, and nosological entities in accordance with the International Statistical Classification of Diseases and Related Health Problems. PC-6. Clinical practice: competency in managing and treating patients with hereditary disorders. PC-9. Rehabilitation activities: competence in administering pharmacological and non-pharmacological therapy and other methods in need of medical rehabilitation.	GPC-5. Competence in prescribing treatments for diseases and/or medical conditions, while monitoring therapeutic efficacy and safety. GPC-6. Competence in implementing and monitoring the effectiveness of medical rehabilitation interventions for diseases and/or health conditions, including through individualized rehabilitation or habilitation programs for persons with disabilities. GPC-8. Competence in delivery and monitoring efficiency of events aimed at disease prevention and promotion of healthy living, and sanitary and hygienic education of the population.	GPC-9. Competence in implementation of principled of quality management in professional activities. GPC-10. Competence in solving standard professional tasks using informational and bibliographic resources, biomedical terminology, and information-communication technologies while adhering to core data security requirements. GPC-1. Competence in the implementation of moral and legal norms, ethical and deontological principles in professional activities.	GPC-6. Competence in implementing and monitoring the effectiveness of medical rehabilitation interventions for diseases and/or health conditions, including through individualized rehabilitation or habilitation programs for persons with disabilities. GPC-8. Competence in analyzing medical and statistical information, keeping medical documentation, organization of activities of available medical personnel.

Table 1. *Sections of the CPE for SMA5q and their characteristics*
Таблица 1. *Разделы Программы ДПО по СМА5q и их характеристики*

[1] Clinical guidelines of the Ministry of Health of the Russian Federation "5q Proximal Spinal Muscular Atrophy", children, 2023, p. 67.
Clinical guidelines of the Ministry of Health of the Russian Federation "5q-associated Spinal Muscular Atrophy", adults, 2024, p. 77.

At the same time, some papers identified insufficient readiness of medical specialists to provide medical care to SMA5q patients based on the modern multifaceted approach [10–13]. Besides, our analysis of the Professional Standard "Neurologist" No.1240 (the PS)[1] showed that the document contains generalized data on job functions described as tentative working actions, required skill and knowledge. The specific knowledge required for the management of SMA5q patients are described in that document by way of mentioning the knowledge of "etiology, pathogenesis, diagnostics, clinical manifestations, …modern methods of treatment of… *general* diseases and (or) conditions of the nervous system" including "neuromuscular diseases". What diseases and conditions of the nervous system are 'general' and whether the SMA5q belongs to the same, is not specified in the PS.

The analysis of the Federal State Educational Standard 31.08.42 "Neurology"[2] (FSES) shows the possibility of an arbitrary approach of educational institutions towards development and implementation of the respective programs. According to the said FSES, "professional competences are determined by the educational institution proper based on the PSs compliant with the professional activities of the graduates" (FSES, paragraph 3.4). Here the authors of the FSES indicate that "from each of the chosen PSs, the educational institution selects one or several generalized job functions (GJF)", and the "GJF may be selected fully or partially". At the same time, paragraph 3.6 of the FSES determines unambiguously that the program of residency training for the specialization "Neurology" complies with the FSES if it provides to the graduate the competences in one of the spheres of professional activities (administrative, education, and healthcare, paragraph 1.12 of FSES) and in completion of tasks of one type (medical, scientific research, organizational and managerial, pedagogical, paragraph 1.13 of the FSES) [14].

We also studied the principal specialized educational programs (PSEP) of higher education: residency training programs for the specialization 31.08.42 "Neurology" of ten higher educational institutions for the period of 2021–2024. The analysis of PSEPs of Russian Universities for the specialization "Neurology" revealed that a dedicated class of four academic hours for the topic SMA5q was planned only in one out of ten academic programs; that SMA5q was mentioned in four out of ten academic programs in the context of a class on neuromuscular diseases; that neuromuscular diseases, without details, was found in the structure of other classes in three out of ten academic products.

Thus, the neurologists who received only the base education have insufficient competences to provide quality care to SMA5q patients [14]. Moreover, the advent of new diagnostic and therapeutic tools, and regular revision of guidelines for the management of such patients require delivery of additional educational activities for specialists involved in provision of medical care.

In order to improve the level of competence of doctors on the multidisciplinary team engaged in treatment and management of SMA5q patients, in the year 2022 the Institute of Higher and Continuing Professional Education of the N.P. Bochkov Medical Genetic Research Center developed and implemented the supplementary professional education program "Multidisciplinary approach to managing patients with a confirmed diagnosis of 5q spinal muscular atrophy" (36 hours; "the SMA5q CPE Program")[3].

AIM

To evaluate the effectiveness of the professional education program as a tool for improving the level of competence of doctors within multidisciplinary teams providing medical care to SMA5q patients.

MATERIAL AND METHODS

In the course of preparation of this article, the materials were used filled by the course tutors and trainees who underwent training for the SMA5q CPE Program. These materials included entrance control forms, final certification forms, and certification reports, which were provided by the Institute of Higher and Continuing Professional Education of the N.P. Bochkov Medical Genetic Research Center. The statistic analysis of the results was performed by methods of descriptive statistics, and diagrams were prepared in the STSS program (Syunyakov Timur Sergeevich Statistics analyzer).

The aim of the SMA5q CPE Program is to form the capacity and readiness of medical professionals of various specializations to identify pathological conditions, symptoms, syndromes, characteristic of the hereditary SMA5q in patients, to management and treatment of such patients, to use pharmacological and non-pharmacological therapy, as well as other methods.

The form of tuition was in-person training including remote educational technologies and electronic learning as simultaneous learning in the classroom.

The components of the academic program formulated as modules are presented in **Table 1**, and the contents of modules is shown in **Tables 2-4**.

The entrance control had 12 questions with four choice options. The qualification class included two forms of control, an interview and a test. The final testing included questions for each of the three modules: "Hereditary SMA5q: etiopathogenesis, classification, specifics of clinical manifestations, diagnostics" (12 open questions and 14 multiple-choice questions); "Implementation of a multidisciplinary approach in provision of medical care to SMA5q patients" (29 control questions and 45 test tasks); "Legal, ethical and coordination aspects of the multidisciplinary approach provision of medical care to SMA5q patients" (9 control questions and 12 test tasks). The test cards for the qualification class contained three control questions (one for each module) and fifteen test tasks.

[1] Approved by the Order of the Ministry of Labor and Social Protection of the Russian Federation dated 29 January 2019 No.51n, as amended 25 September 2023.
[2] Approved by the Order of the Ministry of Science and Higher Education of the Russian Federation dated 2 February 2022 No. 103.
[3] The Program is approved by the Education and methodology Commission of the IHCPE of Medical Genetic Research Center (Protocol No. 2 dated 06 May 2022); the first curriculum is approved by the Order of the Director of Medical Genetic Research Center dated 11 May 2022 No.19-DPO.

Topics, Elements and Sub-elements
Structure and functions of the peripheral neuromotor apparatus
Structure of peripheral motor neurons and principle of their functioning
Pathogenic mechanisms of hereditary spinal muscular atrophies and functional roles of disease-associated gene products
Classification of hereditary spinal muscular atrophies
Clinical and genetic characteristics of hereditary spinal muscular atrophies
Clinical, genetic and neurophysiological characteristics of SMA5q
Interpretation of results of neurophysiological examination in cases of suspected SMA5q
Differential diagnostics of hereditary spinal muscular atrophies with other groups of neuromuscular diseases
Medical and genetic counseling for families with a history of SMA5q
Principles of genealogy analysis in inherited disorders and genetic status determination for relatives of SMA5q probands
Approaches to prevention of recurrent cases
Methods of molecular genetic diagnostics of SMA5q
Molecular genetic foundations of SMA5q
Screening methods: requirements, limitations, possibilities
SMA5q diagnostic methods: requirements, limitations, possibilities
Methods used to diagnose SMA5q carrier status
Prenatal and pre-implantation SMA5q diagnostics
Summary on molecular genetic study of SMA5q

Table 2. *Contents of the module "SMA5q: etiopathogenesis, classification, features of clinical manifestations and diagnostics"*

Таблица 2. *Содержание модуля «СМА5q: этиопатогенез, классификация, особенности клинических проявлений и диагностика»*

Topics, Elements and Sub-elements
Respiratory function in SMA5q patients
Principles of modern approaches to organization and delivery of respiratory support for SMA5q patients
Criteria of monitoring efficiency of respiratory support
Diagnostics of acute respiratory disorders in SMA5q patients; methods of management of life-threatening situations
General approaches to home-based non-invasive ventilation (NIV)
Emergency and urgent care for acute conditions (e.g., decannulation, aspiration) and respiratory support in infectious diseases in SMA5q patients
Coordination of work of pulmonologists and respiratory support specialists in the multidisciplinary team managing SMA5q patients
Digestion function in SMA5q patients
Under-nourishment and problem of weight gain, growth and muscular development delay; causes of obesity in SMA5q
Correction of nutritive status and principles of nutritional support to provide adequate nutrition to SMA5q patients
Pathological disorders of the intestinal tract and their correction in in SMA5q patients
Prevention of aspiration syndrome in impaired deglutition in SMA5q patients
Prevention of acute conditions: aspiration, probe displacement and migration, feeding tube obstruction, peristomal infections, metabolic disorders in SMA5q patients
Musculoskeletal system in SMA5q patients
Diagnostics of pathological changes in the musculoskeletal system
Approaches to physiotherapeutic and orthopedic correction in children with SMA5q of various types
Orthopedic support: prevention and treatment, including surgical treatment, of spinal deformities, subdislocations/dislocations of the hip joint, contractures, osteoporosis-associated fractures
Orthopedic interventions in SMA5q patients
Physical and device-assisted contracture prevention, scoliosis, retention of movement range and prevention of pain syndrome
Practical skills of orthopedic support, rehabilitation procedures and physiotherapy
Coordination and provision of nutritive and respiratory support in patients with orthopedic devices, basics of cooperation between members of the multidisciplinary team
Home-based adaptation activities to ensure maximum independence of patients
Basic principles and methods of assessment of condition and treatment of SMA5q patients
Principles of assessment of SMA5q patients using motor function scales
Motor function scale in SMA5q (Hammersmith Functional Motor Scale Expanded (HFMSE)
Revised Upper Limb Module (RULM)
Children's Hospital of Philadelphia Infant Test of Neuromuscular Development, CHOP-INTEND
6-minute walking test in SMA5q patients (6MWT)
Modern approaches to pathogenetic therapy of SMA5q
Possibilities of gene therapy of SMA5q and methods of agent administration
Recommendations on choosing drugs for SMA5q gene therapy from the list of drugs registered in the Russian Federation: Nusinersen, Ridisplam, Onasemnogene abeparvovec
Long-term intrathecal therapy of SMA5q with Nusinersen
Regulations of oral drug use
Specifics of pathogenetic treatment of patients of AVL/NIV and feeding through the feeding tube
Rehabilitation procedures in patients with varied clinical manifestations
Principles of symptomatic therapy in SMA5q patients on pathogenetic therapy
Assessment of efficiency of pathogenetic therapy in compliance with standards as per generally accepted clinical scales
Palliative care of SMA5q patients
Definition and formalization of indication for palliative medial care to children and adults with SMA5q within the functions of the medical advisory commission of healthcare institutions
Principles of organization of outpatient and inpatient palliative care to patients with SMA5q, patient routing and interdisciplinary cooperation of specialists
Provision of medical devices for the support of organ and system functions to SMA5q patient
Principles of effective communication and psychosocial support of SMA5q pediatric patients and their family members. Principles of delivering bad news; methodology for shared decision-making between physicians and legal guardians in the provision of palliative medical care; educational and recreational needs of a child with SMA5q receiving palliative medical care

Table 3. *Contents of the module "Implementation of a multidisciplinary approach in providing medical care to patients with SMA5q"*

Таблица 3. *Содержание модуля «Реализация многопрофильного подхода в оказании медицинской помощи пациентам со СМА5q»*

Topics, Elements and Sub-elements
Ethical problems of medical and genetic care
Ethical principles of medical and genetic counseling; rights of patients
Ethics of genetic testing
Communication between doctors and patients or their legal representatives
Principles of delivering bad news
Psychological component of medical and genetic counseling
Legal aspects in provision of medical care to SMA5q patients
Fundamentals of legal regulation of procedures of medical care and provision of medicines to patients of SMA5q patients
Rights and obligations of patients and medical personnel implemented in the provision of medical care to SMA5q patients
Legal aspects and procedure of free medical care to SMA5q patients depending on terms and conditions of its provision within the state guarantee program
State programs of preferential provision of medicines
Rules and regulation for the prescription of drugs and specialized products of clinical nutrition and medical products
Special feature of medical care provided with telemedicine technologies
Procedure of communication of medical personnel with the "Krug Dobra" Foundation, "SMA Families" Foundation

Table 4. *Contents of the module "Legal, ethical and coordination aspects of a multidisciplinary approach in providing medical care to patients with SMA5q"*

Таблица 4. *Содержание модуля «Юридические, этические и координационные аспекты многопрофильного подхода при оказании медицинской помощи пациентам со СМА5q»*

Medical specialization	Number of trainees
Neurologists	78
Medical genetics specialists	37
Gastroenterologists	4
Pediatricians	4
Pulmonologists	3
Rehabilitation specialists	2
Orthopedic traumatologists	2
Physiotherapists	1
Physical rehabilitation specialists	1
Physicians	1
Anesthesiologists	1
Nutritionists	1
Palliative care specialists	1

Table 5. *Distribution of doctors trained under the SMA5q CPE by specialization*

Таблица 5. *Распределение врачей, прошедших обучение по Программе по специальностям*

RESULTS

As of January 2025, four groups of trainees received training under this program (136 medical specialists from 39 administrative units of the Russian Federation). The distribution of trainees by specializations and regions is presented in Tables 5, 6.

In the course of entrance control, less than 50% correct answers were given by 69 trainees; 51–70% by 42 trainees; 70–80% by 2 trainees; 23 more trainees did not participate in the entrance control. In the qualification testing of the training program, all trainees showed a relatively high level of competence while performing the test tasks: 70–80% of correct answers were given by 96 trainees; 81–90% by 36 trainees; 91–100% by 4 trainees. At least one control question was correctly answered by 42 trainees; two questions, by 85, and all three questions, by 9 medical specialists. The diagram comparing the results of entrance control and final testing is shown in **Fig. 1**.

Region of the country	No.	Region of Russia	No.
Orenburg Region	49	Belgorod Region	1
Volgograd Region	8	Voronezh Region	1
Moscow	8	Republic of Dagestan	1
Irkutsk Region	7	Izhevsk Region	1
Tyumen Region	7	Kemerovo Region	1
Republic of Bashkortostan	5	Kostroma Region	1
Krasnodar Region	4	Republic of Crimea	1
Moscow Region	4	Kurgan Region	1
Saratov Region	3	Leningrad Region	1
Tomsk Region	3	Magadan Region	1
Republic of Buryatia	2	Novgorod Region	1
Krasnoyarsk Region	2	Novosibirsk Region	1
Oryol Region	2	Omsk Region	1
Rostov Region	2	Penza Region	1
St.-Petersburg	2	Samara Region	1
Republic of North Ossetia-Alania	2	Sverdlovsk Region	1
Stavropol Region	2	Smolensk Region	1
Republic of Yakutia	2	Tver Region	1
Yaroslavl Region	2	Republic of Chechnya	1
Amur Region	1	**Total**	**136**

Table 6. *Distribution of the SMA5q CPE Program students by regions*

Таблица 6. *Распределение обучающихся Программы по регионам*

The trainees found the following questions the most difficult: module "Hereditary SMA5q: etiopathogenesis, classification, specifics of clinical manifestations, diagnostics", section "Clinical and genetic characteristics of hereditary spinal muscular atrophies" (6 correct answers in the entrance control and 101 correct answers in the final test); and from the module "Legal, ethical and coordination aspects of the multidisciplinary approach provision of medical care to SMA5q patients", section "Legal aspects in provision of medical care to SMA5q patients" (11 correct answers in the entrance control and 98 correct answers in the final test). The easiest were the questions related to clinical manifestations of the disease (module "Implementation of a multidisciplinary approach in provision of medical care to SMA5q patients", sections "Basic principles and methods of assessment of condition and treatment of SMA5q patients" and "Musculoskeletal system in SMA5q patients").

DISCUSSION

The first experience of delivery and the analysis of results of SMA5q CPE Program in 2023 showed that the specialists most interested in improving their qualification

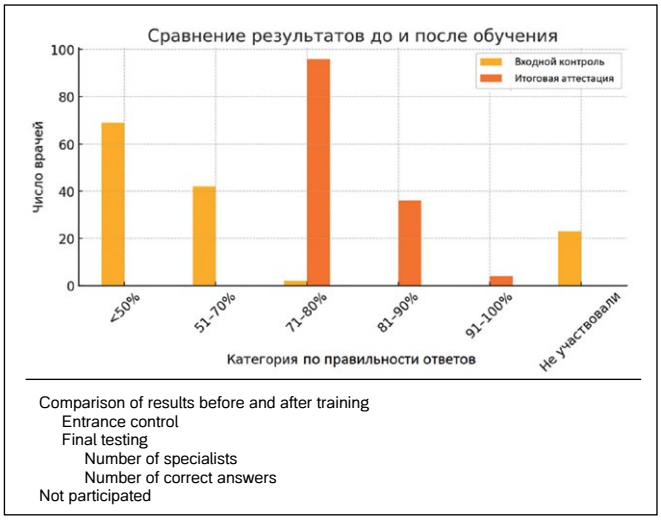

Figure 1. *Comparison diagram of the results of incoming inspection and final certification.*

Рисунок 1. *Диаграмма сравнения результатов входного контроля и итоговой аттестации.*

and gaining new competences in the orphan pathology in question are specialists in neurology and genetics. The demand for training under the SMA5q CPE Program from other specialists is relatively low, which might be related to the actual shortage of personnel in the regions and to the local normative and organizational deficit with respect to provision of medical care to SMA5q patients [15].

Mastering of the considered program provides the specialists of multidisciplinary teams with the necessary knowledge and skills in compliance with the federal state educational standards, and assists in obtaining the lacking skills that are needed to provide medical care to SMA5q patients not specified in the professional standards.

It proved difficult to compare the results of implementation of SMA5q CPE Program with similar programs in Russia and abroad: Elibrary.ru and Cyberleninka databases have no publications on the evaluation of educational programs on SMA5q and orphan diseases generally. PubMed lists only one publication describing a similar initiative [16].

CONCLUSION

The supplementary professional education program "Multidisciplinary approach to managing patients with a confirmed diagnosis of 5q spinal muscular atrophy" (36 hours) proved high efficiency in the improvement of professional competences of specialists of multidisciplinary teams working on provision of medical care to SMA5q patients. Improvement of quality of medical care to this category of patients requires organization of multidisciplinary teams in all administrative units of the Russian Federation, which in its turn calls for active cooperation from the federal and regional ministries and departments of health represented by the respective Chief Consultants thereof.

ADDITIONAL INFORMATION	ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ
Study funding. The study was the authors' initiative without external funding.	***Источник финансирования.*** Работа выполнена по инициативе авторов без привлечения финансирования.
Conflict of interest. The authors declare that there are no obvious or potential conflicts of interest associated with the content of this article.	***Конфликт интересов.*** Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с содержанием настоящей статьи.
Contribution of individual authors. Vlasov Ya.V., Kutsev S.I.: initial idea for creating the manuscript and final proofreading of the text, participation in the development of the educational program, development of test and assessment materials. Sunyakov T.S.: decision making on the choice of statistical methods of analysis, formation of graphs and tables. Gaiduk A.Ya.: preparation of the primary text of the manuscript, participation in the development of the educational program, development of test and assessment materials. Gazheva A.V., Kamynina N.N.: recommendations on the presentation of materials and proofreading of the primary text. Pesneva O.V., Bukharova T.B., Nikitin S.S.: participation in the development of the educational program, development of test and assessment materials, interpretation of students' responses using a scoring system. The authors gave their final approval of the manuscript for submission, and agreed to be accountable for all aspects of the work, implying proper study and resolution of issues related to the accuracy or integrity of any part of the work.	***Участие авторов.*** Власов Я.В., Куцев С.И. – первичная идея создания рукописи и финальная корректура текста, участие в разработке образовательной программы, разработка тестовых и аттестационных материалов. Сюняков Т.С. – принятие решения о выборе статистических методов анализа, формирование графиков и таблиц. Гайдук А.Я. – подготовка первичного текста рукописи, участие в разработке образовательной программы, разработка тестовых и аттестационных материалов. Гажева А.В., Камынина Н.Н. – рекомендации по изложению материалов и корректура первичного текста. Песнева О.В., Бухарова Т.Б., Никитин С.С. – участие в разработке образовательной программы, разработка тестовых и аттестационных материалов, интерпретация ответов обучающихся по балльной системе. Все авторы одобрили финальную версию статьи перед публикацией, выразили согласие нести ответственность за все аспекты работы, подразумевающую надлежащее изучение и решение вопросов, связанных с точностью или добросовестностью любой части работы.

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