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THE ELECTRONIC MEDICAL RECORD DOCUMENTATION AUTOMATING ACCORDINGLY TO THE E-HEALTH SYSTEM

The author offers his own outlook of solving the some problems of modern state of Ukrainian health system – the typical problems that arise from the primary layers of the health system – from the necessary contacts of primary doctors and their patients. These contacts give rise to a myriad of critical documents for these patients and the entire medical system. In turn, these documents are often unclear, inaccurate or simply erroneous, archaic and often are the basis for petty and massive corruption. This work is aimed at creating a positive step in eliminating this, to put it mildly, archaic way of registration or giving doctors all kinds of information about their patients. The author offers a real mass software product that works "in pairs" with a patient database of any medical institution, and it is able to automate both the creation and accounting of versatile primary medical documents and standardized forms. This software product is based on the MS Excel spreadsheet. The "demo"-version of the product is able to create an imitational database of patient: its structure is very realistic. In reality, any doctor or medical institution should have its own database of patients, since the Application is designed to work specifically with it: one automatically gets versatile medical forms and fills them in the relevant sections with proper information from the patients' database. The author's choice of the MS Excel processor is reasonable: in Ukraine MicroSoft Excel is studied in detail twice – in any secondary school and in any high school up to university. Therefore, any doctor is already well prepared for the assimilation of this Application. It can be easily adapted to the needs of any Doctor/Physician or any medical institution, for any type of medical service. Experience shows that the introduction of such IT-tools is the good engine for obvious positive changes in any sphere of human activity.

Keywords: e-Health system, health information technology, medical record documentation.

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АВТОМАТИЗАЦІЯ СТВОРЕННЯ ЕЛЕКТРОННИХ МЕДИЧНИХ ДОКУМЕНТІВ ВІДПОВІДНО ДО СИСТЕМИ E-HEALTH

Автор пропонує своє вирішення однієї з давніх проблем пострадянської системи охорони здоров'я – автоматизації формування та обліку різноманітних «первинних» медичних документів, які, зокрема, стосуються оформлення контактів на рівні первинної ланки «Доктор – Пацієнт». Крім того, ці документи часто неясні (як мінімум нерозбірливі), недбало оформлені, містять помилки, і легко можуть стати основою для дрібної і масової корупції. Метою даної роботи є створення програми, за допомогою якої можна усунути вказані негативи, вийти з «середньовічного» способу реєстрації та обліку медичних документів первинної ланки, піти з епохи «нашкрябування» вихідних документів і форм. Автор пропонує справді «масовий» програмний продукт, який розрахований на роботу «в парі» з БД пацієнтів (БД будь-якої структури) практикуючого лікаря / мед. закладів. Головна функція цього додатка – автоматичне створення "ready-to-print" різноманітних вихідних первинних медичних документів і стандартизованих форм. Ці електронні документи будуть автоматично названі тим ім'ям, яке запропонує Користувач, і автоматично збереже згенерований документ в зазначених користувачем місцях згідно зі схемою «ім'я ПК → диск → папка». Важливий позитив пропонованого рішення – використання знайомого кожному українському лікарю процесора MS Excel, що мінімізує «хворобливість впровадження» пропонованого ПО в якості бази даних пацієнтів і Додатки для роботи з цими даними. Серед інших позитивів впровадження цього Додатка – скорочення часу на лікарський «архаїзм» та іншу рукописну роботу, крім того прогнозується різке скорочення всякого роду помилок / неточностей, на порядки поліпшення обліку і зберігання подібних медичних документів і форм, зменшення можливостей зловживань в цій сфері.

Ключові слова: система e-Health, IT в охороні здоров'я, ведення медичної документації.

Introduction

The efficiency of the Health Care was – always and everywhere – a highly important matter, and its value cannot be overestimated at all. The functioning of the Healthcare system is inevitably linked with a large number of specific documents [1]. From early childhood each of us receives medical support and has his own history of illnesses and appeals to doctors, but – *attention*! – that is all documented *on paper* as a rule. But in our days this document circulation is rapidly becoming paperless all around. Both computerization and automation in practical medicine develop at the same gigantic move as all other branches of human activity that are touched by IT. And it is now not surprising to hear that experts of the US company *Frost & Sullivan* predict that by 2025 medical doctors will prescribe to their patients not recipes, but applications [2].

The development of national electronic health records systems has created great positive support for health systems in general, naturally in those countries where it has been implemented. Throughout the World, in the transition to e-Health conception [3, 4], there is remarkable economic benefit for the entire community. For example, according to the research [5], conducted in 2005, such work on reforming the information component of the US national health system allows to save budget and extra-budgetary funds directed to these purposes for more than $81 billion annually. At the same time, it is stressed that this saving is achieved due to better functioning of the country's health system. But such indicators can be achieved if all components of the Health Care system are reformed and coordinated on a national scale, and not only by simple replacing the existing clinical, laboratory-diagnostic and pharmaceutical equipment with the most advanced and revolutionizing information in the Health system [6].

Surely, computerization in Healthcare brings with itself a lot of positives, for example, mutual economic benefits and mutual legal protection.

Medical record documentation is usually created for Safety of patients and Defensibility of medical Doctors (Physicians). Poor or out-of-standard medical records make it difficult to determine whether an adverse outcome resulted from factors beyond the doctor's control or from negligent medical care. It has already been clarified that the subject of medical record documentation is highly important since the outcome of litigation and the promptness of reimbursement depend on the adequacy, legibility, completeness, timeliness and accuracy of medical records [7].

Aside from medical-legal considerations, the most important reason for physicians to maintain accurate, credible medical records is that good documentation protects patients. Medical records contain information required to inform physicians of past and present treatment decisions, and to provide evidence that such care was appropriate in all respects. Everyone who writes in the medical record must ensure that entries are legible. Unreadable entries in a medical record usually are a great problem (*see illustration* below – Fig. 1).

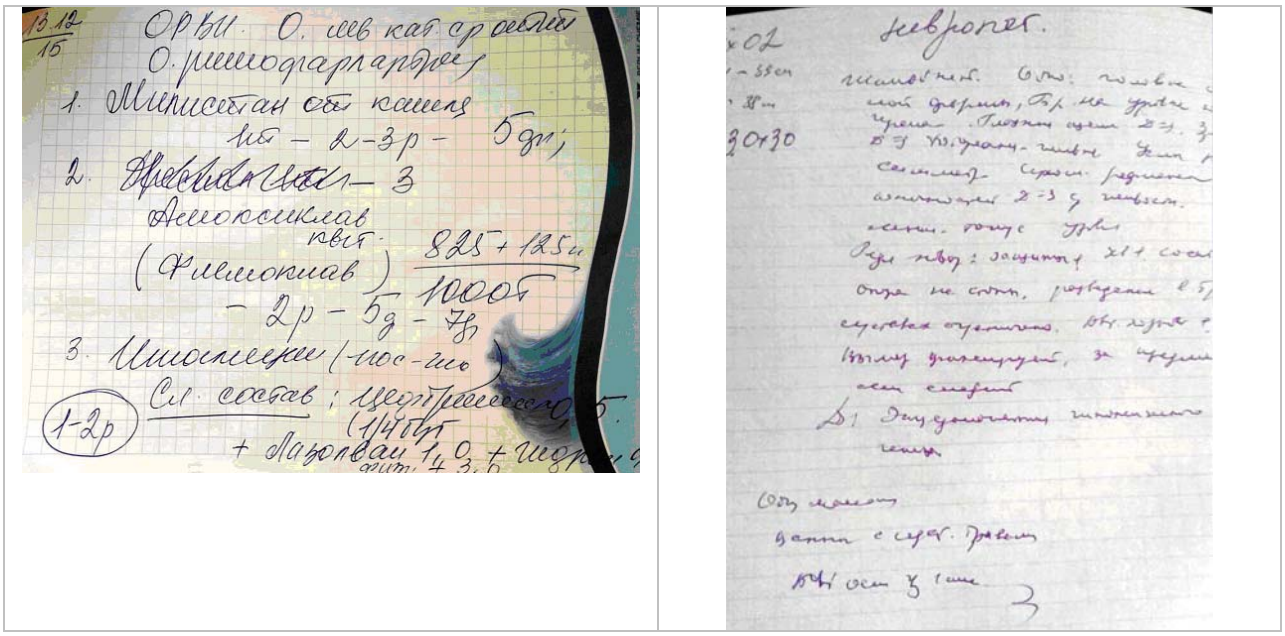


Fig. 1. The typical appearance of the common *handmade* modern (!) medical document

An increasing number of software programs and complete documentation systems are available for doctors who want to computerize their medical records [8]. When choosing an electronic medical record (EMR) system, doctors should first assess their practice management and documentation needs, and spend some time evaluating the EMR product and the company's stability. Computerized medical records should include the essentials of good documentation as outlined in this text [9]. Specifically, the EMR should offer (among other features): default fields that cannot be skipped (e.g., allergies, medications); reminders for health maintenance diagnostic testing; pop-up warnings about contraindicated medications due to allergies or prescribed drugs; safeguards against undetected alterations; an automatic backup system; and more.

We need to reach the widest possible audience – these are the widest possible layers of medical Doctors (Physicians), and we need to do this in the shortest possible time. And this, of course, is an ideal, but the author believes that is not only Idea. So, this is one of the reasons why the author offers his solution to a part of this really great Task.

Naturally, one must proceed from the realities of the present day. Anyone who tackles this problem in modern Ukraine will have to overcome a number of "standard" difficulties in such cases (the mental attitude of the part of medical personnel to the new – their fear and rejection, as well as low degree of their "technological" willingness to introduction of progressive methods of work, etc.), and also it is necessary to take into account a number of "purely Ukrainian" details. These features include the fact that both the Ukrainian secondary school curriculum and the university curriculum include studying of MS Office Suit, in particular, MS Word and MS Excel. And the fact is considered by author as a good starting point for realization so needed medical reforms at least through IT.

1. On "IT-*fication*" within the Ukrainian Health sector and the Roadmap of the work

Undoubtedly, Ukraine has to find its own practical solution to this problem, in particular in the medical sector, which is being reformed for optimizing and improving the quality of national medical services [10]. In fact, in March 2017, it was created the Ukrainian Project Office for Reforming within the Electronic Healthcare System

(***e-Health***) as the first real step in order to coordinate its real steps in implementation of the electronic document management system.

To obtain economic benefits from e-Health practice, of course, it is necessary to update radically both the structure and mechanisms of the regional and national health systems in order to implement the all of required changes that are inevitable due to the introduction of new information processing technologies into the national industry. Now the information space of the industry lives as a special principality, which usually solve their tasks autonomously: for the present network of laboratories, for medical centers, etc. In Ukraine, there must be created a *unified* information system – it must be modern in its functioning!

Surely, Ukraine is not the first country faced these problems – at least the great general problem (say, how to build up the *modern effective* national Health care system) and particular tasks (one of them is how to automate the specific medical certificate creation). But these tasks are real, urgent, and they must be resolved more quickly.

Since this problem is considered by author as massive and old, it is necessary and it is possible to solve it "from within". The author offers his own way of solving a similar problem, because the way seems to be simple, effective and realizable.

So, the present work is one of solutions for the automatic creation of medical records, and if to be more precise, it is about automatic generating of certain medical certificates according to the current requirements of the Ukrainian Ministry of Health using information from the patient's personal medical history[1] within the *e-Health* concept in Ukraine.

Since electronic databases of patients (DBP) and automation of the document circulation process in the Health care system are extremely necessary for all items of the list: doctors, patients, administrations of medical Institutions (***MIs***) and any State in general, then one can declare **the purpose of this work:** it is to develop an algorithm for the automatic formation of certain particular documents in digital form and implement this algorithm into program module, which allows to create automatically some specialized medical forms of the standard sample and to fill them with the necessary information from the electronic database (the DBP). Naturally, the created software product should be maximally adapted for current potential users in Ukraine.

The urgency of the work is that at present there is an extra need to organize and implement the turnover of electronic documents, in particular, in the medical field (corresponding to the tasks of medical reform in Ukraine).

The tasks to be solved:

- Formation of an *imitational database of patients* (***iDBP***) and their history of diseases with maximum realism – for proper testing of the created software product and for the demo version of the software application;
- Identification of the patient personal information by his ID (both the specific medical one or the state general one);
- Formation of a step-by-step request for obtaining a medical certificate for an identified person by a specified specimen in accordance with the requirements of the Ministry of Health of Ukraine;
- Automatic formation of specialized forms according to approved examples (as a separate file with a unique name, in a separate folder on a certain medium) and filling out the prepared form of the relevant information about a particular patient;
- Ensuring the convenience of storing information on certain patient and keeping it protected. Preparing a secure registry of already prepared and output medical documents one considers as a separate task.
- Preparing the automatically generated and completed documents to be printed.

The object of the study was electronic documents from the list of the regulatory framework of the Ministry of Health of Ukraine, namely, the accounting and reporting forms, the rules for their conduction, the definition of links between them and relevant contents.

The subject of the study was the creation and development of a system for the automatic formation of electronic medical documents in accordance with the official list of documents and requirements of the Ministry of Health of Ukraine, as well taking into account the requirements for the *e-Health* system.

The mentioned work is undoubtedly practical. The tasks were solved based on MS Excel spreadsheet processor and VBA programming languages. The choice of software is due to the fact that MS Excel is a powerful IT-tool and at the same time one of the most popular and well-known office applications, in addition, it is studied in high school and university. In this "duet" MS Excel is a database repository with patient data of a particular MI, and the author's software module is able to process the existing database and form a new file from very beginning.

In order to achieve the stated purpose of the work, the main sequential assignments were outlined:

- Formation of the model of the patients' DB which is close to the real one, taking into account the statistical reports of the Ministry of Health of Ukraine for the last three years concerning diseases of our citizens [11, 12];
- How to identify a patient as a person? Development of a method for identifying a patient in two ways: 1) by the traditional one, that is on the usual set of common attributes of a person (name, date of birth, address); 2) by the ID number of a patient, if it is provided;

[1] = a personal health record, or PHR

- Automatic generating the selected medical document according to a specific person's request with creation of a unique file name without user intervention in the process. This requires access to the current database information as well to the system clock for current date and time;
- Determining the ways to organize the storage and security of database information and medical documents that were generated by the program. Maintenance of the automatically protected register of already formed medical documents.

On the Technical Task of the work: developing a conceptual algorithm and the corresponding program modules (hereafter – the *Application*) which are capable to form and fill automatically certain medical documents of the established templates with data relatively to a specific patient. The author believes that taking into account the realities at this stage, it will be optimal to create a software product in the form of software modules for the MS Excel data processor.

On some Features of the developed Application. 1) The core of this software product is the special *Excel* "*master-file*". 2) It was created the specific software module as a "standing apart" database simulator[1] for patients of a MI (a Physician/Doctor). When developing of the mentioned imitating database of patients, in order to create maximum realistic records, the following was don e:

- it has been studied some normative documents of the Ministry of Health of Ukraine that regulate the procedure for maintaining medical records as well as some reporting documents of the Ministry regarding the prevalence of infectious and non-infective diseases among the Ukrainian population over the last 3 years;
- it has been used statistical data on the current gender characteristics of the population of Ukraine.

Input data. For the created *Application*, the input data is the specific data from the patients' DB of a medical institution (a doctor) with the certain structure of records for each patient. This database has to contain some basic information about the MI (Doctor) and information about each patient of the institution: his name/surname, personal ID-number (if available), date of birth, address, history of illnesses and so on. For the trial version of the *Application*, the separate imitating module for patients' DB was created for 50 persons.

Output data: there are automatically generated forms of certain medical certificates of the established sample as a result of the work of program modules. The current version of the Application allows you to get up to 4 types of forms for a patient in the form of separate "particular" files, which are filled with relevant information from the DB of the MI (Doctor/Physician).

The diagram below (Fig. 2) shows the interaction of the primary data from the DBP and the author's Application itself (which nests in the Excel-*master*-file), and it results to the required *e*-document formation.

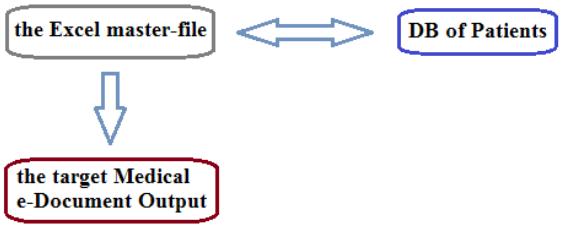


Fig. 2. The illustration which showing the required *e*-document forming

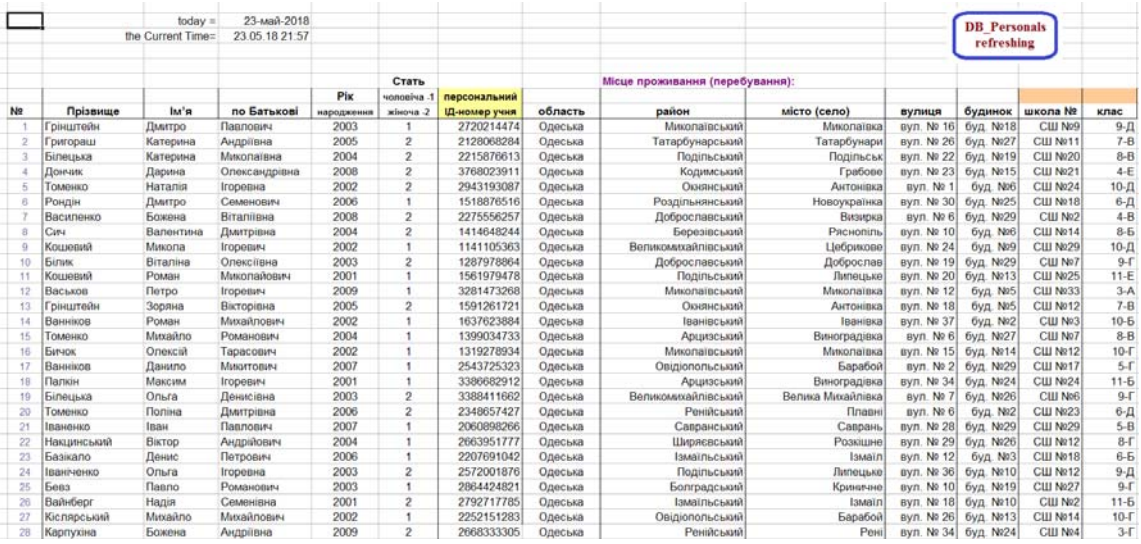
2. On the imitational Database of Patients (iDBP)

For the debugging of the software application and for its work demonstration the generator of the *imitational database of patients of the Medical Institution #XXX* was created, and the task of which is to create the imitating but the most realistic database of patients. If there is a need to radically update the patient database, then this database is instantly updated by a special software module at each run.

When this simulation database (iDBP) was under development, the purpose of its approximation to the maximum reality of records was pursued, and therefore the contents of the corresponding records of the database were carried out taking into account the current statistics of diseases of the Ukrainian citizens. In order to achieve that, an additional module (subroutine) was created by which the structure of the corresponding database is reproduced and then is filled in with the relevant information: the mentioned iDBP contains general personal data about any patient of the MI, including his parents data, infectious and non-infectious diseases, hobby and so on (Fig. 3), as it established by the Ukrainian MoH.

In general, this database is filled with proper data driven with a random number generator, which is programmed in accordance with the requirements outlined above. The algorithm for the generation of patient data also takes into account the frequency of registration of certain diseases in accordance with modern data on the incidence in Ukraine.

[1] for the demonstration version it is iDBP, and in real case it is the DBP of a certain medical institution.



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DB_Personals refreshing

№	Прізвище	Ім'я	по Батькові	Рік народження	Стать чоловіча -1 жіноча -2	персональний ІД-номер учня	Місце проживання (перебування): область	район	місто (село)	вулиця	будинок	школа №	клас
1	Гринштейн	Дмитро	Павлович	2003	1	2720214474	Одеська	Миколаївський	Миколаївка	вул. № 16	буд. №18	СШ №9	9-Д
2	Григораш	Катерина	Андріївна	2005	2	2128068284	Одеська	Татарбунарський	Татарбунари	вул. № 26	буд. №27	СШ №11	7-В
3	Білецька	Катерина	Миколаївна	2004	2	2215876613	Одеська	Подільський	Подільськ	вул. № 22	буд. №19	СШ №20	8-В
4	Дончик	Дарина	Олександрівна	2008	2	3768023911	Одеська	Кодимський	Грабове	вул. № 23	буд. №15	СШ №21	4-Е
5	Томенко	Наталія	Ігорівна	2002	2	2943193087	Одеська	Окнянський	Антонівка	вул. № 1	буд. №6	СШ №24	10-Д
6	Рондін	Дмитро	Семенович	2006	1	1518876516	Одеська	Роздільнянський	Новоукраїнка	вул. № 30	буд. №25	СШ №18	6-Д
7	Василенко	Божена	Віталіївна	2008	2	2275556257	Одеська	Доброславський	Визирка	вул. № 6	буд. №29	СШ №2	4-В
8	Сич	Валентина	Дмитрівна	2004	2	1414648244	Одеська	Березівський	Ряснопіль	вул. № 10	буд. №6	СШ №14	8-Б
9	Кошовий	Микола	Ігорович	2002	1	1141105363	Одеська	Великомихайлівський	Цебрикове	вул. № 24	буд. №9	СШ №29	10-Д
10	Білик	Віталіна	Олексіївна	2003	2	1287978864	Одеська	Доброславський	Доброслав	вул. № 19	буд. №29	СШ №7	9-Г
11	Кошевий	Роман	Миколайович	2001	1	1561979478	Одеська	Подільський	Липецьке	вул. № 20	буд. №13	СШ №25	11-Е
12	Васьков	Петро	Ігорович	2009	1	3281473268	Одеська	Миколаївський	Миколаївка	вул. № 12	буд. №5	СШ №33	3-А
13	Гринштейн	Зоряна	Вікторівна	2005	2	1591261721	Одеська	Окнянський	Антонівка	вул. № 18	буд. №5	СШ №12	7-В
14	Ванніков	Роман	Михайлович	2002	1	1637623884	Одеська	Іванівський	Іванівка	вул. № 37	буд. №2	СШ №3	10-Б
15	Томенко	Михайло	Романович	2004	1	1399034733	Одеська	Арцизський	Виноградівка	вул. № 6	буд. №27	СШ №7	8-В
16	Бичок	Олексій	Тарасович	2002	1	1319278934	Одеська	Миколаївський	Миколаївка	вул. № 15	буд. №14	СШ №12	10-Г
17	Ванніков	Данило	Микитович	2007	1	2543725323	Одеська	Овідіопольський	Барабой	вул. № 2	буд. №29	СШ №17	5-Г
18	Палкін	Максим	Ігорович	2001	1	3386682912	Одеська	Арцизський	Виноградівка	вул. № 34	буд. №24	СШ №24	11-Б
19	Білецька	Ольга	Денисівна	2003	2	3388411662	Одеська	Великомихайлівський	Велика Михайлівка	вул. № 7	буд. №26	СШ №6	9-Г
20	Томенко	Поліна	Дмитрівна	2006	2	2348657427	Одеська	Ренійський	Плавні	вул. № 6	буд. №2	СШ №23	6-Д
21	Іваненко	Іван	Павлович	2007	1	2060898266	Одеська	Савранський	Саврань	вул. № 28	буд. №29	СШ №29	5-В
22	Накцинський	Віктор	Андрійович	2004	1	2663951777	Одеська	Ширяєвський	Розкішне	вул. № 29	буд. №26	СШ №12	8-Г
23	Базікало	Денис	Петрович	2006	1	2207691042	Одеська	Ізмаїльський	Ізмаїл	вул. № 12	буд. №3	СШ №18	6-Б
24	Іваніченко	Ольга	Ігорівна	2003	2	2572001876	Одеська	Подільський	Липецьке	вул. № 36	буд. №10	СШ №12	9-Д
25	Бева	Павло	Романович	2003	1	2864424821	Одеська	Болградський	Кримчане	вул. № 10	буд. №19	СШ №27	9-Г
26	Вайнберг	Надія	Семенівна	2001	2	2792717785	Одеська	Ізмаїльський	Ізмаїл	вул. № 18	буд. №10	СШ №2	11-Б
27	Кіслярський	Михайло	Михайлович	2002	1	2252151283	Одеська	Овідіопольський	Барабой	вул. № 26	буд. №13	СШ №14	10-Г
28	Карпухіна	Божена	Андріївна	2009	2	2668333305	Одеська	Ренійський	Рені	вул. № 34	буд. №24	СШ №4	3-Г

Fig. 3. The general view of the main database (DBP) spreadsheet

Another role of this database is "auxiliary", i.e. for testing and debugging. For example, it can be used to search for a variety of "weaknesses" in the software application.

That is, the main tasks for the imitational database named as "*The Patients of Polyclinic № XXX*" are:

1) the procedure of "self-testing" of all the files created by the software application – it is for domestic control;
2) comprehensive "external" testing, which is done when demonstrating the results of a software application.

Thus, it can be proved that the software application is workable and suitable for use in different institutions of the Ministry of Health. Currently, the present demo version of the software product (the simulation database of patients) has its own databank for only 50 people with unique entries in the corresponding fields. It is also possible to change the structure of database records to the needs or features of certain medical institutions or doctors. Theoretically, the software application is able to create unique personal records for unlimited number of participants.

3. On Personification of a Patient, or recognition of the person which data entered in the DBP

In the generated database of patients it is listed all of 26 districts of the Odessa region, and within each district taken two "real" settlements. Surnames of patients vary depending on their gender.

Since the unified database of Ukraine can be of more than 40 million people, therefore it is necessary to provide a procedure for unambiguous identification of the patient.

In this software product, there are two ways to identify any person as a Patient:

1. At the presence of an identification code (the governmental ID), which has an overwhelming number of people under the age of 14 years. This manner of identification one can call "via ID";
2. In the absence of the mentioned ID, the person is traditionally defined: by his surname, name, date of birth and his own address.

For the identification of the patient, one uses the special button at the start page that activates the main form of the application: it will offer two ways of a Patient identification (as it was described before) – the traditional one or by his ID number (see Fig. 4). In the case of identification of a patient by his surname, such records may be more than one because of surname coincidence, therefore the user (doctor) itself chooses from the list of found records by clarifying the information, for example, after the surname, taking into account names and patronymics, and even addresses that should be specified to complete the identification process.

In the future, necessary identification procedures of patients can be done by using barcodes or QR-codes. The software application is in principle designed to work together with the appropriate scanning devices.

Conclusion. The software application provides unambiguous identification of the patient in the presence of his ID number or by the traditional procedure, that is, according to the triad "1^{st}_*name*→2^{nd}_*name*→3^{rd}_*name*" of a Patient with specification of additional personal information about the patient.

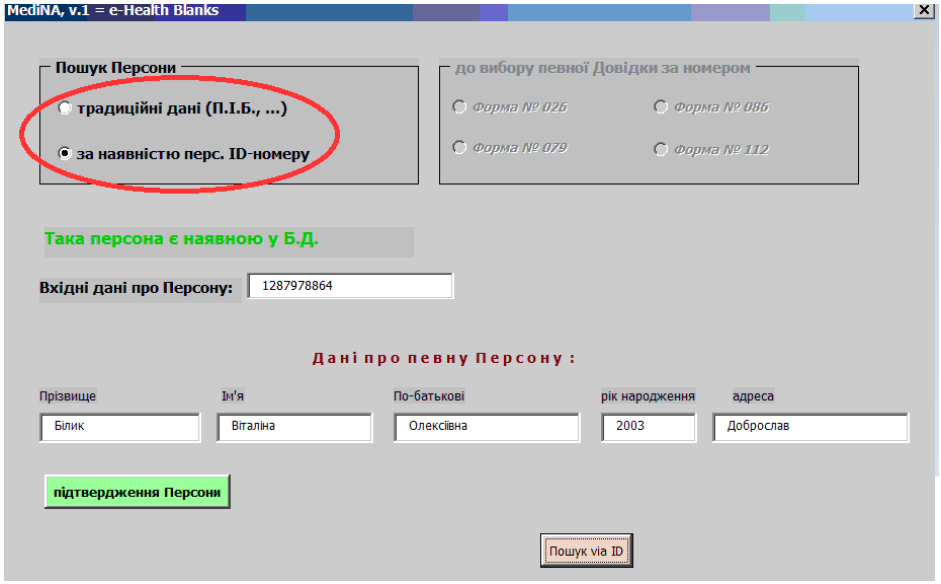
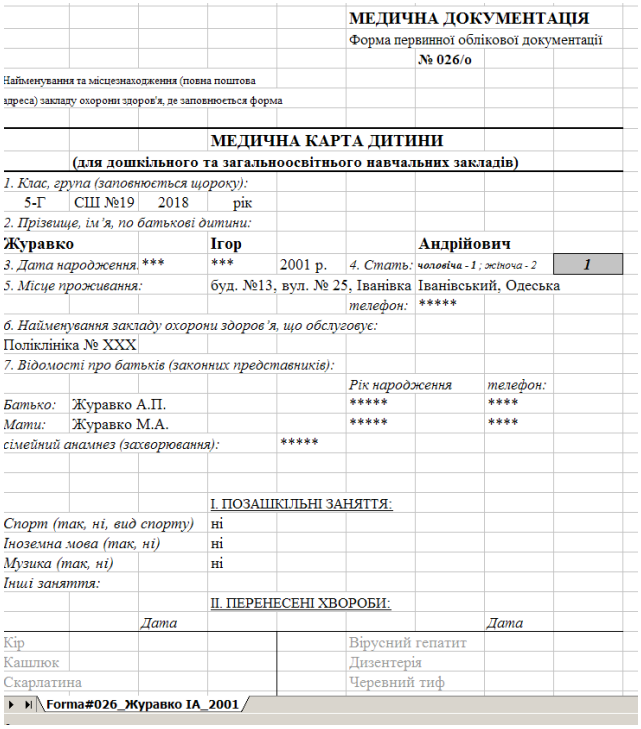


Fig. 4. On two ways of a Patient identification: the traditional one
(via the triad "*Surname+Name+PatronymicName*") or by his ID number

4. Automatic formation of the given medical e-document and its confidentiality

Reminder: currently the task is that after identification of a Patient the Application will be able to create and fill a special medical form from the list of the Ministry of Health of Ukraine.

Programming of this task faces some features: both the DB of patients and the forms of target medical documents are nested and processed in the table processor MS Excel. Surely, when developing the program, its own opportunities and its convenient features of this office software were used. The author is convinced that using MS Excel is an advantage for potential users, since the vast majority of Ukrainian PC users have experience working with this table processor, therefore, using of the presented software will not require special training for doctors.



МЕДИЧНА ДОКУМЕНТАЦІЯ
Форма первинної облікової документації
№ 026/о

Найменування та місцезнаходження (повна поштова адреса) закладу охорони здоров'я, де заповнюється форма

МЕДИЧНА КАРТА ДИТИНИ
(для дошкільного та загальноосвітнього навчальних закладів)

1. Клас, група (заповнюється щороку):
5-Г СШ №19 2018 рік

2. Прізвище, ім'я, по батькові дитини:
Журавко **Ігор** **Андрійович**

3. Дата народження: *** *** 2001 р. *4. Стать:* *чоловіча - 1; жіноча - 2* 1

5. Місце проживання: буд. №13, вул. № 25, Іванівка Іванівський, Одеська
телефон: *****

6. Найменування закладу охорони здоров'я, що обслуговує:
Поліклініка № ХХХ

7. Відомості про батьків (законних представників):

		Рік народження	*телефон:*
Батько:	Журавко А.П.	*****	****
Мати:	Журавко М.А.	*****	****

сімейний анамнез (захворювання): *****

I. ПОЗАШКІЛЬНІ ЗАНЯТТЯ:

Спорт (так, ні, вид спорту)	ні
Іноземна мова (так, ні)	ні
Музика (так, ні)	ні
Інші заняття:	

II. ПЕРЕНЕСЕНІ ХВОРОБИ:

	Дата		*Дата*
Кір		Вірусний гепатит	
Кашлюк		Дизентерія	
Скарлатина		Черевний тиф	

Forma#026_Журавко ІА_2001

Fig. 5. The final look (a fragment) of the outgoing medical document as the product of the Application

After determining the appropriate form of the given medical document by the user, the program creates a certain file in a separate folder on the computer: the file gets its name which has the following structure: "***S_N_b***", where "***S_N***"-fragment coincides with the both patient's surname and name, "***b***"-part of the file name is the year of the patient birth. The required information for the electronic medical document is automatically entered from the Patient's database – from the history of the certain patient's illnesses (according to the scheme shown in Fig. 2).

Besides, the operational data, such as the results of the last review, the results of urgent analyses, recommendations, etc. – a Doctor is able to enter any "fresh" data to the just created form on his own. Of course these "newborn" data are automatically duplicated in the DBP.

As for the date of the current document: all the dating components specified in the outgoing document – "day/month/year" – are placed in the document also automatically and correspond to the system date of the Doctor's computer. It allows to organize the information on outgoing documents which simplifies the control and accumulation of statistical information by medical doctors and the doctor in person.

Solving the problem of information security as well multilevel access to certain records of patient database (confidentiality of information) in this work were not prioritized and their solution in the program is envisaged in the near future. But for this version of the program, the author recommends the use of the security features of information provided by MS Excel, in particular the protection of the password of a database book file and/or electronic form file.

It should be noted that all of the above information components are taken by the Application from the patient database after the identification by a doctor of a particular patient and his confirmation that the collected information about the patient is relevant.

Finally, this medical form which automatically generated by the application program, has all the necessary attributes according to the requirements of the MoH, such as the name of the institution of the health care system, personal data of the patient, etc., and it is ready-to-print electronic document. So, both the appearance of the form and the format of data filling meet the current requirements. After that the form is ready to be transmitted electronically with the electronic signature of the Doctor/Physician (Fig. 5).

After its creating the requested form (*e*-document) can be printed, sent on demand, etc., that is to say, this the ready-to-use *e*-document one can run for document circulation using the available IT, such as the Internet and/or mail services.

Conclusion. The program generates a user-selected form/document as a separate Excel file with a specific name and at a specific location on the hard disk of the MI-computer or on any other media at the specified address.

Summary

The task of the research is fulfilled: the author developed a conceptual algorithm, and then a corresponding software application, which is able to create automatically certain medical documents of the established specimen with respect to the chosen patient. The current demo version of the software product (the Application) allows any Doctor to automate creation of ready-to-sign and ready-to-print *e*-documents accordingly to requirements of the Ministry of Health of Ukraine – namely the Form # 026 and the Form # 079, as well as fill them automatically with information of given patient from the patient's database, which is available for the physician after identification of the patient's person.

The software application provides unambiguous identification of the given patient in the presence of the ID number of the patient, as well when the patient's "common triad" (like *Surname+Name+PatronymicName*) is entered with further clarification of corresponding personal data. The software application generates a user-selected form of official *e*-documents as a separate Excel file with a unique filename. At this stage, the protection of data databases and forms is provided by the capabilities of MS Excel.

Since the created software application is a simple and convenient generator of medical forms of electronic reporting, after a minor updating this program will generate many other documents from the official list of reporting documents of Ukrainian MoH.

It has been foreseen that the mentioned Register of outgoing documents will be protected from destruction or some kinds of forgery (against distortion of information); this Application is able to protect certain information about patients by a password (according to the current legislation).

The practical use of the current software application and the related benefits of using:

- an automatic forming of certain *e*-documents upon the request of the authorized user, the appropriate forms of medical reports and/or the output documents of the medical institution (physician);
- this software application is maximally adapted to experience of the "usual" software (such as MS Office Suite) users, and it will not require the user to specially prepare or install any additional software;
- the use of this software application will provide an opportunity to minimize paperwork circulation in medical institutions;
- the use of this software application will significantly reduce the time that a doctor needs to prepare the relevant reports and documents, as well as reduce different mistakes and errors associated with the "human factor";
- the use of this software application will promote the implementation of the principle of medical ethics for the protection of specific patient's medical information.

A Note:

As a simplified ("the child") version of the mentioned application, the program "MediNA-1" was presented at the following intellectual competitions:

1) at the All-Ukrainian Championship Information Technology "Ecosoft-2018", the category "Programming" – the 3rd degree Diploma;

2) the XXII Belorussian (open) competition of students' research works (Minsk, 2018), the category "Computer Science" – the Encouraging Diploma (Fig. 6).

The Diploma of 3rd degree of the All-Ukrainian Championship Information Technology "Ecosoft-2018", the category "Programming", for the program "MediNA-1"; the Nominee is Cherevatyi Andrii – the student of 8-Am form (school #24, Odessa) (Kyiv, feb.'2018)

The Encouraging Diploma of the XXII Belorussian (open) competition of students' research works, the category "Computer Science", for the program "MediNA-1"; the Nominees are: a student of 8-Am form (school #24, Odessa) and a student of 10-A form (school #49, Odessa) (Minsk, feb.'2018)

Fig. 6. The Diplomas (2018) for the program "MediNA-1"

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