

Case Study Report:
Asthma in Adolescents

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1. Introduction

Asthma is an inflammatory airway disease that is long-lasting and is characterised by frequent cough, wheeze, chest tightness and shortness of breath, caused by reversible airway constriction (World Health Organization, 2026; Goldin and Cataletto, 2024). In the world, an estimated 363 million people had asthma in 2023, and it is the most common chronic disease in children and a big cause of missed school and work (World Health Organization, 2026). In the framework of this report, the author takes on the role of a practice nurse who runs a fortnightly asthma clinic for adolescents in a GP surgery, where young people often present with poorly controlled symptoms associated with changes in lifestyle.

Asthma in adolescents is multifactorial. Genetic predisposition, contact with environmental allergens, tobacco smoking and vaping, respiratory infections caused by viruses, obesity and air pollution have been established as risk factors (Goldin and Cataletto, 2024). Epidemiological evidence has indicated that traditional risk factors cannot be fully attributed to explain the worldwide difference in the prevalence of symptoms, indicating the role of local behavioural and environmental factors in determining outcomes (Rutter et al., 2024).

This report aims to describe the physiology of respiratory system, discuss how lifestyle factors impact the pathophysiology of asthma, interpret how regular monitoring data can be used to make clinical decisions, and provide four evidence-based lifestyle recommendations that can be used with adolescent patients. The report ends with a reflection on the role of the practice nurse in promoting self-management among this age group.

2. Anatomy and Physiology of the Respiratory System

2.1 Structure of the Respiratory System

The respiratory system has an anatomical subdivision into an upper and a lower tract. The superior tract includes the nose, pharynx and larynx which warm, humidify, and filter inhaled air. The lower tract originates at the trachea that splits into right and left main bronchi and further into lobar and segmental bronchi, bronchioles and lastly the terminal alveoli where gases are exchanged. The diaphragm, external and internal intercostal muscles, as well as the double-layered pleura are the supporting structures that facilitate the mechanical movements needed to breathe (Chaudhry, Omole and Bordoni, 2023).

2.2 Mechanical Ventilation

Alterations in thoracic volume and intrapulmonary pressure cause ventilation. Inspiration, the diaphragm flattens and contracts and the external intercostals raise the ribs, enlarging the thoracic cavity. This increase in volume in accordance to the law of Boyle reduces the

intrathoracic pressure below the atmospheric pressure, and pulls air into the lungs. Passive processes dominate at rest: respiratory muscles relax, the spring of lung tissue is lowered, the intrapulmonary pressure exceeds the atmospheric pressure, and air is discharged (Powers and Dhamoon, 2023).

2.3 Gas Exchange at the Alveoli

Exchange of gases takes place between the alveolar-capillary membrane. Alveoli are tiny, thin-walled cavities with an enormous total surface area that is well supplied by capillaries in the lungs, which have a favorable environment of passive diffusion. The diffusion of oxygen across the alveoli into pulmonary capillary blood occurs along its partial-pressure gradient, and binds haemoglobin in erythrocytes to take oxygen to peripheral tissues. At the same time, carbon dioxide is diffused out of the blood into the alveolar space to be exhaled. Good ventilation, well-preserved alveolar architecture, and well-suited perfusion are thus required to ensure good gas exchange (Powers and Dhamoon, 2023). Narrowing of the airways, thickening of the mucosal lining or disturbance of ventilation–perfusion matching will impair gas exchange, which is a key concept in explaining the clinical manifestations of asthma (Chaudhry, Omole and Bordoni, 2023).

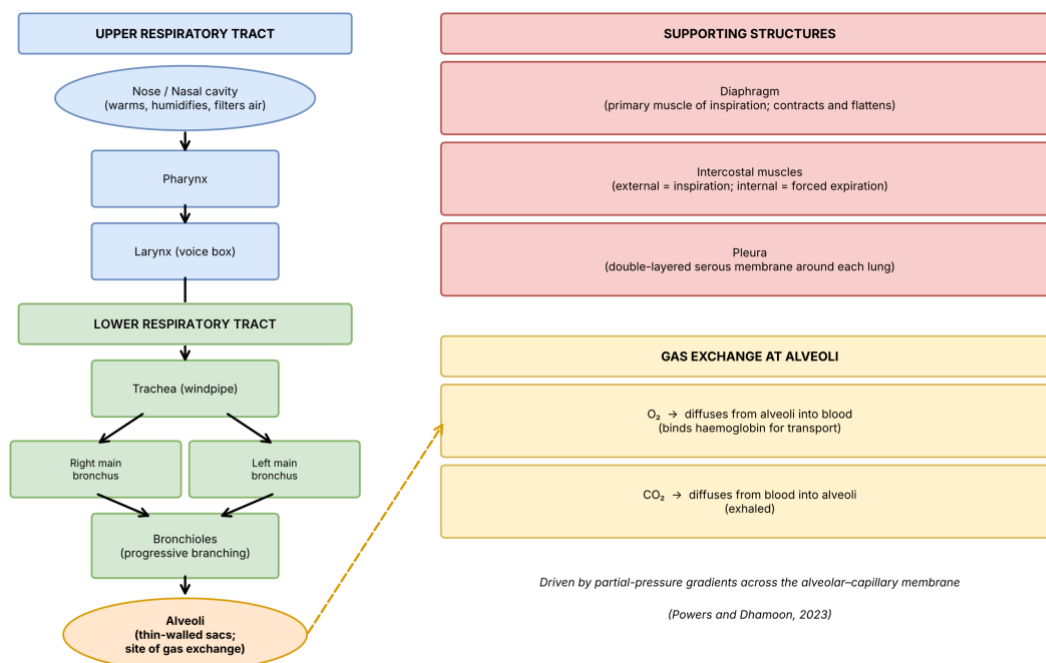


Figure 1: Structure of the Human Respiratory System, showing the upper and lower airways, supporting musculature and the site of gas exchange at the alveoli (adapted from Chaudhry, Omole and Bordoni, 2023; Powers and Dhamoon, 2023).

3. Pathophysiology of Asthma and the Impact of Lifestyle Factors

3.1 Airway Changes in Asthma

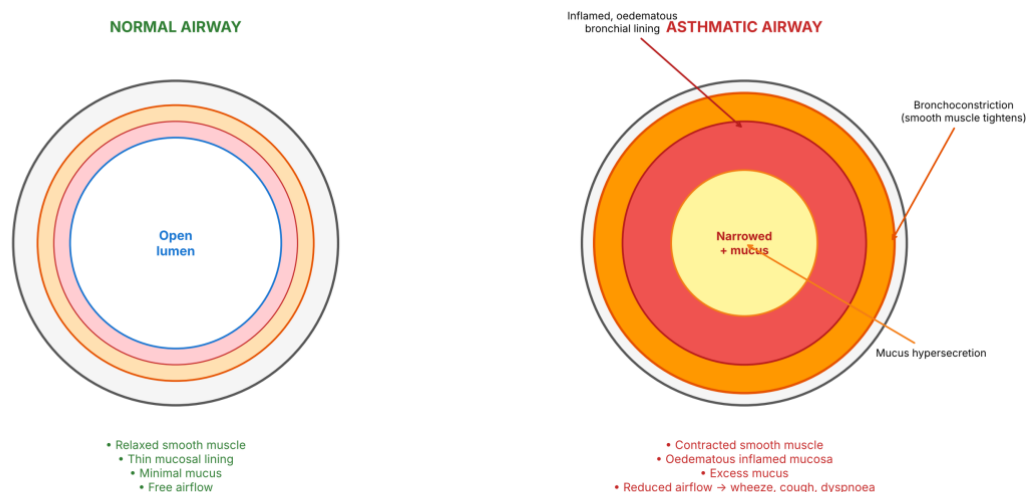
The airways are hyperirritable to various stimuli in asthma. Narrowing of the bronchial lumen occurs in three processes: contraction of the bronchial smooth muscle (bronchoconstriction), inflammation and oedema of the bronchial lining, and hyper secretion of mucus that are interrelated. The combination of these decreases the airflow, especially during expiration, causing wheeze, cough, chest tightness and breathlessness (Goldin and Cataletto, 2024; Barbas, 2024).

3.2 The Inflammatory Cascade

The inflammatory cascade is triggered when an irritant (e.g. allergen, cigarette smoke, cold air or viral infection) is detected by the immune cells of the airways. Histamine, leukotrienes and prostaglandins are released by the degradation of mast cell and a type-2 helper T-cell response leads to the recruitment of eosinophils and the formation of immunoglobulin E. Ongoing inflammation triggers structural changes (airway remodelling) that include sub-epithelial fibrosis, smooth muscle hypertrophy and goblet cell hyperplasia that can result in some amount of permanent airflow limitation with time (Barbas, 2024).

3.3 Impact of Smoking, Vaping and Respiratory Infection

The issue of smoking and vaping is especially important to the teens. Cigarette smoke blocks the clearance with the cilia, enhances mucus secretion and intensifies the eosinophilic and neutrophilic inflammation. Reactive carbonyls, flavouring agents and nicotine delivered by electronic cigarette aerosol cause airway inflammation and oxidative stress, which is often perceived by the young people as a safer option (Chatziparasidis and Kantar, 2022). A meta-analysis and systematic review identified a significant increase in the odds of asthma in adolescent e-cigarette users as compared to non-users with a pooled odds ratio of about 1.31 (Li et al., 2022). The most common cause of acute exacerbation has always been respiratory viral infections, and rhinovirus infection is the most common in adolescents; they are highly exposed to school, sport, socialization, and part-time employment (Goldin and Cataletto, 2024). These mechanisms can then be directly converted into the symptom patterns, trigger histories and exacerbation frequencies that nurses record at every review within the clinic.



TRIGGER (allergen / smoke / vaping aerosol / virus / cold air) → Mast cell degranulation → Histamine + leukotrienes → Type-2 (Th2) eosinophilic inflammation → Smooth muscle contraction, oedema & mucus → Airway remodelling over time

Figure 2: Pathophysiology of asthma showing a normal airway compared with an asthmatic airway affected by bronchoconstriction, mucosal inflammation and mucus hypersecretion (adapted from Goldin and Cataletto, 2024; Barbas, 2024).

4. Monitoring and the Use of Routine Data

4.1 The Importance of Monitoring

Adolescents with asthma will be properly managed on the basis of monitoring. It allows clinical deterioration to be identified promptly and empowers patients to have control over their illness by self-management, and it gives the objective data that clinicians can rely on to make decisions on whether to raise or lower the level of treatment according to the national guidelines (National Institute for Health and Care Excellence, 2024).

4.2 Peak Expiratory Flow and Supporting Clinical Tools

One of the key self-monitoring measurements is peak expiratory flow (PEF). The adolescent does a forced expiration using a hand-held peak flow meter and measures the highest rate attained, which is compared to his/her personal best reading. Clinicians typically use these readings to refer to a traffic-light methodology: a green zone (80 percent or more of personal best) is evidence of good control and maintenance therapy continuation; an amber zone (50–79 percent) is evidence of deterioration and need of reliever therapy and reassessment; a red zone (below 50 percent) is evidence of a medical emergency and requires immediate intervention (American Lung Association, 2026). NICE says regular PEF monitoring should only be used when it is part of the person's written action plan, and that a PEF variability of

20% or more between twice-daily readings supports a diagnosis of asthma (National Institute for Health and Care Excellence, 2024). PEF, in itself, however, gives only a partial picture of the asthma status, as it only correlates weakly with actual asthma activity and young people often do not keep up with the monitoring (Rhee and Katchamat, 2025). These additional measures (symptom diaries (Rhee and Katchamat, 2025), questionnaires such as the Asthma Control Test [ACT], regular inhaler technique checks and periodic spirometry during clinic visits) provide a more holistic view of the disease control and response to treatment (National Institute for Health and Care Excellence, 2024).

4.3 Routine Data in Health and Social Care

Data collected on a regular basis within health and social care contexts is also collated and analysed systematically to influence service provision and the broader policy. Commissioning is informed by de-identified datasets describing prescribing patterns, emergency department visits, hospital admissions and primary care visits, and the national respiratory audit uses this kind of data to train clinicians, support people living with respiratory disease and inform national and local policy (Royal College of Physicians, no date). At the individual level, NICE also says personalised action plans should include ways of reducing exposure to indoor and outdoor air pollution (National Institute for Health and Care Excellence, 2024). Monitoring data then serves on both individual and population level altogether, creating a direct connection between the asthma clinic and the healthcare improvement at a system level.

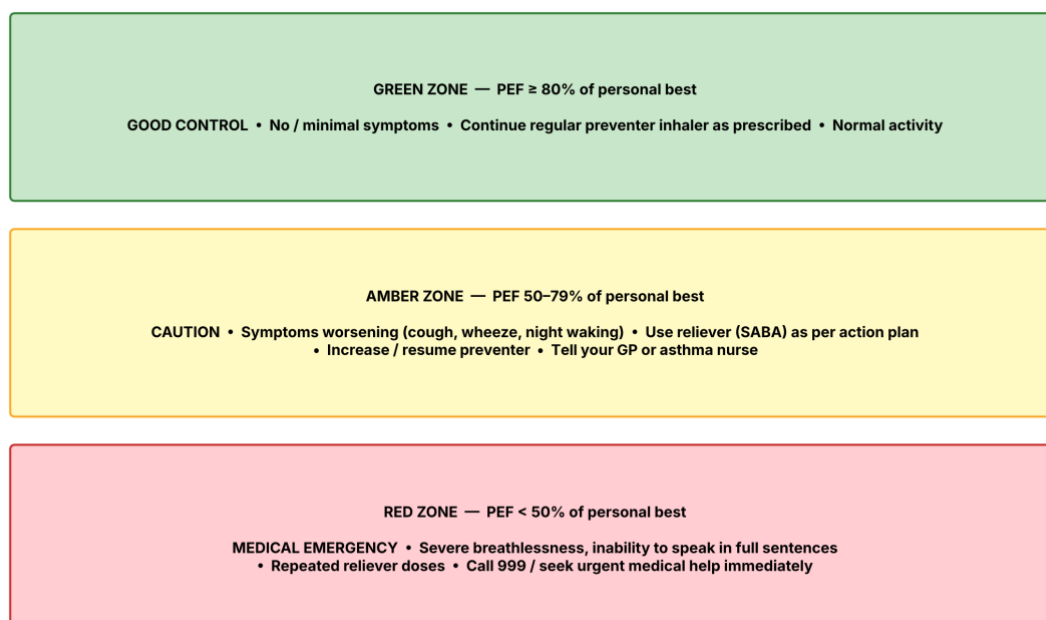


Figure 3: Peak expiratory flow traffic-light zones used in adolescent self-monitoring (adapted from American Lung Association, 2026; National Institute for Health and Care Excellence, 2024).

5. Evidence-Based Lifestyle Recommendations

The adolescent asthma clinic is proposed to have four realistic and evidence-based recommendations.

5.1 Smoking and Vaping Cessation

First of all, cessation of smoking and vaping should be given priority. Cessation of tobacco and e-cigarette smoking decreases the inflammation in the airways and minimizes the frequency of exacerbation; adolescents have to be referred to local NHS stop-smoking services and provided with behavioural support (National Institute for Health and Care Excellence, 2024). This suggestion is supported with the evidence that vaping aerosol in itself poses an increment in the onset of asthma in adolescents (Li et al., 2022).

5.2 Regular Physical Activity

Second, physical activity ought to be routinely promoted. Aerobic exercise enhances cardiorespiratory fitness, lung function and quality of life associated with asthma, and can help decrease systemic inflammation. Exercise does not necessarily have to be a trigger; however, exercise-induced bronchoconstriction can be treated clinically through adequate exercise warming up, use of pre-exercise short-acting beta-2 agonists when prescribed and good baseline control. The net weight of evidence indicates the exercise to be a therapeutic intervention and not an avoidable one (Price and Simpson, 2023).

5.3 Weight Management and Diet

Third, dietary quality and weight management must be taken care of. Obesity exacerbates asthma control by mechanically limiting lung expansion, and by systemic low-grade inflammation. Another diet that can help to reduce airways inflammation and improve asthma outcomes among young people is a Mediterranean-style diet with a high intake of fruit, vegetables, whole grains, oily fish and olive oil which contain antioxidants and omega-3 fatty acids (Deligeorgopoulou et al., 2025). Dietary counselling needs to be feasible, culturally sensitive and based on the whole-family change.

5.4 Inhaler Technique and Adherence

Fourth, the inhaler technique and adherence should be assessed every time of the clinic visit. Lapse of compliance is especially prevalent during adolescence as a result of peer pressure, memory loss and personal appearance anxiety. Proper technique is a guarantee of accurate administration of medications, optimal therapeutic outcome and minimisation of the risks of exacerbations; the application of spacer devices and individualised asthma action plans is highly encouraged (National Institute for Health and Care Excellence, 2024).

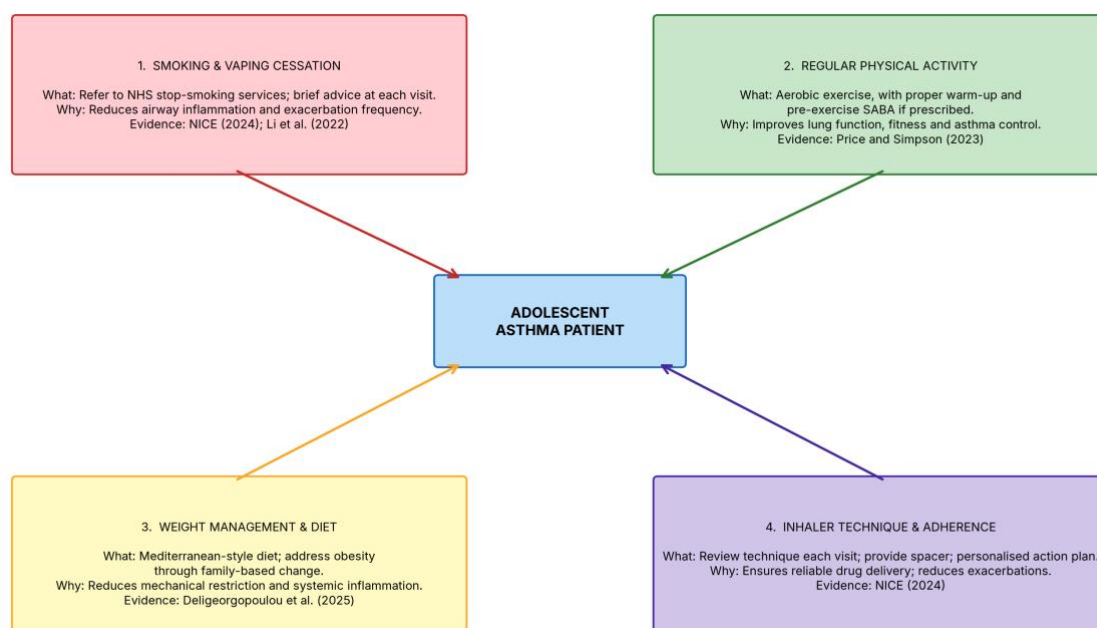


Figure 4: Summary of four evidence-based lifestyle recommendations for adolescents with asthma (based on National Institute for Health and Care Excellence, 2024; Price and Simpson, 2023; Deligeorgopoulou et al., 2025; Li et al., 2022).

6. Conclusion

This report has described the construction and operation of the respiratory system, the pathophysiological mechanisms, which underlie the asthma, and the way lifestyle determinants like smoking, vaping, infection, inactivity and poor diet worsen the disease among adolescents. It has demonstrated how regular monitoring data, such as the specifics of a single reading of peak flow to national data sets, can underpin clinical decisions and broader health and social care planning. In young, adolescent people who are prone to unique behavioural and social pressures, the concept of understanding, monitoring and self management is of particular significance.

Patient education, motivational interviewing and shared decision-making will play a central role in this process, with the practice nurse supporting adherence and lifestyle change (National Institute for Health and Care Excellence, 2024). Since asthma is a major cause of chronic illness worldwide, the enhancing of nurse-based care of adolescents also leads to an expanded public health agenda (World Health Organization, 2026). In the future, promising opportunities to engage and involve the youth in the use of digital tools are available like smart inhalers, connected peak flow meters and mobile health applications, which will allow the next generation of asthma adolescents to live productive and well-controlled lives.

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