THE CONCEPT OF THE INFORMATION SYSTEM FOR MONITORING THE EPIDEMIOLOGICAL SITUATION IN THE REPUBLIC OF MOLDOVA

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Abstract

The paper examines the situation in the field of monitoring and operational reporting of cases of SARS-Cov-2 infection in the Republic of Moldova. The existing problems of this process are highlighted. The lack of a centralized information system for the collection and processing of primary medical data, necessary for the operational and strategic decisions of the central administration, is emphasized. The concept of an information system for monitoring the epidemiological situation in the Republic of Moldova is proposed.

Keywords: pandemic situation, operative monitoring, information systems.

JEL Classification: L86, I13

INTRODUCTION

The evolution of the epidemiological situation of SARS-Cov-2 virus infection in the Republic of Moldova has demonstrated the lack in the medical system of the republic of reliable and secure mechanisms for the acquisition, modification, verification, search and operative processing of personal and medical data. The existing information system within the National Agency for Public Health (NAPH) is mainly manual and does not allow the operative and efficient management of statistical medical data and the operative decision-making at national level. Within the NAPH information system, it is not possible to generate operatively the various synthesis reports and graphs in territorial, institutional, time profiles, by age and occupation categories, due to the lack of a database with operational data, provided by the medical units in the territory. Mechanisms for secure data retrieval and selective access to data for different categories of authorized users are lacking. These gaps in the information system of NAPH represent persistent vulnerabilities for the socio-economic security of the Republic of Moldova, which affect the decision-making process of the governing bodies regarding the efficient management of the epidemiological situation.

As previously demonstrated (Oprea, 2021), public health information systems in the Republic of Moldova do not currently provide the necessary functionality to monitor the epidemiological situation and automatically generate the statistical reports needed to make country-level decisions. This necessitates the urgent design and implementation of an information system for monitoring the epidemiological situation (ISMES), interconnected with government information systems and with access to government and medical databases.

In order to operate ISMES in real time, input data is required, which reflects the de facto situation at the territorial and republican level. In essence, these data are synthesis data and can be obtained as a result of the processing of primary medical data, obtained by performing verification tests on the SARS-Cov-2 virus. The primary data, obtained as a result of citizens' testing, must be recorded in a database in the computer system of the National Agency for Public Health. This database can serve as a data source for ISMES, which will automatically generate various forms and output reports needed for operational management decisions.

PAPER BODY

The analysis of the technological process of processing medical data related to SARS-Cov-2 virus infection within the information system of the National Agency for Public Health revealed a number of nonconformities and logical and functional errors in organizing data in the form of Excel files. These may include the following: manual data processing, lack of data validation and verification mechanisms, logical data redundancy, data isolation using different formats, lack of information needed to generate generalizing reports, inability to generate data reports in territorial, institutional, time, age, sex, country of import of the virus, type of test performed profiles. Only confirmed cases of SARS-Cov-2 virus infection are reported in the document. Synthesis data on the total number of tests performed, the total number of positive / negative primary tests, the number of positive / negative repeated tests, the total number of free / paid tests, etc. cannot be obtained from Excel documents.

Based on the above, it becomes clear the need to develop and implement an information system for operational data management, which describes the epidemiological situation in the Republic of Moldova. It is proposed that this computer system be set up on the basis of client-server technology (Figure 1), which would ensure real-time operation of the system and operational access of various categories of users to certain categories of data stored in a relational database.

The functional logic of the processing of personal data in the information system for monitoring the epidemiological situation (ISMES) is presented in Figure 1. Testing and identification of cases of COVD-19 will be performed in authorized medical units (licensed laboratories), which will take the biological samples from the citizens and will generate based on them the primary input data of the computer system in the form of test results. These data will also include the personal data of the tested citizens (state identification number of citizen (IDNP), name, surname, date of birth, sex, address, telephone, email, number of family members, profession, place of work, date of first symptom of the disease, country visited last 14 days, date of return to the country).

In order to automate the process of collecting personal data, it is proposed that the medical testing units have automated devices for reading the barcodes in the identity cards of citizens, and the staff authorized to enter personal data in the system to have access to verify this data at other government databases (databases of the Public Service Agency, the General Inspectorate of Border Police of the Ministry of Internal Affairs, etc.).

Within ISMES, personal data will be stored and processed which, according to the legislation of the Republic of Moldova, are subject to a special regime of collection, processing, storage, transmission and access (Law 133, 2011). For these reasons, only authorized persons within the medical units and NAPH should have access to the data of the citizens. On the computer system server will be configured specific roles for each user category, which will determine the rights to access and process certain data in the database.
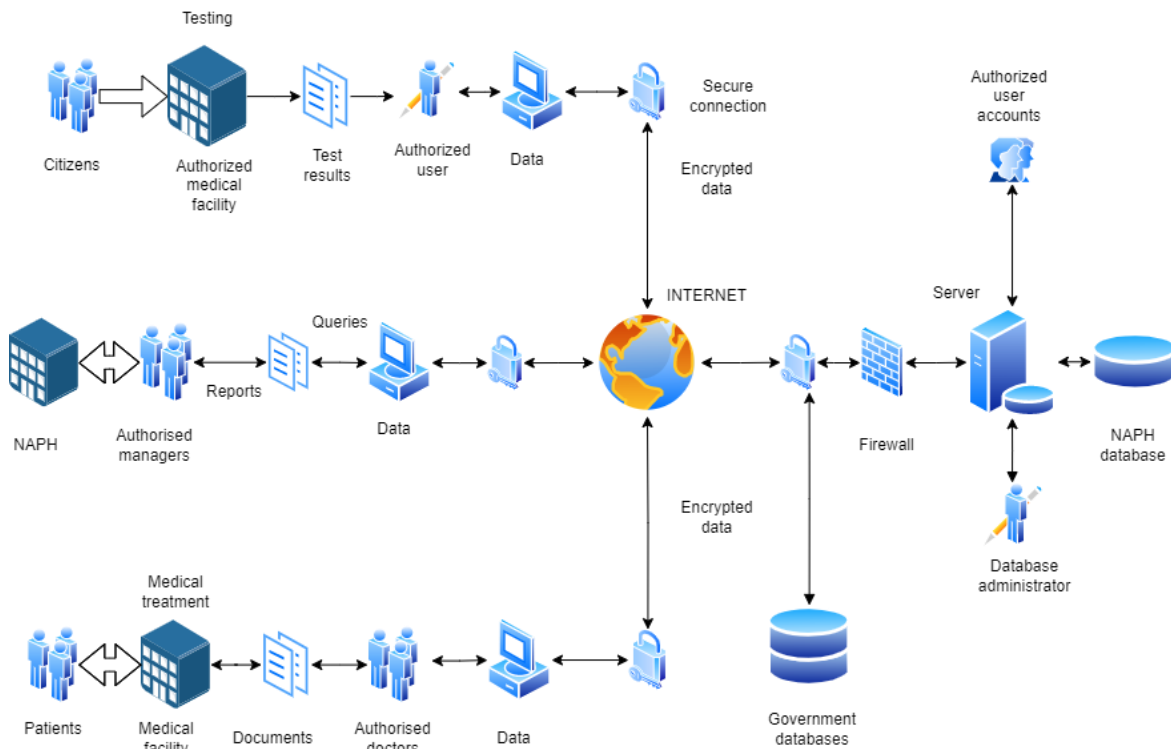
Figure 1. Functional logic of data processing based on client-server technologies
Source: author

System users will be identified on the server by their accounts (login, password), and all their actions in the system and with the data in the database will be recorded and analyzed periodically by the supervisors and the database administrator. For this reason, the authentication of doctors in ISMES will be done through the government service **MPass** [3] by electronic signature, mobile signature or electronic identity card.

All users of the IT system will be divided into categories of users with specific roles and rights. The following categories are possible:
- **Within medical testing units (medical laboratories)**
  - **data operator** with the right to insert the current data (in the current day) in the database, but without the right to view, modify and delete them;
  - **supervising operator** with the right to view, delete, insert and modify the current data entered by the database operators within the laboratory.
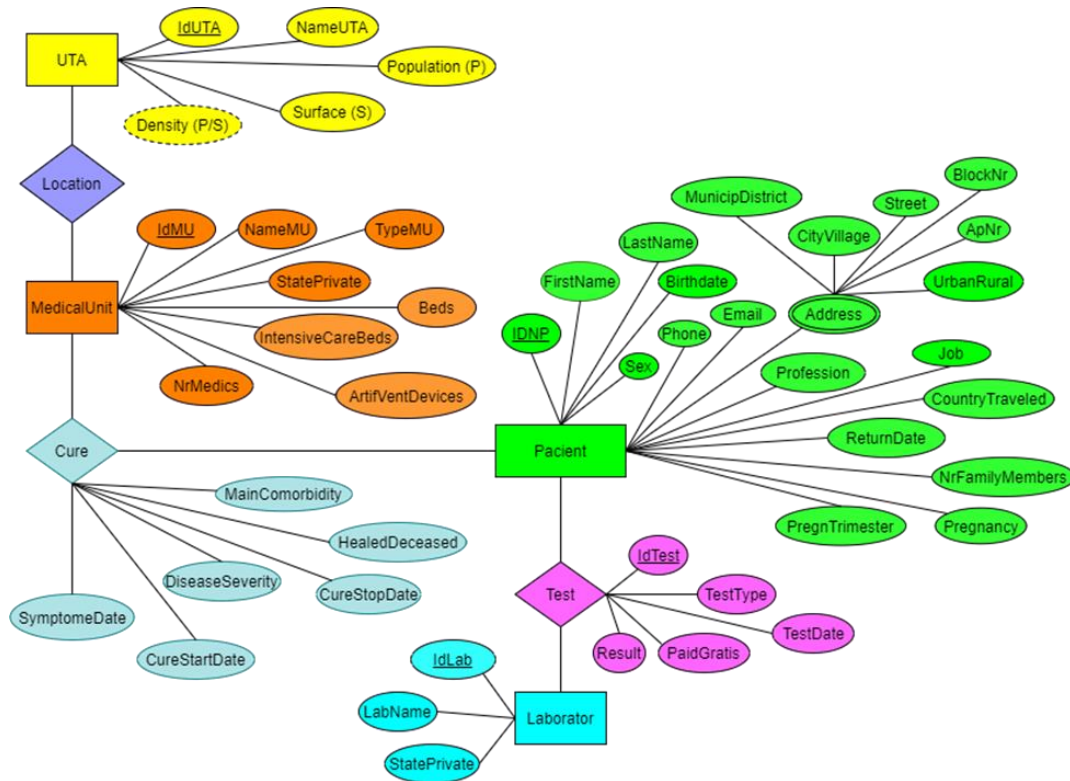- **Within the medical units**
  - **authorized doctor** with the right to access and view the data of patients treated in the medical unit in which he operates and to modify the medical data of patients (without the right to delete);
  - **authorized medical manager** with the right to access and view the data of patients treated in the managed medical unit, to modify the medical data of patients (without the right to delete), to monitor the actions of authorized doctors in the system and to cancel the effects these actions. Has the right to generate lists and summary reports based on the data of patients treated in the given medical unit.
- **Within the National Agency for Public Health**
  - **database operator** with the right to modify the NAPH database, to monitor the actions of the data operators and to cancel the effects of their actions. The database operator has access to the entire NAPH database without the right to delete tables and the database;

- **manager** with the right to query the NAPH database and generate detailed and summary reports throughout the database;
- **supervising manager** with rights to supervise the actions of NAPH managers and medical managers and the right to cancel the effects of these actions. It has access to the entire NAPH database without the right to delete;
- **database administrator** with full database rights.

Based on the scenario for grouping the users of the IT system, the security policy at the institution level and the technical policies at the IT system, server, database level can be elaborated.


Figure 2. Conceptual scheme of the ISMES database
Source: author

ISMES within the National Agency for Public Health will ensure the creation and management of a database with statistical medical data. It is proposed that this database be developed based on the conceptual scheme in Figure 2. The relational model of the database describes the entities Patient, Laboratory, Medical unit, UTA (Territorial-administrative unit). Between the given entities are established the relations Test, Cure, Location. Both the entities and the relationships are characterized by their specific attributes, with the possibility of extending them in case of need, based on the business rules of the field. The database will allow real-time remote collection of daily operational data. To this end, a web interface is to be developed and implemented on the NAPH server, which would allow authorized healthcare workers to connect to the database and enter the operational data obtained within the medical unit.

The proposed structure of the database allows the application of computational algorithms and the automatic obtaining of synthesis data, necessary for the daily operational reporting of the epidemiological situation on the territory of the Republic of Moldova (e.g., daily number of new cases of infection, total number of cases registered in territory, number of new import cases, total number of repeated positive tests, etc.). The implementation of the proposed database will allow the National

Agency for Public Health to carry out operational monitoring of the epidemiological situation and to obtain the necessary information for decision-making at the state level.
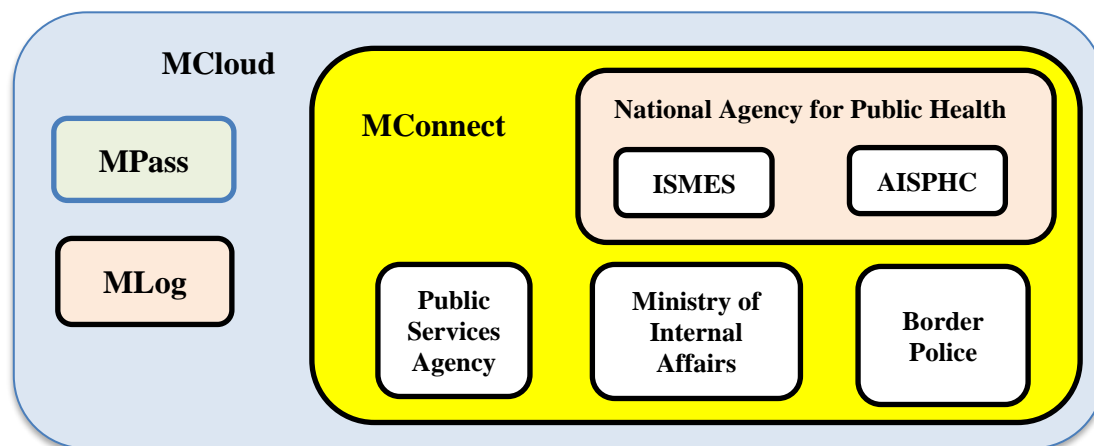
Figure 3. Interoperability of government information systems
Source: author

The information system for monitoring the epidemiological situation (ISMES) must be interconnected with other medical and governmental information systems, primarily with the automated information system "Primary Health Care" (AISPHC) (https://sia.amp.md/), but also with the information systems of the Public Service Agency, the Ministry of Internal Affairs and the Border Police (Figure 3), based on the principles of data exchange and interoperability (Law 142, 2018).

The **MCloud** information platform (https://stisc.gov.md/ro/content/mcloud) could serve as a platform to ensure this interconnection and interoperability. The **MCloud** platform [1] is a common government information infrastructure, which operates on the basis of "cloud computing" technology, hosted in the consolidated infrastructure of data centers. The platform is a model for the provision of IT services, through the telecommunications system of public administration authorities, as well as through public communications networks, exclusively through secure data access and transport channels. The **MCloud** platform is used exclusively by central administrative authorities and organizational structures within their sphere of competence, subordinated to the Government.

The **MConnect** interoperability platform [2] can be used as an integration platform for governmental and medical information systems (https://mconnect.gov.md/#/). The exchange of data between interconnected systems is to be carried out in the telecommunications network of public administration authorities. Only HTTPS will be used for all data exchange scenarios. Users of computer systems will be authenticated through the government's **MPass** access authentication and control service [3]. **MConnect** platform data exchange events are logged through the government's **MLog** logging and auditing service [4], ensuring a high level of information security. Logging provides search, reporting capabilities and allows the generation of detailed statistics as well as auditing, including analysis of personal data processing events.

CONCLUSIONS

The current situation in the field of medical information systems imposes the need to develop a new government information system for managing the epidemiological situation in the republic. Such a system could become ISMES, the concept of which is proposed in the paper. It is imperative to interconnect this system with the **MConnect** platform to ensure its interoperability with other government information systems. The **MConnect** platform will provide real-time access to quality, accurate and authentic data, ensuring transparency and accountability in the use of administrative and personal data. The **MConnect** platform will ensure the security and confidentiality of the data, events

and information systems involved in the data exchange. Effective mechanisms for monitoring, journaling and auditing will be provided and the compatibility of different information systems and various data formats will be ensured, as well as the scalability and integrity of data in a distributed environment.

BIBLIOGRAPHY

1. *Hotărîrea Guvernului RM Nr. 128 din 20.02.2014 privind platforma tehnologică guvernamentală comună (MCloud).* (2014). Available at:
   http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=351760
2. *Hotărîrea Guvernului RM Nr. 211 din 03.04.2019 privind platforma de interoperabilitate (MConnect).* (2019). Available at:
   https://www.legis.md/cautare/getResults?doc_id=113642&lang=ro
3. *Hotărîrea Guvernului RM Nr. 1090 din 31.12.2013 privind serviciul electronic guvernamental de autentificare şi control al accesului (MPass).* (2013). Available at:
   http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=351035
4. *Hotărîrea Guvernului RM Nr. 708 din 28.08.2014 privind serviciul electronic guvernamental de jurnalizare (MLog).* (2014). Available at:
   http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=354589
5. *Legea Nr. 133 din 08.07.2011 privind protecţia datelor cu caracter personal*. (2011). Available at: https://www.legis.md/cautare/getResults?doc_id=10607&lang=ro
6. *Legea Nr. 142 din 19.07.2018 cu privire la schimbul de date şi interoperabilitate. (2018).* Available at: https://www.legis.md/cautare/getResults?doc_id=105501&lang=ro
7. Oprea, S. (2021). *Interconnection of public health information systems for the operative monitoring of the pandemic situation in the Republic of Moldova.* The Collection of the Online International Scientific-Practical Conference "Economic security in the context of sustenable development" (December 11, 2020, ASEM, Chişinău) – Chişinău: ASEM, [2021], pp.195-198. Available at: https://ase.md/wp-content/uploads/2021/03/Collection_Scientific_Papers-Conference_December_2020.pdf