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POSITION PAPER

Italian Pediatric Respiratory Society position paper on physical activity recommendations in pediatric patients affected by chronic respiratory diseases: an expert group statement

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ABSTRACT

Physical activity (PA) is associated with numerous health benefits in healthy individuals; therefore, the World Health Organization (WHO) recommends specific levels of PA across all age groups. However, disease-specific guidelines, particularly for pediatric populations, are still lacking. This gap also applies to chronic respiratory diseases (CRDs). Several studies have identified PA and exercise as an important therapeutic strategy for individuals with CRDs, highlighting their value alongside pharmacological therapy as part of personalized disease management plans. However, practical guidance regarding exercise prescription for pediatric patients with CRDs remains limited. The Italian Pediatric Respiratory Society/Società Italiana per le Malattie Respiratorie Infantili (IPRS/SIMRI) aims to provide a comprehensive review of the available literature on the role of PA and E in CRDs management and, consequently, to develop pragmatic recommendations to support the safe and effective implementation of exercise prescriptions in this special population.

IMPACT STATEMENT

Physical activity should be considered a core component of the multidisciplinary management of pediatric chronic respiratory diseases. This position paper provides pragmatic evidence-based recommendations to support clinicians in prescribing individualized and safe exercise programs aimed at improving functional capacity, quality of life, and long-term respiratory outcomes in children and adolescents with chronic respiratory conditions.

KEY WORDS

Physical activity; exercise; chronic diseases; respiratory diseases; children.

INTRODUCTION

The latest World Health Organization (WHO) guidelines define physical activity (PA) as “any bodily movement produced by skeletal muscles that requires energy expenditure” (1). PA may occur at varying intensities and in various contexts (domestic, occupational and recreational), including exercise and sports. These recommendations apply to all age groups, from children aged 5 years to adults over 65 years, regardless of gender, culture, socioeconomic status or ability (1).

In children and adolescents, PA provides broad health benefits, including improved physical fitness, healthier body composition, better cardiometabolic and bone health, enhanced cognitive function, and improved mental well-being (1, 2).

Although international guidelines specify recommended PA levels for healthy youth (**Figure 1**), disease-specific guidelines for pediatric populations remain limited. As a result, clinicians often face uncertainty when prescribing the appropriate frequency, intensity, duration, and type of PA for children with chronic conditions.

Children with chronic respiratory diseases (CRDs) require individualized assessment of exercise tolerance, tailored to the severity of respiratory impairment (3). CRDs are characterized by structural and functional abnormalities that frequently result in exercise intolerance. Affected children commonly experience fatigue and breathlessness which restrict physical activity compared with healthy peers. Underlying mechanisms include: 1) ventilatory limitation; 2) impaired gas exchange; 3) central and peripheral hemodynamic limitations; 4) skeletal muscle dysfunction (3).

Physical inactivity may further aggravate respiratory mechanics and muscle dysfunction, leading over time to declining lung function, reduced oxidative type I muscle fibers, peripheral weakness, and diminished endurance during moderate-to-high intensity exercise (3).

To address this risk, the Italian Pediatric Respiratory Society/Società Italiana per le Malattie Respiratorie Infantili (IPRS/SIMRI) recommends integrating regular PA and structured exercise into CRDs management.

In the absence of national guidelines, an expert panel of pediatric pulmonologists developed pragmatic evidence-based recommendations to support safe and effective exercise prescriptions.

The panelists conducted a review of the literature on PA and specific respiratory conditions, aiming to address the following points: 1) the rationale for PA and exercise; 2) evidence on the health benefits of PA/exercise according to frequency, intensity, time, and type (FITT principles); 3) the impact of PA and exercise on specific chronic respiratory conditions and related extrapulmonary comorbidities. Based on the available evidence as well as the clinical experience of the working group, recommendations have been developed.

The resulting position paper serves as a practical guide.

PA IN PEDIATRIC CRDs

Asthma

PA and structured exercise are increasingly recognized as core components of asthma management, supported by growing evidence of safety and multidimensional benefits across ages and disease severities (**Table 1**). Reduced habitual activity may contribute to rising asthma prevalence and severity, through deconditioning, increased breathlessness, and adverse airway biological effects (4, 5). Despite historical concerns about exercise-induced symptoms, substantial evidence shows that children and adults with asthma can exercise safely and achieve significant improvements in cardiovascular fitness, symptom burden, and quality of life without compromising asthma control (6).

Regular aerobic training appears to modulate airway inflammation and remodeling. Studies in adults and children report reductions in type 2 cytokines (IL-4, IL-5, IL-13), TNF-α, VEGF, fractional exhaled nitric oxide (FeNO), and circulating eosinophils, along with increases in anti-inflammatory mediators such as IL-10, IL-1ra, relaxin-3 (7). These biological effects, combined with consistent clinical improvements, have led guideline committees to endorse exercise as a key non-pharmacologic strategy in asthma care (4, 5, 8). Programs associated with the greatest benefits generally follow FITT (Frequency, Intensity, Time, Type) principles, most often three sessions per week, 30 to 60 minutes each, for 8 to 12 weeks (6, 7, 9). In adults, moderate-intensity aerobic training improves asthma control and quality of life while reducing airway inflammatory cells (9). Vigorous-intensity training (30 min, three times weekly) provides comparable, though slightly smaller benefits (9). In children, aerobic exercise prescribed at the ventilatory threshold or delivered progressively enhances VO_2peak and ventilatory efficiency (6). Modalities such as walking, cycling, running, and swimming improve aerobic capacity (VO_2peak), six-minute walk distance and selected spirometric indices (FVC%, FEF25%-75%) in pediatric meta-analyses (6). Combined aerobic and resistance programs (three times weekly, 60 minutes) add muscular strength with strong cardiovascular benefits, although quality-of-life changes are less consistent (6). High-intensity interval training (HIIT), often school-based (30 min, three times weekly, 10-30 second bouts >90% HRmax), improves maximal aerobic fitness and stabilizes BMI without worsening symptoms or lung function in adolescents (10). Breathing- and singing-based programs enhance respiratory and peripheral muscle strength, reduce dynamic hyperinflation, and improve dyspnea and quality of life in children (11, 12). Adding yoga to standard care further improves asthma control and reduces exacerbations compared with non-yoga exercise in adults (13).

Exercise also benefits key extrapulmonary comorbidities. In overweight and obese youth, structured programs reduce BMI and improve VO_2max and exercise capacity similarly to non-asthmatic peers (14). HIIT in adolescents improves LDL cholesterol and diastolic blood pressure, although effects on overall cardiometabolic risk are inconsistent (10). These findings align with broader evidence linking inactivity, symptom-related fear, and parental concern to overweight in pediatric asthma (4, 15). Aerobic training in obese asthmatic children lowers high-sensitivity CRP and IL-6 while enhancing cardiorespiratory fitness (15). In adults, exercise reduces airway and systemic cytokines and profibrotic markers, suggesting additional cardiometabolic benefits (7). Psychological health also improves: in fact, aerobic training reduces anxiety and depressive symptoms in adults with moderate to severe asthma (8), while pediatric studies associate regular activity with better quality of life particularly in those with more symptomatic disease (5).

Cystic fibrosis and Non-CF bronchiectasis

For individuals with chronic suppurative lung disease and bronchiectasis, regular airway clearance techniques (ACTs) reduce sputum burden, improve quality of life and may reduce exacerbations (16). Beyond its general health benefits, PA may complement ACTs by inducing mechanical airways stress and promoting mucus hydration, thereby facilitating expectoration (16).

Cystic fibrosis

Cystic fibrosis (CF) is characterized by thick secretions leading to multiorgan damage. Mucous stagnation drives inflammation, recurrent infections and progressive lung function decline, the leading cause of morbidity in CF patients (pwCF). Management includes CFTR-modulating therapies, multidisciplinary care, ACTs and structured exercise, all of which are integral to treatment. Annual cardiopulmonary exercise testing (CPET) is recommended for all pwCF (17) to establish functional capacity.

PwCF are encouraged to follow general PA guidelines and remain active most days of the week, although adherence is often low (18).

Higher PA levels are associated with better respiratory outcomes, enhanced mucociliary clearance, bone mineral density improvement, better quality of life and prognosis in adolescents (19-21). Conversely, sedentary behavior and poor exercise capacity correlate with faster lung function decline and higher mortality (21).

Adults pwCF using exercise as an adjunct to ACT report slower lung function decline and reduced sputum production (22). A systematic review of 23 controlled trials found that pulmonary rehabilitation and exercise did not significantly improve FEV_1, FVC, FEV1/FVC, or RV/TLC, but increased VO_2max by 2.74 ml/kg/min, a key prognostic marker, and showed favorable trends in 6-minute walk distance. Effects on exacerbations and hospitalizations were not significant, though some studies reported improvements in vitality, emotions, well-being and physical functioning (23).

Establishing exercise efficacy as an ACT remains a research priority in CF (22).

A recent statement from European Cystic Fibrosis Society calls for large prospective studies evaluating mortality, morbidity, cost-effectiveness, and quality of life outcomes (24).

Telemedicine interventions, including web-based platforms, fitness trackers, and tailored exercise plans have shown limited additional benefits over standard care, with no consistent improvements in lung function or overall physical performance, aside from isolated gains in muscle strength in children and adolescents (25-27). With the advent of CFTR modulators, increasing attention is being directed toward promoting habitual moderate-to-vigorous PA and reducing sedentary time. However, optimal exercise type, intensity and duration remain undefined.

People with CF often perceive treatments such as aerosol therapy, ACTs, and the maintenance of respiratory equipment as time-consuming and burdensome. The advent of

CFTR modulators has altered the natural history of the disease, with many patients becoming less prone to mucus hypersecretion and pulmonary exacerbations.

For these reasons, many pwCF are independently modifying their treatment regimens based on personal preferences, replacing or supplementing conventional ACTs with exercise (ExACT) (28).

Although reducing treatment burden remains a key priority for pwCF, the current evidence supporting ExACT as a viable, lower-burden alternative to chest physiotherapy is limited.

Non-CF bronchiectasis

Bronchiectasis involves irreversible airway dilatation, chronic productive cough and recurrent exacerbations (29). ACTs and exercise are key management strategies (30), yet only about half of affected children meet PA recommendations, especially those older, and those with severe disease (31).

Interventions such as active video gaming and play-based therapeutic exercise programs have demonstrated improvements in aerobic fitness, muscular strength, fundamental movement skills, and quality of life (12, 32). Social engaging parent-supported activities also promote participation (33). Home-based respiratory programs performed twice daily for 8 weeks improved lung function, exercise capacity, and respiratory and peripheral muscle strength in children with bronchiectasis and CF (32).

Primary ciliary dyskinesia

Primary ciliary dyskinesia (PCD) is characterized by impaired mucociliary clearance due to defective cilia, leading to bronchiectasis, airway obstruction and reduced exercise capacity (34, 35). In the absence of long-term RCTs, recommendations are extrapolated from other chronic lung diseases, with regular PA advised (36). However, the effect of physical exercise in this population remains understudied. Evidence remains limited, though inspiratory muscle training may improve maximal inspiratory pressure, and short PA may modestly increase oxygen saturation (37, 38).

Interstitial lung diseases

Interstitial lung disease in children (ChILD) comprises a heterogeneous group of rare disorders associated with high morbidity and mortality, posing significant challenges for pediatric pulmonologists. Exercise intolerance is a prominent symptom and results from three main mechanisms: 1) impaired gas exchange with hypoxemia; 2) ventilatory dysfunction due to reduced lung compliance and increased respiratory load; and 3) peripheral muscle dysfunction leading to deconditioning (39). All these factors promote a vicious cycle in which reduced exercise and daily activity further worsen functional capacity and quality of life. Pulmonary rehabilitation and structured exercise counteract deconditioning. Studies, mainly in adults, show improvements in exercise tolerance, 6-minute walk test (6MWTD), dyspnea scores, and quality of life (QoL) (40, 41). A 2020 review by the European Respiratory Society highlighted the role of pulmonary-function tests (PFT) in ChILD, including the use of the 6MWT or VO_2 peak and exercise limitation (42). Symptoms, such as dyspnea, fatigue and difficulty to run or to walk are common. Qualitative pediatric data indicate that fatigue significantly limits participation in PA and is influenced by physical, psychological, and social factors, underscoring that exercise capacity reflects more than physiological impairment alone (43). Most robust evidence derives from adult ILD. A meta-analysis of 16 RCTs including 899 adult patients found that exercise training improves 6MWTD, peak work rate, VO_2 peak measured with CPET, symptoms and QoL (44). Another review demonstrated that exercise capacity and PA levels predict important long-term clinical outcomes, supporting early intervention in adults (45). In children with ChILD, however, evidence is limited, with few trials and no standardized protocols regarding exercise type, intensity, duration, or safety threshold for desaturation. Extrapolating adult data requires caution. An older pediatric study showed that exercise-induced desaturation correlates with a lower FVC, indicating the need for careful monitoring (46). Exercise prescription in ChILD should therefore be individualized, considering disease severity and oxygenation. Aerobic activities such as walking, cycling, or swimming are generally preferred, performed several times per week in manageable sessions with gradual progression. Moderate intensity, possibly incorporating intervals, is advisable, with caution in more severe cases.

A prospective, single-arm study in children aged 7-18 years with chronic lung diseases, demonstrated that a three-month home-based program (three sessions weekly) improved FEV_1, peak expiratory flow (PEF), respiratory muscle strength, 6MWTD, dyspnea and QoL with high adherence and no serious adverse events (47). Data on extrapulmonary comorbidities in ChILD are poor. A 2021 case-control study including children with bronchiectasis and ILD showed that nutritional intervention improved weight, body composition, lung function, respiratory symptoms, and hospitalizations, highlighting the importance of multidisciplinary rehabilitation approaches (48).

Lung transplantation

Lung transplantation is an established option for children with chronic lung diseases (CLDs) and severe respiratory failure unresponsive to other therapies. CF has historically represented the leading indication, but the introduction of CFTR modulators has markedly reduced transplants rates: in the USA, CF-related transplants declined from 49% in 2016 to 16% in 2021 (49).

Post-transplant survival has improved substantially, rising from a median of 5.7 years to 9.1 years beyond the first year. Children with CF show particularly favorable outcomes, with median survival of 9.7 years, compared with 7 years for idiopathic pulmonary arterial hypertension and 6 years for chronic obstructive pulmonary disease (50).

Transplantation leads to major improvements in QoL and respiratory function. However, exercise capacity remains reduced with VO_2max typically reaching only 40-60% of predicted values, partly due to sarcopenia and other multifactorial limitations (51).

Adult studies report that regular PA after transplantation offers important benefits, including increased muscle mass and strength, improved cardiopulmonary performance, prevention of obesity and diabetes, and enhanced self-esteem and social participation (52). Resumption of activity should be gradual, beginning with physiotherapy and progressing gradually toward more demanding exercise programs. Contact sports and high-intensity aerobic activities are generally avoided during the first 6 months (53). Eligibility for competitive sports requires stable clinical status and close collaboration with the transplant center to ensure individualized risk assessment and safety.

TREATMENT STRATEGIES TO IMPROVE PA

CRDs can limit PA in children due to disease burden, symptom perceptions, and parental concern. Achieving good symptom control at rest and during exercise is essential to improve adherence to individualized programs. Four main strategies support PA participation: 1) optimizing pharmacological therapy; 2) providing oxygen when needed; 3) enhancing pulmonary rehabilitation; and 4) promoting behavioral change.

Pharmacological therapy

Optimizing medical treatment is the first step toward disease control. In asthma with exercise-induced bronchospasm (EIB), inhaled short-acting B2 agonist (SABA) at standard dose 200 µg taken 15 minutes before exercise or pre-exercise ICS/formoterol combination are first-line therapy (54). If symptoms persist or SABA is frequently required, daily inhaled corticosteroids (ICS) are recommended (54). In CF and non-CF bronchiectasis (NCFB), management may include aerosol therapies (*e.g.*, hypertonic saline, inhaled antibiotics when indicated) (30). CFTR modulators have further improved CF care (17). In childhood ILD, treatment may include systemic steroids, hydroxychloroquine, or azithromycin (55). After the lung transplantation management, immunosuppressive regimen, commonly methylprednisolone, tacrolimus and mycophenolate are essential to prevent rejection (55).

Oxygen therapy

Supplemental oxygen is indicated in cases of exercise-induced desaturation, enabling safe participation in PA. It is particularly important in ILD, where impaired gas exchange limits oxygenation (56).

Pulmonary rehabilitation

In CF and NCFB, pulmonary rehabilitation is a cornerstone treatment. Techniques include airway clearance methods (percussion, autogenic drainage, positive expiratory pressure [PEP], high-frequency chest wall oscillation) combined with exercises. Programs should be performed regularly and tailored to clinical status (30).

Behavior changes

Behavioral strategies are equally important. A structured warm-up exercise is recommended before exercise in all patients with CRD (54). Environmental factors, particularly air pollution and tobacco smoke, negatively affect respiratory health during PA (57). Avoiding smoke exposure is therefore a key preventive measure to support safe and sustained PA (58).

DIGITAL TOOLS FOR PROMOTING PA AND MANAGING CHRONIC RESPIRATORY DISEASE

Digital technologies are increasingly used to promote PA and support management of CRD, in children and adolescents (**Table 2**). In pediatric pulmonary hypertension, the iTONE trial demonstrates how a 16-week home-based exercise program can be "enhanced" by mobile health tools. The intervention combines individualized exercise prescriptions with wearable accelerometers for real-time activity monitoring, interval goal setting to build self-efficacy, and a digital platform for two-way communication and safety oversight (59). Automated text messages triggered by heart-rate thresholds, low device wear time, or symptoms alerts help maintain adherence and safety during unsupervised training, providing a model for future pediatric cardiorespiratory trials (59).

More broadly, innovation in respiratory monitoring include smart inhalers, wearable sensors and home spirometry devices that allow continuous assessment of lung function and treatment response in daily life. These data can be integrated with machine learning algorithms for advanced interpretation and personalized care (60). In pulmonary rehabilitation programs, wearable devices are increasingly embedded within behavior-change strategies to monitor PA and clinical outcomes (61).

In children with chronic suppurative lung diseases, especially CF, eHealth-delivered exercise interventions, such as video games, videoconferencing, and digital spirometers over 3-12 weeks, have shown measurable benefits. A meta-analysis reported a pooled improvement of approximately 37 meters in 6-minute walk distance compared with controls, along with gains in pulmonary function, exercise capacity, balance, muscle strength, and health-related quality of life, although many studies have short follow-up and risk of bias (62). Ongoing systematic reviews aim to clarify whether digital health tools improve adherence and clinical outcomes in CF (27).

Narrative reviews suggest that web/mobile apps, exergames, and web-based platform are generally feasible, acceptable, for increasing PA in healthy youth and those with CRD, including during periods of restricted mobility such as the COVID-19 pandemic (63). Emerging tools – including wearables, virtual reality, and location-based applications – offer scalable and engaging strategies to promote PA across home, school, and clinical settings, though they may also contribute to sedentary screen time if not thoughtfully designed (64).

In pediatric respiratory care, implementation requires attention to interoperability, data protection, equitable access, and standardized clinical validation. Professional guidance emphasizes careful governance to ensure that digital tools are safe, effective, and accessible within routine care pathways (65).

MEDICATIONS FOR CRD AND THE RELATIONSHIP TO DOPING

Medications for CRD include 1) bronchodilators to relieve airway obstruction; 2) anticholinergics to support bronchodilation; 3) anti-inflammatory drugs such as systemic and inhaled steroids and leukotriene receptor antagonists; and 4) mucolytics and expectorants to enhance mucus clearance. Some of these drugs may have performance-enhancing effects, improving muscle strength, endurance or recovery, and therefore raise concerns in competitive sports. The use of potentially doping agents is increasing among adolescents. Lifetime prevalence of nonprescribed anabolic steroid use ranges from 1% to 6%, with higher rates in boys (4.0%) than in girls (2.2%), and greater use among adolescent athletes compared with non-athletes (66, 67).

Doping in youth carries significant physical and psychological risk, including cardiovascular and liver damage, endocrine dysfunction, psychiatric disorders, low self-esteem, and anxiety (68). To protect athlete health and ensure fair competition, the World Anti-Doping Agency (WADA) and other regulatory bodies enforce strict rules on medication use in sport. Asthma therapies such as corticosteroids and long- and short-acting β2-agonists are regulated because of their potential performance effects. Nevertheless, as the health of athletes with asthma is always prioritized, inhaled beta-2 agonists (*e.g.*, salbutamol, formoterol) are permitted within specific dose limits, and therapeutic use exemptions (TUEs) are available when prohibited medications are medically necessary, provided that athletes can supply objective evidence of asthma.

PA IN PEDIATRIC CRDs: WHAT DOES IPRS/SIMRI SUGGEST?

PA provides substantial physical and mental health benefits across all ages. Nevertheless, about 80% of adolescents fail to meet the WHO recommendations (69), with even lower adherence among those with CRDs, despite strong evidence supporting PA as a key component of disease management.

Although acute exercise temporarily increases pro-inflammatory mediators, regular training exerts anti-inflammatory effects that may reduce disease progression (7).

Experimental models show that aerobic exercise decreases airway inflammation, hyperreactivity, and remodeling by lowering T helper 2 (Th2) cytokines and increasing anti-inflammatory mediators such as interleukin (IL)-10 and IL-1 receptor antagonist (IL-1Ra) (7). In asthma, these effects correspond to reduced FeNO levels and sputum eosinophils (70).

Clinical studies demonstrate that structured programs, typically three weekly sessions of moderate-to-vigorous aerobic exercise lasting 30-60 minutes for at least eight weeks with or without resistance training – improve functional capacity in asthma and are safe adjuncts to pharmacologic therapy. Benefits extend beyond lung function, positively affecting obesity, anxiety, depression, sleep disturbances, gastroesophageal reflux disease, and bone fragility related to prolonged corticosteroid therapy in adults (71, 72). Exercise should therefore be considered foundational in asthma care.

In CF, PA improves FEV_1, FVC, and VO_2max; in NCFB it enhances endurance and six-minute walking test (32). While optimal training parameters remain unclear in CF and data are limited in NCFB, regular moderate-to-vigorous PA combined with reduced sedentary time is recommended.

Nevertheless, based on the available evidence, it appears reasonable to recommend regular PA – particularly moderate-to-vigorous intensity exercise – within structured daily programs, alongside strategies aimed at reducing sedentary behavior, in both populations.

In ILD, mainly in adults, exercise training improves 6MWT performance, lung function, VO_2 peak, and may reduce pulmonary hypertension (44). Evidence in children with ChILD remains scarce. Exercise also benefits before and after lung transplantation, by improving exercise capacity and QoL (55).

Evaluating habitual PA levels and identifying barriers to participation are equally important.

As reported in some studies carried out in adult population, wearable devices can support individualized planning and monitoring (73, 74).

Exercise prescription should follow comprehensive baseline assessment, including medical history and, when feasible, spirometry with bronchodilator reversibility testing. Additional measures such as FeNO, blood eosinophil count, and diffusing capacity of the lung for carbon monoxide (DLCO) may be particularly useful for monitoring CRDs. CPET is considered the gold standard for evaluating exercise tolerance, as it provides an integrated assessment of the cardiovascular, respiratory, and musculoskeletal systems under physiological stress (75, 76).

The 6MWT offers a practical functional assessment with heart rate and peripheral oxygen saturation (SpO_2).

Digital tools, including telemedicine and mobile applications, show short-term promise in promoting adherence and reducing treatment burden. However, robust long-term trials and clear ethical, technical, and policy frameworks are still needed to ensure their safe and effective integration into routine care (27, 59, 65).

It must be taken into consideration that disease control is the "*conditio sine qua non*" for safe participation in most physical activities.
Although children and adolescents are usually encouraged to be physically active, some activities are less appropriate for people with CRDs, especially when their condition is not well controlled. For example, cold-weather endurance sports can worsen asthma because cold, dry air may trigger bronchospasm (77). High-altitude sports are not recommended for patients with impaired lung function and suboptimal gas exchange, as reduced oxygen availability can further stress compromised lungs (78).
Swimming in poorly ventilated, chlorinated pools may exacerbate respiratory symptoms in individuals whose airways are sensitive to chlorine. Scuba diving is generally contraindicated in uncontrolled asthma because of the risk of air trapping and barotrauma.

Outdoor PA in areas with high air pollution or allergen exposure (*e.g.*, during pollen seasons) can worsen symptoms in patients with bronchial hyper-responsiveness and allergen sensitization. Contact sports are not recommended for patients with fragile health (*e.g.*, patients with CF or transplant recipients).

Finally, high-intensity continuous endurance sports (*e.g.*, running or cycling), which require sustained ventilation, can provoke symptoms when airway control is poor.

Given limited high-quality trials, disease-specific exercise guidelines remain underdeveloped.

A multidisciplinary approach is essential to tailor age, disease severity, fitness, and motivation, while ensuring safety through oxygen saturation monitoring and access to rescue medication.

CONCLUSIONS

In line with current evidence, SIMRI supports regular physical activity as an essential component of the multidisciplinary management of pediatric chronic respiratory diseases (**Table 3**). Exercise should be considered a therapeutic intervention alongside pharmacological treatment because of its beneficial effects on functional capacity, exercise tolerance, psychological well-being, and quality of life.\n\nAlthough pediatric disease-specific exercise prescriptions remain incompletely defined, clinicians should promote individualized, safe, and enjoyable physical activity programs tailored to disease severity, patient preferences, and functional limitations. Future research should focus on standardized pediatric exercise protocols, long-term clinical outcomes, and the integration of digital health technologies into routine respiratory care.

COMPLIANCE WITH ETHICAL STANDARDS

Conflicts of interest

The authors declare no conflicts of interest.

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Author contributions

FP, SLG: conceptualization. FP, CC, VF, EL, LM, GT, AT, SLG: writing – original draft, writing – review & editing. The members of SIMRI Advocacy Council and Executive Committee contributed to drafting the paper based on their expertise on the subject. All authors discussed and approved the final recommendations. All authors read, critically reviewed and approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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N/A.

Data sharing and data accessibility

Data are available along with the paper.

Publication ethics

Plagiarism

Authors declare no potentially overlapping publications with the content of this manuscript and all original studies are cited as appropriate.

Data falsification and fabrication

All the data corresponds to the real. AI used for Figure 1.

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Table 1. *Typical exercise prescriptions and main asthma outcomes.*

Population & Type	Typical FITT	Main benefits	Citations
Adults, aerobic (moderate/vigorous)	3×/wk, 30–45 min, 12 wk, mod–vig intensity	↑AQLQ, ↑ACQ, ↓airway inflammation	(7-9)
Children, combined (aerobic+resistance)	3×/wk, 60 min, 12 wk	↑VO_2peak, ↑strength, no loss of control	(6)
Adolescents, HIIT	3×/wk, 30 min, 6 mo, >90% HRmax intervals	↑fitness, BMI maintenance	(10)
Obese children, incremental aerobic	3×/wk, 8 wk, progressive	↓CRP/IL-6, ↑VO_2peak, ↑6MWT	(70)

FITT: Frequency, Intensity, Time, Type; wk: week; AQLA: asthma quality of life questionnaire; ACQ: asthma control questionnaire; min: minutes; VO_2peak: peak oxygen uptake; mo: months; HR: heart rate; BMI: body mass index; CRP: c-reactive protein; 6MWT: 6-minutes walking test.

Table 2. *Summary of main digital tools and functions.*

Digital approach	Main role in PA/respiratory care	Citations
Wearables/accelerometers	Monitor daily PA, support home exercise, track PR outcomes	(58-61)
Apps, web platforms, SMS systems	Goal setting, feedback, adherence prompts, symptom/safety monitoring	(27, 58, 63, 64)
Active video games/exergames	Deliver engaging exercise, improve capacity and QoL	(61)
Telehealth/videoconferencing	Supervise remote exercise sessions, maintain access during constraints	(27, 61)
Smart inhalers, sensors, digital spirometers	Real-time lung function and treatment-use monitoring	(59, 61, 64)

AI/machine-learning on lung data	Advanced interpretation, pattern recognition, therapy evaluation	(59)

PR: patient reported; QoL: Quality of Life; AI: Artificial Intelligence.

Table 3. *SIMRI recommendations on physical activity (PA) in pediatric patients affected by CRDs.*

1. Physical activity, exercise and pulmonary rehabilitation provide numerous health benefits; therefore, they are to be considered as integral part of the treatment plan of CRD and lung transplanted patients, in addition to pharmacotherapy.
2. Before to suggest PA in patients affected by CRD, a respiratory function evaluation – including spirometry, cardiopulmonary exercise test, six-minutes walking test, diffusion lung capacity of carbon monoxide – should be made to ensure safety, efficacy and to personalize the exercise plan.
3. Comorbidities such as obesity, anxiety, depression, gastroesophageal reflux disease and cardiometabolic disease should be considered when PA is prescribed.
4. Aerobic activity is the suggested modality (walking, running, cycling, and swimming).
5. Warm up exercise should be considered at the beginning of the activity.
6. PA frequency should be about 3-5 days per week.
7. Daily session of moderate-to-vigorous aerobic exercise should last about 30-40 minutes.
8. Intensity should be gradually adjusted according to patient resistance.
9. Administration of SABA before PA or O2 delivering during PA could facilitate adherence to the exercise program.
10. Avoidance of exercise following acute exacerbation is recommended until symptoms and lung function have improved.
11. For lung transplanted patients sports contact and those with high aerobic impact should be avoided for at least the first 6 months.
12. Periodical evaluation of patients is useful to assess disease and redraw the exercise plan according to patient's condition and disease evolution.
13. Telehealth and remote monitoring can be used for managing CRD patients, assessing respiratory function periodically and empower adherence to PA.

14. Despites the benefits of regular exercise outweigh the health risks associated with air pollution in the general population, it should be useful to consider that some factors (chemical components, air pollutants, airborne allergens and the atmospheric temperature) can trigger or worsen respiratory symptoms in CRD patients.
15. Because, overuse or misuse can lead to positive doping tests, even if the drug was medically indicated, physicians must balance therapeutic needs with regulatory compliance, especially in pediatric or competitive sports contexts.

Figure 1. *Levels of PA for healthy children and adolescents recommended by 2020 WHO guidelines.*

AI has been used for figure creation.