Ontology and Geographical Information System for End- Stage Renal Disease: the SIGNE

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The SIGNE program (Système d'Information Géographique en NEphrologie) is dedicated to transpose the notion of Geographical Information System, accessible via Internet, to the aid to public health decision-making for renal diseases. It was introduced in the field of End-Stage Renal Disease (ESRD) within the French Renal Epidemiology and Information Network (REIN) [1]. It is aimed to answer to needs of representation, analysis and prediction necessary to decision making in public health. A spatio-temporal approach is used to develop methodologies based upon the means used in the domain of geographical information. We aimed at developing generic tools adapted to the management of other chronic diseases, possibly leading to terminal organ failure.

Geographical Information Systems (GIS) might favour interactions between epidemiology, public health and geography since they integrate several types of data related to populations, socio-economical conditions, environmental characteristics, and analyse their spatial connections. Besides their ability to integrate and analyse correlated data, GIS favour to share data while using standard formats and a highly efficient communication tool: the map [1,2,3]. It displays graphically spatial correlations that are very difficult to materialize via other means. Moreover, the map may help to implement simulations and propose defined public heath scenarios. Thus, the map is a potentially powerful tool for public health decision-making. However, it might be an informational support of primary importance in so far the principles and methods of its use are respected.

GIS and their access, for example via Internet, constitute the preliminary step for new advances in the description of several phenomena. Statistical approach of the observed phenomena, either in time or space, is necessary to pass from description to interpretation [4,5,6]. GIS and their related tools provide means for efficiently capturing, organizing, storing, and retrieving the required data. Appropriate knowledge of geomatics are required to generalize, symbolize, and classify the data in such a way that the map becomes an efficient tool of communication and decision. For example, detailed accessibility measures permitted by GIS technology call into question for instance the continued use of crude empirical measures of accessibility to care. Collaborative efforts between epidemiologists, biostatisticians, environmental scientists, GIS specialists, and medical geographers are required to apply the full potential of GIS technology. It may lead to innovative solutions to complex questions.

The emergence of distributed or interoperable computer systems, and data warehouses [Ana 2003] offer the possibility to generate powerful GIS, associated with spatial data. These technologies are useful not only for organizing, analyze, and represent data sets, but also modeling local data may provide global views and simulations to help the development of health care programs. The possibility to link and merge files of distinct sources affords the

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6 Cox, L.H., Protecting confidentiality in small population health and environmental statistics. Stat Med, 1996. 15(17-18): p. 1895-905.

opportunity to generate medical or medico-economical databases. Either individual or aggregated data are concerned. The principle of medico-economical data warehouse extends the approach of decision-making to the health care domain. However, the population considered, the medical events registered, the types of coding used, the types of collection of exposure, the modalities of data entry, follow-up, or data quality control are often very variable and the source of potentially biased results.

Thus SIGNE requires an ontology including a geographical ontology. In effect, the multi-sources information system we developed for the Renal Epidemiology and Informational Network is based on a n-tier architecture [Landais 2002,Ben Said 2003,]. In this context, declarative approaches build upon semantic intermediaries are required for defining the links between source and target data, their migration and aggregation. The nature and types of the aggregated objects presented in the data warehouse is presently explored. An effort to define the spatial and geographic concepts is necessary. Moreover, modeling events and spatio-temporal processes is of primary importance for ESRD.

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