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IMPROVING THE PROCESS OF PREVENTIVE MEDICAL EXAMINATION OF CHILDREN USING LEAN TECHNOLOGIES

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Abstract. The article presents ways to improve the process of preventive medical examinations of children aged 12 months. The existing system of preventive medical examination of children did not meet the child's priorities for high-quality and affordable medical care, as it required a lot of time and unnecessary movements on the part of the patient. The basic tools of lean manufacturing (mapping, timekeeping, spaghetti diagram), as well as the sociological method were used to analyze the root causes. The use of lean technologies during the reorganization of the process of preventive medical examination of children aged 12 months has reduced the burden, first of all, on parents, as well as on the medical organization for the implementation of this process. The number of visits by the patient to the polyclinic for preventive medical examination decreased by 6 times, the time spent by the patient for preventive medical examination decreased by 8.3 times, convenient schedule of doctors' appointments and rational navigation and routing of patients led to the disappearance of queues at the offices, the production efficiency of the team of medical workers involved in preventive medical examinations increased, which was expressed in a 2 fold increase in admitted patients, from 16 to 32 people per shift, as a result, the coverage of children aged 12 months with preventive medical examinations in the month they reach this age was 100%. According to the data of a sociological survey of parents after the introduced transformations, their level of satisfaction with the process of passing a preventive medical examination of a child is 100%. The selected lean manufacturing technologies have proven their effectiveness in improving the process of preventive medical examination of children in a children's polyclinic.

Keywords: *lean manufacturing tools, preventive medical examination, process improvement, accessibility and quality of medical care*

СОВЕРШЕНСТВОВАНИЕ ПРОЦЕССА ПРОФИЛАКТИЧЕСКОГО МЕДИЦИНСКОГО ОСМОТРА ДЕТЕЙ С ПРИМЕНЕНИЕМ БЕРЕЖЛИВЫХ ТЕХНОЛОГИЙ

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Резюме. В статье представлены пути совершенствования процесса проведения профилактических медицинских осмотров детей в возрасте 12 месяцев. Существовавшая система прохождения профилактического медицинского осмотра детей не отвечала приоритетам ребенка на доступную медицинскую помощь, так как требовала больших временны`х затрат и лишних перемещений со стороны пациента. Для анализа коренных причин были использованы основные инструменты бережливого производства (картирование, хронометраж, диаграмма спагетти), а также социологический метод. Использование бережливых технологий в ходе реорганизации процесса профилактического медицинского осмотра детей в возрасте 12 месяцев позволило снизить нагрузку, в первую очередь, на родителей, а также на медицинскую организацию по реализации данного процесса. Количество посещений пациентом поликлиники для прохождения профилактического медицинского осмотра сократилось в 6 раз, время, затрачиваемое пациентом на прохождение профилактического медицинского осмотра, уменьшилось в 6,8 раза, удобное расписание приема врачей и рациональная навигация и маршрутизация пациентов привели к исчезновению очередей у кабинетов, производственная эффективность бригады медицинских работников, задействованных при проведении профилактических медицинских осмотров, выросла, что выражалось в увеличении принятых пациентов в 2 раза, с 16 до 32 человек в смену, в результате охват детей в возрасте 12 месяцев профилактическими медицинскими осмотрами в месяц достижения ими данного возраста составил 100%. Согласно данным социологического опроса родителей после введенных преобразований, уровень их удовлетворенности процессом прохождения профилактического медицинского осмотра ребенка составил 100%. Выбранные технологии бережливого производства доказали свою эффективность для совершенствования процесса профилактического медицинского осмотра детей в условиях детской поликлиники.

Ключевые слова: *инструменты бережливого производства, профилактический медицинский осмотр, совершенствование процесса, доступность и качество медицинской помощи*

INTRODUCTION

Preserving and strengthening the health of the child population is the main strategic objective of the health care system of the Russian Federation. The state of health of the child population is characterized by demographic processes, the level of physical development, morbidity and disability indicators. At present, there are negative trends in the growth of morbidity and chronic pathologies in children, which determines the need to improve treatment, diagnosis and preventive measures. One of the priority principles of organizing and conducting preventive medical measures among children is the coverage of certain age categories with timely and high-quality medical check-ups in children's polyclinics [8–10]. In accordance with the order of the Ministry of Health of Russia from 10.08.2017 N 514n "On the order of medical check-ups for minors", check-ups are carried out in the established age periods for the purpose of early (timely) detection of pathological conditions, diseases and risk factors for their development, non-medical use of narcotic drugs and psychotropic substances, as well as for the purpose of determining health groups and making recommendations for minors and their parents or other legal representatives [1]. This order expands the program of check-ups for children compared to the one in force before it. Medical organizations perform professional medical check-ups in the scope stipulated by the list of tests stipulated in Order N 514n of the Ministry of Health of the Russian Federation.

All the above-mentioned reasons have shown the necessity to create a certain system of organization of professional medical check-ups.

AIM

To analyze and identify time losses in the process of organizing and performing professional

medical check-ups for children at the age of 12 months.

MATERIALS AND METHODS

The study was conducted within the framework of the regional project "Development of primary health care system" aimed at improving the availability and quality of medical care. On the basis of one of the medical organizations providing primary health care to children ("Children's polyclinic"), a pilot project was implemented to introduce the principles and methods of lean production in the process of "Reducing the time of medical check-ups for children aged 12 months" in order to reduce time losses during preventive medical check-ups and the patient's stay in the medical organization.

The organization and implementation of medical check-ups for children aged 12 months with the use of lean production techniques have been studied. Within the framework of this study, the main tools of lean production [5, 6, 11] (the mapping, timekeeping, spaghetti diagram), as well as the sociological method were used to analyze the root causes.

This study was implemented in four stages. At the first stage, a questionnaire was administered to parents of children who underwent this event, in order to identify problems and assess the organization of medical check-ups. The questionnaire included a number of questions: accessibility of medical care, conditions of stay in the polyclinic, waiting time for examinations, time to undergo a preventive medical examination, awareness of the possibility to undergo it. A total of 221 respondents took part in the questionnaire. The main share of respondents were mothers — 81.0%, grandmothers — 11.8% and fathers — 7.2%.

At the second stage, lean production methods and tools were applied to solve the identified problems within the framework of the questionnaire such as the mapping, timekeeping and spaghetti diagram [5–7, 11].

In the third stage of the study, targets were determined based on the results obtained in the second stage.

In the course of the fourth stage, a map of the target state was built and a set of measures to achieve the target indicators was developed.

RESULTS AND DISCUSSION

The medical organization selected as the base of the study is located in an actively building dormitory district of St. Petersburg. The children's polyclinic is provided with medical equipment necessary for medical activities in accordance with the order of the Ministry of Health of Russia from 07.03.2018 N 92n "On approval of the Regulations on the organization of primary medical and sanitary care for children" [2]. The structure of the children's polyclinic includes the following medical and preventive departments: pediatric, department of organization of medical care for minors in educational organizations, department of specialist doctors, ophthalmology department, department of medical and social assistance, department of functional diagnostics, dental department, department of physiotherapy, manual exercise, hydrotherapy, healthy child department. The children's polyclinic has 18 pediatric districts, and the staffing level of pediatricians is 100%. The children's polyclinic serves 16,244 children according to the district principle, of whom 6.0% are children aged 12 months.

The results of the questionnaire survey conducted within the first stage of the study showed that 35.3% of respondents were fully satisfied with the medical check-up. The share of partially satisfied respondents was 42.1%, the share of dissatisfied respondents was 22.6% (Fig. 1).

Among the partially satisfied and dissatisfied respondents, 54.2% noted that they had to visit a children's polyclinic to see all specialists and tests within the framework of medical check-up more than 5 times, 64.8% experienced difficulties in making appointments with specialists, 26.4% were dissatisfied with the conditions of stay in the medical organization (lack of seating in the waiting area, having to wait in line with older children). 67.6% of respondents spent more than 20 minutes waiting for appointments in front of doctors' cabinets and 72.2% took a month to do their medical checkup.

In order to solve the problems identified in the questionnaire, to determine the procedures and regulations for the organization of the medical check-ups in the second stage, complete information about all operations of the process was collected and the current state was assessed using lean production tools: the mapping, timekeeping and spaghetti diagram [5–7, 11]. Based on the analysis of the duration and sequence of all the operations of the process using timekeeping, the patient's itinerary and their time cost for investigations in the professional medical check-ups were studied. The cycle time of the whole process and the tact time of each operation were calculated [3–6, 9, 11].

The spaghetti diagram made it possible to see the unnecessary movements of the patient around the pediatric polyclinic and to identify the intersection of flows during medical check-ups.

Based on the results of the conducted timekeeping and mapping of the current state, the following were identified: intersection of different patient flows in front of doctors' cabinets, at the reception (for vaccinations, for preventive medical examinations, to obtain health certificates); a large number of visits to the children's clinic (undergoing specialist doctors, functional and laboratory tests on different days) — up to 6 visits; excessive movement around the medical organization (cabinets of doctors and cabinets for examination were located on the different floors of the children's clinic); long waiting time in the queue (up to 20 minutes); the process takes 9 hours 10 minutes; the lack of routing during professional medical check-ups (parents independently chose the traffic patterns for visiting a specialist doctor); long time for processing medical documentation; low throughput per shift — no more than 16 people (Fig. 2).

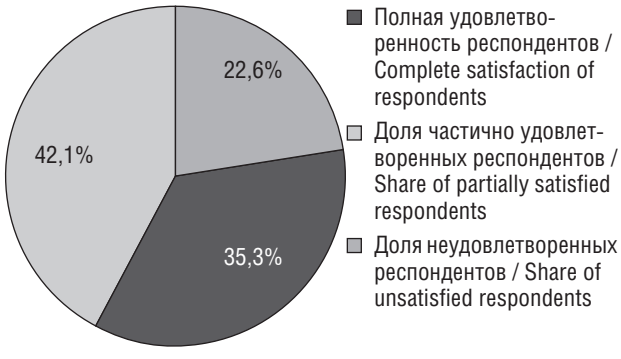

Fig. 1. Indicators of satisfaction of parents by the process of preventive medical examination of their children (%)

Рис. 1. Показатели удовлетворенности родителей проведением профилактического медицинского осмотра ребенка (%)

At the third stage of the study, taking into account the mapping and the identified problems in the process, target indicators for optimizing the medical check-ups of children aged 12 months were determined (Table 1).

To eliminate the problems and achieve the target indicators, a target state map was constructed with the estimated time of passing the preventive medical check-up of a child aged 12 months (Fig. 3).

Taking into account the identified problem areas, a set of measures was developed to improve the process of medical check-ups:

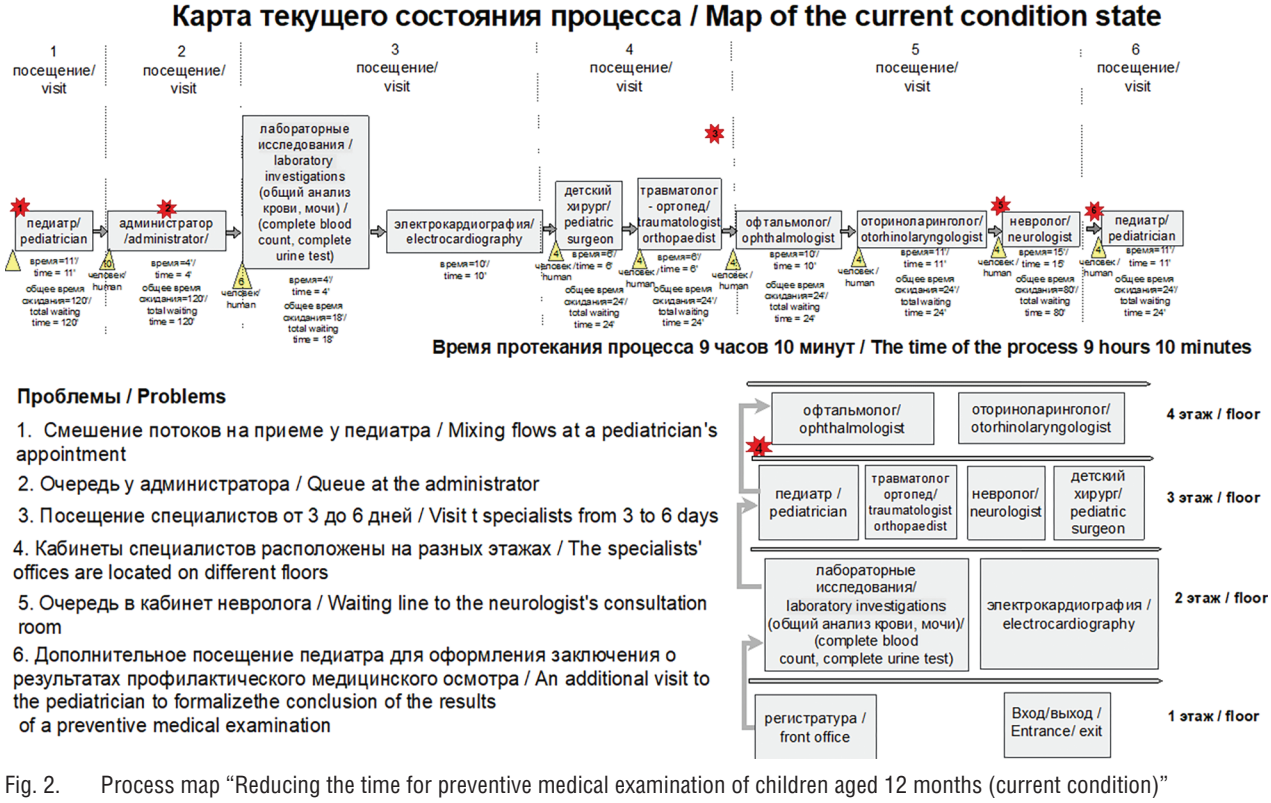

Fig. 2. Process map "Reducing the time for preventive medical examination of children aged 12 months (current condition)"

Рис. 2. Карта процесса «Сокращение времени прохождения профилактического медицинского осмотра детей в возрасте 12 месяцев (текущее состояние)»

Table 1. Target indicators of the process "Reduction of time for preventive medical examination of children at the age of 12 months"

Таблица 1. Целевые показатели процесса «Сокращение времени прохождения профилактического медицинского осмотра детей в возрасте 12 месяцев»

Наименование цели (ед. изм.) / Target name (unit)	Текущий показатель / Current indicator	Целевой показатель / Target indicator
Сокращение количества посещений медицинской организации при прохождении профилактического медицинского осмотра / Reduction of number of visits to the medical organization for preventive medical examination	6 посещений / 6 visits	1 посещение /1 visit
Сокращение времени пребывания в медицинской организации при прохождении профилактического медицинского осмотра / Reduction of the time period spent at the medical organization for preventive medical examination	До 9 часов 10 минут / Up to 9 hours 10 minute	До 1 часа 20 минут / Up to 1 hour and 20 minutes
Сокращение времени ожидания в очереди перед кабинетом врача-специалиста / Reduction of the time of waiting in turn at consultation rooms (doctors-specialists, procedure unit)	20 минут / 20 minutes	0 минут / 0 minutes
Увеличение пропускной способности детей в смену (чел.) (план / факт) / Increase of admission capacity per shift (people) (plan/actual)	16 детей / 16 children	32 ребенка / 32 children

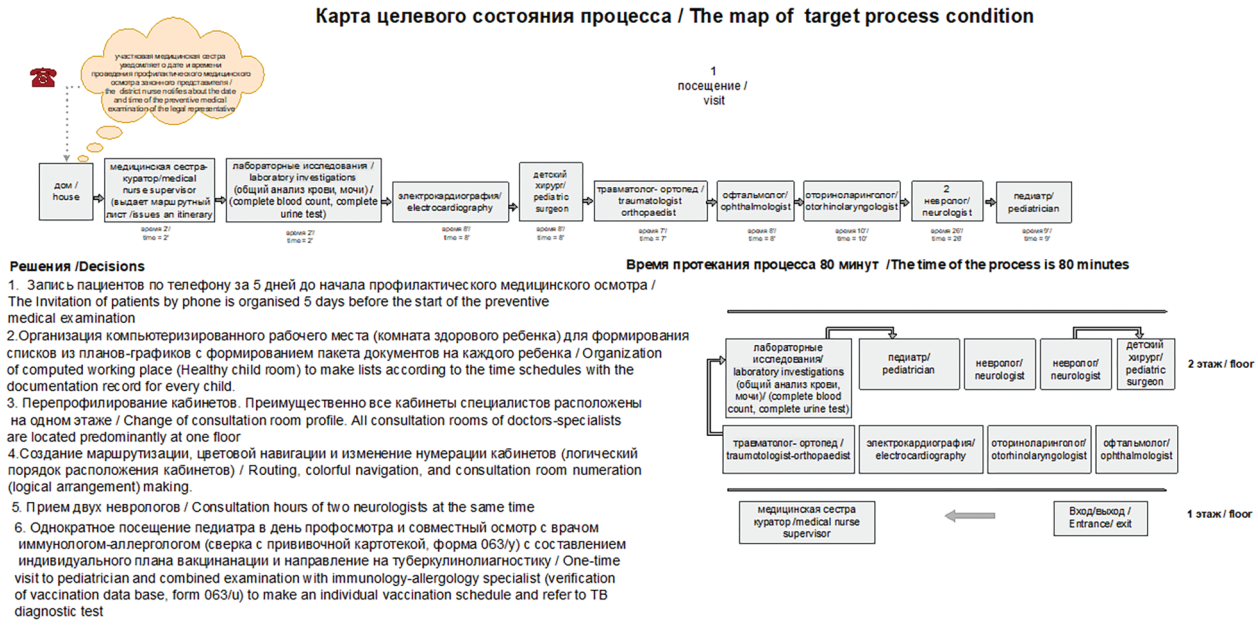

Fig. 3. Process map "Reducing the time for preventive medical examination of children aged 12 months (target condition)"

Рис. 3. Карта процесса «Сокращение времени прохождения профилактического медицинского осмотра детей в возрасте 12 месяцев (целевое состояние)»

- Streamlining of patient flows has been organized — the intersection of sick and healthy children, including those from different age categories, has been eliminated.
- A separate area has been set aside in the children's polyclinic, where specialist doctors' cabinets and a procedure room are concentrated side by side, and specific days and times for preventive medical examinations have been determined.
- The schedules of all specialist doctors involved in the preventive medical examination of children aged 12 months have a separate appointment time for this patient flow only (Thursday from 9:00 a.m. to 3:00 p.m.).
- For patients with an indication of the date, time of appointment by a specialist/examiner, the technology of preventive medical examination, developed in this polyclinic according to the "Carousel" principle, is implemented.

The "Carousel" technology consists in the fact that all types of examinations within the framework of medical check-up are concentrated in a separate block of the children's polyclinic. Lists of children needed the medical check-up are compiled for the Day of a Healthy Child. According to the list, the number of children is divided into groups of 8 people equal to the number of "Carousel" rooms, and each group is invited to a certain time. The administrator routes parents with children who have come for medical check-ups directly at the entrance to the children's polyclinic, which ensures that there is no overlap with other patients, and then parents with children are directed to the examination area. In the examination area, they are met by a nurse-curator and given a package of documents: a voluntary informed consent for a preventive medical examination, referrals for laboratory tests and an itinerary, which contains a list of tests and the time for each test. All patients start the examination in different rooms at the same time, and then, according to the itinerary, they change each other. After the first group has passed the medical checkup, the next group is invited in the same number of patients (Fig. 4).

- Standards of work of specialist doctors with uniform optimal time of tact have been developed and implemented.
- Clear and accessible navigation with prioritized flow for medical check-ups was developed.
- Information was improved and scripts were developed for district nurses and nurse supervisors to invite parents with a child to a medical checkup through modern telecommunication technologies (AI (artificial intelligence) to automate the initiation of sending targeted voice and text notifications to patients).
- An additional visit to a pediatrician to draw up a conclusion on the results of a medical checkup has been excluded from the process.
- A memo for parents has been developed for children undergoing medical checkups.
- All cabinets are standardized according to the 5C method.
- Monitoring has been implemented through systematic questionnaires to parents of patients and quarterly audits by the internal quality control service.

The implementation of the measures made it possible to achieve the following results:

- the number of patient visits to the outpatient clinic for medical checkup was reduced from 6 to 1;
- the patient's time in the medical organization for medical checkup decreased from 9 hours and 10 minutes to 1 hour and 20 minutes;
- queues at the cabinets disappeared;
- an increase in the number of admitted patients aged 12 months subject to medical checkups from 16 to 32 per shift;
- coverage of children of the appropriate age by medical checkups amounted to 100%;

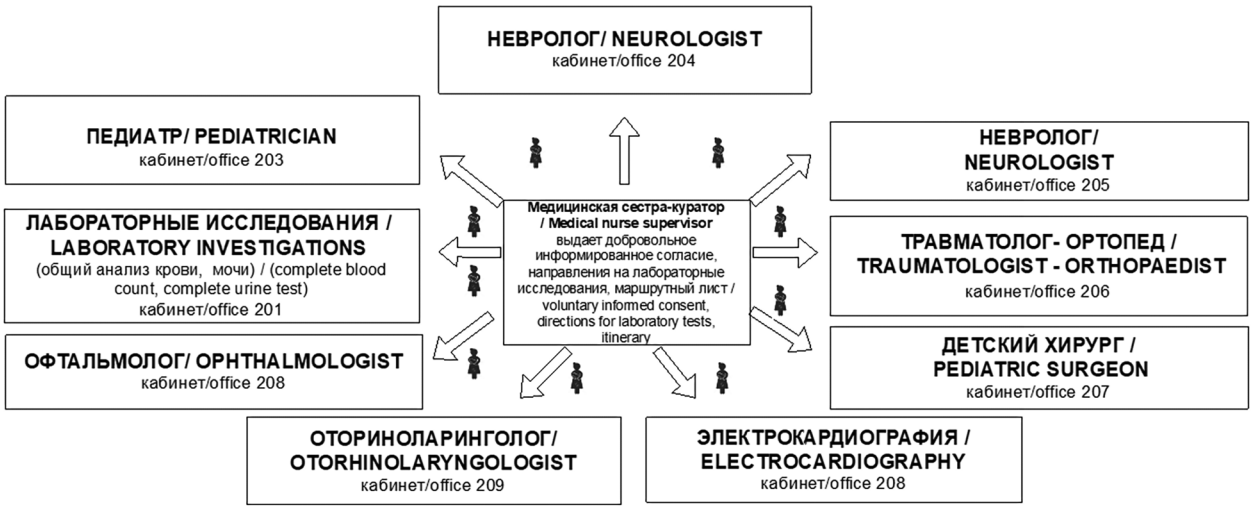

Fig. 4. Routing of children at the age of 12 months for preventive medical examination (according to the principle of "Merry-go-round")

Рис. 4. Маршрутизация детей в возрасте 12 месяцев при прохождении профилактического медицинского осмотра (по принципу «Каруселька»)

- parents' satisfaction with the organization of the process of medical checkups for their children, based on the results of a questionnaire survey, was 100%.

CONCLUSION

The application of lean production technologies improved the process of organizing medical checkups for children aged 12 months by increasing the availability and quality of medical care, which increased the value for the patient and parental satisfaction with the medical care provided. The successful experience of the children's polyclinic has been replicated in medical organizations providing primary health care to the pediatric population of St. Petersburg and the subjects of the Russian Federation.

ADDITIONAL INFORMATION

Author contribution. Thereby, all authors made a substantial contribution to the conception of the study, 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 they have no competing interests.

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Consent for publication. The authors received written consent from the respondents to publish the data.

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

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