

The Implementation of a System for Monitoring Natural Population Movements in a Large Agro-Industrial Region

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Abstract: The paper presents a system developed for monitoring natural movements of the population on the basis of the automated creation of medical certificates of birth and death. As a result of this, it becomes possible to form a single information resource. Its creation would allow for the real-time monitoring of the processes of the natural movement of the population. A software product in the form of a web application is created, ensuring the operation of this information system.

1. Introduction

In the system of state and medical statistics, the reliability of the collected and analyzed information is based on the quality of record-keeping and its error-free processing [1; 2]. Currently, a number of problems are noted in the compilation of statistical data on medical demography and their analysis [3]:

- The readability of records in medical documents filled out (created) by medical personnel by-hand;
- The speed of obtaining statistical data on birth-rate and mortality and combining them into a single information resource for analysis.
- The technical, software, and information support for the analysis of the natural population movement.

A reasonably satisfactory solution already implemented in other document management systems is the automation of filling out documents using application software in particular, and the introduction of electronic document management systems in general [4].

2. Materials and Methods

The technology of registration of births, deaths, and analysis of vital movement at present is as follows [5]:

- 1) Each case of birth and death must be registered by a doctor, with the mandatory completion and issuance of a medical certificate (birth, death).
- 2) Further, the medical certificate through the relatives of the born (deceased) gets to the registry office, where, based on the medical certificate of birth (death), the state registration of birth (death) is carried out.
- 3) All information about births (deaths) is accumulated in the city (district) departments of the registry office and transferred to the territorial body of the federal state statistics service. This is where all demographic statistics are generated, which is the primary source of data on the natural population movement.

- 4) Further, for departmental health needs, medical certificates can be transferred for re-processing and analysis of the natural movement of the population. Or one could use state statistics that do not always reflect the medical aspects of demography.

Currently, in the Altai region, in medical statistics, there is a system of personified registration of the dead. This system is based on the input of data from paper medical death certificates. [6]. This system uses proprietary software. The existing information system is outdated and does not correspond to the modern tasks of monitoring and analysis of the natural movement of the population.

3. Results

In order to solve the mentioned problems, we developed information software and implemented a system for monitoring and analysis of the main processes of the natural movement of the population, which is entitled "Medical Demography" ("MedDem"). The system of monitoring the natural movement of the population is applicable at the level of the region. It also could be used by large administrative-territorial entities in healthcare, regional governments, and research institutions. This system saves the input and output data of the system of registration and analysis of the natural movement of the population, changing (automating) the process inside [7].

The software allows us to generate a medical certificate by entering the necessary information and subsequently print the document. Simultaneously, with the created document, all information from it replenishes a single database on the region. The expert part of the system allows us to generate the main output data for the analysis and monitoring of birth-rate and mortality, with a set of tables and lists. The user certificate registration software is implemented through a web application. The application allows us to generate essential documents that register the natural movement of the population (cases of birth and death). The user can be either the doctor registering the birth or death and issuing the certificate, or the medical registrar who only enters the necessary information and prints the document out. By clicking on the link to the site, they pass authentication and get access to work in the system. The user creates reports by filling out the appropriate forms. Once having the certificate saved, it is possible to print it out.

A single replenished real-time database allows us to obtain information quickly, both for current statistical observation and for a retrospective analysis of the natural population movement. The created software allows getting a set of analytical tables on birth-rate and mortality, taking into account various selection criteria for analysis. The result of the work is a report with a large amount of data characterizing intensive, extensive, dynamic characteristics, and characteristics of the mortality distribution by the analyzed group of causes.

All information for monitoring and analyzing the natural movement of the population as a result of implementing web applications is immediately available for analysis at the time of issuing the certificate. In contrast, it was 3-4 months before the implementation of the "MedDem" System. The formation of a list of births and deaths in the form of a table allows us to apply information processing methods, using the OLAP technologies or any other means of working with spreadsheets for obtaining the required information.

Thus, the implemented system is changing the technology of the formation and issuance of certificates, monitoring, and analysis of the natural movement of the population. This system significantly improves the quality of documents (certificates), which are then used for state registration of birth and death in the registry offices. The developed system allows improving the quality of filling out medical certificates significantly, increase the statistical registration of birth and mortality, and monitor and analyze the natural population movement.

Starting from January 1, 2012, in accordance with the order of the Altai Region General Directorate for Healthcare and Pharmaceutical Activities "On Approving a New Procedure for Automated Filling of Medical Documents Certifying Births and Deaths in the Medical Organizations of Altai Region" (December 23, 2011 No. 777), the registration of births and deaths in all medical institutions of the Altai Territory has been carried out through the "MedDem" system [7].

4. Discussion

We conducted a study to test the possibilities of analyzing the health status of the population outside the administrative-territorial borders with continuous statistical monitoring.

The mortality rate of the population living in conditions of low access to medical care due to geographical and infrastructural characteristics was chosen as the object of the study.

In the Altai region, there are several rural areas, the territory of which is divided into two unequal parts by the Ob River. Thus, there are two parts. The larger part has a regional center, transport, and social infrastructure, and there is a smaller one, where several settlements remain, residents who live in conditions of less access to medical care. Consequently, there is a significant difference in the state of health in these two regions. In particular, conditions of low availability of medical care differ, and they can be comparatively studied.

Relying on the collected data, we analyzed all deaths of the residents from both river banks. We focused on the three-year period, and the values and indicators necessary for the analytical tables were calculated.

It was determined that the mortality rate among the population living on the right bank (RB), in the context of the relatively low availability of medical care, is higher than among the population living on the left bank of the Ob river (LB) (Table 1).

TABLE 1. THE MORTALITY OF THE POPULATION RESIDING ON THE LEFT (LB) AND RIGHT (RB) BANK OF THE OB RIVER

Class of diseases	per 100 thousand		±m		t	RB>LB %
	LB	RB	LB	RB		
Respiratory diseases	1.5	3.4	0.1	0.6	2.8	117.8
Circulatory system diseases	10.6	13.2	0.2	1.3	2.1	25.3
Accidents, injuries	2.4	3.4	0.1	0.6	1.5	39.9
Neoplasms	2.3	2.3	0.1	0.5	0	-0.7
Total	18.5	23.1	0.3	1.6	2.8	25.2

The most significant effect of territorial and infrastructural characteristics on mortality can be seen in a comparative assessment of the seasonal fluctuation index. Thus, in the absence of a pronounced seasonality of total mortality in the LB group, the pronounced peaks of intense mortality in the winter in the RB group are noted. The seasonality of mortality from diseases of the circulatory system is seen even more clearly [7].

Thus, a decrease in the availability of medical care can increase the mortality rate by 25%, especially due to respiratory diseases (2.3 times) and diseases of the circulatory system (1.3 times).

5. Conclusion

The created information system “MedDem” allows us to use medical and demographic methods to study the laws of public health formation outside the administrative division of territories, in specially formed ex-administrative-territorial zones (EATZ) on any factor basis. The demographers of the last century dreamed of such a methodological approach.

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