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# An Approach to Analysis and Classification of Medical Errors

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**Abstract.** The paper is devoted to organization of paperless technologies in in medicine, especially in the first and urgent medical care in the Republic. Application of information technologies increased the importance of electronic information exchange, which in turn it enables to develop paperless work process. Today it can be argued that electronic information prevails in many fields social action and its priority is the development of paperless technology. The protocol forms suggected in the paper imply continuous information transfer, connecting them with the center and connection of the station that is very important with polyclinics, city hospitals, information exchange. The system provides error detection to ensure patent's safety, the study and examing a doctor's errors and construction of fair information exchange in hospitals and outpatient practices.

**Key Words and Phrases**: automation, doctor's error, mathematical statistics, frequency analysis, protocol

**2010 Mathematics Subject Classifications**: 34B05, 34B15, 34C23, 47H11, 47J10, 47J15

## 1. Introduction

A civilized society naturally means qualitative, that is, efficient strategic planning and based on personnel, medical, technical and information policy, a society to provide state guarantee for the provision of necessary medical services [1]. Application of information technologies increased importance of electronic information exchange, which in turn allows to develop a paperless work process. Today we can argue that electronic information prevails in many fields of social action and its priority is the development of paperless technology.

Increasing role of information and communication technologies (ICT) could not bypass this area of health care. Its application in healthcare is on the one hand can significantly remove fiscal constraints in the provision of medical services. On the other , digital ICTs can enable consultations and facilitate daily tests and information transfer for patients and most importantly, can save clinicians from a large amounts of paperwork.

Mistakes of medical personnel has a particularly negative effect on the ability of a person to realize their human rights, freedoms and legal interests. The contradictions about the quality of medical services show that the people in need of medical care often

 

become hostages of the prevailing stereotype connected with inevitability of medical errors. Specialists who harm the patients, in order to avoid spiritual and legal responsibilities, show their mistakes as one of the natural directions in the development of the existing professional status.

The argument in favor of the inadmissibility of the side effects of the activities of medical workers is mainly based on the fact that existing legislation, science, medicine and law enforcement practice, with the content characteristics of the medical services category an uniquivocal position has not yet been formed.

Objective assessment of the level and dynamics of crimes because of negligence is complicated by the lack of official statistics on the damage to the patient interests. The observed trend creates a significant social threat. A growing sense of irresponsibility among incompetent medical workers for mistakes made cannot ensure the safety of human life and his health. This, in turn causes an increase in the cases of neglecting the diagnostic and treatment standards.

Even in the most developed, that is, industrialized countries, health care is not safe as it should be. This issue remains a problem. True, the 1970-s and 1980-s there was a sharp increase in medical malpractice lawsuits started to happen. This was especially felt in the United States [1]. So, the Harvard Medical Practice Study [2,3], the researches conducted in Colorado and Utah [4] systematically show where the patients were often harmed. Collected data on hospitals and the results of both studies in the United States formed the basis of the report on the quality of health care. In 2000, in the article "To err is human" [5] Klaus Deter Scheppokat and Johann Neu note that the number of people who died in a year as a result of a doctor's error in America was between 44000-98000. Subsequently, many developed countries conducted similar research [6] and created relevant institutions. The goal to improve the patient level of security. Of these in Great Britain National Parient Safety Agency (NPSA), in Germany German Coalition for Patient Safety (Aktionsbündnis Patientensicherheit, APS) organizations can be named.

According to the All-Russian Public Opinion Research Center, today 60% of patients in Russia are dissatisfied with the quality of medical care. It is quite right that the public price is low for the level of medical care. Compulsory Medical Insurance Fund reports that about 10% of medical care in Russia is defective.

Acute social nature of the medical malpractice problem is complicated by the fact that law enforcement agencies and the court pay little attention to the harmful activities of incompetent health workers [7]. Only in recent years some steps have been taken to eliminate this problem. So, in order to improve patient safety in the first step, three basic strategies were proposed:

1. reporting errors by the security control system,
2. studying and investigating errors
3. setting fair information exchange in hospitals and doctor's outpatient practices.

If these are performed critical events can be identified, reported and analyzed so that similar incidents can be prevented and measures taken. Every happened event must

be necessarily evaluated. Finally, if any preventable adverse events occur, appropriate measures to prevent damage should be taken.

The public is also very interested in this problem. For example, based on the 2005 year's survey, 72% of citizens of the European Union, 78% of German and European Union are dissatisfied with medical errors and in general they consider the existence of these types of errors to be an important problem. 28% of them are patients that expressed theirconcern after the treatment they received [8].

## 2. Problem statement

The article discusses the problem of organizing paperless technology in first urgent medicine for complete medical care especially throughout the republic.

Development of such a system considers uninterrupted data transmission to networks of substations, their center coordination and as a very important issue, communication of the station with hospitals and clinics, and information exchange. And the goal is to determine the shortcomings of the existing electronic system in the emergency medical service based on the study of the whole period, to revise the work process, to take into account requirements of society as a whole and to develop a new electronic solution throught evalution.

## 3. Problem solving

Successful completion of the problem requires solving a number of sub-tasks. Among these sub-tasks the main ones are:

Conducting proper preliminary analytics for formation and analysis of process and requirements;

Preparation of a functional document based on the created requirements (technical tasks);

Technical development of the software base;

Design of compatible screens;

Preparation of the internal and external part of the registration department (for the internal part 4 screens, and 4 screens for the outer part);

The final completion of the first phase of the software and the preparing a temporary login screen;

Early stage of software testing and recording the results of the software;

Systematic analysis of medical errors;

Presentation and first testing of the software in the Emergency Medical Station and production in the test environment, etc.

More than 40 forms of tables for various purposes have been developed [9]. Let's mention some of them:

Filters related to the large doctor service window:

| Start date | End date | Auxiliary aid station | Doctor | Individual identification number | Patient's name | Patient's last name | |
|---|---|---|---|---|---|---|---|
| Call addres | District | Settlement | Type of transportation | Type of call | Diagnosis name | Hospital | See the result |

Figure 1.

1. (a) organization of the medical team (disruption of work functions: did not come to work, extension called, working time is over);
   (b) functions of doctors:

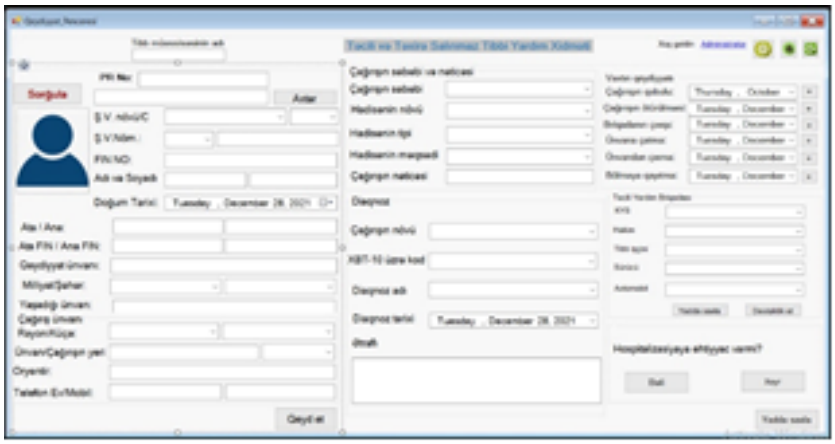

Figure 2. Fragment from the doctor's tablet

1. (a) types of accident; survere cases; call points, etc.
   (b) the result of the call:

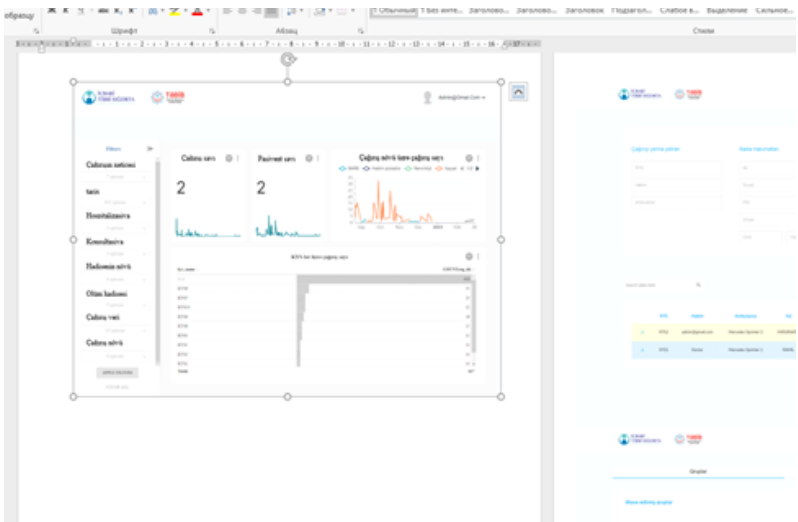

Figure 3. Analysis of results

In general, since 1990 doctros in developed countries, national and international discussions devoted to the problem of minimizing and at best eliminating errors are being conducted. Forward as the main context the safety of the patient is put. Errors encountered are classified, classes are expanded and discussions are held to prevent adverse events, quality standards are being developed, and the topic of raising the level of health care services is the basis of meetings..

Based on todays accepted context, doctro's mistakes can be divided into the groups indicated in table 1.

**Table 1**. Overview of physician errors

| ? | Event | Explanation |
|---|---|---|
| 1 | Adverse event | More treatment-induced adverse events-may ot may not be preventable |
| 2 | A preventable adverse event | The negative event that can be prevented |
| 3 | Critical event | An event resulting in a negative event or an event with an increased probability of occurrence |
| 4 | Error | Action or inaction that leades to deviation fron the goal, following a wrong plan, lack of planning |
| 5 | Partial ignore | A mistake that does not cause much damage |

A medical malpractice, whether large or small, both quantitative and qualitative should be examined and evaluated from a qualitative point of view. Evalution of its performance is equivalent to evaluting the functional

$$A = A\{N;\ N_i;\ N_t\ \ (i \geq t)\,; D_i^m;\ Y_i^m;\ Q_i^m\} \qquad (1)$$

Here A is the doctor of call team;

N is the number of working days of the doctor in a month;

$N_i$ the number of real calls of the doctor during one working day;

$N_t\ \ (i \geq t)$ the number of times the doctor attended the call directly without intervention (false calls, refusal of the doctor, absence of the patient at the call address, etc);

$D_i^m$ initial diagnosis made by the doctor;

$Y_i^m$ provided first aid;

$Q_i^m$ the decision making by the doctor.

But we cannot forget that the problems in the doctor's work are inevitable, especially in the work of emergency physicians. For example, the information about the calls of the Emergency and first Medical Aid Station in Baku city in 2020-2021 is given in table 2. Based on the data, it can be seen that what kinds of calls doctors face every day.

**Table 2**. Events encountered by the medical team

| ? | **Call events** | **2020** | | **2021** | |
|---|---|---|---|---|---|
| | | **During the year** | **1 day** | **During the year** | **1 day** |
| 1 | Unsuccessful call | 63555 | 175 | 62424 | 171 |
| 2 | False calls | 1015 | 3 | 1206 | 4 |
| 3 | Not found at location | 6206 | 17 | 6310 | 17 |
| 4 | Address not found | 749 | 2 | 1076 | 3 |
| 5 | Death before the doctor | 16044 | 44 | 16852 | 46 |
| 6 | Unreasonable call | 39541 | 108 | 36980 | 101 |

The effectiveness of the organization of medical assistance to the population mainly depends on how adequately the influences of the regional features are taken into account. Therefore, it is necessary to analyze the activity of ambulatory and emergency medical services at the regional level, and then to develop measures aimed at improving their work. We believe that in application evidence-based measures and methods the role of modern information technologies is undeniable.

At different stages when evaluating the quality of medical care to patients we need to stop on a concept such as inconsistency in diagnoses. According to discrepancy between diagnoses, etiology of the disease and the nature of the pathological process (for example, according to the nature of stroke) we can meet two cases. So, low diagnosis (presence of another nosology) and extreme diagnosis (absence of this nosology) can be classified. Differences in the diagnoses may also be related to late diagnosis.

Within these terms it is appropriate to conduct a selective analysis of the ratio of similar diagnoses in the provision of medical care at different stages. In different years (2010-2020), although the share of discrepancies in diagnoses by selection method was observed with the decrease trend, it varied between 0.9-4.1%. At the same time, it is necessary to survey among doctors to investigate the reason for the existence of these cases, to define the main reasons for the discrepancy between the diagnoses. It is important to determine the issue, because at the same time several reasons (combination of objective and subjective reasons) the result containing non informative and makes further analysis extremely difficult.

In diagnoses in the assessment of diseases by the doctors the main reasons for non-compliance are the short duration of the patient stay in the medical institution, the difficulty in diagnosing the disease, as well as hiding manifestation of a number of nosological forms.

According to the questionnaire survey of doctor's survey table was developed for the objective analysis of the objective reasons discrepancies in diagnoses (percentage of positive answers).

Outpatient, polyclinic, emergency and urgent care organizations doctors are asked to answer to the following types of questions: they are collected; lack of information to assess the patient's state, in some cases incompleteness of diagnostic equipment or apparatus,

hidden form of the disease, the rarity or severity of the disease.

It should be noted that the cases of inconsistency in the diagnoses of the emergency and first aid station and the hospital can be explained by a number of reasons – time shortage, extreme situation, absense of additional laboratory, diagnostic methods of research, mainly the lack of paramedic staff of mobile groups, and unexpected situation. When analyzing inconsistency in diagnoses based on a questionnaire survey of doctors the subjective reasons especially inifficient examination of the patient, incorrect assessment of anamnestic data, clinical underreporting or incompletereporting of information should not be overlooked.

Since the work is devoted to the development of paperless technologies it is intended to create intellectual information system through which it implements uninterrupted transmission of information to networks of substations, their connecting with the center and very important, theconnection of the station with polyclinic, city clinics and exchange information with hospitals and clinics. As we mentioned above, different purpose forms have been developed, doctors have been provided with tablets. Each medical team includes to this table the tima spends on call, the initial diagnosis, the actions and decision taken. Thus, a set of data allows monitoring the work of each medical team.

For example, the work of the medical teams of the divisions 6, 1, 20, 4, 8, 2, 13, 16, 22, 3, 5, 7, 9, 11, 18, 19 of Baku Emergency during a month was analyzed, that is functional (**??**) was evaluted. The information filled in for each call on the doctors tablet is examined.

44 defective cases were detected. 2% of them - anesthesiological reaminatology brigde without reguest (ARB) was called; 4.5% - the situation was not evaluted correctly and resulted in death at the doctor; 6.8% - diagnosis does not it the complaint; 18% - incomplete medical care; 15.9% - acute cerebral circulation disorder, to reduce arterial pressblood pressure is not targeted, drug extravagance, assistance tactics were not chosen correctly, etc.; 13% - the diagnosis was not made correctly; 26.7% - symptoms confirming the diagnosis were not fully checked; 13.1% - incompletely filled out accompanying sheet (protocol form on tablet).

Created system for detection and elimination of medical errors can be considered as an approach. The frequency of errors, along with ensuring their classification can be submitted to the commission that makes decisions objectively for the doctors in the form of advices (taking into account legislative reguirements).

The system can always submit such type of analysis to the decision making person.

## 4. Main result

The development of paperless technology in healthcare is an unseparable part of telemedicine. From this point of view, this system can be considered as a basis for remote transmission of information followed by all ethical moral norms and legal rights and at the same time for its safe strage. When the system detects doctors error, in one hand he can sort (systematize) and analyze them and on the other hand, to give consultative advice.

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