

# Basic Principles of the Organisation of Automated Record-Keeping of Medical Care in Medical and Preventive Treatment Institutions

Georgy Lebedev  
Relax  
Moscow, Russia  
gera@sonnet.ru

Oleg Zekiy  
Relax  
Moscow, Russia  
relax@sonnet.ru

## Abstract

The paper considers a universal formal model for keeping track of the amount of medical care rendered in medical and preventive treatment institutions of the Russian Federation. The model can be used by establishments concerned with compulsory health insurance. The model is based on the experience gained in introducing automated information systems in different parts of Russia.

**Key words:** health protection (HP), compulsory health insurance (CHI), federal CHI fund (FCHIF), territorial CHI fund (TCHIF), territorial health department (THD), licensing and accreditation commission (LAC), medical and preventive treatment institution (MPTI), health insurance organisation (HIO), medical standard (MS), set of medical standards (SMS), medico-economic standard (MES), international disease classifier (IDC), amount of medical care (AMC), universal labour input unit (ULIU), medical service (MS), MS classifier (MSC), territorial MSC (TMSC), and automated information system (AIS).

## 1. Introduction

The rational economic organisation of health protection in an unstable market environment has become a key problem on whose solution depends actually the normal functioning of the population. It is competent organisation of health management that holds the key to an efficient present-day approach to guaranteed medical care.

---

*Permission to copy without fee all or part of this material is granted provided that the copies are not made or distributed for direct commercial advantage, the CSIT copyright notice and the title of the publication and its date appear, and notice is given that copying is by permission of the Institute for Contemporary Education JMSUICE. To copy otherwise, or to republish, requires a fee and/or special permission from the JMSUICE.*

**Proceedings of the Workshop on Computer Science and Information Technologies CSIT'99  
Moscow, Russia, 1999**

The basic principles of organisation and automation of MPTI activity were formulated in accordance with RF Law "On Health Insurance of Citizens of the Russian Federation", a number of other documents and instructions, and also more than five years' experience (in fact, from the moment of introduction of health insurance) of establishing and running AISs in different spheres of insurance medicine and managing HP and CHI resources.

As we developed and introduced ever new systems for managing HP and CHI resources, improved and adapted the previous versions of software packages, and communicated with and consulted specialists in these areas, we formulated for ourselves a seemingly simple conclusion: automation is not a cure-all, because one cannot automate chaos. That is, with no rational organisation of management, automation is pointless.

The next difficult step for us was to shed one more delusion typical of specialists in automation, which can be formulated as follows: the aim of a conceived automated system is to automate some or other functions of an entity, some or other institution. It appears that automation is in fact introduced for the sake of automation. So the purpose, place, role and designation of automation should be formulated proceeding from the very idea of insurance medicine: keeping record of and financing medical care actually rendered to the population.

Problems of insurance medicine are dealt with in a sufficient number of works [1,2,3]. Not claiming to make a study of all problems of contemporary insurance medicine and not trying to find an optimum way of improving it (which moreover does not exist), we offer below systematised and summed up experience of automating the work of MPTIs, TCHIFs and HIOs, based on the present-day management of insurance medicine.

The MPTI is a key element of the modern system of health protection and insurance medicine, and this paper is therefore devoted to analysis and description of information processes in and automation of the MPTI.

## 2. Information structure MPTI

In the information process of the MPTI one can single out the following levels of information processing:

- Forming a bank of data on medical services rendered by the MPTI;
- Registering patients and keeping record of services rendered to them;
- Forming rolls of and making out accounts for treated patients.

To insure these information processes it is necessary to make a formalised economic description of the MPTI, to form a mechanism for costing medical care rendered, to follow up the register of the catchment area population, and to define a mechanism for keeping a record of medical care rendered both to every patient and by the MPTI as a whole.

Work done by Relax specialists in information studies of MPTIs and the engineering of medical specialist knowledge has made it possible to ascertain the basic processes and concepts of the subject concerned, which laid the groundwork for an AIS of the MPTI. Practice has shown that in those MPTIs, where management was organised well, introduction of an AIS had the maximum effect. Historically, MPTIs of the in-patient or the out-patient type, when the AMC was standardised, were based on the IDC and a set of diagnostic and remedial measures.

In going over to the health insurance scheme it was necessary to work out a unified model of AMC record-keeping, which accounted for the cost of every MS rendered. In our view there is an urgent need now for standardising the basic terms of insurance medicine. Terminological disparity remains one of the obstacles to forming a common approach to AMC record-keeping. Different TCHIFs use different approaches and differ between themselves. But the common problem remains the costing of services rendered by the MPTI.

A logical basis for devising techniques for costing medical services by experts was the following: the time taken by specialists in rendering a given service; and qualification (validation) of a specialist. Each group of medical specialists is known to have a standard working time fund. For example, the annual working time fund of doctors and paramedical personnel with a 38.5-hour working week is 1,925 hours, for specialist doctors on duty with a 36-hour working week 1,800 hours, etc. To measure labour inputs we adopted an ULIU equal to 10 minutes.

Since not all working time of medical specialists is, tentatively speaking, used productively, experts have derived a coefficient of productive time, which is defined individually for every MPTI. Usually it varies within 0.65-0.85. This means that 15-35 per cent of the working time is ineffective. In that way, the ULIU expresses the cost of a specialist, with due account taken of the productive time in the working time fund.

Every medical service is expressed by the number of ULIUs for each category of a specialist taking part in rendering the medical service concerned.

The value of one ULIU for specialist is therefore the ratio of his wage rate to the number of ILIUs (the number of ULIUs = working time fund \* the coefficient of productive time/6). A more detailed treatment of the costing techniques, as adopted in insurance medicine, is given in [5], while here we will consider only the very concept of "the medical service", which is the basic concept of insurance medicine.

To have it formalised proved by far the most complex task when developing and introducing an AIS at an MPTI. And here of invaluable help were future users of our systems. It was their valuable remarks and recommendations that were helpful in jointly forming an economic concept of the medical service.

Normally the MPTI uses the SMS and the MS classifier, and, when going over to economic categories, the MES. The basis for forming the SMS for every TCHIF is the IDC. But even for individual MPTIs of one region the SMS undergoes certain change and may differ substantially. This is due to the specifics and the category of the MPTI concerned. Formally the SMS is an n-tuple of the type:

$SMS = \langle MS_1, \dots, MS_i, \dots, MS_n \rangle$ , where  $MS_i$  is a medical standard, which in turn is a construction of the type:

$MS = \{ \text{list of diseases} \},$   
 $\{ \text{list of diagnostic measures} \},$   
 $\{ \text{list of remedial measures} \},$   
 $\{ \text{list of medical preparations} \},$   
 $\{ \text{list of treatment results} \},$   
 $\langle \text{number of bed-days} \rangle.$

What is more, one and the same disease may belong to different MSs. For example, "acute German measles" may be included in MS "German measles", MS "eruptive diseases" or MS "diseases with complications". The SMS serves to represent the entire package of remedial measures rendered by the MPTI for the whole group (list) of diseases.

A second important component is the MSC. Usually, it has the status of the TMSC. Classification is based on a breakdown of services according to specialised departments or specialists. Source data for such a breakdown are taken from a classifier of specialised departments and leading specialties as approved by Russia's Health Ministry.

It ought to be stressed here that usually the MPTI provides for keeping a record of an MS rendered both by several units (or one unit as a whole) and by a separate specialist. In the former case we have an organisational breakdown and the average cost of the service, and in the latter the cost of a service is calculated individually for a concrete specialist. This is characteristic, above all, of MSs rendered by highly-qualified specialists.

The MSC (or a register of medical services) normally has a territorial status. Its content is determined by the specifics of the region and the territorial programme of compulsory

health insurance. Structurally, the classifier is arranged as follows:

- The code of the medical service XXXXXX, where the first three symbols denote the service group, and the second three symbols, the index number.
- Name of the service.
- Labour input in ULIUs.
- Additional parameters.
- Territorial tariff.

The additional parameters are usually used in medical expert examinations. They may represent the gender (male or female), age, and a possible number of MSs given per day.

As a rule, a medical service is used to designate different notions, for example, a remedial measure, specialist consultation, etc. Having summed up the experience of MPTIs in more than twenty regions, we have arrived at the following formal representation of a medical service (MS).

```
MS::= <diagnostic measure> V
<remedial measure> V
<visiting a specialist> V
<consulting a specialist> V
<medicinal preparation> V
<bed-day> V
<"mainstream" patient> V
<set of remedial measures>.
```

A diagnostic measure is a terminal concept describing a specific medical manipulation when diagnosing a case.

Remedial measures are subdivided into specialist services, operative interventions, and anaesthesiological aids (the latter two types only in hospitals).

The following three types of MSs do not enter into the SMS, but also need recording and costing, because here we have labour inputs and expenses as well.

The "bed-day" service is provided by a hospital when the patient is not charged for concrete remedial measures, but spends a concrete bed-day in the hospital. The cost of this service is derived from the wages of medical personnel (basic and office), the specialisation of the department, the cost of medicines for the "mainstream" bed, medical treatments, and accommodation costs.

Accommodation costs in a hospital are made up of overhead expenses (depreciation of buildings), wear and tear of equipment (fixed assets, medical facilities, fittings and fixtures) and hospital bedding.

The "mainstream patient" service is called upon when care is extended according to a certain specialisation of the department without due account taken of the specific diagnosis and the number of bed-days spent.

The "set of remedial measures" service represents a meta-service, which may cover services of all the above-listed types. In effect, it is a typical process of rendering medical assistance. Ascertaining such typical processes is a complex

enough procedure, but it simplifies not only record-keeping but also planning, because in this case we manipulate with higher-ranking concepts.

Now we will proceed to examine the concept of the MES. As in the case of the SMS, the MES allows a rather loose interpretation as a classifier.

The explanation is that the MES may vary substantially from region to region. MES-based data should be fed according to regulatory documents or in line with the MPTI's own data, approved jointly by the TCHIF and the THD. In the MES the diagnosis group is correlated with those services that must be rendered in accordance with the treatment prescribed in the group concerned. In this respect the MES is similar to the concept of "the set of remedial measures". In a hospital, for example, acute appendicitis requires an appropriate surgical intervention and 10 bed-days.

The main snags in using the MES are the following: first, a formal description of the treatment is needed for each diagnosed case; and second, there are difficulties in monitoring the fullness of the services rendered. So the MES is only just beginning to be used in territorial MPTIs. Also, the MES is used mainly in hospitals to cover the "bed-day" service. The principal components of the MES are as follows: the MES code, the name of diagnosis, the list of services, and a tariff.

The cost of treatment according to the MES is determined by a tariff which is the sum total of all service tariffs. Cost planning at the MPTI is based on wage rates of the personnel, staff numbers, and the MPTI's average expenses. Then the entire set of MSs is translated into ULIUs, with each service costed separately.

Now we will specify some important concepts for CHI. The full cost of a medical service is one that allows the MPTI to recoup its expenses (provided medical personnel has the normal work-load and the equipment the normal rate of utilisation). The price of a medical service is the cost of a medical service multiplied by the margin of profit (profitability) of the MPTI. It figures in cash payments.

The cost of a service according to CHI is the cost covered only by protected items of expenditure. Here it should be emphasised that items of expenditure which will be financed under the CHI system are defined by a tariff agreement. A tariff agreement is part of the CHI territorial programme and is concluded between the TCHIF, THD, collegium of doctors, the medical workers union, and an association of insurance companies. It is items of expenditures to be financed out of the CHI funds that are called the protected items.

### 3. Paying AMC

For the MPTI as a whole one may determine the following categories of paying institutions: the TCHIF, the HIO, directly enterprises, and individuals. With all categories appropriate agreements are concluded. The first two categories make payments according to the CHI tariff.

The CHI tariff may be individual for a specific MPTI or be a territorial one. An individual tariff may be set only in the

following case. First, the LAC establishes the correspondence between the manning table and the amount of medical care rendered, as represented by a totality of MSs. Then it gives the MPTI its category rating and issues it with a licence. The territorial CHIF, proceeding from the LAC licence, then checks whether the individual tariff has been calculated right.

It is also the TCHIF that introduces territorial tariffs according to MPTI categories as established by the LAC. A territorial tariff for the MPTI is fixed both from the specifics of the region and the MPTI category. The category rating of the MPTI is determined by:

- the catchment-area population (the greater the number the higher the category);
- the manning and rating tables (the numbers and qualifications of medical personnel);
- the make-up of medical facilities;
- the composition and amount of medical care rendered.

The LAC uses special techniques to determine the status (category) of the MPTI. To upgrade the MPTI rating, it is necessary, for example, to improve the quality and increase the number of MSs, to extend the catchment area, etc. Separate units of the MPTI may enjoy a higher rating than the MPTI itself. Usually there are the following categories of MPTIs:

- the regional hospital;
- the city and the central district hospital (polyclinic);
- the rural hospital;
- the feldscher and obstetrician's station.

There may be even higher categories: the inter-regional, the republican and the federal.

Apart from the category rating, CHI costs are also, via wage allowances, influenced by the coefficient of district regulation. The specifics of a region also decides particular ways of dealing with paying organisations and choosing a payment scheme for treated patients.

Information about a patient's treatment is collated according to the following scheme: registration of a polyclinic visit -> registration of MSs rendered in the polyclinic and admission to a hospital -> registration of MSs rendered in the hospital -> discharge from hospital.

Forming the rolls is the initial stage in settling accounts between the MPTI and the paying organisation for MSs rendered to patients. Rolls are formed according to periods under review and in accordance with the terms of the agreement. A roll for a given period of time must include only those kinds of services and their costs which are laid down by the terms of the agreement.

In the case of a hospital the rolls are formed according to results shown over a certain period, while in the case of a polyclinic this is done for periods when services rendered during the period under review by each MPTI unit are

summed up. A commercial invoice is drawn up in the final analysis.

The MPTI's performance is reflected in annual, quarterly and monthly statistical reports for all units. These reports, incidentally, include a report on the performance of the MPTI functioning in the CHI system, a report on the number of diseases registered among patients in the catchment area of the given MPTI, a report on the hospital's performance, an annual MPTI report, etc.

The mechanism for serving patients and making up bills, rolls and reports is described in detail in our instruction manuals [4,5]. The aim of this paper is not to examine them at length, because these processes are not complex conceptually and are determined by a chosen technique of costing an MS, while the scope of this paper is limited and does not make it possible to give a full description of all information processes.

#### **4. Functional structure of the AIS of the MPTI**

Following information studies and conceptual modelling we have developed an AIS of the MPTI, which was updated as it was introduced and tested in pilot and actual operation and is now successfully functioning in more than 800 copies in different parts of the country.

The specifics of the subject matter and of information processes pre-determined the following functional structure of the AIS of the MPTI (or a software package for the MPTI). The basic principles of the MPTI AIS are the principle of instrumental support, adaptivity, openness, and possibility of upgrades.

The system is an instrumental one, that is, a concrete version is generated from the core in line with the particulars of the subject matter concerned and the Customer's requirements.

It is adaptive, because it incorporates mechanisms of adaptation to the specific work of users.

It is open to other software products developed by Relax. Moreover, each new update is fully compatible with the earlier one and offers new possibilities for users.

The system is designed to implement the mechanism of health insurance in the MPTI, keeping record of all kinds of CHI, and forming final documents for settlements with the TCHIF and the HIO.

The system features the following principal functional blocks used for:

- keeping up of regulatory and reference information;
- structural and economic description of the MPTI;
- costing of medical services;
- catering to MPTI patients (including the drawing up and issuing discharge documents).

In general form, the structure of the MPTI AIS is given in [4].

The block of maintaining regulatory and reference information is designed to classify and code basic concepts (unalterable or partly alterable information) and to guarantee the fullness and agreement of the system's information support.

The principal functions of the block of maintaining regulatory and reference information are: feeding, storage and updating the concepts in the classifiers and vocabularies used by the other functional blocks of the MPTI.

The block for the structural economic description of the MPTI is designed to form a model of MPTI activity in the CHI system, and to form the MPTI's regulatory economic base. Its principal functions are:

- structural description of the MPTI as a whole and of its units;
- fixing of values of the basic regulatory economic coefficients of the MPTI;
- drawing up of personnel manning and rating tables;
- description of the material and technical facilities of the units;
- forming a general list of services rendered by the MPTI.

The block for costing medical services is designed to keep track of and calculate all medical services for the MPTI as a whole, for its units, individual specialists, and for each patient. Its main function is to cost and price medical services rendered.

The block catering to patients is designed to submit and process current information on all patients, kinds and costs of services rendered, and to form a bank of data on them. The principal functions of the block are:

- registration of treated patients;
- keeping track of the amount of medical care (medical services) rendered;
- costing treated patients;
- drawing up of agreements to render services to the population;
- drawing up of bills and rolls for services rendered;
- drawing up and issuing of statistical documents (reports).

A detailed description of the sequence of operations in each block and the AIS as a whole is given in [4,5].

## 5. Conclusion

In conclusion we would like to remark the following. The present-day situation is prompting the need for rational organisation and record-keeping both inside an entity of the CHI system, and in relations between entities.

Not all questions by far have been solved, of course; there is, for example, no complete mechanism yet for the TCHIF to monitor MPTI activity, while, on the other hand, an unstable economic situation in the country keeps insurers from paying money in full to MPTIs for real CHI rendered.

But if we look at relationships between the MPTI and the TCHIF or the MPTI and the HIO in "buyer-seller terms", we

shall see that real benefits have accrued from the rational organisation of insurance medicine and its automation.

The MPTI has got into its hands a mechanism for arguable "extraction" of real money for factually rendered medical care. According to one of the experts: "They now know how much they actually spend and can demand from the funds the paying of their bills". But the main thing, in our view, is that the MPTI management now has a real picture of the state of affairs in their institution. It can size up the situation and work out appropriate decisions to optimise and streamline their work and reorganise the MPTI.

Territorial CHI funds and HIOs have got into their hands an instrument of control to pay for real rather than "pseudo" services of the MPTI.

## References

1. Grishin V., Semenov V., Poljakov I. and others. Compulsory health insurance; organization and paying - Moscow, 1995.
2. Organization of compulsory health insurance on the territorial level. Allowance. Under the general editing Grishin V. and Zekiy O. - Moscow, Relax, 1994.
3. Zekiy O., Grishin V., Bobnev P., Lebedev G. and others. Automatic managerial system, organization and legislative-normative base of obligatory medical territorial level insurance. Practical guide. - Moscow, Relax, 1994.
4. Zekiy O., Lebedev G., Turin A. and others. Programme complex of ensuring an operation medical and preventive treatment institution. Practical guide. - Moscow, Relax, 1996.
5. Zekiy O., Lebedev G., Turin A., Bobnev P. Automatic account system of medical help in medical and preventive treatment institution. (Programme complex). Practical guide. -Moscow, Relax, 1998.
6. Zekiy O., Lebedev G., Turin A., Bobnev P. Calculation of medical service cost (software). Practical guide. - Moscow, Relax, 1998.