



Burden of Bronchial Asthma in School-Going Adolescents: A Narrative Review of Prevalence, Risk Factors, Severity and Functional Outcomes

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ABSTRACT:

Background: Bronchial asthma is one of the most common chronic diseases affecting school-going adolescents worldwide and remains a significant cause of morbidity, impaired quality of life, and educational disruption. While prevalence estimates are widely reported, growing evidence suggests that asthma burden in adolescents is inadequately characterized when severity, control, academic participation, and health-related quality of life (HRQoL) are not assessed in an integrated manner.

Objective: This narrative review synthesizes studies published between 2015 and 2025 to summarize current evidence on the epidemiology, determinants, severity and control, academic impact, and HRQoL of bronchial asthma among school-going adolescents, with particular relevance to low- and middle-income settings.

Methods: A narrative review was conducted using PubMed-indexed literature. Eligible studies included peer-reviewed research involving adolescents (approximately 10-19 years) that reported asthma prevalence, risk factors, severity, control, academic outcomes, or HRQoL. Major international surveillance studies, systematic reviews, and observational cohorts were prioritized.

Results: Global Asthma Network data demonstrate substantial international variability in adolescent asthma prevalence and reveal that a considerable proportion of symptomatic adolescents experience severe symptoms and poor disease control. Indian evidence shows moderate pooled prevalence with marked heterogeneity across settings, alongside persistent under-diagnosis and treatment gaps. Modifiable determinants such as environmental tobacco smoke, indoor housing conditions, and ambient air pollution consistently contribute to morbidity. Importantly, poorly controlled asthma is associated with school absenteeism, reduced academic performance, and impaired HRQoL, particularly in emotional and activity-related domains.

Conclusion: Adolescent asthma represents a multidimensional burden extending beyond prevalence alone. Integrated assessment frameworks combining symptom-based prevalence, validated control measures, and HRQoL instruments are essential to identify high-risk adolescents and inform effective school-based and public health interventions.



Introduction

Bronchial asthma is a chronic inflammatory airway disorder characterized by variable respiratory symptoms and fluctuating airflow limitation. It remains among the most important non-communicable diseases in children and adolescents. Adolescence is a distinct stage in the asthma life course. Physiological changes during puberty, increasing exposure to environmental triggers, and changing health behaviours can alter symptom expression and disease control. Adolescents also face higher academic demands and greater peer influence. These factors may affect treatment adherence and health-seeking behavior.

Global surveillance data highlight that adolescent asthma burden remains substantial. The Global Asthma Network (GAN) Phase I study reported that the worldwide burden of asthma symptoms and severe symptoms in school-aged children and adolescents shows marked variability by region and setting, with a high burden of severe symptoms that could be reduced by improving access to effective therapy (Asher et al., 2021). In addition, GAN Phase I analyses of asthma management and control across multiple countries show that many children and adolescents have inadequate access to controller medicines and written management plans, with important gaps in control indicators across country income groups (García-Marcos et al., 2023). These findings support the need to evaluate adolescent asthma beyond diagnosis, including severity, control, and functional impacts.

In India, evidence indicates substantial heterogeneity in asthma burden. A systematic review and meta-analysis of Indian studies reported a pooled prevalence estimate of 7.9% (95% CI 6.3–9.6) among children, with higher prevalence in boys and in urban areas, and high between-study heterogeneity related to methods and tools (Daniel et al., 2022). India-specific GAN findings further highlight persistent under-diagnosis and under-treatment, including low use of inhaled corticosteroids, even where symptom burden exists (Singh et al., 2022). Together, these data suggest that prevalence estimates alone

may not capture the true burden in adolescents, particularly in urban settings where exposures and care gaps coexist.

Asthma in adolescence also has consequences that extend beyond clinical symptoms. Academic participation and performance can be influenced by absenteeism, sleep disruption, exercise limitation, and acute exacerbations. A Swedish population-based sibling-control analysis found that asthma associations with school performance can vary by asthma control status, emphasizing the importance of separating diagnosis from uncontrolled disease when evaluating educational outcomes (Lundholm et al., 2020). In a U.S. urban school cohort, pediatric asthma was associated with poorer standardized academic achievement over three years, with worse performance among students more likely to have significant asthma (Senter et al., 2021). These studies support the inclusion of academic outcomes when assessing adolescent asthma burden.

Health-related quality of life (HRQoL) is another critical dimension. HRQoL tools capture symptom burden, activity restriction, and emotional effects that may not be fully reflected by symptom frequency or control scores alone. In a prospective study of newly diagnosed children with asthma, HRQoL measured using a pediatric asthma QoL instrument improved after treatment, but the study emphasized the importance of evaluating QoL alongside clinical severity (Battula et al., 2020). This is particularly relevant in adolescents, where peer relationships, self-esteem, and participation in sports and school activities are central developmental priorities.

Despite expanding literature, evidence remains fragmented across domains. Many studies address prevalence or risk factors, but fewer integrate symptom burden, control, and HRQoL with educational participation in school-going adolescents. A narrative synthesis focused on 2015–2025 human studies is therefore timely. This review summarizes recent evidence on adolescent asthma prevalence, determinants, severity and control, and impacts on academic performance and HRQoL, with implications for school-based asthma programs.



Methods

Search Strategy: We searched PubMed, PubMed Central (PMC), and Scopus for articles published from January 1, 2015 to December 31, 2025. Search terms included combinations of MeSH and keywords: asthma, bronchial asthma, adolescent, school children, prevalence, risk factors, environmental tobacco smoke, air pollution, asthma control, Asthma Control Test, quality of life, PAQLQ, mini-PAQLQ, absenteeism, and academic performance. Boolean operators (AND/OR) were used. Reference lists of key studies were also screened to identify relevant additional articles.

Eligibility Criteria: This narrative review included human studies published in peer-reviewed journals between January 2015 and March 2025. Eligible studies primarily involved school-going adolescents, broadly defined as individuals aged 10–19 years, or studies in which adolescent-specific data could be clearly extracted or analyzed separately. Articles were required to report at least one of the following outcomes relevant to adolescent asthma: prevalence, determinants or risk factors, disease severity, asthma control, academic outcomes (such as absenteeism or school performance), or health-related quality of life (HRQoL). Only studies published in the English language were considered. Studies were excluded if they were animal experiments, case reports, or very small case series, or if they did not provide adolescent-specific findings relevant to asthma. Conference abstracts, editorials, commentaries, and other reports without accessible full-text articles were excluded, as were non-peer-reviewed sources. Studies focusing exclusively on adults or preschool children, without separable adolescent data, were also excluded.

Selection and Synthesis: Titles and abstracts were screened, followed by full-text assessment for relevance. Because this is a narrative review, no formal risk-of-bias tool was applied. Evidence was synthesized thematically under major headings that mirror the aims of adolescent asthma research: epidemiology, determinants, severity and control, academic outcomes, and HRQoL. Priority was given to multicenter

surveys, large observational cohorts, and studies using validated instruments.

Ethical Considerations: Ethical approval was not required because this review used previously published literature.

Result:

Epidemiology of asthma in school-going adolescents

Global burden and variability: Recent multicountry evidence confirms that asthma symptoms remain common among adolescents, with marked variation across regions and settings. In the Global Asthma Network (GAN) Phase I cross-sectional study, adolescents aged 13–14 years showed a substantial worldwide burden of current wheeze, and nearly half of symptomatic adolescents reported severe symptom features, with pronounced between-centre differences that likely reflect interactions between environment, health systems, and social determinants (Asher et al., 2021). Trend-focused synthesis further supports that international patterns of asthma prevalence and severity are dynamic, with evidence of plateauing in some high-income settings and increasing burden in some low- and middle-income contexts, reinforcing the need for contemporary, location-specific adolescent data (Asher et al., 2020; Dharmage et al., 2019). In addition to global pooled analyses, regional adolescent studies illustrate this heterogeneity in practice. For example, a GAN Phase I site analysis from southern Brazil reported adolescent symptom prevalence and associated factors within a standardized GAN framework, emphasizing how local determinants shape adolescent asthma burden even within the same international methodology (Urrutia-Pereira et al., 2021). A large adolescent study from Taiwan reported meaningful prevalence of physician-diagnosed asthma and current wheeze, and also described measurable impacts on daily life and school-related outcomes, underscoring that adolescent asthma burden includes functional effects beyond symptoms alone (Su et al., 2023). Recent evidence from rural South Asia also demonstrates that asthma is not limited to urban environments; an analytical cross-sectional study from rural Sri Lanka documented adolescent



asthma symptomatology and associated factors in 13–14-year-olds, reinforcing that setting-specific exposures and care pathways can influence observed prevalence and morbidity (Siriwardhana et al., 2024). In parallel, a 2024 meta-analysis across Eastern Mediterranean Region countries reported a pooled asthma prevalence in children and adolescents and highlighted between-country variability, further illustrating the extent of geographic heterogeneity in pediatric and adolescent asthma burden (Taherian et al., 2024). Importantly, adolescent asthma should be framed as both an epidemiologic and a service-delivery challenge. A parallel GAN Phase I analysis across 25 countries assessed asthma medicine use, management plan availability, and disease control in children, adolescents, and adults. This study identified persistent gaps in controller medication use and asthma action plan availability, with differences by country context and health-system capacity (García-Marcos et al., 2023).

India: pooled estimates and heterogeneity: Indian evidence demonstrates substantial heterogeneity in asthma prevalence among school-age children and adolescents, driven by geographic region, degree of urbanization, and methodological differences in case definition and measurement tools. A systematic review and meta-analysis of 33 Indian studies (pooled sample 167,626) reported a pooled asthma prevalence of 7.9% (95% CI: 6.3–9.6), with very high between-study heterogeneity ($I^2=99\%$), indicating that prevalence varies widely across Indian settings and study designs (Daniel et al., 2022). In subgroup analyses within this meta-analysis, prevalence differed by sampling frame and geography, with estimates reported separately for school-based versus community-based studies and for urban, rural, and mixed settings, reinforcing that a single pooled national estimate may not reflect the true burden within a given city or school population (Daniel et al., 2022). These patterns support the need for local, city-level surveys using standardized symptom instruments to enable valid comparisons and to minimize misclassification due to variable diagnostic labelling and healthcare access.

India-specific data from the Global Asthma Network (GAN) provide additional context for adolescent burden and help interpret heterogeneity in relation to diagnosis and treatment practices. The GAN India analysis reported prevalence of current wheeze in 13–14-year-olds and highlighted important treatment gaps, including low controller use despite symptom burden, indicating that “measured prevalence” can be influenced by under-diagnosis and under-treatment (Singh et al., 2022). Recent Indian field studies further illustrate how setting and measurement shape observed prevalence and risk profiles. For example, an urban North India school-based survey reported asthma prevalence of 2.8% and identified household and lifestyle correlates such as cooking fuel use and inadequate ventilation, demonstrating how local environmental patterns and operational definitions contribute to variability in estimates (Patra et al., 2021). In contrast, a rural north Karnataka cross-sectional study of children aged 5–15 years reported measurable current wheeze and ever-asthma with socio-demographic gradients, emphasizing that rural settings can also carry a meaningful burden but may differ in exposure profiles and access to guideline-based care (Rashmi et al., 2021).

Determinants and risk factors relevant to adolescents

Environmental tobacco smoke and household smoking exposure: Exposure to environmental tobacco smoke (ETS) in the home is one of the most consistent and actionable determinants linked to adolescent wheeze and asthma morbidity. In the GAN Phase I management and control analysis across 25 countries, persistent symptom burden in children and adolescents was observed alongside important modifiable household- and management-level gaps, supporting ETS reduction as a core preventable target within broader asthma control strategies (García-Marcos et al., 2023). Evidence also supports ETS as a driver of greater morbidity among children with asthma. A systematic review and meta-analysis showed that children with asthma exposed to second-hand smoke had higher odds of adverse outcomes, including



hospitalization and urgent care/ED visits, and more symptoms compared with non-exposed peers (Wang et al., 2015). Adolescent-specific analyses strengthen this association. Using nationally representative U.S. data, Merianos et al. (2018) reported that second-hand smoke exposure among asthmatic adolescents was associated with greater symptom burden and healthcare utilization, reinforcing the clinical relevance of ETS for adolescent asthma control (Merianos et al., 2018). Outside high-income settings, a large adolescent study from Kuwait documented high prevalence of home ETS exposure and reported higher asthma-related symptom reporting among exposed adolescents, demonstrating that ETS remains a major determinant across diverse cultural contexts (Booalayan et al., 2020). In India, school-based evidence from an urban North Indian setting also incorporated household and environmental exposures when estimating asthma prevalence, supporting the inclusion of ETS assessment in adolescent-focused surveys (Patra et al., 2021).

Indoor environment and housing-related factors: Indoor environmental conditions including poor ventilation, dampness/mould, and adverse housing characteristics remain important determinants because adolescents spend substantial time indoors for sleep and study. Although individual school-based studies vary in exposure ascertainment, indoor risk-factor profiling is increasingly recognized as essential to interpret symptom heterogeneity and to guide targeted prevention. In the urban North India school survey, Patra et al. (2021) evaluated household and indoor exposure variables alongside prevalence estimation, supporting routine inclusion of ventilation and household conditions in adolescent surveys. At a broader evidence level, Caillaud et al. (2018) synthesized findings from systematic reviews and longitudinal studies and reported that indoor mould exposure and dampness are consistently associated with asthma and respiratory symptoms, providing biologic and epidemiologic justification to assess these exposures in adolescent populations (Caillaud et al., 2018). More recent meta-analytic evidence continues to

support this relationship; a 2024 meta-analysis concluded that children living in mouldy homes have increased asthma risk and poorer respiratory outcomes, although causal inference is constrained by the predominance of cross-sectional designs in some settings (Varga et al., 2024). Importantly, Indian pooled prevalence estimates show very high heterogeneity, indicating that local housing, micro-environmental factors, and exposure measurement differences can meaningfully alter observed prevalence patterns, further strengthening the rationale for standardized and detailed indoor exposure characterization in Indian adolescent surveys (Daniel et al., 2022).

Ambient air pollution and traffic-related exposures: Evidence linking air pollution with asthma development and morbidity has strengthened, especially for traffic-related pollutants that are common in rapidly urbanizing cities. A large systematic review and meta-analysis found statistically significant associations between childhood exposure to traffic-related air pollutants (including NO₂, PM_{2.5}, PM₁₀, and black carbon proxies) and incident asthma, supporting a contributory role of pollution in the pediatric asthma burden (Khreis et al., 2017). While exposure windows often begin earlier than adolescence, these findings remain highly relevant for urban adolescents because ongoing ambient exposure can perpetuate symptoms and increase exacerbation risk among those with established disease. In a recent study examining urban youth, Altman et al. (2023) reported that outdoor air pollutants were associated with non-viral asthma exacerbations and airway inflammatory responses, reinforcing ambient pollution as an independent trigger of exacerbations in children and adolescents living in urban environments (Altman et al., 2023). Indian evidence on pollution-related asthma outcomes is still comparatively limited relative to the magnitude of exposure; however, time-series research from India has evaluated associations between ambient pollutants and asthma-related hospital admissions in children, highlighting the plausibility of similar



trigger pathways in exposed Indian urban pediatric populations (Malamardi et al., 2023).

Severity and control in adolescents: Severity and control are related but distinct constructs, and both are important when interpreting adolescent asthma burden. Symptom-based epidemiology identifies adolescents with current wheeze and severe symptom patterns at a population level, whereas control tools reflect the adequacy of current management over a recent recall window and capture treatable morbidity. In the Global Asthma Network (GAN) Phase I cross-sectional study, a substantial proportion of symptomatic adolescents reported severe symptom indicators (e.g., sleep disturbance and speech-limiting wheeze), supporting severity “mapping” as a meaningful epidemiologic objective beyond prevalence alone (Asher et al., 2021). Complementing this, the GAN Phase I management analysis across 25 countries demonstrated persistent gaps in controller medication use and written management plans, alongside indicators of poor control, highlighting that service-delivery constraints and suboptimal long-term therapy likely contribute to ongoing severe symptoms and functional impacts in adolescents (García-Marcos et al., 2023). India-specific GAN evidence similarly reported continued symptom burden and low controller use in urban Indian centers, reinforcing the need for Indian adolescent studies to quantify control status alongside symptom prevalence (Singh et al., 2022).

Evidence from adolescent cohorts using standardized control instruments further supports the high frequency of poor control and its relevance to outcomes. In a school-based study from Jordan, adolescents with asthma assessed using the Asthma Control Test (ACT) showed very low mean ACT scores with a high proportion reporting uncontrolled asthma, demonstrating that poor control can be common in adolescent school populations (Al-Sheyab et al., 2018).

Beyond single-country studies, registry-based evidence from Sweden (ages 6–17 years) found that uncontrolled asthma defined using ACT thresholds and/or exacerbation and lung function

criteria remains common even among children under specialist follow-up, underscoring that uncontrolled disease is not confined to low-resource settings and requires systematic monitoring and step-appropriate management (Stridsman et al., 2024).

Academic performance and school participation:

The relationship between asthma and educational outcomes is nuanced and appears most consistent when asthma is poorly controlled, disrupts sleep, or increases school absenteeism. In a large Swedish population-based sibling-control study, associations between asthma and school performance differed by phenotype and control status; uncontrolled asthma was associated with slightly worse school performance, whereas confounding explained much of the association for asthma overall (Lundholm et al., 2020). Longitudinal evidence from U.S. urban schools similarly suggests that asthma burden can translate into measurable academic differences over time. A three-year analysis of standardized testing in urban elementary and middle-school students reported poorer academic achievement among students with asthma, with larger differences among those with more significant asthma (Senter et al., 2021). Importantly, a multicenter study evaluating school functioning showed that inadequate asthma control was associated with higher school absenteeism and poorer indicators of school life and peer relations, supporting a plausible pathway from uncontrolled symptoms to reduced educational participation and performance (Toyran et al., 2020). Absenteeism is a key mediator linking asthma morbidity to academic participation. In a U.S. study focused on children with asthma, asthma-related school absenteeism was common and associated with morbidity and modifiable factors, suggesting that absenteeism can serve as a practical indicator of suboptimal asthma status and a target for intervention (Hsu et al., 2016). Evidence synthesis focused on adolescents further reinforces that educational impacts vary across studies and are likely influenced by control, severity, and socio-environmental confounding; a structured review of empirical studies on



adolescents concluded that asthma may compromise academic performance under certain conditions, highlighting the importance of measuring control and context rather than assuming uniform educational effects (Schneider et al., 2020).

Health-related quality of life in adolescents:

HRQoL assessment complements symptom prevalence and control by capturing how asthma affects daily functioning, activity participation, and emotional well-being domains that are highly salient during adolescence. Evidence from India supports the feasibility and value of pediatric asthma HRQoL measurement and demonstrates improvement after treatment while highlighting domain-wise differences. In a prospective Indian study using the mini-Pediatric Asthma Quality of Life Questionnaire (mini-PAQLQ) among newly diagnosed children, HRQoL improved after treatment and showed meaningful relationships with clinical severity scoring, supporting concurrent assessment of HRQoL alongside symptom and control metrics (Battula et al., 2020). Additional Indian clinical evidence also demonstrates responsiveness of HRQoL measures to standard therapy over follow-up, supporting the practical utility of PAQLQ-based assessment in routine pediatric and adolescent asthma care (Savdahiya et al., 2021). International adolescent-focused studies reinforce that HRQoL is closely linked to control and adherence-related behaviours. In adolescents, illness perceptions, medication beliefs, and adherence behaviours correlate with asthma control and HRQoL, suggesting that psychological and behavioral factors can amplify or mitigate functional impact even when clinical severity is similar (Kosse et al., 2020). A cross-sectional study including children and adolescents in Palestine identified determinants of poorer QoL, supporting that social, clinical, and environmental factors influence HRQoL beyond symptom frequency alone (Khdour et al., 2022). Importantly, school-functioning evidence indicates that inadequate control is associated with poorer quality of school life and reduced participation in school activities, illustrating the

overlap between HRQoL domains and school participation outcomes (Toyran et al., 2020).

Table 1: High-quality human evidence informing adolescent asthma domains

Domain	Key study (Author et al., Year)	Setting / population	Relevance to adolescent asthma
Global prevalence & severity burden	Asher et al., 2021	GAN Phase I, adolescents 13–14 years	Demonstrates worldwide variability and substantial severe symptoms
Management gaps & control indicators	García-Marcos et al., 2023	GAN Phase I, 25 countries	Documents controller/plan gaps and control differences across settings
India pooled prevalence	Daniel et al., 2022	India (systematic review/meta-analysis)	Pooled prevalence; heterogeneity; urban/sex patterns
India prevalence & practices (GAN)	Singh et al., 2022	Urban India centers	Prevalence, trend context, and treatment practice gaps
North India school-based prevalence & risk factors	Patra et al., 2021	Urban North India school survey	Illustrates school-based approach and risk-factor profiling
Air pollution and asthma risk	Khreis et al., 2017	Systematic review/meta-analysis	Supports role of traffic-related pollutants in asthma development
Air pollution and	Altman et al., 2023	Large urban pediatric analysis	Supports role of ambient pollutants in



pediatric exacerbations			exacerbations
School performance linkage	Lundholm et al., 2020	Sweden population sibling-control	Shows importance of uncontrolled asthma for performance outcomes
Longitudinal academic impact	Senter et al., 2021	Urban school cohort	Links asthma to multi-year standardized achievement
HRQoL evidence (India)	Battula et al., 2020	Prospective pediatric cohort	Demonstrates feasibility and responsiveness of QoL measurement

Discussion:

This narrative review synthesized studies on bronchial asthma in school-going adolescents and focused on prevalence, determinants, severity and control, academic participation, and health-related quality of life (HRQoL). Overall, the evidence indicates that adolescent asthma remains a substantial health burden and that this burden is not captured by prevalence alone. The Global Asthma Network (GAN) Phase I study documented wide international variability in symptom prevalence and showed that almost half of adolescents with wheeze reported severe symptom features, including sleep disturbance and speech-limiting wheeze, supporting the need to assess severity proxies in addition to prevalence (Asher et al., 2021). Complementing these epidemiologic findings, the GAN Phase I management analysis across 25 countries demonstrated major gaps in controller medicine use and written management plans, with strong variation by country context and health-system access, reinforcing that symptom burden is closely linked to service delivery and sustained long-term management (García-Marcos et al., 2023). More recent school-based evidence from early adolescents in sub-Saharan Africa further strengthens the global interpretation that a large proportion of adolescents with symptoms may be

undiagnosed and/or uncontrolled, highlighting that symptom prevalence can underestimate the “true” clinical burden when diagnosis and access are limited (Oyenuga et al., 2024).

Indian evidence mirrors this dual challenge of epidemiologic burden and care gaps. A systematic review and meta-analysis of Indian studies estimated a pooled asthma prevalence of 7.9% and reported higher prevalence among boys and in urban settings, while also noting very high heterogeneity attributable to differences in definitions and tools, which limits direct comparison across studies without standardized measurement (Daniel et al., 2022). India-specific GAN analyses similarly suggest that even when symptom prevalence is modest, under-diagnosis and under-treatment remain important, including low controller use and ongoing symptoms, supporting the need for integrated approaches that quantify symptoms, management practices, and current control status in adolescent populations (Singh et al., 2022).

Determinants highlighted in recent literature consistently include modifiable household and environmental exposures. Second-hand smoke exposure is a well-supported and actionable determinant of asthma morbidity; a systematic review and meta-analysis quantified associations between second-hand smoke and increased asthma severity and healthcare utilization in children, supporting continued emphasis on smoke-free homes as a prevention and control strategy (Wang et al., 2015). Indoor housing conditions are also relevant; evidence synthesis indicates that dampness and indoor mould exposure are associated with asthma and respiratory symptoms and should be considered when interpreting heterogeneity in adolescent respiratory morbidity across settings (Caillaud et al., 2018). At the environmental level, traffic-related air pollution has been linked to childhood asthma development in a large systematic review and meta-analysis, supporting biological plausibility that sustained exposure contributes to asthma risk and may worsen disease expression over time, particularly in urban settings where exposure is continuous (Khreis et al., 2017). In addition, urban cohort evidence indicates that



outdoor air pollutants are associated with pediatric asthma exacerbations, including non-viral exacerbations, emphasizing the role of ambient triggers in ongoing morbidity among children and adolescents living in cities (Altman et al., 2023).

Academic participation and performance are increasingly recognized as relevant functional outcomes. High-quality evidence indicates that the asthma–education relationship is nuanced and influenced by phenotype and control. In a Swedish population-based sibling-control study, associations between asthma and school performance were modest overall and were more apparent for patterns consistent with uncontrolled disease, suggesting that poor control and exacerbation-prone illness rather than diagnosis alone are more likely to interfere with educational outcomes (Lundholm et al., 2020). Longitudinal data from U.S. urban school settings also suggest that asthma can be associated with lower academic achievement over time; a three-year analysis of standardized test performance reported poorer achievement among children with asthma, with differences more pronounced among those likely to have more significant disease (Senter et al., 2021). Importantly, absenteeism is a plausible mediator of educational impact. A large U.S. study demonstrated that asthma-related school absenteeism is associated with morbidity and modifiable factors and may be useful for identifying students who would benefit from targeted asthma interventions (Hsu et al., 2016). Complementary multicenter evidence indicates that inadequate asthma control adversely affects school absence and quality of school life, strengthening the rationale to measure control status alongside school participation outcomes in adolescent surveys (Toyran et al., 2020).

HRQoL evidence reinforces the importance of evaluating asthma beyond symptoms and healthcare utilization. An Indian prospective study using the mini-PAQLQ documented improvements in QoL after treatment and showed that QoL captures burden in domains not fully explained by clinical severity scoring alone (Battula et al., 2020). Additional international evidence in children and adolescents indicates

that QoL impairment is associated with clinical and contextual factors and is closely linked with control assessment, supporting routine inclusion of HRQoL measures when studying adolescent asthma burden (Khdour et al., 2022). This is particularly relevant during adolescence, when activity limitation and emotional impacts can directly influence school participation, peer interactions, and self-confidence, even when symptom control improves.

Synthesis of Evidence and Evidence Gaps

The validated literature suggests several persistent evidence gaps that are especially relevant to school-going adolescents and directly justify city-level adolescent surveys. First, much of the standardized, internationally comparable epidemiologic evidence is concentrated in the 13–14-year band used in ISAAC/GAN protocols, which strengthens comparability but limits inference for older school adolescents (15–17 years) who may have different exposure profiles, adherence behaviours, and symptom patterns (Asher et al., 2021; Singh et al., 2022). This limitation is also reflected in contemporary multi-country school studies from low- and middle-income settings that continue to sample early adolescents, while reporting substantial undiagnosed symptoms and severe morbidity, thereby reinforcing both the age-band constraint and the importance of measuring “hidden” burden beyond diagnosis (Oyenuga et al., 2024). Second, while pooled national estimates provide an essential benchmark, they mask local heterogeneity driven by differences in urbanization, housing, environmental exposures, and health-system access. The Indian meta-analysis reporting pooled prevalence also documented very high heterogeneity, emphasizing that pooled estimates cannot substitute for city-level prevalence and severity mapping when planning locally responsive interventions (Daniel et al., 2022). Third, many studies assess prevalence or determinants in isolation, whereas fewer integrate symptom burden with management indicators and functional outcomes, despite strong evidence that persistent symptoms often coexist with major care gaps in controller use and self-management



supports. This integration gap is particularly important because GAN Phase I management findings show that insufficient controller access/use and limited availability of written plans are common and vary substantially by setting (García-Marcos et al., 2023), and India-specific GAN analyses similarly highlight under-diagnosis and under-treatment among symptomatic individuals (Singh et al., 2022). Fourth, the education-related evidence base is comparatively smaller in low- and middle-income settings, even though high-quality studies from other contexts indicate that uncontrolled disease and morbidity patterns, rather than “asthma diagnosis” alone, are more likely to be linked with reduced academic performance. This nuance is supported by population-based quasi-experimental evidence from Sweden and by longitudinal findings from urban school settings in the United States (Lundholm et al., 2020; Senter et al., 2021). Additionally, school absenteeism an actionable mediator between asthma morbidity and educational participation has been robustly associated with asthma control, exacerbations, and modifiable factors in multi-state U.S. data, and school-functioning studies show that control status is associated with school absence and quality of school life (Hsu et al., 2016; Toyran et al., 2020). Fifth, HRQoL is not consistently measured in population studies, despite evidence that validated QoL tools detect clinically meaningful impairment and improvement with treatment. Indian prospective evidence demonstrates that QoL improves after therapy and captures burden beyond clinical severity scoring (Battula et al., 2020), while mixed child–adolescent samples from other settings show that poorer QoL is associated with clinical and contextual risk factors and can be assessed alongside ACT-based control measurement (Khdour et al., 2022).

Implications for School-Based and Public Health Interventions: The reviewed evidence has practical implications for adolescent health and school systems. First, school-based screening initiatives can use standardized symptom questions to identify probable asthma and severe symptom patterns, consistent with the

epidemiologic approach used in GAN Phase I (Asher et al., 2021). Second, because international evidence documents major gaps in controller use and written management plans, school–health linkages should prioritize referral pathways, inhaler education, and action plan uptake to improve control indicators (García-Marcos et al., 2023). Third, environmental risk reduction should be emphasized where feasible, as high-quality synthesis supports a role for traffic-related pollutants in asthma development and for ambient pollutants as triggers for exacerbations in urban youth (Khreis et al., 2017; Altman et al., 2023). Fourth, school programs should include functional metrics such as absenteeism and participation in physical education, because evidence indicates that sustained asthma burden can be associated with reduced academic achievement, especially among those with more significant disease (Senter et al., 2021), and that control-related patterns can be relevant when interpreting performance outcomes (Lundholm et al., 2020). Finally, HRQoL assessment should be considered alongside symptom outcomes, as pediatric QoL evidence from India supports feasibility and responsiveness of QoL measurement to treatment and clinical status (Battula et al., 2020).

Strengths and Limitations

A key strength of this review is its restriction to studies published within the last decade (2015–2025), emphasizing multicenter surveillance and large observational evidence where available. The review integrates clinical burden with management indicators and functional outcomes, consistent with the multidimensional impacts documented by GAN analyses and academic and QoL studies (Asher et al., 2021; García-Marcos et al., 2023; Lundholm et al., 2020; Battula et al., 2020). The limitations reflect the narrative design and reliance on published literature, which may be subject to publication bias and uneven geographic representation. In addition, heterogeneity in asthma definitions and measurement approaches in Indian studies remains a constraint when interpreting pooled estimates and comparing across settings (Daniel et al., 2022).



Conclusion: This narrative review highlights that bronchial asthma in school-going adolescents remains a significant and multifaceted public health challenge that extends beyond prevalence estimates alone. Evidence from the last decade demonstrates that a substantial proportion of adolescents continue to experience severe symptoms, poor asthma control, and functional impairment, despite the availability of effective therapies. International surveillance data consistently show wide geographic variability and persistent gaps in controller medication use and self-management support, while Indian evidence underscores marked heterogeneity by setting and ongoing under-diagnosis and under-treatment.

Importantly, the burden of adolescent asthma encompasses educational participation and health-related quality of life, with studies indicating that poorly controlled disease, rather than asthma diagnosis per se, is more strongly associated with school absenteeism, reduced academic performance, and impaired emotional and activity-related well-being. Modifiable determinants including environmental tobacco smoke, indoor housing conditions, and ambient air pollution emerge repeatedly as contributors to ongoing morbidity, particularly in urban environments. Collectively, the evidence supports a shift toward integrated assessment frameworks for adolescent asthma that combine standardized symptom-based prevalence measures, validated tools for assessing severity and control, and patient-reported outcomes such as HRQoL. Addressing current evidence gaps especially the under-representation of older adolescents, limited city-level data, and inconsistent evaluation of functional outcomes will be essential to inform targeted, school-based and public health interventions. Future strategies should prioritize early identification, optimization of long-term management, and mitigation of environmental risks to reduce morbidity and improve educational and psychosocial outcomes for adolescents living with asthma.

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