

## Chapter 8

# Assessment of Clinical Decision Support Systems for Predicting Coronary Heart Disease

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### ABSTRACT

*The use of data mining approaches in medicine and medical science has become necessary especially with the evolution of these approaches and their contributions medical decision support. Coronary artery disease (CAD) touches millions of people all over the world including a major portion in Algeria. However, much advancement has been done in medical science, but the early detection of CAD is still a challenge for prevention. Although, the early detection of CAD is a prevention challenge for clinicians. The subject of this paper is to propose new clinical decision support system (CDSS) for evaluating risk of CAD called CADSS. In this paper, the authors describe the characteristics of clinical decision support systems CDSSs for the diagnosis of CAD. The aim of this study is to explain the clinical contribution of CDSSs for medical decision-making and compare data mining techniques used for their implementation. Then, they describe their new fuzzy logic-based approach for detecting CAD at an early stage. Rules were extracted using a data mining technique and validated by experts, and the fuzzy expert system was used to handle the uncertainty present in the medical field. This work presents the main risk factors responsible for CAD and presents the designed CASS. The developed CADSS leads to 94.05% of accuracy, and its effectiveness was compared with different CDSS.*

## **1. INTRODUCTION**

Medical data mining has great perspective for discovering the hidden patterns in the data sets of the medical domain. With the technological advancements in recent years, an enormous amount of information in health care systems is saved in electronic form such as the electronic patient record. However, the available raw medical data are widely distributed, heterogeneous in nature, and voluminous. These data need to be collected in an organized form. This collected data can be then integrated to form a hospital information system. These data are saved for the management and analysis of the patient population.

Data mining technology provides a user-oriented approach to the novel and hidden patterns in the data. Data mining in the medical domain is an effort to reduce medical errors as much as possible and increases patient safety and consistency. Argumentative reactions can occur if a disease is not diagnosed precisely and timely. Furthermore, an operative treatment of illness can reduce medical errors, medication errors, and cost of unwanted medical tests. An intelligent CDSS can support healthcare experts in medical decision-making tasks such as diagnosis of CAD patients.

Coronary artery disease (CAD) is the leading cause of death in countries under development such as Algeria. It is estimated that 45% of mortality in Algeria are due to cardiovascular disease (Kheirredine Merrad, 2012). CAD is the result of plaques accumulation within the coronary arteries which affects the oxygen-rich blood supply to the myocardium. This artery wall thickness led to the accumulation of plaques which, are composed of fat, cholesterol, calcium and other substances, is so called Atherosclerosis. Consequently, the blood flow to the heart muscle decreases. Atherosclerosis can produce different pain symptoms (such as the chest pain, abdomen, etc.) also called angina. The gradual decline in the lumen of coronary arteries affects the oxygenated blood supplied to the tissue that is inadequate to the tissue need. Therefore, the tissue does not work at its complete capacity provoking a myocardial ischemia. The near complete blockage of coronary artery lumen restricts the flow of the oxygenated blood, and the myocardium starts dying and leads to the myocardial infarction (heart attack).

The risk of cardiovascular disease is related to numerous factors such as environmental, psychological, genetic, demographic variables and health services. Many of these diseases require surgical treatment, including coronary heart disease, vasculopathies. Cardiovascular surgery has developed considerably in recent decades, becoming one of the most common surgeries in the world (CABG, valve replacements....). However, most of these surgical interventions are expensive, and not affordable for the normal population. (Coste-Manière, Adhami, Mourgues, & Carpentier, 2003) (Coste-Manière, Adhami, Mourgues, & Bantiche, 2004) (Pike, & Gundry, 2003) (Walther et al., 2008) (Holzhey et al., 2008). On the other hand, much effort is ongoing for improving diagnostic procedures. The usual clinical process of CAD diagnostics is stepwise (Falk et al., 2000) (Falk et al., 2005), consisting of four diagnostic levels:

- Signs and symptoms evaluation and electrocardiogram (ECG) at rest;
- ECG testing during the controlled physical exercise;
- Myocardial scintigraphy;
- Coronary angiography.

At this level, the coronary angiography diagnostic level is considered as the “gold standard” reference method. Moreover, the diagnosis of CAD is challenging, especially when there is no symptom. Much information from patients is needed.

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