American Academy of Allergy Asthma & Immunology

Recommendations for Physical Activity in Asthma: A Work Group Report of the AAAAI Sports, Exercise, and Fitness Committee

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Regular physical activity not only improves general health but also can positively impact asthma outcomes, such as control and quality of life. Despite this, many asthma patients do not engage in regular physical activity because they mistakenly believe that they should restrict exercise participation. Health care providers have an opportunity to influence the physical activity levels of their patients during regular office visits. Nonetheless, health care providers often overlook physical activity counseling as an adjunct to pharmacological therapy in asthma patients, and in particular, overlook physical activity counseling. Some providers who acknowledge the benefits of physical activity report being unaware how to approach a conversation with patients about this topic. To address these issues, members of the Sports, Exercise, and Fitness Committee of the American Academy of Allergy, Asthma, and Immunology (AAAAI) performed a focused literature search to identify and evaluate the effects of physical activity in patients with asthma. The purpose of this report is to summarize the evidence for physical activity's impact on asthma patients' disease control, pulmonary function, and overall well-being. Several subpopulations of patients with asthma, including children, adolescents, and older adults, are considered individually. In addition, this report offers practical recommendations for clinicians, including how to identify and overcome barriers to counseling, and methods to incorporate physical activity counseling into asthma treatment practice. © 2021 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2022;10:433-43)

Key words: *Asthma; Physical activity; Counseling; Providers*

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No funding has been received for this study.
Conflicts of interest: S. M. Nyenhuis receives funding from National Institutes of Health and is a writer for UptoDate. The rest of the authors declare that they have no relevant conflicts of interest.
Received for publication June 4, 2021; revised September 27, 2021; accepted for publication October 15, 2021.
Available online November 26, 2021.
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2213-2198

https://doi.org/10.1016/j.jaip.2021.10.056

INTRODUCTION

Approximately 80% of U.S. adults and adolescents are insufficiently active.[1] Physical activity fosters normal growth and development and can make people feel, function, and sleep better.[1] It also reduces the risk of many chronic diseases, including asthma.[1,2] Physical activity is defined as any bodily movement generated by the skeletal muscles that results in energy expenditure. Individuals with asthma may be particularly at risk for being physically inactive, owing to the fear of provoking exercise-induced bronchoconstriction (EIB). Although effective therapies (both pharmacological and nonpharmacological) are available to manage asthma symptoms and EIB, individuals with asthma may avoid or limit their physical activity in order to

Abbreviations used
EIB- Exercise-induced bronchoconstriction
FEV1- Forced expiratory volume in 1 second
FVC- Forced vital capacity
TTM- Transtheoretical model

prevent asthma exacerbations, ultimately leading to significant negative health consequences.[3]

Several studies have used large cohorts to examine the physical activity levels of individuals with asthma. Recent systematic reviews of physical activity levels in adults with asthma found lower levels of physical activity compared with controls (meta-analysis sample n = 32,606).[4,5] Sex and age contribute to differences in physical activity levels among individuals with asthma. Older adults with asthma had lower levels of physical activity,[6] whereas some studies found children and younger adults with asthma to have equal or even higher levels of physical activity than in controls.[2,7-9] Females had lower levels of physical activity than males and exercise-avoidance behavior appeared at a younger age in women than in men with asthma.[6,10] Although sex and age differences in physical activity are also seen in the general population, the fact that the discrepancy among asthma patients occurs earlier may suggest a greater impact on overall health.

Much of the existing research in this area is in people with mild-to-moderate asthma. Of the few studies in the severe asthma population, Cordova-Rivera et al[11] found adults with severe asthma had significantly lower daily step counts and moderate-to-vigorous physical activity compared with controls. Similar findings of reduced physical activity have been found in children with severe asthma.[9,12]

This work group report highlights the importance of physical activity to asthma patients as well as the barriers patients face, with an ultimate aim of providing suggestions for practicing clinicians on how to approach physical activity when counseling individuals with asthma.

WHAT IS THE EVIDENCE FOR THE BENEFIT OF PHYSICAL ACTIVITY IN ASTHMA PATIENTS?

Children and adolescents

Children and adolescents benefit from physical activity.[13] These benefits are so great, and carry such low overall costs and risks, that the U.S. Department of Health and Human Services for decades has set exercise recommendations for children. Multiple studies have shown that children who exercise on a regular basis have a lower risk of depression,[14] improved lifetime bone health,[15] lower risk of obesity and hypertension,[16] decreased insulin resistance,[17] and improved lung function.[18,19] These benefits expand in children with chronic diseases including asthma. Several asthma-specific benefits have been demonstrated including reduced hospitalizations, reduced school absenteeism, fewer primary care provider visits, reduced rescue medication usage, and a general improvement in ability to manage asthma.[13,20,21]

At baseline, children with asthma have lower exercise tolerance to both aerobic and anaerobic exercise than their peers without asthma.[22,23] There are multiple reasons for this including concerns about the safety of the activity, poor baseline asthma control, and exacerbation of symptoms by physical activity itself.[20,24,25] It is known that prolonged inactivity can lead to breathlessness when activity is resumed, even in those without asthma. This exercise fatigue may lead to further inactivity, thus worsening the child's deconditioned state.[26,27] Nonetheless, children with asthma have shown themselves able to subsequently improve their fitness and their asthma control.

Studies evaluating asthma control in children have considered a variety of primary outcomes from symptom control to aerobic capacity to lung function. One review specifically considered the nocturnal benefits for children with asthma.[28] This analysis evaluated 5 studies and concluded that 6 weeks of twice-weekly exercise was associated with reduced nocturnal wheezing. Further, a more intensive regimen of supervised aerobic activity for 8 weeks can both alleviate nocturnal symptoms and improve aerobic fitness.[29-32]

A 2013 Cochrane review evaluated 8 studies of swim training for children with stable asthma, from mild to severe.[33] The interventions involved 30 minutes of swimming 2 to 6 times a week for 6 to 12 weeks. The outcomes most commonly evaluated were aerobic capacity, asthma exacerbations, asthma control, or corticosteroid use. Interestingly, this review found swimming was associated with an improvement in lung function (demonstrated by increased forced expiratory volume in1 second [FEV_1], forced vital capacity [FVC], and forced expiratory flow at 25%–75% of FVC). The FEV_1 improved by 100 mL, near the effect seen with daily inhaled fluticasone proprionate 100 μg. However, this finding may be an outlier because the majority of physical activity interventions in children with asthma have not yielded significant improvement in lung function measurements.[34,35] Although the effects of physical activity on lung function are mixed, the positive effect on cardiovascular fitness is more definitive. The degree of improvement in cardiovascular fitness measures has been as high as 25% when compared with asthmatic control subjects.[32,36-40] The variable degree of improvement may be due to nuances within the physical activity interventions, such as intensity and duration. Participants with the greatest improvement had longer training sessions several times per week.[34]

Also, multiple studies specifically evaluated quality of life and exercise training in children with asthma.[31,41,42] Finally, other studies have found exercise is associated with a reduction in the need for medications, fewer emergency department visits, and less absenteeism from school.[25,43] Although 1 large study did not, this was attributed to a population with relatively strong baseline asthma control.[44] Across the board, physical activity appears to improve quality of life, lung function, cardiovascular fitness, and depression in children with asthma.

Adults

The most recent Physical Activity Guidelines for Americans, 2nd edition, recommends regular physical activity for adults with chronic health conditions and disabilities because it can provide physical and cognitive benefits.[1] Ideally, the physical activity should be moderate-to-vigorous because substantial health benefits are seen at these levels of physical activity, but reducing sedentary time and increasing physical activity at any level may also yield health benefits.[1] Specifically in asthma, observational and cross-sectional studies have found individuals who engage in regular physical activity had fewer asthma exacerbations, improved disease control and an improvement in lung function (peak expiratory flow and FEV_1).[45,46] A recent systematic review

affirms these benefits of physical activity.[4] These findings have spurred an interest in randomized controlled studies to assess physical activity as a treatment for asthma in adults.

Evidence from a number of randomized controlled studies has revealed positive effects of physical activity on physiological and psychological outcomes. The majority of studies conducted focus on the moderate-to-vigorous intensity aerobic exercise. A Cochrane review of aerobic training in asthma showed a significant improvement in maximum oxygen uptake but no other metrics of lung function (peak expiratory flow, FEV_1, or FVC).[35] Since the Cochrane review was published, 2 studies[47,48] found improvements in lung function (FEV_1, FVC) with only 1 showing clinical significance[47,49] ($\geq$20% change). A recent meta-analysis of aerobic exercise training in adults with asthma found FEV_1 slightly increased with a standard mean difference of −0.36 (−0.72 to 0.00) in favor of aerobic exercise training.[50] Other effects of the physical activity interventions were an improvement in asthma symptoms and cardiopulmonary fitness (measured by maximum oxygen uptake), and a trend toward improved quality of life and reduced airway inflammation (measured by sputum eosinophil counts and fractional exhaled nitric oxide).[28,35,48,51,52] One study compared breathing exercises plus aerobic activity versus breathing exercise alone in adults with asthma found that, in addition to increasing the number of symptom-free days, aerobic exercise was significantly associated with lower psychosocial stress.[53] Further, physical training was well tolerated in adults with asthma, with no significant adverse effects identified.[35]

The physical activity interventions that were studied ranged from running, cycling, swimming, high-intensity interval training, walking, and gymnastics. All of these were shown to be safe and to improve asthma outcomes, suggesting that the decision to pursue physical activity is more important than the modality chosen. However, swimming has often been the recommended exercise for patients with asthma owing to promising results from observational studies.[54,55] A 2013 Cochrane review found that swimming training had a meaningful effect on asthma outcomes and patients' exercise capacity, while noting that no significant differences could be established when comparing swimming with other physical activities.[35] Further study is needed to determine the relative efficacy of exercise modalities. We should note that exposure to pool chemicals is also associated with asthma exacerbations and has been shown to increase airway eosinophil and mast cell counts.[56] The Cochrane review acknowledged this effect but noted there were insufficient studies comparing chlorinated and nonchlorinated pools. Asthma patients interested in swimming may need to be cautiously monitored for chemical-induced exacerbations. In addition to controller asthma medications, premedicating with an inhaled mast cell-stabilizing agent may be an option for these patients.[57]

In summary, physical activity is well tolerated in adults with asthma of any severity as in children with asthma. Regular aerobic physical activity can improve asthma outcomes including asthma symptoms, quality of life, lung function, and cardiopulmonary fitness. Physical activity should be considered as a nonpharmacological add-on treatment in adults with asthma. One limitation of the existing literature is much of it has focused on moderate-to-vigorous levels of aerobic physical activity, which most Americans do not achieve.[1] Three studies have focused on lifestyle physical activity (eg, walking) and all found improvements in disease control and quality of life.[58-60] Additional studies are needed that focus on the impact of lifestyle physical activity and reduced sedentary time on asthma outcomes.[61]

BARRIERS TO EXERCISE IN PEOPLE WITH ASTHMA (TABLE I)

Children and adolescents

International guidelines encourage physical activity in individuals with asthma; however, unique barriers to physical activity may be present in children and adolescents.[62,63]

Disease-related barriers. Children and adolescents with asthma face many added challenges at school, including embarrassment because of their disease, feeling different from their peers, and bullying.[64] Physical activity can exacerbate asthma symptoms and can negatively influence motivation and participation in extracurricular activities.[65] Uncontrolled asthma has the potential to impact children's social interactions, academic progress, and self-confidence. Children, adolescents, and their parents or caregivers may perceive asthma as a firm barrier to physical activity or sports. Negative experiences, including fear of being excluded or isolated from group physical activities, have led to children avoiding participation in activities they otherwise would have been interested in pursuing.[66]

Fear of physical activities exacerbating asthma may lead parents to enforce unnecessary limitations. Indeed, parental beliefs about asthma triggers have been shown to predict lower activity levels in children and adolescents with asthma.[24] Some parents or caregivers intentionally reduce activity in children as a strategy to avoid asthma exacerbation. In a cross-sectional study, 37% of mothers acknowledged restricting their children's physical activity. Nearly the same proportion of surveyed mothers believed exercise is dangerous for children with asthma.[67]

School personnel. Inadequate asthma management in schools may be a significant barrier to children's participation in school-based physical activity. In the setting of urban elementary education, 1 study found limited teacher knowledge about asthma and asthma management, especially among those whose students have intermittent manifestations of asthma.[68] In addition, communication between school personnel, students, and parents was observed to be lacking.

In a qualitative interview study of 23 inner-city minority children with asthma, aged 8 to 10 years, a majority of students (17 of 23) admitted experiencing asthma symptoms while performing any physical activity during the school day.[64] All students were either unaware or did not adhere to a formal asthma action plan. Furthermore, there was lack of accessible medication and a perceived stigma around publicly administering asthma medication before physical activity.

Physical education teachers and coaches play a crucial role in management of asthma and as motivators for participation in physical activities and sports. A qualitative study examined the perspective of physical education teachers on in-school asthma management and barriers to physical activity for children with asthma attending urban elementary schools.[69] The study revealed that physical education teachers may have a lack of knowledge about the disease, which could lead to delayed identification of asthma symptoms, underestimation of the severity of the

situation, ineffective treatment, and inadequate exercise levels in students with asthma.

Children with asthma need encouragement and reminders to administer appropriate medications prior to physical activity and when symptoms present during physical activity. Having well-defined asthma management plans and trained school personnel are effective ways for schools to help children and adolescents with asthma participate in physical activity. Physical education teachers and coaches must encourage safe physical activity and be familiar with asthma action plans.[63] The National Heart, Lung, and Blood Institute developed recommendations on the roles and responsibilities for physical education teachers for asthma management, including a guide to enabling full participation for students with asthma. Incorporating asthma education into the health curriculum at school can increase asthma awareness and promote physical activity for children and adolescents with asthma.[63]

Obesity. Obesity represents an indirect barrier to exercise in children and adolescents with asthma. In a cyclical manner, physical activity deterred by asthma symptoms predisposes children and adolescents with asthma to weight gain.[70] Obesity is associated with increased asthma severity, poor asthma control, and impaired quality of life.[71,72] Furthermore, the combination of obesity and physical inactivity is associated with uncontrolled asthma and decreased response to therapy.[73] This same combination can increase airway inflammation and lead to further exercise avoidance in the obese child with asthma. Physical activity in obese and overweight children with asthma is known to contribute to reduced body mass index and improvements in fitness as measured by maximal oxygen uptake, lung function, and quality of life.[74]

Nonadherence. Nonadherence to asthma management is a widely reported barrier to achieving and maintaining asthma control. Uncontrolled asthma is, in turn, a frequently reported barrier to physical activity. Despite evidence supporting the safety and efficacy of controller medications in prevention of uncontrolled asthma, adherence to asthma treatment regimens in children and adolescents is below 50%.[75] A systematic review found the mean level of inhaled corticosteroid adherence ranged from 22% to 63% and poor adherence was responsible for 24% and 60% of exacerbations and asthma-related hospitalizations, respectively.[76]

Poor adherence is often difficult to detect and can be overlooked in clinical practice, leading to an inappropriate titration of asthma medications. Although there is no consensus approach to achieving adherence in children and adolescents with asthma, barriers must be identified and treatment strategies adjusted to promote adherence.

Understanding the barriers to exercise in children and adolescents with asthma is crucial when implementing a successful physical activity program that improves health outcomes. Unless baseline asthma control is poor, exercise intolerance should not be a limiting factor among children and adolescents with asthma.

Adults

Disease-related. Similar to children and adolescents, many adults with asthma avoid or limit physical activity. A negative association between exercise and asthma has been propagated for many years due to misunderstandings about EIB.[77] Although there are several studies examining the barriers to exercise among children and adolescents with asthma, few studies have examined the barriers to physical activity among adults with asthma. A small survey examined barriers to physical activity among 60 men and women with asthma.[78] The study identified concerns for physical activity triggering asthma, but extreme weather or air-quality triggers and an overall lack of knowledge regarding the benefits of physical activity were also cited as barriers.[78] In addition, negative perceptions of physical activity were found in patients with less asthma knowledge and self-direction.[78] Another study evaluated barriers to physical activity among urban African American women with asthma. Whereas commonly cited barriers to engaging in physical activity were found (eg, time, nonenjoyment), 2 asthma-specific barriers were identified: fear related to past personal experiences with life-threatening asthma exacerbations and a lack of community with others living with asthma.[79] These were in addition to numerous other barriers urban African American women face, such as social and culturally based preferences for hair and body type, neighborhood characteristics (violence, walkability), family or caregiver responsibilities, and few role models.[80-82] Additional studies in identifying barriers to physical activity among adults with asthma are needed.

Comorbid conditions. An estimated 45% of all Americans, or roughly 150 million individuals, suffer from at least 1 chronic disease, and the number is growing.[83] Chronic diseases such as obesity and arthritis and overlap with chronic obstructive pulmonary disease may pose a barrier to physical activity in adults with asthma.[84,85] These conditions can result in reduced exercise tolerance and/or mobility, which can lead to, or exacerbate, obesity. As described previously, obesity is associated with greater asthma severity and poorer asthma outcomes.[86]

DISCUSSING PHYSICAL ACTIVITY WITH PATIENTS

Despite the known benefits of exercise in asthma patients, there remain gaps in physician knowledge of exercise recommendations and counseling behaviors. A 2019 national survey of U.S. and Canadian allergy/immunology and pulmonology physicians revealed that, whereas 92% believe exercise should be a component of asthma management, only 69% regularly perform exercise counseling.[87] One respondent commented that, whereas exercise is "probably the most important [recommendation]" for asthma patients, lack of time presents a barrier to counseling. A lack of confidence in discussing exercise with patients was also noted among survey respondents: 26% described having no knowledge or very little knowledge on exercise counseling, whereas only 9% felt that they were very knowledgeable about encouraging patients to exercise. Eighty percent of physicians surveyed reported that they were unaware of exercise guidelines for asthma patients (unpublished data, American Academy of Allergy, Asthma, and Immunology). These results are consistent with those of a global survey distributed by the World Allergy Organization to asthma providers,[88] in which less than half (46%) of respondents considered themselves to have sufficient knowledge to advise asthma patients about physical activity and 95.5% responded that doctors need more training in preventive care, including expanded knowledge around physical activity. With the arrival of the ongoing coronavirus disease 2019 (COVID-19) pandemic, emphasizing exercise to all patients in

TABLE I. Commonly encountered barriers to physical activity in asthma patients and recommendations for effective counseling, by age group

Age group	Barrier	Recommendation
All age groups	False beliefs about physical activity in asthma	Explore current beliefs and why they are held
	Low confidence in ability to adhere to physical activity routine	Emphasize gradual approach
	Poor baseline asthma control	Explore adherence to medication and escalate medication if appropriate
	EIB	Review pretreatment with short-acting beta-agonist and using warm-up/cool-down exercises
	Concurrent obesity	Motivational interviewing
	Lack of access to a gym or exercise facility	Refer to online resources (www.health.gov) or walking outdoors if safe
	Environmental factors (eg, neighborhood safety, air quality)	Refer to online resources (www.health.gov) Consider utilizing local social work resources
Children and adolescents	Embarrassment around classmates and peers	Normalize exercising with asthma
	Social isolation (including bullying)	Explore barriers with child and parents and correct misunderstandings
	Lack of school-based resources	Engage school support staff
Adults	Comorbid medical conditions	Referral to cardiovascular specialist when appropriate
	Time restraints (real and perceived)	Discuss shorter-duration/higher-intensity exercises Consider recommending wearable fitness technology
Older adults	Mechanical limits to physical activity	Consider water-based exercises
	Polypharmacy	Consider low-intensity exercises

an allergy and immunology practice, including those with asthma, is paramount.[89] Physical activity can help improve mental as well as physical well-being.[89]

Because no 2 asthma patients are identical, successful management of asthma requires a personalized approach. Accordingly, the discussion of exercise with an asthma patient or caregiver should start with an individual assessment. The provider may begin by evaluating the patient's beliefs about exercise, readiness to discuss physical activity, and confidence in his or her exercise abilities. Combining motivational interviewing techniques with the transtheoretical model of change (TTM) offers 1 framework for evaluation.[90] The provider begins by recognizing the patient's autonomy and listening actively while withholding judgment. The TTM outlines 4 stages a patient may fall into during the initial visit: precontemplation, contemplation, preparation, and action. A full elaboration of these stages is beyond the scope of this report; however, to illustrate 1 example, a patient who has not previously attempted exercise for personal asthma management would be in the precontemplation stage.[90] When a patient's TTM stage is assessed, recommendations may be tailored appropriately. Some providers who use this model may find additional value in quantifying a patient's level of motivation using a validated 1 to 5 scale.[91]

The remainder of the assessment aims to identify patient factors that may be used to guide individualized recommendations. These include the patient's asthma knowledge, current physical activity level, social support, material resources, and estimated free time. The provider will also want to take note of the patient's age group, asthma severity, and medication adherence level at this time. Finally, and most importantly, the patient's general health including nonasthma medical history should be considered.

It is worth reemphasizing here that certain subpopulations of asthma patients may have unique needs related to exercise counseling. Parents of young children may not be aware when their child is intentionally avoiding physical activity owing to perceived limitations from asthma.[92] These parents may benefit from education about exercise safety in children with asthma. Adolescents and teenagers perceive a stigma around discussing asthma and feel ashamed, for instance, to use their medication in public prior to exercise.[93] However, patients in this age group may be encouraged by the idea of using exercise to take control of their asthma and assert their independence from caregivers.[94] Older adults may have, in addition to medical comorbidities, mechanical limitations on exercise intensity.[1] The older adult with asthma should be encouraged to be as active as their body allows and be reminded that quality of life even at advanced age is improved by increasing exercise and decreasing sedentary behaviors.[95] Adult patients with highly restricted time owing to personal or professional obligations may be counseled that 75 minutes of more vigorous physical activity per week is believed to be comparable with the 150 minutes at moderate intensity currently recommended by professional guidelines.[96] High-intensity interval training is another option for this group. Asthma patients, especially adults, may have other chronic medical conditions that should be addressed before exercise recommendations are made. The Physical Activity and Readiness Questionnaire is a screening instrument designed to identify patients with serious comorbidities.[96] Patients who score highly on this questionnaire should be referred to a specialist (such as a cardiologist in the case of coronary artery disease) prior to being cleared for strenuous exercise. In patients who are physically unfit, providers can consider referral to a pulmonary rehabilitation program or supervised exercise in a gym to start a gradual regimen.

Providers with limited office time may find alternative ways to incorporate discussion of physical activity. For example, physical activity habits may be inquired about as part of the social history

TABLE II. Physical activity measures

Physical activity measure	Number of items	Time	Items	Scoring/interpretation
Exercise Vital Sign (EVS)	2	<30 s	1. On average, how many days per week do you engage in moderate to strenuous exercises (like a brisk walk)? 2. On average, how many minutes per day do you exercise at this level?	Multiply the responses to both questions to estimate number of minutes per week of moderate to strenuous exercise This score is used to determine whether the patient achieves the recommended 150 min of moderate to vigorous physical activity per week
Physical Activity Vital Sign (PAVS)	2	<30 s	How many days during the past week have you performed physical activity in which your heart beats faster and your breathing is harder than normal for 30 min or more? How many days in a typical week do you perform activity such as this?	Score presented as days during the past week over days in typical week (range 0/0−7/7)
Speedy Nutrition and Physical Activity Assessment (SNAP), physical activity component	1	<1 min	1. Are you active for 30 min on 5 days of the week? Examples of activity are • walking • housework • work in the yard or garden • dancing • jobs that require walking, lifting, or other hard work • exercise Circle 1 number only: 1. No, and I have no plans to be more active 2. No, but I have been thinking about being more active 3. Sometimes I am active for 30 min, but not all the time 4. Yes, I am active for 30 min on 5 days of the week	A score of 4 (ie, chose item 4) is classified as sufficiently active
General Practice Physical Activity Questionnaire (GPPAQ)	7	60 s	1. Please tell us the type and amount of physical activity involved in your work. 2. During the last week, how many hours did you spend on each of the following activities? 3. How would you describe your usual walking pace?	Inactive = sedentary job and no physical exercise or cycling Moderately inactive = sedentary job and some but <1 h of physical exercise and/or cycling per week OR standing job and no physical exercise or cycling Moderately active = sedentary job and 1.0−2.9 h of physical exercise and/or cycling per week OR standing job and some but <1 h of physical exercise and/or cycling per week OR physical job and no physical exercise or cycling Active = sedentary job and ≥3 h of physical exercise and/or cycling per week OR standing job and 1.0−2.9 h of physical exercise and/or cycling per week OR physical job and some but <1 h of physical exercise and/or cycling per week OR heavy manual job*
Stanford Brief Activity Survey (SBAS)	2	<5 min	1. On-the-job activity (A−G responses) 2. Leisure-time activity (F−J responses)	Respondents' activity level categorized as either inactive, light intensity, moderate intensity, or hard intensity based on qualitative self-evaluation of work and leisure-time physical activity

From Golightly YM, Allen KD, Ambrose KR, Stiller JL, Evenson KR, Voisin C, et al. Physical activity as a vital sign: a systematic review. Prev Chronic Dis 2017;14:E123.

*Questions concerning walking, housework/childcare, and gardening/do it yourself are included to allow patients to record their physical activity in these categories; however, these questions may not yield sufficiently reliable data to contribute to an understanding of overall physical activity levels.

TABLE III. Physical activity counseling strategies

5As	Ask	Address behavior change agenda • Have you ever participated in regular physical activity? • What activities do you enjoy?
	Advise	Provide personalized information on benefits of change • Regular physical activity for 30 min/d, on most days of the week will substantially improve your health
	Assess	Address previous attempts, identify barriers, assess readiness for change • Have you tried to increase your physical activity in the past?
	Assist	Strategize to overcome barriers, match advice to stage of change • Discuss situations when patient is most likely to fail and strategize plan
	Arrange	Arrange follow-up, inquire about behavior, consider readiness for change • Arrange follow-up; praise attempts at change; stress long-term commitment
TTM	Precontemplative (no exercise, and not even thinking about it)	• Emphasize the benefits of physical activity • Allow patients to voice reservations about becoming physically active • Clarify what constitutes physical activity and the threshold at which benefits can be reaped • Give clear advice that you recommend beginning a physical activity program
	Contemplative (no exercise, but thinking about it now and then)	• Engage in active listening before giving advice or making recommendations • Use specific patient information as motivational hooks • Explain level of physical activity necessary to achieve health benefits • Develop a specific plan for increasing physical activity
	Preparation (irregular participation in exercise)	
	Action (regular exercise for < 6 mo)	• Offer praise and positive reinforcement
	Maintenance (regular exercise)	

along with a nutrition assessment. Any physical activity tracking information the patient provides, including from their own wearable technology, can be copied into the vital signs section of the physical examination. The Office of Disease Prevention and Health promotion has tools to help health care providers talk to patients about physical activity (www.health.gov). At the most basic level, the physician may discuss physical activities that a patient enjoys or wants to perform. It is important to counsel that both aerobic and muscle-strengthening activities are useful, and patients may receive additional exercise resources such as handouts (many of which can be found on www.health.gov).

After exercise recommendations are discussed and a plan agreed upon, the provider may take steps to promote adherence. These include adding exercise to the patient's asthma action plan and avoiding overly complex exercise recommendations. Patients should be cautioned that the benefits of physical activity may not be perceived immediately. Highly motivated patients may benefit from daily record-keeping and setting specific goals.[90]

An asthma patient who has committed to exercise is at only the beginning of her or his journey. Studies demonstrate that patients view support from their provider as a facilitator to physical activity.[97] Providers, therefore, would do well to check in with the patient's exercise habits at periodic wellness visits. In addition to serving as a gentle reminder for the patient, a check-in has the added benefit of allowing the provider to adjust recommendations based on previous successes and disappointments.

Asthma frequently has a variable course and it is far from uncommon for patients to experience setbacks. Promoting lifestyle change in an individual is difficult for a friend or relative, let alone for a physician who only sees that person once every several months. It is, therefore, important to avoid the temptation to view exercise as prescriptive. The effective physician will use shared decision-making tools to personalize physical activity recommendations. When counseling exercise, the asthma provider may take heed of the author Dale Carnegie's advice that "There is only one way… to get anybody to do anything. And that is by making the other person want to do it."[98]

TECHNOLOGY TOOLS TO PROMOTE EXERCISE

Innovations in personalized fitness technology over the last decade have promoted connected models built around a person's own needs rather than those of a generic group. Exercise trends in the past tended to focus on large groups gathered in 1 location, a model that failed to cater to individual fitness goals. Personal training focuses on individual needs but is prohibitively expensive for many. By creating a tailored experience through technology, fitness companies are granting consumers access to customizable exercise routines that have only grown in popularity with the arrival of COVID-19. Personalized fitness tools have the potential to enable asthma patients to overcome their physical activity barriers.

The first technological milestone in personalized fitness came in 2014 with the advent of wearable technology like fitness trackers and smartwatches. Current health trackers provide users with snapshots of their activity and recovery data, including advanced performance metrics like step tracking, heart rate, body fat percentage, and sleep quality.[99] Currently, 19% of Americans use a wearable fitness tracker (eg, Fitbit, Apple Watch). Sales are projected to double by 2022, to an estimated $27 billion.[100,101] The goal with these applications is to deliver accurate feedback to users so that they can have a better sense of how their daily activities and behaviors impact them physically, providing additional motivation to stay engaged and more proactively manage their health. Patients with asthma who experience anxiety with

exercise may feel comforted by the ability to monitor their own health in real time.

An integrative connected fitness model can also offer social support through online forums or networks where users are able to interact with peers with similar fitness goals, helping to further enhance the experience and improve adherence. Home exercise company Peloton pioneered the concept of interactive fitness back in 2012. What makes fitness models like Peloton so successful at retaining subscribers is their extremely compelling fitness studio content, engaging instructor personalities, and a wide range of fitness class types well beyond just cycling. Noncycling classes including yoga, meditation, walking, running, boot camp, strength, and stretching programs add to the depth and variety of their content. Despite these benefits, the main reason for loyalty cited by Peloton users is not the fancy bike or easy-to-use app, but the community of fellow riders and the company's personable coaches. Asthma patients will be reassured to know that their exercise journey is not something they need to face alone.

By harnessing exciting developments in personalization, digitization, wellness, and consumer engagement, fitness companies can improve access and increase compliance in ways never before possible. Providers would do well to counsel asthma patients about the potential of these tools because this may help overcome barriers.

NEXT STEPS

Implications for clinical practice

The importance of addressing physical inactivity in asthma should not be underestimated. One analysis found that increase in physical activity was associated with a 25% reduction in asthma exacerbations that required emergency department visits or hospitalizations.[45] Improving overall physical activity rates may, therefore, lead to a larger proportion of asthma patients with well-controlled disease and a decreased reliance of pharmaceutical therapy. Naturally, there are also economic benefits to be found in reducing emergency department visits. Because emergency care accounts for much of the economic burden in asthma, increasing physical activity levels by 20% could yield over $23 million of savings in emergency department visits and $117 million in hospitalizations each year. In addition, increasing physical activity may have additional health benefits such as reducing cardiovascular and metabolic diseases risk, which could have long-term impact on quality of life and life expectancy.

With this in mind, it is important that physical activity levels are routinely assessed in our asthma patients and patients are assisted in achieving age-appropriate physical activity levels that not only positively impact their asthma but also aid in the prevention of other diseases, such as diabetes and cancer. Using a systematic approach to physical activity assessment may help specialists incorporate it into practice. Tools such as Physical Activity Vital Sign or Exercise Vital Sign can be completed in less than 30 seconds and could alert providers of inadequate physical activity to prompt counseling or referral (Table II).[102,103] There are several counseling strategies that can be used (Table III). Using a longitudinal approach to changing physical activity behavior is another option. With this model, clinicians can spend a little bit of time spread out over several visits to enlist the patient in shared goal-setting leading to improved outcomes as discussed previously. Effective educational tools to help providers implement physical activity assessments into their practice and feel more comfortable providing physical activity counseling are needed. To further guide clinicians, we agree with the recent editorial by Bacon and Platts-Mills[104] that physical activity counseling is worthy of inclusion in national asthma treatment guidelines.

Last but not least, the physician who spends considerable effort on counseling patients on physical activity should expect to be reasonably reimbursed. Time-based endocrine and metabolic coding may often be appropriate. An International Classification of Diseases, 10th Revision (ICD-10), code for comorbidities of physical inactivity, such as depression, overweight or obesity, asthma, or fatigue, could be linked to the endocrine and metabolic code. Documentation must include the total time spent with the patient as well as a description of the counseling or coordination of care activities. As the evidence regarding the dangers of physical inactivity comes to light, even specialty health care providers will need to take a role in promoting physical activity and, as such, should be adequately reimbursed for the time and greater medical complexity.

Implications for research

Although evidence to date supports the safety and benefits of physical activity in asthma, many research questions still remain. When asthma patients do engage in physical activity, many prefer low-intensity activities such as walking, which has a low likelihood of causing asthma symptoms.[78,105,106] Only 3 studies to date have examined the effects of lifestyle physical activity (walking) in people with asthma.[59,60,107] Whereas all studies found walking to be safe and led to improvements in asthma outcomes (control and quality of life), 1 was conducted[60] in a supervised exercise facility and none examined sustainability.[59,60,107] Well-designed studies that address the impact and sustainability of physically active lifestyles, such as walking, are needed in asthma populations.

A recent update to the physical activity guidelines for Americans highlighted the importance of reducing sedentary time.[1] Few studies in asthma have assessed sedentary time, despite an association of sedentary behavior with higher health care use and poorer lung function, asthma control, and exercise capacity.[4] Interventions that target sedentary behavior are needed to determine the full impact of reducing sedentary time on asthma outcomes.

Future research in physical activity interventions should include identifying subpopulations that benefit most from physical activity promotion as well as best practices for incorporating physical activity into treatment guidelines and clinical practice. Specific subpopulations to consider are those with varying asthma phenotypes. Three physical activity interventions have shown reductions in eosinophilic airway markers (fractional exhaled nitric oxide, sputum eosinophils) and this may be an indicator of which patients respond positively to these interventions.[45,48,49]

The behavioral and biological mechanisms of physical activity in asthma are not well understood. Early physical activity research did not include behavior change theory, but over the last 2 decades, its importance has been recognized.[79] It is crucial that, when designing behavioral physical activity interventions, researchers identify and test specific hypotheses about theoretical factors that will be changed in the intervention.[78] Limited

evidence exists on the biological mechanisms of physical activity in asthma. Available evidence suggests that it is mediated by physiological, metabolic, and immune pathways.[61] Consequently, a better understanding of the complex mechanisms that yield improved asthma outcomes is needed.

DISCUSSION

Asthma affects millions of people worldwide. Using physical activity to improve the lives of patients with asthma has been underrecognized and underutilized. Evidence supports the benefits of physical activity on asthma control and quality of life, yet implementation of physical activity counseling into clinical practice has been slow. A thorough examination of the barriers to implementation in clinical practice is essential, from both the patient and the health system perspectives, as is increased awareness of reimbursement policies for physical activity counseling. Physical activity may be 1 of the most important adjunct strategies in the management of asthma, with the extra benefit of improving other prevalent chronic disease outcomes.

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