WEBIOMED

Sk Resident

WEBIOMED

The platform of predictive analytics and risk management based on Artificial intelligence

25 October 2022 г., K-Skai LLC.ru

Problem: increasing morbidity and treatment costs

1.5 **MLN PEOPLE**
Have died from chronic noncommunicable diseases (NCDs) in 2019 in Russia

2.7 **TRLN RUB (3,2% GDP)**
Russian economic loss from CVD
Losses from CAD: over 1 trln rub.

220 **BLN RUB**
Make up direct costs of public health care for CVD treatment and diagnosis

8X **NCDs TREATMENT COSTS**
Higher than costs of screening and prevention

40% **CHRONIC NCDs CASES**
Preventable by screening, identifying high-risk patients, and follow-up preventive treatment

Healthcare does not use all the possibilities to prevent morbidity and excessive costs of medical care:

Physicians are overburdened. There is not enough time at an appointment for a careful analysis of patient data as the flow of patients is large. Therefore, physicians hardly perform patient risk stratification.

Focus on treatment. Healthcare systems prioritize treatment, which is expensive and often ineffective.

Low use of technology. Healthcare facilities store lots of date, however we do not analyze it and do not create value from it.

It is necessary to implement a risk-based approach and predictive analytics based on AI technologies to improve the effectiveness of disease prevention

Solution: Webiomed platform

Analysis of de-identified medical data

Automatic analysis of medical data, including the extraction of information from unstructured medical records using NLP technologies

Artificial Intelligence

Big data collection and machine learning for suspected disease detection and deep mining of patient data

Predictive analytics

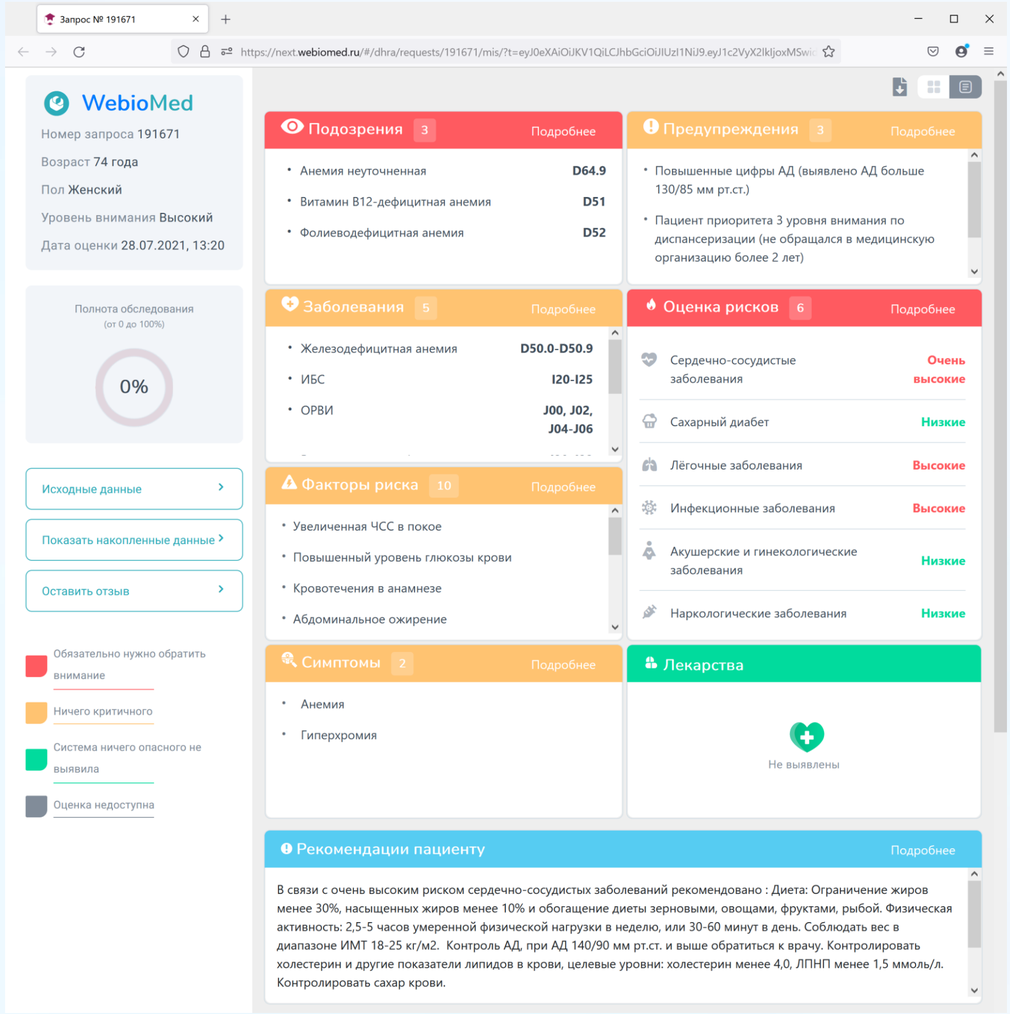
Clinical and management decision support based on a personal risk assessment and accurate predictions of a possible deterioration in a patient's health in the future

Recommendations for doctors and patients

Personal advice to doctors and patients on the prevention of diseases, formed on the basis of approved clinical guidelines

Clinical decision support

* **Automatic analysis** of anonymized electronic health record
* **Identification** of hidden diseases missed by a physician
* **Identification of risk factors**
* **Prediction of possible negative events** in a patient's health, including complications of existing diseases, hospitalization or death
* Comprehensive patient **risk assessment**
* Personalized **clinical guidelines** for physicians and patients

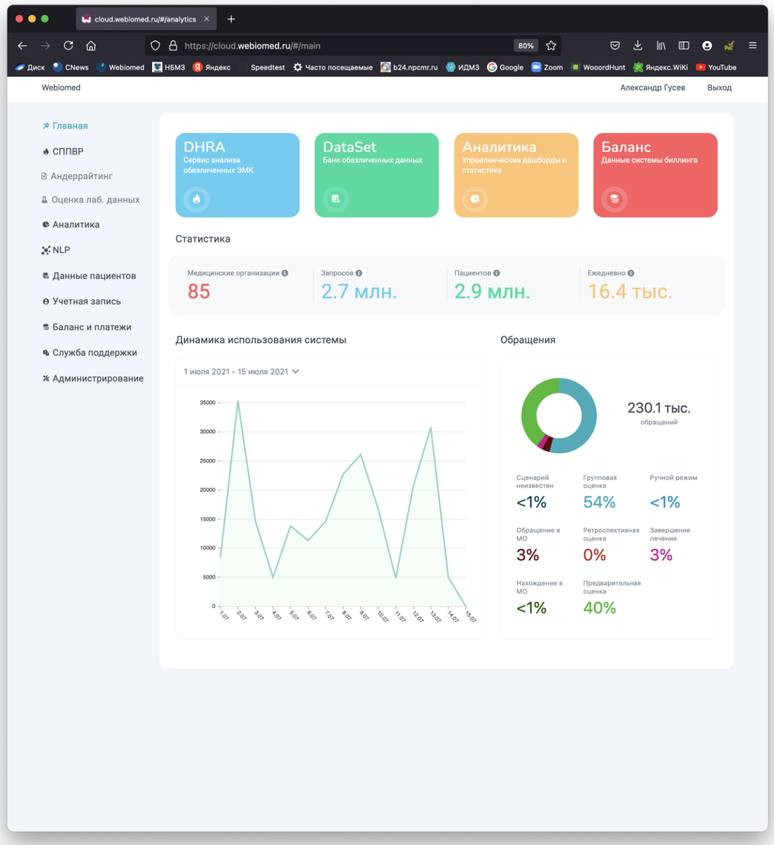


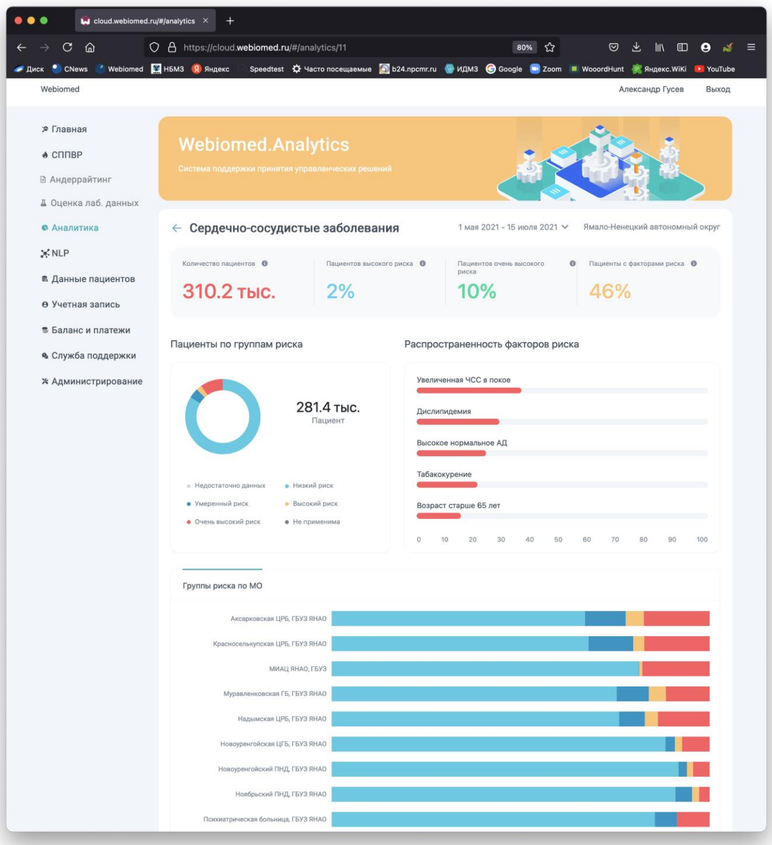
Included in the register of Russian software

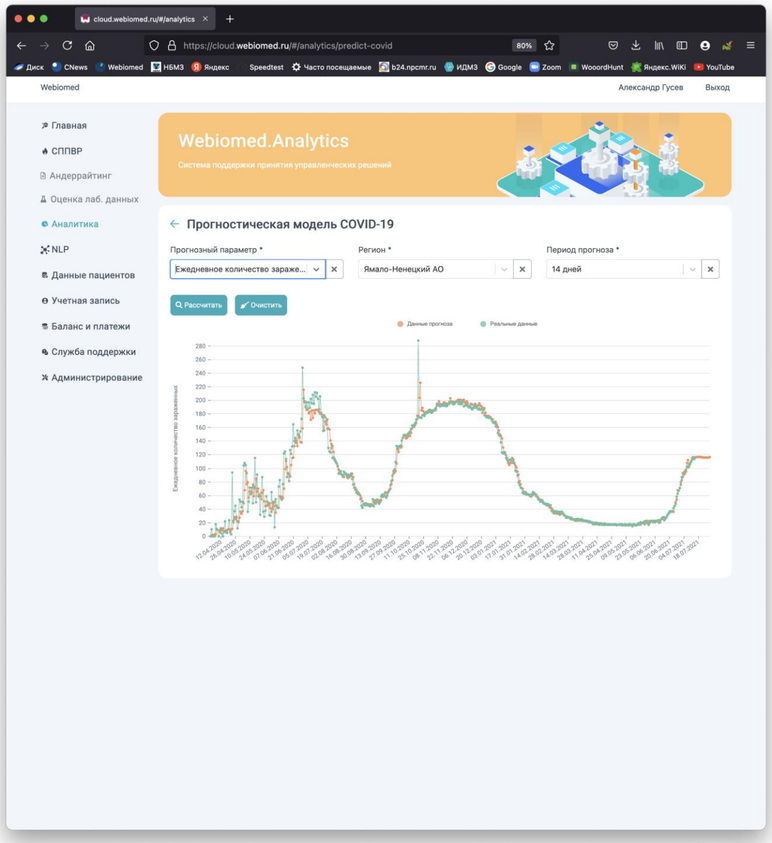
Registration certificate of Roszdravnadzor

Management decision support

Based on the collected anonymized digital patient profiles, **Webiomed forms a unified management analytics, helps to make correct and timely decisions** to reduce morbidity and mortality based on dashboards and population predictive models







Included in the register of Russian software

Supported diseases

40 **DISEASES**
The platform is able to identify

14 **DISEASES**
Are evaluated by the system for possible negative events

We support the following disease areas:

* Cardiovascular diseases
* Blood disorders
* Diabetes
* Respiratory diseases
* Gastrointestinal diseases
* Chronic kidney disease
* Oncology
* Orphan diseases

* Cardiovascular diseases
* Diabetes
* Pathology during pregnancy
* Infectious diseases (COVID-19)
* Addiction
* Respiratory diseases
* Metabolic diseases

Algorithms and models implemented in CDSS

Score	Predictive models	Diagnostic models
Overall cardiovascular risk score	Risk of developing CVD within 10 years.	Suspected case of Anemia, Unspecified
SCORE: 10-year risk of fatal CVD.	Risk of death from coronary artery disease and stroke within 10 years.	Suspected case of Arterial hypertension
SCORE (relative risk): 10-year risk of fatal CVD.	Risk of hospitalization in the next 12 months for patients with CVD	Suspected case of Vitamin B12-deficiency anemia
Framingham score: 10-year risk of developing acute CVD.	The risk of atherosclerotic plaques of brachiocephalic arteries in obesity	Suspected case of Secondary polycythemia
PROCAM score: 10-year risk of coronary complications.	Risk of developing atrial fibrillation in one year	Suspected case of Hemolytic anemia
UKPDS Cardiac Risk score: 10-year risk of coronary artery disease in patients with type 2 diabetes mellitus.	Risk of having pulmonary embolism	Suspected case of Iron-deficiency anemia
CHA2DS2-VASc score: risk of stroke and thromboembolic complications in patients with flutter and atrial fibrillation.	Risk of death within a year for patients with type 2 diabetes	Suspected case of Infectious-inflammatory syndrome
CART score: risk of cardiac arrest in hospitalized patients.	Risk of death within 5 years for patients with type 2 diabetes	Suspected case of Primary polycythemia
PORT score (PSI index): assessment of the severity of the condition of patients with community-acquired pneumonia.	Risk of hospitalization over the next 12 months for patients with type 2 diabetes	Suspected case of Latent iron deficiency
CURB score: assessment of the severity of the condition of patients with CAP.	Risk of hospitalization within the next 12 months for patients with respiratory diseases	Suspected case of Primary immune thrombocytopenia
CRB-65 score: assessment of the severity of the condition of patients with CAP.	Risk of preeclampsia during pregnancy	Suspected case of «Тромбоцитопения неуточненная».
SMART CO score: assessment of the severity of the condition of patients with CAP.	Risk of hospitalization within the next 12 months for patients with gynecological diseases	Suspected case of Folate-deficiency anemia
SMART-COP score: assessment of the severity of the condition of patients with CAP.	Risk of hospitalization in the next 12 months for patients with substance abuse	Suspected case of Chronic lymphocytic leukemia
Methodology for assessing the risk of hazardous alcohol consumption based on the Methodological recommendations "Organization and behavior of preventive medical examination and clinical examination of certain groups of the adult population in 2019".		Suspected case of Chronic myeloid leukemia
Vascular age score		Suspected case of Essential thrombocythemia
The score for assessing the risk of complications of delivery and routing of pregnant women according to the Order of the Ministry of Health of October 20, 2020 No. 1130n "On approval of the Procedure for the provision of medical care in the obstetrics and gynecology.		Risk of developing adult systemic inflammatory response syndrome (SIRS)
A score for assessing the risk of a potentially severe course of COVID-19 depending on comorbid conditions.		The risk of developing an infectious-inflammatory syndrome based on a blood test
Risk Assessment score for Severe COVID-19 in Hospitalized Patients.		Suspected case of Diabetes mellitus
Adult Systemic Inflammatory Response Syndrome (SIRS) Risk Rating score.		Suspected case of COVID-19
Infectious-inflammatory syndrome risk assessment score based on a blood test		Risk of severe COVID-19 in hospitalized patients

Services for collecting and extracting data from EHR

Webiomed.NLP

Responsible for extracting features from unstructured EHR in machine-readable format

2923
Supported features

- Up to 80% of clinically significant information is stored in EHR in unstructured text records
- Webiomed extracts the necessary data (features) from the EHR using the NLP service
- Physicians do not need to fill out special forms or maintain separate registers.
- Webiomed takes over the entire burden of extracting information from the EHR.
- This saves physician's time at the appointment, giving the opportunity to focus on a patient

Webiomed.DataSet

Responsible for the centralized storage of the extracted and cleaned data, suitable for the creation of datasets and the operation of machine learning models

13,9 mln
Patients

67 mln
Treatment cases

195 mln
Medical records

655 mln
Features extracted

Social data and medical history

* Date of birth, sex, region of residence, social group etc.
* Registered diagnoses, height, weight, waist circumference, smoking
* Genetic background, story of treatment

Clinical and morphological data

* Clinical investigation and lab test records, etc
* Medical examination records, operative notes, etc.
* Prescriptions data
* Screening data, patient questionnaires, etc.

Data processing scheme

INPUT DATA:
electronic health record (EHR)

- Health examinations
- Lab tests
- Clinical investigations
- Medical history
- Other patient data

METHODS OF ANALYSIS:

MACHINE LEARNING

+

- Analysis based on published risk assessment techniques
- Analysis based on legal and regulatory requirements
- Analysis based on clinical guidelines

OUTPUT:

- Identified risk factors
- Prediction of disease development
- Hidden diseases
- Clinical recommenations
- Personal recommendations for patients
- Warnings
- Complex patient risk assessment

Used technologies

The development of the Webiomed platform and machine learning uses the most modern technologies and software

Server software	Development and testing	AI model development	Monitoring
PostgreSQL	GitLab	jupyter	Prometheus
redis	slack	Redash	Alertmanager
Zookeeper	Hub	TensorFlow	Pushgateway
kafka	YouTrack	dmlc XGBoost	Node-exporter
NGINX	TeamCity	scikit learn	Grafana
RabbitMQ	Upsource		Loki
HAPROXY COMMUNITY EDITION	PyCharm		Promtail
Docker	DataGrip		cAdvisor
	WebStorm		Portainer
	IntelliJ IDEA		
	Python		
	Django		
	Swagger		
	React		
	node		
	GraphQL		
	Webpack		
	BABEL		
	TEST IT		
	SENTRY		
	Postman		

The value of Webiomed for healthcare

Webiomed predictive analytics for healthcare executives

* **See the future morbidity and mortality** of patients based on real clinical practice data. The ability to pre-select the most problematic areas and work ahead of the curve

* **See the demand for medicines and health products** and reduce inefficient spending on unnecessary purchases or supply disruptions if there is a lack of medicines/devices

Webiomed predictive analytics for physician

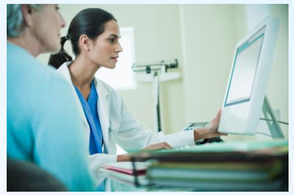
* **See an accurate forecast** of possible deterioration in the patient's health in the near future and take targeted measures

* **See the prognosis of a possible diagnostic finding** and prescribe the one that is most likely to give a result

* **Pay attention to the patient in need of additional examination and/or treatment** to prevent the manifestation of the disease and consequent death

Current operation scheme

USERS



Physicians

Clinical decision support (CDDS)

Digital patient profile, personal predictions of possible worsening of diseases, identification of diagnoses missed by physicians, tips based on digitized clinical recommendations

Managers

Management decision support

Management analytics, including a population forecast for the development of morbidity, mortality and other data in any context for more efficient healthcare management

Patients

Mobile application to access medical data and manage your health

Personal EHR of a patient with access to data collected from healthcare organizations. Personalized recommendations based on clinical guidelines and science

Planned to be launched on the market in 2022.

WEBIOMED PLATFORM

Webiomed generates a patient risk assessment record with a digital profile, characterizing the development of diseases. The profile is suitable for machine processing and creation of structured data sets

Webiomed turns to machine learning models to identify suspected missed diseases and assess the likelihood of various events/health deterioration/ death in the future

Webiomed extracts structured features from EHR, removes duplicates, cleans up erroneous values, calculates additional data (BMI, GFR, etc.) and distributes it by treatment episodes

The Webiomed API accepts depersonalized EHRs from the medical organization as input and combines these data into a single digital patient profile (integrated EMR: EHR)

HIS of outpatient clinics

Results of clinical examination, etc

HIS of in-patient facilities

Medical history, data of medical and surgical treatment

HIS of first-aid stations

Карта вызова скорой медицинской помощи

HIS of other facilities

Rehabilitation records, spa treatment, etc.

PAYERS

Pharmaceutical organizations

Get the opportunity to conduct real-world data research (RWD) as well as improve the effectiveness of drug therapy searching for patients by formalized criteria and creating anonymized datasets for obtaining real-world evidence (RWE)

Private clinics

Get the opportunity to efficiently route patients in various clinical situations, automatically analyze the entire pool of EHRs, find high-risk patients and schedule additional examinations/studies to increase the flow of patients to the clinic; increase of an average bill.

Research organizations

Get the opportunity to create anonymized datasets and conduct research and development in the field of artificial intelligence for healthcare, incl. custom machine learning and data analysis services

Webiomed is hosted in a reliable data center

The product version of the system works in the **IBS DataFort** data center

* firewall (FortiGate)
* intrusion detection system (IDS \ IPS)
* vulnerability scanning (xSpider, ser. FSTEC)
* streaming antivirus
* means of protection against unauthorized access (Secret Net, FSTEC certificate)
* encryption of communication channels (GOST VPN ViPNet)
* virtualization protection system
* protection against distributed attacks (Anti-DDoS)
* logging system
* data backup system
* firewall for web applications (Web Application Firewall, FortiWeb)

* Presence of MMTS-9, MMTS-10 at the traffic exchange points
* Fully independent optical connections to each of the points of presence, 5 independent Internet operators, network bandwidth - 40 Gbit/s
* Tier III compliant, 45,000 vCPU, 150 TB RAM, 5 PB Storage
* 3 data centers, several independent power substations
* Best SLA in the market segment (not less than 99.95%)
* Certification to meet the regulation requirements (Federal Act on personal data FZ-152 (UZ1), Federal act on state information systems (GIS K1)
* Certificate of Compliance with Information Security Requirements for Personal Data Information Systems and State Information Systems No. 11 / 20-148ATT
* Certificate of conformity of the Quality Management System to the requirements of ISO/IEC 9001: 2008 and ISO/IEC 20000-1: 2011
* Certificate of compliance of the Information Security Management System with the requirements of ISO/IEC 27001: 2013.
* Federal Service for Supervision of Communications, Information Technology and Mass Media (Roskomnadzor) license for the provision of telematic services and services for the provision of communication channels.
* FSB license in terms of work with cryptographic means.
* FSTEC license for technical protection of confidential information

More details about the data center: https://www.datafort.ru/

Results for 2021

1 ST PLACE in the rating of AI startups for healthcare in the Russian Federation

5X revenue growth

8 HIS integrated with Webiomed

1 ST AI SYSTEM connected to Unified State Healthcare Information System

8 REGIONS Russia territory coverage

MORE THAN 200 MLN medical records processed by Webiomed

3 MLN PATIENTS health data processed

MORE THAN 418 MLN extracted features

2660 FEATURES the platform can analyze

14 DISEASES evaluated by the system for possible deterioration

40 DISEASES the platform can identify as a suspicion

31 OBJECTS OF INTELLECTUAL PROPERTY registered

19 PUBLICATIONS in Russian and foreign scientific journals

4 VICTORIES in Digital Health competitions

3 PATENTS obtained

Our research

Scientific background

The project team consists of **6 experts** with Ph.D., ensuring proper adherence to the principles and methods of research

51 Total number of published research papers on the project

A complete list of our publications can be obtained on our website: https://webiomed.ai/publikacii/

Some important publications of our team

№	Статья
1	Gusev A.V., Gavrilov D.V., Novitsky R.E., Kuznetsova T.Yu., Boytsov S.A. Improvement of cardiovascular risk assessment using machine learning methods. Russian Journal of Cardiology. 2021;26(12):4618. (In Russ.) https://doi.org/10.15829/1560-4071-2021-4618
2	Ivshin A.A., Bagaudin T.Z., Gusev A.V. Artificial intelligence on guard of reproductive health. Akusherstvo i Ginekologiya/Obstetrics and Gynecology. 2021; 5: 17-24 (in Russian), https://dx.doi.org/10.18565/aig.2021.5.17-24
3	Gavrilov DV, Gusev AV, Nikulina AV, Kuznetsova TYu, Drapkina OM. Correctness of cardiovascular risk assessment in daily clinical practice. The Russian Journal of Preventive Medicine. 2021;24(4):69–75. (In Russ.), https://doi.org/10.17116/profmed20212404169
4	Gusev AV, Morozov SP, Kutichev VA, Novitsky RE. Legal regulation of artificial intelligence software in healthcare in the Russian Federation. Medical Technologies. Assessment and Choice. 2021;43(1):36–45. (In Russ.), https://doi.org/10.17116/medtech20214301136
5	Gusev A. V., Novitsky R. E. Predictive analytics technologies in the management of the COVID-19 pandemicInformation technologies for the Physician. 2020.- №4.- P. 24-33 https://doi.org/10.37690/1811-0193-2020-4-24-33
6	Gusev A.V., Novitskiy R.E., Ivshin A.A., Alekseev A.A. Machine learning based on laboratory data for disease prediction. FARMAKOEKONOMIKA. Modern Pharmacoeconomics and Pharmacoepidemiology. 2021;14(4):581-592. (In Russ.) https://doi.org/10.17749/2070-4909/farmakoekonomika.2021.115
7	Ivshin A.A., Bagaudin T.Z., Gusev A.V. Artificial intelligence technologies in predicting preeclampsia. Obstetrics, Gynecology and Reproduction. 2021;15(5):576-585. (In Russ.) https://doi.org/10.17749/2313-7347/ob.gyn.rep.2021.229

All the leading media in Russia wrote about us

Efficiency Example

Implementation of Webiomed in the Kirov region

- All state medical organizations are connected
- An automatic analysis of patients is carried out when they go to the clinic (new completed case) or are hospitalized (new case history)
- An automatic assessment of the risk group of patients is performed

RESULTS:

In 52% of cases, the system gives a more accurate assessment of cardiovascular risk

In 64% of cases, the system determines the patient's risk group according to clinical guidelines more accurately

In 50% of cases, the system identifies dangerous and/or missed risk factors

In 82% of patients who underwent clinical examination, the system makes it possible to determine the absolute risk of death from CVD more correctly

Up to 30% more patients needing preventive treatment

Up to 15% of patients' health groups are determined incorrectly

The region received a full predictive characteristic of high-risk patients and the opportunity to organize the prevention of CVD morbidity and mortality more efficiently.

Advantages of the Webiomed platform

Automatic EHR analysis

without additional burden on doctors.
Interaction with Webiomed is carried out through a web service.
Doctors immediately receive a ready-made assessment without the need to enter additional information, fill out special forms, etc.

Registration certificate of Roszdravnadzor

The system has the right to interpret medical data and its conclusions can be used in the treatment and diagnostic process. Due to this, we enable medical information system to comply with legal requirements without the need to register it as a software medical device.

Comprehensive analysis of patient data

We do not analyze just a single disease or event. We **are able to take into account comorbid conditions** and support a wide range of diagnoses.

Predictive analytics for doctor and patient

We make it possible to understand what negative events will happen with the health of every inhabitant of the region in the near future using artificial intelligence. You can take the necessary preventive measures without waiting for acute problems.

Ability to select narrow target patient cohorts

Having a pre-prepared digital passport of risk factors and patient's medical data, any necessary models can be built to identify narrow target groups of patients in order to **carry out precise preventive measures**.

Integration with any medical information system

Can be used in any projects and developments, which significantly expands the audience of system users

Webiomed today: main achievements

01 Registration certificate of Roszdravnadzor for AI-based medical device / CDSS (clinical decision support system)

02 Registration as an "Other IS" by the Government of the Russian Federation (connection to the state IS/MIS of the subjects of RF, EGISZ)

03 Place in the register of domestic software of the Ministry of Digital Development of the RF

04 Attestation for compliance with safety requirements for state IS of the 2nd risk class

05 **Certified** for compliance with the international quality management system (QMS) standard according to **ISO 13485:2016.**

06 Implemented over 20 different projects

07 Integrated with ECP RT-MIS, Netrika, Renovatio and a number of other information systems; Free integration for any MIS of the customer

08 31 RIAs have been registered, incl. 3 patents

98% Accuracy of data extraction from EHR

92% Forecast Accuracy

50 ML models

TRL9 Product readiness

*Rating of Start-ups of Artificial Intelligence: Prospects for Healthcare in Russia 2021, https://evercare.ru/news/reyting-startapov-iskusstvennogo-intellekta-perspektivy-dlya-zdravookhraneniya-rossii

Leader of the Russian market of AI systems for healthcare *

* **Data Awards 2022** winner in the in the nomination **"Creation of a new data-driven business model"**
* **First place** in the "incubation track" of the MedLAB Innovation Lab program
* The company is included in the **"100 best enterprises in Russia"** rating
* Winner of the **Data Fusion Awards 2022** in **the Data Fusion Rising Stars** nomination from the Skolkovo Foundation
* **Future Healthcare** accelerator winner
* Winner of the **"Technological breakthrough 2021"** award in the nomination: **"Technological breakthrough in the field of personal medical assistants"**
* Winner in the nomination **"Best Innovative Project"** of IP Russia Awards
* Winner National Prize **"Priority-2021"** in the nomination **"Artificial Intelligence"**
* Winner of **Global Health & Pharma's Healthcare & Pharmaceutical Award**
* Winner in the nomination **"Digital solutions for healthcare"** of the competition of the Analytical Center under the Government of the Russian Federation
* Digital solution **recommended for implementation** and replication in the constituent entities of the Russian Federation
* 2020 Digital Health Awards **Breakthrough of the Year** Winner
* Winner in the nomination **"Digital Medicine"** of the competition "Startup Rally 2020"
* **Sanofi Digital Health** Innovator Award Winner
* **AstraZeneca Skolkovo StartUp Challenge 2020 Commercial Track Winner**
* Roche **Personalized Medicine** Winner Startup Rally 2020
* Winner of the **"Smart Clinic Technologies"** contest, SBGMU

Project team

Project managers

Roman Novitsky
CEO,
Project co-founder

* 20 years in leadership positions in the IT field
* From 2007 to 2020 - the CEO of K-MIS, one of the leaders in the automation market for medical organizations
* In 2020 he was included in the 10 best CEOs of Karelia

Andrey Salikov
Chief Commercial Officer

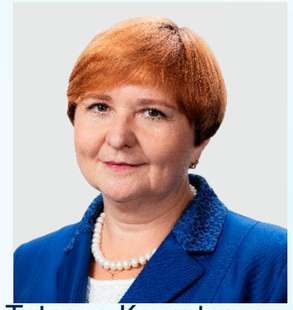
Sergey Gilev
Chief Marketing Officer

Anna Andreichenko
Head of the Artificial Intelligence department

Project Experts

Alexander Gusev
CBDO,
Project co-founder

* Leading Russian expert on digital health
* Over 20 years of professional experience in the field of health IT
* Degree in Mathematical Modeling in Medical Information Systems
* Author of 100+ scientific publications



Tatyana Kuznetsova
PhD in Medicine, Head of the Department of Faculty Therapy, Phthisiology, Infectious Diseases and Epidemiology
Research expert

Alexander Ivshin
PhD in Medicine, Head of the Department of Obstetrics and Gynecology, Dermatovenereology of the Medical Institute of PetrSU

Denis Gavrilov
Chief medical officer, cardiologist, member of the Russian Society of Cardiology and the European Society of Cardiology

40+ **people**
Permanent staff

57 **The overall Hirsch Index**
Of experts and research consultants of the project

Project founders Roman Novitsky and Alexander Gusev: serial entrepreneurs, have over 20 years of experience in digital healthcare,.
Previous project: K-MIS, one of the leading health IT developers in Russia

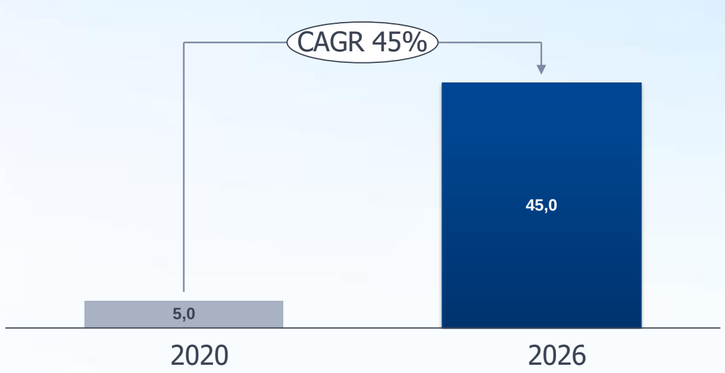
Achievements of Webiomed founders:
1. In 2011, they became the first Russian company to pass the Health Integration Framework certification in the USA
2. In 2012 they reached the final of the prestigious international IBM "Beacon Awards" competition for developments in the field of electronic health records. They were the only Russian company that made it to the final in this competition
3. In 2016, K-MIS ranked 2nd in terms of revenue and the size of the client base in Russia among developers in the field of healthcare informatization (CNews rating)

Webiomed operates in promising markets

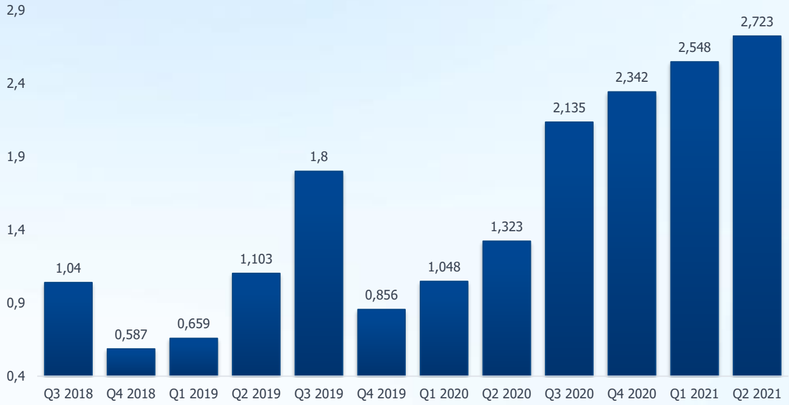
AI Market for Healthcare

First place among all industry investments in terms of the number of transactions: in Q2 2021, 96 transactions were concluded here (16.8%). Second largest fund raised: $2.766 billion (13.82%) of total AI investments

Global quarterly investments in artificial intelligence for healthcare, 3Q 2018 - 2Q 2021, billion USD.



Source: Facts and Factors marketing agency

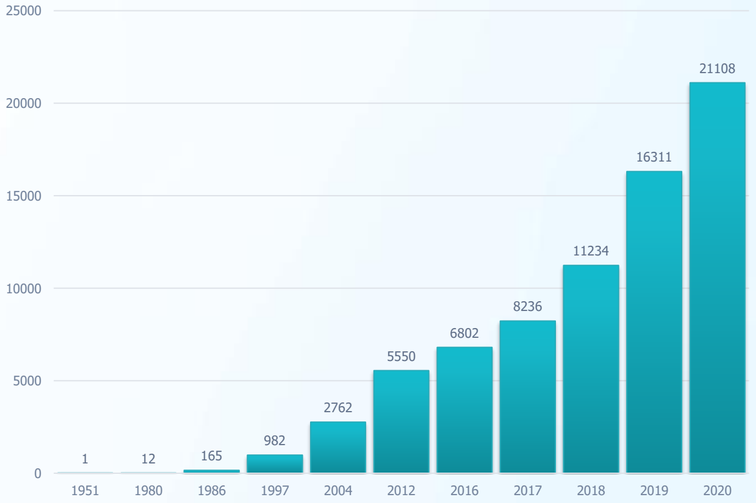


Source: State Of Healthcare Q2'21 Report CBInsights

Market trends

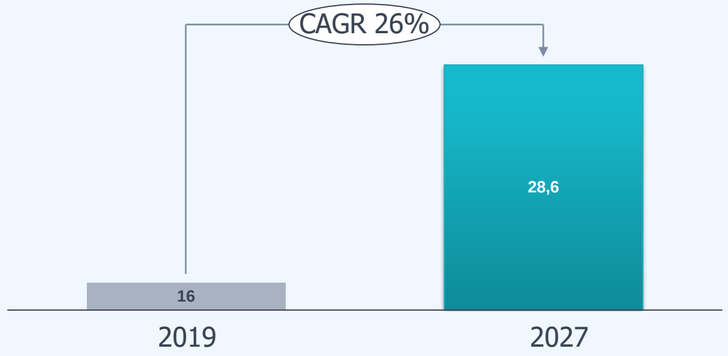
* Improving the accuracy of machine learning models
* Ensuring trust and transparency in the work of AI algorithms
* Registration of AI systems as software medical devices (SaMD)
* Integration into basic software products (EMC systems, PACS/LIS)
* Publication of research results and model development data in peer-reviewed scientific literature
* Key areas of application: support for managerial and clinical decision-making, replacement of routine and inefficient manual information processing

Dynamics of publications in the peer-reviewed scientific medical literature on the application of artificial intelligence, PubMed



Predictive analytics market for healthcare

is the most promising area of application of AI in medicine, according to Nvidia



Source: Meticulous Research marketing agency

Market trends

* Prescriptive analytics (recommender systems)
* Cloud Services / SaaS
* Integration with EHR systems and automatic back-end analysis
* Clinical Decision Support Systems

Main effects

* Reduce loss by predicting events such as empty beds, lost expired medicines, etc.
* Promptly redistribute resources when the load on the Ministry of Defense changes, for example, during epidemics
* Identify high-risk patients before the onset of chronic disease and thereby significantly increase the effectiveness of prevention
* Reduce manual processing and analysis of big data, give physicians and managers not only current indicators, but warnings about immediately dangerous situations

WEBIOMED

CONTACTS

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