



Unlocking the Potential of Nasal Drug Delivery: Strategies for Formulation Success



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As pharmaceutical developers seek innovative ways to improve patient outcomes and adherence, nasal drug delivery has emerged as a versatile and increasingly important route. It offers opportunities for local and systemic therapies, including treatments for allergic rhinitis, CNS disorders, migraines, and even vaccines.

However, nasal delivery isn't without challenges. The nasal cavity acts as a highly evolved barrier designed to keep foreign substances out. Overcoming these defenses requires a deep understanding of nasal anatomy, physiology, and formulation science.

At MedPharm, we have spent years refining strategies and tools to help developers navigate the challenges of topical drug delivery to help bring successful nasal products to market.

Why Nasal Drug Delivery Matters

The global topical drug delivery market was estimated to be worth \$125-\$150 billion in 2024, with the nasal delivery segment representing about 12%, and growing. The appeal of this route of administration lies in its several advantages:

- Rapid absorption through a highly vascularized surface.
- Direct CNS access via the olfactory region, bypassing the blood-brain barrier.
- Non-invasive administration, potentially improving patient compliance.

These benefits make nasal delivery an attractive route for a wide range of therapies—but to be successful developers must overcome unique biological hurdles.

Understanding the Nasal Barrier

The nasal cavity is equipped with multiple defense mechanisms including the mucus layer, which traps particulates and microbes; cilia, responsible for moving mucus and trapped particles toward the throat for clearance; and tight epithelial junctions, which maintain a robust barrier.

While these features protect the body, they accelerate clearance of formulations and reduce drug residence time and absorption. Successful nasal products must therefore be designed to counteract rapid mucociliary clearance and optimize drug delivery to the intended site.

Targeting the Right Nasal Region

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Formulation Strategies for Nasal Delivery

At MedPharm, our approach begins with preformulation studies to assess solubility, stability, and particle size. These insights guide whether a solution or suspension system is most appropriate, with drug-in-solution being simpler, but limited by solubility or drug-in-suspension, which allows for higher drug loading but requires precise particle size control to avoid irritation and ensure effective delivery.

Device compatibility is considered from the outset, as, for example, spray orientation and droplet size can significantly influence deposition patterns. Throughout development, MedPharm scientists perform rigorous characterization—covering mucoadhesion, rheology, osmolality, and particle/droplet size distribution—to select the ‘best few’ most promising prototypes for further testing.

De-risking Development with Advanced Nasal Models

Traditional nasal models using excised animal tissue have served the industry for decades, but they have limitations. MedPharm has pioneered next-generation preclinical tools, such as:

- Reconstructed Nasal Epithelium (RNE): Cultured from human cells at an air-liquid interface, reproducing the ciliated, mucus-producing barrier of the nose.
- The MedCast™ Nasal Cast: 3D-printed from CT scans, customizable for specific delivery strategies and constructed from materials tested for API adherence and extraction efficiency.

These models provide realistic, quantifiable insights into formulation performance and deposition, helping developers make informed decisions early in the process—saving time, reducing risk, and increasing confidence in clinical success.

Partner with MedPharm for Nasal Delivery Excellence

Nasal drug delivery offers immense potential, but success depends on overcoming complex anatomical and physiological barriers. MedPharm combines deep scientific expertise, innovative preclinical models, and end-to-end development capabilities that help its partners navigate these challenges.

Whether you are developing a CNS-targeted therapy, a vaccine, or a systemic treatment, our team can guide you from concept to commercialization with proven strategies and cutting-edge tools.

Read the full article [<gated link here>](#), and Explore all our specialist routes of delivery.