Asthma
Evidence Based Prevention
(As of 12/10/08)

Unlike many conditions there is a wealth of information relating to risk factors and prevention strategies for asthma. The difficulty is in choosing an appropriate strategy for your unique patient. Asthma is a multifactorial disease that is not well understood and can have a variety of risk factors. In the United States it affects over 22 million people, results in 4000 deaths annually (1) and is responsible for 200,000 hospitalizations annually (2). Of additional concern is the observation that the number of asthma cases has doubled in the United States since 1980 (3). Considering the fact that standard asthma treatment protocols only address symptom reduction and do not resolve the condition, prevention is the most viable treatment option. The risk factors outlined below may play a role in the etiology of the condition as well as exacerbate the condition when already present.

It is important to note the conclusions made by Saglani and Bush review of the origins of asthma. It was stated that "the roots of asthma are to be found in the first three years of life…By age 3, the die is cast and lung function tracks lifelong "(4).

The strength of the recommendation given below is for identification of risk factors. There is significantly less evidence relating to actual prevention strategies, which in some cases the evidence is conflicting.

RISK FACTORS AND PREVENTION STRATEGIES

1. Allergens (A): Atopy is defined as an allergic hypersensitivity affecting parts of the body not in direct contact with the allergen. It is considered by many to be a major factor in the genesis of asthma and as high as 56% of asthma cases are attributable to atopy (5). Preventative measures are often an attempt to reduce allergen exposure (6-9), although the effectiveness of the approach has some detractors. Some studies, which include one by the National Academy of Sciences, identified dust mites, cockroaches and cats as potential allergens (10;11), while others have identified house dust (12), dogs (13), mold (14) and various pollens (15). The confusing nature of prevention strategies is demonstrated in part by the observation made in a study by Platts-Mills et al, which found children exposed to high levels of cat allergens were less likely to be sensitized to cats than those exposed to moderate levels (16). This finding was subsequently expanded to include dogs in a recent review, which concluded it may be unwise to rid homes of pets as their presence may be protective (17). A second review came to the conclusion that exposure to pets in older children increases the risk of asthma but may reduce the risk in young children (18).

At least one author suggested maternal exposure to allergens may influence the unborn child and its susceptibility to atopy (19).

Prevention Strategies

A significant degree of controversy exists in the role that allergen exposure plays in the prevalence of asthma or prevention of exacerbations. In a review by Lau et al pillow and mattress encasements, carpet removal, dehumidification, essential oil washes, steam cleaning, heat treatments and filtration systems are listed as possible prevention strategies. Five articles were found in a 2001 review which demonstrated a degree of effectiveness of encasement of pillows and mattresses (20). A Cochrane Review in 2003 could not conclude air filtration or pet removal from homes were effective in controlling asthma (21). A second Cochrane review could not determine whether synthetic bedding was superior to feather bedding (22), but in a strongly worded counterpoint, one journal editor stated synthetic materials were superior (23). General measures to control allergens were described in a 2006 article by Phipatanakul (24). Although evidence is lacking in some instances, this approach appears the most comprehensive.

1. All bedding should be encased.
2. Wash bedding weekly at 55 degrees Celsius.
3. Vacuum weekly using HEPA filters.
4. Install HEPA filters in home.
5. Damp mop smooth floors.
6. Reduce indoor humidity to less than 50%.
7. Replace carpets when possible.
8. Replace upholstered furniture with leather, vinyl or wood.
9. Replace draperies with blinds.
10. Remove stuffed toys from bedroom or periodically freeze them to -20 degree Celsius.
11. Cockroach control.

2. Genetics (A): The role genetics plays as a risk factor is well established in the scientific literature (25-28). However, understanding the mechanisms at play and the identification of specific genes remain a goal of many genetic researchers (29-31). It has been estimated that if both parents or one parent and a sibling have asthma, there is a 40% chance other siblings will develop to asthma (8).

3. Food allergy (A): There are two primary manifestations of food allergies. The first is an IgE-mediated reaction which is essentially the production of antibodies to certain proteins. The second is non-IgE mediated reaction, that is usually of late onset, which involves activation lymphocytes and eosinophils. Blinded food challenges are considered by most authorities the “gold standard” to determine food allergy (32). According to an article by James, food triggered asthma occurs in 6% to 8% of children with asthma and 2% of adults (33). A wide variety of offending foods in children have been identified to include rice, carrots, potato, apples, banana, grapes, mutton, chicken and cheese (34). Other studies have also included peanuts and milk (35). Fish, tree-nuts, shellfish and seeds have been implicated as offending foods in adults (36). There is a general consensus that exclusively breastfeeding an infant for the first four months

of life provides a protective effect against food allergy, asthma and other forms of atopy (37-39).

4. Pollutants (A): A remarkably wide variety of pollutants, primarily by-products of modern life, have been identified in the literature as possible factors causing or exacerbating asthma. These include:

1. Particulate matter which include, but are not limited to, by-products of cooking, burning candles, tobacco smoke, citrus scent in cleaning products (40)
2. Isocyanates which are present in polyurethane products (41;42)
3. Formaldehyde, particle board, paint products (43)
4. Ammonia or bleach (44)
5. Ozone (45-47)
6. Nitrogen dioxide and sulphur dioxide as a byproduct of combustion (45;48;49)
7. Tobacco smoke (50)
8. Diesel exhaust particles (51;52)

5. Exercise (A): Exercise is uniquely distinct from other risk factors, in that it can both exacerbate as well as a prevent asthma. It is the most common trigger for an acute asthma attack in individuals with a diagnosis of asthma (53). Considered to be the most dangerous is vigorous exercise in a cool dry setting for 3 to 8 minutes at 80% maximal heart rate (54). Stensrud et al found exercise capacity was markedly reduced, while exercise induced bronchospasm was increased in a cold environment (55). While vigorous exercise is considered a trigger for exacerbation of asthma, many researchers have found submaximal exercise to be of benefit in improving quality of life and exercise capacity (56;57). Swimming has demonstrated value as an exercise program since it eliminates dry, cold air from the risk equation and requires controlled breathing (58-60). Another approach to lessen the risk of exercise induced bronchospasm in cold weather climates is the use of a heat exchanger mask. These reasonably priced, commercially available masks have demonstrated effectiveness in reducing the amount of cold air that reach the air passages and increase exercise capacity (61). Tan et al recommended the following to reduce the risk of exercise induced bronchospasm: 10 minute warm up period, cover mouth during cold weather, exercise in warm humidified environments and warm down after exercise (54).

6. Viral infection (B): A longitudinal cohort study of 1214 children concluded that repeated viral infections, other than lower respiratory tract infections, reduced the risk of developing asthma until a child reached school age (62). This protective effect appears to be lost as the child ages. Another study, which was a 12 year follow-up of a randomized controlled hygiene intervention study of 982 children, concluded there was no difference in the clinical course of asthma at age 15 regardless of number of respiratory tract infections (63). Others found that viral infections appear to play a significant role in acute exacerbations of asthma (64;65).

7. Obesity (C): Although a relationship between obesity and asthma has been established, it is uncertain that obesity is directly related to asthma. It is possible the same factors that lead to obesity may also lead to asthma and/or obesity is just a side

effect of the process. For example, risk factors for asthma, which may also result in obesity include the lack of exercise (66) and diet. Other authors have postulated **gastro-esophageal reflux** as a causative factor (68;69), a condition which often results from obesity. However, increased BMI was not found to be a risk factor for asthma in a 2003 study which examined findings from seven epidemiological studies of 5993 children (70). In studies that have found a relationship between weight and incidence of asthma, obese females were the subgroup at greatest risk (67;71). A systematic review of 15 studies published in 2008 did show, in all studies, improvement in at least one asthma outcome associated with weight reduction (68).

8. Daycare/number of siblings (C): There was a protective effect of having older siblings in the group of children with allergic rhinitis and asthma in a study of the children of 31,145 mothers. However, children with asthma without allergic rhinitis were not protected (72). A retrospective survey of parents showed siblings increased the risk of asthma slightly (73). The author of a review of nine asthma and daycare studies concluded that found the relationship between daycare and asthma is unclear. The review found no relationship in three of the studies and a positive relationship in five of them. (74).

9. NSAID's (C): The role of NSAID's in asthma onset remains controversial. A systematic review of 21 studies of aspirin sensitivity and cross sensitivity of other NSAID's was published in 2004. This study concluded the prevalence of aspirin induced asthma is 21% in adults and 5% in children. Cross sensitivity was present in most patients with aspirin induced asthma (75). Other investigators have reached different conclusions. A second review published in 2007 retrieved 471 articles but found only three were of sufficient quality to include in the review. The authors of this review concluded there was low risk for asthma with the use of ibuprofen. In addition, ibuprofen may be possibly be protective when compared to acetaminophen (76). The general consensus appears to be that the use of NSAID's should be permitted in children with the warning parents should be advised to observe the child for the presence of asthma (77-79).

10. Diet (C): There is a growing body of evidence that diet may play a role in asthma. When diet is inadequate, supplementation may provide protection. A surprising number of nutritional protocols have been discussed as being possibly effective in reducing symptoms or preventing asthma. Several authors have identified omega 3 fatty acids, 2 to 5 grams daily, while maintaining at least a 1 to 4 ratio (1 to 1 is best), of omega 3 to omega 6 fatty acids (80-83) as a possibly effective intervention. Vitamins C and E, in doses yet to be determined, may also be beneficial (84;85). Low salt diets have been recommended by at least two authors, particularly for exercise-induced bronchospasm, (86-88). However, Pogson et al found no therapeutic benefit with a low sodium diet (88). Other novel approaches have also been identified. In a small case series of nine subjects, alternate day caloric restriction was found to improve several outcome measures over baseline, with the exception of spirometry. (89). Contrary to the beliefs of many, farm milk may offer protection to asthma. In a cross-sectional multi-center study of 14,893 children, it was concluded that the "consumption of farm milk may offer

protection against asthma and allergy" (90). Consumption of genistein, a soy isoflavone, was associated with better lung function in patients with asthma in a study of 1033 patients (91).

11. Other (C): Several other recommendations should be considered, although the evidence is based primarily on observational studies. According to a 2007 commentary article by Devereaux, **reduced maternal intake of vitamin E, D, zinc and fish oil during pregnancy** appears to be related to an increased risk of asthma in children up to age 5 (92). He based his opinion on two cohort studies totaling 2884 subjects which found the correlation. Weiss and Litonjua go as far as to state 40% of all asthma in children is based on deficiency of these vitamins during the prenatal time period (93). The cutoff in dosage to achieve these effects was 400 IU of vitamin E (94). Of interest is the finding in an animal study that gamma tocopherol, the dietary form, was found to be more effective than alpha tocopherol, the form most commonly found in supplements. The authors found it worked by inhibiting inflammatory pathways (95). **Gender** is recognized as a risk factor for asthma as it is more common in boys, yet females are at greater risk after adolescence (96;97). Although **race** is considered by some to be a risk factor, it appears more socioeconomic and that urban living may be a more significant factor (98). Lastly, a review article concluded **preterm delivery** (< 37 weeks) increased asthma risk by approximately 33% (99)

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Asthma
Evidence Based Diagnosis
(As of 01/23/09)

The National Asthma Education and Prevention Program (NAEPP) has published guidelines for the diagnosis of asthma (1;2). Diagnosis is based on the following:

1. Episodic episodes of airflow obstruction
    - A. Difficulty breathing
    - B. Chest tightness
    - C. Cough (worse at night)
    - D. Symptoms worsening at night, awakening the patient
    - E. Symptoms worsening with exercise or viral infections, changes in weather, strong emotions, or menses; or in the presence of animals, dust mites, smoke, pollen or chemicals.
    - F. Wheezing
2. Airflow obstruction at least partially reversible
    - A. Diurnal variation in PEF of more than 20% over one to two weeks
    - B. Increase of at least 12% and 200ml in FEV_1 after bronchodilator use
    - C. Reduced FEV_1 and FEV/FVC using spirometry

Diagnostic steps for children under the age of 5 are the same as noted above without use of spirometry (3)

Although the diagnosis of asthma appears to be straight forward, the reader should remember that guidelines do not necessarily equate to a "gold standard". The accuracy of a test is usually measured against a "gold standard" and the lack of a standard can weaken diagnostic studies. In the case of asthma experts disagree as to the "gold standard" for diagnosis. One has said "the preponderance of evidence" is the "gold standard" (4), others state there is no validated "gold standard" (5;6) while still others state bronchial provocation tests are the "gold standard" (7).

In addition to making the diagnosis of asthma the physician should also determine severity based on pulmonary function tests, symptoms and use of rescue medication. These are graded as 1 (mild intermittent), 2 (mild persistent), 3 (moderate persistent) and 4 (severe persistent) (3).

CLINICAL TESTING

1. Spirometry (B): Spirometry consists of many individual tests. Minimal recommendations for spirometry equipment, as established by American Thoracic Society, is the ability to measure vital capacity, (VC), forced vital capacity (FVC), timed forced expiratory (FEV_1), largest expiratory flow (PEF), time zero, mean expiratory flow during the middle half of FVC ($FEF_{25-75\%}$), instantaneous forced expiratory flow (V), forced expiratory time (FEV%) and maximal voluntary ventilation (MW) (8). Additionally peak flow meters (PFMs), a form of spirometry, are commonly used to monitor asthma status (9;10). Although spirometry is considered a mainstay in the diagnosis of asthma by many, it is not without critics. In one randomized cohort study of 102 patients undergoing lung function tests general practitioners and specialists were in diagnostic agreement only in 20.4% of

the cases with the greatest separation between "normal" and "asthma" patients (11). Another found most asthmatic children have normal lung function, especially FEV_1, and most lung studies do not correlate well with severity (12). Others have found significant differences in the accuracy of different peak flow meters which provide inconsistent results (13). Additionally at least one author has called for improved tools to interpret data to better reflect validity rather than ease of use (14) and the need for standardization of charts (15). Another form of spirometry is a bronchial hyperresponsiveness (BHR) test which introduces substances (i.e. histamines, methacholine or saline) into the airway which induces at least a partial asthmatic response. Worsening of FEV_1 is considered diagnostic. In one study 53% of those with BHR had no asthma diagnosis and 48% of all subjects with diagnosed asthma did not have BHR (16). In a separate cohort study of 123 patients BHR was deemed as the most accurate asthma test with high positive (87.3%) and negative (93.5%) predictive value (17).

2. Questionnaires (B): Questionnaires are often used in epidemiological studies to determine prevalence of asthma or as a basic screening tool to identify potential asthmatic patients. Additionally the questions often mimic questions the physician would ask when taking a patient history. Several different types of questionnaires have been introduced to include the International Study of Asthma and Allergies in Childhood (ISSAAC), Collaborative Study on the Genetics of Asthma (CSGA) and European Respiratory Health Survey (ECRHS). Most of these instruments have high specificity but low sensitivity (18-21) which reduces their value in ruling out asthma as a diagnosis but are helpful in ruling in a diagnosis. Most authors consider questionnaires to be of value as a component of the diagnostic process (18;20-23).

3. Exhaled nitric oxide (B): Fractional exhaled nitric oxide (FE_{NO}) is a biomarker of airway eosinophilic inflammation which is present in asthma (24). When used correctly it may be of value in the identification of individuals with subclinical allergic airway inflammation which may ultimately result in clinical asthma (25). However, it is most helpful in moderate and severe asthma (26). The use of FE_{NO} as a marker for inflammation in asthma is a relatively recent event. Its value as a diagnostic procedure is a source of intense discussion in the scientific literature although movement towards acceptance is the current trend. The advantages of exhaled nitric oxide are its ease of use and noninvasive nature. Several studies tout its value in the diagnosis and management of asthma (27-31) while others consider measurement of exhaled nitric oxide promising but suggest additional study prior to incorporating into widespread use (32-35). Others, as recently as 2008, concluded FE_{NO} "cannot be recommended for routine clinical management of adults with asthma" (36). For authors accepting its value, it should be noted the greatest value is in children and adults and has lesser value in infants (37).

4. Eosinophils (B): Eosinophils are present in the blood and sputum. They are considered markers for airway inflammation and correlate well with FE_{NO}. They are of value in the diagnosis of asthma according to several studies (29;38-42). In a cohort study of 162 subjects 2/3's of the subjects with mild to moderate asthma had increased sputum eosinophils (43). The primary concern with sputum eosinophil counts is the safety of the procedure. A cohort study of 71 children examined this question and concluded the inhalation of 3% saline aerosol to induce sputum production "has a predictable risk" and "should be undertaken in carefully monitored conditions" (44). For this reason FE_{NO} is the preferred method of measuring airway inflammation.

5. Imaging (C): The use of imaging in the diagnosis of asthma is limited. Two forms of imaging have been found in the literature, high resolution computed tomography (HRCT) (45-47) and hyperpolarized helium-3 MRI (48). Both forms visualize the airspaces to determine the degree of remodeling. Primary use of these technologies has been limited to more severe cases or as a research tool.

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Asthma
Evidence Based Treatment
(as of 02-11-09)

The use of complementary therapies in the treatment of asthma is quite remarkable. Sixty percent of individuals with moderate asthma and 70% of individuals with severe asthma have sought additional treatment to complement the traditional medical model (1). A wide variety of conservative interventions were located for the treatment of asthma. Unfortunately most studies for individual interventions are either limited in number or of limited quality. Although most therapies have a clinical basis of evidence, support in the scientific literature is weak. Most authors emphasize the urgent need for additional study in this understudied yet extremely important area of healthcare (2-4). Virtually all conservative interventions are tested while the patient is maintaining regular medical care.

CONSERVATIVE TREATMENT OPTIONS

1. Education (A): Clear evidence exists in the literature supporting education as a beneficial intervention, although improvements are generally modest in nature. The strongest evidence of effectiveness is for children. A Cochrane review reported, based on 32 RCT's, modest improvements in days of school missed, days of restricted activity and emergency room visits. Moderate improvement of airflow measures were also noted (5). Similar benefits do not appear present in educational programs for adults according to a second Cochrane review of 12 trials (6).

2. Exercise (B): It is sometimes difficult to rate effectiveness of a treatment because different studies are looking for improvements in different areas. Exercise has been investigated to determine effect on lung function, quality of life, use of inhalers, cardiovascular fitness or days of wheezing just to name a few. A recent Cochrane review concluded exercise had no effect on lung function or quality of life although Improvements in cardiovascular fitness were acknowledged (7). Others have found improvements in quality of life as well as improvements in overall fitness. Fanelli et al found in their RCT of 38 children that an exercise program meeting 2x per week for 16 weeks, which included 30 minutes of aerobic exercise and 30 minutes upper and lower limb and abdomen exercises, improved quality of life, reduced need for daily medication and reduced episodes of exercise induced bronchospasm (EIB) (8). Another RCT of 62 children found 8 weeks of basketball training improved fitness, quality of life and reported no episodes of EIB (9). Although swimming is considered a good form of exercise for asthmatics (10-12), at least one very small RCT reported no changes in asthma symptoms or improvements in lung function (11). Coping behavior as well as physical fitness in children was reported as improved in an RCT investigating the effectiveness of a 3 month exercise program (13). Non traditional exercise programs have also been studied. A RCT of 30 children tested Tai chi training over 12 weeks and reported statistically significant improvements in pulmonary function in the short term (14).

3. Breathing exercise (B-): Nasal breathing, mouth and nasal breathing, diaphragmatic breathing, slow breathing and Buteyko breathing are just a few of the different breathing techniques investigated for asthma. The variety of techniques makes evaluation of the different techniques under the umbrella of "breathing exercises" difficult. Although a

Cochrane review published in 2000, stated “no conclusions can be drawn”, two new studies have changed the authors’ conclusion to “encouraging” (15). A 2009 RCT with 183 patients utilizing diaphragmatic and nasal breathing resulted in statistically significant improvements in asthma-specific health status, but not in asthma physiology at the 6 month follow up (16). Improvements were also noted in an RCT of 57 patients utilizing two different breathing exercises (17) and in a cross-over trial of 18 patients using yoga (pranayama) breathing exercises (18).

4. Yoga (C+): Several small RCT’s have demonstrated yoga may be of limited benefit as a complementary therapy in the treatment of asthma (19-21). A 2008 review of yoga for children stated yoga “may benefit children” but larger trials are needed. It should be pointed out that there are many forms of yoga and only a few, such as sahaja and pranayama have been tested. Manocha et al suggested the physiological improvements noted may be the result of altered breathing patterns (19).

5. Herbal Remedies(C+): A significant number of RCT’s have been performed on herbal preparations for the treatment of asthma. However the number of studies is more a reflection of the number of different herbs tested rather than a thorough investigation of one treatment. A recent Cochrane Review located 27 different trials which investigated 21 different herbal preparations. Generally the reporting qualities of these studies were poor and the number of subjects small. The authors concluded there is insufficient evidence to determine the effectiveness of herbal preparations although some study results were promising (22). Another systematic review, published in 2007, located 16 RCT’s and 21 quasi-experimental studies on herbal preparations. The most commonly investigated herb was ***Tylophora indica*** *(T-indica)* with a total of 8 studies. Generally the results of these studies were positive but a high number of side effects were noted to include sore mouth, loss of taste for salt, nausea and vomiting and upper abdominal pain. For these reasons the authors questioned the safety of *T-indica* (2). Huntley and Ernst in their review found limited positive outcomes, considering the quality of the studies, for **ginkgo liquor**, **IKPA tablets** (a blend of herbs), **WTM** (a blend of herbs), **dried ivy extract**, *T-indica* and ***Boswellia serrata*** aka frankincense (23). **Butterbur root** (*Petasites hybridus*) has demonstrated effectiveness in 1 RCT (24) and 1 open trial (25) with minimal side effects. In both studies butterbur was used in conjunction with inhaled corticosteroids or regular medical treatment. The RCT noted improvements in bronchial hyperresponsiveness, exhaled nitric oxide and serum eosinophils. The open trial demonstrated decreased number, duration and severity of attacks with improved peak flow and forced expiratory volume. Although most formulations comply, it should be noted processed butterbur that removes pyrrolizidine alkaloids, a potential carcinogen, should be utilized in treatment protocols (25).

6. Nutrition (C+): There is significant disagreement whether nutritional supplementation has established itself as a viable treatment option in asthma. Cochrane reviews have explored **vitamin C**, **selenium**, and **marine fatty acids** and essentially concluded there was insufficient evidence to demonstrate effectiveness (26-29). Two RCT’s, one on **omega 3 fatty acids** (30) and another on **vitamin E** (31), could not establish a treatment effect. Still there is a relatively large body of evidence in smaller, lower quality studies supporting the use of nutritional supplements. A RCT of 10 athletes found a protective effect in EIB for 5.4 g of **fish oils** taken daily for 3 weeks (32). Another prospective study of 7 subjects found decreased seasonal asthma due to

allergy after taking 3 g of **fish oils** for a minimum of 8 weeks (33). Two studies found 250 mg of **vitamin C** and 50 mg of **vitamin E** were protective against air pollutants and high ozone in asthmatic children (34;35). A RCT of 37 patients, aged 7 to 19 years, tested 300 mg of **magnesium** against a placebo for two months. At the completion of the study the authors found the magnesium group reduced medication usage and had fewer exacerbations of their condition (36). An interesting editorial was published 2008 where the authors flatly state 40% of all asthma in children is attributable to deficiencies in fat soluble vitamins and asthma is a vitamin deficiency disease (37). In a prospective study of 2032 patients researchers found a correlation between intake of soy genistein and improved lung function in asthmatic patients. Although the authors refuse to make a causal link between soy genistein and improved asthma they note there is a relationship between genistein and severity of asthma (38). In a randomized cross-over trial of 32 patients researchers found decreased intake of **lycopene-rich foods** resulted in worsened asthma outcomes and increased intake resulted in improved outcomes (39).

7. **Spinal manipulation (C):** Anecdotal evidence and tradition within the chiropractic community, similarly to traditional osteopathic medicine, has generally supported the use of spinal manipulative therapy (SMT) in the treatment of asthma. Several investigators have tested the hypothesis and results have been mixed. Most studies have been small in size and scope thereby limiting their utility. A Cochrane review for manual therapy concluded "there is insufficient evidence to support the use of manual therapy" (3). A review performed in 2002 concluded SMT could not be supported as a primary treatment but due to reports of subjective improvement may be effective as a complementary intervention (40). The largest study located was a RCT of 91 children which found no statistically significant outcomes in favor of the chiropractic group compared to the sham group (41). A randomized clinical pilot study of 36 children demonstrated improvements in quality of life and decreased asthma severity. The authors of this study concluded the improvements were probably not the result of SMT alone (42). Two lower quality studies demonstrated improved lung function immediately following osteopathic intervention, but long term follow ups were not performed (4;43). No adverse events were reported in any of the referenced studies.

8. **Relaxation therapies (C):** A PubMed search for RCT's on asthma AND **hypnotherapy** located only 3 studies that were conducted since 1990 (44-46). Although results were promising, one was limited to hayfever patients with mild asthma (9), one was a pilot study (10) and one had only 5 subjects (11). A recent review from 2007 concluded hypnosis was possibly effective for asthma symptoms and illness behavior but there was insufficient evidence to determine an effect on the inflammatory response (47). A 2002 systematic review on relaxation therapies, which included hypnosis, concluded "there was no evidence that hypnosis, autogenic training or **biofeedback** are effective for asthma symptoms (48). One RCT was located that found that biofeedback may be an effective adjunct in the treatment of asthma (49).

9. **Acupuncture (C):** The value of acupuncture is difficult to evaluate, if for no other reason, there is a significant variety in the different points selected for stimulation in different studies. A 2004 Cochrane review, last assessed as of 2008, concluded "there is not enough evidence to recommend the use of acupuncture in the treatment of asthma" (50). This review included 12 studies which were considered of poor reporting quality. A separate meta-analysis of 11 trials "did not find evidence of an effect of

acupuncture" and suggested there was publication bias in favor of acupuncture (51). Although these reviews did not find benefit, acupuncture is a commonly used complementary therapy to traditional medicine (52). Two **laser acupuncture** studies have been recently published (53;54). The first, using an 830nm wavelength with an output of 22.5mW, showed no effect for a single treatment of laser acupuncture compared to a placebo (11). The second, published in 2008, using a 904nm wavelength and with an output of 15W had more favorable outcomes. The author utilized *Su Jok* principles and demonstrated improvements in 3 of 5 lung function measurements. Power calculations were not performed in this study and outcomes were measured after 12 days of treatment. There was no long term follow up. It should be noted in all studies located, acupuncture was utilized in conjunction with drug therapy, not as a stand alone therapy.

10. **Probiotics (C):** Two systematic reviews of probiotics were located. One stated there was "no effect of probiotics on asthma treatment" (55) and the other stated probiotics may be beneficial in reducing allergy and, as a result, atopic asthma (56).

Asthma
Evidence Based Pharmaceutical & Invasive Treatment
(as of 2-20-09)

At this time there are no curative treatments available for asthma. Due to the wide variety of available interventions and the complex nature of asthma treatments, the information provided below is based on review articles from the *American Family Physician.* These articles are available free online. The discussion offered here will address only two of the most commonly utilized interventions, inhaled corticosteroids and beta agonists. For a more in depth review the reader is encouraged to access the full text articles.

1. Inhaled corticosteroids (A): Inhaled corticosteroids are considered the first-line therapy in all patients with asthma. According to the National Asthma Education and Prevention Program (NAEPP) corticosteroids do not have long term, clinically significant or irreversible adverse effects (57) (http://www.aafp.org/afp/20040915/1061.html).

2. Beta agonists (B): Beta agonists are available in two forms, short and long lasting. The role of short acting beta agonists is as a rescue medication in acute exacerbations. Long lasting beta agonists are used in combination with inhaled corticosteroids for improved outcomes in patients with moderate persistent symptoms (57;58) (http://www.aafp.org/afp/20040915/1061.html and http://www.aafp.org/afp/20050515/1959.html).

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