

A Public Health Approach To Pediatric Wellness Via Nasal Application (*Pratimarsha Nasya*)

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ABSTRACT

Air pollution poses a significant global health challenge, particularly for vulnerable groups like children. As we know, Pollutants are associated with serious problems affecting the respiratory, cardiovascular, and neurodevelopmental systems. Children are especially at risk due to their developing systems and higher pollutant intake, leading to conditions like asthma, allergic rhinitis, and cognitive delays. Traditional Ayurvedic therapies, such as *Pratimarsha Nasya* (Nasal instillation), offer a promising preventive approach for the same. This practice involves medicated nasal oils application to strengthen the nasal mucosa, reduce inflammation, and limit pollutant exposure. These oils possess anti-inflammatory and antioxidant properties which help to enhance immunity and protect against respiratory diseases. Integrating this into public health strategies could provide a cost-effective and non-invasive method to address pollution's health impacts. Studies suggest its efficacy in reducing symptoms of allergic rhinitis and asthma while supporting immune modulation. However, limited empirical evidence and cultural acceptance remain barriers to widespread adoption. Interdisciplinary research and awareness campaigns are essential to overcome these challenges. By aligning Ayurvedic methods with modern health needs, *Pratimarsha Nasya* could serve as a holistic preventive measure, reducing pollution-related diseases in children and contributing to global health resilience.

Introduction

Air pollution is a major global concern with serious health consequences, caused by pollutants such as particulate matter (PM), nitrogen oxides (NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), and ground-level ozone (O₃). Common sources of air pollution include traffic emissions, coal-fired power plants, wood-burning stoves, and forest fires. Toxicants from these sources can affect organ development from the fetal stage to late childhood.¹

Air pollution is the most common type of pollution and is known to negatively impact the respiratory, cardiovascular, neurobehavioral, and immune systems.² PM_{2.5}, or fine particulate matter, poses a significant health risk as it can reach deep into the lungs and bloodstream, worsening conditions such as asthma, COPD, and heart disease.³ Children are particularly susceptible to air pollution because their lungs, brains, organs, and immune systems are still developing. Their faster breathing rate also increases pollutant intake.⁴ Air pollution leads to allergic rhinitis⁵, eye and throat irritation⁶, asthma and respiratory infections⁷, headaches⁸ etc. Its long-term effect also contributes to premature mortality, cognitive decline, and neurodevelopmental disorders.⁹ In 2017, the nation had the highest global under-five mortality rate, with malnutrition responsible for 68.2% of deaths, followed by unsafe water and sanitation (10.8%) and air pollution (8.8%).¹⁰ Urbanization and industrialization

have intensified pollution, making it a public health priority. The WHO attributes millions of premature deaths annually to outdoor air pollution.¹¹

Addressing this challenge necessitates the implementation of innovative strategies, encompassing the integration of clean energy technologies, advanced pollution mitigation measures, and sustainable urban development frameworks. Equally vital are initiatives aimed at enhancing public awareness, formulating evidence-based policies, and fostering global collaboration to mitigate health risks and establish a foundation for a healthier and more sustainable future.

Nasal health is particularly affected, as pollutants like PM_{2.5} and ozone damage the mucosal barrier, reducing drug efficacy and increasing chronic disease risks.¹² Protective therapies such as antioxidant nasal sprays, immunomodulatory agents, and Ayurvedic practices like *Pratimarsha Nasya*, which employ medicated oils to trap and expel pollutants, offer relief. These approaches, alongside improved nasal hygiene and drug delivery methods, are essential for mitigating air pollution's systemic and neurological effects. *Pratimarsha Nasya*, helps to trap, detoxify, and expel pollutants from the nasal passages using medicated oils that form a protective barrier.¹³ Numerous studies have indicated that oils enriched with anti-inflammatory and antioxidant herbs can help alleviate oxidative stress, improve mucociliary clearance, and promote respiratory well-being. Consistent use strengthens the nasal barrier, lowers the risk of pollution-related issues such as rhinitis and sinusitis, and provides overall benefits by harmonizing *Dosha* and soothing the nervous system.¹⁴

The nasal passages, with their extensive surface area and vascularized mucosa, are vulnerable to pollutants, causing oxidative stress, inflammation, and barrier damage that may impact systemic and neurological health.¹⁵ Practices like improved nasal hygiene, protective measures, and *Pratimarsha Nasya* can help mitigate these risks and promote overall well-being.

Material & Methods

Information on "*Pratimarsha Nasya*" was gathered from key Ayurvedic texts (*Charaka Samhita*, *Ashtanga Hridaya*, *Sushruta Samhita*, *Ashtanga Sangraha*) and electronic databases (Google Scholar, PubMed, Google Search, Ayush Research Portal). Search terms like air pollution, *Nasya*, *Pratimarsha Nasya*, nasal drug delivery, nasal pathways etc were used. Identified articles were screened for duplicates, irrelevant data, non-English language content.

Impact of air pollution on children's health

Air pollution has numerous harmful effects on children's health. Studies link it to conditions such as allergic rhinitis & asthma^{16,17}, pneumonia¹⁸, lung development abnormalities¹⁹, acute respiratory infections²⁰⁻²², developmental delays & behavioral issues^{23,24}, poor academic performance²⁵, and insomnia²⁶. Exposure to polluted air is also significantly associated with depression.²⁷ Additionally, research highlights links between air pollution and stunting, wasting, being underweight, low birth weight, premature delivery, and stillbirth.²⁸⁻³¹ Notably, third-trimester exposure to PM_{2.5} has been strongly correlated with newborn mortality.³²

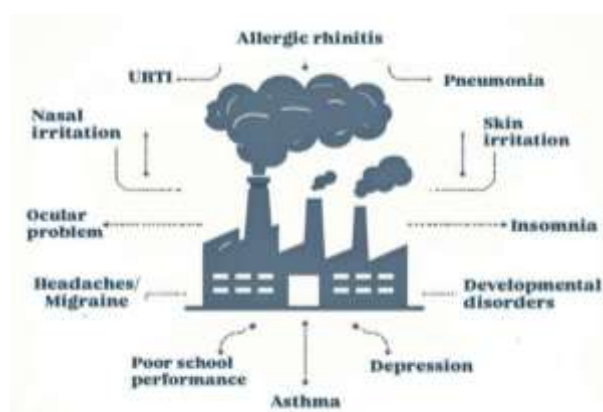


Figure 1: Air Pollution and its Impact on Health

Pratimarsha Nasya: A Historical Perspective

Nasya (nasal instillation) is one of Ayurveda's main five procedures (*Panchakarma*). It is a therapeutic procedure where medicated oil, *Swarasa* (extracted juice), *Churna* (fine powder), or *Kwatha* (decoction) etc is used. “*Nasa hi sirso dwaram*”, The nose serves as the entrance to the head (or the brain)³³ and *Nasya* therapy is primarily recommended for conditions caused by the accumulation and aggravation of *Doshas* in the head and neck. There are five types of *Nasya* according to *Acharya Charak* i.e. *Navana* (medicated oil nasal instillation), *Avapeeda* (squeezing or extracting nasal instillation), *Dhmapana* (medicated nasal insufflation), *Dhuma* (fumigation), and *Pratimarsha Nasya* (daily or gentle nasal instillation) is one of the five types of *Nasya* in which *Sneha* (oil based composition) is used. This procedure has no complications and used for both *Sodhana* (purification)and *Shaman* (pacification).³⁴ The process is simple, easy to manage independently, and free of complications. Another classification by *Acharya Vagbhata* is *Marsha Nasya* and *Pratimarsha Nasya*. They are also type of *Sneha Nasya* and the only difference is the amount of *Sneha* that is used. *Pratimarsha Nasya* serves both the purpose i.e. *Snehana* (Oleating) and *Shodhana* (Purificatory) and does not produce any ill effects.³⁵ *Acharya Vagbhata* stated that *Pratimarsha Nasya* is beneficial throughout life, from birth to death.³⁶

Dose of Pratimarsha Nasya:

Acharya Vagbhata has prescribed 2 *Bindu* (Drops) of oil to be applied to each nostril.³⁷ This practice is recommended to be performed in the morning, at night, and at any time throughout the day, using an oleated finger for nasal application. It is important not to inhale the substance deeply. This treatment is beneficial for individuals in good health and is intended to enhance the strength of the head.³⁸

PRATIMARSHA NASYA KALA:

According to *Acharya Sushruta*, there are 14 *Kalas* (specific timings) for administering *Pratimarsha Nasya*, which are as follows:³⁹

Table 1: Pratimarsha Nasya Kala (Time)

S. No.	Kala (Time)	Benefits/Significance
1.	<i>Shayanotthita Kala</i> (After waking up in the morning)	Helps expel accumulated <i>Kapha</i> from nasal passages, clears the mind, lightens the head, and enhances mental clarity.
2.	<i>Dantaprakshaloparanta</i> (After brushing the teeth)	Strengthens the teeth, keeps the mouth fresh, and promotes a pleasant smell.
3.	<i>Bahirgamana Kala</i> (Before going out for daily work)	Lubricates nasal passages, moistens the mucosa, protects the upper respiratory tract, and guards against environmental irritants like fumes and dust.
4.	<i>Vyayamottara Kala</i> (After exercise)	Alleviates tiredness, reduces exertion, and relieves stiffness in the body.
5.	<i>Vyavayottara Kala</i> (After sexual activity)	Replenishes energy and counters the fatigue caused by coitus.
6.	<i>Yatra/Adhwashranta Kala</i> (After long journeys/ prolonged walking)	Relieves tiredness and reduces physical stiffness and fatigue.
7.	<i>Mala Visarjanoparanta Kala</i> (After defecation)	Reduces heaviness in the eyes and clears congestion.
8.	<i>Mutra Visarjanoparanta Kala</i> (After urination)	Alleviates heaviness in the eyes and clears nasal passages.
9.	<i>Kavaloparanta Kala</i> (After gargling)	Enhances eyesight and promotes clarity of vision
10.	<i>Anjanoparanta Kala</i>	Improves eyesight and promotes visual acuity.

	(After applying collyrium)	
11.	Bhojanottara Kala (After meals)	Cleanses bodily channels and supports digestion.
12.	Vamanottara Kala (After therapeutic emesis)	Removes residual <i>Kapha</i> from the throat and enhances appetite.
13.	Divashayanotthita Kala (After waking up from a daytime nap)	Reduces bodily heaviness and restores alertness.
14.	Sandhya Kala (During evening)	Clears the respiratory tract and promotes restful sleep.

Acharya Vagbhata, however, added an additional *Kala* (Time), *Hasyoparanta* (After laughing), and replaced *Shiro Abhyangaparanta* (After head massage) with *Bahirgamana Kala* (before going out) in the list. Among all the mentioned *Kala*, *Bahirgamana Kala* (before going out) appears to be the most suitable time for *Pratimarsha Nasya*, offering protection against air pollutants.

Evidence indicating the potential benefits of *Pratimarsha Nasya*

Pratimarsha Nasya, as described by Acharya Vagbhata, is a therapeutic practice that purifies bodily channels, alleviates fatigue, enhances vision, strengthens teeth, and balances *Vata Dosha*.⁴⁰ Modern research supports its efficacy in countering the adverse effects of air pollution, enhancing mucosal immunity, and reducing respiratory illnesses.⁴¹ It has proven beneficial in managing Allergic Rhinitis (AR). *Pratimarsha Nasya* with *Shadbindu Tail* and *Haridra Khanda* alleviates symptoms such as rhinorrhea, nasal obstruction, sneezing, and itching⁴², while *Anu Taila Nasya* with *Shirisha Avaleha* significantly reduces IgE levels.⁴³ Similarly, *Nasya* with *Rathulunu Thailaya* and *Triphala Kwatha* is effective in chronic rhinitis.⁴⁴ *Pratimarsha Nasya* with *Anu Taila* effectively relieves allergic rhinitis symptoms like sneezing, runny nose, nasal congestion, and itching. Combined with yoga and a balanced diet, it helps prevent *Pratishyaya*.^{45,46} The therapy also shows promising results in respiratory conditions like *Tamaka Shwasa* (seasonal bronchial asthma), improving FVC, FEV1%, and reducing AEC levels,⁴⁷ and in children with recurrent upper respiratory infections including nasal discharge, nasal obstruction, expectoration, cough, sore throat, mild fatigue, and fever, using *Tulsi Swarasadi Taila* and *Akshadi Yog*.⁴⁸

In neurological and psychological conditions, *Pratimarsha Nasya* has shown notable benefits. *Goghrita Nasya* with *Kusthadi Shirolepa* alleviates *Vataja Sirasula* (headaches)⁴⁹, It also alleviates symptoms like eye strain, irritation, redness, discharge, blurred vision, and headaches.⁵⁰ It also helps in insomnia when performed using *Ksheerbala* (14 Aavartita).⁵¹ *Brahmidrakshadi Kashayam* and *Panchagavya Ghrita Pratimarsha Nasya* exhibit significant antidepressant effects.⁵² *Siddharthaka Agada Arka Pratimarsha Nasya* aids in managing depressive disorders (*Kaphaja Unmada*).⁵³ Additionally, *Saraswata Ghrita*-based *Pratimarsha Nasya* is useful for Autism⁵⁴, while *Anu Taila Nasya* combined with *Shirodhara* and *Matra Basti* has shown positive results for ADHD.⁵⁵

Immune Modulation Through Nasal Administration

Nasal administration takes advantage of the nasal mucosa's vascular and immune properties to influence both local and systemic immune responses. It delivers bioactive compounds directly to the respiratory tract, boosting antibody production (e.g., IgA) and stimulating innate immunity.⁵⁶ Nasal administration has shown promise for immune modulation, utilizing the nasal mucosa's vascularity and immune activity. Nasal Foralumab, an anti-CD3 monoclonal antibody, helps reduce inflammatory markers like IL-6 and C-reactive protein in COVID-19 patients while modulating T-cell activity.⁵⁷ Additionally, mesenchymal stem cell-derived supernatants administered nasally reduced lung inflammation in mice by balancing pro- and anti-inflammatory cytokines.⁵⁸ Combining antigens and immunomodulators at different mucosal sites enhances IgA and IgG production, optimizing immune responses.⁵⁹ These findings suggest nasal administration as a potential treatment for autoimmune diseases, CNS disorders, and infections.

Nasal application of sesame oil improves nasal mucosa, prevents dryness, reduces lung edema and neutrophilic inflammation, and protects the upper respiratory tract.⁶⁰ It also has antioxidant, anti-carcinogenic, analgesic, antibacterial, and anti-inflammatory properties.⁶¹⁻⁶³ This method of nasal administration using substances like herbal oils or vaccines will also reduce inflammation, improve pathogen clearance, and strengthen the mucosal barrier, enhancing the body's defense against airborne threats while minimizing side effects.

Mode of Action of *Nasya*

Nasya drug administered through nasal route enters into *Shringataka Marma*, spreads into *Murdha* and from there reaches to *Netra*, *Srotra*, *Kantha*, *Siramukhas* etc.⁶⁴

In modern medicine, nasal drug delivery has become a viable alternative to intravenous administration, offering advantages such as a large surface area, a permeable endothelial membrane, increased blood flow, bypassing first-pass metabolism, and convenient accessibility.⁶⁵ This method is now used for both local and systemic effects, with lipophilic drugs showing high absorption rates and bioavailability nearing 100% in many cases.⁶⁶ The nasal cavity's extensive surface area and rich vascularization enable rapid absorption and effectiveness.

The nose is a complex organ and consists of three distinct regions: Olfactory region, Vestibular region, Respiratory region, .⁶⁷⁻⁷¹

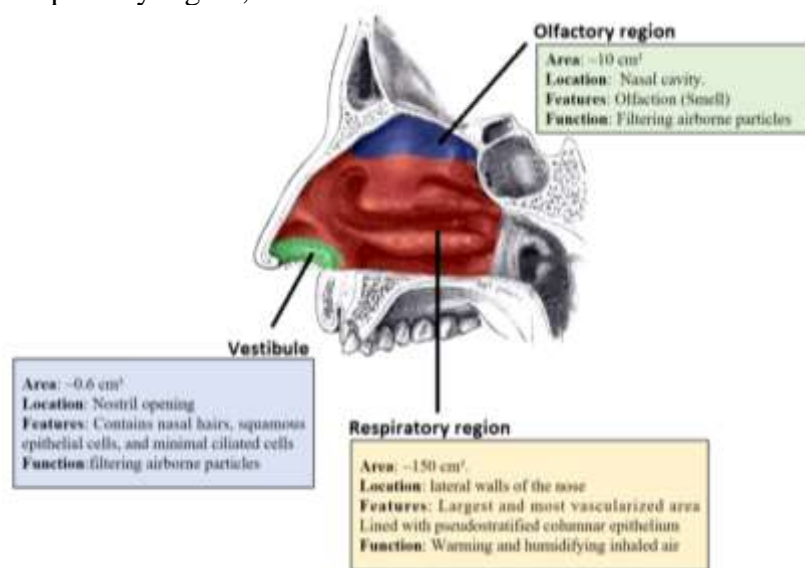


Figure 2: Nasal region with Anatomy & Functions

Nasal Drug Delivery:⁷²⁻⁷⁶

Nasal drug administration enables quick absorption through the mucous membrane for both local and systemic effects, while also providing direct CNS access by bypassing the blood-brain barrier.

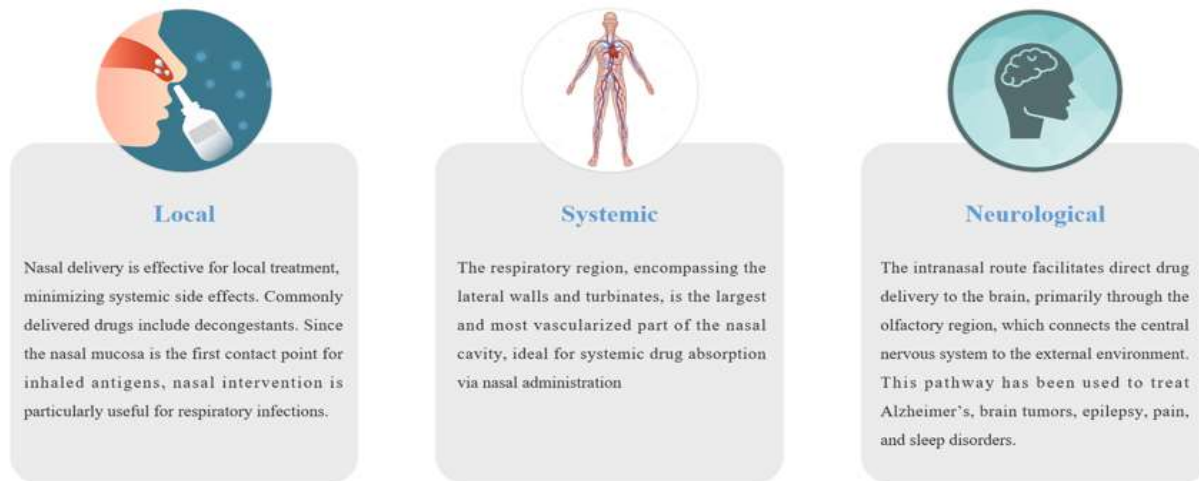


Figure 3 : Nasal Drug Delivery System

Integrating *Pratimarsha Nasya* into Public Health Initiatives

Integrating Nasal application into public health strategies could provide a natural, preventive approach to reduce the health impacts of air pollution. Medicated oils used in *Nasya* having anti-inflammatory and antimicrobial compounds can neutralize allergens and toxins while maintaining mucosal integrity. By promoting daily *Nasya* as part of personal health regimens, public health initiatives can help individuals better resist respiratory disorders caused by pollution. This cost-effective, non-invasive method aligns with holistic health promotion and could complement existing measures like air quality management and education on pollution risks.

Challenges and Opportunities in Promoting *Pratimarsha Nasya*⁷⁷

Pratimarsha Nasya, a subtle form of Ayurvedic nasal therapy, holds promise for holistic well-being by harmonizing *Pran Vayu* with mental clarity. Challenges in its promotion include a lack of widespread awareness, limited empirical evidence to support traditional claims, and difficulties in integrating it into modern healthcare systems. However, its simplicity, safety for daily use, and potential to enhance immunity and respiratory health offer significant opportunities. Awareness campaigns emphasizing its role in preventive care and disease management, coupled with clinical research validating its efficacy, can bridge traditional practices and contemporary healthcare needs.

Strategies to Raise Awareness About *Pratimarsha Nasya*⁷⁸

Raising awareness about *Pratimarsha Nasya* requires a multifaceted approach combining traditional wisdom and modern outreach. Key strategies include public education on its respiratory and stress-relief benefits, wellness program integration, and workshops led by Ayurvedic practitioners. Collaboration with healthcare providers and scientific validation can enhance credibility. Digital platforms, social media, and apps can effectively engage younger audiences. Incorporating it into school and workplace wellness initiatives further broadens its reach.

Discussion

Children are more susceptible to the harmful effects of air pollution compared to adults due to several anatomical and physiological reasons. They breathe faster than adults, increasing their exposure to air pollutants relative to their body weight. Their respiratory system is still developing, making it more susceptible to damage, with lungs continuing to grow until late adolescence, which means early exposure can have long-term consequences.⁷⁹ Additionally, children have smaller airways, making them more prone to obstruction or inflammation from pollutants, as even minor swelling can significantly affect airflow. They also spend more time outdoors, often engaging in physical activities that increase their exposure to pollutants, particularly in areas with poor air quality. Furthermore, their immune systems are still developing, and their airway epithelium is more susceptible to pollutants,

making it less effective in protecting against and combating the harmful effects of environmental toxins.⁸⁰ The smaller size of their nasal cavity also limits the effectiveness of filtering particulate matter, and being closer to the ground exposes them to higher concentrations of ground-level pollutants like heavy metals and particulates. These combined factors make children especially vulnerable to the adverse health effects of air pollution, including respiratory illnesses, allergies, and impaired long-term lung function. Nasal application has demonstrated several potential benefits for children when appropriately administered.

Pratimarshanasya Nasya (Nasal instillation), offers a novel perspective by emphasizing preventive care through enhanced nasal hygiene. Nasal application of oil-based compounds is effective in nasopharyngeal protection by creating a biological mask, a protective barrier over the nasal mucosa.⁸¹ This barrier potentially prevents pollutants from entering the respiratory tract, reducing inflammation and allergic responses commonly seen in polluted environments. It could serve as a preventive tool against conditions like asthma, allergic rhinitis, sinusitis etc. The nasal route provides a direct connection to the brain via the olfactory nerves, making *Pratimarsha Nasya* a valuable practice for enhancing cognitive functions and supporting overall mental clarity.⁸²

Research studies show that immune modulation through nasal administration enhances both mucosal immunity and overall systemic resilience. Research conducted during COVID-19 emphasized the significance of *Pratimarsha Nasya* in enhancing immunity and preventing upper respiratory tract infections, reinforcing its role in preventive healthcare strategies.⁸³ The inclusion of nasal therapies in public health strategies could complement existing measures, such as air quality management and public education on pollution's risks, offering a holistic approach to mitigating health impacts.

Despite its potential, several challenges hinder the widespread adoption of *Pratimarsha Nasya*. Limited empirical evidence and the lack of integration into modern healthcare frameworks remain significant barriers. Furthermore, cultural and educational gaps in understanding traditional therapies restrict their acceptance among broader populations. To overcome these challenges, interdisciplinary research that bridges Ayurveda and modern science is essential.

The therapy aligns well with pediatric public health strategies, emphasizing preventive care and holistic wellness. It complements other holistic health approaches like *Dinacharya* (daily regimen) and *Ritucharya* (seasonal regimen).⁸⁴ Its integration into routine care, particularly in urban and industrial areas with high pollution levels, could reduce the healthcare burden by lowering the incidence of pollution-related respiratory diseases. Awareness campaigns and collaboration with schools and pediatric clinics can play a vital role in normalizing its use.

By incorporating *Pratimarsha Nasya* into public health strategies, pediatric care can address both immediate health issues like respiratory allergies and long-term cognitive benefits. Further, this practice's affordability and ease of application make it an accessible and scalable intervention for communities.

Conclusion

The article reinforces the urgency of addressing air pollution as a public health priority. The innovative perspectives offered in the article, particularly on nasal health and Ayurvedic interventions, highlight the potential for integrating traditional approaches to enhance resilience against pollution-induced health risks. Moving forward, a concerted effort involving research, education, policy-making, and public engagement will be instrumental in mitigating the far-reaching effects of air pollution and securing a healthier future for vulnerable populations worldwide.

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