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Asthma and the Environment

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High School in the Community

OBJECTIVES: This unit is designed to acquaint the student with the causes, symptoms, treatment and environmental relationship of asthma; and to help the student to better understand how to deal with this problem at school and at home as a day-to-day phenomenon.

GOALS: The students will learn what causes asthma, how asthma may affect growth and development, why asthma has such a negative effect on school work, and how their environment is the most significant factor in this disease. The students will also learn what may be done at home to limit the environmental components which cause this disease.

UNIT PLAN:

INTRODUCTION:

One aspect of the majority of science curricula that seems to be neglected or overlooked in school systems is the study of environmental health. And yet we are generally aware that we are all constantly subjected to environmental interactions with air, water and soil. We absorb an astonishing number of contaminants from the air and water we use, plus many other pollutants derived from soils, that we ingest in the plants and animals that we eat.

I have been interested, especially for the past four years, in the relationship between the city environment and asthma. In my forty years of teaching, I have seen the incidence of asthma increase steadily, especially in urban environments. Since I began teaching at High School in the Community, an urban regional magnet school, I have had a number of students who are severely asthmatic. This condition has detracted from their ability to fully participate in school and in social activities. Asthma has become a severe handicap to a fairly large number of my students.

What is the relationship between asthma, the urban environment in New Haven and socioeconomic status? A significantly higher rate of asthma in urban environments is well documented (Am. Thoracic Soc. Sym., 1996; Bernstein, 1999; Aligne, 1998; Augustine-Reaves and Augustine-Jefferson, 1996). It seems on the surface that

most of my students who suffer with asthma live in older homes and mostly in poorer neighborhoods. What environmental factors cause asthma? How are the age of the home, diet, smoking of parents, and parental income related to asthma?

I see students barely passing in school because of excessive asthma-related absences. Poor performance and poor grades seem to be typical of most of my asthmatic students. But there are a number of them who simply refuse to let asthma stand in their way. They work hard to keep up, but they are in the minority (Taylor, 1997). For most of my asthmatic students, I feel this condition is a major negative factor in their lives. Many of them are angry, have low self-esteem and seem to lose hope, direction and conviction and thus fail to graduate from high school.

The reasons for this are fairly easy to understand, but are not often dealt with directly at school. Every time a student is absent, whether for a long or short period of time, they return to a class that has continued on, leaving the returning student behind. The more severe the asthma, the longer each absence lasts. If a student has mild persistent asthma (JAMA, 1997a), they may be absent two days per week. By the end of week three they have missed one week of school. It is very difficult for a student to get caught up in five or six subjects. Even if the student is able to make up the work, it is still not quite like being there in school. How good are someone else's notes? When do you make up labs? tests? Class discussions cannot be made up, the information developed here always remains second hand for the absent student. Being behind can be profoundly depressing.

Stress itself can cause an asthma attack. We recently had a bomb scare at school. We immediately evacuated the students to another school and held them there until our building was secured. Several students complained of breathing difficulties, and one girl had a full asthma attack complete with wheezing, shortness of breath and an EMS ambulance. If a student feels anxious and under stress because they have been absent and are behind, this may only exacerbate an already bad situation, and asthma symptoms may worsen. Thus students with many absences may inadvertently be bringing more troubles on themselves through stress.

We must remember that at this time of life our teenaged students are young adults and are distancing themselves from their parents as they grow up. They look more and more for support and companionship to their friends. The peer group becomes the dominant social force in the life of a teenager. How devastating it must be to be away (absent from school) from your friends.

Teens with asthma often seem to be on the fringes of social groups. It is hard to be an integral part of a group when you are constantly absent from school and the group. I have observed several students who seem to have a very hard time making friends. And their attendance records seem to indicate that those students who are constantly absent usually have a much harder time making friends. Frustration over social relations often seems to cause asthmatic students to act in a negative, aggressive manner. Asthmatic boys in particular seem prone to disciplinary problems in school, while asthmatic girls often exhibit low self-esteem.

Considering all of these factors together, it must be extremely depressing to be a teenaged asthmatic. And it is easy to become discouraged with yourself if you are asthmatic. This rather easily leads to a feeling of hopelessness. "What's the use? I'll just be absent again next week!" This attitude contributes greatly to low self-esteem and despair. If not encouraged and aided, the asthmatic student often fails to finish high school and does not graduate.

Two other factors come into play here. Asthmatics miss school more often than other students and most are on medications more often than other students. Both of these factors may contribute to a lower level of

academic achievement. At what age does the asthmatic begin to think that they are not quite as bright as other students? I had one young woman student who several times referred to herself as "dummy"! If you think you are not very smart, why try at all? This is another negative aspect of being an asthmatic student.

From the perspective of the patient there are two vital physical issues involving effective medication. First the bronchioles must be relaxed and opened by a bronchodialator inhaler. But this gives only short-termed relief to asthma sufferers. In order to effectively control asthma the patient normally must also take an anti-inflammatory. These anti-inflammatories do not work immediately and need to be taken regularly for a period of weeks to be effective. (JAMA, 1997). Many children need to take an anti-inflammatory on a continuing basis until they are adults. This gives their lungs a chance to grow to adult size with the minimum amount of scarring and the maximum chance of outgrowing the asthmatic condition.

Unfortunately, many children seem to use mostly the bronchodialator and do not have the patience to continue long-term treatment with the anti-inflammatory medicines. This prevents a more complete remission of the asthma, and leads to further frequent attacks. Many inner city children are in charge of their own medication. In one study, over one half of the children nine years or older supervised their own medication, much of which turned out to be over-the-counter inhalers, such as Primatene Mist (Eggieston *et al* , 1998).

Medications taken by asthmatics have very definite side effects. The most common bronchodialator is albuterol. Its side effects may include tremors, nervousness, excitement, insomnia, hoarseness, cough, increased difficulty breathing, rapid heartbeat and palpitations. The anti-inflammatories in most common use are the corticosteroids.Their side effects include oral thrush, hoarseness, cough, impaired growth in children, adrenal suppression, impaired bone formation/resorption, cataracts, bruising, dermal thinning and behavioral disturbances. The most common non-steroidal anti-inflammatory is Cromolyn. It can prevent asthmatic bronchiole spasms, and help reduce inflammation. Its side effects include irritation of the throat and air passage, bad taste, hoarseness, cough, increased difficulty breathing, wheezing, sneezing,stuffy nose and lightheadedness.

Of course not all of these symptoms are present in each patient. Children under medication for asthma cannot help but feel sub-par or under the weather part of the time just from the effects of the medicines. If adrenal suppression occurs, the frequency of urination will change. Fluid retention usually leads to puffiness of the face and other body parts. Impaired growth is another serious concern for children taking corticosteroids.

Other bronchodialators have side effects very similar to albuterol. The main point is that all of these medicines may make patients, especially children, feel rather poorly. It is no wonder that children are often reluctant to keep on a regimen of medication, especially once they are past the initial asthma attack. My grandson gets "dull" when he is on constant anti-inflammatory medicines. He uses *Ginkgo biloba* extract at those times to combat this feeling of mental dullness.

This unit will explore this situation and attempt to offer some answers and encouragement to those afflicted students. Perhaps we will be able to explore what is known about dealing with asthma attacks, and in some small way this will allow these students better access to school and less time being incapacitated.

ASTHMA: The Basics

Just what is asthma? It is a "disease that is characterized by increased responsiveness of the trachea and bronchi to some type of trigger that causes widespread narrowing of the airways that changes in severity either as a result of treatment or spontaneously." (Kupstas Soo, 1999). This definition is not entirely clear. Let us explore this in more detail.

Asthma is an increased response by the trachea and bronchi to "some type of trigger"? What are these triggers? In a word - irritants, mostly foreign proteins or allergens (Kovesi, 1996; 1996a; Asthma Triggers, 1999). The body's response is an immune system allergic response. White blood cells, including lymphocytes and eosinophils, are found in large concentrations at the bronchiolar sites of invasion. And these white blood cells seem to marshal the body's defenses. The result is an inflammatory response followed by constrictions of the bronchioles. (Boushey and Fahy, 1995).

The body has a number of responses to foreign proteins and other irritants. In the respiratory passages, especially the bronchioles, these may be collectively termed asthma. The asthma response is inflammation of the bronchiolar lining followed by spasmodic constrictions of the bronchioles plus secretion of thick, ropey mucus. Some of the more common irritants that trigger asthma include animal dander, specific plant proteins, tobacco smoke, house mites and cockroach waste. There is a long list of irritants that could be included as well, among them pesticides, byproducts of various manufacturing processes, and many common household chemicals.

Bronchioles may dilate as a result of medication or from natural recovery. The longer a person suffers from asthma, the less likely it is that the bronchioles will fully recover. Those people with asthma during childhood have a chance as they grow to be an adult, and as their airways reach adult size, to make a full recovery from asthma. Thus the teenage years become of critical importance. But only about 25% of children who suffer from asthma seem to reach a full recovery as adults. Those people who continue to suffer into their adult lives seldom reach complete recovery. (Boushey and Fahy, 1995). A further comprehensive discussion of asthma basics can be found at Allergy, Asthma & Immunology Online (1998) and at a number of other sources (JAMA, 1997b; Kovesi, 1996b; 1996c; 1996d). These articles are written for the general public, at a basic level. They do not explore the asthma immune mechanisms.

A Few Vital Statistics:

- Asthma is the #1 cause of school absences caused by chronic disease
- Asthma is the seventh-ranked chronic disease in the U.S.A.
- About 5% of the population lives with asthma, although this percentage may be much higher under some conditions
- Children spend approximately 50% of their time in their bedrooms, the most common site of irritation
- Asthma costs the country $9.5 billion annually
- An estimated 12.4 million Americans have asthma. Of these, 4.2 million are under the age of 18
- The prevalence rate of pediatric asthma (rate per 1000 children) rose from 40.1 in 1982 to 63.4 in 1992

• Children of smokers are twice as likely to develop asthma as children of non-smokers

• Only about 25% of the children outgrow the asthmatic condition when their airways reach adult size

• In the U.S.A. there were 4,964 deaths from asthma recorded in 1992. Blacks represent 12% of the population, but account for 21% of these deaths from asthma

• In 1989 there were 479,000 hospitalizations with asthma as the first listed diagnosis. From 1979-1989 asthma hospitalization for children under 15 increased 56% (Am. Lung Assoc. of Ohio, 1995)

ASTHMA: Increase in Incidence

There is no doubt that the incidence of asthma is on the rise (Am. Lung Assoc of Ohio, 1995; Am. Thoracic Soc. Symposium, 1996; Laino, C., 1999; Kaleidoscope News & Features, 1998; Assoc. Press; 1997; Yahoo! News, 1999; Healthbeat, 1998). The problem is in understanding the magnitude of the increase. Most of the sources mentioned above agree that the incidence of asthma has doubled within the past 20 to 30 years. The old figures for asthma were 5 to 6 million afflicted people. Latest estimates range from 12 to 17 million people, about 5% of the population in the United States.

However, local situations may show a much higher incidence (Bernstein, 1999). Results of a survey conducted

by the author at High School in the Community indicate that 26% of our students are asthmatic. (See below). This is five times the national average. World-wide, the asthma rate is increasing in industrialized countries but not in developing countries (Laino, 1999).

As we have worked so diligently since the 1960's to eliminate air pollution, it is strange that there is twice as much asthma now as there was formerly in the very countries where air pollution has decreased. There are a number of reasons put forward to explain this phenomenon.

Most sources attribute the increase in asthma to factors in the environment (Laino, 1999; Yahoo! News, 1999). However, they do not attempt to identify which environmental factors may be contributing to the increase. In general, the increase seems related to more pets, tighter house construction, more carpeting and furnishings,increased room temperatures, poor air quality and poverty (Kronemyer, 1997; Augustine-Reaves and Augustine-Jefferson, 1996). The rise in inner city cases has been attributed to cockroach waste (Anon, 1997; Rosenstreich *et al* , 1997) and there has definitely been a greater increase in urban areas, attributed to under- medication, poverty and high levels of trigger allergens (Am. Thoracic Soc. Symposium, 1996). One study indicated that the increased risk of asthma for black children is linked to where they live (i.e. predominantly in the inner city) and not to race or poverty *per se* (Aligne, 1998).

It is also thought that the increase in asthma may be partly because we now spend so much more time indoors (Platts-Mills and Carter, 1997). Those young people that spend so much time watching television, playing video games or just hanging around indoors increase their exposure to indoor allergens. Their lungs are not cleared by sitting around indoors.

One other explanation for the doubling of the asthma rate is that there are now fewer childhood infections in the United States and other industrialized countries. Infections such as whooping cough and tuberculosis may "train the immune system" to ignore such irritants as dust mites and pollen. Without such infections as whooping cough and tuberculosis the immune system remains more sensitive to the allergens, leading to asthma. (Assoc. Press, 1997; Healthbeat, 1998; Kronemyer, 1997).

ASTHMA: The Condition

Asthma is a disease of the immune system. Asthmatics react to substances in the bronchioles of the lungs with what is termed "bronchial hyperreactivity". Two things happen in a reaction. First, there accumulate secretory cells at the site of the irritation , eosinophils that release eosinophil-cationic protein and eosinophil-derived neurotoxin, and lymphocytes that secrete interleukin-2 and interleukin-5. (See Boushey and Fahy, 1995, for a detailed discussion of this mechanism). Second there are severe contractions of the smooth muscles in the bronchioles, resulting in serious constriction and limiting of air flow. These constrictions of the smooth muscle are caused mostly by the proteins secreted from the eosinophils and lymphocytes. These proteins cause an immune reaction in the bronchioles. This leads to inflammation of the involved bronchiolar tissue.The result is the constrictions of the airways, swelling of the inflamed tissue and secretion of an abnormally large amount of mucus material which characteristically is thick and ropey.

Not only do the bronchioles become spasmodically constricted, but the inflammation of the bronchiolar tissue further constricts the air ways. And at the same time, subepithelial collagen is deposited which causes the

basement membrane to appear thicker. This all leads to further constriction and permanent damage to the air ways. (Boushey and Fahy, 1995)

The combination of constricted bronchioles, inflammation and excessively thick mucus results in severe impairment of the air flow in these areas. This results in shortness of breath and usually a wheezing sound that is typically associated with an attack of asthma. It is particularly hard for asthmatics to exhale.

This results in a loss of capacity to exchange air - which may be measured by a peak flow meter (PFM). This meter is capable of showing constriction before the onset of obvious symptoms, and is thus an invaluable aid to those with asthma. It is now strongly urged that asthmatics carry a PFM at all times. They are small, the newer ones hardly bigger than a lipstick case.

Asthma and Intelligence: School performance & Psychological Patterns

Two studies give some insights as to the psychological effects of asthma. (McCowan *et al* , 1998; Yellowlees *et al* , 1987). McCowan studied a population of asthmatic Scottish children for four years. He reported slightly slower growth rates, but no apparent decrease in intelligence. Yellowlees examined a sample of fifty older people with chronic airflow obstruction. He found them twice as likely (when compared to a control group) to be anxious (general anxiety disorder) as well as showing depression, hysteria and cognitive deficits.

Yellowlees *et al* (1987) also reported that these patients were in an "emotional straight jacket" and could not effectively express rage, anger, agression, hostility and resentment because of the adverse effects these emotions have on breathing. In other words, asthmatics soon learn to suppress and internalize strong emotions to avoid triggering an asthma attack. How hard this situation must be for adolescents, who are just developing an adult personality (Adams *et al* , 1994)

In contrast, other papers report a long list of emotional symptoms for asthmatic children (Lehrer *et al* , 1993; Carr *et al* , 1992). These symptoms include:

- Greater emotional facial expression
- Greater expression of direct and indirect anger
- More expression of helplessness and decreased competence
- Greater agression, at least verbally
- Marginally greater psychiatric disturbances
- A higher prevalence of behavioral and school-related problems
- A higher prevalence of social competence problems in asthmatic boys
- A higher degree of low self-esteem in asthmatic girls
- Greater maladjustment than in normal children
- A tendency to hold anger in
- Emotions expressed for a shorter duration

Some of these findings are contradictory and obviously not all symptoms occurred in all children. However, it is evident that there is a considerable emotional burden placed on young people with asthma.

One important aspect of the psychological side of asthma is the effect asthma medicines may have on the patients. I was able to find direct side-effects of bronchodialators and corticosteroids (see the forth page of this paper) but little other information. I consulted three manuals for asthma management written for physicians, (Glaxo Cont. Ed, 1994; Nat. Asthma Ed. Prog., 1991; 1992) but could find nothing on the side-effects of asthma medicines. The interplay of adolescent personality development, the asthmatic condition and side-effects of medicines for asthma should be a fascinating story. But I was not able to find references to such a study.

As far as asthma relates to school work, I can add nothing beyond what I have already said (See pages 2-4 of this paper). Students who are constantly absent because of asthma fall behind. Poor performance on tests and other types of assignments are usual simply because they have missed so much. These same students become frustrated and are often at odds with the school administration over rules and regulations. They are often in disciplinary trouble and may be suspended from school more often than other students. All of these factors contribute to poor academic performance. If you compare attendance records and grades, there is usually an inverse correlation between grades and rate of absenteeism.

Asthma Classification:

The severity of asthma varies enormously from an occasional mild attack to constant breathing difficulties which may only be controlled by daily medication. (JAMA, 1997a). Asthma may be classified into a number of categories as follows:

- Intermittent - only when exposed to a specific trigger
- Mild Persistent - symptoms more than twice a week but less than once a day. Nighttime exacerbation occurs more than two times per month. Lung function is 80% of normal
- Moderate Persistent - daily symptoms and daily use of quick relief medication. Exacerbation occurs more than twice a week and may persist for days. Nighttime exacerbation occurs more than two times per week. Lung function is 60% to 80% of normal.
- Severe Persistent - the patient has continuous symptoms, limited physical activity and frequent daily and nighttime exacerbations. Lung capacity is less than 60%.
- Status Asthmaticus - a severe, life threatening attack that does not respond to medication. Emergency treatment at the doctor's office or hospital is needed. Hospitalization is usually required.

This classification provides a convenient way to talk about asthma. The classifications in themselves do not mean that much. Asthmatics may shift from one group to another and back. The main thing is that this classification provides a structured way with which to deal with asthma. (JAMA, 1997a).

Asthma: The Survey

One of the problems that most schools must deal with is the under-reporting of asthma at school. In most schools and school systems the statistics for asthmatics are not well documented. I am trying in my school to develop a survey that will tell us much more about our school population. A copy is included in Appendix B for your use. With this survey I hope to be able to construct a profile of our school.

Preliminary use of the survey indicates that 28% of the students in two of my classes suffer from asthma. This is much higher than the 5% national figure. A subsequent survey conducted during the last week of school (6/7/99) showed that 26% (38) of the students responding (n=145) were asthmatic. This is approximately five times the national average! but still not as high as some inner city children (Bernstein, 1999).

Below I have summarized most of the information from the survey. It is somewhat incomplete, as all students did not complete all of the categories.

ASTHMA SURVEY

(chart available in print form)

Relationship to the Environment

Asthma is related to the environment through the environmental triggers already mentioned. For a long time it has been stated (Kovesi. 1996) that the most common trigger is dust mites. Recently there have been articles suggesting that cockroaches in low-income houses were the primary trigger under those circumstances (Anon., 1998; Rosenstreich *et al* , 1997). Mold spores in older or damp houses are also often mentioned as being a main trigger. Tobacco smoking by parents is a major cause for the development of asthma in children. And if the mother smokes during pregnancy, the child may even be born with asthma. (Gergen *et al* , 1998)

Other triggers include animal dander (mostly from pets) (Kovesi, 1996) and pollen. The pollen trigger is the same as hay fever, but the result is an asthma attack. One extremely important trigger for asthma attacks is stress. This is not always recognized, but is a very important factor in some people. In children, asthma is often triggered by a cold or the flu. It may also be triggered by exercise in cold, dry air. Aspirin especially and other medications may also trigger asthma attacks. A check list of possible triggers and a self-test is available on the internet at Asthma Triggers (1999).

Finally, there are a number of air pollutants that can trigger asthma (Bethea, 1998). These include organic solvents, various air-borne chemicals such as sulfur dioxide, nitrogen oxide, ozone and a whole host of organic

compounds that are part of our modern life. These range all the way from pesticides (Etzel, 1995) to cleaners to catalysts in plastics and paints.

To summarize, environmental triggers include:

1. Dust mites
2. Cockroaches
3. Smoking
4. Animal Dander
5. Pollen
6. Mold Spores
7. Stress
8. Aspirin and other medications
9. Colds and Flu
10. Exercise in cold, dry air
11. Pollutants
    a. Organic solvent aerosols
    b. Air-borne chemicals (Sulfur dioxide, nitrogen oxide, O3 etc.)
    c. Air-borne organic compounds (pesticides, etc.)

Environmental tobacco smoke (ETS) is well documented as an asthmatic trigger (Gergen et al, 1998). In a national health and nutrition survey of children two months through five years of age from 1988-1994, 38% of the children were exposed to ETS in the home and 24% were exposed by maternal smoking during pregnancy. Three conditions were studied - chronic bronchitis, wheezing and asthma. While ETS had little effect on upper respiratory infections or on the respiratory health of children three to five years of age, it did definitely increase the prevalence of asthma. ETS seems to approximately double the prevalence of asthma in children under six years of age (Gergen *et al* , 1998).

Another study by Abulhosn *et at* (1997) looked at the recovery of asthmatic children, from hospitalization for an acute asthma attack, in smoking and non-smoking home environments. The data here is again very clear. Children recovering in a smoking home had approximately three times as many symptomatic days as children recovering in a non-smoking home.The use of a bronchodialator was significantly less in the non-smoking homes (Abulhosn *et at* , 1997).

Treatment

The treatment of asthma involves two basic steps: reducing the swelling of the bronchioles and encouraging the bronchiolar tissue to be less sensitive. The first of these is of immediate concern, while the second is more of a long-term problem. Asthma treatment is complicated by the fact that much of the responsibility for the actual treatment falls upon the patient. After all, asthma can be triggered any time, and it is not possible to have a physician always available. The situation is further complicated by the large number of asthma patients who are children. One study of inner city children (Eggieston, 1998) indicated that more than 50% of children over the age of nine are completely responsible for their own treatment. And many of these children (35%) use only an over-the-counter medicine.

Each patient needs to be able to carry and use a peak flow meter. This small pocket device can be used to set a base-line peak flow. Whenever there is a suspicion of an on-coming attack, the peak flow meter can confirm bronchiolar constriction before there are obvious symptoms. If there is constriction, treatment can be initiated at a very early point thus limiting the severity of the attack.

Each asthmatic needs to be evaluated for a treatment regimen. No two people are exactly alike. Some patients need only to carry an inhaler and use it when needed. Others may need up to six medicines each day. This is a complicated situation which needs to be resolved by an expert. This paper deliberately lacks a significant discussion of the medical treatment of asthma. Asthma is a serious, life-threatening condition which needs proper professional medical attention and supervision. It is not a time for home treatment. Despite the seriousness of asthma, there are a large number of web sites promising relief (e.g. AsthmaMan, 1999). But there are also a number of procedures that may be accomplished at home to lessen the number and severity of asthma attacks.

Home Solutions/Remedies

(This entire section should be xeroxed and given to students, particularly those who are asthmatic)

There are a number of simple actions that anyone may take to lessen the exposure to environmental triggers at home. Most young children spend up to 50% of their time in their bedroom. This an ideal place to start to defend oneself against the triggers of asthma.

If you are asthmatic, you need a bedroom of your own. Sharing a bedroom with a sibling or other relative is simply not acceptable. So the first job you have is to convince your parents that you need and deserve a bedroom for yourself. I realize that all families may not have sufficient income to do this. However, a small room may be rather easily and inexpensively framed and sheet-rocked by almost anyone. And in the long run, giving you a room of your own will pay for itself in time and money saved from the emergency room and doctor.

If you ask at a store such as Home Depot or Lowe's, you will find someone who can explain what needs to be done and exactly how much it will cost. They will usually have booklets available for free that will show you the exact procedure. The cost of medical visits and medicines is not cheap. You should be able to pay for the

room with money saved. Finally, additions such as a room in your home may require a permit from your city or town. You must check on this before you begin your project.

You have the right to a smoke-free environment. If there is anyone in your family who smokes, you need to strongly request that the smoking takes place out of doors. Simply going to another room to smoke does not do the trick. House insulation makes our New England homes too air-tight. The tobacco smoke will permeate the house and there will be exposure. I know this is another hard thing to convince your parents of, but you need to try. Again, there should be money-saving benefits from doing this.

The key to this situation is education. You must become the teacher and teach your parents how asthma triggers affect the bronchioles and why even a small amount of tobacco smoke may induce an asthmatic response. You must then explain the absolute necessity of smoking only outdoors. There is overwhelming evidence that tobacco smoke is one of the primary triggers for asthma (Gergen *et al* , 1998; Abulhosn et al, 1997; Etzel, 1995; Kovesi, 1996a). What arguments might you use to convince your parents? First and foremost is the health argument. The fewer asthma attacks you have, the better your chances of outgrowing asthma completely by the time you are an adult. Secondly is the economic argument. Emergency room or doctor's office visits cost money. Medicines are not free. The healthier you stay, the less it will cost your parents. Finally, your house will smell better and be cleaner if it is a tobacco-free environment.

So what can you do to improve the quality of the air in your own bedroom? To begin with, remove as much from the room as you can. The simpler the room is kept, the less there will be to collect dust and encourage dust mites. This includes removing the rug from the floor, posters from the walls, excessive books and all magazines. Clothes should all be stored in the closet and dresser. Do not leave clothes lying around the room. All dirty clothes need to go in a laundry hamper or laundry bag, which should not be kept in the bedroom.

The main source of food for dust mites is you. All of us constantly shed dead skin cells. As these fall to the floor and onto our bedding, they provide food for dust mites. One of the most effective ways of limiting dust mites is to obtain mattress and pillow covers that do not allow skin cells and dust mites through. These covers may be found in any store that sells bedding, and are not expensive. If you cut off most of the food supply to the dust mites, you will reduce their population and thus their effect on you! Dust mites also need moisture. Keep your room as dry as you can. This by itself will limit the dust mite population.

In addition to dust covers for the mattress and pillows, you must be sure to change the bedding every week and wash it in hot water; and to damp mop the room as often as you can - at least twice a week. Do not dry mop! All this does is stir up the dust that is present, and along with the dust, the mites! This may sound too complicated a weekly procedure. I assure you it is not. Once you initially get the room clean, it is rather easy to keep it that way.

If your room is your refuge, what other things might you do to keep it as clean as possible? There are dust filtering machines - expensive. Here are some practical answers. Change into something like sweats when you enter the house. Keep the sweats in the bathroom, back hall, someplace that is not your room. Make sure you change your shoes. A great deal of dirt and contamination is carried on shoes. When the shoes dry out in the house, the dirt falls off.

Keep the door to your room closed. There are simple screen-door springs that cost very little. You can get one at the hardware store. Install this spring yourself with just two screw eyes and a screwdriver. Your door should always close by itself. You can also purchase foam weather stripping for your door very inexpensively at the hardware store. You can easily install this, and it will keep a certain amount of dust and dirt out of your room.

Finally, you have to face some hard facts. You know more about asthma than anyone else in your family. After all, you are the one who suffers from the condition. Your parents are not at fault for anything, but probably feel some guilt that you suffer from asthma. You must make them understand in a kind and gentle way that it is imperative that no one smokes in the house, that you have your own room, even if small and that your room must be private. If your room is invaded by your siblings all the time, or if your mother lets the cat or dog in there to take a nap, you are not going to gain the benefits that a clean, relatively dust-free room offers you.

On the next three pages are some class exercises that will demonstrate some aspects of the trigger problem.

Appendix A

Dust mites in your Bedroom

We have talked some about dust mites being the major environmental trigger in our homes. Have you ever seen a dust mite? How do you think you might be able to see one? (Would you want to see one?) This exercise is designed to show you actual dust mites, and these from your own home. This is a very simple exercise.

Procedure:

1. Obtain two clean facial tissues and a clean envelope at home.
2. Take one of the facial tissues and wiggle under your bed.
3. Wipe up the dust from the floor as near under your pillow as possible
4. Wriggle out from under the bed.
5. Fold the tissue so that the dust is inside.
6. Wrap the tissue in the second tissue and place in the envelope.
7. At school, open the inner tissue
8. Using a pair of forceps, place a small amount of the dust on a slide.
9. Add one drop of methylene blue stain and examine under the microscope.
10. Look for dust mites. For pictures and a detailed discussion of dust mites see Bodanis (1986)
11. Try to draw what you see. How many pairs of legs does a dust mite have? What class of arthropods does a dust mite belong to?

Write up a laboratory report on this exercise for tomorrow. Be sure to include your drawings of what you saw. Were dust mites the only living thing present? What else did you see?

Air-borne pollutants

There are a large number of things in the air that might be triggers for asthma. If these are chemical molecules, we probably cannot show them to you. But how about particulates? These particles are mostly visible with a microscope, if you just know how to visualize them. So let us set up an experiment to trap and accumulate air-borne particles.

Equipment and supplies needed: Fan and prepared petri dishes

Procedure:

1. Set up a small fan aimed at 8 petri dishes. Each petri dish should contain a 1% nutrient agar with 2% sucrose.
2. Adjust the pH of the agar in four of the petri dishes to pH=5.5.
3. Place all of the petri dishes in front of the fan. Keep one of each type covered, uncover the other six.
4. Start the fan and let it blow continually on the petri dishes for a period of 12 hours. At the end of that time, cover all of the petri dishes.
5. Place the control (the dish left covered) and two others of each type in an incubator at 90°F. Leave them for forty eight hours. Place the other Petri dishes in a drawer and leave them for 48 hours.
6. Examine two of the Petri dishes immediately. Where there is discoloration of the agar, scoop up a small sample with a toothpick and make several slides. Use methylene blue stain on some of the slides. What do you see? What do you think was in the air?
7. After 48 hours examine all of the Petri dishes. Is there a difference between the incubated and non-incubated dishes? Draw a sketch of one of each type of dish; incubated, non-incubated and control.
8. If there is a stereo dissecting microscope available, examine the cultures under magnification. What do you see?
9. Prepare slides from each type of culture and examine them under the microscope. What do you see? Make sketches.

Write up a laboratory report on this exercise for tomorrow. Be sure to include your drawings of what you saw. What did you see?

Chemical Pollutants in the Air

Have you ever noticed that many objects have an odor about them, especially when new? When you get into a new car there is definitely a distinct odor. If you remove the lid from a new plastic container there is certainly an odor. These odors come from the catalyst materials that were used to polymerize the plastics, or from other organic compounds added to make the product retain its flexibility, remain slippery or for some other reason.

These compounds may be biologically active, either as carcinogens or as hormone mimics or as asthma triggers. And over time, they leach out into the surrounding environment. That is why you can smell them when the product is new. But how about when the product is several years old? Are these dangerous compounds gone? Maybe we can find out. This is an extremely easy experiment.

Equipment and supplies needed: Microwave oven, old plastic containers with lids and some clean old polyester carpeting, (4" x 4").

1. Make sure the piece of polyester carpet is clean. If not, wash it in detergent and water and be sure to rinse it thoroughly and dry it.
2. Place a plastic container with the lid on in the microwave oven. Heat the container for thirty seconds.
3. Gently open the container and cautiously smell the insides. Careful! Remember this is poisonous! Do not sniff if you are asthmatic!! What do you smell? Is the odor a "plastic smell"? Describe the odor. If you think this is too harmful an experiment, you do not have to sniff the container.
4. Place the clean dry piece of carpet in the microwave. Heat it for thirty seconds. Does it have an odor? what is the odor like? Describe the odor. How much of the odor is simply dirt in the carpet? Can you detect any odor that could be from an organic catalyst?
5. For the next class, each student should bring in something that they think will give off an odor when microwaved. Try some of the samples. If the teacher thinks the sample might in any way present a danger, do not microwave it!.

Write up a laboratory report on this exercise for tomorrow. Be sure to include a table of data - what was heated and how it smelled.

Appendix B

Teacher's Notes for Lesson Plans

Below I have included some notes that may help teachers with preparing and using the three included class exercises.

Dust Mites in your Bedroom:

1. Dust mites are very small. Your students may not be able to see much under the microscope. Check the book by Bodanis. There is a good photograph in there that you should be able to xerox for your classes to see.

2. Methylene blue stain is a stain. If students get it on clothes or shoes it may not come out easily. This stain is generally available from biological supply houses. If it spills on fingers, it will persist for a few days. Washing does help.

3. Dust mites are related to other mites, spiders, scorpions and ticks. They are in the Arachnid group of the Arthropods. Dust mites have four pairs of legs.

Air-Borne Pollutants:

4. If you have no way to prepare petri dishes, you can obtain them already prepared and ready to go from a biological supply house. Otherwise, they need to be autoclaved and sterility maintained as much as possible.

5. Your students should see a number of bacterial and fungal colonies. If the fungus is black it is probably Aspergillus. If it is greenish-blue, it is probably Pennicillium. The bacterial colonies could be any color. Although they were air-borne and are probably common, they may be more toxic in a colony. Have your students take only a small amount on a tooth-pick for examination.

Chemical Pollutants in the Air:

6. This lab seems very simple. However, it may be too risky to try, especially with a group of immature students. The fumes from the heated plastic may make some student or you sick. It is probably better if you, the teacher, try this out first. You should be able to find some carpet and plastic containers that will not asphyxiate the class when heated.

Other Exercises that might be Included:

7. Have all the asthmatics do a detailed study of their environment. Be careful! Not all asthmatics are willing to admit to asthma, and most do not wish to be identified as asthmatic.

8. Have the lab class administer this survey to the entire school and analyze the results.

9. Have the class try to find out what causes the odors? i.e. the contents of plastics that volatilize or the chemicals released from carpet? How about perfumes?

Appendix C

Asthma Survey

This survey is being conducted in order to characterize our school population with regards to asthma. All

information given is voluntary and confidential. Only the total numbers will be used for statistical analysis. We will use the statistics from the survey to profile the status of asthma at HSC. The survey forms then will be destroyed and there will be no permanent record identifying any student. Would you please answer the following questions. Circle the closest value or Fill In the answer

Neighborhood (optional) _____

Grade 9 10 11 12

Gender Female Male Your Age _____

Number of Sisters _____ Number of Brothers _____

How old is the house you live in? 10 20 30 50 70 90 100+

How many parents do you live with? 1 2

If there is only one parent, is the parent Woman Man

Income of parents Below 20,000 21,000 - 50,000 50,000 - 95,000 +

Do your parents smoke? No Mother Father

Did parents smoke when you were born or were young? Yes No

Have you ever seen a doctor about asthma? Yes No

Have you been hospitalized or to the emergency room because of asthma?

Yes No

Do you have asthma? Yes No

(If no, you may stop here, and we thank you for your help.)

Are you currently taking medications for asthma? Yes No How Many? _____

What are your current medications?

beta agonist (albuterol, terbutaline, pirbuterol, etc.)

cromolyn Others _____
inhaled steroid _____
bronchodialator _____

How many days did you miss from school last year because of asthma? _____

Does an asthma attack make you Anxious Angry Depressed? Other _____ ?

What kind of heat does your home have?

Oil (hot water, steam, or baseboard) Forced hot air Wood stove Kerosene

Are your floors covered with:

a. Wall to wall b.Carpet c.Area rugs d.Wood e.Vinyl f.Tile g.Other_

_____

Indicate which room has which type of floor covering (use a., b., etc.)

Your bedroom ___ Living room ___ Kitchen ___ Rest of house _____

How would you characterize your diet?

Much fat and carbohydrate Mostly proteins and fiber

"Average" food Vegetarian

What is your height _____ ? weight _____ ?

How often do you eat fresh vegetables?

twice per day once per day three times a week less than 3 times/week

Do you regularly eat breakfast? Yes No

Do you regularly eat lunch? Yes No

Do you engage in any sport or form of exercise? Yes No

If Yes, what form of exercise? _____

Do you have any specific allergies? Yes No

If Yes, to what are you allergic? _____

_____

Anything else you would like to tell us or comment on? _____

_____

_____

_____

Thank you very much for completing this survey. We will try to publish the results for all students to see when we are finished.

R. R. MacMahon

Bibliography

For Students:

These first six references present comprehensive discussions of asthma basics. These articles are written for the general public, at a basic level. They do not explore the asthma immune mechanisms. They are very good at explaining the basics of a very troublesome condition.

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For Teachers:

General level articles and other general interest articles will be found in the section above for students. Many of them are excellent articles which you should read.

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