Benefits of Inhaled Drug Delivery

Rapid onset, smaller doses → fewer side effects

Bypasses first-pass metabolism

Effective for poorly absorbed oral drugs

Factors Influencing Deposition

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Breath-holding

Particle aerodynamic diameter

Humidity & formulation properties

Spacer Devices

Reduce throat deposition (down to 15%

Improve lung delivery (~20%)

Eliminate need for timing coordination

Require cleaning; bulky

Formulation Notes

Drug particle:	~5 µm
Carrier particle:	30–60 µm

Must balance adhesion (mixing) with desorption (release)

Nebulizers

General Info:	Converts liquid into inhalable mist

Nebulizers (cont)

		Used for large doses, severe attacks
		Suitable for children and elderly
		Inhaled during normal breathing
Types of Nebulizers:	Jet:	Uses compressed air; most common
	Ultrasonic:	Vibrates crystal → liquid mist
	Mesh:	Liquid pushed through vibrating mesh → fine spray

Mesh Nebulizers offer finer droplets & faster delivery

Formulation for Nebulizers
- Water-based; may include cosolvents, antioxidants
- pH ~7+ preferred to avoid bronchoconstriction
- Usually 1–2.5 mL dose

Respiratory System Overview

Air pathway:	Nasal cavity → pharynx → trachea → bronchi → bronchioles → alveoli
Bronchi:	Cartilage rings, cilia for clearing particles
Bronchioles:	<1 mm diameter; end in alveoli for gas exchange

Correct MDI Technique

1.Shake well, prime if needed
2.Exhale fully, seal lips around mouthpiece
3.Inhale slowly & press inhaler
4.Hold breath for 10 seconds
5.Rinse mouth afterward

Breath-Activated Inhalers

Release dose during inhalation **(e.g. Easi-Breathe, Autohaler)**

Ideal for patients with coordination difficulties

Types of DPI Devices

Single Dose (e.g., Cyclohaler):	Capsule pierced manually
Multidose – Foil-based (Diskhaler, Accuhaler):	Blister packs
Reservoir-based (Turbohaler, Easyhaler):	Multiple doses, drug stored inside

New Technology

Thermal Inhalers:	Thin film drug heated (~400°C), vaporized, and condensed into 1–3 µm particles

Triggered by breath; compact and efficient

Barriers to Drug Delivery

Mucociliary clearance:	removes particles
Pathologies:	inflammation, obstruction, reduced elasticity

Deposition affected by particle size and breathing pattern

Aerosol-Based Delivery

Inhalations:	Vapors from volatile substances or hot water
	Examples: eucalyptus oil, propylhexedrine
Vitrellae:	Crushed glass capsules releasing vapors
	Example: amyl nitrite for angina

Dry Powder Inhalers (DPIs)

Overview:	Breath-activated → no propellants needed
	Drug in dry powder form, usually with a carrier (e.g., lactose)
	Requires deep, strong inhalation to disperse powder
Advantages:	Larger doses possible
	No need for coordination
Disadvantages:	Performance depends on user's inspiratory effort
	Drug exposed to humidity
	Generally more expensive

Proper DPI Technique
1.Exhale away from inhaler
2.Inhale quickly and deeply
3.Hold breath 10 seconds
4.Don't breathe into device (moisture clumps powder)

Particle Deposition Mechanisms

Inertial Impaction (>5 µm):	Upper airways
Sedimentation (~1–5 µm):	Bronchi/bronchioles

Particle Deposition Mechanisms (cont)

Diffusion (<0.5–1 µm):	Alveoli or exhaled

Ideal size for lung deposition: 1–5 µm

Metered Dose Inhalers (MDIs)

Features:	Pressurized canister delivers metered dose
	Propellants: HFA (replaced CFCs)
	Dose reliability decreases near empty
Formulation:	Mostly suspensions due to poor solubility in propellants
	Evaporation affects particle size
Advantages	Only 10–15% of dose reaches lungs
	High velocity = throat deposition (up to 80%)
	Requires coordination; poor compliance
Disadvantages	Only 10–15% of dose reaches lungs
	High velocity = throat deposition (up to 80%)
	Requires coordination; poor compliance

Key Info

Particle size is key for targeting specific areas in the lungs.
MDIs are common but inefficient unless paired with a **spacer.**
DPIs require strong inhalation—less suitable for some patients.
Nebulisers are best for **high dose** delivery in critical care or paediatric use.
New tech like thermal inhalers offers promising advancement.