# Managing Asthma in Children And Analyzing Best Possible Treatment With Data Mining Approach of Classification

Meghana Nagori , Pawar Suvarna and Vivek Kshirsagar

***Abstract*- Data mining helps end users extract valuable information from large databases. In medical field, practioners have with them mountains of patient data. Any successful medical treatment is based after complete analysis of vast amount of patient data. But practitioners are often faced with the problem of extracting relevant information and finding certain trend or pattern that may further help them in the analysis of treatment of any disease. Data mining is such a tool, which sifts through voluminous data and presents the data of essential nature. In this paper we have focused on managing asthma in children. The approach used is C4.5 algorithm. Our predictive model will help in categorizing of asthma and also suggesting the best possible treatment. The choice of treatment is dependent on severity of the disease. The trick in building a successful predictive model is to have some data in the database that describes what has happened in the past. Classification method is designed to learn from the past successes and failures and then predict the outcome. Decision trees are a from of data mining technology that has been around for almost 20 years. They are increasingly used for prediction.**

## 1. INTRODUCTION

As a great number of data are collected in database, classification analysis has been a very active research subject in data mining field. Data mining provides tool to integrate every method organically, making them show their strong points and hide their weaknesses. We need to apply an algorithm, which can handle all kinds of symptoms of asthma in children.

According to above theory, the article puts forward a method based on classification algorithm using decision tree .In cognitive psychology, human process is divided into different phases, mainly it has primary cognition and second cognition besides cognition has different strategies. When we see complicated cases or things, the most important cognitive process of human is that firstly we classify the things and then further cognize every kind in order to make the complicated things arrived at the simplified aim. In the same manner when we developed the application specific classification algorithm for asthma management all the different symptoms were considered, and then Cognized to simplify the things. After classifying dependent and independent variable we categorized asthma as either intrinsic or extrinsic. Further Categorization yielded in severe or general asthma. Input to the model is in the form of .arff file where symptoms and their best possible treatments are stored.

The next session of the paper shows how classification algorithm can also be further extended in selecting the best treatment by choosing one among the various drugs available. The model follows the procedure of attribute selection in order to build the decision tree. Evaluation techniques are used in determining the accuracy of the algorithm. We conclude our paper with the results obtained by the decision tree in showing the best treatment for childhood asthma management.

Classification is further extended to group as severe or general. In the. arff file format various symptoms like wheezing, coughing, shortness of breathe, chest tightness etc. are entered. Then the algorithm works on the data and outputs the result in the form of decision tree indicating the best possible treatment.

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Author details are as follows :
1. Prof.Meghana Nagori working with Government college of Engineering, Aurangabad
Email: kshirsagarmeghana@gmail.com, Mob. 09850159145
2. Prof.Pawar Suvarna working with Amrutvahini College of Engineering,Sangamner, Dist.Ahmednagar
Email : pawar.suvarna@gmail.com, Mob. 09890824566
3. Prof.Vivek Kshirsagar working with Government college of Engineering, Aurangabad
Email : vkshirsagar@gmail.com, mob.09890603949

## 2. AGEWISE CLASSIFICATION OF ASTHMA

### 2.1 *Introducing the disease asthma.*

Asthma is global health problem and the prevalence is increasing all over the world.
It's a lung disease with following characteristics:-

- Airway obstruction which is reversible either spontaneously or with treatment
- Airway obstruction which is reversible either spontaneously or with treatment
- Airway inflammation
- Airway Hypersensitivity

Asthma is a disease that causes the airways of the lungs to tighten and swell. It is common among children and teenagers. The asthma attack happens when the lungs are not getting sufficient air to breathe and the child may cough or wheeze during an attack.

### 2.2 *Classifying asthma*

According to the age group of 0-4, 4-8,8 to 12 yrs we classify the asthma as intrinsic and extrinsic. The classification is further extended to group as severe or general. In the. arff file format various symptoms like wheezing, coughing, shortness of breathe, chest tightness

etc. are entered. Then the algorithm works on the data and outputs the result in the form of decision tree indicating the best possible treatment. When we are actually able to classify the asthma according to the severity present, In that case following **Fig.2.1** shows exactness for asthma categorization.

Fig 2.1 Grades of asthma

| | Symptoms of airflow | night time obstruction symptoms | Peak expiratory flow |
|---|---|---|---|
| Grade 4 Severe persistent | -Continuous - Limited physical Activity | Frequent | >60% of Personal best |
| Grade 3 Moderate Persistent | .>once a day .attacks affect activity | >once a week | >60%--<80% |
| Grade 2 Mild Persistent | >once a week but <once a day | >twice a month | >80% |
| Grade 1 Mild intermittent | <once a week symptomatic & normal between attacks | <twice a month | >80% |

## 3. ATTRIBUTE SELECTION BASED ON ASTHMA CATEGORY

### 3.1 *Measures for selecting the best fit*

The impurity measure employed in selecting the variable is information gain
Attribute selection involves searching through all possible combinations of attributes in the data to find which subset of attributes works best for prediction. Actually variable selection is difficult and important problem in machine learning. For classification tasks, it can lead to increased accuracy or reducing computational costs. The method is to assign a worth to each subset of attributes. To select the worth, we use C 4.5 algorithm through which we get decision tree.

C4.5 builds decision trees from a set of training data using concept of information gain. It chooses symptoms as an attribute of the data that most effectively splits its set of samples into subsets enriched in one class or the other. Its criterion is the normalized information gain (difference in entropy) that results from choosing an attribute for splitting the data. The attribute with the highest normalized information gain is chosen to make decision.

## 4. DECISION TREE METHOD FOR ASTHMA DETECTION

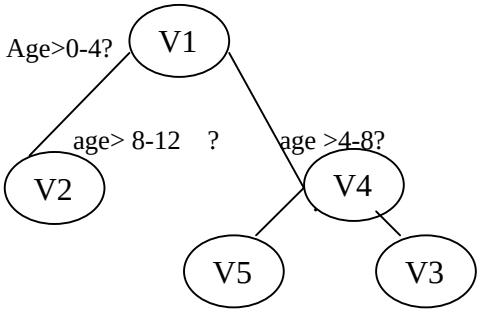
Decision tree is a predictive model which maps observations about an item to conclusions about the items target value. It is also called as classification trees or regression trees.

The C4.5 algorithm follows the following steps:

1. Check for basic symptoms for asthma
2. For each indefinite symptom of asthma as selection attribute V
   - Find normalized information gain from splitting on node V
   - Let v_best be the attribute with highest normalized information gain.
3. Create a decision node that splits on v_best
4. Recurse on the sublists obtained by splitting on v_best and add those nodes as V1, V2, V3 etc.
5. Those will be children of node V which has highest information gain.

Example:
Let calculated information gain for 5 nodes will be as follows:
V1=0.98 V2=0.86 V3=0.5 V4= 0.74 V5= 0.6

Among above the node having highest information gain will be decision node like v1 i.e. node V1 contains maximum information within it.




According to age group as a selection attribute, we got the following results for our experiments done on symptoms table as shown in table 2. It contains the various devices used to control the asthma diseases. These devices in turn do the functioning of controlling and prevention also. This also explains about the MDI i.e. meter dose inhaler, MDI with spacer, dry powder inhaler and important one is the nebulizer. Among all nebulizer plays a very efficient role to control the asthma. It is treated as one of the very efficient & fast treatment for asthma. Actually it is totally dependent on severity of the disease. This table also explains about age wise classification for acute & severe kinds of asthma. It mainly emphasis on preventive regimes included for various age groups. Just by looking at the experimental results we can easily able to understand that according to classification of age mainly in childhood, we can select the appropriate treatment depending upon severity may be for acute home or acute hospital.

Fig 4.1 Devices used in controlling asthma Grades of asthma

| Device | Age | preventer regimes | For acute episodes (Home) | For acute episodes (Hospital) |
|---|---|---|---|---|
| Metered dose inhaler (MDI) | Children>10-12 years spacer is still recommended | For regimes incorporating cromoglyca-te or low dose inhaled steroid with or without long acting beta2 agonist (LA $ß_2$ agonist) | May treat mild episodes | No role |
| MDI with Spacer | Suitable for all ages groups. For smaller children <3year attach a face mask | For all regimes. Recommended for patients on medium to high dose inhaled steroid | Recommended for mild moderate episodes | Suitable for mild moderate episodes |

The advent of Inhaled therapy is known as most important milestone in the history of asthma management. As shown in **Fig 4.1** MDI and MDI with spacer is recommended for the age groups below 10-12 & MDI with spacer is actually applicable for all age groups. Especially Selecting proper device according to age bar is an very important task and if it meant for children's who are less than 3 years then facemask is compulsory for them. For acute home type of attack various treatments are there but steroids are more preferred by the recommended doctors.

**Fig 4.2** shows the use of devices in controlling asthma Grades, which actually explains, and show the experimental results by using nebulizer in fig 4.3 & fig. 4.1In case of asthma, inhaler gives an instant reaction to the attack as with help of it medicines are directly forcefully push into the respiratory system so that within very short time span attack will get covered & patient get relaxed.

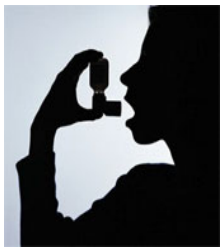


Fig4.2. shows patient with use of inhaler

Fig 4.3 Devices used in controlling asthma Grades of asthma

| Device | Age | preventer regimes | For acute episodes (Home) | For acute episodes (Hospital) |
|---|---|---|---|---|
| Dry Powder Inhaler | May be used above 7-8 years age | For regimes incorporating cromoglycate or low dose inhaled steroid with or without long acting LA $ß_2$ agonist | May treat mild episodes | No role |
| Nebulizer | Suitable for all age groups | Do not recommend purchase | May be used | Recommended for patient with severe episodes or ventilator |

Having diagnosed asthma, Quantify the symptoms over a period of time to access the severity. Based on different observations, following treatment can be suggested.
*Smaller Dose:* Contrast the milligram (mg) concentration of syrups and tablets with the microgram (mcg) concentration of the same drug in the inhaled form.
*Target Delivery & Quicker Action*: Drug is delivered directly to the site of action. Reliever drugs, therefore, act faster.
*Safer:* Smaller dose and thus, much better safety profile than with oral therapy. This is particularly relevant for steroids.

## 6. CONCLUSION

Now in this century, database and Internet technology skill have developed rapidly. Decision analysis and knowledge discovery of the high layer is still immature; as a result these lead to the phenomenon of " information explosion" and "knowledge explosion". Although different fields have researched the classification algorithm problem, every algorithm can't do it with large volume of data along with formation of decision tree. Based on the experiments done we enclosed experimental datasheet which gives best possible treatment for better management of asthma in childhood. Start the regime appropriate by considering grade of asthma & titrate upwards start from grade 2 to grade 4 if asthma is not controlled as shown in fig. 5.1.
Following measures we have to consider while treating asthmatic patients.

*Oxygen:* Hypoxia is due to ventilation-perfusion mismatch. ß2 agonists may increase the mismatch by

attenuating the hypoxic pulmonary vasoconstriction. Hence, oxygen must always be administered.
Along with nebulizer SA ß2 agonists. Oxygen saturation Must be maintained > 91%.

*Hydration*

The child may need more than maintenance fluids initially due to increased insensible losses. Fluids are also required to make secretions less viscous. The amount required reduces when the patient is ventilated. SIADH must be anticipated, especially if the patient is on positive pressure ventilation.

*Drugs Used in management*

Short-acting ß2 agonists (SA ß2 agonists): Saibutamol and terbutaline are similar in their efficacy, actions, kinetics and adverse effects. An isomer of salbutamol (Laevalbuterol), which is now available in the Indian market, is equipotent to salbutamol at half the dose but there is no added advantage as far as side affects or efficacy are concerned. While inhalation is the method of choice, Oral alternative may be justified in children whose symptoms are mild and infrequent. High dose/ frequent nebulization with ß2 agonists may result in hypokalemia. This has been postulated as a cause for the occurrence of arrhythmia and sudden death. Long-acting ß2 agonists have no role in the management of acute episodes. If a child is on a prevent regime containing this class of drugs, there is an additional need for SA ß2 agonists for relief from acute symptoms.

Rescue steroid: Advent of this regime of steroid usage has drastically reduced morbidity and hospitalization in children with acute exacerbation. Steroid therapy directly reduces inflammation and also induces expression of ß2 agonists receptor. Rescue steroids take about 6-8 hours to document an effect, irrespective of route of administration and in situation assessed to be moderate to severe, it is justified to initiate usage early. Underuse of steroids has been incriminated in fatal cases. Oral prednisolone is the best option. Rescue therapy used for 3-7 days has no contraindication and adverse effects with such usage are insignificant. No tapering of dose is necessary. Parenteral steroids do not confer any advantage in an outpatient setting may be used in hospitalized children who are severely distressed, drowsy or unable to retain oral medication. High dose inhaled steroids are under trial for their role as rescue agents and some studies have reported encouraging results.

*Ipratropium bromide*: Inhaled ipratropium may add to the bronchodilator benefits seen with inhaled ß2 agonists; but is less effective when used alone. Usage may be limited to 24-48 hours to minimize incidence of atropine-like side effects.

*Aminopalline:* Aminophylline still finds place in the management of acute severe episodes in award / ICU setting. Improved diaphragm contractility and mucociliary clearance may be beneficial effects. The risk for adverse effects in high, especially in those who are on long acting theophylline as a preventer drugs and a loading dose must be avoided in such patient. A calculated intravenous drip rather than a bolus dose is a safer option.

Fig 5.1 Best possible treatment based on grades of asthma

| Asthma Grades | FIRST CHOICE | OTHER OPTION |
|---|---|---|
| GRADE 4 Severe persistent | Severe persistent Medium to high dose Inhaled steroid +LABA(Formational Salmeternol) If needed Add oral steroid | *** |
| *GRADE 3* Moderate, Persistent | LABA* or Medium dose Inhaled steroid** If recurring severe Exacerbation Medium dose in haled steroidLABA* | Low / medium dose steroid + Leukotriene receptor antagonist / SR theophylline* |
| GRADE 2 Mild persistent | Low dose inhaled steroid | |
| GRADE 1 Mild intermittent | No Daily Medication | |

*For children above 5 years only
**For children below 5 years
***Evidence to date dose not support using a third long-term control medication added to inhaled corticosteroids and long acting inhaled ß agonists in order to avoid using systemic corticosteroid therapy.

**Note:**

At every grade of severity acute episodes should be managed with reliever drugs.
If a trail of an add-on treatment is ineffective stop the drugs (or in case of increased inhaled steroid reduced to the original dose).

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