



## International Journal of Control Theory and Applications

ISSN : 0974-5572

© International Science Press

Volume 10 • Number 25 • 2017

### A Data Mining Approach for Managing Asthma in Children Using Level Based Analysis

K. Kasturi<sup>a</sup> and S. Prasanna<sup>b</sup>

<sup>a</sup>Ph.D Research Scholar, Vels University, Chennai, India. Email: [kasturi.scs@velsuniv.ac.in](mailto:kasturi.scs@velsuniv.ac.in)

<sup>b</sup>Associate Professor, Vels University, Chennai, India. Email: [prasanna.scs@velsuniv.ac.in](mailto:prasanna.scs@velsuniv.ac.in)

#### Abstract:

**Objectives:** Asthma that leads to COPD (Chronic Obstructive Pulmonary Disease) will have the high rate of morbidity and mortality by 2020. This paper describes about the development of a level based system analysis model to manage asthma.

**Methods:** In this paper the level based asthma analysis model is proposed using C5.0 algorithm decision tree methodology. To the patients, it gives the knowledge about their level of asthma and the environment surrounding them. The patients should answer the questions about the current health condition. The data gathering regarding asthma is done through the Doctors interview and online medical resources.

**Findings:** This model allows the patients to know by themselves, their level of asthma and how to avoid the asthma attack. Most of the works regarding asthma have been done for adults. But few work has been done for age group of children (15 to 21).

**Application:** This system assesses the patient's asthma level and categorizes them. This analysis allows patient's self management of asthma to live asthma-free life.

**Keywords:** Asthma, COPD, level-based System, Decision tree, patient's self-management.

#### 1. INTRODUCTION

Since asthma is a chronic disease, it requires continuous medical care. Different levels of asthma need different methods. Many patients are not able to afford the time and the cost for their health. This makes their health condition down.

Most of the works regarding asthma have been done for adults. But few work has been done for the teen age children. This group have the risk within their house and educational environment. This system assesses the patient's asthma level and categorizes them. Different patients encounter different stages of asthma with different backgrounds. This analysis model takes different inputs from patients and produces the respective feedbacks.

## **2. EXSISTING SYSTEM**

As for<sup>2</sup> the author builds a tree-based decision model for predicting the asthma severity for children. The model is used as supplement to the asthma clinical guideline practices. It provides predictions for incomplete observations and can be used as stand-alone decision tool. Since asthma is also like diabetes and cardiovascular diseases, it can be prevented substantially by the patient's knowledge of self-management<sup>3</sup>.

By using level-based, the knowledge embedded in the expert, for example doctors, in the form of levels for problem solving<sup>4</sup>. According to the research done by<sup>5</sup> reveals that visiting to an asthma specialist improves asthma outcomes of children. The author developed a telemedicine access which involves real-time audio and video conferencing between the school nurse and students accompanied with the asthma specialist at the hospital. This effort educate the remote parts, where access to specialist is difficult and to make them to manage their health.

According to the research done by<sup>6</sup> the decision making tool can be suggested based upon the rules for asthma. Research done by<sup>7</sup> reveals the rule based approach which is used as the best practice guidelines for pediatric asthma. In this research the data gathering is done from the patients of the emergency ward.

Research done by<sup>8</sup> is an integrated data mining system for monitoring asthma patients in the hospital. This system can predict the chances of asthma attacks and provide proper medical instructions or health messages based on the patient's daily bio-signal records. Research done by<sup>9, 10</sup> is to improve the asthma treatment which was developed to better understand the clinical experts making medical decisions, so as to manage asthmatic patient by assessing their severity. This work gathered data from the patient and assesses the severity of the asthma. Therefore, the authors of the related work felt that it is useful to provide a system to assist asthmatic patients. People of different locations need the expertise occasionally and it is also cheaper as compared to hiring a human expert.

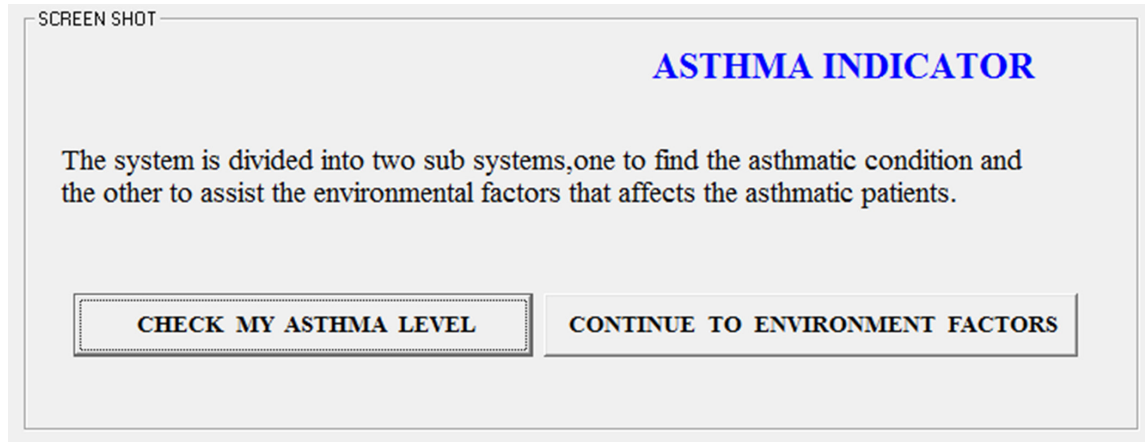
In Malaysian website<sup>11</sup> there are some questionnaires that should be asked to know the severity of the asthmatic patient. In this website a person can input their demographic data to assess their asthmatic level.

## **3. PROPOSED SYSTEM**

This proposed system is designed for people of teen age group. This system can be used at the various locations like home, or even can be placed in hospital as kiosks. It is developed using level-based asthma that manipulates patient's inputs to produce corresponding suggestions accordingly<sup>6</sup>. Data for asthma was gathered from medical practitioners and medical sources<sup>12, 13</sup>.

The system analysis is done to access a person's asthma level based upon certain questionnaires. Most of the systems are developed to categorize the severity of a patient before entering the clinic. However this system provides an alternative method to the patients themselves to access their asthma severity level. As a dry run this system has been developed from visual studio. The system gets the data from the patient about their severity of wheezing, allergies and stores them in a database. Rules are created by analyzing the patient data and it is transformed to the decision tree to make successful decision in the patient's level of asthma So that the system will provide the needed results for the patients. In Figure 1 the system is simple and easily understandable. It ensures the maximum accuracy by making the patients not able to skip the vital questions.

A set of clarity questions of the current asthmatic level is asked to the patient to gain their current health condition. These questions are then processed by the system to produce outputs which are in the form of suggestions to help patient's asthmatic problem<sup>6</sup>. Examples of sample questions are listed below:



**Figure 1: Two parts of the system**

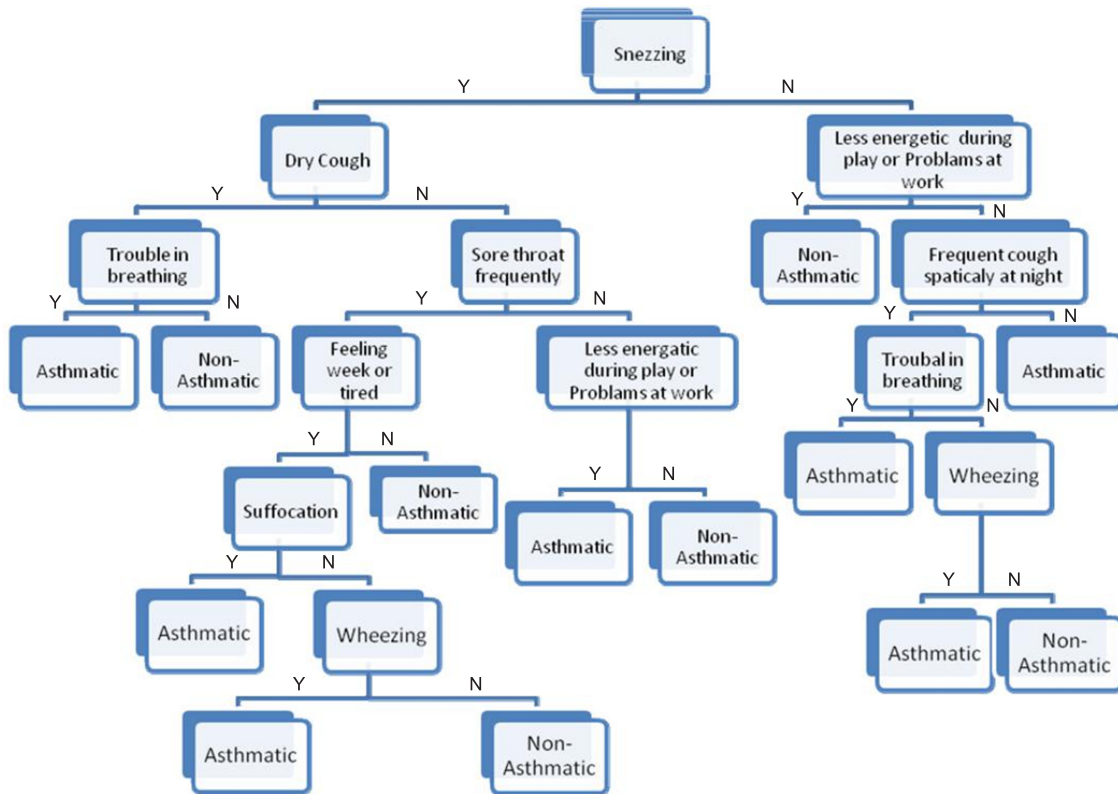
1. Did you wheezed, coughed and have chest tightness at night, on waking or during the day for the past four weeks?
2. Can you able to take part in ALL your normal physical activities?
3. Do you have allergy exposure?
4. Do you have cold or flu?
5. Did you use your inhaler regularly?
6. What is your peak flow level?

#### **4. LEVELS OF ASTHMA**

A level-based algorithm was developed based on C5.0 algorithm tree based modeling technique. The analysis of the clinical data of asthma. These levels indicate the stages of asthma from Intermittent to Severe. Therefore the levels of asthma are divided into:

- (i) **Intermittent-Level 1:** Wheezing and coughing symptoms not more than 2 days a week and the Forced Expiratory Volume FEV1 is normal and this is the first level and is considered as free of asthma symptoms.
- (ii) **Mild-Level 2:** This second level indicates the mild case or safe zone. For a mild asthma patient, the symptom of asthma prolong more than 2 days a week or 2 nights per month. But continuously have their intake of medication which their doctors prescribed them and their lung function should be normal > 80%.
- (iii) **Moderate-Level 3:** For third level of asthma, the symptoms occur daily. Coughing and wheezing may disrupt the patient's normal activities and make them difficult to sleep. In moderate level of asthma, the lung function is normal between 60% and 80%. At this level, the patient has to be more careful to avoid it from worsening.
- (iv) **Severe-Level 4:** In severe cases, if the symptoms occurs more frequent, when the patient is not able to control their asthma and it is causing them to take more reliever, they would have to call their doctor to tell them their asthmatic has worsen. Else, they can immediately go to the hospital for a more thorough checkup.

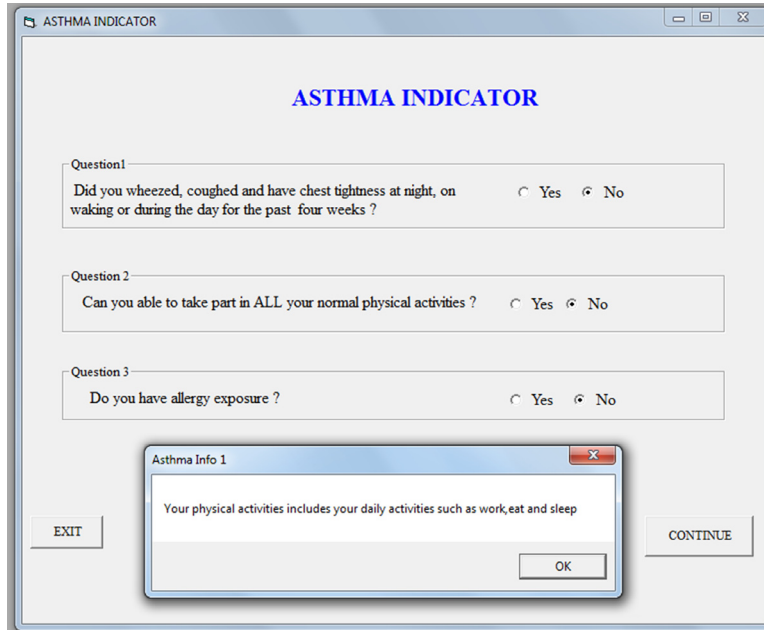
## Decision Tree for Asthma Diagnosis



Based upon the data collected, the if-else condition is used for knowledge representation. It was developed, to categorize the different levels of asthma<sup>6</sup>. The sample representation is:

1. IF (Level 3) OR (Level 4)  
THEN (Asthma not well controlled)
2. IF (take part all activity freely)  
THEN (Level 1)  
ELSE IF (take part all activity with hesitation)  
THEN (Level 2)  
ELSE IF (take part certain activity)  
THEN (Level 3)  
ELSE IF (not take part all activity)  
THEN (Level 4)
3. IF (wheeze) OR (cough) OR (chest tightness)  
THEN (Asthma not well controlled)

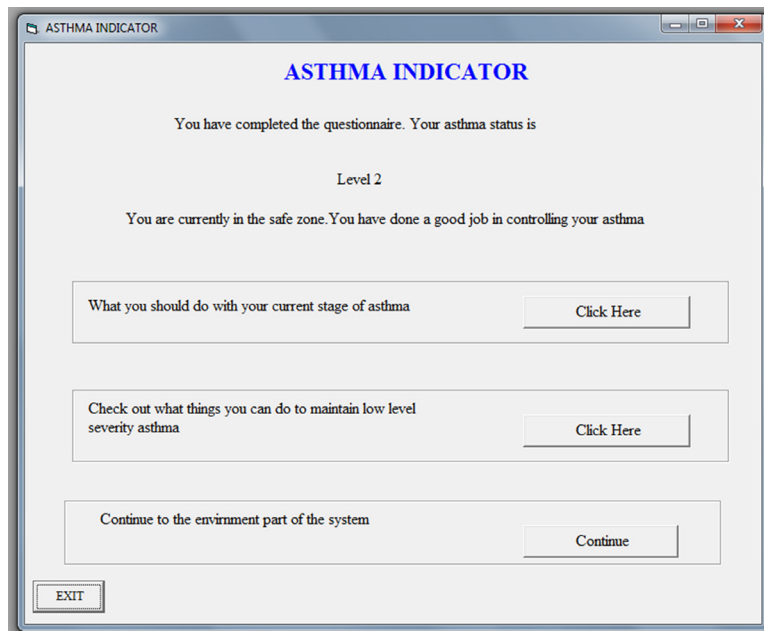
The sample screenshot Figure 2 shows the number of questions to be answered by the patient for accessing his/her level of asthma. The Figure 3 shows a possible output for the patient who has completed the asthma questionnaire. Every output will have the suggestions on how to improve the patient's asthmatic condition.



**Figure 2: Sample screenshot of the system**

In Figure.3 the patient can choose the ‘Continue’ button to know the environmental factors that affect his/her asthma condition. After clicking the button a new window is opened with set of questions regarding their working environment .This makes the patient to know how it will affect their asthma condition. Sample questions below:

1. How is the temperature and the airflow at your educational environment?
2. How is the surrounding of your house? Is it open to chemicals and dangerous substances (i.e.: painting, plastic manufacturing, etc)?
3. Do you have animal allergy (i.e.: poultry farms, pet animals)?



**Figure 3: Level 2 stage asthma output**



Figure 4: Screen shot for the House environment

## 5. CONCLUSION

This system was analyzed and developed using level-based asthma. This system helps asthmatic patients to be more aware of their current level of asthmatic condition and surroundings. This system is meant for the asthmatic patients having zero awareness of asthma to prevent them from getting an asthma attack. This system can also be incorporated on mobile phones which will be more ideal for patients. Through this system, the patients can change their environment and lifestyle that is better suited to their asthma level where they can prevent from an asthma attack.

## REFERENCES

- [1] Shiffman R N. Towards Effective Implementation of a Pediatric Asthma Guideline: Integration of Decision Support and Clinical Workflow Support, *Journal of the American Medical Informatics Association*, 1998, pp. 797-801.
- [2] Farion K, Michalowski W, Wilk S, Sullivan D O, Matwin S. A Tree-Based Decision Model to Support Prediction of the Severity of Asthma Exacerbations in Children, *J Med Syst* 2010, 34(4), pp. 551-562.
- [3] ShaetK. Robustness of a Computer-assisted Diabetes Self-management Intervention Across Patient Characteristics, Healthcare Settings and Intervention Staff, *The American Journal of Managed Care*, 2006, 12, pp. 137-145.
- [4] Negnevitsky M. *Artificial Intelligence*, 2<sup>nd</sup> ed., Pearson: England, 2005, pp. 25-54.
- [5] Bergman D A. The Use of Telemedicine Access to Schools to Facilitate Expert Assessment of Children with Asthma, *International Journal of Telemedicine and Applications*, 2008, pp. 1-7.
- [6] Nee G K. The Development of a Rule-based Asthma System, *International symposium on Information Technology* 2010, 3, pp. 1104 - 1108.
- [7] Porter SC, Cai Z, Gribbons W, Goldmann D A, Kohane I S. The Asthma Kiosk: A Patient-centered Technology for Collaborative Decision Support in the Emergency Department, *Journal of the American Medical Informatics Association*, 2004, 11(6), pp. 458-467.
- [8] Tseng V S, Lee C H, Chen J C. An Integrated Data Mining System for Patient Monitoring with Applications on Asthma Care, 21<sup>st</sup> IEEE International Symposium on Computer-Based Medical Systems, 2008, pp. 290-292.
- [9] Redier H. et. al., Assessment of the severity of asthma by an expert system. Description and evaluation, *American Journal of Respiratory and Critical Care Medicine*, 1995, 151(2), pp. 345, 352.

- [10] P. Ramanathan, Pradip Manjrekar, “Wireless Sensor Network for Monitoring a Patient’s Physical Conditions Continuously Using Zigbee”, Indian Journal of Science and Technology, 2011 Aug, 4(8), Doi no: 10.17485/ijst/2011/v4i8/30900.
- [11] Asthma Council Malaysia, <http://www.asthma.com>, Date accessed: 05/2016.
- [12] Asthma UK, <http://www.asthma.org.uk/index.html>, Date accessed: 06/2016.
- [13] Asthma Canada, <http://www.asthma.ca>, Date accessed: 06/2016.

