

- 2) Medesk — this cloud-based medical information system is used in more than 20 countries around the world and in 72 regions of Russia. It is suitable for healthcare institutions of any size, from private clinics to networks. electronic medical records, CRM, telemedicine and solutions for managers and physicians are available in Medesk.
- 3) KMIS is a complex MIS suitable for automation of any medical institutions, the feature of which is integration with Federal systems.
- 4) MEDMIS is a relatively young MIS that entered the market in 2017. In 4 years, MEDMIS has been used by more than 200 medical organizations. MEDMIS is constantly evolving and gaining momentum: updates are released once a week.
- 5) MedAngel is an MIS with the possibility of individual customization for the specifics of the clinic's work. There is only a boxed version of the program with open code. The system is modular, you can assemble a personalized kit.

The list represents the most popular systems on the market. Each system has its own advantages and features, and the choice depends on the needs of a particular healthcare facility.

An Intelligent Medical System (IMS) is an information system that uses artificial intelligence techniques and approaches, including semantic technologies, to process, store and analyze medical data. Such systems represent a key element in modern healthcare, providing effective management of patient information, improved decisionmaking in medical practice and personalized patient care.

With the rapid development of artificial intelligence systems, IMS are becoming increasingly in demand. Their ability to analyze and interpret large amounts of data allows to reduce the workload of medical personnel, improve diagnostic accuracy and optimize treatment processes.

However, problems arise due to the variety of formats for storing medical data in different countries. Norms and legislation governing the processing and protection of medical information may differ from country to country. For example, the Republic of Belarus, Russia and the Republic of Kazakhstan have different standards and requirements for storing and processing medical data. This can create difficulties in integrating and sharing information between systems, as well as increase the risk of breaches of patient data privacy and security. For successful implementation of intelligent medical systems, it is necessary to take these differences into account and develop appropriate mechanisms for data standardization and interoperability.

### III. Proposed approach

At the heart of any knowledge-based IMS is a formalized knowledge base, the quality and volume of which directly affects the effectiveness of the system. For uniform representation and unambiguous

interpretation of knowledge bases, a common set of all terms used in practice is required. Terminology should be generally accepted and understandable to medical specialists, i.e. it should be the result of ontological agreement in the field of medicine.

Ontological modeling of the subject domain includes specification, conceptualization and formalization. At the specification stage, a glossary of terms is built, including all terms important for the subject area and their descriptions. In the conceptualization stage, important objects of the subject domain are identified. In this stage, the hierarchy and relationships between the objects of the subject domain are also defined. In the formalization stage, meta-objects and relationships between meta-objects are created that correspond to the objects and relationships between the objects of the subject domain. As a result, an ontology of the subject domain will be obtained. At the actualization stage, object parameters and their domains are defined (parameter domain is the area of acceptable parameter values), as well as values, classes, subclasses and class instances. Parameters, parameter domains, parameter values, classes, subclasses and class instances are realized as metaobjects (a metaobject is some text representing a definition, concept or some other description.) of appropriate types. After the work at the actualization stage, the ontology is turned into a knowledge base. The result of ontology modeling is the ontology of the subject area. To turn the ontology into a knowledge base, it is necessary to actualize it.

In MIS, the problem of incompatibility of data formats is a significant challenge that can hinder effective information sharing and interoperability between different healthcare systems. OSTIS (Open Semantic Technology for Intelligent Systems) is proposed to address this problem. OSTIS provides innovative tools and approaches for creating semantically interoperable medical systems that original format and structure.

One of the key features of OSTIS technology is its ability to unify the representation of different types of knowledge in a single database. This enables the creation of centralized information repositories where medical data can be organized and structured according to common semantic standards, while ensuring a high degree of compatibility and interoperability.

OSTIS technology is also highly flexible and modifiable, allowing the system to be customized to meet the specific requirements and standards of each country, including the Republic of Belarus, the Russian Federation and the Republic of Kazakhstan. As a result, medical information systems based on OSTIS technology can easily adapt to various regulatory and legislative requirements, which ensures their seamless integration into the existing healthcare infrastructure.

One of the key benefits of using OSTIS technology is the ability to automatically convert and compare data from different formats. This helps eliminate interoperability issues and ensures seam-

less information exchange between different medical systems and institutions, which ultimately improves system efficiency and the quality of care provided.

Thus, the use of OSTIS technology is an effective and promising approach to solving the problem of incompatibility of data formats in medical information systems. It ensures the creation of modern and innovative healthcare systems capable of adapting to a variety of requirements and changes in the medical field, which is a key factor for improving the quality and accessibility of medical care in different countries.

As an illustrative example, let us give the possibilities of using OSTIS formalization technology for two subject areas related to intelligent medical systems.

Formalizing the subject matter of a patient's medical record using OSTIS technology demonstrates significant convenience and efficiency in processing and storing medical data. The formalization process allows describing various aspects of a patient's health, including medical history, diagnoses, treatments and symptoms of diseases.

One of the features of formalization on OSTIS technology is the ability to create a single semantic model that integrates different aspects of medical information in a unified format. For example, information about gastrointestinal (GI) diseases can be organized in the form of semantic entities such as disease type, symptoms, diagnosis and treatment methods.

The advantage of using OSTIS technology is that information on GI diseases can be stored in a single semantic format, making it easier to access and share data between different medical systems and institutions. In addition, thanks to the semantic approach, information about diseases and their symptoms can be structured and categorized for easy analysis and processing.

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#### IV. The subject area and ontology of a patient's medical record

Medical records are kept according to the order approved by the Ministry of Health. In the Republic of Belarus, this is Order No. 710 of the Ministry of Health of the Republic of Belarus of August 30, 2007 "On Approval of the Forms of Primary Medical Documentation in Outpatient and Polyclinic Organizations". The card of a patient receiving medical care in outpatient conditions must comply with the form 025/-07 "Medical card of an outpatient". In the Russian Federation it is the Order of the Ministry of Health of the Russian Federation from December 15, 2014 № 834n "On approval of the unified forms of medical documentation used in medical organizations providing medical care in outpatient settings, and procedures for filling out the form № 025/u "Medical card of a patient receiving medical care in outpatient settings". In the Republic of Kazakhstan it is the Order of the Acting Minister of Health of the Republic of Kazakhstan from October 30, 2020 № KR DSM- 175/200 "On approval of forms of record documentation in the field of health care" form № 052/u "Medical card of an outpatient". There are similarities and differences. There is a common part: full name, sex, date of birth, place of work, blood group and Rh. There are also differences, for example, in the RF there is a section SNILS, in the RK IIN, and in the RB personal number on the passport [9]– [11].

Based on OSTIS technology, it is possible to effectively formalize various concepts from a patient's medical record, taking into account the peculiarities of regulatory documentation in different countries. Despite the differences in the formats and structure of medical documents in the Republic of Belarus, the Russian Federation and the Republic of Kazakhstan, OSTIS technology can be used to create a universal model for data storage and processing, ensuring their standardization and flexibility.

The advantage of OSTIS technology lies in its graphbased approach to information representation, which allows for quick changes to the system without changing its structure, just modifying the knowledge base. This approach makes the system flexible and adaptable to new requirements and changes in legislation, which is especially important in the medical field, where requirements and standards are constantly changing.

Fig. 1 shows a fragment of a patient medical record ontology formalized using SCG language and including such basic concepts as:

