Development of a comprehensive approach to personalized patronage of patients with stable angina using a mobile application

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Abstract. This article discusses the problems of modern treatment and patronage of patients in the rehabilitation period. The authors of the work developed a new approach to accompanying a patient suffering from cardiovascular diseases, in particular, such a disease as stable angina was considered. A service was developed that includes an app for the Android mobile operating system and a website. The work describes the main functionality of that service, as well as shows the changes that occurred during the integration of the service into the existing process of patient patronage.

1. Introduction
Coronary heart disease (CHD) [7, 14] is an insufficient supply of oxygen and nutrients to the heart muscle (myocardium) due to damage to the coronary arteries.

Angina is the most common form of coronary heart disease, which is manifested by attacks of chest pain. Pain of a compressive, pressing or burning nature usually occurs during physical and emotional stress, is localized behind the sternum, can be transmitted under the left shoulder blade, to the left arm, neck or lower jaw. Usually, the pain passes at rest or after taking nitroglycerin.

As of 2016, 2782700 cases of various forms of angina were registered in the Russian Federation. Of these, in 392 thousand cases, the pathology was detected for the first time in life. It was found that modifiable factors such as diabetes mellitus, arterial hypertension, Smoking, dyslipidemia, low physical activity [9], and obesity play an important role in the development of angina and its worsening in patients with an existing disease. This is why it is important for patients with angina to monitor the values of such parameters as, for example, blood pressure and body mass index, as well as heart rate, which is one of the factors that affect the value of coronary blood flow, along with the resistance of the coronary arteries and perfusion pressure.

Demographic processes of the last decades, characterized by labor shortage and the growing demands of sociomedical to achieve and provide a decent quality of life dictate the need for effective and accelerated medical and social rehabilitation of patients with critical vascular accident (infarction,
stroke). To date, there are no available and universal tools for online monitoring and management of the treatment and rehabilitation process in patients, which leads to the preservation of a very high percentage of complications of treatment measures.

B2Doc Service: Stable Angina is designed to improve the existing process of accompanying a patient with angina.

2. Materials and methods
Existing analog services used in this or similar areas of use were used as materials for research and optimization of existing business processes in the patronage of patients during the rehabilitation period. Among them are such online services as Yandex Health, SCIHealth Storylines, Medicine online and others.

3. Analogues
As a rule, similar to the developed service products allow to consult a doctor online without making an appointment, as well as find descriptions of drugs on the Russian market. Usually, the patient can communicate with the doctor online via video, audio or chat, decipher the results of tests and at any time re-read the report on consultations on the medical record.

The negative sides are:
- The service works only in a mode “question-answer”. Almost all doctors work on a schedule and are often unavailable;
- Features of the services.

Thus, similar products allow the patient to contact the doctor in real time on a specific issue, but do not allow them to personally build a rehabilitation plan.

Since none of the products presented completely solves the problem described above, it was decided to develop a new approach to accompanying a patient with heart disease.

4. The description of the service
Based on the existing clinical recommendations, it was decided to place personalized clinical prescriptions prescribed by the doctor to patients on a universal software platform that will allow monitoring the patient in a simple and convenient format in order to achieve the best clinical result, which, in turn, will avoid and reduce the number of possible complications. At the same time, the platform format is focused on the possibility of interaction between the patient and the attending doctor in real time to assess and monitor the patient's condition. As a result, the doctor will be able to track the dynamics of important indicators of the patient's health and, if necessary, adjust their prescriptions.

For the patient, in turn, conditions are created for easy and convenient access in real time to information about what preventive measures they need to perform to eliminate the risk factor. Constant monitoring of blood pressure, heart rate, arrhythmia and weight, proper nutrition, a healthy lifestyle can eliminate risk factors for a patient with angina.

If you strictly follow all the doctor's recommendations on how to treat angina, take prolonged nitrates, and constantly see a specialist, then remission can be quite long.

Thus, the creation of a special application based on a universal software platform for patients [2, 8, 13] with stable angina, the content of which will be based on the standards and clinical recommendations of the expert community in certain specialties, is designed to minimize the number of described and other serious complications.

5. The presentation of the service
Considering the internal structure, the service has a three-tier architecture, shown in Figure 1.
Figure 1. Three-tier architecture of the service.

The architecture consists of the following tier-modules:
- Data base;
- REST server [1, 3, 19], directly through which requests to the database server are made;
- Android client [4, 6, 10, 11, 18] for the patient that communicates directly with the server over REST;
- A web site for a doctor who also communicates with the server via REST [5, 12, 15, 17].

On the part of the user, the service, providing the possibility of direct patronage of patients by a doctor without direct contact of both parties, is presented in three available service roles:
- Attending doctor;
- Patient;
- Relative of the patient.

In addition to adding and removing individual patients from the list of their "wards", the doctor is able to create, change and prescribe medication to patients, track patients' compliance with their prescribed medical prescriptions, view test results, and track the following indicators of their patients:
- Patient's state of health during the day;
- Blood pressure;
- Result of search;
- Heart rate;
- Arrhythmias;
- The number of tablets of nitroglycerin;
- Number of attacks per day;
- Progress of medical treatment.

The patient, in turn, has the following functions in the service:
- Passing tests;
- View test results;
- View the history of taking pills;
- Speed dial 112;
- Assessment of the current state on a 100-point scale;
- Keeping a diary of pills taken;
- Keeping a seizure diary;
- Receive a notification about approaching of the medication;
- Keeping a diary of taken nitroglycerin tablets;
- Adding an entry to the diary.;
- View reference information;
- View the history of blood PRESSURE, heart rate.

The patient's relative is also able to monitor the patient's condition and monitor the implementation of medical prescriptions.
A complete diagram of the service’s use cases is shown in Fig. 2.

\textbf{Figure 2.} Use Case Diagram of the service. Reductions: C – create, R – read, U – update, D – delete.

Let's look at the process of using the service by the patient. First of all, the patient must register in the system through a doctor. After that, they will start receiving recommendations and medication schedules - doctor's orders. Further, if the patient has relatives, they can start monitoring the patient. The patient follows the recommendations and takes medication during the course of treatment. If complications occur, the patient should consult a doctor to get a new course of treatment or adjust the current one. After the end of the treatment course, the patient stops using the service.
The role of the doctor in this process is to monitor the patient's condition, follow recommendations, take necessary medications, and prescribe or adjust the patient's treatment course. The role of a relative is only to monitor the patient's condition and follow the recommendations and take the necessary medications. The service is presented as two different platforms – a web site designed for doctors, and a mobile application designed for patients [16]. This solution is based on the principle of creating maximum comfort for doctors, as well as to develop maximum comfort for patients.

6. Conclusion
The result of the work is an analysis of the approach to monitoring and managing the treatment of patients with identified stable angina, as well as the implemented and implemented service, which includes a service infrastructure for monitoring and managing treatment of patients at various stages.

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