The Effects of Exercise on Asthma and Quality of Life

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THE EFFECTS OF EXERCISE ON ASTHMA AND QUALITY OF LIFE

Abstract

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Asthma remains an increasingly serious health condition affecting 24.6 million people (8.2% of the US population) causing decreased quality of life and even death. Asthmatics are more likely to lead sedentary lifestyles related to fear of exercise-induced bronchospasms, physical barriers, such as resting airflow obstruction, and parental beliefs about exercise harming their children. A literature review was conducted to assess the effects of exercise on asthmatic quality of life as measured by respiratory function, asthmatic symptoms, and emotional wellbeing. Research strongly suggests that varying types of aerobic exercise (swimming, running, basketball, cycling, etc.) can improve respiratory function, decrease asthma symptoms, decrease medication use, decrease hospitalizations and physician visits, increase self-management, improve school and work attendance, and increase emotional wellbeing in asthmatics across all degrees of asthmatic severity. This literature review concludes that asthmatics should be encouraged to aerobically exercise to reap the research-supported benefits and be less affected by their asthma. Further research is warranted for greater understanding on amount, types, and exertion required when exercising to reap the greatest benefits.

Key Words: asthma, asthmatic, exercise, aerobic exercise, physical activity, quality of life, emotional wellbeing, asthma symptoms, respiratory function, medication, asthma prevalence, asthma barriers
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The Effects of Exercise on Asthma and Quality of Life

Asthma affects 24.6 million people in the United States (U.S.), which accounts for 8.2% of the population (Zahran, Bailey, & Garbe, 2011), and are more likely to have a diminished quality of life because of unique barriers (Basaran et al., 2006). Asthma is a chronic inflammatory disease of the airways causing bronchospasms, bronchial swelling, and mucous production that produces airway obstruction. This pulmonary hyperresponsiveness leads to shortness of breath, wheezing, and even death initiated by stimuli such as cold air, exercise, dust mites, air pollutants, stress, and anxiety (American Lung Association, 2008). Asthma has four classifications of severity, intermittent, persistent-mild, persistent-moderate, and persistent-severe, based on an algorithm of symptoms, interference with normal activity, and lung function tests.

Despite better air quality and a decrease in 2nd hand smoke (Zahran, Bailey, & Garbe, 2011), the current prevalence of asthma signifies a continued increase from 2001 to 2009 of 4.3 million individuals (1.1%) as measured in a Center for Disease Control survey. According to the American Lung Association, asthma is the leading cause for chronic childhood illness affecting 9.6% of children (2008). While the prevalence of asthma has increased across all populations, the increase has been greatest among non-hispanic blacks, those residing in low-income areas, and individuals with greater body mass index’s (Zharan, Bailey, & Garbe, 2011; Nelson, Awad, Alexander, & Clark, 2009). Moreover, the direct and indirect financial impact of asthma is greater than $50 billion/year, including $3.8 billion/year in missed school or work, and $2.1 billion/year in premature deaths (Zahran, Bailey, & Garbe, 2011).

Basaran et al. (2006) found that the quality of life in those who are afflicted with asthma is decreased compared to their non-asthmatic peers, because of unique barriers. The greatest
determinant of quality of life in asthmatics was directly related to exacerbation of asthma symptoms. The better the asthma control, the greater the quality of life and vice versa. The American Heart and Lung Association indicates that the goal of asthma control is for individuals to live normal lives uninhibited by their condition (2008). Therefore, aims at achieving this goal should be directed at decreasing asthmatic symptoms to improve asthmatic quality of life.

Further contributing to poorer quality of life, asthmatics are also more likely to lead sedentary lifestyles due to their increased exertional dyspnea (Pianosi & Davis, 2004). Ford, Heath, Mannino, and Redd (2003) found that asthmatics are less likely than their non-asthmatic peers to be active and avoid more intense or vigorous activities like running and basketball. These findings were supported by research conducted by Lang, Butz, Duggan, and Serwint (2004), who found that 21% of asthmatics, versus 9% of non-asthmatics participants didn’t exercise regularly. A lack of exercise in asthmatics can cause an increased risk of psycho-social problems, such as “low self-esteem, psychiatric disorders, poor social competence, and poor school performance” (Van Veldhoven et al., 2001, pg. 361; Maclean, Perrin, Gortmaker, & Pierre, 1992). The decrease in asthmatic quality of life is exacerbated by the lack of regular exercise. Exercise has been well documented in improving several different quality of life measures, including immune protection, health promotion, emotional benefits, and longevity.

Mansour, Lanphear, and Dewitt (2000) found that parental health beliefs, parental knowledge of asthma and asthma management skills, and cultural issues may influence exercise belief and tolerance. Lang, Butz, Duggan, and Serwint (2004) found that the two limiting factors predicting whether a child would be active for less than 30 minutes per day was the severity of the asthma and if the parent believed that physical activity would exacerbate the symptoms. Parents were concerned of the impact from physical activity and would not allow their children
to participate in exercise when they believed it would worsen their symptoms. Dozier, Aligne, and Schlabach (2006) noted 58% of parents accurately assessed the status of their child’s asthma, which suggest that some parents may not allow their child to participate in physical activity without correct reasoning.

Some research indicates that those with asthma are believed to have decreased exercise tolerance related to resting airflow obstruction and bronchial hyperresponsiveness (Basaran et al., 2006; Pianosi & Davis, 2004). Asthmatic fear of exercise induced asthma coupled with research stating that exercise may cause asthma exacerbations has lead to recommendations that asthmatics avoid or proceed with extreme caution when exercising. Conversely, research by Welsh, Roberts, and Kemp (2004) found that poor aerobic fitness was related to a sedentary lifestyle, rather than asthmatic pathophysiology suggesting that those with asthma should not be inhibited by exercise any more than their non-asthmatic counterparts.

The purpose of this literature review is to study the effects of exercise on quality of life as measured by respiratory function, symptoms, and emotional wellbeing. The results of this review will be used to determine if exercise should be avoided by asthmatics because of the lack of benefit or should exercise be encouraged because of the evidence of benefit.

Theoretical Framework

The theoretical framework utilized for this literature review is The Theory of Planned Behavior developed by Icek Ajzen and Martin Fishbein. This theory has played a substantial role on nursing practice after its inception in the 1970s and since its growing application in the 1980s (Jahankhani, Lilburn, Me, & Leonhardt, 2010). The theory states that an individual’s behavior is influenced by attitude (how an individual perceives the consequences of the behavior), subjective
norms (influence from other individuals), and perceived behavioral control (the individual’s perceived volitional control over the behavior) (Ajzen, 1991). Understanding these concepts can lead to applications of the Theory of Planned Behavior in measuring behavior influences, increasing educational impact, and allowing for more accurate assessment of an individual’s potential for behavioral change. If the literature review of the effects of exercise on asthmatic quality of life indicates that exercise is beneficial to those with asthma, then the Theory of Planned Behavior can be utilized by health care professionals to aid in the implementation of exercise for asthmatics by influencing the individual’s attitude, subjective norms, and perceived behavioral control. The Theory of Planned Behavior can guide practitioners to create greater compliance and thus better health outcomes and quality of life in their patients.

**Literature Review**

A literature search was conducted using the CINAHL and EBSCO database for the following keywords: *asthma, prevalence, exercise, quality of life, and effects*. Inclusion criteria included English language, full text and abstract available. Literature reviews and articles without objective findings regarding quality of life and/or an exercise intervention in those with asthma were excluded, except for articles used to cite asthma prevalence, barriers, or guidelines. Twenty-one articles were found between 1992 and 2011, which adequately discussed the effects of exercise on quality of life in children and adults with asthma. It is noteworthy to define the concept of quality of life used in this literature review as the effects that asthma has on an individual by positively or negatively impacting their lives by such factors as respiratory function, amount of symptoms, and emotional wellbeing.
Respiratory Improvement After Exercise

A study conducted by Basaran et al. (2006) gathered 62 children with mild – moderate asthma and split them into two groups. The control group (N=31) received an eight-week home respiratory exercise program that consisted of relaxation and breathing techniques, while the exercise group (N=31) received the eight-week home respiratory exercise program in addition to an eight-week intensive basketball training program. The results of the study indicated that no significant pulmonary changes were detected, except the exercise group had significant improvement in peak expiratory flow (PEF) values, but even this proved statistically insignificant when compared between groups (exercise group: pre-training PEF = 82.9, post-training PEF = 87; control group: pre-training PEF = 81.9, post-training PEF = 86.1). Contrary to common asthmatic fears, the exercise group did not experience an increase in exercise-induced bronchospasms (EIB) or medication use when compared to the control group. Zero exercise-induced bronchospasms were witnessed during training sessions, which included a 15 minute callisthenic warm-up, 30-35 minutes of submaximal basketball training, and 10 minutes of stretching and cool down. The study does not delineate whether or not a bronchodilator was used prior to training in the exercise group. The fact that there wasn’t a greater difference in pulmonary function tests between groups may indicate the importance of relaxation and breathing techniques that were initiated in both the control and exercise group.

Another study involving children in a non-exercise group (N=17) and an exercise group (N=21) found respiratory function variances in favor of the exercise group (Fanelli, Cabral, Neder, Martins, & Carvalho, 2007). The non-exercise group received only an education program that included an educational video tape about the basics of asthma, an interactive class to clarify disease pathophysiology, proper medication use, and directions to create a written asthma action
plan. The exercise group did not receive education and was subjected to a physical training
program that was conducted twice a week for 90 minutes over 16 weeks. The training program
included a 15 minute warm-up and stretch, 30 minutes of aerobic exercise on a cycle and/or
treadmill, 30 minutes of upper-limb, lower-limb, and abdominal endurance exercises, and 15
minutes of cooling down, stretching, and relaxation. At the end of the 16-week study period, the
exercise group had significant improvements in respiratory function at submaximal and peak
exercise (control group: oxygen consumption = 0.5, oxygen uptake per heartbeat = 0.5; trained
group: oxygen consumption = 3.3, oxygen uptake per heartbeat = 1.4), a decrease in severity of
exercise-induced bronchospasms as measured by force expiratory volume in 1 second (FEV1)
(control group: FEV1 decline = 9.7% from baseline; trained group: FEV1 decline = 5.4% from
baseline), and lessened post-exercise breathlessness, when compared to the non-exercise group
(control group: dyspnea = 2; trained group: dyspnea = -2). The exercise group also had a
decrease in daily doses of inhaled steroids (trained group: 11/21 reduced, 7/21 unchanged, 3/21
increase), while the majority of non-exercise group either maintained or increased their daily
doses (control group: 4/17 reduced, 12/17 unchanged, 1/17 increased).

asthma and five non-asthmatic adult subjects as a control group and had them both complete a
step aerobic conditioning program three days per week for 10 weeks. The participants were
instructed to maintain their target heart rate (70% of their maximum oxygen consumption
measured in milliliters per kilogram per minute – Vo2max) for 30 minutes each session. Unlike
the two previously reviewed articles, this study did not include an education intervention. Both
the asthmatic and the control group showed improved aerobic fitness (asthma group: Vo2max
before = 22.73, Vo2max after = 25.29; control group: Vo2max before = 22.94, Vo2max after =
27.85), indicating the exercise program impacted both groups. The asthma group showed increased maximum voluntary ventilation (before = 96.0 L/min, after = 108.2 L/min), a reduction in dyspnea index at V02max (before = 0.72, after = 0.63), and decreased hyperpnea with exercise (before = 34.6 breaths/min, after = 32.8 breaths/min). These results again support that exercise can improve respiratory function and in some cases decrease the severity of exercise-induced bronchospasms.

**Symptom Improvement After Exercise**

In the Hallstrand, Bates, and Schoene (2000) article previously mentioned, individuals with mild intermittent asthma had “…no significant change in bronchodilator use, daytime or nocturnal asthma symptoms scores, or cough after the conditioning program” (pg. 1462). However, the researchers did not provide specific objective data such as symptom assessment scores to support this statement. Regardless of the small sample size, the study may still significantly negate the idea, especially held by parents, that exercise would worsen asthmatic symptoms (Lang, Butz, Duggan, & Serwint, 2004) and can instead improve exercise symptoms by improving respiratory function.

Tousman, Zeitz, Taylor, and Bristol (2007) evaluated 21 adults (16 women, 5 men) enrolled in a 7-week small group course designed to aid in improving asthmatic self-management and measured their Quality of Life Scores pre- and post-course. These scores measured amount of physical activity, symptoms, attitudes toward their asthma, and environmental exposures; the higher the score indicated a greater quality of life. The authors found that post-course exercise and symptom scores were higher after the 7-week educational course (exercise pre-course score = 4.7, exercise post-course score = 5.5; symptom pre-course
score = 4.5, symptom post-course score = 5.6) indicating a possible correlation with increased exercise and decreased asthmatic symptoms. The results of this small sample size study cannot be attributed to exercise alone, as exercise was not the only intervention. Education was also provided on asthmatic specific behaviors, such as avoidance of asthmatic triggers, medication adherence, and certain lifestyle behaviors like practicing relaxation and hand washing. This study may have had participant bias, as individuals may have reported better outcomes and adherence to interventions, than what would have been objectively observed.

Children (N = 62) with mild to moderate asthma were enrolled in an 8-week basketball exercise program designed by Basaran et al. (2006) to measure the results of exercise on symptoms scores. The study had consistent findings of symptom improvement with physical training compared to a non-exercising control group (exercise group: pre-training symptom scores = 0.74, post-training symptom scores = 0.20; control group: pre-training symptom scores = 0.32, post-training symptom scores = 0.39). The children in the basketball program attended three sessions per week that entailed 15 minutes of warm-up and calisthenics, 30 – 35 minutes of submaximal (70 – 85% of maximal heart rate) basketball training, and then 10 minutes of cool-down and stretching exercises. It is evident that the exercise group had significantly higher pre-training symptom scores, which could have led to falsely perceived lowering of post-training scores. The post-training scores of the training group were also significantly lower than the control group. The control groups pre- to post-training scores actually worsened (0.32 to 0.39). This implies that the intervention of exercise in the training group led to lower symptom scores. The post-training scores of the exercise group were significantly lower than both the control groups pre- and post-training scores (0.20 compared to 0.32 and 0.39) which indicates that, even
disregarding the inflated pre-training exercise symptom scores, the post-training results where much more improved compared to the control group.

A retrospective study to examine the effects of swimming on children with asthma in New South Wales involving 73 children enrolled in a weekly swimming program discussed the pre-participation enrollment results compared to the post-participation results conducted at the end of at least one year (Wardell, Huang, & Isbister, 2006). During the study, asthma qualified volunteer coaches instructed participants to take peak-flow readings before and after swimming, ensured pre-swim breathing exercises were performed emphasizing diaphragmatic and nasal breathing, and that the participant’s parent(s) were present during the session. The post-participation results showed an 18% (N = 71) decrease in snoring, 50% (N = 71) improvement in severity of asthma, 46% (N = 73) reduction in physician visits, 64% (N = 73) reduction in hospitalizations, 74% (N = 58) fewer school absences related to asthma, and a 67% (N = 73) increase in asthma management, when compared to the pre-participation results. Exercise was not isolated as the only intervention and, therefore, it cannot be assumed was the only attributing factor in improving asthmatic symptoms. The peak-flow readings, breathing exercises, parental involvement, and asthma qualified instructors were all possible additional factors in improving asthmatic symptom scores.

Research supports that exercise may have long-term effects on symptom improvement, even after the exercise intervention. A qualitative study conducted by Emtner and Hedin (2005) found benefits three years after a 10-week exercise program involving 21 adults. Initially, all 21 adults were subjected to the 10-week exercise program that was separated into two phases. Phase 1 involved a 2-week period of 45 minute physical training sessions (swimming and land exercises) followed by a three-hour physiotherapy intervention, where participants were
instructed on “Practical sessions in techniques for inhalation, breathing, relaxation and prevention of stress incontinence” (pg. 124), as well as “…theoretical education in anatomy, physiology, physical training, medication, monitoring of peak expiratory flow rate (PEFR), asthma trigger identification and control, stress management, and handling of exacerbations” (pg. 124). Phase 2 involved eight weeks of continued physical training without the controlled physiotherapy or theoretical education, while still allowing discussions during the training sessions to maintain adherence to the 10-week program. After the 10-week training program, the 21 adults were then separated into two groups: one group (N=10) continued exercise twice a week for three years and the other group (N=11) discontinued regular training. Interestingly, they found that both groups three years after the 10-week exercise program were “…more physically active in daily life, less limited by their disease, and they were better able to control their asthma irrespective of being adherent with exercise recommendations” (pg. 132). While the exercise group appeared to be overall less affected by their asthma, when compared to the non-exercise group, both had improvements three years after the 10-week training program. The results of the survey taken by both groups three years after the intervention are as follows: I have asthma symptoms [Always – Not at all, 0 – 10 scale]: exercise group start = 6.9, three years later = 9.6, non-exercise group start = 5.6, three years later = 8.9; My asthma disease influences my daily life [Always – Not at all, 0 – 10 scale]: exercise group start = 6.0, three years later = 9.1, non-exercise group start = 7.3, three years later = 8.5). Overall the results of the study are impactful, but are not easily generalized due to the small sample size, the participants involved volunteers for the study (convenience sample), and interviewer bias. Also, the results of the study are limited to mild to moderate asthmatics, because no severe asthmatics were enrolled in the study.
Emotional Improvement After Exercise

Along with increasing respiratory function, decreasing asthmatic symptoms and physician utilization through better self-management, exercise has also been shown to improve emotional wellbeing in asthmatics. A study of 73 asthmatic children enrolled in a 12-month swimming exercise intervention recorded an increase in quality of life post-intervention (Wardell, Huang, & Isbister, 2006). The authors documented significant improvements in quality of life among participants as evident by a 77% increase in self-confidence (N = 72), and an 81% improvement in feeling less disadvantaged, because of their asthma (N = 73). The participants in this study were noted to have increased participation in the wind section of their school band, sporting, and non-sporting activities. A quality-of-life assessment tool was not mentioned as being used by the study, but instead it appears that authors concluded participant quality of life had increased through self-reported improvement of self-confidence and feeling less disadvantaged, because of their asthma. The researchers only included percentages indicating the difference in improvement in the parameters measured, so it is difficult for the reader to verify the conclusions.

The increase in physical and non-physical activities after an exercise intervention was not isolated to the swimming study alone. Veldhoven et al. (2001) enrolled 47 asthmatic children (ages 8 – 13) and divided them into two groups: an exercise group (N = 23) that was exposed to group exercises twice a week for one hour in a gymnasium and one 20 minute exercise session per week at home over a three month period, and a control group (N = 24) that did not received any exercise intervention. The parents of the exercise group reported an increase in sports activity, time spent outside, and time spent playing with other children after the three-month
exercise program when compared to the control group. Admittedly, this parental report was subject to parental bias. There is also a possibility that the reported increase in activity after the intervention could be related to a number of other factors. A majority of the participants were pre-medicated before exercise (usually with an inhaled beta2-agonist) and thus the improvement after the exercise program could merely indicate proper usage of their inhalers after being instructed on medication use before exercise. The benefits may also be confounded by education intended to improve coping behaviors with asthma.

Tousman, Zeitz, Taylor, and Bristol (2007) provided asthma specific education to 21 adults and discovered an overall improvement in asthmatic quality of life (QOL). Weekly small group discussions were held over seven weeks as an educational intervention. The small group discussions comprised of a 2-hour session, where 60 minutes were spent reviewing the previous week called Individual Status Report (ISR), 45 minutes were spent on the week dependent session discussion topic (asthma action plans, relaxation, medications, behavior change, exercise, hydration, and triggers), and 15 minutes were spent on the homework assignment meant to encourage participants in the practice of self-management behaviors. The homework assignments were completed throughout the week and the participants were instructed to keep track of time spent on recommended activities (relaxation, medications, 4 peak flow recordings, 8 hand washes, 64 oz of water, and exercise for 15 minutes). Participants were then given points based on the time spent on or in the accomplishment of the activity. The only exception to this structure was during week one when the participants spent the first 60 minutes to fill out pre-course surveys on asthma knowledge, QOL, physiologic measurements, and behavior change. The QOL survey completed by the participants were based on "...Juniper’s 32-item asthma QOL survey, in which items were grouped in four subscales: activities, symptoms, emotions, and
environmental exposure. Each of the 32 items had a seven-point scale, with a higher number indicating a better QOL” (pg. 241). According to the Juniper QOL survey, an improvement of greater than or equal to 0.5 constitutes a clinically relevant effect.

The results of the Tousman, Zeitz, Taylor, and Bristol (2007) study, based on the Juniper QOL survey are illustrated in Table 1. The small sample size results indicate that there was substantial improvement in emotional wellbeing and QOL in those who participated in the study. It is difficult to determine what portion of these effects can be attributed to exercise, since exercise was not the only intervention. Average exercise amount did increase by 2.4 relative to pre-course scores (N = 19, pre-course score = 2.7, post-course score = 4.8), but little other information is given in regards to the specifics of the recommended 20 minutes of exercise a day type.

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<td>Pre-course Score</td>
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<td>Activity Limitation</td>
<td>4.7</td>
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<tr>
<td>Asthma Symptoms</td>
<td>4.5</td>
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<tr>
<td>Emotional Function</td>
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<td>Environmental Exposure</td>
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<td>Total Quality of Life</td>
<td>4.5</td>
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*Note:* According to the Juniper QOL survey, an improvement of greater than or equal to 0.5 constitutes a clinically relevant effect.

There is no mention of type of exercise, duration, average heart rate, maximal heart rate, symptoms before, during, and after exercise, medication use, or lung function measurements.
Data suggested that “...there were no significant changes in pulse rate, respiration, blood pressure, or PEF (peak expiratory flow) after the intervention (p > .05)” (pg. 246), which may bring into question the quality and adequate work load of the 20 minutes of exercise reported by the participants. The surveys were also subject to participant bias.

Basaran et al. (2006) measured improvements in 62 children with mild-moderate asthma symptoms using the Pediatric Asthma Quality of Life Questionnaire (PAQLQ) after completing an eight-week exercise intervention. The PAQLQ specifically measures health related quality of life in asthmatic children and includes three domains of measurement: activity limitation (N = 5), symptoms (N = 10), and emotional function (N = 8). Each question has a score range of 1 – 7, 1 indicates maximum impairment and 7 indicates no impairment, and a minimum change in score of 0.5 per domain is required to indicate a clinically significant difference. For this study, an interviewer administered the questionnaire before and after the exercise intervention. The 62 children were separated into two even groups, an exercise group (group E, N = 31) and a control group (group C, N = 31). The two groups did not differ in regards to age, sex, height, body mass index, Tanner stage, duration of disease, or pulmonary function. Group E was subjected to an eight-week moderately intensive basketball training program that was conducted three times per week for one hour each session. The sessions included 15 minutes of calisthenics and warm-up, 30 – 35 minutes of submaximal (70-85% of maximal heart rate) basketball training, and then 10 minutes of flexibility exercises and cool-down. Group C was not encouraged in specific exercise training, but both groups were instructed on regular home respiratory exercise training that consisted of relaxation and breathing exercises.

The post-training PAQLQ indicated both groups had improved scores in each of the three domains measured (activity, symptoms, and emotion) as well as total overall improvement, but
the scores of the group E (N = 31) were much higher compared to group C (N = 31). Group C’s scores were not greater than 0.5, which is required to indicate clinical significance, in emotion, symptom, and total QOL scores. The only measurement in which group C’s PAQLQ post-training scores were significantly higher than their pre-training scores was in the activity domain (pre-training scores = 4.65, post training scores = 5.28, difference = 0.63). Group E’s scores were increased in each domain and total scores. Total PAQLQ score increased 1.2 (pre-training = 5.03, post-training = 6.23), activity scores increased 1.28 (pre-training = 4.65, post-training = 5.93), symptom scores increased 1.32 (pre-training = 4.91, post-training = 6.23), and emotion scores increased 1.16 (pre-training = 5.27, post-training = 6.43). Basaran et al. (2006) concluded that the results of their study supported the effects of submaximal aerobic exercise on increasing QOL in mild-moderate asthmatic children and that, “Children with asthma should be encouraged to engage in sports and lifetime exercise” (pg. 134).

The strength of this study in concluding that exercise proved beneficial and improved QOL in asthmatic children was that the two groups were relatively equal in that they were within a mean standard deviation in age, sex, height, weight, Tanner stage, duration of disease, and pulmonary function. This eliminates extraneous variables and makes it possible to conclude with more confidence that the exercise intervention is what caused the improvement in QOL scores in these participants. The pre-training PAQLQ scores of group E were generally lower compared to group C, which could lead to falsely elevated post-training scores. This point is diminished when considering that even though group E’s pre-training scores were lower than group C’s pre-training scores, group E’s post-training scores were also much higher than group C’s post-training scores. The sample size is small and, therefore; results could be falsely skewed as the results of the PAQLQ scores could be nullified if the extremes of the standard deviations were
taken into account. Overall, this is a well-designed study, isolating exercise as an intervention, and the results suggest that exercise improves QOL scores, when compared to a similar population that doesn’t exercise.

Another exercise intervention study involving moderate – severe persistent asthmatics also utilized the Pediatric Asthma Quality of Life Questionnaire (PAQLQ) to determine the effects of exercise on asthmatic QOL (Fanelli, Cabral, Neder, Martins, & Carvalho, 2007). The authors found “Exercise conditioning was related to a significant improvement in health-related quality of life (PAQLQ scores) compared with the controls” (pg. 1477). The study divided the 38 participating children into two groups: a 21-member exercise group, and a 17-member non-exercising control group. Both groups underwent an educational program in asthma control, but the exercise group also partook in a 16-week physical training program comprised of 90-minute exercise sessions twice a week. The physical training exercise included a 15-minute warm-up and stretch, followed by 30 minutes of aerobic exercise on a cycle and/or treadmill, 30 minutes of upper- and lower-limb and abdomen endurance exercises, and 15 minutes of cooling down, stretching, and relaxation. PAQLQ scores were performed on both groups pre- and post-intervention. Average Pre-intervention PAQLQ scores between the control group (2.42) and the exercise group (2.67) were nearly equal.

Figure 2—Trained children had significantly greater improvements in health-related quality of life (i.e., higher PAQLQ scores) compared with controls. * P < 0.05 (Mann–Whitney test). Data are presented as mean and standard deviation.

Figure 2

Figure 2 provided by Fanelli, Cabral, Neder, Martins, and Carvalho, 2007.
illustrates the difference in post-intervention scores between the control group and the exercise group after the 16-week program. The exercise group had significant improvements in activity, symptoms, emotional function, and total PAQLQ scores compared to the non-exercising control group. The study does not provide detailed numerical values for Figure 2 or the post-intervention PAQLQ scores. This makes it difficult for the reader to objectively measure the difference of the pre- and post-intervention scores. This graph distorts the difference in scores between the two groups because the Y-axis limit in Figure 2 is set to 4, when the highest score possible in each domain is a 7. If the graph’s Y-axis were extended out to the actual limit, the change wouldn’t be perceived as so dramatic. The sample size of the studied population is small, and while it does appear the study is split relatively evenly in regards to sex (control group: 11 males, 6 females; exercise group: 12 males, 9 females), there is no mention on whether the groups were equal in regards to age, race, socio-economic standards, or severity of asthma. Overall, the article leaves out necessary information to help support that exercise proved to be substantially beneficial for the asthmatics enrolled in the study.

The three-month Veldhoven et al. (2001) study involved two groups: an exercise intervention group (N=23) that participated in group exercises twice a week for one hour in a gymnasium and one 20-minute exercise session per week at home, and a control group (N=24) which did not receive any extra treatment or care. The authors found that there was a dramatic decrease in pre-test to post-test anxiety scores, when compared to the control group. The exercise group developed better asthmatic coping skills and reported more success and pleasure in sports. Parents found that their children enrolled in the exercise group had improvement in sports activity, as well as a more positive outlook for their children’s athletic future. Veldhoven et al. (2001) concluded that in light of the benefits of activity and exercise individual with
asthma “…should be encouraged to engage in ‘life-time’ sports/physical activity, and to change from a more sedentary lifestyle to a more physically active lifestyle” (pg. 369).

Discussion

While reviewing articles regarding the effects of exercise on asthma and quality of life, it appears that most articles which fit the criteria mentioned in the literature review support the encouragement of exercise for those with asthma, and in particular, aerobic exercise. There are some discrepancies between research articles, namely that there were no standards of measurement for several dependent variables. For instance lung function was measured using different instruments and some measurements were omitted in some articles, while they were included in others. This leaves unmeasured changes that could further support or negate the benefits of exercise. Quality of life was measured using different assessment tools and thus cannot be as objectively compared between articles. Those who have asthma may be affected at different degrees (intermittent, persistent-mild, persistent-moderate, and persistent-severe) and may produce different results depending on the severity. Exercise intensity, length, duration, and activity can differ greatly between articles making it difficult to assess if certain types of exercise produces greater benefits. Some articles cited in the literature review didn’t have strictly exercise interventions only, but also included educational interventions that may have influenced results. Also, most articles reviewed involved a non-random, short-term, small sample size that demonstrates a need for further research with a larger randomized sample size and duration.

Of the articles reviewed, a large majority supported the benefits of exercise in the dimensions that were measured. Because the greatest difference between articles were their exercise intervention, literature suggests that different types of exercises with different intensities
and lengths can still prove beneficial. It appears that the benefits from exercise are accrued from regular exercise and not as much from a particular type of exercise. Further research is needed to conclude if different types of exercise may have more beneficial results than other types of exercise for the asthmatic individual.

**Implications for Nurse Practitioners**

Control of asthma symptoms should be comprehensive enough for individuals to lead normal lives, which includes physical activity (Lang, Butz, Duggan, & Serwint, 2004). From the literature review the benefits of exercise for asthmatics can have improvements for many dimensions of their lives. Exercise should be encouraged to everyone who has asthma and the Theory of Planned Behavior can be utilized to guide practitioners in creating greater adherence to exercise recommendations. First, addressing an individual's attitudes, how they view the consequences of exercise, is critical. Practitioners should assess if the individual views exercise as beneficial or not beneficial and then begin to address common barriers or fears the asthmatic individual may have such as exercise-induced bronchospasms or "asthma attacks." The goal with addressing the attitude of the individual in regards to exercise is to help solidify their view of exercise as beneficial. According to the Theory of Planned Behavior a positive attitude toward a certain behavior will increase the likelihood of the individual engaging in that behavior.

The second area according to the Theory of Planned Behavior that the practitioner should assess in the asthmatic patient is their subjective norms or what influences they receive from others that may aid or hinder them in engaging in exercise. Parental misconceptions that exercise may worsen their child's asthma or exacerbate their symptoms are an example of a subjective norm that may negatively influence the patient from exercising. In an adult, it may be
the lack of support from a spouse or friends. Practitioners can help positively influence the subjective norms by educating them that exercise in asthmatics have been shown to improve respiratory function, decrease symptoms, decrease medication use, increase self-control, and increase emotional wellbeing. Those that may personally influence an asthmatics ability to exercise should be encouraged to aid the individual in exercising, because of its many benefits especially pertaining to asthmatics.

The third area practitioners should address in order to increase the likelihood of their asthmatic patients engaging in exercise, according to the Theory of Planned Behavior, is volitional control. Volitional control is whether the individual views the behavior, such as exercising, as something they have the means to accomplish or not. A practitioner can assess this in the individual by asking if they are physically able to perform some type of exercise, do they have the resources available (gym, school, park, sports, etc.), and do they have the time available required to reap the benefits of exercise. The practitioner can be an excellent source in providing community resources and aiding the individual in discussing ways on how to implement exercise into their life schedule. According to the Theory of Planned Behavior, the practitioner should be a resource to guide the individual in personally addressing attitudes, subjective norms, and volitional control and making their own goals in addressing these issues. While the practitioner may make suggestions, it is important that the individual don exercise as their own goal and not one merely suggested by their physician. This will increase the actual behavior of exercising and improve health and quality-of-life outcomes.

Practitioners should also view aerobic exercise as one of the few prophylactic interventions that can be recommended to their patients, along with trigger avoidance and daily medication use, which aid the practitioner from embarking on the difficult task of controlling
asthma exacerbations. Aerobic exercise is a proactive intervention that provides a broad range of benefits. The greatest determinant of asthmatic quality of life is directly related to exacerbation of asthma symptoms (Basaran et al. 2006); therefore, interventions like aerobic exercise that prevent exacerbation, should be highly encouraged to maintain asthmatic quality of life. Exercise adds another dimension of prophylactic treatment that may empower asthmatics to have better control of their asthma.

The practitioner should remember that while research reviewed showed benefits of exercise for mild, moderate, and severe persistent classified asthmatics, practitioners should be cautious about encouraging exercise for severe persistent asthmatics. One author recommended that patients with severe persistent asthma should not be engaged in aerobic activity until the patient’s asthma has stepped down to at least moderate persistent asthma (Rosimini, 2003). The practitioner should have every asthmatic patient understand the Asthma Action Plan to assist in self-management and follow the 2007 National Heart, Lung, and Blood Institute’s guidelines on asthma management, classification, and treatment for acute and long term care (Rance, 2008). In addition to exercise, recommendations also include allergy avoidance, air pollutant avoidance, infectious precautions, and avoidance of other asthma triggers such as stress, changes in the weather, aspirin, and ibuprofen.

While some research focuses on reaching submaximal or maximal heart rate during exercise to reap the greatest benefits (Tsai, Lai, Chen, & Jeng, 2010), the variability of exercise amongst the other articles reviewed suggests that benefits can be reaped from different exercise activity and length. From swimming to basketball, practitioners should encourage their asthmatic patients to be aerobically active regularly. Generally, regular aerobic exercise indicates at least 20 minutes of exercise for at least two days per week (Fanelli, Cabral, Neder,
Increased benefits could be seen with increased aerobic activity, but the practitioner should at least set a goal for their patient to be active for two days a week, 20 minutes at a time.

Summary

It is well documented that exercise is healthy for children and adults, including those with asthma. Literature supports that those with asthma typically exercise less for a variety of reasons including the fear of exercise induced asthma, perceptions of the benefits of exercise, and parental perception of children’s asthma severity and their exercise tolerance. Exercise can improve asthmatic respiratory function, decrease medication use, decrease symptoms, decrease asthma severity, decrease hospitalization and physician visits, increase self-management, and increase overall quality of life. The Center for Disease Control states that the top priority for asthma should be getting people to manage their asthma better (Zahran, Bailey, & Garbe, 2011) and encouraging aerobic exercise in those with asthma can help accomplish that goal.
References


