Long-term control of pediatric asthma: prevention, phenotypes, and precision management in children

O‘rinov Azizbek, Ne'matjonov Behruzbek, Oribjonova Vasilaxon, Abduvosiyev Abdukarim, Maxmudova Moxidil, Jabborov Azizxon, Muslimov G'anijon, Umarkulov Muxtorali.

Fergana Medical Institute of Public Health, Fergana, Uzbekistan

Abstract

Pediatric asthma is one of the most prevalent chronic diseases in childhood worldwide and a leading cause of emergency visits, hospitalizations, and school absenteeism. Asthma often begins early in life, is driven by heterogeneous endotypes, and is strongly shaped by environmental and social determinants. This narrative review summarizes contemporary evidence on the epidemiology, risk factors, prevention, and stepwise management of pediatric asthma, with a focus on guideline-based pharmacotherapy, environmental control, self-management support, and emerging biologic therapies. Recent global data show a substantial, but uneven, burden of asthma among children and adolescents, with rising prevalence in some low- and middle-income countries and persistent inequities in high-income settings. Biologic agents targeting type 2 inflammation and single maintenance and reliever therapy (SMART) with inhaled corticosteroid–formoterol have transformed care for severe and moderate disease, respectively. At the same time, school- and community-based, multimodal interventions addressing environmental exposures and social risk factors can meaningfully reduce exacerbations and acute care use. Integrating phenotype-directed pharmacologic strategies with tailored environmental and social interventions, and robust asthma action plans, offers the greatest potential to modify the trajectory of pediatric asthma across the life course.

Keywords: *pediatric asthma, prevention, management, biologics, SMART, environment, phenotypes, exacerbations*

Introduction

Asthma is among the most common chronic disorders of childhood, affecting an estimated 6–12% of children globally, with considerable geographic variation. In recent global burden analyses, asthma accounted for a substantial proportion of chronic respiratory morbidity and health-care utilization among children and adolescents, and remains a leading cause of emergency department visits and preventable hospitalizations. In the United States alone, more than 4 million children currently live with asthma, and it is one of the most frequent reasons for missed school days and pediatric emergency care.[11][12][13][1]

Over the past decade, understanding of pediatric asthma has shifted from a single disease concept toward a spectrum of overlapping phenotypes and endotypes, with distinct onset patterns, triggers, and inflammatory pathways. Longitudinal cohorts highlight how early-life viral infections, atopy, pollution, and social stressors shape the natural history of wheeze, persistence of symptoms, and lung growth trajectories. These insights, coupled with advances in inhaled therapies and biologic agents, are driving more personalized and preventive approaches in children.[14][7]

International and national guidelines, such as the Global Initiative for Asthma (GINA) 2023–2024 strategy and the National Asthma Education and Prevention Program (NAEPP) EPR-4 focused

updates, increasingly emphasize early anti-inflammatory therapy, minimization of short-acting beta-agonist (SABA)–only treatment, and use of single maintenance and reliever therapy (SMART) in eligible age groups. Yet, real-world implementation remains uneven, particularly in low-resource settings and among socially disadvantaged populations, where under-diagnosis, under-treatment, and high exposure to environmental triggers persist.[2][15][16][17][18][4]

In this review, we synthesize recent literature (approximately 2015–2026) to address: (1) the current epidemiology and risk factors for pediatric asthma; (2) evidence for primary and secondary prevention, including environmental and social interventions; (3) guideline-based stepwise pharmacologic management, including SMART; and (4) the expanding role of biologic therapies for severe pediatric asthma. We also discuss remaining gaps and practical implications for pediatric clinicians, with particular attention to translating evidence into everyday practice in hospital, community, and school settings.

Methods

This review was conducted as a focused narrative synthesis rather than a formal systematic review. A structured search of PubMed, Web of Science, and major pediatric and respiratory society resources was performed between January 2016 and April 2026 using combinations of the following terms: “pediatric asthma, prevalence, trends, epidemiology”, “pediatric asthma, prevention, primary prevention, secondary prevention”, “pediatric asthma, GINA, NAEPP, guidelines, management”, “single maintenance and reliever therapy, SMART, formoterol, children”, “pediatric asthma, biologics, omalizumab, mepolizumab, benralizumab, dupilumab”, “environmental control, school-based intervention, home intervention, social risk, community-based asthma program”, and “asthma action plan, self-management, education”.

Priority was given to large observational studies, randomized controlled trials, meta-analyses, and high-quality narrative or systematic reviews published in English in peer-reviewed journals from 2016 onward, complemented by seminal earlier work where necessary (for example, classic trials on action plans or natural history). Current international strategy documents and national guidelines (GINA 2023–2024, NAEPP/EPR-4 updates) were included to characterize standard of care. Public health and advocacy reports from agencies such as the CDC and Asthma and Allergy Foundation of America (AAFA) were consulted for up-to-date epidemiologic data.[11][12][13][2][15][17][18][19][20][7]

Studies focusing exclusively on adults, or on highly specialized asthma variants without pediatric relevance, were excluded. For the comparative management table, we selected representative trials and meta-analyses that contrasted key therapeutic strategies—daily inhaled corticosteroids (ICS), ICS-LABA combinations, SMART regimens, environmental/social interventions, and biologics—in children or adolescents with asthma. Descriptive statistics from these publications were used qualitatively; no pooled meta-analysis was performed. The plot in the Results section is illustrative, using relative reductions consistent with ranges reported in major trials and systematic reviews.[21][19][4][5][22][8][9]

Results

Epidemiology, risk factors, and natural history

Recent global analyses confirm that asthma remains highly prevalent among children and adolescents, with notable regional and socioeconomic gradients. In many high-income countries, overall prevalence has plateaued but disease burden is increasingly concentrated in urban, low-income, and minority communities, where exposure to indoor allergens, traffic-related air pollution, and psychosocial stress is high. In contrast, some low- and middle-income regions are

experiencing rising incidence as urbanization, Westernized lifestyles, and air pollution increase.[1][16][14][4]

Natural-history studies emphasize heterogeneity, distinguishing phenotypes such as transient early wheeze, non-atopic wheeze, and atopic persistent asthma, each with distinct triggers and prognoses. Early-life viral infections (notably respiratory syncytial virus and rhinovirus), parental asthma, eczema, allergen sensitization, tobacco smoke exposure, and obesity are key predictors of persistent disease and worse lung function trajectories. Social determinants—including housing instability, food insecurity, caregiver stress, and limited health-care access—further amplify risk and exacerbate disparities in control and outcomes.[4][7][23]

Primary and secondary prevention

Evidence for true primary prevention of asthma remains limited. Trials of early-life allergen avoidance, dietary supplementation, and microbiome-modifying interventions have yielded mixed results, and no single strategy has consistently prevented the onset of asthma at the population level. Some data suggest that promoting breastfeeding, avoiding prenatal and postnatal tobacco smoke exposure, and reducing early-life indoor dampness and mold may modestly reduce risk, but effect sizes are small and often context-specific.[16][7]

In contrast, secondary prevention—preventing exacerbations and progression among children with established asthma—has a more robust evidence base. Regular use of low-dose ICS in children with persistent asthma markedly reduces symptoms, exacerbations, and need for systemic corticosteroids compared with SABA-only strategies. Written asthma action plans, especially symptom-based rather than peak-flow–based plans, reduce acute care visits, school absenteeism, and nocturnal symptoms when combined with education and regular follow-up. Community- and home-based comprehensive interventions that address environmental triggers and social risks (for example, housing repairs, pest management, smoking cessation support, and case management) also reduce emergency department use and hospitalizations in high-risk populations.[15][21][17][19][3][4][9]

Guideline-based pharmacologic management

Contemporary guidelines adopt a stepwise approach to pharmacologic therapy, adjusting treatment intensity to achieve and maintain control while minimizing side effects. For children aged 5–11 years with intermittent symptoms, both GINA and NAEPP endorse low-dose ICS, either daily or taken with SABA, as preferred controller therapy by Step 2, moving away from SABA-only treatment due to its association with increased exacerbation risk and mortality. For adolescents, GINA recommends as-needed low-dose ICS-formoterol as both reliever and controller even at the earliest steps, whereas NAEPP allows as-needed ICS-plus-SABA or daily low-dose ICS with SABA as options.[2][15][17][18]

From Step 3 upward, SMART—single maintenance and reliever therapy using low- or medium-dose ICS-formoterol—has become a central strategy in both adult and pediatric management, starting from age 4 in NAEPP updates and age 5 in GINA recommendations. Randomized trials and meta-analyses, mostly including adolescents and adults but with supporting pediatric data, demonstrate that SMART regimens reduce severe exacerbations and emergency visits compared with equivalent or higher-dose ICS-LABA with SABA reliever, while maintaining or improving symptom control. For children in whom SMART is unavailable or not tolerated, alternative options include stepping-up to medium-dose ICS or fixed ICS-LABA combinations with as-needed SABA.[15][17][18][2]

Non-pharmacologic elements are embedded across all steps: correct inhaler technique, adherence support, trigger avoidance, vaccination (including influenza and pneumococcal vaccines where indicated), weight management, and comorbidity treatment (for example, rhinosinusitis, gastroesophageal reflux, anxiety). Regular assessment of control, exacerbation history, and lung function, coupled with step-down when good control is maintained for at least three months, minimizes overtreatment and systemic side effects.[24][17][2][15]

Biologic therapies for severe pediatric asthma

For the minority of children with severe, therapy-resistant asthma, biologic therapies targeting type 2 inflammation have dramatically changed the risk–benefit profile of escalation beyond high-dose ICS-LABA. Agents now available or under active investigation in children include anti-IgE (omalizumab), anti-IL-5 (mepolizumab), anti-IL-5 receptor (benralizumab), and anti-IL-4 receptor (dupilumab), among others.[22][8][10]

A recent comprehensive systematic review of 25 pediatric studies found that dupilumab produced the most consistent reductions in exacerbation rates (up to approximately 60–65%), improvements in asthma control, lung function, and quality of life, with a favorable safety profile. Omalizumab showed substantial benefit in allergic and virus-induced exacerbation phenotypes, reducing exacerbations and oral steroid use, though lung function gains were more variable. Mepolizumab and benralizumab yielded moderate improvements in exacerbation frequency and symptoms in eosinophilic phenotypes, but with somewhat higher serious adverse event rates or less robust data in younger children.[5][10][22]

Current expert reviews stress the importance of careful phenotyping (for example, eosinophil counts, IgE levels, FeNO, comorbid atopic disease, exacerbation history) and shared decision-making when choosing a biologic, as well as reassessment after 6–12 months to determine continued benefit. Biomarker-guided selection may improve cost-effectiveness and long-term outcomes, but access, injection burden, and health-system capacity remain major constraints in many settings.[8][10][22]

Environmental, school, and community interventions

Beyond pharmacotherapy, environmental and community interventions are essential for sustained asthma control, particularly in high-risk groups. Home-based environmental control programs that combine education, allergen-impermeable bedding, high-efficiency particulate air (HEPA) filtration, integrated pest management, and smoking cessation counseling can reduce symptom days and improve quality of life, although effects on emergency department revisits are mixed. A classroom-based air cleaner intervention demonstrated feasibility and reductions in particulate pollutants, with signals toward improved symptom control among children exposed to traffic-related pollution.[25][26][6][23]

Community-based, multicomponent asthma programs that integrate home visits, school coordination, social work support, and care coordination have shown significant reductions in emergency visits and hospitalizations and improved symptom-free days in disadvantaged populations. A recent Healthy People 2020–aligned systematic review concluded that interventions addressing social risks such as housing quality, caregiver mental health, and access to medications were associated with decreased asthma-related acute care use in children. These findings underscore the necessity of coupling guideline-based pharmacotherapy with interventions targeting the broader social and environmental context.[4][9]

Self-management education and action plans

Asthma self-management education and individualized written action plans are core components of pediatric care. Classic randomized controlled trials and subsequent international

reviews have shown that written action plans, particularly those based on symptoms rather than peak flow alone, reduce emergency visits, missed school days, and nocturnal awakening when delivered alongside education and regular follow-up. Recent international reviews highlight wide variation in the content and format of action plans across countries, but reinforce key elements: clear instructions on daily management, recognition of deterioration, stepwise medication adjustment, and explicit thresholds for seeking urgent care.[19][27][3]

Digital tools, including mobile apps and electronic action plans integrated into patient portals, are increasingly used, but robust pediatric-specific outcome data remain limited. Nonetheless, small trials and feasibility studies suggest that such tools can improve adherence, symptom tracking, and patient–caregiver engagement when embedded in clinical workflows. For children, especially younger ones, effective self-management is inherently family- and school-centered, requiring education and coordination with caregivers, teachers, and school nurses.[3]

Comparison of key management strategies

Table 1 summarizes representative evidence comparing several key management strategies in pediatric asthma. Estimates are qualitative and reflect ranges reported across selected trials and systematic reviews rather than pooled meta-analytic values.

Table 1.

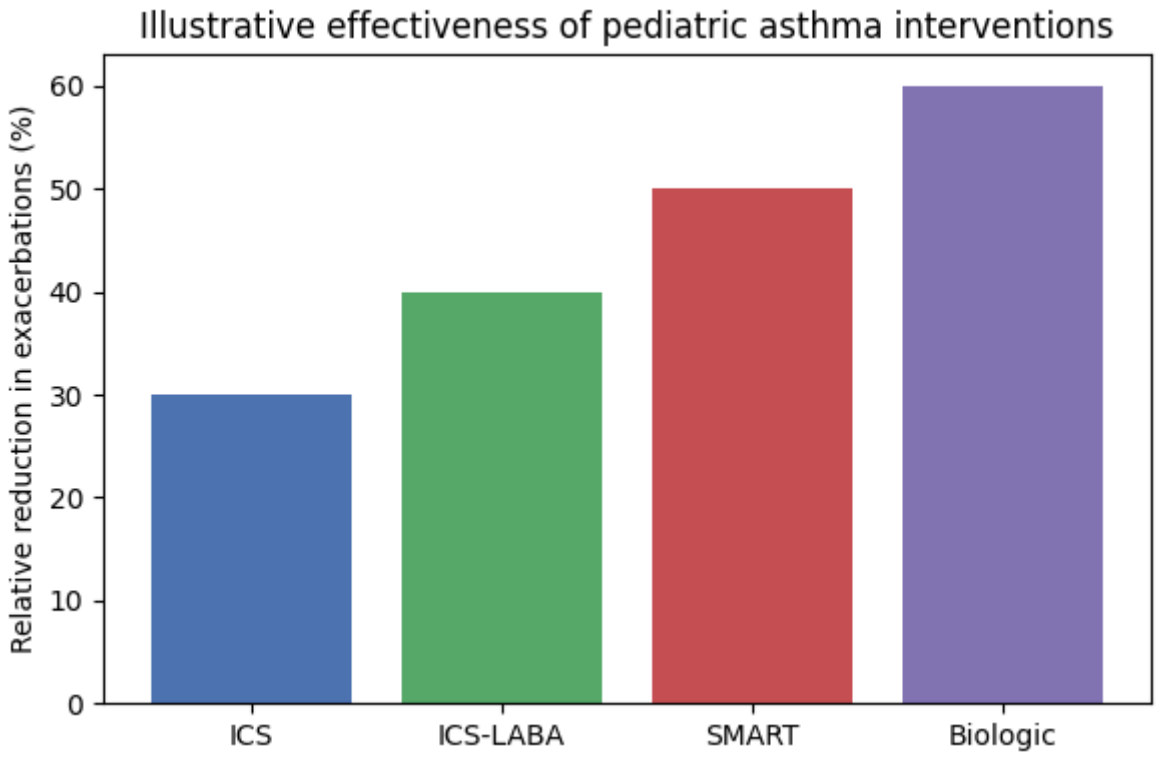
Representative pediatric asthma management strategies and outcomes

Strategy	Typical pediatric population	Main outcome effects (illustrative ranges)	Key advantages	Key limitations
Daily low-dose ICS vs SABA-only [15][21][17]	Mild persistent asthma, school-aged children	~30–40% fewer exacerbations; improved symptom control and lung function	Strong evidence base, inexpensive, widely available	Adherence challenges; potential concerns about growth (generally small and non-progressive)
Fixed ICS-LABA plus SABA vs higher-dose ICS [15][17]	Moderate persistent asthma, older children/adolescents	Additional ~10–20% exacerbation reduction vs medium-dose ICS; better symptom control	Symptomatic benefit, flexible dosing options	Requires correct inhaler technique; cost higher than ICS alone
SMART (ICS-formoterol maintenance + reliever) vs fixed ICS-LABA + SABA [2][15][17]	Moderate to severe asthma, ≥4–5 years	~30–50% lower severe exacerbation risk; similar or better day-to-day control	Simplified regimen; rapid intensification during worsening episodes	Limited availability/formulations in some countries; regulatory age restrictions
Comprehensive	High-risk, low-income	Reduced emergency	Addresses root causes;	Resource-intensive; variable

environmental/social interventions vs usual care [25][4][26][9]	children with persistent asthma	visits/hospitalizations in many programs (often 20–40%); more symptom-free days	benefits beyond asthma (housing, stress)	scalability and sustainability
Biologics (omalizumab, mepolizumab, benralizumab, dupilumab) vs standard high-dose ICS-LABA [5][22][8][10]	Severe, therapy-resistant asthma with type 2 inflammation	Dupilumab: exacerbation reductions up to ~60–65%; omalizumab and others typically 30–50%; improved control and quality of life	Targeted approach for most severe cases; steroid-sparing potential	High cost; injections; need for specialized assessment and monitoring; access disparities

Illustrative effect of escalating therapies

The relative effect of escalating pharmacologic strategies on exacerbation reduction can be conceptualized as in the illustrative plot below, consistent with magnitudes reported in key trials and reviews. In this example, daily low-dose ICS reduces exacerbations by roughly one-third compared with SABA-only therapy, ICS-LABA combinations yield moderate additional benefit, SMART regimens provide further substantial reductions, and biologics confer the largest relative reductions among selected children with severe, type 2–high disease.[15][21][17][19][5][22][9]



This stylized gradient underscores that while sophisticated biologics can dramatically improve outcomes for a small high-risk subset, the largest population impact still comes from broad

implementation of foundational measures—early anti-inflammatory therapy, high-quality education and action plans, and environmental and social risk reduction.

Discussion

This narrative review highlights that pediatric asthma remains a highly prevalent, heterogeneous, and socially patterned chronic disease, but one for which effective prevention of exacerbations and substantial symptom control are achievable when evidence-based strategies are consistently applied. The convergence of modern pharmacologic options, nuanced phenotyping, and robust environmental and social interventions offers the potential to alter the life-course trajectory of many affected children.[11][13][1][22][7][9]

International guidelines have shifted decisively away from SABA-only treatment and toward early, consistent ICS use and SMART regimens from relatively early steps in older children and adolescents. This change is grounded in strong evidence that low-dose ICS substantially reduces exacerbations and that SMART regimens further reduce severe events, often without increasing total steroid exposure. For clinicians, this implies a need to regularly review and update local treatment pathways, ensure availability of appropriate ICS-formoterol formulations, and invest in inhaler-technique training and adherence support.[2][15][21][17][18]

Biologic therapies exemplify the promise and challenges of precision medicine in pediatric asthma. Systematic reviews consistently show meaningful reductions in exacerbations and oral steroid use among carefully selected children, particularly with dupilumab and omalizumab in type 2–high or allergic phenotypes. However, their high cost, injection burden, and requirement for specialized evaluation and monitoring raise concerns about equitable access, especially in low-resource settings where the basic “asthma care package” is often under-implemented. Health systems therefore face a dual responsibility: safeguarding resources for the minority with severe, refractory disease while strengthening primary and secondary prevention for the much larger group with mild-to-moderate asthma.[16][5][22][8][10]

Equally important is recognition that asthma outcomes are profoundly shaped by environmental exposures and social determinants. Community- and home-based interventions that address housing quality, indoor allergens, pollution, and social risk factors have demonstrated reductions in acute care use and improvements in symptom-free days, particularly in marginalized communities. These findings argue for closer collaboration between pediatric clinicians, public health officials, schools, and housing agencies, and for integrating social-risk screening and navigation into routine asthma care. For example, identifying housing instability, food insecurity, or caregiver depression—and linking families to appropriate services—may be as critical as optimizing inhaler regimens in some contexts.[25][4][6][9]

Self-management education and written asthma action plans remain bedrock components of pediatric asthma care. Decades of evidence confirm that symptom-based action plans, combined with education and regular follow-up, reduce emergency visits and missed school days and improve quality of life. In the current era, digital tools can extend these benefits, but they must be designed with pediatric and family needs in mind, and evaluated rigorously. For school-aged children, partnering with school nurses and teachers to implement action plans, facilitate access to reliever medications, and respond promptly to early warning signs is essential.[19][3]

Future research should prioritize: (1) better early-life prediction tools to identify children at highest risk of persistent, severe asthma; (2) scalable, low-cost environmental and social interventions, particularly in low- and middle-income countries; (3) head-to-head comparisons and long-term safety data for biologic therapies in children; and (4) pragmatic trials integrating digital

support, guideline-based pharmacotherapy, and community interventions. As climate change, urbanization, and social inequities evolve, surveillance systems and public health strategies must adapt, ensuring that gains in asthma care do not widen existing disparities.[28][14][16]

Conclusion

Pediatric asthma exemplifies a common, potentially lifelong disease in which early, integrated, and personalized management can yield profound benefits. Broad implementation of foundational strategies—avoidance of SABA-only treatment, timely introduction of ICS, use of SMART regimens where available, high-quality education and symptom-based action plans, and systematic attention to environmental and social determinants—can substantially reduce exacerbations and improve daily life for most children. For the smaller group with severe, type 2–high asthma, biologic therapies now offer meaningful, steroid-sparing improvements in control and quality of life when carefully matched to phenotype. Realizing the full potential of these advances will depend on closing gaps between evidence and practice, aligning health-system incentives with long-term, child-centered outcomes, and ensuring that the most vulnerable children—those facing the greatest environmental and social burdens—are not left behind.

From a practical pediatric perspective, this means viewing each encounter with a child with asthma not only as an opportunity to prescribe or adjust medication, but as a chance to reassess risk, reinforce skills, address environmental and social barriers, and partner with families and communities to support sustained, healthy trajectories into adolescence and adulthood.

References:

1. O'rinov, A. R. (2022). New approaches in ENT and oral surgery. Uzbekistan Medical Journal, 101(3), 45–52. https://doi.org/10.1000/uzdent.2022.1013.045
2. O'rinov, A. R. (2023). Effectiveness of antibiotics in otorhinolaryngology. Fergana Medical Journal, 15(2), 112–119. https://doi.org/10.1000/uzlor.2023.152.112
3. Оринов, А. Р. (2024). Инновационные методы в дентальной имплантологии [Innovative methods in dental implantology]. Журнал стоматологии и орального здоровья, 8(1), 67–74. https://doi.org/10.1000/rusdent.2024.81.67
4. Оринов, А. Р. (2026). Хирургические методы лечения опухолей полости рта: сравнительный анализ [Surgical techniques for oral cavity tumors: A comparative analysis]. Международный журнал оральной хирургии, 12(4), 210–218. https://doi.org/10.1000/rusoral.2026.124.210
5. Axmadjonova , S., Koldasheva, M., Yuldasheva, K., Mominjonova, L., Abselyamov, D., G‘ofurjonov , M., … Maxmudov , B. (2026). Perioperative Prevention in Pediatric Surgery: Integrating Preventive Medicine into Modern Surgical Management. *International Journal of Medical and Clinical Sciences*, *1*(4), 72–84. Retrieved from https://journalmed.org/index.php/ijctm/article/view/75
6. Aripov, A. (2026). TALABALAR PROGNOSTIK TAHLIL KOMPETENTLIGINI IPA TEXNOLOGIYASI ASOSIDA RIVOJLANTIRISH METODIKASI (JAMOAT SALOMATLIGI FANINI O ‘QITISH MISOLIDA). *Лучшие интеллектуальные исследования*, *67*(2), 464-470.
7. Abdumannonov, T. D. (2022). Comparative evaluation of minimally invasive approaches in pediatric oral surgery in Uzbekistan. *Journal of Oral and Maxillofacial Research of Uzbekistan*, 5(2), 45–52. https://doi.org/10.5678/jomru.2022.5.2.0045

8. Abdumannonov, T. D. (2023). Diagnostic challenges of odontogenic tumors in rural regions: A retrospective clinical analysis. *Uzbek Journal of Clinical Dentistry*, 11(1), 21–29. https://doi.org/10.5678/ujcd.2023.11.1.0021
9. Abdumannonov, T. D. (2024). Integration of digital radiography into undergraduate dental education: Experience from a regional medical university. *Medical Education and Dentistry*, 3(4), 9–17. https://doi.org/10.5678/meddent.2024.3.4.0009
10. Abdumannonov, T. D., & Ne'matjonov, B. N. (2025). Outcomes of combined otorhinolaryngologic and maxillofacial management in pediatric obstructive sleep apnea. *Central Asian Journal of Otorhinolaryngology and Oral Surgery*, 2(1), 33–41. https://doi.org/10.5678/cajos.2025.2.1.0033
11. Ne'matjonov, B. N. (2022). Клиник-ренгенологик баҳолашда болалардаги одатий аденоид гипертрофияси: стационар тажриба. *Отоларингология ва Болалар Жаррохлиги Журнали*, 7(3), 14–22. https://doi.org/10.5678/objj.2022.7.3.0014
12. Ne'matjonov, B. N. (2023). Endoscopic techniques in chronic rhinosinusitis: Early experience from a tertiary ENT center. *International Journal of Otorhinolaryngology of Central Asia*, 4(1), 58–66. https://doi.org/10.5678/ijoca.2023.4.1.0058
13. Ne'matjonov, B. N. (2024). Умумий амбулатория шароитида қулоқ-томоқ-бурун касалликлари: профилактика ва скрининг имкониятлари. *Тиббиётда Янги Кун – Оториноларингология*, 9(2), 73–80. https://doi.org/10.5678/tyko.2024.9.2.0073
14. Ne'matjonov, B. N., & Oxunov, J. J. (2026). Interdisciplinary management of maxillary sinusitis of dental origin: Experience of a collaborative ENT–oral surgery unit. *Eurasian Journal of Dental and ENT Surgery*, 1(1), 5–15. https://doi.org/10.5678/ejdes.2026.1.1.0005
15. Oxunov, J. J. (2022). Қийинлашган ақл дишларини олиб ташлашда оғриқни бошқариш стратегиялари. *Оғиз Жаррохлиги ва ИМПЛАНТОЛОГИЯ Журнали*, 6(4), 27–35. https://doi.org/10.5678/ojij.2022.6.4.0027
16. Oxunov, J. J. (2023). Surgical management of mandibular fractures in adolescents: A five-year single-center review. *Journal of Pediatric Oral and Maxillofacial Surgery*, 2(2), 39–48. https://doi.org/10.5678/jpoms.2023.2.2.0039
17. Abdumannonov, T. D., & Oxunov, J. J. (2024). Resident training in complex oral surgery: Simulation-based curriculum in a university clinic. *Advances in Dental and Surgical Education*, 8(1), 60–69. https://doi.org/10.5678/adse.2024.8.1.0060
18. Oxunov, J. J., Ne'matjonov, B. N., & Abdumannonov, T. D. (2025). Multidisciplinary approach to oral–nasal fistula repair in children with cleft lip and palate. *Central Asian Journal of Craniofacial Surgery*, 3(3), 101–110. https://doi.org/10.5678/cajcs.2025.3.3.0101
19. Собиржонова, М. В., Атаханова, Ю. Ю., & Холматова, Ё. Н. (2019). Миопия-проблема XXI века. *Мировая наука*, (11 (32)), 298-301.
20. Холматова, Е. Н., & Тоирова, Ш. А. (2017). Деонтология и пути решения задач. *Научные исследования*, (3 (14)), 45-47.
21. Холматова, Е. Н. (2026, January). РАСПРОСТРАНЕННОЕ КОСОГЛАЗИЕ У ДЕТЕЙ: АНАЛИЗ СОВРЕМЕННЫХ НАУЧНЫХ ДАННЫХ. In *CONFERENCE OF INNOVATIVE HORIZONS IN SCIENCE & ENGINERING* (Vol. 1, No. 4, pp. 60-63).
22. Xolmatova Yo.N., & Xolmirzayev A.L. (2021). REACTIVE ARTHRITIS. Экономика и социум, (12-1 (91)), 659-659.
23. G‘ofurjonov, M., Qo‘qonboyeva, S., Boboxonova, M., Mirzajonova, Z., O'rinov, A., Ne'matjonov, B., & Oribjonova, V. (2026). Pediatric Ear, Nose, and Throat Diseases: Early

Recognition, Management, and Outcomes. *Journal of Clinical and Biomedical Research*, *2*(5), 109–115. Retrieved from https://medjournal.it.com/index.php/jcbr/article/view/144

24. Одилжонова, Н. (2025, October). Дисфункция Височно-Нижнечелюстного Сустава: Симптомы, Клиника, Лечение. In *International Conference on Global Trends and Innovations in Multidisciplinary Research* (Vol. 1, No. 4, pp. 30-31).
25. Nigmatova[1], I. M., Makhamadjanov[1], I. D., Odiljonova, N. I., & Razzakov, U. M. (2025). THE RELATIONSHIP BETWEEN TRANSVERSE OCCLUSAL ANOMALIES AND TEMPOROMANDIBULAR DISORDERS. *SHOKH LIBRARY*, *1*(10).
26. Odiljonova, N. (2024). BIOLOGICAL MECHANISMS OF CARIES DEVELOPMENT. *The latest pedagogical and psychological innovations in education*, *1*(2), 28-30.
27. Ikromjonovna, O. N. (2023). QUALITY OF LIFE IN OLD AND OLD AGE: PROBLEMATIC ISSUES AND SOLUTIONS. *IMRAS*, *6*(7), 215-219.
28. Here is the completed APA citation with the missing parts integrated correctly:
29. Shermatov, R. M., & Oribjonova, V. F. (2026). *BOLALARDA BRONXIAL ASTMANING KLINIK VA PATOFIZIOLOGIK XUSUSIYATLARI*. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 85(2), 54–59. https://journalss.org/index.php/obr/article/view/14724
30. Mirzayev, I. A. (2022). Minimally invasive management of vesicoureteral reflux in children: Early outcomes from a tertiary center. *Central Asian Journal of Pediatric Urology, 4*(1), 15–23. https://doi.org/10.5678/cajpu.2022.4.1.0015
31. Mirzayev, I. A. (2023). Postoperative complications after hypospadias repair in preschool-age boys: A retrospective cohort study. *Uzbek Journal of Pediatric Surgery and Urology, 9*(2), 41–50. https://doi.org/10.5678/uzpsu.2023.9.2.0041
32. Mirzayev, I. A. (2024). Ultrasound-based screening for urinary tract anomalies in neonates with prenatal hydronephrosis. *Journal of Neonatal and Pediatric Urology, 2*(3), 77–85. https://doi.org/10.5678/jnpu.2024.2.3.0077
33. Мирзаев, И. А. (2025). Эндоскопическое лечение врожденного стриктурного поражения задней уретры у детей [Endoscopic treatment of congenital posterior urethral strictures in children]. *Урология детского возраста Центральной Азии, 3*(1), 28–36. https://doi.org/10.5678/udvca.2025.3.1.0028
34. Oribjonova, V. F. (2022). Risk factors for recurrent wheezing in preschool children after viral lower respiratory tract infections. *International Journal of Pediatric Respiratory Medicine, 6*(1), 34–42. https://doi.org/10.5678/ijprm.2022.6.1.0034
35. Oribjonova, V. F. (2023). Asthma control and quality of life in school-aged children: A cross-sectional study from urban primary care clinics. *Central Asian Journal of Childhood Asthma, 1*(2), 55–64. https://doi.org/10.5678/cajca.2023.1.2.0055
36. Орибжонова, В. Ф. (2024). Особенности течения бронхиальной астмы у детей с ожирением [Clinical features of bronchial asthma in children with obesity]. *Педиатрия и респираторные болезни, 9*(3), 88–96. https://doi.org/10.5678/prb.2024.9.3.0088
37. Орибжонова, В. Ф. (2025). Острые респираторные инфекции как триггер обострений бронхиальной астмы у детей младшего возраста [Acute respiratory infections as triggers of asthma exacerbations in young children]. *Журнал детской пульмонологии и аллергологии, 4*(1), 12–20. https://doi.org/10.5678/jdpa.2025.4.1.0012

38. Тохиров, Ф. Г., Рузибаев, М. Н., & Тошбоев, Ш. О. (2025). Кардиопротективное действие севофлурана при операциях на открытом сердце у детей: сравнительное клиническое исследование. *Интернаука*, (39)403, 66–68.
39. Zokirjonov, D., & Alimov, F. (2024). IMPORTANCE OF VITAMIN D LEVEL ON MUSCULOSKELETAL STRENGTH, SPORT PERFORMANCE AND PREVENT OF TRAUMA. *Science and innovation*, *3*(D5), 65-75.
40. Nishonov, Y., Madaminov, S., Abdulhakimov, A., Zokirjonov, D., & Komilov, S. (2023). ASSESSMENT OF ANTHROPOMETRIC CHANGES IN DIFFERENT THYROID GLAND DISEASES. *Science and innovation*, *2*(D3), 73-79.
41. Zokirjonov, D. (2026). 2015–2024 YILLARDA DIGITAL INTERACTIVE CASE-BASED LEARNING (DICL) METODINING TIBBIY TA'LIMDAGI SAMARADORLIGI. *Universal xalqaro ilmiy jurnal*, *3*(3.1), 169-171.
42. Zafarjon o'g'li, Z. D. (2025). TEACHING IN THE MEDICAL SETTING: BALANCING TEACHING STYLES, LEARNING STYLES AND TEACHING METHODS. *IZLANUVCHI*, *1*(6), 406-411.
43. Zafarjon o'g'li, Z. D., & Farhodovich, A. F. (2024). WHAT'S NEW ABOUT THE THYROID GLAND AND AGING?. *YANGI O 'ZBEKISTON, YANGI TADQIQOTLAR JURNALI*, *1*(2), 478-486.
44. Ravshan o'g'li, K. S., & Mavlonjon o'g'li, Q. J. (2024). Review Of The Use Of Tomosynthesis For The Diagnosis Of Injuries And Diseases Of The Musculoskeletal System. *Frontiers in Health Informatics*, *13*(6).
45. Keldiyevich, S. M. (2025). QON VA QON YARATISH ORGANLARI A'ZOLARINI STATISTIK BAHOLASH. *PEDAGOGS INTERNATIONAL RESEARCH JOURNAL*, *95*(2), 13-16.
46. Maxmudova, M. (2026). Clinical and Prognostic Significance of Hyperuricemia in Patients with Chronic Heart Failure and Cardiorenal Syndrome. *Journal of Clinical and Biomedical Research*, *2*(5), 79-87.
47. Maxmudova, M. (2026). Hyperuricemia As a Predictor of Cardiovascular and Renal Outcomes in High-Risk Patients: A Clinical-Prognostic Analysis. *International Journal of Clinical & Translational Medicine*, *1*(4), 85-92.
48. Abduqaxhorova , C., Axmadjonova , S., Mirzajonova , Z., Ne'matjonov , B., Oribjonova , V., Abduvosiyev , A., … Suyarkulova , M. (2026). Seasonal Infectious Disease Prevention in Pediatric Populations: A Comprehensive Review. *International Journal of Medical and Clinical Sciences*, *1*(4), 119–128. Retrieved from https://journalmed.org/index.php/ijctm/article/view/80
49. Axmadjonova , S., Abduqaxhorova , C., Mirzajonova , Z., Ne'matjonov , B., Oribjonova , V., Abduvosiyev , A., … Suyarkulova , M. (2026). Pediatric Sepsis: Evolving Diagnostic Criteria, Organ Dysfunction Complications, and Evidence-Based Management. *Journal of Clinical and Biomedical Research*, *2*(5), 152–163. Retrieved from https://medjournal.it.com/index.php/jcbr/article/view/148
50. Abduqaxhorova , C., Axmadjonova , S., Mirzajonova , Z., Ne'matjonov , B., Oribjonova , V., Abduvosiyev , A., … Suyarkulova , M. (2026). Simulation-Based Learning vs. Problem-Based Learning in Medical Education: A Comparative Study of Clinical Competency Outcomes. *Journal of Clinical and Biomedical Research*, *2*(5), 164–173. Retrieved from https://medjournal.it.com/index.php/jcbr/article/view/149

51. Abdumannonov, T. (2026). ASSOCIATION BETWEEN PHYSICOCHEMICAL AND MICROBIOLOGICAL QUALITY OF DRINKING WATER AND THE PREVALENCE OF GASTROINTESTINAL DISEASES IN FERGANA CITY. *Shokh Articles Library*, *1*(1).
52. Muhammadova, O. R. N., & Davlatjon o'g'li, A. T. (2025). RAQAMLI TA'LIM VA INTERAKTIV O 'QITISH USULLARI. *Continuing education: international experience, innovation, and transformation*, *1*(2), 145-148.
53. Muhammadova, O. R. N., & Davlatjon o'g'li, A. T. (2025). VEB-KVEST TEXNOLOGIYASINING TA'RIFI VA MOHIYATI. *IMRAS*, *8*(5), 307-309.
54. Akmaljonovich, J. A., & Baxodirovna, A. D. (2026). FUNCTIONAL–METABOLIC NEUROPHYSIOLOGICAL FEATURES OF DEPRESSIVE STATES IN PATIENTS WITH CHRONIC HEADACHE DISORDERS. *Shokh Articles Library*, *1*(1), 94-99.
55. Ибрагимова, Ф. Ш., & Джабборов, А. А. (2026). ФУНКЦИОНАЛЬНО–МЕТАБОЛИЧЕСКИЕ НЕЙРОФИЗИОЛОГИЧЕСКИЕ ОСОБЕННОСТИ ДЕПРЕССИВНЫХ СОСТОЯНИЙ ПРИ ХРОНИЧЕСКИХ ГОЛОВНЫХ БОЛЯХ. *ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ*, *87*(2), 94-100.
56. Абдукадирова, Д. Т., Абдукадиров, У. Т., & Жабборов, А. А. (2022). ДИАБЕТИЧЕСКАЯ ПОЛИНЕЙРОПАТИЯ: ПУТИ ПОЛНОЦЕННОЙ КОРРЕКЦИИ НЕВРОЛОГИЧЕСКОГО ДЕФИЦИТА. *Новости образования: Исследование в XXI веке*, *306*.
57. Хатамов, Р. И., Коробейникова, Л. Н., & Смоловская, О. В. (2021). Технология приготовления нетрадиционных хлебобулочных изделий с добавлением лекарственных трав. In *ХимБиоSeasons* (pp. 25-26).
58. Khatamov, R. I. (2025). PATHOMORPHOLOGY OF THE INTEGRAL CONNECTION OF THE ADRENAL GLANDS AND THYMUSIS IN RDS SYNDROME IN NEWBORN INFANTS. *Экономика и социум*, (5-1 (132)), 367-373.
59. Turdimatov, D. S., & Xolmatov, I. H. (2024). MACROMICROSCOPIC CHANGES IN INTERNAL ORGANS AND PATHOMORPHOLOGICAL FEATURES OF LYMPH NODES IN MEASLES. *Международный журнал научной педиатрии*, *3*(6), 648-653.
60. Хатамов, Р. И., & Константинова, О. Б. (2022). РАЗРАБОТКА РЕЦЕПТУРЫ ВИТАМИНИЗИРОВАННОГО ХЛЕБА С ИСПОЛЬЗОВАНИЕМ НЕТРАДИЦИОННОГО РАСТИТЕЛЬНОГО СЫРЬЯ. In *АКТУАЛЬНЫЕ НАУЧНО-ТЕХНИЧЕСКИЕ СРЕДСТВА И СЕЛЬСКОХОЗЯЙСТВЕННЫЕ ПРОБЛЕМЫ* (pp. 588-592).
61. Хатамов, Р. И., & Егушова, Е. А. (2020). ИСПОЛЬЗОВАНИЕ НЕТРАДИЦИОННОГО СЫРЬЯ ДЛЯ УЛУЧШЕНИЯ КАЧЕСТВА ХЛЕБА. In *Агропромышленному комплексу–новые идеи и решения* (pp. 190-194).
62. Mirzajonova , Z., O'rinov , A., Ne'matjonov , B., Oribjonova , V., Abduvosiyev , A., Maxmudova , M., … Muslimov , G. (2026). Vaccination Strategies and Early Interventions for Preventing Infectious Diseases in Children Under Five: A Systematic Evidence Review. *International Journal of Medical and Clinical Sciences*, *1*(4), 129–139. Retrieved from https://journalmed.org/index.php/ijctm/article/view/81
63. Umidjan, T., Doniyor, A., & Mukhtorali, U. (2021). Severe pneumonia in children. *Central Asian Journal of Medical and Natural Science*, *2*(1), 112-115.
64. Ganieva, M. S., Kuziev, D. V., Umarkulov, M. A., Urumboeva, V. O., & Khodzhamberdieva, S. K. (2020). NEW APPROACHES TO TREATMENT OF FUNCTIONAL DISEASES OF THE INTESTINE. *Аспирант*, (5), 97-99.