The Design of a Cloud-based Clinical Decision Support System Prototype: Management of Drugs Intoxications in Childhood

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ABSTRACT

The authors developed a mobile cloud-based clinical decision support system for drug poisoning in children. The system has a Client/Server architecture and provides a mobile application and a web service to be deployed on the Amazon Cloud infrastructure. Physicians benefit from a user interface to input patient data and to receive diagnosis and treatment protocol. The objective of this article is to help doctors, and particularly the beginners to manage and to treat children suffering from drug poisoning when toxicity is known or unknown. To do this, an intelligent system is developed. It is composed of an expert system, used when the toxic drug is known, and a case-based reasoning system applied when the toxic being ingested is unknown.

KEYWORDS

Case-Based Reasoning, Clinical Decision Support System, Cloud Computing, Mobile, Drug Poisoning, Rule-Based Reasoning, Web Service

INTRODUCTION

Drug poisoning among children is a serious health problem in many countries; therefore, it requires more attention. Solutions must not rely only on educational and legislation efforts, but an interdisciplinary mobilization is necessary to achieve better improvement.

In Algeria, the poisoning in children is gaining a considerable scale, but this phenomenon remains insufficiently investigated due to the lack of national data and statistics. However, in 2013, data collected by the Algiers Poison Control Centre1 (2013) show that drug poisoning is at the top with 60% of cases treated and affects both children and adults. Statistics reveal a significant increase in the number of poisonings by drugs in recent years, from 688 cases recorded in 1991 to 5,312 in 2013, representing 67.2% of the total number of poisonings. As shown in Figure 1, children aged 2 to 5 years are the most vulnerable to poisoning (36.6%), followed by young adults aged 19 to 29 years (25.6%). This figure also indicates that 49.6% of adults are intoxicated, compared to 50.4% of poisoned children.

Such accidents predominate among preschoolers. The findings from the study carried out in the year 2000 by the Algerian National Institute of Public Health explain that these figures are the

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result of several factors including the lack of safe drug storage and the limited size of the housing. In addition, the healthcare culture in many families is very limited or absent, especially those with low school education and living in a poor socio-economic environment (cited in Zidouni, 2000). Furthermore, the examination of healthcare coverage rates reveals an inequitable distribution of healthcare facilities by region. According to the CNES, statistics from the Ministry of Health for the year 2013 show deficiencies and inequalities in certain regions compared to others. In fact, 61% of hospitals are located in the North. However, the south receives only 11.7% including 1.4% in the Great Sahara (CNES, 2015, pp. 88).

Medical management thus, suffers from a problem of unequal distribution, within the national territory. According to the same source, statistical analyzes show a concentration of doctors, especially of specialists, in the center of the northwestern region with 44.5%, and, a clear deficit in all specialties, in the Southern part. For medical staff, in particular, it is mainly concentrated in the large northern cities with about 90% of the population, and then, decreases as we move further southward to the Sahara.

Although there are already many studies on CDSS using mobile and cloud technologies, this problem is still a limited area in case of drug poisoning. More precisely, in Algeria, to date, there is no such system, which deals with drug poisoning in children. On the other hand, the physicians also residents working in the intensive care unit of the pediatric hospital of Canastel (located at Oran city in the west of Algeria) have expressed their need for such a system to help them make fast and correct decisions. Dealing appropriately with drug poisoning in children to predict the extent and severity of the toxic and, accordingly give proper treatment is the main problem that the doctors daily face. In fact, as stated by the physicians of this unit, actually, there is an absence of an accurate protocol for the treatment of drug intoxication. All these reasons motivated us to carry out this study.

The aim of this work is threefold: (1) Address the problem of lack of specialists on Algerian territory and avoid the application of inappropriate treatments. (2) Make a diagnosis promptly and provide appropriate treatment as soon as possible. Because any delay can have serious consequences. (3) Address children affected by known or unknown drug intoxication.

We propose for the first two objectives, a CDSS based on mobile computing and cloud computing technologies for managing childhood drug poisoning. We consider the CDSS as an alternative that supports physicians and mainly novices in their daily decision-making process. Rather than soliciting

Figure 1. Distribution of drug poisoning by age; according to statistics of Algiers Anti-Poison Center in 2013

![Graph showing distribution of drug poisoning by age](image-url)
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