Specialist Bayesian Pediatric Anthropometric System

Eduardo Adratt, Claudia M. C. Moro, João Dias

Health Technology Post Graduate Program – PPGTS /PUCPR Curitiba - PR, Brazil

Abstract

Monitorng growth is an important resource for evaluating the health of individuals and society. However, many Brazilian children are cared for by doctors who have not been trained as pediatricians. This study deals with the proposal and validation of a decision making support system to assist doctors who are not pediatricians to interpret anthropometric and graphic growth data, assisting them to carry out procedures relating to patient investigation, referral and follow-up. The system used a Bayesian network.. Validation compared the performance of the system, as well as the performance of general practitioners and pediatricians in relation to a gold standard developed by specialists. The overall sensitivity of the system was 84.5% whereas that of the pediatricians was 55.1% and that of the general practitioners was 46.5%. Specificity was 78.2%, being very close to that of the other groups. The system showed itself to be statistically valid for implementation in public health services, its performance enabling it to be used not only by general practitioners but also by pediatricians.

Introduction

Growth depends on genetic and environmental factors. Environmental factors are understood to mean physical and social factors, such as diseases and nutritional conditions. Several international organizations, such as the World Health Organization (WHO), and national organizations, such as the Ministry of Health and the Brazilian Pediatric Society, recommend the accompaniment of growth as a routine activity in child health care, owing to the recognition of the important influence that living conditions exercise over growth. Furthermore, because of the socio-economic reality in Brazil, children are not always cared for by pediatricians. Usually they are attended by general practitioners who, frequently, are faced with complex and specific pediatric cases which are hard to deal with, even for pediatricians.

The purpose of this study is to model a Specialist System (SS) to assist general practitioners in the application of guidelines for investigating, following-up and referring pre-school pediatric patients with suspected growth disturbances.

Materials and Methods

Given the inherently probabilistic characteristics of the knowledge domain in question, the Bayesian network was chosen as the artificial intelligence technique to be used in building the specialist system. In order to establish the system's variables and parameters, three professionals (referral service specialists who teach resident medical officers) were consulted in isolation from each other. The information gathered was then combined in a joint discussion. The semantic network and the conditional probability tables were then built. The modelling of the knowledge base met the following requirements: compliance with medical literature of excellence and World Health Organization, Brazilian Health Ministry and Brazilian Pediatric Society projects; applicability and adaptation to the proposed context. The Norsys Netica™ shell (http://www.norsys.com) was selected to implement the SS, since it enables integration with other systems and facilitates system learning and evolution.

Evaluation

The system's performance was evaluated in two phases. The first phase (Phase I) consisted of a comparison between the system's performance in relation to a gold standard created by a group of specialists having the same specifications as described earlier. The gold standard was comprised of 25 clinical cases, involving cases with the highest incidence, those that presented risk of not being diagnosed, as well as cases in which important and frequent errors occur.

Results

A Bayesian network is the result. The network's principal variables are the patient referrals. Taking referral to the pediatric endocrinologist as an example, the system displayed 100% sensitivity and 91.6% specificity. The sensitivity of all the doctors assessed was lower than a 60%, and their specificity was even lower. In addition to its high performance in relation to this variable, the system was also able to reduce the number of referrals in other ways: referral to pediatric gastroenterology can only be made following preliminary investigation; part of the patients are referred to general pediatricians, since they have a greater number of clinics and are able to resolve most of the problems that present difficulties for general practitioners.

Conclusion

The system developed was suitable for use by specialists. In everyday practice a system of this nature connected to the Patient's Electronic Health Record can limit medical error, avoiding errors caused by distraction. In the case of doctors who are not specialists, the system is a strong ally especially in preventing errors through lack of expert knowledge. Costs are reduced and patient care is improved.