



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
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A Child's Journey through Medicine

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Introduction

For centuries children have experienced illnesses. Throughout history technology has made advances that have enhanced the quality of life for humans especially for children. Some diseases that once had a high mortality rate are now non-existent; for example, vaccines are used to prevent the disease from attacking the body. Families did not have access to doctors or medicine as they have now in our society. However, with all of the technology available there is still a need to educate people on illnesses that affect us today. In 2002 a survey showed among racial and ethnical groups, Puerto Ricans had the highest rate of lifetime asthma at 196 per 1,000 people. Mexicans had the lowest rate at 61 per 1,000, for non-Hispanic Blacks and Native Americans 25% were diagnosed with asthma over their white counterparts. Females diagnosed with asthma were 7% greater than males. Among children ages 0-17 the male would most likely be diagnosed with asthma at a rate of 139 per 1,000. One of the most prevalent illnesses that affect millions of people is asthma. Asthma affects the lungs thus inhibits a persons breathing.

The unit will (a) discuss what asthma is and who it affects, (b) discuss the drug delivery systems for treating asthma, and (c) correlate how asthma affects the respiratory/circulatory system with use of medicine. The unit will be designed for students in grades 4-6. It will include content, lesson plans, reading list, teacher resources and bibliography. Teachers can utilize this unit to familiarize students about the seriousness of asthma. Students will know how the illness occurs, how it can be treated and maintained.

I'm a fifth grade teacher at East Rock Magnet School. Our school has approximately 800 students, from K-8th grade. We have two full-time nurses. Our population is comprised of Special Needs Students. We have classes with handicapped children. Some of these children are on various medications for seizures, and upper respiratory conditions. There are also a few who have tubal feedings. The students at East Rock are familiar with these children. It's commonplace for our students to interact with them. Some of the children are able to be mainstreamed into regular classes. I feel it's important for the others to gain knowledge and an understanding of their medical conditions.

Students work in their classrooms as volunteers. They need to also know what the nurse's responsibilities are to these children. We also have a large percentage of non-disabled students who also have medical conditions. A large percentage of them have asthma. Their classmates must be informed about asthma and

what to do in case of an emergency, or to prevent an attack. They need to know what the symptoms are, the types of medications that are available, and the most frequently used medications used by students at East Rock School.

The human body is part of the fifth grade science curriculum. In my classroom there are regular and special education students. The students are taught the same curriculum with modifications included in the subjects the students have difficulties with.

This curriculum unit is a journey through medicine that affects children in correlation to the illnesses and diseases that are prevalent among children in the United States. The unit will be designed to teach students Life Science, Ecology, Bio-Medicine, and Engineering. Science will be integrated with reading and language arts. The teachers have limited time to teach science in isolation. The Cross-Curriculum approach is an effective way to cover the various aspects of the fifth grade curriculum.

The students will experience a variety of activities that relate to human physiology and their functions. Working with the school nurse with hands-on demonstrations will prove to be very helpful. They will create graphs and charts after testing their heart rates and blood pressure. Experiments regarding the environment will be conducted by students working in cooperative groups. The students will conduct a survey of the student body. There will be questions created that relate to asthma and medications consumed by students. The research project discusses the drug delivery system for asthmatics and other conditions discovered through the survey completed by students.

Rationale

Teaching this curriculum unit will include background information in science, hands on activities, math lessons, reading, and writing activities. The unit will be taught as part of our fifth grade science curriculum. Our curriculum requires we teach the human body. I will focus on the respiratory and circulatory systems. The students will learn and have hands on demonstrations for the various drug delivery systems for asthma in correlation with our school nurse, using nebulisers, spacers and recognizing the differences.

The students with our school nurse will test heart rates.

The objectives for this unit are:

- The students will learn the identification and functions of the circulatory and respiratory systems.
- The students will identify symptoms of asthma.
- Students will be able to identify different drug delivery systems children use for treating asthma.
- Students will have knowledge of the most prevalent illness with children in the U.S.
- Students will be able to understand biomedicine and engineering.

Strategies

The curriculum unit has a variety of teaching methods, such as reading and answering questions, class discussions, or hands-on activities. My teaching strategies include a combination of reading, whole group instruction, small groups for activities, small groups for research projects, and writing. For whole group instruction use of visual aids (pictures of the lungs and heart) will be presented with an introduction to asthma.

During whole group instruction the teacher can read aloud; this ensures that students who are limited in their reading ability will be included in lesson. Small group instruction will allow for further explanation according to reading ability. The high group can be introduced to more technical functions of the lungs and heart. The low group can be asked to draw the organs or create them out of different materials along with the art teacher.

Research projects will involve students finding information about biomedical technology for common illnesses in infants, toddlers, school age and adolescents. Each group will have (3) students. Each group will be assigned a different age group. Students will be paired according to ability. Students with low, middle, and high abilities will be grouped together. Students help one another and each person brings his/her positive attributes to the project.

Background Information

Asthma is one of the most common chronic medical disorders. It affects one in ten of the population. For a small minority of the population, asthma has become a severe lifelong problem. It is a disorder of the breathing tubes. The bronchi are a series of branching tubes in which air is carried from the main windpipe to lung tissues. Oxygen gets absorbed into the bloodstream. In asthma inflammation occurs in the lining of the bronchi tube. It becomes swollen and narrowed. As a result less air passes through the tubes, therefore breathing becomes more difficult. Coughing and breathlessness develops, wheezing noises are heard because the air is traveling through narrowed tubes. Asthma affects almost five million children under the age of 18 in the United States. From 1980-1998, the incidence of asthma has nearly doubled.

Over 17.3 million Americans were affected by asthma in 1998. Five thousand fifty deaths occur from asthma each year in the U.S. Asthma requires daily treatments, however many patients do not follow the regimen given to them by the doctor. Deaths can be prevented in most patients if they would follow the script. Statistics from the American Lung Association have found that asthma is 26% more prevalent in African American children than in Caucasian children. This is one of the reasons for high absenteeism among school children. Approximately 10 million children are absent from school on a yearly basis. Asthmatic people have an abundance of restricted days of activity each year. The cost from this illness has exceeded four million dollars per year.

Asthma creates a heavy burden on the health care community. Approximately over 8.7 million prescriptions are written for children under the age of 18 per year. Visits to the emergency room for children under 15 have reached 570,000 yearly. There were 170,000 hospitalizations for asthma in 1995. The cost for asthma treatments were \$387 million dollars. There are 3 million children who visit their physicians due to asthma.

In order to diagnose asthma in children, a detailed history of symptoms and a physical examination are extremely important. Diagnosing asthma in infants is very difficult. Under diagnosis and under treatment are problems in this age group. Childhood asthma is a disorder with genetic predispositions and a strong allergic component. Approximately 70-80 children with asthma have significant allergies.

Lungs

The lungs fill most of the thorax. The right lung is larger than the left. The heart takes up more room on the left side of the lung. The lungs are held in an inflated state by surface tension. It is created by fluid produced by a thin lining around the lungs and chest wall. This holds the lungs open. When the chest expands the lungs are pulled out and the air is taken into the alveoli. As the body exhales the rib muscles relax gradually. If the body relaxes completely, the lungs will spring back rapidly.

When air gets between the lungs and chest wall the surface tension breaks and the lungs collapse. The lung is connected to the trachea by the bronchus and to the pulmonary vessels. In normal lungs, oxygen from the air is transferred to the capillaries that surround each alveolus. A person who has a lung disorder experiences air constriction. Here are some useful definitions:

Pneumonia - air sac are filled with fluid.

Emphysema - the walls of the air sacs break down.

Asthma - muscular walls of the bronchioles are narrowed.

Bronchitis - bronchus fills with mucus.

Heart

The heart is a large muscular organ. It is located in the middle of the chest area. The vessels leading into the heart are the aorta, superior vena cava, pulmonary arteries and pulmonary vein. The entry and exit to different chambers of the heart are projected by valves: pulmonary valve, tricuspid valve, mitral valve, and aortic valve. The four chambers of the heart are the right atrium, left atrium, right ventricle, left ventricle and the inferior vena cava. The valves ensure that blood travels in one direction through the heart by preventing backflow. Two or three leaflets close off when the blood has passed through.

The mitral and aortic valves control the flow of oxygenated blood on the left side of the heart. The tricuspid and pulmonary valves control the passage of deoxygenated blood on the right. The atrium (left and right) are the two low pressure pumping chambers of the heart; they pump the blood to corresponding ventricle chambers. The coronary arteries supply the heart muscle with the oxygen and nutrients it needs. There are three main arteries. Two parts are on the left artery and one part on the right artery. The arteries are like pipes. They carry the blood outwards from the heart to the tissues. The veins carry blood on the return

journey.

Common Asthma Triggers

Many common substances can stimulate or aggravate an asthmatic attack. Included with common substances are environmental factors. The following are a list of environmental triggers and the conditions associated with them.

Smoke: Exposure to any type of smoke such as cigarette and second-hand smoke, wood, coal, leaf burning, industrial waste, kitchen fires, and chemistry labs.

Animals: Classroom pets, family pets, (especially cats and pets with long hair) and birds.

Dust Mites: These are microscopic organisms which are found in bed linen, pillows, drapes, stuffed animals, carpeting, and upholstery.

Molds: They can be found in several places like showers, restrooms, indoor swimming pools, basements, leaky roofs, classroom aquariums, plants, biology and microbiology labs, and damp areas which materials are stored. These molds and spores are also found in newspapers, old books, exercise and athletic mats.

Weather: Exposure to cold air or high humidity.

Pollens: When the children are outside having recess, transportation to and from school, open windows, cut flowers, grass, weeds, flowering trees and plants, gardens, nature walks, seasonal and holiday decorations.

Odors/Fumes: Cleaning solutions, perfumes/colognes, bio-chemical labs, paints, fumigation chemicals, traffic fumes, room deodorizers, art supplies, roofing tar, sealants, and automotive shops.

Foods: Specific foods and additives such as peanuts/peanut oil, soy, eggs, dairy products, fish, wheat, sulfites (these are found in dried fruits, shrimp, and wine), MSG and food dyes.

Insects: Such as cockroaches are found in infested buildings, kitchens, garbage, leaky faucets and pipes.

Aerosol Spray: Hairsprays, deodorants, disinfectants, janitorial supplies, cooking sprays, art supplies, overhead transparencies and cleaning solutions.

Miscellaneous: Acid reflux, sensitivity to aspirin, non-steroidal anti-inflammatory medications, and (NSAIDS) beta blockers.

Infection: Colds, sinusitis, upper respiratory tract infections, influenza, and respiratory syncytial virus (RSV).

Emotions: Crying, laughing, and stressful situations.

Exercise can also cause an asthmatic episode/attack. When breathing becomes intense water loss occurs. Water loss cools the lung's moist lining in which the temperature drops in the body. It begins a process of constricting the muscles around the airways and inflammation within the airways occurs.

Exercise induced asthma can happen during an exercise routine or minutes of vigorous activity. It reaches its peak 5 to 10 minutes after activity has stopped. It may resolve in 20-30 minutes. Among Olympic athletes 10% have asthma. Despite their condition many have won medals. Proper asthma management is the key to success.

Asthma and allergies are closely related. There is an estimate of 40-50 million people who suffer from allergies. This figure comes from the National Institute of Allergies and Infectious Diseases. Allergic rhinitis, more commonly known as hay fever is the most common of all allergies. Some allergy symptoms are, sneezing (which can last for long periods of time), clear watery nasal discharge, nasal congestion, itchy nose, eyes, ears, and throat. These symptoms are similar to an upper respiratory infection. Aches and fever that come with a cold rarely occur with allergies.

For many people allergies are seasonal, for others it occurs year round. If people have both asthma and allergic rhinitis this can trigger asthma symptoms. Approximately 50% of asthmatic adults and 80% asthmatic children have allergies that trigger their asthma. An estimated 20% of all children with allergic rhinitis will develop asthma in 8-10 year period. Six times as many people with rhinitis allergies will likely have asthma. However, not all allergy sufferers have or will develop asthma.

Allergy treatments are usually the following types of medication: antihistamines, decongestants, steroids, nasal sprays, and non-steroidal nasal sprays. Popular medications are Benadryl, Zyrtec, Claritin, Allegra, and Tavist which are anti-histamines. Decongestants used are Claritin-D, Allegra-D, Contac, Dristan, Sudafed-Plus, and Actifed. Immunotherapy or allergy shots could be beneficial for people with allergies.

Treatments for Asthma

Asthma is commonly treated by inhalers. Use of inhalers allows the medication to be taken in smaller doses. Tablets or injections may take longer to absorb into the body. The inhaler goes straight to the lungs. There are two types of inhalers used for drug delivery, aerosol and dry powder. The most commonly prescribed is the aerosol inhaler. In some cases children and older adults are using the drugs for asthma with a nebuliser. This is a machine which converts the drug into a fine spray. A mouth piece accompanies this machine; the nebulizer makes it easier to breath in the medicine.

Treatments for asthma come in two basic types: relievers and preventers. Reliever treatment drugs relax muscle spasm in the bronchial tubes. These are called bronchodilators. Asthma medications are divided into five categories: inhaled bronchodilators, anti-inflammatory, systemic bronchodilators, systemic corticosteroids, and leukotrine modifiers .

Inhaled bronchodilator medications are highly effective. They open the airways that become narrowed by asthma. The medication comes in metered dose inhalers which can be in aerosol or powder form. Use of tablets, syrups and nebulizers are also delivery methods. Tablets and syrups are prescribed for very young children. It takes approximately one hour for these types of medications to work.

Children with mild asthma in most cases will only need to use the inhaled bronchodilator. For children, its effectiveness is high. The medication goes to the targeted area very quickly. There are only a few severe side effects. It takes 5-10 minutes for the medication to take effect. Powdered inhalers are most useful for children. The child just breathes in the medication which activates the device. There really is not a need for the child to be coordinated in order to use the inhaler. The side effects for using bronchodilators are heart rate increase, trembling and headaches.

Many patients, especially children, have not always followed the steps for using inhalers and the drug becomes ineffective. A delivery device called a spacer is prescribed along with the inhaler. The spacer reduces the amount of drug that gets swallowed instead of being inhaled. Spacers allow the metered dose to be sprayed into the container first; the amount given is usually 6 to 16 ounces in size. The patient can then receive the dose directly into the lungs. Proper usage increases from 50-100%.

Nebulizers are quite useful for very young children with asthma. It can also be used for patients who have a severe asthmatic episode. Nebulizers can also be effective for routine treatments. The machine allows medicine to become a liquid; the child inhales it through a mask or mouthpiece. It's important to clean the machine properly. It must be cleaned on a daily basis to prevent contamination.

Nebulizers have many health professionals concerned about long term usage. Large doses are delivered which can increase side effects. A condition called hypoxia (lack of oxygen in the blood) can develop which could be fatal.

Nebulized steroids in high dosages can cause the eyes to develop cataracts. The central nervous system can be affected and also an increase in blood pressure.

The following are reliever drugs: Ventolin or Airomir (salbutamol) and Bricanyl (terbutaline). As the muscle spasm relaxes it brings immediate relief due to tightness in the chest which hinders ones breathing.

The reliever drugs are taken when needed. Some doctors may prescribe them to be taken regularly. Preventer drugs prevent or suppress the inflammation that is the underlying problem. These drugs are inhaled steroids- Becotide or Pulmicort, Tilacle (nedocromil) or Intal (cromoglycate). Cromoglycate (Intal) known as cromolyn has been used for 30 years. It has very few side effects. These medications are used most often for moderate to severe asthmatics. The anti-inflammatory drugs are used for daily management of asthma treatments. The National Heart, Lung, and Blood Institute recommend the use of these medications for children with mild intermittent, moderate, and severe asthma. The medications are assured to be safe and effective for long-term use.

Systematic bronchodilator medications are effective. However, the side effects can be uncomfortable for the patient, but are not life threatening. The medications come in capsules as released tablets. Their effectiveness lasts from 12-24 hours. This is useful for asthma symptoms that occur at night. They are also utilized for daily treatments for controlling asthma symptoms and are not normally prescribed for young children. The doctor checks blood levels on a regular basis.

Systemic corticosteroid medications can reverse severe asthmatic episodes. They are highly effective but can have serious side effects. This can occur after long usage of the drug. The drugs usage is limited to severe or chronic asthmatic episodes.

Corticosterios is a hormone produced by the adrenal gland, which is found in the human body. When children

are having an attack, allergy or asthma related, the adrenal gland responds by producing 10 times more corticosteroids. This helps the body to control the asthma. When bronchodilators are not able to control asthma, corticosteroids are given as an additional treatment. The medication is given for a 2 week period. Long-term use should be avoided.

It is extremely important that the treatments are taken on a daily basis, as prescribed by the doctor. The drugs are fairly safe with side effects being rare. Many patients especially children haven't always followed the steps for using the inhaler. The drug becomes ineffective. A delivery device called a spacer is prescribed along with the inhaler. The spacer reduces the amount of drug that gets swallowed instead of being inhaled.

In some people acute asthma occurs. The sign that indicates this problem is the failure of the usual treatment of asthma. A peak flow meter measures how much air is going through the bronchi tube. Any score under 150 is an indication that the patient may be in a crisis. The peak flow meter is a vital tool for all asthmatics to have in their home. Using this device can help in preventing asthma attacks before they happen. The peak flow meter comes in different shapes and sizes. It's a plastic tube with a mouth piece at the end of it.

There is a mechanism inside where a small pointer moves along a scale. The movement occurs when patient blows into the tube. The scale indicates the amount of air that is expelled from the lungs. When air is expelled it is measured in liters per minute; it is called the peak expiratory flow (PEF).

The way you know how controlled your asthma is, you must use the meter. There are 3 zones your score will fall into.

1) The green zone means your asthma is doing well.

- No cough, wheezing, chest tightness or shortness of breath during the day or night.
- Can do usual activities.

The range on the scale is 280-350 for children. The patient blows into the meter 3 times. The best of the three scores is their peak flow at 80%-100%. The peak flow meter should be used for a period of one week in order to have the correct peak flow score. Each person's score will be different.

2) The yellow zone means your asthma is worsening.

- Coughing, wheezing, chest tightening and shortening of breath.
- Waking up at night due to asthma.
- Can do some, but not all usual activities.

The range on the peak flow scale is 175-275 for children and the peak flow average is between 50%-80%.

3) The red zone means you have a medical emergency.

- Trouble walking and talking due to shortness of breath
- Lips or finger nails are blue.

The range on the peak flow scale is 150 and below for children and the peak flow average is 50% or less.

If asthma is left untreated and becomes acute, death can occur but rare in most cases. Untreated asthma can also lead to lung damage. Patients with asthma can develop chronic obstructive pulmonary disease (COPD) and/or emphysema.

Genetics of Asthma

People develop asthma because of an interaction between the genes they inherit and the environment in which they live. Researchers are studying families in different ethnic and geographic communities to identify which genes are related to asthma. So far multiple genes appear to be involved. Genetic studies have also revealed differences in the way patients respond to medications. Understanding the genetics of asthma should provide clues to preventing the disease and help physicians select the most effective treatments for individual patients.

There has been an ongoing debate on whether asthma is caused predominantly by a genetic factor or the environment in which one lives. Several studies have been conducted, and although research shows support in the area of genetics, research does not support it as the one and only cause of asthma.

In Arizona a study took place involving 344 families. The researchers conducted the study to see if asthma was passed on to the children from their parents. In families with parents not having asthma, the percentage of children with asthma was 6%. One parent with asthma the percentage was 20. When both had asthma the number of children with asthma was 60%. This shows a significant connection between genetics and asthma. When studying other conditions and genetics twins are better candidates for conducting research. Identical twins have the same genetic makeup; however, fraternal twins do not. In 1995 two researchers Sarafino and Goldfeder did research to support the theory that both genetics and the environment were significant in the cause of asthma.

Three hundred twenty-five pairs of twins were studied out of eighty-four pairs of twins at least one twin had asthma. These sets of twins became the focus of the study. The eighty-four consisted of 39 identical twins and 55 fraternal twins. Of the 39 pairs of identical twins, 23 pairs both had asthma (59%), of the fraternal twins only 13 out of 55 (24%) both had asthma.

The experiment proved an interrelationship between the environment and asthma. Solely based on genetics all the identical twins both would have asthma. If asthma were only caused by the environment, identical and non-identical twins would have the same chances of developing asthma. The research found instead that we

inherit the tendency to develop asthma. Asthma occurs when exposed also to environmental triggers of asthma.

When asthma runs in families the genetic factor is a stronger contributor to asthma when it does not run in families genetic factors are not as dominant. The environmental factor then becomes the domineering factor. For certain we know that there is not one particular gene that causes asthma. Instead we know that several genes interact with one another, this making people more susceptible to asthma. People can have genes that predispose them to asthma, and yet they never acquire any of its symptoms.

Genetic research can be very complicated because of the 3 following factors: interactions between genetic predisposition, environment and gene interactions. Progress is being made in this area. Some of the researchers have made claims to have found certain genes to be one of the causes of asthma.

Researchers from the University of Southampton conducted a study called Respiratory Cell and Molecular Biology. In this study they found a connection between a specific gene and asthma. This gene is called ADAM33. It is located on the 20th chromosome; it is expressed in the lung and muscle cells. The ADAM gene according to researchers relates to asthma when it causes the airways to over respond and constricts the airway passage.

Another experiment conducted by Zou, Young et.al; found several other genes on specific chromosomes that affect a person's susceptibility to asthma. The experiment was called Microarray profile of differentially expressed genes in a monkey model of allergic asthma. The monkey had allergies and induced asthmatic attacks. They were given treatments that challenged their breathing. The monkeys were given an antigen or interleukin-4. These treatments induced asthmatic attacks. Their lung tissue was then collected after 4, 18, and 24 hour intervals and the tissue was analyzed. The samples were compared to monkeys that were not given the treatment who were normal.

This experiment allowed them to use a new technique that is used for analysis. They were able to view cDNA on microarrays. cDNA is special because it only contains introns (which is protein coding information) this lead to identifying the gene. Microarray technology helps gain insight into global gene-expression profiles in asthma. The profiles lead to identifying asthma-associated genes. Microarrays are a gene chip technology. The cDNA are in sequence and seen on high density glass slides. Then the sequenced genes are hybridized to cDNA probes which come from RNA-contains both exons and introns which coded and non coded information.

The two sets of cDNA probes can be labeled with two different fluorescent dyes. This gives a clearer view of the genes. Microarrays can detect the thousands of levels of gene differential expressions simultaneously.

During an asthma attack different genes are expressed in airway constriction. In the experiment with the monkeys, the scientist caused any genes that were related to asthma to be expressed. The genes appeared different than the controlled monkey group.

From the study gene expression provided a large scale profile. Microarrays with real-time PCR (Polymerase Chain Reaction) which is a quantity of DNA that is amplified by repeated sessions of replication and separation; proved to be a powerful tool for identifying and validating different types of genes which are expressed in a disease model.

History of Asthma

Asthma was not always viewed as a disease. During the 17th century there were two English physicians, Thomas Willis and Sir John Floyer, who argued and defended their findings about asthma. They believed that asthma was different from other breathing disorders of their time period. It was noted that asthma was a specific form of disordered breathing which had to be treated differently from other forms of breathlessness.

By the late 19th century, physicians believed asthma was a disease which had a specific set of causes, clinical consequences and requirements for treatment, despite the various individual experiences.

Asthma is a word derived from the Greek word *aazein*, which means sharp breath. The physician Hippocrates used the term to acknowledge it as a medical condition. He believed that the spasms were symptomatic to people who worked for a living as tailors, anglers, and metal workers.

An Italian physician, Bernardino Ramazzini discovered a correlation between asthma and organic dust. Organic dust comes from chemical compounds which are found in molecules. Some chemical compounds found in the organic dust are carbon, hydrogen, carbonates, and carbon oxides. This discovery took place in the 17th century.

Galen a Greek physician concluded that asthma was caused by a partial or total obstruction of the bronchial tube. His findings came six centuries after Hippocrates noted his findings as a medical condition. Some physicians conducted analysis of conditions in the human body. A Jewish rabbi named Maimonide wrote an analysis which described the prevention, diagnosis and treatment of asthma.

Drug Delivery (Asthma)

The following are systems used for delivery of medications for (asthma attacks and maintenance of attacks) injections, nebulizers, spacers, spray inhalers and tablets.

Spray inhalers/spacers-a group of people from an agency called the Cochrane Airways Group conducted a study. They reviewed the clinical trials that compared the delivery of the same beta agonist used with nebulizers and also with inhalers. The study found 16 trials, these trials were relevant.

The total population of patients was 686 children (two years of age and up) and 375 adults. The assessment of the delivery method was by the number of hospital admissions. The length of the hospital stay in the ER was also measured. Pulse rates, respiratory rates, lung functions, tremors, blood gases were checked as well as the use of steroids. The results of the study concluded that the rates for hospital admissions were similar in the groups of patients that used nebulizers and inhalers. The outcome of the study showed that metered dose inhalers with spacers were equivalent with medication delivered with nebulizers.

Current delivery systems being utilized are the following: Aero Chamber, Optichamber, InspirEase, and MicroChamber. The Aerochamber delivers the medication to the recesses of your lungs where the restriction of the airways has occurred. The chamber allows the aerosol to slow down and can mix with the air. The size

makes it more convenient for road trips and in the home. It can be washed and reused on a frequent basis. It's durable and lasts for a longtime.

The Optichamber is a new holding chamber. Through clinical trials it has proven to be effective in allowing the medication to be broken down into smaller particles. The medication therefore reaches down into the peripheral airways more efficiently. It has 3 different size masks to meet individual needs.

The Optihaler has been designed differently from other spacers. It makes this spacer unique. It allows the medication to actively mix with the air. The particles are directed away from the mouth therefore the particles mix with the air in several stages. As a result of this process the particles that are not useful are filtered out. An increase in the delivery of the drug successfully occurs. The Optihaler has caps for each opening; it keeps the device from becoming contaminated. The Optihaler has been rated by patients as the most convenient drug delivery system for asthma.

InspirEase is a metered dose inhaler. The difficulty with coordination especially among children is eliminated. The metered doses allow for more concentration from the patient to breathe in the medication more effectively. The medication goes directly to the lungs.

The Microchamber is also a metered dose inhaler. It functions the same way as the InspirEase inhaler. The difference in them is that the Microchamber is smaller. It's convenient to use and carry with you.

Pulmicort Respules (nebulized therapy) is an option for children 12 months to 8 years old. The nebulizer has advantages for children. The first being it does not require good coordination skills; the next is the convenience during an acute attack. Lastly it is easy to use when children are sick or sleeping. The Pulmicort Respules is delivered by a jet nebulizer. It utilizes air pressure to turn the medication into a mist. The mist is inhaled through a face mask or mouth piece. It is a corticosteroid inhaler. It has been approved for children as young as twelve months in the United States. This medication is not a quick relief medication; it can not be used solely alone during an asthma attack. This product is manufactured by AstraZeneca.

There has been a breakthrough in medications which treat allergy-related asthma. When dangerous substances are inhaled the airway passages tighten and become inflamed. The body reacts this way in order to prevent the substances from traveling too far into the lungs.

When someone has asthma the airways become too responsive to wrong things. Allergic related asthma can be caused by excessive responses to certain trigger make excessive antibodies (IgE) to dust, mold, and pollen. The extra antibodies IgE make people allergic to the triggers. IgE can recognize the triggers which begins the whole process of an asthma attack. The medications used for treatment only relieve symptoms or bring down the inflammation and tightening in the airway passages.

The new medication is targeted at stopping the asthma triggers before they can act as triggers. The new medication is called Xolair (omalizumab). Its development specifically targets the excess antibodies.

Classroom Activities

The following lesson plans are designed for 60 minutes. However, if more or less time is needed; adjustments can be made by the teacher.

Lesson One: What is Asthma?

(Reading and Language Arts 1-2 class periods)

Introduction to lesson: Direct whole group instruction

Materials: KWL chart, Pencils/Paper

Together with teacher KWL chart is completed with students. Teacher will write down student responses then discuss answers.

Questions:

- 1) Do you know what asthma is?
- 2) Does anyone you know have asthma?
- 3) How many lungs does the human body have?
- 4) What types of medications do people with asthma use?
- 5) Is our school asthma friendly?

Each question will generate discussion. A list of the answers will be listed on chart paper.

Lesson Two: Organs Organs Everywhere!

Whole group instruction: Procedure-Teacher gives students a worksheet explaining the functions of the lung/heart.

Teacher reads aloud to class information about the lungs/heart.

Group work - students will draw/label/models of the lungs/heart

Small group - students will answer questions together (teacher made).

Materials - worksheets, visual models of lung and heart.

Lesson Three: Breathe Right

Materials - straws, stop watch, journal notebooks

Working in groups of 2

Procedures:

- 1) Students will run in place for 60 seconds
- 2) Their partner will have the stop watch. Partner gives straw to student when he/she finishes running in place.
- 3) Student closes lips tightly around the straw, then he/she pinches their nose close.
- 4) He/she breathes in and out of the straw for 20 seconds.
- 5) Pinching the straw with one hand allows air to be restricted and the opening becomes narrow.
- 6) Breathe in three more breaths of air.
- 7) Remove the straw and breathe normally.

The students will give written responses as to how it felt not to be able to breathe freely. Class discussion of each groups findings.

Lesson Four: Math - Graphing Surveys

(2 class periods approximately 2hrs)

Materials - students and teacher will conduct a survey for grades K-6, graph paper, markers, questionnaire survey.

Procedures:

- 1) Students in groups of 2 will be given the survey to complete with each class. Twenty students will conduct survey, class size may vary.
- 2) This will be done for each grade level and each class (three classes per grade level).
- 3) The students will tally up their findings.
- 4) Teacher will correlate findings with school nurse.
- 5) Teacher/students will create the bar graph.

The survey will consist of (3) questions:

- 1) Do you have asthma?
- 2) What is the name of your medication?
- 3) Do you take your medicine in school?

Lesson Five: Research Project - Delivery Systems

Materials - Use of Library/Library Media Specialist and Computers

Objective 1: Students will learn about the various types of delivery systems for asthma; Students will work in groups of three; four groups will research preventive medications and the remaining groups will research reliever medications.

Objective 2: Students will learn how the heart and lungs are affected by asthma as well as the types of medications taken.

Lesson Six: The Match Game

Objective: Students will be able to match asthma triggers with the asthma type (environmental, exercise-induced, or allergy related).

Materials - Pictures of dust, mold, trees, flowers, smoke, tobacco, animals, food, etc.

Stop watch or timer.

Procedure: Working in groups of two the students will be given labels naming the types of asthma. Each group will be given the same set of 20 pictures. The students will have 10 minutes to match the triggers with the asthma type. The first team to complete the sets is the winners. You can repeat the game as many times as you would like to play adding pictures to the set. Teachers can make pictures, buy pictures or have students draw pictures as they are introduced throughout the lesson.

Lesson Seven: Lungs

Objective: Students will be able to identify the parts of the lung and its function in the body.

Materials - overhead projector, pipe cleaners, tissue paper, glue scissors, pictures of lungs copied onto transparencies, empty paper towel rolls, markers, plastic baggies.

Procedure:

- 1) The students will learn the parts of the lung through teacher guided lessons.
- 2) The students will build a model of a pair of lungs along with instructions from the art/classroom teacher.

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