

Research on homocysteine: the importance of data communication on the diffusion of clinical research

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This work started on demand of the Neurology Department staff of the Sestri Ponente Hospital in Genova.

The aim of the project is to organize, in the best way, a study on a possible relation between levels of homocysteine in blood and the type, severity and progression of dementia. The core of this paper is to identify the main helps that actual achievements of computer science can give to medical doctors in the development of their researches.

The high diffusion of dementia causing diseases in elderly population and the increase of the average age in developed countries put the study of these neurological diseases at the centre of attention for a large section of clinical doctors.

Probably a high level of homocysteine in the blood causes dementia to develop faster [1].

It seems that extremely high homocysteine levels (hyper-homocysteinemia) is caused by inadequate alimentation and lifestyle habits. For this reason the problem of hyper-homocysteinemia is wide spread through North Europe and North America. In these countries, peoples lifestyles are characterized by many habits that may cause hyper-homocysteinemia which can also be due to stress.

To investigate the relations among elevated homocysteine levels and cerebrovascular disease progression it is necessary to correlate the plasmatic homocysteine level with:

- 1 age of the patient ;
- 2 entity of the cerebrovascular disease estimated with neuropsychological tests;
- 3 neuroradiological status considering atrophy and number/localization of cerebral hypodensity;
- 4 eco-doppler referrals.

All this information must be corrected considering some common vascular risk factors such as diabetes, hypertension, and unbalanced lipid contents

in blood.

This high level of interrelations between a large number of co-factors makes this type of study suitable for a computer based organisation even for clinical trials located in small hospitals.

When the database is completed with the necessary information, it will allow to perform an analysis of the data by operation of data mining. In particular the method called "Discovering Patterns and Rules" will be used in this study. This method will allow to find unknown relationships among collected data starting from a set of observational data [2].

Data collected by this hospital can also be of great interest for more specialized health structures in which progressive patients can be addressed for more specific treatment. This arises the major thematic of data interoperability in health care. For this reason we have planned to provide this database with an input/output standardized interface based on HL7 (Health Level Seven) recommendations. HL7 provides valuable assistance in the standardization of the necessary interfaces between systems. It was developed in the USA and is now an official ANSI standard. It is important that the communication solution is independent of the software used as well as the underlying hardware and the chosen network. Thus the user has the freedom to choose a solution best tailored to his/her needs [3].

The construction of a database for this study lead to the development of an electronic patient record (EPR) oriented to people affected with dementia. In literature there are many cases similar to this. The electronic patient records seem to be necessary in the actual hospital setting. Thanks to this new way of organizing data, the frequent errors present in the old paper records will disappear because the data will be inserted into the database only once.

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Compilation errors and redundancy of the data will also disappear.

The Department of Neurology of the Maastricht University Hospital collaborated with the Department of Medical Informatics of Maastricht University in a project to develop an EPR for stroke patients. This case is very similar to this project because it started by demand of a neurology department [4].

At the neurology department many health care workers collaborate in a multidisciplinary team to treat stroke patients. Accurate and timely information exchange is a prerequisite for a good functioning team. In daily practice it appeared that the current paper records did not always fulfil the information needs. It was suggested that the use of an EPR could contribute to optimising care.

These are the same aims which bring the Department of Neurology of the Padre Antero Micone Hospital and the Department of Communication Computer and System Sciences of the University of Genoa to collaborate to produce a well organized database and an electronic patient record dedicated to patients affected by dementia.

The developed prototype is mainly a data communications tool based on a Web application.

The Database is actually present on the Medinfo Web server. All users are provided with a username and password to access the database by Web. So security in the Web is at the centre of this study. Security in web applications is fundamental in the hospital environment and the interface, which is used to see and modify the database as an ASP.NET application. The Database was built with security as one of the main goals. ASP.NET allows

to set up different levels of protection for the application by implementing in a very efficient way the theoretical concepts of authentication, authorization, and personification.

The authentication function receives a username and a password and if these data are valid, it gives the user an authenticated identity. The authorization function uses the authenticated identity to determine if the user can have access to resources. The personification qualifies the execution of an application in relation to the role of the user.

Data managed in this way are, without any doubt, safer and more readily available than old paper archives, this is one of the reasons that makes this technology a key in future organization of the medical environment.

The idea for the future is to build up a complete EPR in order to administrate patient records electronically without the need of old paper records. All departments in the hospital will be able to communicate among themselves in a very easy way and patient care will be optimized.

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