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Assessment: Component 1 Written assignment (Asthma)

Asthma Management in Adolescents: A Physiological and Preventative Approach

Situated within a clinical scenario in which a practice nurse and GP deliver a fortnightly asthma clinic for adolescents presenting with an increase exacerbation. Many of these individuals were diagnosed in childhood a deterioration in symptoms control is evident, reflecting the influence of evolving lifestyle behaviours during adolescences. In particular, the uptake of smoking and vaping, and frequent exposure to crowded environments such as bars and clubs. These factors increase contact with respiratory irritants and infections, highlighting the need for improved patient education and self-management.

Current guidance from the Global Initiative for Asthma (2023) emphasises the importance of a personalised and preventative approach to asthma management, focusing on both clinical treatment and behavioural modification. In the UK, strategies promoted by NHS England and the National Institute for Health and Care Excellence further highlight the role of patient education, early intervention, and self-management in improving outcomes.

This report will examine the physiological mechanisms of asthma, including the process of gas exchange and how it is disrupted in affected individuals. It will critically evaluate the role of modifiable risk factors such as smoking, vaping, and respiratory infections in disease progression. Additionally, the report will explore the importance of monitoring and self-management strategies, particularly the use of peak expiratory flow (PEF), and provide evidence-based recommendations to improve asthma care among adolescents.

Asthma is a chronic respiratory condition that significantly impacts adolescents in the United Kingdom, with increasing concerns surrounding exacerbations linked to lifestyle and environmental factors such as smoking, vaping, and exposure to crowded social settings. These behaviours contribute to airway inflammation and reduce respiratory function, thereby increasing the frequency and severity of asthma attacks. However, asthma control is multifactorial, influenced not only by modifiable risk factors but also by individual susceptibility, disease severity, and access to healthcare services.

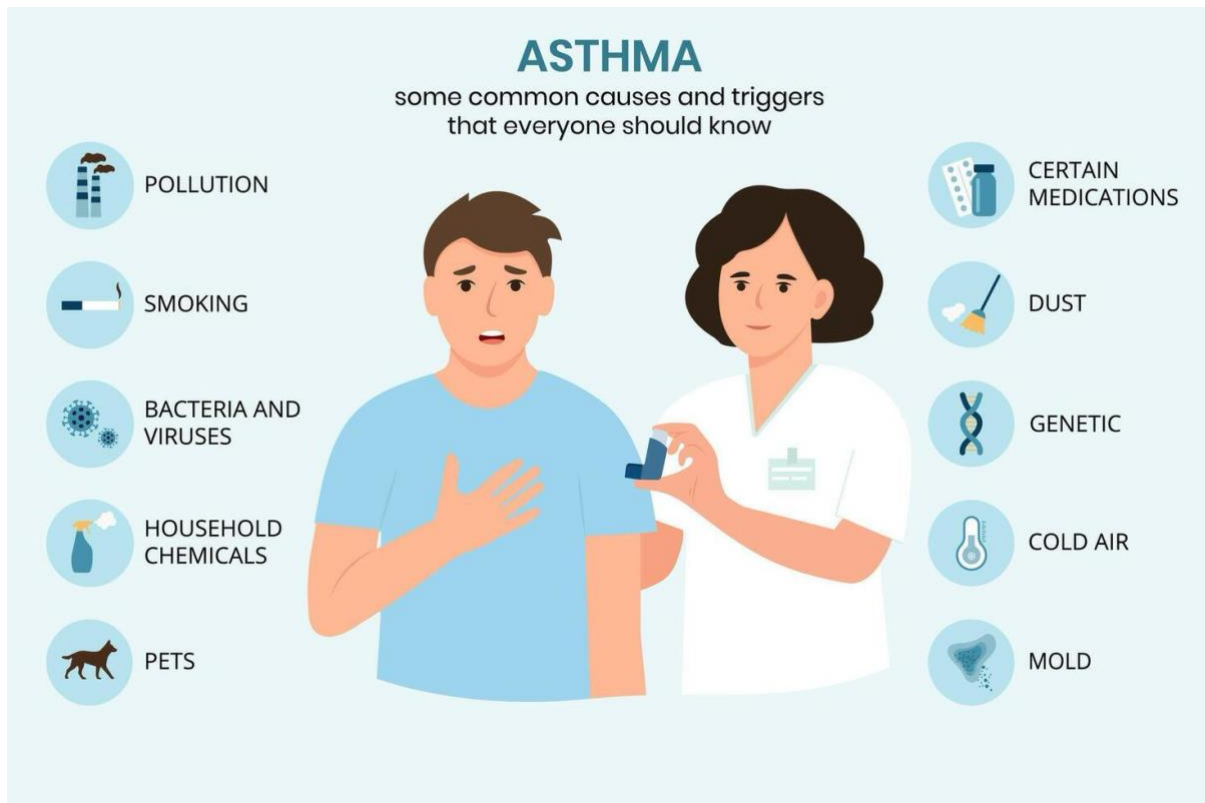


Figure 1: Risk factors of Asthma illustration (Oksana Petrykanyn, 2026)

Risk Factors and Triggers in Adolescents

Asthma exacerbations in adolescents arise from a complex interaction of environmental, behavioural, and biological influences. Among these, smoking and vaping represent key modifiable risks, as both introduce irritants that trigger airway inflammation, increase mucus secretion, and impair overall lung function. Although e-cigarettes are frequently perceived as a safer alternative, emerging evidence indicates that vapour exposure can still cause significant respiratory irritation and may contribute to worsening asthma control (Clemente-Suárez et al., 2023).

The comparative impact of smoking and vaping, however, remains uncertain. Conventional cigarettes contain a broader spectrum of toxic compounds with well-established long-term effects, whereas e-cigarettes deliver concentrated nicotine and chemical flavourings whose chronic effects on the developing lung are not yet fully understood. This creates a degree of clinical uncertainty, but current evidence suggests that neither behaviour is safe, particularly during adolescence when respiratory development is ongoing.

Beyond behavioural factors, respiratory infections also play a critical role in triggering exacerbations. Viral pathogens can heighten airway reactivity and inflammation, precipitating acute symptoms such as breathlessness. In addition, being around pollution, such as tiny airborne particles (PM_{2.5}), has been shown to exacerbate airway damage by promoting inflammatory pathways and disrupting normal alveolar function (Cui et al., 2025).

However, the impact of these risk factors is not uniform. Socioeconomic status, access to healthcare, and environmental conditions all influence exposure and outcomes. For example, adolescents living in urban or deprived areas may be more exposed to pollution and have limited access to preventative care. This highlights the need for a holistic approach that considers both clinical and social determinants of health.

In the UK, public health strategies supported by NHS England emphasise prevention and early intervention. This suggests, addressing behavioural risk factors such as smoking and vaping requires targeted education and engagement strategies tailored to young people.

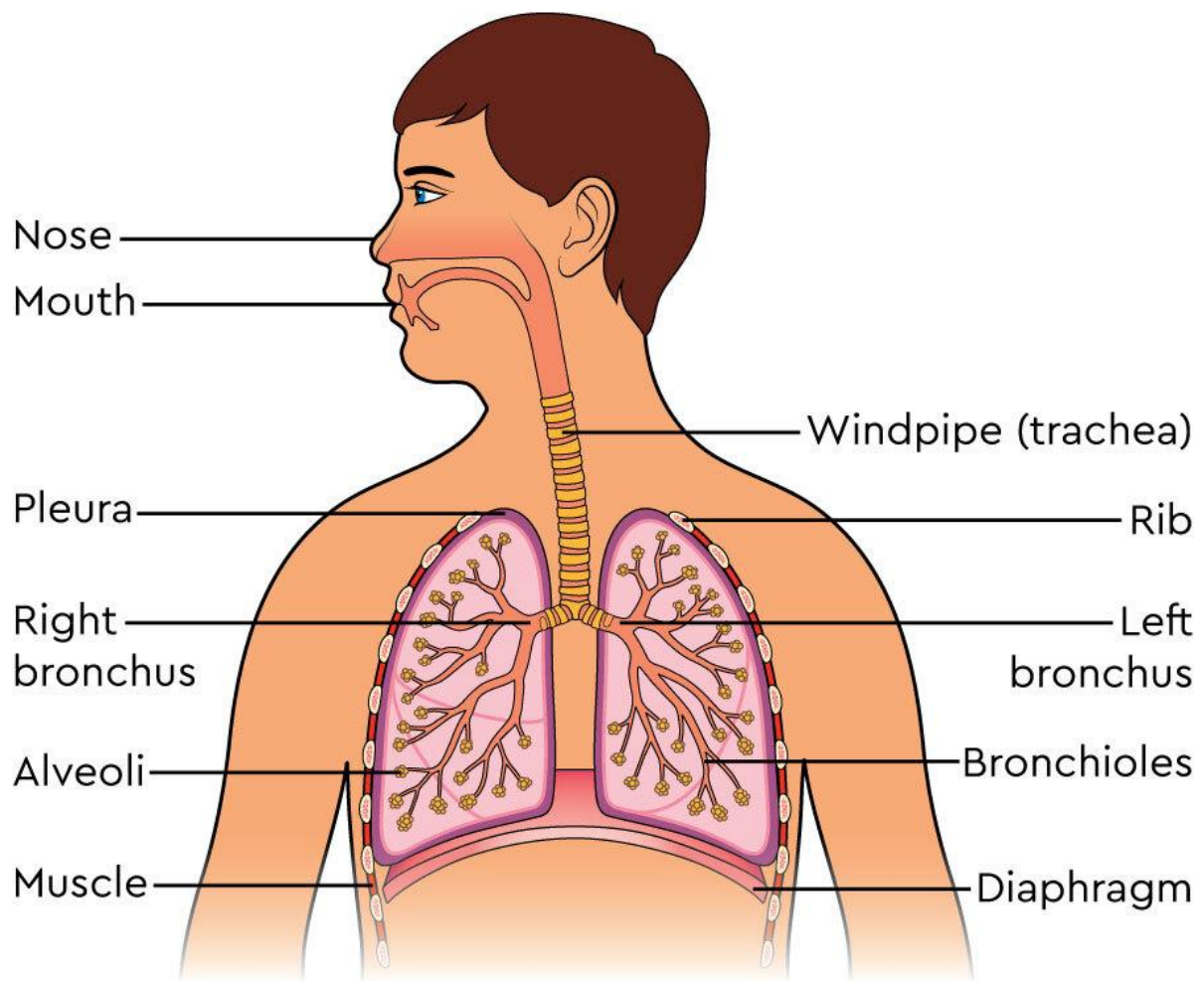


Figure 2: Respiratory System (Macmillan, 2021)

Image: The respiratory system is depicted. It shows two airways: one through the mouth and one thorough the nose. They unite and descend into the windpipe, or trachea. This extends beyond the neck area. It divides into the left and right bronchus, two tubes that go into the corresponding left and right lungs. This divide into smaller tubes called alveoli are found at the terminus of bronchioles.

By simulating lung and airway behaviour, modelling techniques aid in the understanding of respiratory mechanics. For instance, alveolar distribution along airways, acting as a, respiratory bronchioles link the air-transport tubes to the areas where oxygen is actually absorbed is included in a polyhedron-based model of the pulmonary acinus. By optimising

airway structure to maximise alveolar number and minimise path length, this model may increase the efficiency of gas exchange. These structural models can depict the mechanical characteristics of lung tissue and airway branching and are useful for numerical investigations in respiratory biomechanics.

In general, the mechanical respiratory system includes fluid dynamic of airflow, structural modelling of lung units, physiological evaluation during ventilation, and neural control mechanisms that collectively contribute to knowledge and treatment of respiratory mechanics (Giosa et al., 2024).

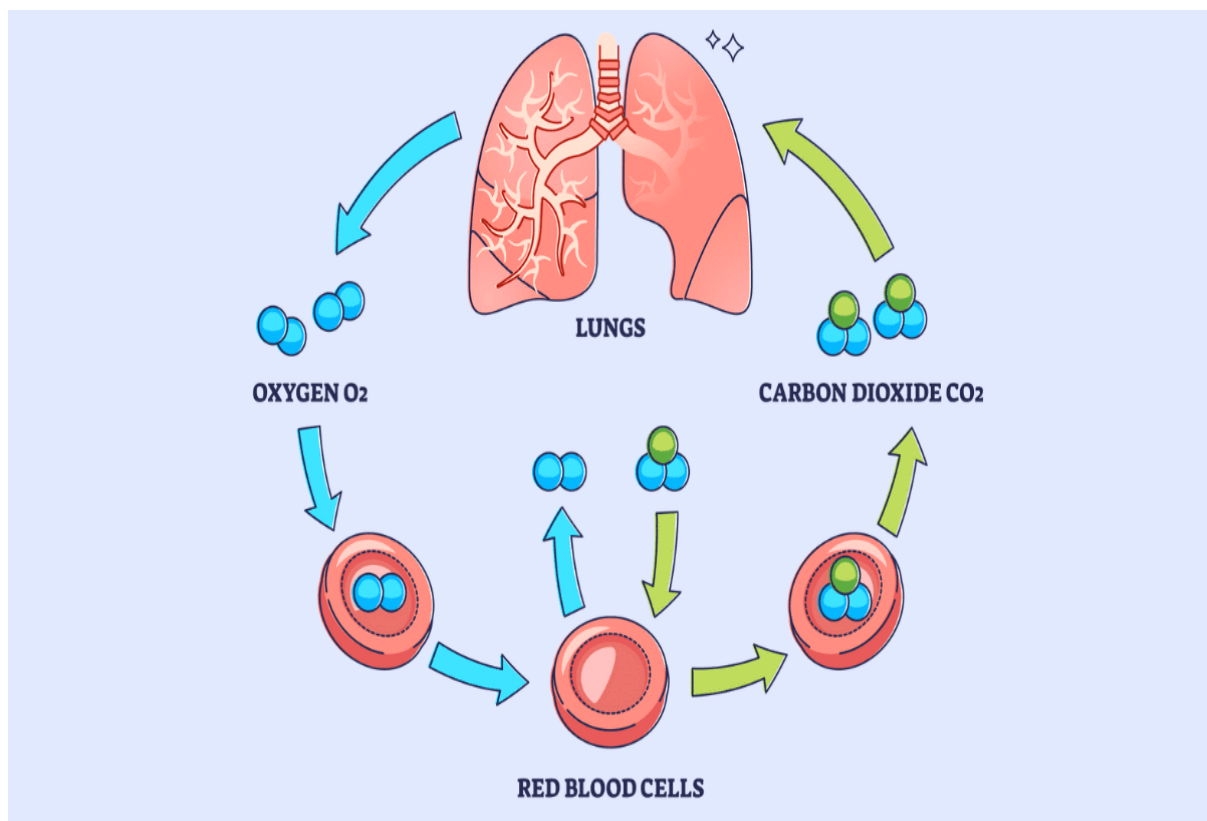


Figure 3: Human gas in lungs (Landry, BS and RRT, 2023)

Pathophysiology of Asthma and Gas Exchange

Asthma is identified by chronic inflammation of the airways, leading to bronchoconstriction, airway oedema, and mucus hypersecretion. Such alterations cause airway narrowing and elevated resistance, primarily during the expiratory phase. Consequently, individuals experience symptoms such as wheezing, breathlessness, chest tightness, and coughing (Martin, Townshend and Brodlie, 2022).

Under normal physiological conditions, gas exchange occurs efficiently deep within the lungs, where the diffusion of respiratory gases occurs across the bloodstream is removed. This process relies on effective ventilation–perfusion matching, ensuring that oxygen reaches well-perfused areas of the lung (Marquis et al., 2021). However, in asthma, airway obstruction disrupts this balance, leading to reduced oxygen uptake and impaired carbon dioxide removal.

The severity of this disruption varies between individuals, highlighting the heterogeneity of asthma. For example, some patients present with mild, intermittent symptoms, while others experience severe, persistent inflammation associated with specific phenotypes such as eosinophilic asthma. A uniform treatment strategy fails to account for individual variability leading to poor clinical outcomes. Instead, personalised care plans are required to address individual triggers and disease patterns. Importantly, adolescents may experience additional challenges due to developmental and behavioural factors. Poor adherence to medication, increased exposure to environmental triggers, and a lack of understanding about the condition can all contribute to poor asthma control. Therefore, understanding the underlying physiology is essential not only for clinical management but also for educating patients about the importance of adherence and trigger avoidance.

Monitoring and Self-Management

Effective asthma management relies on regular monitoring and active self-management. Peak expiratory flow (PEF) is a valuable objective tool used to assess lung function and detect early signs of airway obstruction, enabling timely intervention. The National Institute for Health and Care Excellence recommends combining objective monitoring with symptom assessment to improve asthma control (NICE, 2024). Peak expiratory flow (PEF) monitoring provides a convenient and cost-effective method for assessing airway obstruction and identifying early deterioration in asthma control. However, its clinical utility in adolescents is debated, as studies have demonstrated a relatively weak correlation between PEF variability and patient-reported symptoms (Ananth et al., 2022). This limitation is further compounded by poor adherence in this age group, reducing its reliability as a standalone monitoring tool. Consequently, current NICE guidance advocates for a combined approach, integrating objective measures such as PEF with symptom-based assessments and personalised action plans to enhance accuracy and patient engagement.

Digital technologies, such as app-based monitoring tools, can enhance engagement and improve tracking, although their effectiveness depends on access and user motivation.

Education is also essential, as it empowers patients to understand their condition and engage in self-management, reducing the risk of severe exacerbations. Evidence implies that individuals who actively participate in self-management experience fewer hospital admissions (Karampatakis et al., 2023).

Improving asthma outcomes requires a holistic, person-centred approach that incorporates habits like nutritious food intake and greater physical exertion and psychological support (Clemente-Suárez et al., 2023). These strategies align with UK healthcare priorities set by NHS England, which emphasise prevention, education, and personalised care.

Recommendations for Practice

Improving asthma outcomes in adolescents requires a multifaceted approach that integrates clinical care with behavioural and educational interventions. One effective strategy is the promotion of peer support through online health communities, which can enhance engagement and provide emotional support. Research indicates that such interventions can improve self-management and reduce healthcare utilisation (Karampatakis et al., 2023).

In addition, lifestyle interventions such as improving diet, increasing physical activity, and providing psychological support can contribute to better asthma control.

Nutritional strategies, including increased intake of fruits and vegetables, have been associated with reduced inflammation and improved respiratory health according to (Clemente-Suárez et al., 2023). However, the success of these interventions depends on their ability to be tailored to individual needs. Adolescents are a diverse group with varying levels of motivation, understanding, and access to resources. Therefore, a person-centred approach is essential, ensuring that care plans are adapted to the individual's circumstances and preferences.

From UK perspective, integrating these strategies within primary care aligns with the goals of NHS England and National Institute for Health and Care Excellence, which emphasise prevention, education, and personalised care. Healthcare professionals play a crucial role in delivering these interventions and supporting adolescents in making positive behavioural changes.

Conclusion

The integration of patient education, self-management strategies, and personalised care approaches is essential in improving health outcomes. Encouraging adolescents to engage with their condition through tools such as digital monitoring, peer support, and lifestyle modifications can enhance adherence to treatment plans and promote long-term disease control. Evidence-based interventions, including nutritional, psychological, and behavioural strategies, further support holistic asthma management.

However, the existence of modifiable risk factors such as smoking, vaping, and exposure to the environment significantly affects the course of the disease and needs to be addressed with focused interventions.

Finally, while these strategies are associated with reduced systemic inflammation and improved overall health, their direct impact on asthma control varies, highlighting the need for individualised care plans. This reinforces the importance of a person-centred approach, aligned with national guidance, which considers not only clinical symptoms but also the broader social determinants influencing health outcomes.

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