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Evolution of a Regional Health-care Information System - the design phase

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Abstract In 1996 a program of the Soros Foundation was launched to study a *regional* health care model Main stake holders of health care financing and providing in three counties in South-Western Hungary. found the idea appealing and the *Soros Model Region Program* was started. *This paper outlines the activity of the second sub-project of the model region program: the development of a regional health care information system.* The build-up of a data and knowledge base serving the differing needs of mentioned goals is based on international standards. Availability and user involvement is based on different media for presenting the information as printed publications, CD-ROM data bases and World Wide Web availability. A congruency and coherency principle is maintained by a unified data model used for different purposes and a planned unified communication protocol among all participants in the model region program. Studies regarding health care status, economics and financing on regional level show that a better fitting health care services profile and a more flexible resource management might be achieved based on the mentioned regionality principle.

1. Introduction: background and goals of the regional information system

In 1996 the Soros Foundation launched a program to study the possibilities of establishing a regional health care model where financing and providing of health-care services are optimized upon the principles of regional decentralization in contrast with todays' institution oriented, centrally administered budgeting in Hungary. Main stake holders of health care financing and providing of three counties (Tolna, Somogy, Baranya) in South-Western Hungary found the idea appealing and the Soros Model Region Program was launched. Research activities exploring population health status, related environmental factors, health care providing infrastructure, modeling of region oriented health care political decision making started, all requiring extensive and intensive informatics infrastructure. Studies regarding economics and financing on regional level show that a better fitting health care services profile and a more flexible resource management might be achieved by the mentioned regionality principle. To serve the above mentioned outlined wide range of health care system research and development activities, an information system was envisaged, that can serve the following specific needs:

- storing large amounts of health-, and health care-related data in a structured way,
- enabling retrospective data surveys,
- enabling design of new parameters / health care indicators for prospective data collection
- creating data views according to international standards and quasi-standards for international comparability and analysis: OECD (Eco-Sante), WHO Health for All by 2000 data set mirrors
- providing user friendly way different sort of information services as
    - differently structured information for experts in sociology, epidemiology, for health care managers, for practicing doctors and for the public
    - a "Yellow Pages"-like general information service on health care services, providers, organizations and institutions in the model region

2. Methods and means

2.1. building an architecture

The regional information system (RIS) is developed according to the ISO 3-layer architecture: bitways, middleware and application. Forthcoming CEN/TC251 standards (mainly HIF - Health-care Information Framework) are also taken in account. The RIS is conceptually designed object-oriented for future extensibility. In it's implementation it has been "downgraded" to an affordable relational database structure.

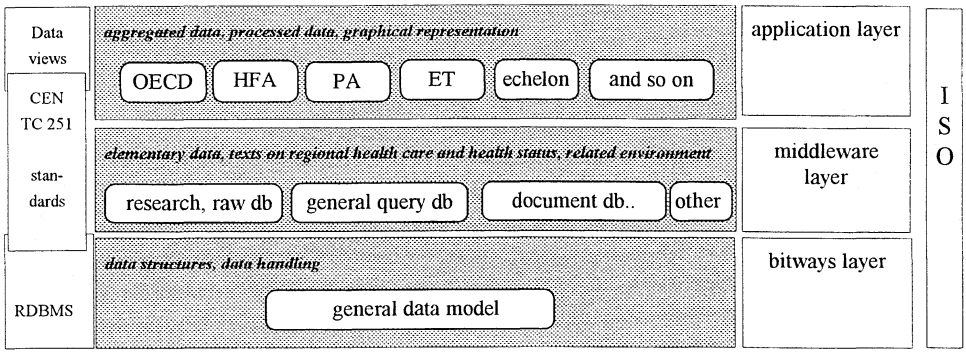

Fig.1. regional information system architecture
(see explanation for abbreviations in the text below)

2.2. designing information system views for the end user

The following "information views" are generated from the common, integrated data base:

- *OECD* > Eco-Sante provided data set of health indicators applied for the region enabling international comparability
- *HFA* > Health for All by 2000 data set - WHO health indicators applied for the region

- *Echelon>* Echelon view - a systematic approach to visualize and discuss health care organizations / institutions and health care services / tasks
- *"Whois" >* Information service on health care services, providers, organizations and institutions in the model region
- *PA>* Pannon almanac - a comprehensive data set about the region (environment, social status, health state of Hungarian inhabitants, risk factors, prevention programs, morbidity, nursing, health services, health care resources, health care financing, health care informatics)
- *ET>* Health Plan / Health Status Assessment - structured data about education, employment, social handicap, home budget, physical environment, lifestyle-health behavior, demography and mortality, occupational health care, health status self-assessment, mentalhygiene, disability and rehabilitation, social care, alternative care/homeopathy, local health politics and resource management, civil groups and organizations

2.3. methodology of communicating with end users

To communicate with end users the following aspects has to be considered: wide availability of data, usability in different environment, techniques to maintain up to date status. Three methods were chosen to present the results of data collection and processing: (i) printed material of partial results for wide availability, (ii) CD-ROM versions for flexible handling of large amount of data and (iii) World Wide Web availability for interactivity and updating.

3. Results and discussion

Designing a multipurpose, but consistent database used by different actors with differing methodology is not a trivial task. In the following we shall discuss a few principles that we found worth to consider.

3.1. object oriented architecture features

The conceptual model of the regional health care information system has to cover the broad spectra of health care information. Features of object oriented thinking as application of inheritance and object embedding to express hierarchy are useful to organize the large amount of different data characterizing health care.

3.2. conceptual modeling on the application level is based on a (health care) functional point of view

The above mentioned "object-oriented" thinking is used to model the structure of health care related information. The model below (fig.2.) shows the result of this thinking. The echelon model is one of the views of the "application layer" aimed at connecting population related data with health care related data. As shown on this (2.) figure a single layer model is not sufficient to represent all health related concepts.

3.3. data modeling on bitways layer uses a generalized mode

A common general data model (fig.3.) is developed ensuring congruity among particular data bases of the regional health care information system.

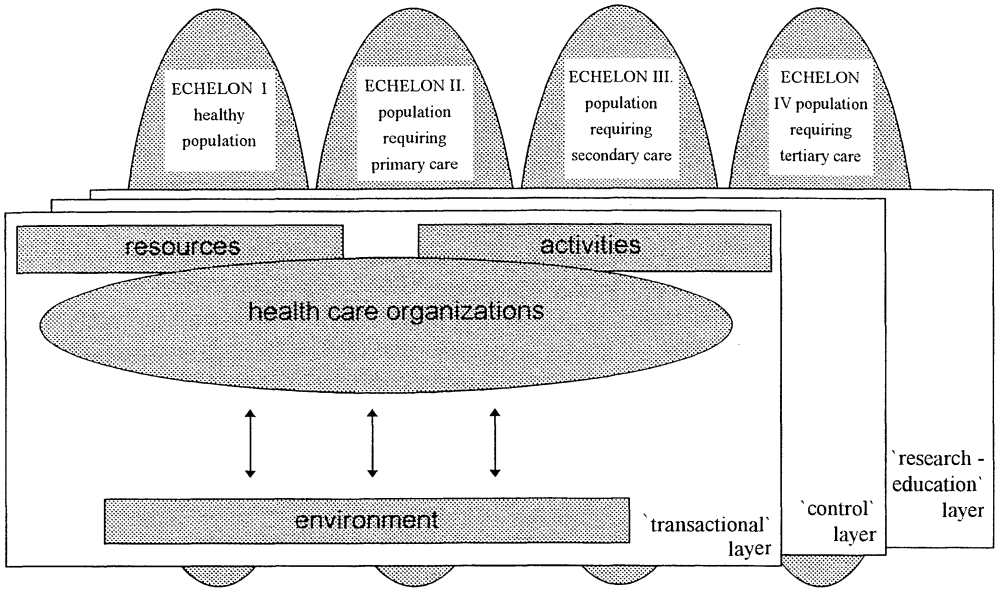

Fig.2 . echelon model of health care related concepts

data model entity	explanation
data abbreviated name	mnemonic abbreviation for data entities, maximal length 8 character
data name	name of data entity
data definition	detailed data description
data classification according to a "data view" and hierarchic position within the given view	The model region program uses the same data for different purposes. For each purpose systematic data views are constructed, as listed in paragraph "*designing information system views for the end user*" A given data might be classified within more data views (resulting in a list), where as default value the position in OECD classification is used.
data conversion to other views	If possible, a conversion algorhitm is given to other classifications instead of the above mentioned list of classification positions.
data type	raw or calculated data
unit of data	if the data is quantifiable, the measurement unit is given here
data sources	name and availability of the data source
validity characterization	time or time span of validity, specificity and sensitivity of data measurement method, predictive value if relevant
frame of reference	as e.g. date, time period, geographic area, specific population

Fig3. the unified data model

4. Summary

The paper describes the design phase of establishing a regional data base to support research and development leading to better health policy making. Cogent handling of the broad spectra and large amount of data requires a clear and consistent conceptual framework. A three level ISO inspired architecture, object-oriented concept handling and a unified data model are serving the above mentioned goals.