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# Минимальный стандарт оснащения поликлиник города Москвы ультразвуковыми диагностическими приборами

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***АННОТАЦИЯ***

***Обоснование.*** Разнообразие подвидов ультразвукового оборудования и отсутствие общепринятых классификаций приводит к неэффективному оснащению медицинских организаций, ошибочно подобранному с точки зрения вида прибора, наборов и характеристик датчиков, а также уровню качества исследования. Системный подход к оснащению однотипных медицинских организаций ультразвуковым оборудованием позволит обеспечить доступность и повысить качество первичной медицинской помощи в амбулаторно-поликлинических центрах.

***Цель*** — разработать алгоритм расчёта и рекомендации составления минимального стандарта оснащения амбулаторных медицинских организаций государственной системы здравоохранения для региона на примере г. Москвы.

***Материалы и методы.*** В процессе исследования использовали программные средства статистического и сравнительного анализа, согласно данным системы Управления материальным обеспечением Единой медицинской информационно-аналитической системы (УМО ЕМИАС), формы федерального статистического наблюдения № 30, а также технические данные и обзоры современных ультразвуковых диагностических приборов.

***Результаты.*** Разработанный минимальный стандарт оснащения учитывает такие факторы, как потребность в оказании медицинской помощи отдельно детскому/взрослому населению; соответствие современным диагностическим технологиям; обеспечение территориальной доступности диагностики при условии эффективной эксплуатации работы оборудования.

***Заключение.*** Стандартизация оснащения амбулаторных медицинских организаций ультразвуковыми диагностическими приборами способствует повышению качества проведения диагностики, улучшению доступности оказания необходимых исследований прикреплённому населению, снижению срока ожидания исследований; сокращению дефицита необходимого оборудования; расширению спектра медицинских услуг, оказываемых населению города; минимизации дублирующих исследований на последующих этапах оказания медицинской помощи.

**Ключевые слова:** стандарт оснащения; ультразвук; поликлиники; ультразвуковые диагностические приборы; медицинское оборудование.

**Как цитировать**

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# Minimum standard for equipping Moscow clinics with ultrasound diagnostic devices

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***ABSTRACT***

***BACKGROUND:*** A variety of ultrasound equipment and a lack of generally accepted classifications lead to inefficient equipment of medical organizations, incorrectly selected types of device, sets and probes' characteristics, as well as a level of study quality. A systematic approach to equipping similar medical organizations with ultrasound devices will ensure the availability and improve the quality of primary medical care in outpatient centers.

***AIM:*** To develop a calculation algorithm and recommendations for the minimum standard for equipping regional outpatient medical facilities of the state healthcare system based on the Moscow example.

***MATERIALS AND METHODS:*** In conducting the study, we used software for statistical and comparative analysis based on the data of the Material Support Management System of the Unified Medical Information and Analytical System (MSMS UMIAS), Form No.30 of Federal Statistical Observation, as well as a number of assigned population to the outpatient center (hereinafter referred to as the OC), technical data, and reviews of modern ultrasound diagnostic devices.

***RESULTS:*** The developed minimum standard for equipment considers the following factors: 1) need to provide medical care to children and adult populations separately; 2) compliance with modern diagnostic technologies; 3) ensuring the territorial availability of diagnostics under the condition of efficient equipment operation.

***CONCLUSIONS:*** Standardization of equipment of outpatient medical facilities with ultrasound diagnostic devices contributes to improving the quality of diagnostics and the availability of providing required examinations to the assigned population, reducing the waiting time for examinations, reducing the shortage of necessary equipment, expanding the range of medical services provided to the city population, and minimizing duplicate studies at subsequent stages of medical care.

**Keywords:** equipment and supplies; ultrasonography; ambulatory care facility; medical equipment.

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# 为莫斯科综合医院配备超声诊断设备的最低标准

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**简评现实意义。**超声设备的种类繁多，缺乏通用分类，导致医疗机构的装备效率低下，在设备类型、换能器的设置和特点以及检查质量水平方面的选择都是错误的。为单一类型的医疗机构配备超声设备的系统性方法，将确保门诊综合医院的可及性并提高初级保健的质量。

**目的。**以莫斯科市为例，开发一种计算算法与推荐来制定该地区公共医疗系统中门诊医疗机构的最低设备标准。

**材料与方法。**根据统一医疗信息和分析系统材料管理系统（UMO EMIAS）的、联邦统计观察第30号表格的及指定归综合门诊中心（以下简称APC）的人口数的数据，研究中使用了统计和比较分析的软件工具，以及现代超声诊断设备的技术数据和评论。

**结果。**在已经制定的最低设备标准中，考虑了以下因素：

1） 对儿童和成人分别进行医疗护理的需求；
2） 符合现代诊断技术；
3） 根据设备的有效运行，确保诊断的地域可用性。

**结论。**为门诊医疗机构配备超声诊断设备的标准化有助于提高诊断质量，增加民众获得必要检查的机会，减少检查的等待时间，减少必要设备的短缺，扩大为城市人口提供的医疗服务范围，尽量减少医疗服务后续阶段的重复检查。

**关键词：**设备标准；超声波；门诊部；超声诊断设备；医疗设备。

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# INTRODUCTION

In the early 2020s, state outpatient care facilities were equipped by the Order of the Ministry of Health and Social Development of the Russian Federation No. 753 dated December 1, 2005,[1] which divides all healthcare facilities by types of subordination and recommends equipping them according to the schedules provided. However, these standards do not fully reflect the current equipment need of healthcare facilities both in terms of the equipment quantity and availability of state-of-art diagnostic technologies. Therefore, determining diagnostic tasks to be solved using specific types of equipment and comparing them with actual market supply are important. To estimate the need for equipment, it is necessary to forecast the equipment utilization for the next 10 years. By the Order of the Department of Health of Moscow No. 751 dated July 31, 2020, for the effective utilization of ultrasound diagnostic devices (UDDs) in a healthcare facility,[2] the annual number of planned examinations should be approximately 9000 per device provided that a device is operated 12 h a day, 5 days a week.

Currently, healthcare facilities may be equipped as follows [1]:

- Procuring new equipment
- Procuring used equipment
- Procuring modernized equipment
- Long-term equipment leasing

After the procurement of new equipment is approved, a term of reference (TOR) shall be prepared as follows:

1. At the planning stage, technical specifications and equipment configuration shall be clinically reasonable.
2. A qualitative (availability) or quantitative characteristic shall be provided for the parameters required, e.g., the minimum and maximum frequency ranges of probes.
3. When preparing the TOR, suppliers must be contacted to obtain equipment characteristics, clarify technical issues, evaluate the relevance of the TOR for the actual medical equipment market, and make competitive purchases with at least three manufacturers.
4. To prepare the TOR, healthcare facilities may use the list of Russian state standards (GOSTs) for compliance with requirements for state procurement and various healthcare standards.

If the TOR is not consistent with the above-mentioned principles, equipment problems may arise, for example, it is impossible to use adult ultrasound probes in pediatric healthcare facilities, and vice versa. The inadequate configuration of probes and programs can also result in the replacement of the entire system because of limitations in expanding the range of healthcare services of the ultrasound diagnostic department [2].

To prevent such errors in large-scale purchases, methodological materials shall be developed, comparing equipment needs by types of facilities and healthcare services provided to set a minimum equipment standard [3].

To introduce a unified systematic approach to resource distribution, a minimum standard for equipping outpatient centers of the Department of Health of Moscow with UDDs has been developed, indicating the quantity and quality of equipment [4].

# MATERIALS AND METHODS

Based on the current equipment stock available, equipment utilization and distribution were assessed for outpatient centers of the Department of Health of Moscow, separately in adult and pediatric centers and in branches and head offices. The minimum equipment standard was developed considering the size of the attended population, concentration of clinical specialists in the head office, and number of examinations conducted during the reporting period.

We used the data of the Procurement Management System of the Unified Medical Information and Analysis System (UMIAS or EMIAS) of the Department of Health of Moscow (Federal Statistical Monitoring Form No. 30 for the reporting period) and publicly available technical specifications and reviews of state-of-art UDDs.

Most often, TORs classify devices into multipurpose (260250), hand-held (324320), and special cardiovascular (192070) devices, which are indicated in the Nomenclature of Medical Devices,[3] to cover a wide range of necessary examinations for the attended adult and pediatric population.

# RESULTS

## Status of UDD stock in outpatient care facilities of the Department of Health of Moscow

According to the Federal Statistical Monitoring Form No. 30 for 2019, 86 outpatient centers (including city outpatient clinics, pediatric city outpatient clinics, diagnostic centers, clinical diagnostic centers, and consultative and diagnostic outpatient clinics) are equipped with more than

[1] Order of the Ministry of Health and Social Development of the Russian Federation dated December 1, 2005, No. 753 "On Equipping Municipal Outpatient and Inpatient Care Facilities with Diagnostic Equipment". Available at: https://docs.cntd.ru/document/901962043. Accessed on September 26, 2022.

[2] Order of the Department of Health of Moscow No. 751 dated July 31, 2020, "On Approval of Target Indicators for Medical Equipment in Healthcare Organizations of the Moscow State Primary Healthcare System". Available at: https://tele-med.ai/media/documents/%D0%B2%D1%85._3884.1-6_mw9IosC.pdf. Accessed on September 26, 2022.

[3] Order of the Ministry of Health of the Russian Federation No. 4n dated June 6, 2012, "On Approval of the Nomenclature of Medical Devices". Available at: https://docs.cntd.ru/document/902353334. Accessed on September 26, 2022.

1,300 UDDs, which are designed to examine the attended population (>10 million) using the territorial program of state guarantees (Table 1).

To classify UDDs by types of care, three types of devices were considered: multipurpose, special cardiovascular, and hand-held devices (Table 2).

In accordance with the Letter of the Primary Healthcare Office of the Department of Health of Moscow No. 41-18-54078/18, for Ultrasound Diagnostics Departments with two-shift working mode, the target efficacy indicator is 40 examinations per day[4]. The average number of examinations per day is 19, and the average number of shifts is 1.6. Changes in available UDD utilization are presented in Table 3.

Considering the head office and all branches, the attended population included 92,000–300,000 and 28,000–73,000 people per adult and pediatric outpatient centers, respectively. According to the Federal Statistical Surveillance Form No. 30 for 2019, more than 4,800,000 and 2,000,000 ultrasound examinations were performed in adult and pediatric outpatient centers, respectively (including more than 2,300,000 and 214,000 cardiovascular ultrasound examinations). There are approximately 663 and 286 wage rates for diagnostic ultrasound technicians in adult and pediatric outpatient centers, respectively (including 604 and 204 HCPs).

# DISCUSSION

## Minimum equipment standard

According to Reporting Form No. 30 for 2019, adult and pediatric outpatient centers are equipped with more than 1300 UDDs with an attended population of more than 10 million and with more than 7 million examinations performed; therefore, the average annual number of examinations is 6000 per 1 UDD.

For multipurpose UDD utilization for the attended adult population, the above parameter was calculated using the ratio of the attended population to the number of UDDs, multiplied by the ratio of the average attended outpatient population to the total number of examinations, multiplied by the ratio of the number of examinations per 1 UDD per outpatient center to the number of examinations per 1 UDD (excluding cardiovascular examinations). For the attended pediatric population, the minimum equipment standard value is based on the comparison of the number of examinations conducted and the size of attended adult and pediatric populations.

For special cardiovascular UDD utilization for the attended adult population, the above parameter was calculated using the ratio of the average number of cardiovascular examinations per outpatient center to the average number of examinations per one UDD per outpatient center. For

**Table 1.** Current status of ultrasound diagnostic equipment in outpatient centers*

| Parameter | Outpatient centers | | |
|---|---|---|---|
| | Adult | Pediatric | Total |
| Number of equipment (pcs) | 964 | 428 | 1392 |
| Average service life of UDD (years) | 7 | 8 | 8 |
| Number of UDDs with service life >10 years (%) | 17 | 21 | 19 |
| Number of UDDs with service life <3 years (%) | 10 | 2 | 6 |

*Note.* * Based on Federal Statistical Monitoring Form No. 30 for 2019. UDD, ultrasound diagnostic device.

**Table 2.** Distribution of equipment stock by types of care*

| Parameter | Outpatient centers | | |
|---|---|---|---|
| | Adult | Pediatric | Total |
| Number of multipurpose UDDs (pcs) | 726 | 376 | 1102 |
| Number of special cardiovascular UDDs (pcs) | 192 | 9 | 201 |
| Number of hand-held UDDs (pcs) | 46 | 43 | 89 |

*Note.* * Based on Federal Statistical Monitoring Form No. 30 for 2019. UDD, ultrasound diagnostic device.

**Table 3.** Changes in outpatient UDD utilization, 2017–2019*

| Type of healthcare facility | 2017 | 2018 | 2019 |
|---|---|---|---|
| Outpatient centers | 55 | 57 | 59 |

*Note.* * Based on the data of Procurement Management System of the Unified Medical Information and Analysis System (UMIAS, EMIAS), 2017–2019.

[4] Letter of the Primary Healthcare Office of the Department of Health of Moscow No. 41-18-54078/18 dated October 22, 2018. Available at: https://tele-med.ai/media/documents/tselevyye_pokazateli_zagruzki_tmt.pdf. Accessed on September 26, 2022.

the attended pediatric population, the minimum equipment standard value is based on the comparison of the number of examinations conducted and the size of the attended adult and pediatric populations.

To improve the efficiency of radiology and imaging departments, the recommendation was to provide at least one hand-held UDD per adult and pediatric outpatient center, both in head and branches, for sedentary patients and medical check-ups and follow-up examinations outside healthcare facilities.

The minimum equipment standard for adult and pediatric primary outpatient centers (Tables 4 and 5; both tables were included in Order No. 1043 dated September 15, 2020[5]) describes the equipment system at a certain time according to the needs at the city level. An increase in the population with the development of districts requires an increase in UDD stocks. If reasonable, if the number of HCPs is sufficient for full equipment utilization, exceeding the minimum equipment standard is allowed.

To increase the efficiency, it is necessary not only to supply UDDs but also to ensure their complete set. For each device type, certain types of examinations are supposed to be performed (Table 6).

To obtain conclusive results of the above-mentioned examinations, in addition to the minimum model for calculating the equipment need of adult and pediatric outpatient centers, the minimum delivery package was developed for UDDs with minimum frequency ranges (Table 7).

## Comparison of equipment standards

1. Let's consider equipment for adult and pediatric outpatient centers by the Order of the Ministry of Health and Social Development of the Russian Federation No. 753 dated December 1, 2005,[6] and the minimum equipment standard proposed (Tables 8 and 9).

The need for UDDs in an adult outpatient center was calculated as follows: an adult center was considered a basis, having a head office and three branches located at different addresses remote from each other, and each site has a certain size of an attended population.

The number of UDDs was calculated based on the size of the attended adult population (92,149). According to the minimum equipment standard (Table 4), the head office and branches (<50,000) should be provided with two multipurpose UDDs and one special cardiovascular UDD, and one multipurpose UDD and one special cardiovascular

**Table 4.** Minimum standard for equipping adult primary outpatient centers with UDDs

| Type of ultrasound device | Outpatient center | |
|---|---|---|
| | Head office, per 1000 population | Branch office, per 1000 population |
| Multipurpose UDD | <50 — 1 pc<br>50–100 — 2 pcs<br>100–150 — 3 pcs<br>>150 — 4 pcs (but no >4 pcs per office, including 1 expert UDD) | <50 — 1 pc<br>>50 — 2 pcs |
| Hand-held UDD | 1 pc (expert UDD) | 1 pc |
| Special cardiovascular UDD | <100 — 1 pc<br>>100 — 2 pcs | 1 pc |

**Table 5.** Minimum standard for equipping pediatric primary outpatient centers with UDDs

| Type of ultrasound device | Outpatient center | |
|---|---|---|
| | Head office, per 1000 population | Branch office, per 1000 population |
| Multipurpose pediatric UDD | <30 — 1 pc<br>>30 — 2 pcs | <15 — 1 pc<br>>15 — 2 pcs |
| Hand-held pediatric UDD | 1 pc | 1 pc |
| Special cardiovascular pediatric UDD | <50 — 1 pc<br>>50 — 2 pcs | - |

[5] Order of the Department of Health of Moscow No. 1043 dated September 15, 2020, "On Approval of the Model for Calculating the Need for Equipping Healthcare Facilities of the Public Healthcare System of Moscow with Ultrasound Devices". Available at: https://tele-med.ai/media/documents/Приказ_ДЗМ_1043_от_15.09.2020.pdf. Accessed on September 26, 2022.

[6] Order of the Ministry of Health and Social Development of the Russian Federation dated December 1, 2005, No. 753 "On Equipping Municipal Outpatient and Inpatient Care Facilities with Diagnostic Equipment". Available at: https://base.garant.ru/4182310/. Accessed on September 26, 2022.

**Table 6.** Comparison of examination types by types of UDD

| Examination type | Hand-held | Multipurpose | Special* |
|---|---|---|---|
| Neurosonography (for pediatric outpatient centers) | + | + | - |
| Ultrasonography of superficial organs and structures | + | + | - |
| Transabdominal ultrasonography of the abdominal cavity, kidneys, retroperitoneal space, and pelvic organs | + | + | - |
| Ultrasonography of the pleural cavity | + | + | + |
| Echocardiography | + (screening level) | + (screening level) | + (expert level) |
| Transcranial vascular ultrasonography | + (screening level) | + (screening level) | + (expert level) |
| Vascular ultrasonography of the neck and upper and lower extremities | + (screening level) | + (screening level) | + (expert level) |
| Intracavitary ultrasonography of pelvic organs | - | + | - |

*Note.* * For cardiovascular ultrasonography.

**Table 7.** Approximate configuration of UDDs with a minimum range of probe frequencies

| Type of device | Technical specifications | Outpatient center, head and branch offices | |
|---|---|---|---|
| | | Adult | Pediatric |
| Special cardiovascular UDD | Linear probe, frequency range, MHz | 3–10 | 5–12 |
| | Curvilinear probe, frequency range, MHz | 3–5 | 3–7 |
| | Sector-phased array probe, frequency range, MHz | 2–5 | 2–5 |
| | Sector-phased array probe, frequency range, MHz | - | 5–8 |
| Hand-held UDD | Linear probe, frequency range, MHz | 5–12 | 8–14 |
| | Curvilinear probe, frequency range, MHz | 3–5 | 3–7 |
| | Sector-phased array probe, frequency range, MHz | 2–4 | 2–4 |
| | Sector-phased array probe, frequency range, MHz | - | 5–8 |
| Multipurpose UDD | Linear probe, frequency range, MHz | 5–12 | 8–14 |
| | Curvilinear probe, frequency range, MHz | 2–5 | 3–7 |
| | Intracavitary microconvex probe, frequency range, MHz | 4–9 | - |
| | Sector-phased array probe, frequency range, MHz | - | 5–8 |
| | Sector-phased array probe, frequency range, MHz | 2–4 | 2–4 |

*Note.* ?????

**Table 8.** Estimated need for UDDs in an adult outpatient center

| Parameters | Adult outpatient center X | | | | |
|---|---|---|---|---|---|
| | Head office | Branch office No. 1 | Branch office No. 2 | Branch office No. 3 | Total |
| Number of attended population | 26 451 | 20 190 | 26 583 | 18 925 | 92 149 |
| Number of UDDs required according to the Order of the Ministry of Health and Social Development of the Russian Federation No. 753 dated December 1, 2005 | | | | | |
| Medical UDD | 2 | 2 | 2 | 2 | 8 |
| Hand-held | 1 | 1 | 1 | 1 | 4 |
| Number of UDDs required by the minimum equipment standard | | | | | |
| Multipurpose | 2 | 1 | 1 | 1 | 5 |
| Special | 1 | 1 | 1 | 1 | 4 |
| Hand-held | 1 | 1 | 1 | 1 | 4 |

*Note.* UDD, ultrasound diagnostic device.

**Table 9.** Estimated need for UDDs in an pediatric outpatient center

| Parameters | Pediatric outpatient center Y | | | | |
|---|---|---|---|---|---|
| | Head office | Branch office No. 1 | Branch office No. 2 | Branch office No. 3 | Total |
| Number of attended population | 20 640 | 14 639 | 10 160 | 13 889 | 59 328 |
| Number of UDDs required according to the Order of the Ministry of Health and Social Development of the Russian Federation No. 753 dated December 1, 2005 | | | | | |
| Medical UDD | 1 | 1 | 1 | 1 | 4 |
| Number of UDDs required by the minimum equipment standard | | | | | |
| Multipurpose | 2 | 1 | 1 | 1 | 5 |
| Special | 2 | 0 | 0 | 0 | 2 |
| Hand-held | 1 | 1 | 1 | 1 | 4 |

*Note.* UDD, ultrasound diagnostic device.

UDD, respectively. Each office should have one hand-held UDD, regardless of the size of the attended population, for low-mobility patients and examinations outside a healthcare facility.

Therefore, by the Order of the Ministry of Health and Social Development of the Russian Federation No. 753 dated 01.12.2005, 12 UDDs of two proposed types are needed to equip an adult outpatient center with one head office and three branches. The current minimum equipment standard recommends equipping such a center with 13 UDDs, which are divided by types and evenly distributed among branches.

The UDD need in a pediatric outpatient center was calculated similarly to the adult outpatient center.

Based on the size of the attended pediatric population (59,328), the number of devices was calculated. According to the minimum equipment standard (Table 5), the head office and branches (<15,000) should be provided with two multipurpose UDDs and two special cardiovascular UDDs, and one multipurpose UDD, respectively. For each office, one hand-held UDD is required, regardless of the size of the attended population.

Therefore, by the Order of the Ministry of Health and Social Development of the Russian Federation No. 753 dated December 1, 2005, for a pediatric outpatient center with one head office and three branches, only four UDDs of the same type are required. The current minimum equipment standard recommends equipping such a center with 11 UDDs, which are divided by types and evenly distributed among branches.

2. Let's consider equipping an adult and a pediatric outpatient center before and after implementing the minimum equipment standard proposed (Tables 10 and 11).

Table 10 shows the equipment for an adult outpatient center. In total, such a center is equipped with 22 stationary UDDs and two hand-held UDDs per attended population

**Table 10.** Comparison of UDD availability in an adult outpatient center

| Parameters | Adult outpatient center A | | | | |
|---|---|---|---|---|---|
| | Head office | Branch office No. 1 | Branch office No. 2 | Branch office No. 3 | Total |
| Number of attended population | 36 051 | 51 162 | 45 589 | 33 653 | 166 455 |
| Number of UDDs available before equipping according to the minimum equipment standard | | | | | |
| Ultrasound imaging system | 8 | 6 | 4 | 4 | 22 |
| Hand-held ultrasound imaging system | 1 | 0 | 0 | 1 | 2 |
| Number of UDDs available after equipping according to the minimum equipment standard | | | | | |
| Multipurpose | 2 | 2 | 1 | 1 | 6 |
| Special | 2 | 1 | 1 | 1 | 5 |
| Hand-held | 1 | 1 | 1 | 1 | 4 |

*Note.* UDD, ultrasound diagnostic device.

**Table 11.** Comparison of UDD availability in a pediatric outpatient center

| Parameters | Pediatric outpatient center B | | | | |
|---|---|---|---|---|---|
| | Head office | Branch office No. 1 | Branch office No. 2 | Branch office No. 3 | Total |
| Number of attended population | 14 357 | 17 931 | 18 346 | 13 663 | 64 297 |
| Number of UDDs available before equipping according to the minimum equipment standard | | | | | |
| Ultrasound imaging system | 4 | 3 | 2 | 2 | 11 |
| Hand-held ultrasound imaging system | 1 | 0 | 0 | 0 | 1 |
| Number of UDDs available after equipping according to the minimum equipment standard | | | | | |
| Multipurpose pediatric | 2 | 2 | 2 | 1 | 7 |
| Special pediatric | 2 | 0 | 0 | 0 | 2 |
| Hand-held pediatric | 1 | 1 | 1 | 1 | 4 |

*Note.* UDD, ultrasound diagnostic device.

(166,000). The analysis of the equipment utilization efficiency for 2019 shows that the average efficiency of the current UDD stock is 64%, which corresponds to a low level of efficiency. Therefore, the adult outpatient described in the example has some extra UDDs or lacks HCP wage rates to ensure the utilization of stationary UDDs 5 days a week in two shifts, based on the target equipment utilization rate[7]. According to the minimum standard of equipment, this center requires equipping with six multipurpose, five special, and four hand-held UDDs (total of 15 UDDs) and only 11 stationary UDDs, which require a smaller number of HCP wage rates for full and efficient utilization of the equipment.

Table 11 shows the equipment of a pediatric outpatient center. In total, such a center is equipped with 11 stationary UDDs and one hand-held UDD per attended population (64,000). The analysis of the equipment utilization efficiency for 2019 shows that the average efficiency of the current UDD stock is 91%, which corresponds to a high level of efficiency. According to the minimum equipment standard, this center requires seven multipurpose, two special and four hand-held UDDs (total of 13 UDDs).

Therefore, it is necessary to reduce the number of UDDs, re-equip centers, and distribute UDDs by types (Tables 10 and 11) to provide the attended adult and pediatric populations with all the necessary types of ultrasound examinations and increase the efficiency of the new equipment in accordance with international standards[8].

According to this paper, the outpatient ultrasound equipment standard is included in the database that defines the minimum requirements for equipping healthcare facilities with radiology and imaging equipment[9], approved and implemented by the Department of Health of Moscow.

## CONCLUSION

The proposed minimum equipment standard for adult and pediatric outpatient centers contributes to improving the quality of diagnostics. The standard allows even distribution of equipment throughout the healthcare facility for better and more affordable primary medical care in the attended population in the corresponding outpatient center.

The standard is simple to apply because it classifies the equipment by types and describes the necessary equipment. Thus, the equipment required by the head office and branches of outpatient centers should be clarified in accordance with this standard to increase the availability of the necessary examinations to the attended population, reduce the waiting time, ensure reasonable equipment planning for a given period, reduce the shortage of necessary equipment (forecasting the future number of examinations),

[7] Explanatory Letter of the Primary Healthcare Office of the Department of Health of Moscow No. 41-18-54078/18 dated October 22, 2018. Available at: https://tele-med.ai/media/documents/tselevyye_pokazateli_zagruzki_tmt.pdf. Accessed on September 26, 2022.

[8] Practice Parameters and Technical Standards. American College of Radiology (ACR). Available at: https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards. Accessed on September 26, 2022.

[9] Database no. 2022621124/19.05.22. S. P. Morozov, I. V. Soldatov, S. G. Kireyev, et al. Data determining the minimum requirements for equipping healthcare facilities with radiology and imaging equipment. Available at: https://www1.fips.ru/registers-doc-view/fips_servlet?DB=DB&DocNumber=2022621124&TypeFile=html. Accessed on September 26, 2022.

and expand the range of medical services provided to the local population. A state-of-art set of devices is necessary to obtain conclusive results of the examination of various organs and systems and minimize duplicate examinations at subsequent stages of the patient's journey.

The analysis of the outpatient center with a total attended population of 10 million people showed the adequacy of the proposed approach to provide high-quality ultrasound diagnostics. To estimate the economic effect, long-term observations are required because of the gradual replacement of equipment. However, the proposed solution does not reduce the availability of this category of examinations.

An algorithm for calculating the minimum equipment standard can be proposed for other regions of the Russian Federation to standardize the re-equipment of outpatient care facilities.

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