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Telematics and Smart Cards in Integrated Health Information System

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Abstract

Telematics and information technology are the base on which it will be possible to build an integrated health information system to support population and improve their quality of life. This system should be based on record linkage of all data based on the interactions of the patients with the health structures, such as general practitioners, specialists, health institutes and hospitals , pharmacies, etc.

The record linkage can provide the connection and integration of various records, thanks to the use of telematic technology (either urban or geographical local networks, such as the Internet) and electronic data cards.

Particular emphasis should be placed on the introduction of smart cards, such as portable health cards, which will contain a standardized data set and will be sufficient to access different databases found in various health services . The inter-operability of the social-health records (including multimedia types) and the smart cards (which are one of the most important prerequisites for the homogenization and wide diffusion of these cards at an European level) should be strongly taken into consideration.

In this framework a project is going to be developed aiming towards the integration of various data bases distributed territorially, from the reading of the software and the updating of the smart cards to the complete management of the patients' evaluation records, to the quality of the services offered and to the health planning. The applications developed will support epidemiological investigation software and data analysis. The inter-connection of all the databases of the various structures involved will take place through a coordination center, the most important system of which we will call "record linkage" or "integrated database".

Smart cards will be distributed to a sample group of possible users and the necessary smart card management tools will be installed in all the structures involved. All the final users (the patients) in the whole network of services involved will be monitored for the duration of the project.

The system users will also include general practitioners, social workers, physicians, health operators, pharmacists, laboratory workers and administrative personnel of the municipality and of the health structures concerned.

1. Medical Records and Electronic Data Cards

"Electronic Record is an essential technology for health care". With this assertion the Institute of Medicine (IOM) of the American National Academy of Science, in 1991, recommended a wide diffusion within the end of this century.

The social-health record is the collection of all the information about a person collected during his interaction with social health structures (social services, specialized ambulatories, hospitals, labs, home care, General Practitioners, etc.) (1). This record represents a bridge between the user and the social health structures in the different services, and it is the core element of the social and health databases (2) (3).

The possibility of using suitable hw/sw technologies allows the management of the available kinds of information (numerical, textual, eidetic data) even in the social health record: we can speak of multimedia records and databases.

In the social/health record we can consider some essential parts of information:
- administrative data;
- emergency data;
- social security and insurance data;
- health care data.

The health care data should permit a complete evaluation of the patient for an up-to-date treatment based on an appropriate evaluation scale.

By the term Electronic Data Card we mean a way of storing personal data, having a standard format of credit card easily usable and portable by any people (4) (5) A smart card can be considered a portable electronic record. Smart Cards support a microprocessor and data are stored on ROM or EPROM, and the Optical Cards or Laser Cards operate mainly in the WORM modality (write once-read many times). At the European level workgroups exist on the harmonization and homogenization of cards in the Social-health field (as the Concerted Action "Eurocards on Patient Data Cards") (6), where some criteria have been setup regarding the identification of the following basic components of a social-health card:
- administration and identification information
- a set of common attributes (manufacturer company, emission and expiry data), name of the subject with possible additional ID information
- medical emergency data
-data related to particular pathologies and/or pathologies involved in card experimentation (diabetes, dialysis, etc.):
- additional social-health information.

The cards are in the users' hands and their technology guarantees a high grade of privacy, ensuring data integrity through different security methods (cryptography, digital encoding, etc.). As a result of the mobility of people, it is necessary to provide access to social and health services throughout the countries.

The use of the Electronic Data Cards on a wide scale will determine a common effort of change and homogenization among the operators.

One important aspect in using social-health records and cards as a personal record is the interoperability of these device inside of the various information systems. This concept is essential because the smart card is the link between the databases and it can be used in emergency situations , where a standardization of data is needed . Interoperability increases the number of organizations that may have access to the data.

However, this also means that the security procedures of the members of the interoperability agreement must be reviewed, ensuring that the agreement cannot be circumvented and that access to cards should be restricted in an appropriate way.

2. Databases technology and multimedia

The possibility of using appropriate hw/sw technologies allows the management of the heterogeneous available information (data, texts, images) even in the social-health record (7)(8). We can speak of multimedia records and of multimedia database systems.

Complete health information is meant as multimedia. It is hoped that diagnosis images and biosignals could be available for every patient, but conveying such kinds of information presupposes an advanced telematics technology.

The concept of the social-health workstation is to provide a single user friendly access to the electronic record for the operators. With the recent advances in desktop computing in user-friendliness and cost-effectiveness and the more widespread availability of industry standard mechanisms for accessing various databases, the concept is very close to reality. In this way the operators will be able to access data in a consistent manner although it may contain information from various sources in a number of different formats and will be therefore Multi-media in nature, e.g. textual, images, graphical, voice, etc.(9).

The workstation based on multimedia social-health record can integrate documents and image scanning technologies to ensure a comprehensive approach to accessing and archiving information in a multi-site environment (10)(11).

3. Record Linkage and telematic networks

The Record Linkage allows the link of the social-health data from different sources (social services, entertainment centers, hospitals, etc.) resident on different databases or information systems and related to the same individual (12)(13). The implementation of record-linkage methods allows for a quick disposal of the complete and updated social-health situation of every subject: it is possible to know his whole administrative and social/health history, even if fragmented into different archives. The benefits of this technology are manifold in the field of preventive medicine, in epidemiology and in social-health scheduling.

The Record Linkage is applied in different ways in many countries on population groups at a social-health district level. The linkage using communication technologies and/or the use of smart cards including information about all the interactions of the subject with the social-health structure will allow the use of specialized resources allocated in different places for different purposes (clinical , statistical, epidemiological, health planning and scheduling, etc.). The integration effort by networks and/or smart cards must ensure a full inter-operability between records, in order to guarantee readability and comparability between records from different sources (14)(15).

In this context a main role will be played not only by the full connectivity of the suitable hardware supports (modem, local and geographical networks), but also by the standardization and coding methodologies. Moreover, the circulation and exchange of social-health information, as well as the possibility of connection to data banks, databases and remote information services for consultation or access to services, require a definition of international standards in order to guarantee data privacy and security. (The data access

must be controlled by means of protection methods based on different keywords and levels, for example depending on the kind of operator who is asking for access).

The use of local and geographic networks is spreading more and more thanks to the development of the telecommunication technology (telematics). We plan to use a mix of different communication technologies to build up our networking infrastructure:
- Dial Up Analog line.
- Dial Up ISDN line.
- Local, Metropolitan, Wide Area Networks (LAN/MAN/WAN)

Local Area Networks based on a common protocol (e.g. TCP/IP) will be used to connect PC terminals in the same building. For the external connections on a metropolitan scale, ISDN and leased lines will be used (packet network, frame-relay). For the connections over a wide area and with the European partners, Internet will be used, possibly in conjunction with Euro-ISDN.

Internet represents the most well-controlled and widespread method for large-scale connections. Its capillary presence in nearly all the European and worldwide countries, joined to a high number access points on the territory, managed by several Internet Service public and private providers guarantee reliability and low-cost access.

The problem of the access security and control, fundamental in many sectors but in particular in the social-health field, can be faced by arranging in the connected computers suitable "firewalls" that could prevent non authorized computers to access.

Euro-ISDN is the set of the European ISDN networks. It can be used jointly with Internet in the connections between partners , if needed, in order to achieve a better grade of security and interoperability.

4. The Integrated Social-Health Information System

A project concerning the above issues is starting and it is aimed to develop an integrated information system model of social-health care. Data collected on the chart of the patients' evaluation group are integrated with other information from social-administrative-health services by providing a complete on-line computerized record, thereby improving information sharing among all members of the social-health care team. Part of this information will be on the portable social-health record supported by the electronic smart card.

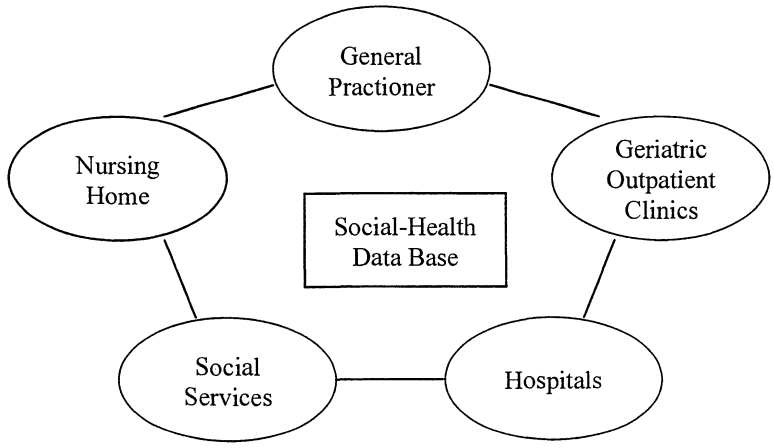

Fig. 1

Linking social centers, physicians office, outpatients' clinics and hospitals can be facilitated by the model of the multimedia and integrated workstation, covering an integration and a cooperation of service groups. At the center of this representation of the system there is the social-health record stored also in the card and in the various Databases accessed through telematics networks (see fig. 1).

5. Conclusions

State of the art telematics and information technology are able to provide an integrated social-health information system whose objective is to create direct communications links, based on common standards, joining General Practitioners, hospitals and social centres on a European scale. The communication can be performed by means of telematics networks and smart cards.

A project with these features is starting in Milano and in other sites, with the following objectives:

- realize a quick interconnection among all the different network nodes of the involved services
- increase the quality of life of elderly and disabled people on a preventive (social and health) level; on a territorial level (integrated home social-health care) and institutional (in a perspective of care and rehabilitation medicine)
- improve the mobility of the risk people, thanks to the integration of the different service networks present in the project
- achieve a full communication among the network nodes, avoiding waiting lists, reducing the answering times both in the data collection and in the distribution of the data results among the operators (e.g. general practitioners) and improving the services effectiveness and the technical quality perceived by the final users.
- reduce the institutionalization trends through an effective monitoring on the territory.
- improve the home stay of the elderly and disabled people in conditions of countinous safety and care from the social-health services
- manage a precise mapping of the autonomy levels of the elderly and the disabled people on the territory , foreseeing the possible social -health difficulties encountered by elderly and disabled.
- supply an information basis for the measurement of the daily activity of the elderly and disabled people , the different levels of their physical and psychical autonomy and the related health and social requirements.

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