

## Remote Monitoring of the Health Status of Pregnant Women in the Context of the Pandemic COVID-19

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### Abstract

The article presents the practical application of telemedicine information technologies that have allowed maternity institutions of the Sverdlovsk region to carry out remote monitoring the health of pregnant women and maternity hospitals, including during outpatient treatment (at home) with asymptomatic and mild COVID-19.

**Keywords:** Information Technologies; Telemedicine; Remote Health Monitoring; Healthcare; Maternity Care; Referral; Routing; Pregnant Woman's Personal Account; COVID-19; Electronic Diary of Self-Monitoring of Health

### The role of remote technologies in the quality management system and safety of medical care

On April 26, 2021, Deputy Chairman of the State Duma Irina Yarovaya at a meeting of the Presidium of the Council of Legislators of the Russian Federation under the Federal Assembly of the Russian Federation called for simplifying the exchange of data between medical institutions and patients.

In the Sverdlovsk region, an automated information system of mobile notifications "AIST\_SMART" for pregnant patients and doctors began to operate. Using a smartphone or, say, a tablet, pregnant patients in their personal account get the opportunity to maintain an electronic diary of self-control of their health. The diary has the functions of automatic interpretation of the results and the formation of signal information for the obstetrician-gynecologist.

Now pregnant women do not need to fill out paper diaries of self-control, call their doctor or the reception of the antenatal clinic or wait for a doctor's call in order to report the results - the process is fully automated.

The women's consultation received an IT tool for remote interaction with pregnant women and women in child child.

The introduction of "AIST\_SMART" technologies made it possible to replace paper diaries with electronic ones. Medical data of the patient are collected in a single database and allow you to track the dynamics of the patient's health around the clock.

The results of electronic diaries are automatically processed by the system and if no abnormalities are detected, the data is simply recorded in the system and does not disturb the doctor (Figure 1).

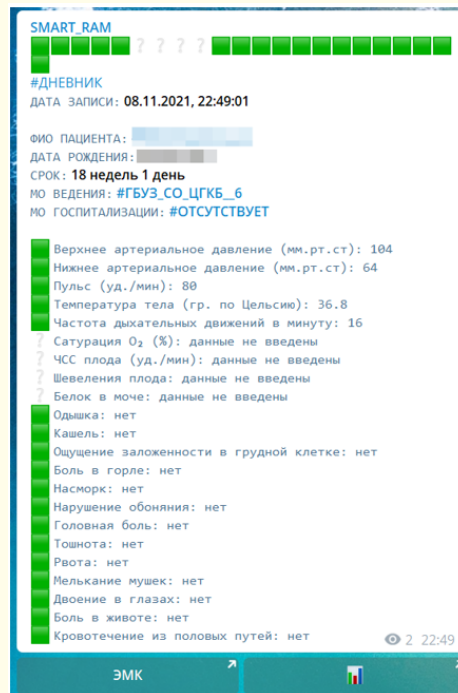


Figure 1: *bjcghklAHla.*

In case of detection of deviations in the patient’s state of health, the system marks the identified deviations and sends a notification to the doctor about the current state (Figure 2).

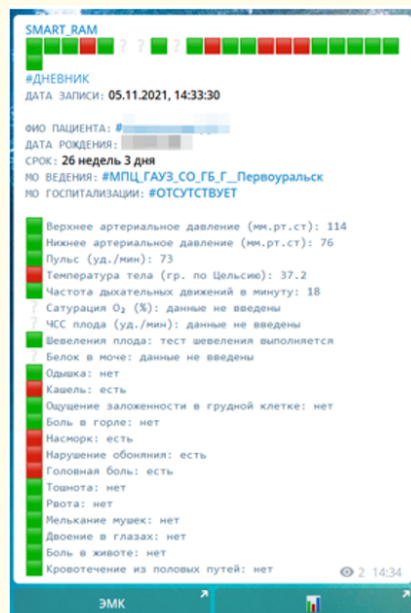


Figure 2: Data of the expanded diary of self-control at NKVI with deviations in the state of health.

Mobile notifications instantly convey accurate and detailed information about the patient's state of health and thus contribute to the timely decision on hospitalization in case of detection of criteria for weighting the course of COVID-19.

All notifications in case of deviations are automatically sent to the attending physician and the doctor in the Obstetric Remote Consultation Center (hereinafter referred to as the ORCC) for the routing of the patient 24/7.

Remote health monitoring functions as follows.

### Registration in the system "AIST\_SMART"

To register the patient in the personal account at the initial appointment of a pregnant patient, a consent-instruction [1] is issued to connect to the mobile service "AIST\_SMART" with an individual QR code. At home, the patient reads the QR code using the camera of her smartphone or tablet and, according to the instructions, undergoes the registration procedure, forming a digital four-digit PIN code. From this moment she is guaranteed a technical code 24/7 support. QR code serves as the patient's identifier and a link between her Electronic Health Records (EHR) in the AIST "RAM" and the personal account in the "AIST\_SMART" system.

To register a doctor in your personal account, you must log in to the medical information system - AIST "RAM", in which all medical personnel of the obstetric service in the region work. Open the "Personal Account" tab and register by scanning an individual QR code.

So, in order to access electronic self-control diaries, the doctor and the patient connect to the AIST\_SMART service, and after registering in the system, notifications about the results of remote health monitoring will be received on their mobile device. The doctor does not need to call on the phone to find out how she feels, how her temperatures, symptoms of SARS, etc.

### How the mobile alert system works

#### Formation of notification of the result of self-control diaries

This process is fully automated. AIST\_SMART performs the role of an intellectual assistant to the obstetrician-gynecologist/midwife. The patient fills in the diary data, and the doctor receives ready-made results with automatic interpretation. Now the patient will not forget to call the antenatal clinic, and the doctor will be able to make decisions on the tactics of conducting comprehensively, taking into account the results of the patient's home self-control and his obstetric status.

#### Patients with NCI are asymptomatic/mild and receiving care on an outpatient basis (at home)

Upon receipt of the results of testing in a pregnant woman/maternity for COVID-19, the data are entered by medical personnel in the AIST "RAM". Notifications about the results are automatically generated in the personal account "AIST\_SMART" (Figure 3 and 4).

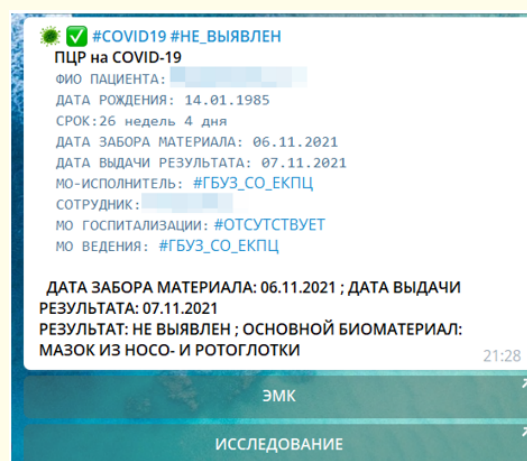


Figure 3: Mobile notification of PCR result for COVID-19: not detected.

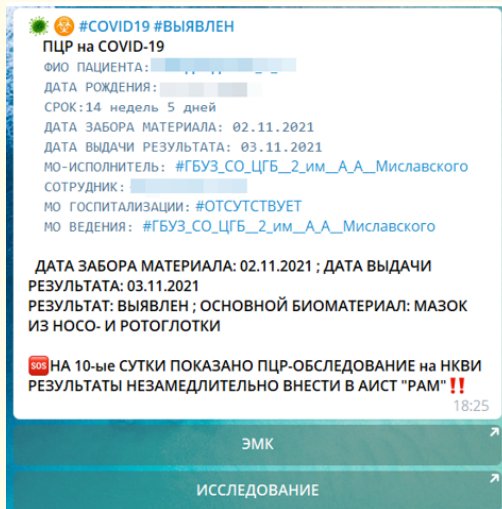


Figure 4: Mobile notification of PCR result for COVID-19: DETECTED.

These notifications are automatically sent to both the patient and the doctors. With what there is control that the patient is also informed about the result (Figure 5).

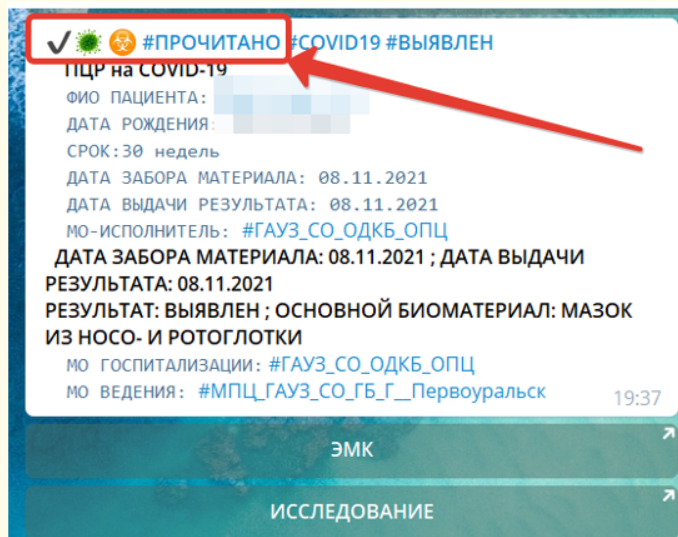


Figure 5: Mobile notification of PCR result for COVID-19: DETECTED.

If a positive result is detected on the COVID-19, the patient receives notifications 2 times a day about the need to fill out a self-control diary, which is also informed by the doctor - full feedback (Figure 6).

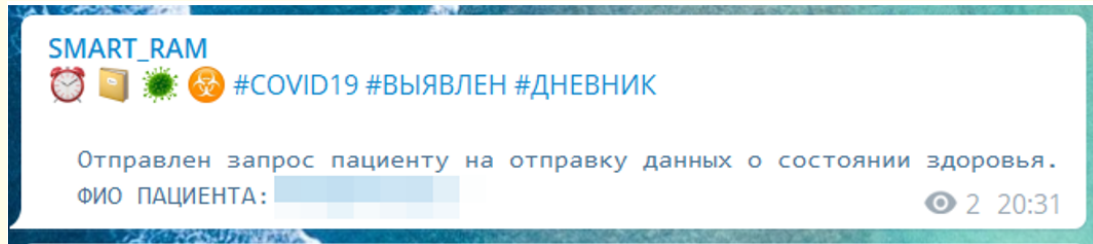


Figure 6: Mobile notification that a reminder has been sent to the patient to complete a self-monitoring diary.

Figure 6 Mobile notification that a reminder has been sent to the patient to complete a self-monitoring diary.

The doctor of the ADC, based on the results of the self-control diary (Figure 7) and obstetric status according to the data in the Electronic Health Records (hereinafter - EHR) in the AIST “RAM”, where there is information about all the results of the examination, the course of pregnancy and diagnoses, decides on further management tactics: to continue outpatient treatment or hospitalization in a covid hospital. The ORCC doctor fixes his decision in the EHR, making a remote consultation for the attending physician of the antenatal clinic or and obstetric hospital (if the patient is in the hospital at the time of detection of COVID-19).

Дата	Время	Наименование	Показатели
14.10.2021	15:40:05	Артериальное давление	110/70
14.10.2021	15:40:05	Пuls (уд./мин)	96
14.10.2021	15:40:05	Температура тела (гр. по Цельсию)	36,8
14.10.2021	15:40:05	Частота дыхательных движений в минуту	18
14.10.2021	15:40:05	Шевеления плода	ТЕСТ шевеления выполняется
14.10.2021	15:40:05	Ощущение заложенности в грудной клетке	ЕСТЬ
14.10.2021	15:40:05	Насморк	ЕСТЬ
14.10.2021	15:40:05	Нарушение обоняния	ЕСТЬ
14.10.2021	00:20:04	Артериальное давление	110/70
14.10.2021	00:20:04	Пuls (уд./мин)	108
14.10.2021	00:20:04	Температура тела (гр. по Цельсию)	38,2
14.10.2021	00:20:04	Частота дыхательных движений в минуту	19
14.10.2021	00:20:04	Шевеления плода	ТЕСТ шевеления выполняется
14.10.2021	00:20:04	Ощущение заложенности в грудной клетке	ЕСТЬ
14.10.2021	00:20:04	Насморк	ЕСТЬ
14.10.2021	00:20:04	Нарушение обоняния	ЕСТЬ
13.10.2021	14:26:49	Артериальное давление	110/70
13.10.2021	14:26:49	Пuls (уд./мин)	84
13.10.2021	14:26:49	Температура тела (гр. по Цельсию)	36,4
13.10.2021	14:26:49	Частота дыхательных движений в минуту	18
13.10.2021	14:26:49	Шевеления плода	ТЕСТ шевеления выполняется
13.10.2021	14:26:49	Ощущение заложенности в грудной клетке	ЕСТЬ
13.10.2021	14:26:49	Насморк	ЕСТЬ
13.10.2021	14:26:49	Нарушение обоняния	ЕСТЬ
12.10.2021	19:08:01	Артериальное давление	110/70
12.10.2021	19:08:01	Пuls (уд./мин)	78
12.10.2021	19:08:01	Температура тела (гр. по Цельсию)	37,8
12.10.2021	19:08:01	Частота дыхательных движений в минуту	18
12.10.2021	19:08:01	Шевеления плода	ТЕСТ шевеления выполняется

Figure 7: Dynamics of the state of health according to the electronic diary of self-control.

If a decision is made on the need for hospitalization, the doctor of the ADC through a confidential «working» chat in AIST\_SMART can contact the patient and clarify her consent to hospitalization and the possibility of transportation by personal transport. If consent is obtained (Figure 8), the ADC doctor additionally draws up a referral for (re-) hospitalization to a particular covid hospital for pregnant women and women in childcare, taking into account the available places.

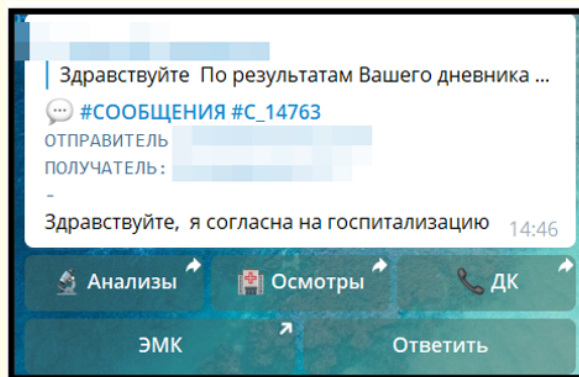


Figure 8: Communication with the patient through a confidential “working” chat in AIST\_SMART.

The patient receives a notification about the completed referral indicating the covid hospital, the date and time of hospitalization (Figure 9).

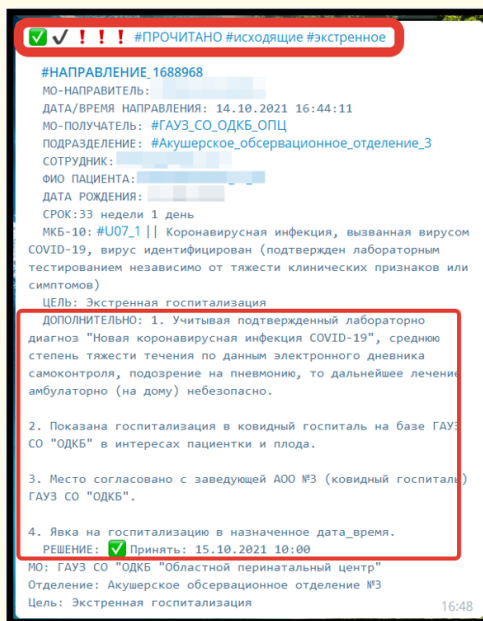
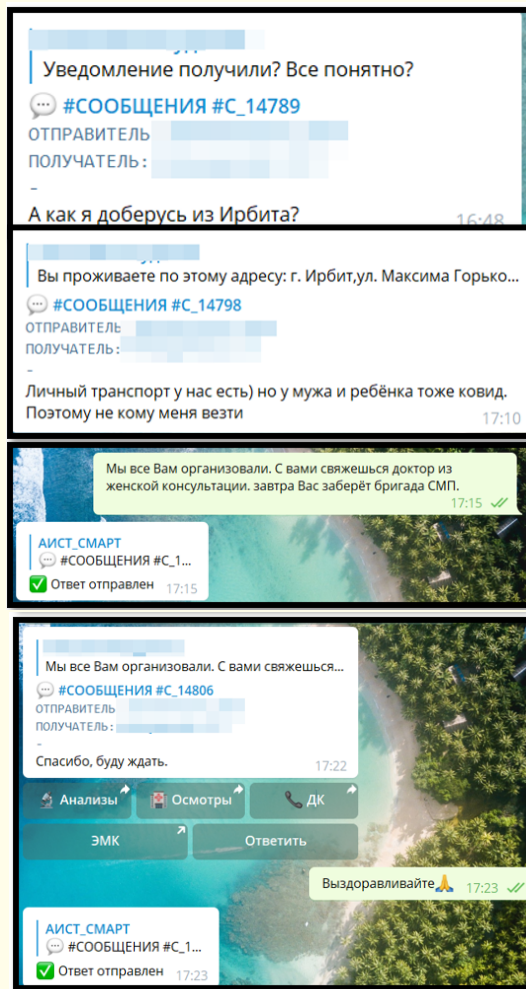


Figure 9: Notification of referral to a Covid hospital and labeling of reading by a patient.

If it is necessary to organize transportation, the doctor of the ADC has resources through communication with the medical organization where the patient is on the dispensary register and agreeing on the method and time of transportation by the NSR team in compliance with the epidemiological rules (Figure 10).



**Figure 10:** Finding out the possibilities of transportation and hospitalization to a covid hospital through a confidential “work” chat in AIST\_SMART.

If necessary, you can print the referral at the place of treatment of the patient, using a single information space of the regional obstetric monitoring of AIST “RAM”.

All the directions that a woman received during pregnancy are reflected in her personal account in the “My directions” section. The patient can open any document, even if the connection with the Internet has disappeared.

### Advantages of remote monitoring of health

The transition to electronic diaries of self-control makes it possible to identify the aggravation of the course of ARVI/ARI in the case of outpatient treatment (at home) with COVID-19, and timely send the patient to hospitalization to prevent the prevention of adverse events, which is from the main directions of the quality management system and safety of medical care.

AIST\_SMART allows you to create constant feedback [2] with the patient and thereby form a patient-centric model of care as one of the priority areas for the development of modern medicine and healthcare in general.

All of the above increases the compliance of doctor-patient interaction and directly affects the quality and safety of medical care in the difficult conditions of the COVID-19 pandemic, which meets the modern needs of society and solves the tasks set by the Government of the Russian Federation in the field of digitalization of healthcare.

### Conclusion

#### Benefits of remote health monitoring

The transition to electronic self-monitoring diaries allows us to identify the aggravation of the course of ARVI/ARI in the case of outpatient treatment (at home) with COVID-19, and promptly refer the patient to hospitalization to prevent adverse events, which is one of the main directions of the quality management system and the safety of medical care. AIST\_SMART allows you to create constant feedback [3] with the patient and thereby form a patient-centered model of care, as one of the priority areas for the development of modern medicine and healthcare in general. All of the above increases the compliance of the doctor-patient interaction and directly affects the quality and safety of medical care in the harsh conditions of the COVID-19 pandemic, which meets the modern needs of society and solves the tasks set by the Government of the Russian Federation in the field of healthcare digitalization.

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