A Logical Database for Geriatric Purposes

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Abstract. We have developed a logical database implemented in Prolog language as auxiliary in the diagnosis of causes and consequences of aging processes. We have designed some belief networks to relate diseases and its consequences, aging processes and prevention processes into a Logical database system oriented to general purposes.
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1. Introduction

Automated reasoning and model-based diagnosis communities have spawned a lot of work on the implementation and improvement in automatic diagnosis and related tasks [2]. Different logical formalisms have been applied to help in the automatic diagnosis, such as: default logic (presented in Reiter's own HS-algorithm, firstly), abduction or cicumscription (presented by McCarthy), as well as network beliefs used currently in automatic diagnosis.

There are several GDE systems that were developed as a medium to inform about specific illness. For example, *Family Doctor System* that works as a symptom checker flowcharts allowing to easily track your symptoms and come to a possible diagnosis [1]. Other example is, *Geriatric syndrome* which is a document that contains a crosstab with geriatric information [3]. Also the *Aging Systems and Geriatrics* [ASG] study reviews applications on studies of age-related conditions and diseases [6].

In some countries, the people are living longer and healthier lives. Even so, many old adults develop one or more related medical problems called geriatric syndromes. Geriatric syndromes usually have more than one cause and involve many parts of the body. Often, one geriatric syndrome can contribute to another, making medical care for old people more complicated.

2. Main Diseases in the Elderly in México

Several international agencies and other demographic centres routinely prepare national mortality estimates or life table compilations as part of their focus on sectoral monitoring. In México, the Inegi and the Conapo are the main institutions that mantain statistic on Mexican's population and life tables. In Mexico in the year 2005, it was informed that there were 8.4 million individuals aged

60 years and over (8.1% of the total population), and it has been projected that there will be 17.5 million (12.4%) by 2025 and 35.7 million (24.3%) by 2050 [2].

In figure 1 is shown the main diseases causing death in México in 2010, and for each one of those diseases what is the average affecting only to old people.

Mortality 2010		Old Adults	
CHD	105 144	79 406 (76%)	
Diabetes Mellitus	82 964	51 128 (62%)	
Malignancy in Oncology	70 240	38 673 (55%)	
Accidents	38 117	7 502 (20%)	
Liver Disease	32 453	12 547 (39%)	
Cerebrovascular Disease	32 306	24 704 (76%)	
Aggressions	25 757	7 502 (29%)	accidents
COPD	19 468	17 558 (90%)	
Pneumonia and influenza	15 620	10 010 (64%)	
Perinatal Period	14 377	NA	
The Others	155 572	13 871* (4%)	of the grand total

Fig. 1. Number of deaths; for general population and for old adults

In order to design a system for geriatric purposes, we are building a database containing information about causes and consequences of the aging processes. We have considered five aging processes, which are: Oxidation by free Radicals, Silent Inflamation, Glycosylation, Descent of hormonal levels and Mitochondrial Deterioration. In a first stage of our system, we have designed an Entity-relationship model relating illnesses which are known to be associated with each one of the aging processes. Currently, those relational models are being refined as belief networks.

3. The Logical Model of our Geriatric System

Bayesian networks with their associated methods are especially suited for capturing and reasoning with uncertainty. They have been around in biomedicine and health-care for more than a decade now and have become increasingly popular for handling the uncertain knowledge involved in establishing diagnoses of disease, in selecting optimal treatment alternatives, and predicting treatment outcome in various different areas [2].

In our system, we have expressed the set of relations that will be expressed as logical rules in Prolog. The system contains all logical relationships between objects to subsequently determine the functions of conditional probabilities.As the goal is to build a series of facts and rules written as prolog rules, the belief network allow us to represent in a graphic way such logical rules. We are refining the belief networks at different levels among aging processes, common diseases in the elderly, causes, effects and methods of preventions for such diseases.

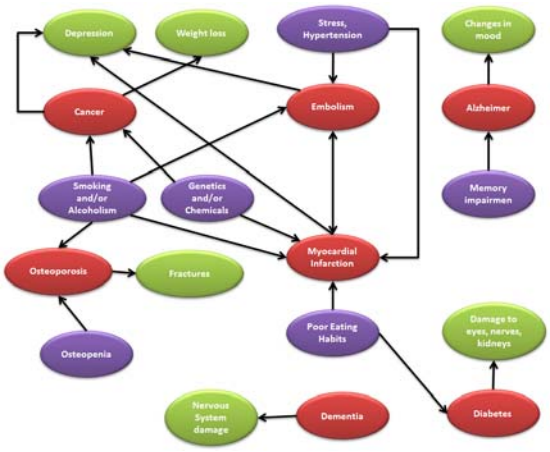

Fig. 2. A first Belief Network

4. Conclusion

Given that people older than 60 years-old show a high vulnerability, it is important to consider the services for this sector. The system that we are developing can be used as a support to increase a culture in the prevention of degenerative diseases affecting to that population, because knowing which are the factors of risk, allow them to correct their lifestyle.

We have designed some belief networks to relate degenerative diseases and its consequences, aging processes and aged care processes into a Logical database system oriented to general purposes. Such Database is written in Prolog languaje.

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