ADULT ASTHMA: EPIDEMIOLOGY, PATHOPHYSIOLOGY, SEASONALITY, SOCIOECONOMIC IMPACT, DIAGNOSIS, COMORBIDITIES, AND THERAPEUTIC ADVANCES – A SCOPING REVIEW (PRISMA-SCR)

ASMA NO ADULTO: EPIDEMIOLOGIA, FISIOPATOLOGIA, SAZONALIDADE, IMPACTO SOCIOECONÔMICO, DIAGNÓSTICO, COMORBIDADES E AVANÇOS TERAPÊUTICOS – UMA REVISÃO DE ESCOPO (PRISMA-SCR)

ASMA EN ADULTOS: EPIDEMIOLOGÍA, FISIOPATOLOGÍA, ESTACIONALIDAD, IMPACTO SOCIOECONÓMICO, DIAGNÓSTICO, COMORBILIDADES Y AVANCES TERAPÉUTICOS: UNA REVISIÓN EXPLORATORIA (PRISMA-SCR)

https://doi.org/10.56238/sevened2026.009-038

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ABSTRACT

Background: Adult asthma is a chronic inflammatory airway disease and remains a major driver of exacerbations and healthcare use.

Objective: To map and critically synthesize contemporary evidence (2015–2025) on adult asthma pathophysiology, objective diagnostic confirmation, classification, stepwise pharmacologic management, and advanced therapies, with emphasis on the Brazilian context.

Methods: Scoping review following PRISMA-ScR. We searched PubMed/MEDLINE, SciELO and LILACS, and screened key guidelines (GINA and SBPT/JBP). We included studies in adults (≥18 years), systematic reviews, clinical trials, consensus statements and policy documents. Screening and full-text assessment were followed by data charting across thematic domains.

Results: Evidence supports the heterogeneity of adult asthma, with type 2 inflammation predominant in many patients and increasing recognition of non–type 2 phenotypes (e.g., obesity-, smoking- and occupational exposure–associated). Objective functional confirmation is essential yet underused. Current recommendations discourage SABA-only treatment and prioritize inhaled corticosteroids (ICS) from early steps; ICS–formoterol maintenance-and-reliever therapy (MART/SMART) reduces exacerbations. In severe asthma, phenotyping, biomarkers, and biologics (anti-IgE, anti-IL-5/5R, anti-IL-4/13 and anti-TSLP) improve outcomes in selected subgroups. Gaps remain in access to spirometry, education, adherence, and equitable incorporation of advanced therapies in Brazil.

Conclusion: Adult asthma management requires objective diagnosis, early anti-inflammatory therapy, and risk- and phenotype-guided personalization, alongside system-level strategies to reduce care inequities.

Keywords: Asthma. Adult. Pathophysiology. Diagnosis. Treatment. Scoping Review.

RESUMO

Introdução: A asma é uma doença inflamatória crônica das vias aéreas e permanece entre as principais causas de exacerbações e uso de serviços de saúde na população adulta.

Objetivo: Mapear e sintetizar criticamente as evidências contemporâneas (2015–2025) sobre fisiopatologia, confirmação diagnóstica objetiva, classificação, manejo farmacológico em etapas e terapias avançadas da asma no adulto, com ênfase no contexto brasileiro.

Métodos: Revisão de escopo conduzida segundo o PRISMA-ScR. Foram pesquisadas PubMed/MEDLINE, SciELO e LILACS, além de diretrizes (GINA e SBPT/JBP). Incluíram-se estudos em adultos (≥18 anos), revisões sistemáticas, ensaios clínicos, consensos e documentos normativos. A seleção foi realizada por triagem de títulos/resumos e leitura do texto completo, com extração (“charting”) dos dados por eixos temáticos.

Resultados: A literatura confirma a heterogeneidade da asma no adulto, com predominância de inflamação tipo 2 em grande parte dos casos e relevância crescente de fenótipos não tipo 2 (p.ex., associados à obesidade, tabagismo e exposições ocupacionais). A confirmação diagnóstica funcional permanece essencial e subutilizada. Recomendações atuais desestimulam o uso isolado de SABA e priorizam corticosteroide inalado (CI) desde etapas iniciais, com estratégias CI–formoterol como manutenção e alívio (MART/SMART) reduzindo exacerbações. Em asma grave, fenotipagem, biomarcadores e imunobiológicos (anti-IgE, anti-IL-5/5R, anti-IL-4/13 e anti-TSLP) ampliaram o controle e reduziram exacerbações em subgrupos selecionados. Persistem lacunas no acesso a espirometria, educação em saúde, adesão e incorporação equitativa de terapias avançadas no Brasil.

Conclusão: A asma no adulto exige diagnóstico objetivo, tratamento anti-inflamatório precoce e abordagem personalizada orientada por risco e fenótipos, com necessidade de estratégias sistêmicas para reduzir desigualdades de cuidado no país.

Palavras-chave: Asma. Adulto. Fisiopatologia. Diagnóstico. Tratamento. Revisão de Escopo.

RESUMEN

Introducción: El asma es una enfermedad inflamatoria crónica de las vías respiratorias y sigue siendo una de las principales causas de exacerbaciones y uso de servicios de salud en la población adulta.

Objetivo: Mapear y sintetizar críticamente la evidencia contemporánea (2015-2025) sobre fisiopatología, confirmación diagnóstica objetiva, clasificación, manejo farmacológico paso a paso y terapias avanzadas para el asma en adultos, con énfasis en el contexto brasileño.

Métodos: Se realizó una revisión de alcance según PRISMA-ScR. Se realizaron búsquedas en PubMed/MEDLINE, SciELO y LILACS, así como en guías (GINA y SBPT/JBP). Se incluyeron estudios en adultos (≥18 años), revisiones sistemáticas, ensayos clínicos, declaraciones de consenso y documentos normativos. La selección se realizó mediante el cribado de títulos/resúmenes y la lectura del texto completo, con extracción de datos ("charting") por ejes temáticos.

Resultados: La literatura confirma la heterogeneidad del asma en adultos, con predominio de la inflamación tipo 2 en una gran proporción de casos y creciente relevancia de fenotipos no tipo 2 (p. ej., asociados a obesidad, tabaquismo y exposiciones ocupacionales). La

confirmación diagnóstica funcional sigue siendo esencial y subutilizada. Las recomendaciones actuales desaconsejan el uso aislado de SABA y priorizan los corticosteroides inhalados (CSI) desde etapas tempranas, con estrategias de mantenimiento y alivio con CSI-formoterol (MART/SMART) que reducen las exacerbaciones. En el asma grave, la fenotipificación, los biomarcadores y los inmunobiológicos (anti-IgE, anti-IL-5/5R, anti-IL-4/13 y anti-TSLP) han mejorado el control y reducido las exacerbaciones en subgrupos seleccionados. Persisten brechas en el acceso a la espirometría, la educación sanitaria, la adherencia y la incorporación equitativa de terapias avanzadas en Brasil.

Conclusión: El asma en adultos requiere un diagnóstico objetivo, un tratamiento antiinflamatorio precoz y un enfoque personalizado basado en el riesgo y los fenotipos, lo que requiere estrategias sistémicas para reducir las desigualdades en la atención en todo el país.

Palabras clave: Asma. Adulto. Fisiopatología. Diagnóstico. Tratamiento. Revisión del Alcance.

1 INTRODUCTION

Asthma is a chronic inflammatory disease of the airways characterized by bronchial hyperresponsiveness and variable airflow limitation, with an oscillating clinical course and risk of potentially severe exacerbations. In adults, asthma may represent persistence of childhood or late-onset disease, often associated with lower atopy, higher burden of comorbidities, and environmental/occupational exposures. Although there is effective therapy, asthma remains underdiagnosed and often poorly controlled, with repercussions on quality of life, productivity, and direct and indirect costs.

In Brazil, national estimates based on surveys and population studies indicate a relevant prevalence of medical diagnosis of asthma and a substantial burden of use of health care services. Data from the JBP also suggest that mortality trends and regional inequalities should be monitored as a warning sign for the public system. Structured control programs, such as ProAR (Bahia), have demonstrated a positive impact on the reduction of emergency care and hospitalizations, showing that integrated policies can modify outcomes.

In recent years, there have been relevant changes in the understanding of endotypes, in the use of biomarkers and in the development of target-specific therapies. In parallel, international (GINA) and national (SBPT/JBP) guidelines have reinforced the need to confirm the diagnosis by functional tests and to avoid the use of short-acting bronchodilators alone. In view of this scenario, a scoping review is useful for mapping, organizing, and critically synthesizing the contemporary literature on adult asthma, identifying trends, advances, and gaps in knowledge that can be applied to the Brazilian context.

Objective: To map and critically synthesize contemporary evidence on the pathophysiology, diagnosis, classification, and therapeutic advances in adult asthma, including guidelines and data relevant to the Brazilian scenario, and to identify knowledge gaps and implementation barriers.

2 METHODS

Study design: Scoping review conducted according to the PRISMA extension for scoping reviews (PRISMA-ScR), with a broad question-oriented protocol and organization of findings by thematic axes.

Question and scope: "What is the contemporary evidence on the pathophysiology, objective diagnostic confirmation, classification, and therapeutic management of asthma in adults, including step-by-step pharmacological strategies and advanced therapies?"

Sources of information and search strategy: Searches were conducted in the PubMed/MEDLINE, SciELO, and LILACS databases, complemented by a query directed to

normative documents and guidelines (GINA 2025; SBPT/JBP recommendations). Controlled and free terms (MeSH/DeCS) related to "asthma", "adult", "diagnosis", "spirometry", "phenotype", "endotype", "inhaled corticosteroid", "formoterol", "SMART/MART", "biologics", "omalizumab", "mepolizumab", "benralizumab", "dupilumab", "tezepelumab", and equivalents in Portuguese were combined. An example of a strategy (PubMed) was: (asthma[MeSH Terms] OR asthma[Title/Abstract]) AND (adult*[Title/Abstract] OR adults[MeSH Terms]) AND (diagnosis OR spirometry OR treatment OR biologic* OR "inhaled corticosteroid" OR formoterol). Filters: 2015–2025; humans; Languages Portuguese/English.

Eligibility criteria: Original studies, clinical trials, systematic reviews, meta-analyses, high-impact narrative reviews, guidelines, and consensus published between 2015 and 2025, focusing on adults (≥18 years) and outcomes related to pathophysiology, functional diagnosis, control/severity, stepped treatment, and advanced therapies were included. Exclusively paediatric studies, isolated case reports, very small series with no relevance to synthesis, pre-2015 studies (except when fundamental for contextualisation) and publications without peer review (with the exception of official guidelines) were excluded.

Selection process: Screening was carried out in two stages: (1) titles and abstracts; (2) evaluation of the full text. Differences were resolved by consensus. The process is presented in a PRISMA flowchart (Figure 1), and must contain numbers of records identified, removed due to duplication, excluded and included after complete reading (fields to be filled in according to the screening worksheet).

Data extraction and organization ("charting"): A standardized form was developed to extract the following study design, population, diagnostic criteria and functional tests, classification/control, pharmacological interventions (including ICS-formoterol and escalation), biomarkers (eosinophils, FeNO, IgE), biological therapies, and main outcomes (exacerbations, pulmonary function, quality of life, use of systemic corticosteroids). The findings were summarized descriptively and presented by axes: (i) epidemiology and risk factors; (ii) pathophysiology and endotypes; (iii) diagnosis and differentials; (iv) control/risk classification and assessment; (v) contemporary pharmacological treatment; (vi) severe asthma and advanced therapies; (vii) Brazilian context and implementation.

Ethical considerations: As this is a literature review, there was no need for approval by the ethics committee.

3 RESULTS

Robust evidence was identified on paradigm shifts in the management of adult asthma in the period 2015–2025, with convergence between international and national guidelines.

The studies analyzed reinforce that adult asthma is heterogeneous in terms of clinical presentation, inflammatory profile, and therapeutic response, requiring objective diagnostic confirmation and a step-by-step approach guided by the risk of exacerbations.

The main findings are summarized below by thematic axes. Epidemiology, age of onset and risk factors.

Asthma can begin in childhood and persist into adulthood or appear late. Late onset is often associated with female gender, obesity, smoking, occupational exposures, and lower atopy. Brazilian population-based studies report a relevant prevalence of medical diagnosis and indicate underdiagnosis and suboptimal management in some adults, contributing to exacerbations and socioeconomic impact. JBP publications also emphasize the importance of mortality and hospitalization surveillance as indicators of quality of care and the effectiveness of public policies.

3.1 PATHOPHYSIOLOGY: ENDOTYPES AND PHENOTYPES

Type 2 (T2) inflammation remains prevalent in many adults, mediated by IL-4, IL-5, and IL-13 cytokines, with eosinophilia and/or IgE elevation, remodeling and mucus production. On the other hand, non-T2 phenotypes (neutrophilic/paucigranulocytic) gain relevance in adults with obesity, smoking, and environmental/occupational exposures, with a lower response to IC and a greater need for optimization strategies (e.g., adherence, inhalation technique, control of comorbidities, and investigation of persistent inflammation). Airway epithelium and alarmins (e.g., TSLP) play a central role in the inflammatory cascade, justifying targeted therapies in advanced stages.

3.2 DIAGNOSIS: FUNCTIONAL CONFIRMATION AND DIFFERENTIALS

The diagnosis of asthma in adults should include a clinical history of variable symptoms (wheezing, dyspnea, chest tightness, cough) with objective confirmation of variable airflow limitation. Spirometry is the standard test, with demonstration of post-bronchodilator obstruction and reversibility (increase in FEV1 ≥12% and ≥200 mL) when applicable. In the absence of baseline obstruction, peak expiratory flow variation, bronchial provocation, or documentation of variability over time may be required. Guidelines reinforce that treatment without functional confirmation increases the risk of misdiagnosis (COPD, vocal cord dysfunction, heart failure, bronchiectasis) and makes control difficult.

The initial evaluation should include investigation of comorbidities and modifiable factors (rhinitis/rhinosinusitis, reflux, obesity, sleep apnea, anxiety/depression, smoking) and

identification of environmental/occupational triggers, considering occupational asthma and aggravated by work when relevant.

3.3 CONTROL/RISK CLASSIFICATION AND ASSESSMENT

Severity is defined retrospectively by the level of treatment required to keep asthma under control (mild, moderate, severe), while control is assessed prospectively (daytime/nighttime symptoms, activity limitation, need for rescue, and exacerbations). Contemporary assessment incorporates future risk, including history of exacerbations, pulmonary function, repeated use of systemic corticosteroids, and presence of comorbidities. Tools such as ACT and ACQ are useful for monitoring and decision-making.

3.4 CONTEMPORARY PHARMACOLOGICAL TREATMENT

There was a paradigm shift with the recommendation to avoid SABA alone, due to the higher risk of exacerbations and lack of inflammatory control. Inhaled corticosteroid (ICS) strategies from the earliest stages are prioritized. Evidence from trials and meta-analyses supports the use of as-needed ICS-formoterol in mild asthma and the MART/SMART regimen (ICS-formoterol as maintenance and reliever) in moderate to severe asthma, reducing exacerbations and hospitalizations, often with lower cumulative ICS exposure when compared with traditional rescue SABA regimens.

Treatment optimization also requires systematic review of adherence, inhalation technique, device choice, patient education, and a written action plan.

Nonpharmacological interventions (smoking cessation, weight loss, physical activity, vaccination, and environmental control) are essential components.

3.5 SEVERE ASTHMA AND ADVANCED THERAPIES

In severe asthma, it is recommended to confirm the diagnosis and investigate causes that are difficult to control (pseudoresistance), including poor adherence, inadequate technique, continuous exposure to triggers, and untreated comorbidities. Once treatment is optimized (CI/LABA bi-therapy at an appropriate dose ± LAMA) and severe asthma is confirmed, phenotyping and biomarkers guide advanced therapies. SBPT/JBP (severe asthma) recommendations emphasize personalized selection and response monitoring.

Anti-IgE immunobiologicals (eg, omalizumab) are indicated in allergic asthma with elevated IgE and proven sensitization; anti-IL-5/anti-IL-5R (mepolizumab, benralizumab) in eosinophilic asthma; anti-IL-4/IL-13 (dupilumab) in T2 inflammation and comorbidities (e.g., atopic dermatitis, rhinosinusitis with polyps); and anti-TSLP (tezepelumab) broadens the

spectrum to more diverse phenotypes, with evidence of reduced exacerbations and improved lung function in uncontrolled severe asthma. Rational use requires clinical and laboratory criteria and periodic evaluation of response for continuity.

3.6 EPIDEMIOLOGY, SEASONALITY, AND ECONOMIC IMPACT

The burden of asthma in Brazil remains high, despite the downward trend in hospitalizations and deaths observed since the end of the 2000s. A longitudinal analysis based on the official national database (DATASUS/SIH) showed that, between 2008 and 2013, the absolute numbers of hospitalizations and their costs remained relevant, with a temporal reduction, but still with an important impact for a middle-income country. This pattern is consistent with the notion that much of the burden of exacerbations is potentially preventable through timely diagnosis, continued access to inhaled corticosteroid therapies, and structured education for self-management.

The use of DATASUS, through TabNet/SIH-SUS, allows monitoring hospitalizations for asthma (ICD-10 J45–J46), hospital costs, and regional distribution, supporting epidemiological surveillance and the organization of care networks. Brazilian studies that analyze SIH/SUS data in recent periods suggest that the volume of hospitalizations and associated costs remain significant, with regional variation and concentration of impact in areas with greater socioeconomic vulnerability and less access to functional diagnosis and longitudinal follow-up.

Seasonality is a relevant component in the epidemiology of asthma, with peaks in exacerbations influenced by respiratory viral infections, variations in temperature and humidity, and exposure to aeroallergens and pollutants. In Brazil, studies describe seasonal fluctuations in emergency room visits, with greater frequency in certain periods (e.g., rainy seasons in some regions, with subsequent increase in humidity and possible proliferation of mites and fungi) and also in colder and drier months, depending on the local climatic context. Additional Brazilian evidence points to an association between meteorological conditions and the risk of hospitalization for asthma, reinforcing that seasonality should be incorporated into care planning (medication stockpiling, preventive control intensification, vaccination, and risk communication).

From an economic point of view, asthma generates direct costs (consultations, exams, hospitalizations, medications, transportation) and indirect costs (absenteeism, presenteeism, loss of productivity, and family impact). Although the cost component is sensitive to inflation, studies with national data and family-level analyses show that part of the burden falls on the household budget, especially when there is recurrent use of

emergency services and the need for systemic corticosteroids. In terms of health care systems, the reduction in hospitalizations for asthma represents a concrete opportunity to decongest tertiary care and redirect resources to more cost-effective actions in primary care.

3.7 HEALTH EDUCATION AND INHALATION TECHNIQUE

Health education is one of the most consistent determinants of asthma control. Inappropriate use of inhalers is common and is associated with poorer control, increased risk of exacerbations, increased need for rescue medication, and increased use of emergency services. Effectiveness and implementation studies show that educational interventions focused on inhalation technique improve patient performance and are associated with improved clinical control.

A practical and scalable approach to primary care includes: (1) teaching and demonstrating at every visit (teach-back: the patient demonstrates the technique after instruction); (2) checklist of critical steps per device (MDI with spacer; DPI); (3) training of nursing professionals and community agents for continuous reinforcement; (4) periodic validation, and not only in crises; and (5) key messages: correct use of the controller, difference between controller and relief, importance of not interrupting IC for improvement, and early recognition of signs of worsening with activation of the action plan.

Education should be integrated with self-management: control goals, triggers, guidance for temporary escalation in worsening, when to seek urgency, and assessment of barriers (cost, beliefs, perceived adverse effects). The combination of appropriate technique, adherence, and a written action plan is one of the most effective measures to prevent exacerbations and reduce hospitalizations.

3.8 DIFFERENTIAL DIAGNOSIS, COMORBIDITIES AND IMPACT ON QUALITY OF LIFE

The diagnosis of asthma in adults requires caution, especially in individuals with smoking, advanced age, chronic dyspnea, or atypical symptoms. The absence of objective confirmation can lead to errors: vocal cord dysfunction, heart failure, bronchiectasis, gastroesophageal reflux disease with chronic cough, or COPD. Asthma can also be underdiagnosed when symptoms are attributed only to anxiety, sedentary lifestyle, or obesity. Thus, it is recommended to document airflow variability and reassess the diagnosis when the response is inadequate.

Comorbidities are important determinants of poorer control and poorer quality of life. Chronic rhinitis/rhinosinusitis and nasal polyps can intensify symptoms, increase exacerbations, and serve as markers of type 2 inflammation. Obesity is associated with a

higher symptomatic burden and greater dyspnea. Gastroesophageal reflux and obstructive sleep apnea can aggravate nocturnal symptoms. Anxiety disorders and depression correlate with poorer symptom perception, lower adherence, and greater emergency use. Smoking reduces response to IC and accelerates functional decline.

In terms of quality of life, uncontrolled asthma impacts sleep, work performance, physical activity, social relationships, and mental health. Validated instruments (ACT/ACQ and quality of life questionnaires) should be incorporated into follow-up to monitor, control, and guide decisions. The management of comorbidities should be an explicit part of the therapeutic plan, avoiding ineffective escalation.

3.9 SEVERE ASTHMA: DETERMINANTS, PRACTICAL ALGORITHM AND REALITY IN THE SUS

Severe asthma represents the end of the spectrum, but many patients reach this stage due to preventable failures during care: late or unconfirmed diagnosis; undertreatment with absence of ICS or intermittent use; prolonged maintenance of SABA isolated; poor adherence and inadequate inhalation technique not identified; barriers to access to medicines and spirometry; untreated comorbidities; and persistent exposure to triggers (smoking, mold, occupational environments). This set can simulate severity ("difficult asthma") and improves substantially after correction of modifiable factors.

The SBPT/JBP guidelines for severe asthma emphasize an algorithm: (1) confirm diagnosis and flow variability; (2) evaluate and correct adherence/technique; (3) identify and treat comorbidities; (4) reduce environmental/occupational exposures; (5) optimize inhalational therapy (ICS/LABA at an appropriate dose ± LAMA, as indicated); and then (6) phenotype and consider advanced therapies. Biomarkers (blood eosinophils, FeNO, IgE, and presence of nasal polyps) guide eligibility and choice of immunobiological. Response should be monitored with explicit criteria (exacerbations, need for systemic corticosteroid, lung function, and quality of life).

In the SUS, there is regional heterogeneity in access to spirometry, specialists, and immunobiologicals. National protocols (PCDT Asthma) standardize diagnosis and treatment, but their effectiveness depends on the continuous provision of medications, training, and care regulation. Severe asthma outpatient clinics and referral centers with a structured interface with primary care can reduce urgency and hospitalizations when there is counter-referral and guaranteed network controllers.

Practical triggers for referral: two or more severe exacerbations/year; repeated use of systemic corticosteroids; hospitalization for asthma; persistent symptoms despite

appropriate therapy; suspected occupational asthma; need for high doses of ICS/LABA; or complex comorbidities.

3.10 COMPARISON WITH DEVELOPED COUNTRIES

In high-income countries, reductions in asthma hospitalizations and mortality have been associated with: widespread and continuous access to corticosteroid controllers; availability of functional diagnosis in primary care; structured self-management programs with an action plan; integration between primary care and specialists; and more homogeneous access to advanced therapies for severe asthma, with transparent eligibility and monitoring criteria.

International guidelines incorporate the concept of avoiding SABA alone and prioritizing ICS–formoterol strategies, as well as emphasizing treatable traits and future risk assessment. In practice, it is common to provide multiprofessional support (respiratory nursing and clinical pharmacists), improving inhalation technique and adherence. Severe asthma clinics with easy access to biomarkers (FeNO, allergy tests) and immunobiologicals are also more common, reducing dependence on systemic corticosteroids.

In Brazil, although national guidelines are robust and aligned with the state of the art, the main gap is one of implementation: variability of access to tests, continuity of medication supply, and operational capacity for education/follow-up in primary care. Moving closer to international best practices requires expanding spirometry coverage, ensuring the availability of ICS and combinations, incorporating structured education as an indicator of quality, and strengthening lines of care with effective counter-referral.

4 DISCUSSION

This scoping review synthesizes contemporary evidence indicating that the effective management of asthma in adults depends on three pillars: (1) objective diagnostic confirmation; (2) early and continuous anti-inflammatory treatment; and (3) risk-based personalization, phenotypes, and biomarkers, especially in severe asthma.

Functional diagnostic confirmation remains underutilized in several scenarios. The practice of treating "asthma" without objective documentation of airflow variability increases the risk of overdiagnosis and underdiagnosis, in addition to delaying the investigation of differential diagnoses, particularly in older adults, smokers, or those with nonspecific symptoms. Current guidelines reinforce the need for spirometry and, when necessary, additional tests (serial peak flow, bronchial provocation), as well as diagnostic reassessment when the therapeutic response is unsatisfactory.

The second pillar is the paradigm shift in relation to the short-acting bronchodilator. The literature reviewed, including clinical trials and contemporary syntheses, supports that the use of SABA alone does not address underlying inflammation and is associated with a higher risk of exacerbations. The ICS strategy from the initial stages, including ICS-formoterol "as needed" in mild asthma and MART/SMART regimens in moderate to severe disease, represents a pragmatic advance with a strong impact on clinical outcomes. In addition to reducing exacerbations, these regimens tend to simplify treatment and improve adherence by linking symptomatic relief to anti-inflammatory relief.

The third pillar refers to heterogeneity. Although type 2 inflammation is predominant, non-T2 phenotypes are relevant in adults with obesity, smoking, and occupational exposures, in which the response to IC may be less robust. The identification of biomarkers (eosinophils, FeNO, IgE, presence of nasal polyps) guides the choice of advanced therapies and can avoid ineffective escalation. Epithelial alarmins, such as TSLP, reinforce the concept that inflammation begins "upstream," justifying broader-spectrum immunobiologicals in severe asthma.

In the Brazilian scenario, structural challenges persist: heterogeneous access to spirometry, limitations in health education, barriers to adherence, and inequality in the incorporation of immunobiological therapies in the public and supplementary systems. Experiences such as ProAR show that integrated care models with education and access to inhaled medications can reduce exacerbations and emergency use, suggesting a promising path for regional and national policies. Recent studies by the JBP on asthma mortality reinforce the importance of strengthening the line of care, with a focus on preventing preventable deaths.

The following gaps are noteworthy: there is a need for national studies with cost-effectiveness assessment of contemporary strategies (e.g., MART/SMART and immunobiologicals), investigation of non-T2 phenotypes in Brazilian populations, and implementation of care models with accessible spirometry and longitudinal follow-up. In addition, future studies should evaluate the integration of digital health (remote monitoring, education, and reminders) and strategies for safe deprescribing of systemic corticosteroids after control with biologics in severe asthma.

Limitations: As a scoping review, the synthesis is descriptive and aimed at mapping concepts and trends, without formal assessment of risk of bias for each individual study, which is compatible with the methodological objective of PRISMA-ScR. Even so, guidelines and studies with greater methodological robustness and clinical relevance were prioritized.

4.1 IMPLICATIONS FOR THE LINE OF CARE AND REDUCTION OF OVERCROWDING

The prevention of asthma exacerbations and hospitalizations depends on a set of organizational and clinical interventions with a strong evidence base. At the primary care level, strategies with the best cost-effectiveness include: (1) diagnostic confirmation by spirometry when available and, in its absence, regulated referral for testing; (2) early initiation of inhaled corticosteroid therapy, avoiding SABA alone; (3) staggered therapeutic intensification according to control and risk; (4) written action plan and longitudinal follow-up with clear goals; (5) systematic review of inhalation technique and adherence; (6) structured management of comorbidities and modifiable factors; and (7) referral/counter-referral protocols for difficult and severe asthma.

Contemporary guidelines converge in emphasizing anti-inflammatory treatment from the earliest stages and periodic risk reassessment. A pragmatic practice for primary care is to institutionalize checkpoints at each consultation: symptom control and functional limitation; record of exacerbations/use of systemic corticosteroids; technique and adherence checking; adjustment of treatment and reinforcement of the action plan. This simple cycle, repeated in a standardized way, reduces dependence on urgent care and decreases late referrals at the tertiary level.

Official protocols of the Ministry of Health (PCDT Asthma) and successful regional experiences indicate that the stable provision of essential inhaled medications, associated with health education, can reduce hospitalizations and costs. The structuring of lines of care that integrate primary care, emergency services, and specialized referral — with explicit criteria for referral — is a systemic measure to reduce overcrowding and improve outcomes.

In addition, pre-seasonal interventions may be useful: review and adjustment of treatment before periods of higher risk, vaccine booster (influenza/COVID-19 according to current recommendations), guidance on environmental control, and intensification of monitoring of vulnerable groups.

5 CONCLUSIONS

Asthma in adults is a heterogeneous disease that requires objective diagnostic confirmation, early anti-inflammatory treatment, and an individualized approach based on risk and phenotypes. Strategies with ICS–formoterol (including MART/SMART) and the expansion of immunobiological therapies have transformed management, particularly in severe asthma. In Brazil, reducing inequalities in access to spirometry, strengthening health education, and expanding the organization of the line of care are essential actions to reduce exacerbations, hospitalizations, and avoidable mortality.

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