

Systematization of e-Health through Hungarian examples

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The author remakes the groups present in e-Health considering the specialities of the healthcare sector and the most important links of the area, while giving a clearer definition of e-Health itself. Through the description of these connections, the article also gives an overview of the healthcare IT in Hungary.

Following my article written last year about the conception system, classification and Hungarian situation of e-Health [1] I received numerous opinions, remarks, questions and ideas. It was interesting for me that the experts being up in the health and the informatics professionals working in other sectors see the problems and the possibilities from quite different aspects. With regard to the above, I made so bold as to review the article published earlier and repeat my publication about the systematization of e-Health extended with the possible directions of development and improvement. The program e-Health Week 2011 held in Budapest with regard to our European Union presidency will make a good opportunity to discuss the prospects of the informatics sector with foreign experts as well and show the less known results of our country achieved in this sector. In the light of the recovery from the economic crisis, both the info-communication technology and the so-called health-industry will create serious opportunities for the country in the fields of both the formation of jobs and the development of underdeveloped regions [2].

INFORMATICS RELATION BETWEEN THE DEFINITION AND THE PLAYERS

The determination of the e-Health definition was the most challenging question for me. It does not amount to the same where we draw the line for the border of the various sectors, branches and fields of science. It is not easy for anybody who would like to position his specialty within the health sector since the meaning of health itself is not exact and not accurately outlined. Some use the definition applied by WHO [3] (e.g. Wikipedia), others interpret its meaning holistically; I met a definition based on sociological approach and some believe that the permanently changing, various interpretations resulting from the societal and cultural differences are correct. The development of the info-communication technology and the societal reactions connecting to it try to widen the traditional structure of health and open its conservative frames [4]. The operation of the interactive community networks (named also WEB 2.0) enforces the change of communication strategy of health services. It's time to face the question because the

problem of information asymmetry between the doctor and the patient known in the attendance system will quickly swing over to an unmanageable and non-comprehensible information technology chaos. In this environment, appeared not only the human but also the more and more sophisticated expert systems, making the complex relations among the players even more complicated.

In accordance with the above as well as the proposals received, I slightly extended my definition of e-Health worded earlier as follows:

E-Health is the whole of the information technology and communication (ITC) methods and solutions helping and supporting all the real and virtual players of health as well as the processes connected with prevention and healing.

Accordingly I had to extend the circle of e-Health players with a further participant defined by the "infrastructure" collective word which may include the intelligent expert systems helping the therapy or the diagnosis, the EPR-Electronic Patient Record, the e-Prescription, the authentic records, the digital signature used for the authentication as well as the various diagnostic instruments, automatic measuring and evaluating devices. Recalling the notation system used in the e-Business classification adapted to the health, we can see that the relation matrix of the processes to be interpreted under e-Health has six players now:

- P-patient patient or citizen
- D-doctor physician or person participating in the healing personally
- H-hospital hospital or health service provider
- A-administration state or public financer
- B-business business player (supplier, operator)
- I-infrastructure data, standards and other virtual devices

	P	D	H	A	B	I
P-Patient	✓	✓	✓	✓	✓	✓
D-Doctor	✓	✓	✓	✓	✓	✓
H-Hospital	✓	✓	✓	✓	✓	✓
A-Administration	✓	✓	✓	✓	✓	✓
B-Business	✓	✓	✓	✓	✓	✓
I-Infrastructure	✓					✓

Figure 1
Relations of e-Health

Because of the number and complexity of various relations and electronic connections, we include the possible relationships and interactions in a table.

For easier comprehension and enlightening the system of arguments for the classification, I will consider the more important relations one after the other and illustrate them with Hungarian examples as well. As was looking for the various solutions and applications, the table "filled up" step by step. Obviously each field and each person uses the electronic connection, change of information in some form.

PATIENT-TO-PATIENT RELATION (P2P)

These are various self-organising web sites, where the patients, persons healed and simple inquirers change experiences informally. In the lack of more serious control or validation, the pieces of information gained here are difficult to evaluate. Since neither the source nor the genuineness of the information can be controlled, such form of gaining information is quite unsafe. Designedly faulty or malicious information cannot be excluded, either. There are also web sites operated by patient organisations controlled professionally, where the inquirers can receive expert guidance, but it is worth inspecting in this case, too, whether there is any pharmaceutical factory or other supplier which utilizes the lack of information of the exposed inquirer with a hidden advertisement. The health as theme can be found in the field of community media as well. For example, Twitter, Facebook, MySpace and IWIW provide possibility for anybody to give information about his condition, share it with others, and receive opinions, remarks or reactions on these.

PATIENT-TO-DOCTOR RELATION (P2D AND D2P)

Recently the health industry mainly focuses on this field. This is the field where the commercial business area sees the greatest possibility of market expansion and the research and conviction of the effective demand is the most efficient. Although the doctor should also be involved in this relation, if the patient "worked up" by marketing trusts in it, and asks his/her doctor, then the latter will not oppose it, if the solution is not harmful. The proper state regulation is important in this field similarly to the ethical code of drug manufacturers, since the resources used or engaged unnecessarily will decrease efficiency in the field of curing or recovery. Only devices and solutions considered to be really effective should be supported and financed.

PATIENT-TO-INSTITUTION (HOSPITAL) RELATION (P2H AND H2P)

Owing to the increase of institutional as well as traffic, transportation and mailing costs, this is the field where we can experience the greatest interest on the level of hospitals, service providers. In addition, the service providers

have become interested in finding the cheapest connection with the patient also because of the capacity restricted artificially by the Performance Volume Limit (PVL). It is important for the patients, too, to be absent from work for as short period as possible in cases when they travel only for a finding, or go to a surgery, control examination unnecessarily because of the change of the booking. As a matter of fact, possibility of direct electronic patient booking has become popular in private hospitals and private surgeries since here quality of service is determined by the need and the demand instead of the order of booking. Various business service providers which create a proper solution between the patient and the private institution also appeared in this field. These are the patient guiding web sites, or service provider selecting portal solutions which solve connection between patient and institution through a complex information chain, using several components. We can mention that it is spreading recently for the institutions to send back signals to patient about findings, examinations which indicates also the improvement of the standard and culture of health services.

PATIENT-TO-ADMINISTRATION (STATE) RELATION (P2A AND A2P)

We should and can be proud of this field. We have proper experience and numerous solutions which could be taken over and utilized by any European country. It may seem a repetition, but when Hungary holds the next EU president position as well our results and experiences may be considered to a greater extent. In Hungary, we can enjoy the convenience and fastness provided by the electronic transaction of affairs within the framework of the services accessible through the so-called "Client Gate" (www.magyarorszag.hu) [5]. The Electronic Governmental Centre prescribed that the services should be offered for the inhabitants in each sector gradually on higher and higher levels. As a part of this process, the own legal relation data and the data of the services, medicine subsidies and pecuniary allowances used under own health public financing are accessible for more than ten years in the health [6]. We can tell about ourselves, that we are in a leading position in this field, since such a transparent (as a result of the dominance of public financing, almost full) patient history is rarely accessible to citizens of any country. As an unexploited opportunity, we can mention that the call for and information about the various screening, prevention programs important in the field of public health as well as the invitations for vaccination could also be solved in the form of electronic correspondence.

PATIENT-TO-BUSINESS RELATION (P2B AND B2P)

This is the field of classical e-Business solutions. Nowadays patients can buy anything at any time through Internet in various web stores. Through our electronic mail box, we are flooded with advertisements of dietary supple-

ments, books necessary for safeguarding our physical and mental health. However, the bidirectional connection means that not only we are looking for these products but those selling the product also find us with their ads. In many cases these sellers are not real persons but virtual traders; I will discuss it in the part explaining the I2P relation. Unfortunately, the unrequested electronic ad messages (spams) constraining us to buy Viagra, other potency pills, young-making creams or blood pressure meter or offering special relaxing massage services in luxurious hotels, spas come to our mind the most frequently in this field. We cannot even imagine how enormous this market is. I have never heard someone to buy a medicine via Internet, but if those sending the ads did not have any income from it, they would have already stopped it long since. We should fight against it with suitable enlightening campaigns, if information technology solutions are not sufficiently effective.

PATIENT-TO-INFRASTRUCTURE RELATION (P2I AND I2P)

It is a matter of interpretation that in the event of a certain relation the person making the infrastructural element available or the virtual solution, device itself is considered the player of the relation. While the state really stands behind the electronic and automatic service accessible through the Client Gate, an expert system (operated anywhere and by anyone) which was created and developed continuously by numerous experts of the world is rather an infrastructural element than a real player. The intelligent data bases to which the service providers, doctors, decision makers turn are able to help effective medical attendance, establishment of suitable capacity and determination of optimal patient paths. The most proper domestic example for it is the Internet Hungarian Health Data Store (IMEA) created and operated by the Health Strategic Research Institute (ESKI), in which anybody can receive any information automatically, certainly from a depersonalized data set of statistical level [7]. A rarer and not really supported tendency is when a certain element of the virtual space addresses the citizen in an unrequested way. Luckily, these malicious systems do not have the knowledge to address actual patients in an orientated way; however, they cause very great societal and material damage to untaught and deceivable persons.

DOCTOR-TO-DOCTOR RELATION (D2D)

This is the relation which is worth receiving the greatest energies in the near future since the attending physician (family doctor) has a key role in optimization of patient paths. This information technology relation is advantageous to both the society and the individual. In many cases it is a process occurring within the relation between the institutions (H2H) where the technical solution consists of almost the same or very similar components. It includes conference of

doctors through video, remote findings through teleradiological means, etc. Within the field of radiology, these applications are used routinely in the Hungarian attendance system since there is no simpler and cheaper solution for bridging the local lack of labour or competency.

DOCTOR-TO-INSTITUTION (HOSPITAL) RELATION (D2H AND H2D)

The establishment of the relation discussed previously within the framework of the institution requires the appearance of an actual economic interest or central coordination. An example of it having the widest functionality in Hungary is the Inter-Institutional Information System of Medical Institutions (IKIR) (hospitals, clinics, family doctors, pharmacies, etc.) which was prepared within the framework of the HEFOP 4.4 project out of EU resources[8]. During its several years of operation it became clear that its extension to nation-wide level cannot be expected without central coordination and support. The experiences show that informatics solution providers have already created several alternatives for the continuance, but we cannot expect real breakthrough in this issue until central decisions are not made in the matters of cost distribution, responsibility, data protection and changing to being directly interested. Nevertheless, the elaborated technical solutions have already been built in the products and solutions of health informatics suppliers. This advantage also belongs to the domestic IT industry only and it could also be shared with the European countries.

DOCTOR-TO-ADMINISTRATION (STATE) RELATION (D2A AND A2D)

The doctor (family doctor) reports his/her performance to the National Health Insurance Fund which arranges the public financing and performs the control of the legal relation day by day during the operation of the praxis. These electronic solutions save time and money on the sides of both the doctor and the state. These cases of data forwarding create basis for other central electronic services so it is very important that this activity is recognised both materially and ethically. The state will provide proper feedback about these reports (list of mistakes); what's more, the family doctors' quality indicator system was initiated recently for evaluating the work according to various parameters, sometimes providing extra financing to the family doctor.

DOCTOR-TO-BUSINESS RELATION (D2B AND B2D)

This system of relations is incidental. It is still not the practice to order medical devices, materials, services electronically from the family doctor's praxis. Active physicians otherwise using Internet purchase electronically, but not to a significant extent now. In the business area, however, especially the health software suppliers already operate the family doctors' software programs dominantly with remote sur-

veillance and remote management and update the central data bases. The provision of remote surveillance means cost and risk-reducing factor for both parties.

DOCTOR-TO-INFRASTRUCTURE RELATION (D2I)

In the case when a physician turns to a community expert system accessible via Internet or uses a community service provided for several players, this relation is live. I range also here the case when a doctor writes an electronic recipe, prepares, sends or receives an electronic case-sheet. The doctor uses such infrastructure which keeps, operates several players because of a certain joint interest or necessity. During the transactions, the family doctor may communicate with an institution (pharmacy, hospital) another doctor, patient, state (financer), but this relation does not mean direct connection but the communication is achieved by means of infrastructure constituting an intermediary condition which coordinates, controls, stores and forwards the proper information in the space and time.

INSTITUTION (HOSPITAL)-TO-INSTITUTION RELATION (H2H)

In actual fact, it is the same as those described for the Doctor-to-Hospital relation; what's more, the examples are also the same as those described for it. Earlier solutions were prepared for supporting regional cooperation; now these are used for improving efficiency of division of capacity and labour on the level of the large region or county. It is the interest of the joint owner or the same maintainer to use its resources, opportunities in an optimum way. Rationality means proper ground for the informatics solutions to become widespread, and it is just the same for the solutions to what area the regional cooperation extends and which legal form the economic company representing it has.

INSTITUTION (HOSPITAL)-TO-ADMINISTRATION (STATE) RELATION (H2A AND A2H)

This is the other field for which I do not feel ashamed of repeating those written last year. "We have decade's traditions in this field. Since the introduction of the financing based on performance, the institutions have been reporting electronically to the single public financing body (OEP or GYOGYINFOK). The set of uniform electronic records was soon formed and these records are known and used by all software development companies. The financing is built on it, the various institutional medical systems convert the patient history through it and the monitoring of the patient life path was also built on it during the years of the operation of the Managed Care System. When Internet appeared, these reports became classical H2A applications. The electronic accounting with the pharmacies and the control of legal relation concerning all medical service providers also belong to this category [7]. We can find the most advanced solution

here, too. The Virtual Electronic Purse supporting the public drug benefit system may serve as an example (Best Practice) for the EU countries by that it has been operated with full coverage for several years (all pharmacies, all patients concerned by the public drug benefit system). As a matter of fact, we can state the penetration is 100% in this field H2A in Hungary but we make very small effort to be proud of this."

In these fields, the relation is two-directional, interactive in most cases. As a result of the developments, intelligent systems communicate with each other on both sides; however, I range these relations here since the operating player is clean-cut.

INSTITUTION (HOSPITAL)-TO-BUSINESS (H2B AND B2H)

Electronic solutions become more and more widespread in the field of procurement of health institutions. Many suppliers maintain web stores and the possibility of electronic auction is also gaining ground. In the field of public procurement, the possibility of purchasing the product of the most favourable price (with or without tender restart) exists for years. The business tries to adapt itself to the features of the sector but real break-through has not yet been made in this field so far because of the strict rules of management. As regards the institutions, the realizable logistics advantages have not yet been proportional to the problems caused by the lack of liquidity. We can speak of regular and extended use only in the case of pharmacies and medicine wholesalers. Since both parties are profit-orientated, the electronic business culture was soon established, independently of that virtually it was enforced to the retailers' network by the wholesalers.

INSTITUTION (HOSPITAL)-TO-INFRASTRUCTURE (H2I), ADMINISTRATION (STATE)-TO-INFRASTRUCTURE (A2I) AND BUSINESS-TO-INFRASTRUCTURE (B2I) RELATION

In addition to the opportunities offered by WEB 2.0, numerous health expert systems accessible in the world and in our country, link, picture and video sharing sites, forums, blogs, knowledge and information repositories, community sites, the state also ensures that the sector has appropriate knowledge repertory. The newest project in Hungary on this subject is the so-called "Catheter-Monika" [10] project, which is a medical capacity analysing and planning software program. Among other things, this system is also able to support selection of alternatives favourable from the aspect of allocation efficiency by representing the pieces of information gained by the data systematization on a digital map. This knowledge repertory can be used by any health institution, the appropriate bodies of the governmental decision makers as well as the business players interested in health industry.

ADMINISTRATION (STATE)-TO-ADMINISTRATION (A2A)

The state sets an example by trying to use and make electronic transaction of affairs as wide-spread as possible. The electronic data exchange among the governmental bodies and offices was enforced by the office gate, the single-window transaction of affairs. The electronic governmental main network (EKG) has been available for several years and the bodies of the central administration are obliged to communicate through it. Nowadays we can observe more significant centralization in this field. The functional concentration into the county governmental authorities can make the utilization of resources more effective, accelerate transaction of affairs and reduce the redundancy as well as the time necessary for the office work.

ADMINISTRATION (STATE)-TO-BUSINESS (A2B AND B2A) AND BUSINESS-TO-BUSINESS (B2B) RELATION

These fields have relations operating also independently of the health sector. Within the electronic relations kept with the state, the company foundation, tax returns and various labour and social insurance reports are not sector-specific. As a matter of fact, business players have long since been using electronic procurement, logistics services monitoring, information sharing and financial settlement (e-invoice, e-banking, etc.), with its volume increasing continuously.

INFRASTRUCTURE-TO-INFRASTRUCTURE (I2I) RELATION

It may be the form of relation the most difficult to describe and imagine, but the development seems to move on to this direction. We can create more and more intelligent expert systems which can perform more and more complex tasks without human intervention. Already now we only supervise and validate the transactions but the time will come when these systems will make individual decisions. Now the health sector has process control systems which on the basis of parameters measured by certain devices can change parameters in another device and sometimes they correct faulty human decisions. The concept of the formation of the authentic central sector records made known recently includes a so-called "central validation device and data distributor" which is already such a component which performs the coordination among the various institutional master data systems [11].

I hope classification of e-Health described above and this brief review far from being complete show our results in the field of health informatics both to Hungarian professionals and foreign visitors. I ask everybody to consider my article as a basis for discussion and I wait contributions, remarks, opinions and modification proposals. I hope the coming 9th National Health Info-Communication Conference and the program of e-Health Week 2011 to be held in Budapest will help both the sector and those working in the health informatics develop such e-Health conceptions and solutions which are technically suitable, financially feasible and relevant from medical aspect.

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