“Inhalers: patients do the silliest things……..”

(Inhaler Devices and Inhaler Technique)

Tuesday 29th April 2008

Jon Bell

Canday Medical Limited

Who ?

Pharmaceutical companies – sales & marketing, then clinical research

Medical device company – peak flow, spirometry, inspiratory (In-Check)

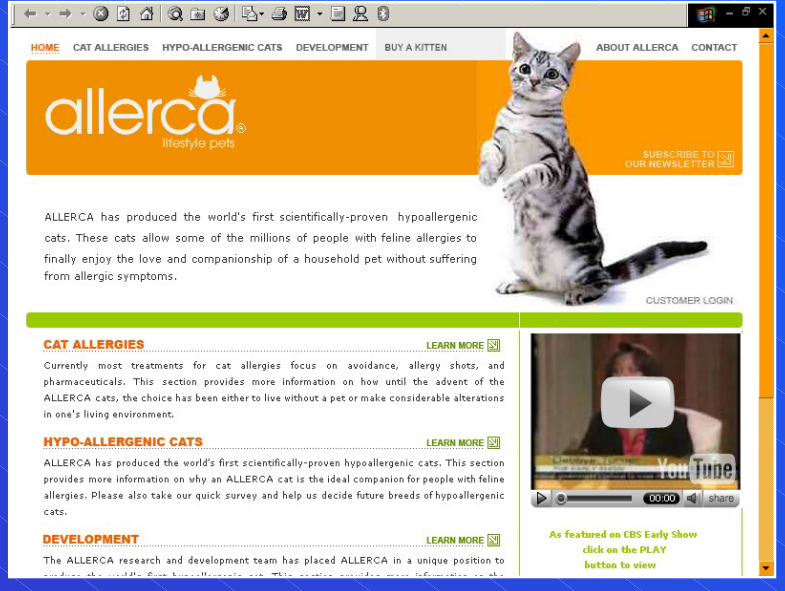
Present – independent research "inspiratory" – measurement & training

(Asthmatic; triggers - cat dander + lime cordial)

Aims / Goal ?

1. Promote improved care through better understanding of basic aerosol science and device characteristics
2. Minimise waste with inhaled drug therapies
3. Suggest that objective measurement of inhaler technique can help rationalise prescribing and improve patient outcomes.

Asthma and Pets



Guideline recommendations
(NICE COPD 2004)

Issue date: February 2004

Quick reference guide

NHS National Institute for Clinical Excellence

Chronic obstructive pulmonary disease

Management of chronic obstructive pulmonary disease in adults in primary and secondary care

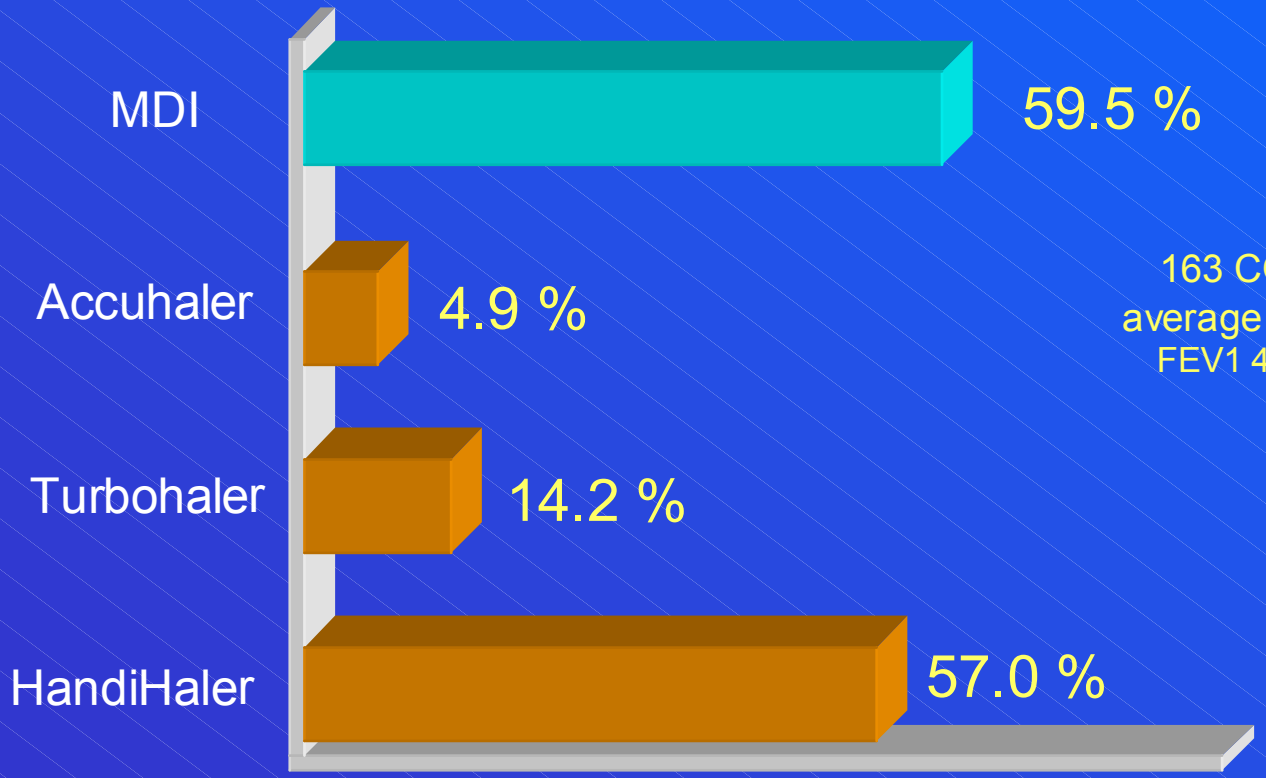
Delivery systems

Inhalers

- Most patients, whatever their age, can learn how to use an inhaler unless they have significant cognitive impairment.
- Hand-held devices are usually best, with a spacer if appropriate. D
- If a patient cannot use a particular device, try another. D
- Teach technique before prescribing an inhaler, and check regularly. D
- Titrate the dose against response for each patient. D

…but what if the half the dose is wasted each time the inhaler is used ….

UK: MDI and DPI Inhalation technique – inhalation too fast for pMDI, or too slow for DPI



Al-Showair R, Tarsin W, Assi K, Pearson S, Chrystyn H Can patients with COPD use the correct inhalation with all inhalers and does training help ? Res Med 2007: 101, 2395-2401

“How do *you* inhale” challenge

Quick test of how you would inhale through two commonly-used devices

- pMDI
- one of the DPI available

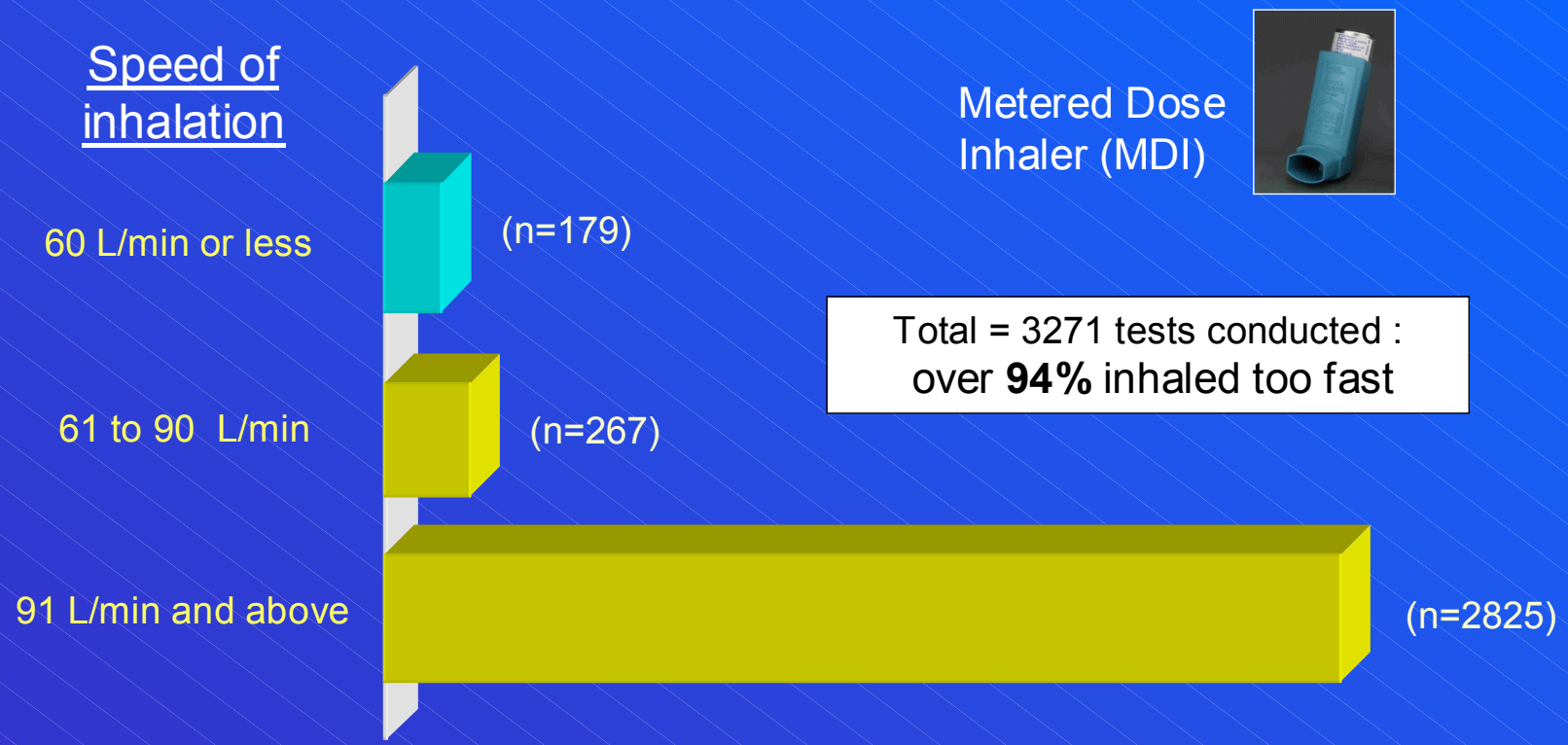
Need to:

1. Simulate resistance of device
2. Measure speed of inhalation

“How you would you (or how would you instruct the patient) to inhale through an MDI / DPI”

Single measurement

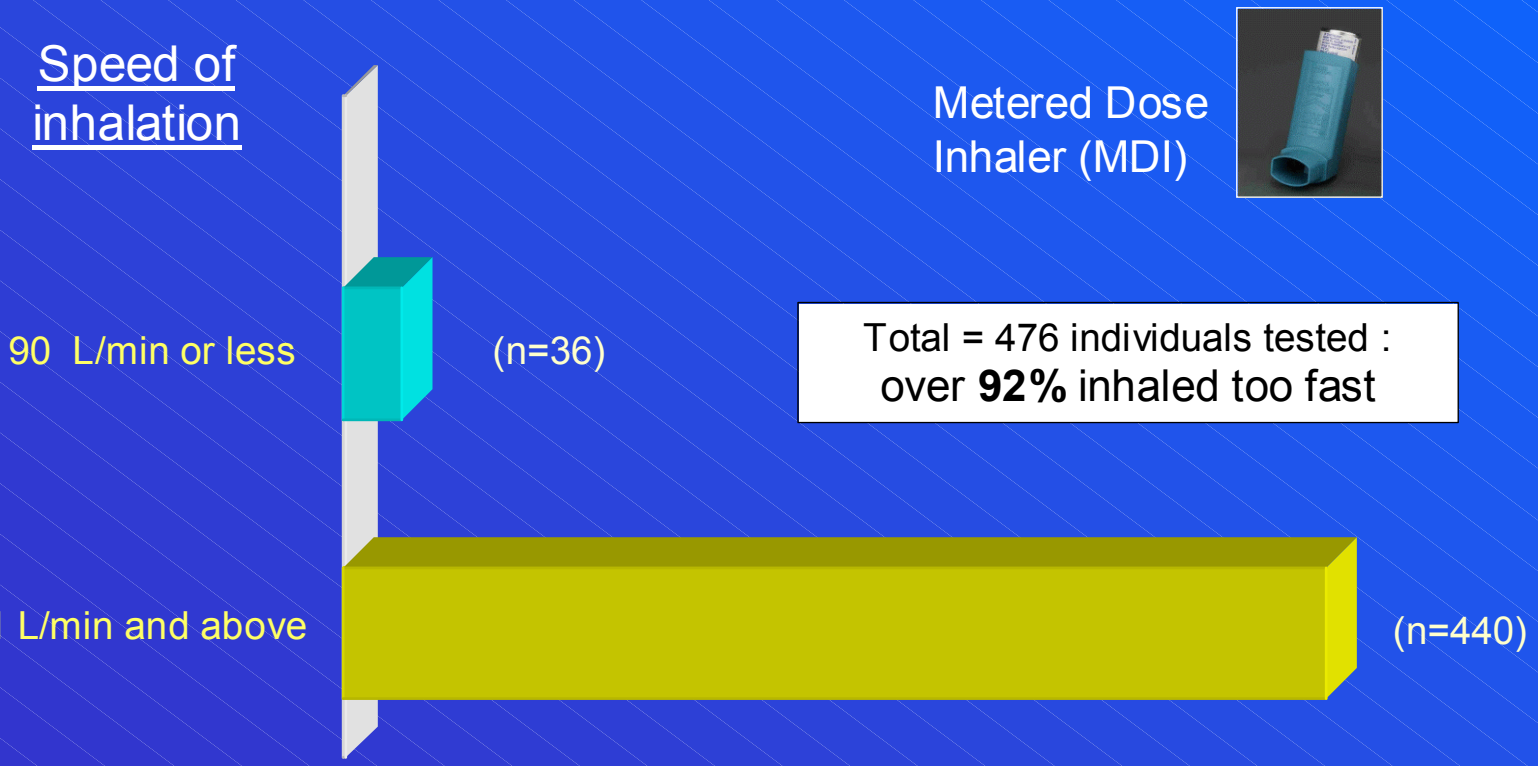
Health Professionals speed of inhalation when asked to inhale as if using an MDI - "Slowly and Deeply"



General Practitioners, Practice Nurses, Respiratory Nurses (Primary & Secondary Care), Pharmacists (Community, Retail and Hospital), Pharmacy Dispensers, Prescribing Advisors, Physiotherapists, Hospital Physicians (General Medicine and Thoracic), Pharmaceutical Company Employees (Representatives, Medical Advisors, Educational Staff)

Presented at ERS Annual Scientific Meeting, Stockholm 2007 (No. 91, Primary Care Day, 15/9/07): Jon Bell, Canday Medical Ltd. data collected between 1st June 2006 and 5th September 2007

Asthmatics - speed of inhalation through Metered Dose Inhaler



Al-Showair R A M , Pearson S B, Chrystyn H. The Potential of a 2Tone Trainer To Help Patients Use Their Metered-Dose Inhalers Chest 2007; 131: 1776-1782

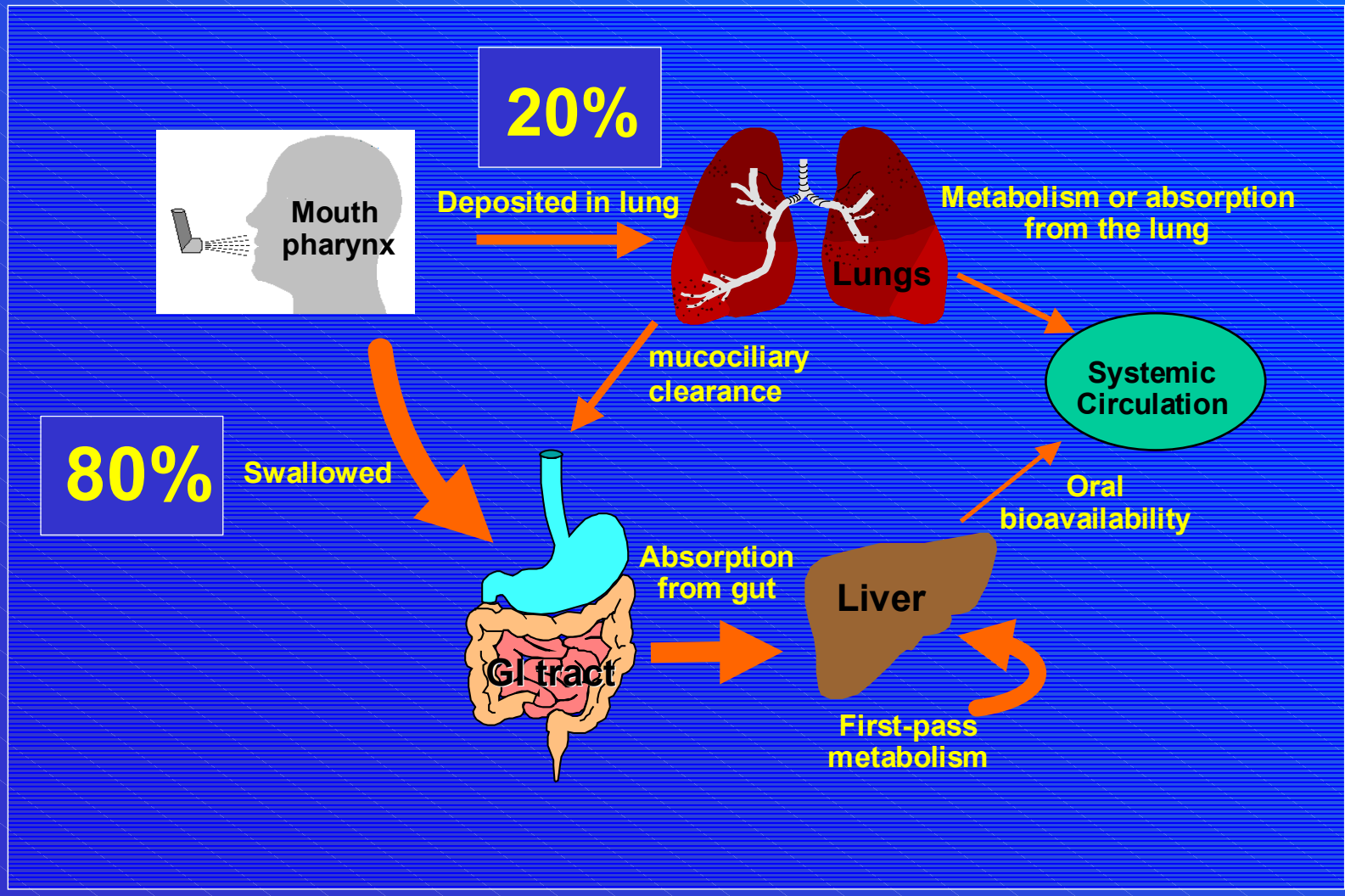
Why are there problems ?

- Design of inhalers vary
  - Formulation of drug
  - Mechanical activation (passive MDI vs active DPI)
  - Internal resistance to airflow

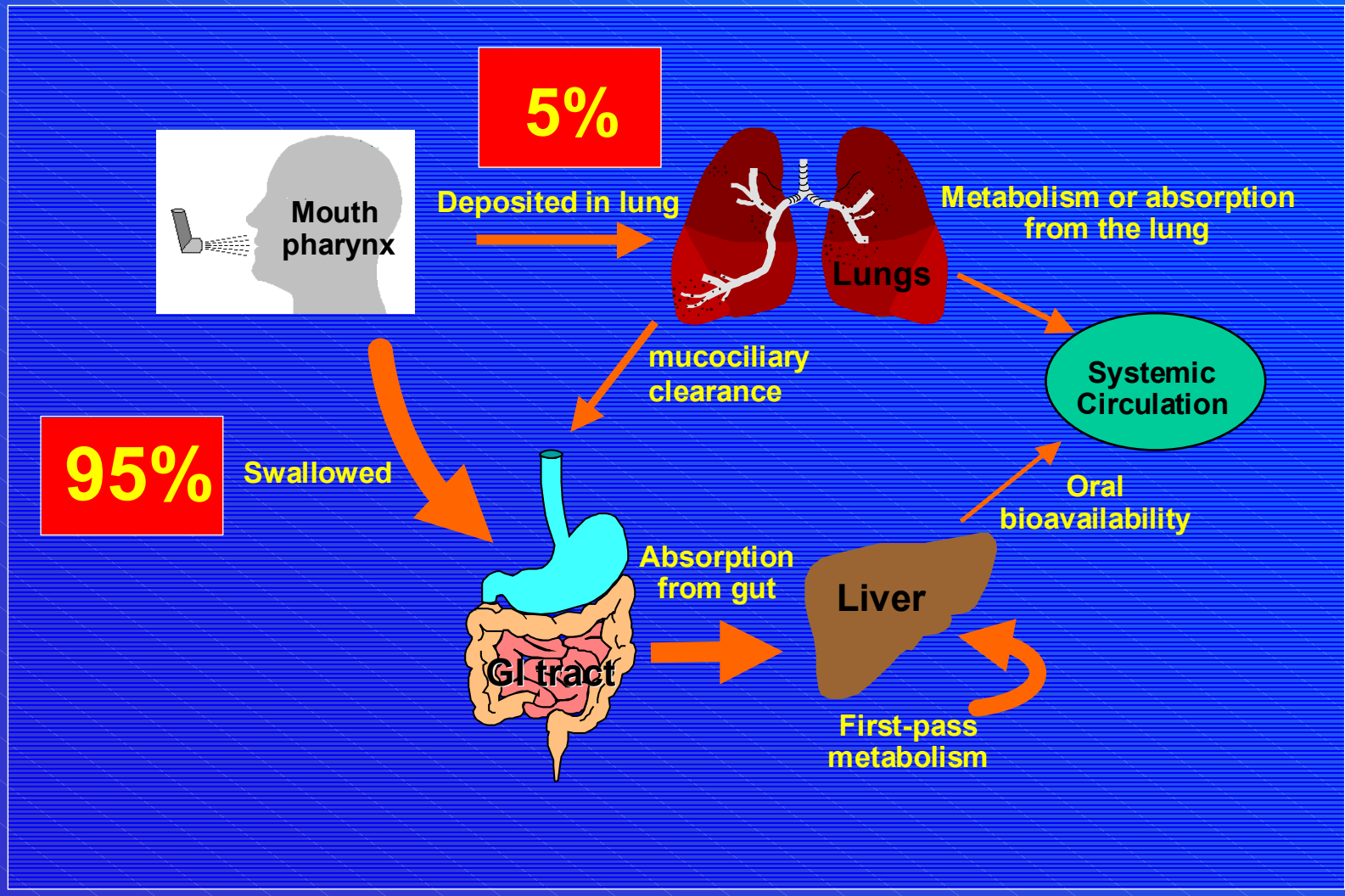
inappropriate selection and/or incorrect inhaler technique

- Patients vary
  - Pulmonary function (reversible Vs irreversible disease)
  - Ability to learn / be taught the correct technique
  - Physical size of lungs (child vs adult)
  - Effort varies from dose to dose

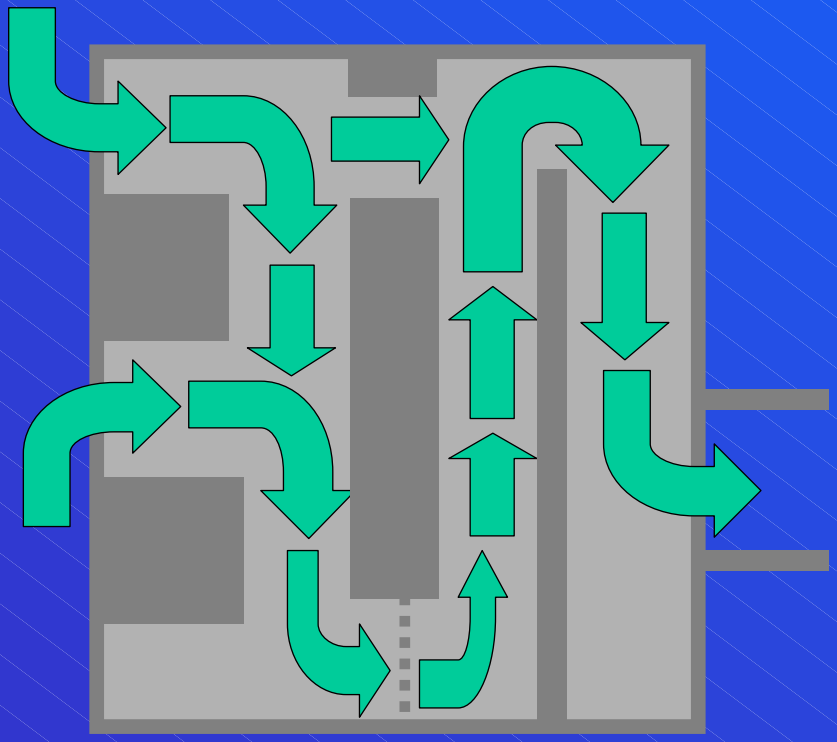
Fate of inhaled drugs – Good Technique



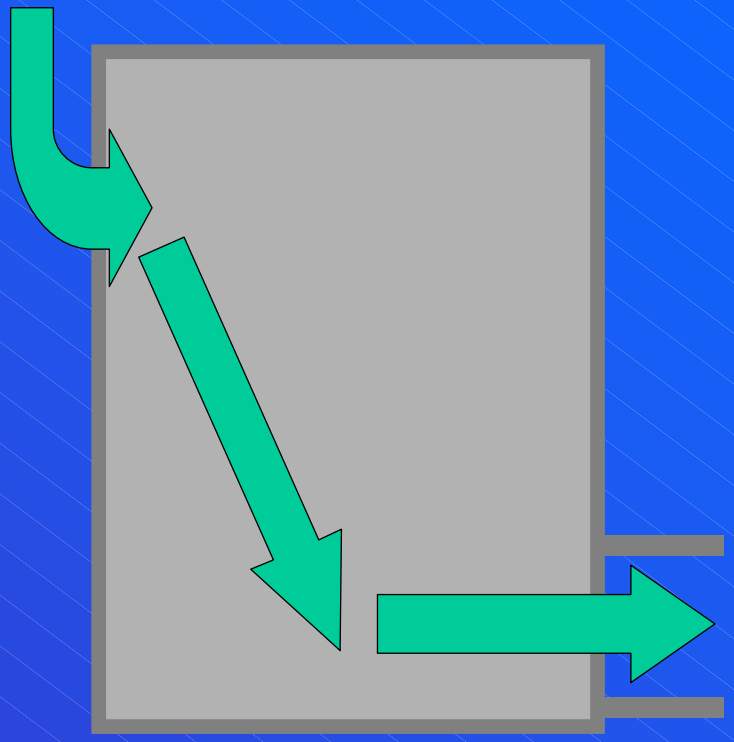
Fate of inhaled drugs – Poor Technique



External shape hides internal differences

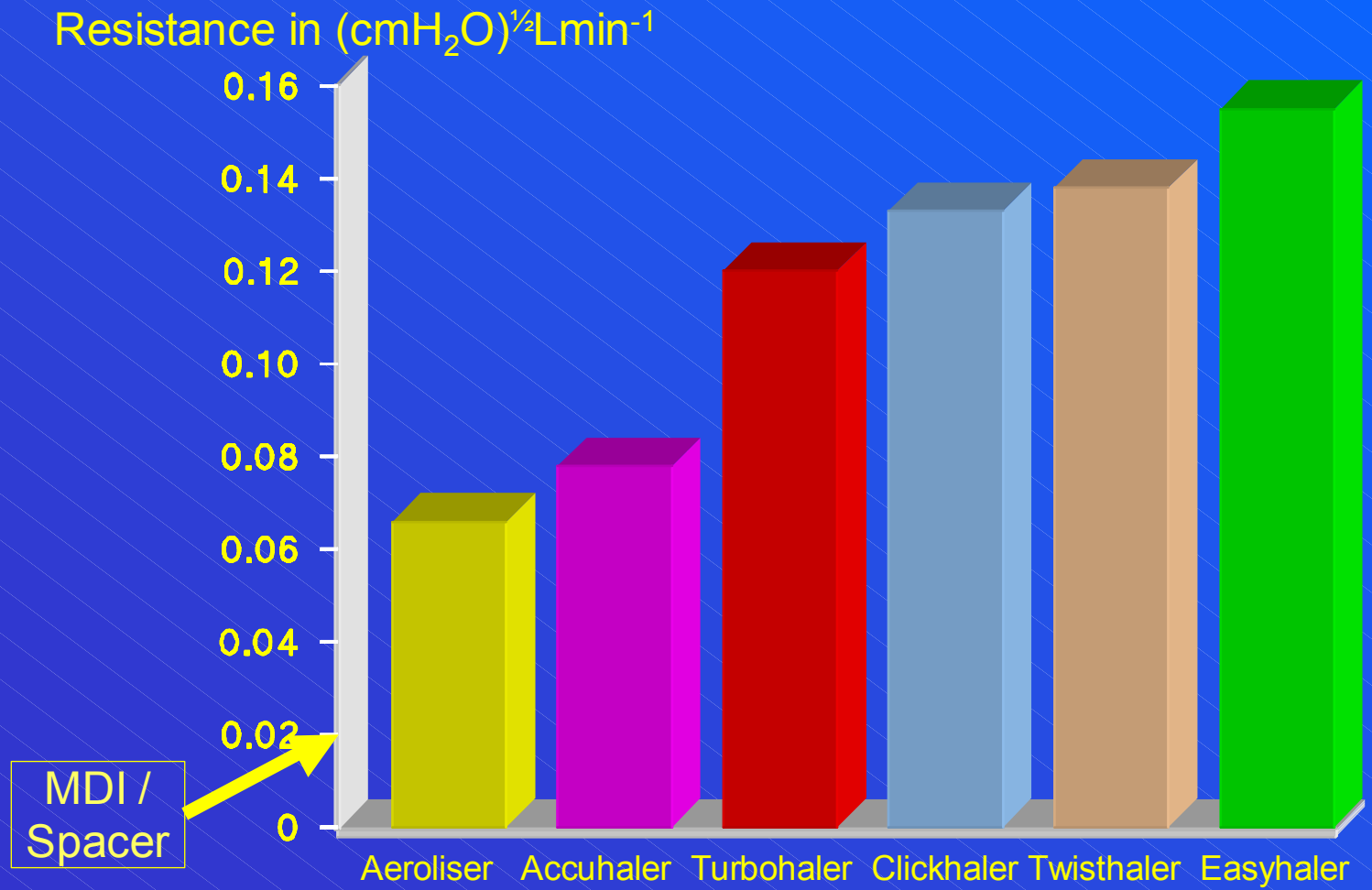


High resistance



Low resistance

Mean resistance of various DPIs



Assi KH, Chrystyn H. The different resistance of dry powder inhalers (DPIs). Am. J Respir. Crit. Care Med. 2001;163(5): A443 (Adapted from)

How changes in inspiratory flow affect output

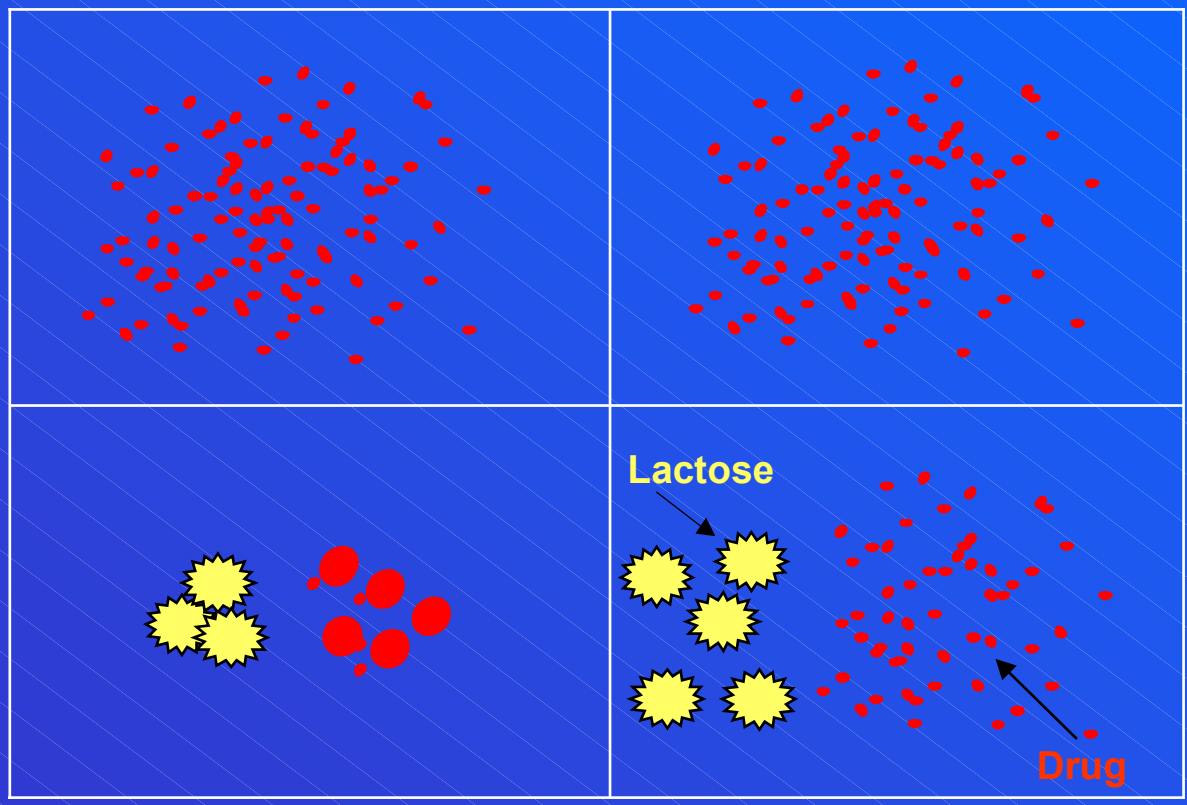
Inspiratory flow

Low

High

Metered Dose Inhaler (MDI)

Dry Powder Inhaler (DPI)



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How changes in inspiratory flow affect output

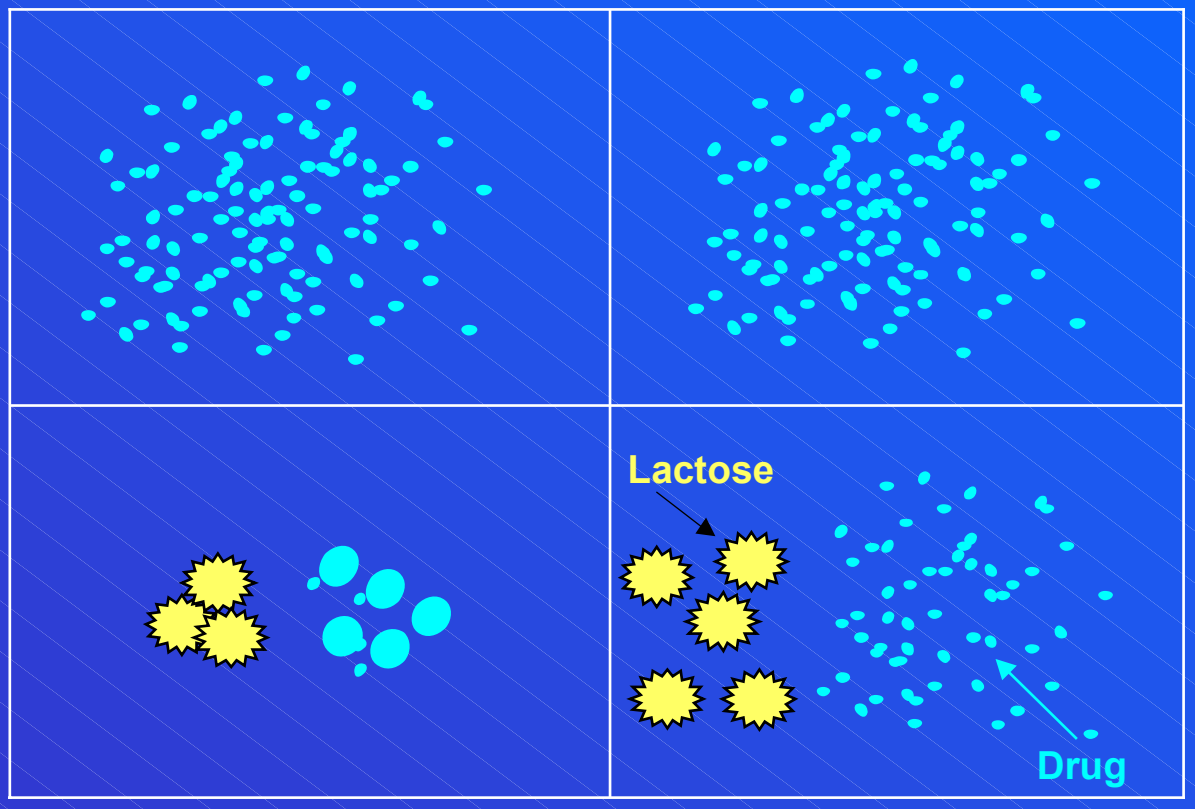
Inspiratory flow

Low

High

Respimat

HandiHaler



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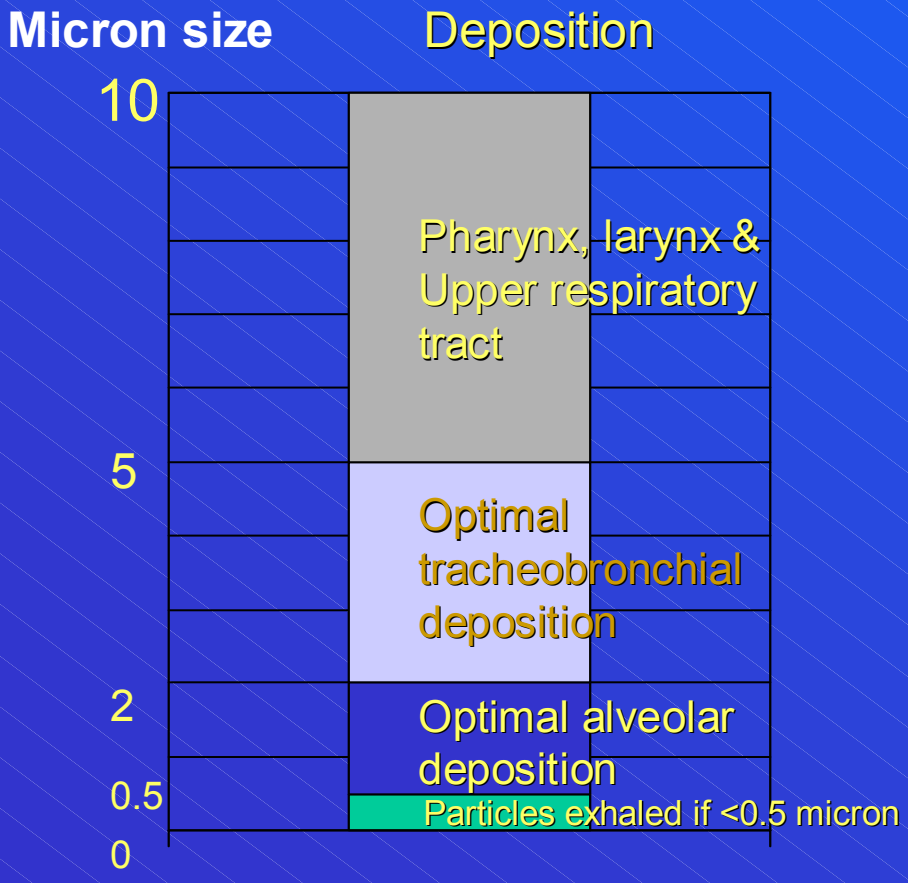
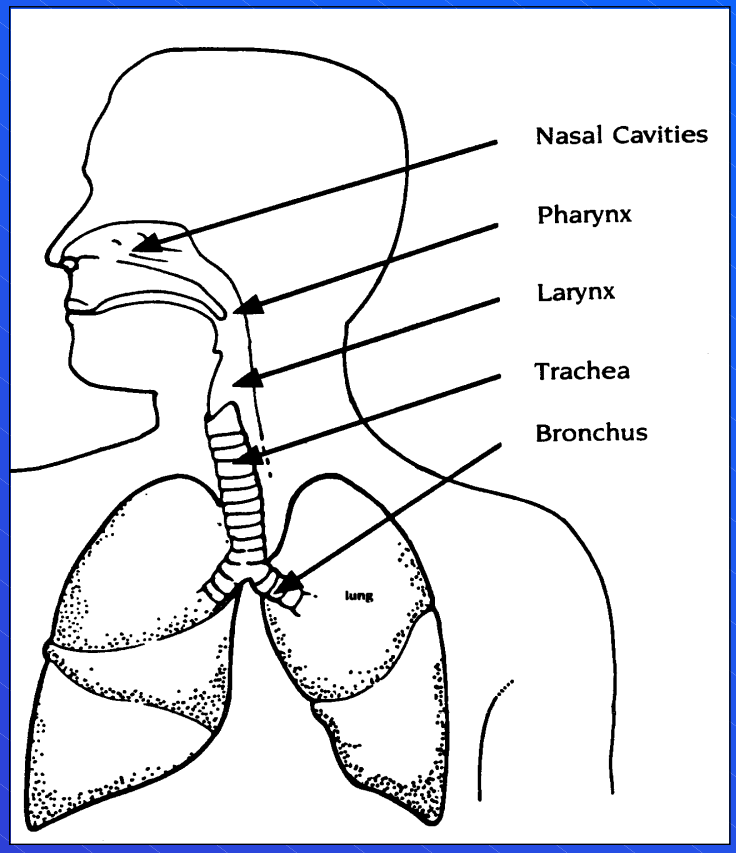
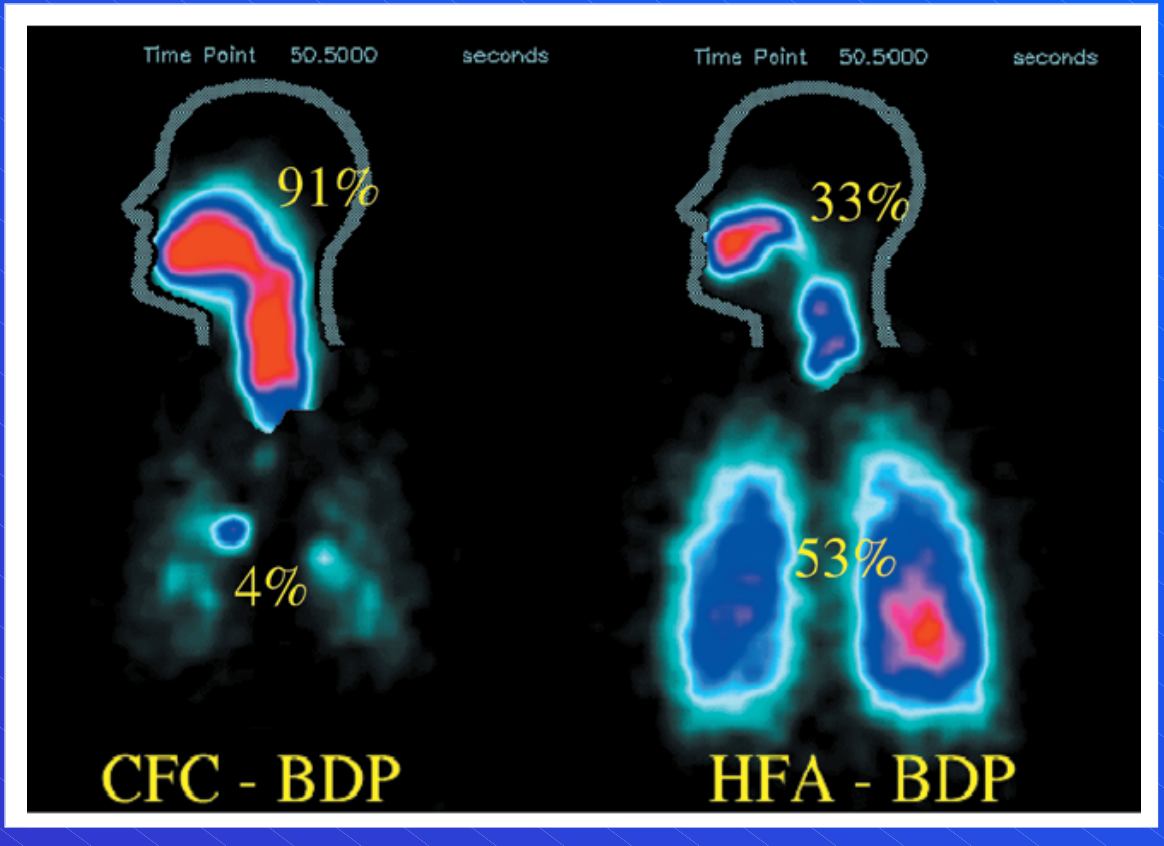
Aerosol Deposition at varying Particle Size





Lower oropharyngeal deposition with HFA-BDP

Gamma scintigraphic lung images of single study volunteer after inhalation

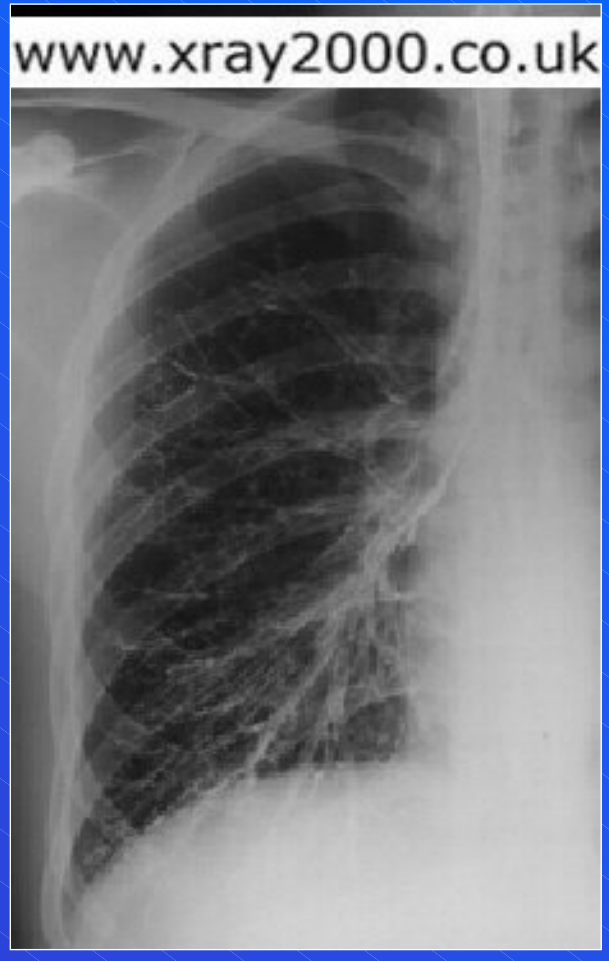


C.L. Leach, P.J. Davidson, B.E. Hasselquist, R.J. Boudreau.
Poster Presentation, ATS 2000

CHEST
The Cardiopulmonary and Critical Care Journal

Facio-Maxillary View (lateral)

Right Bronchogram

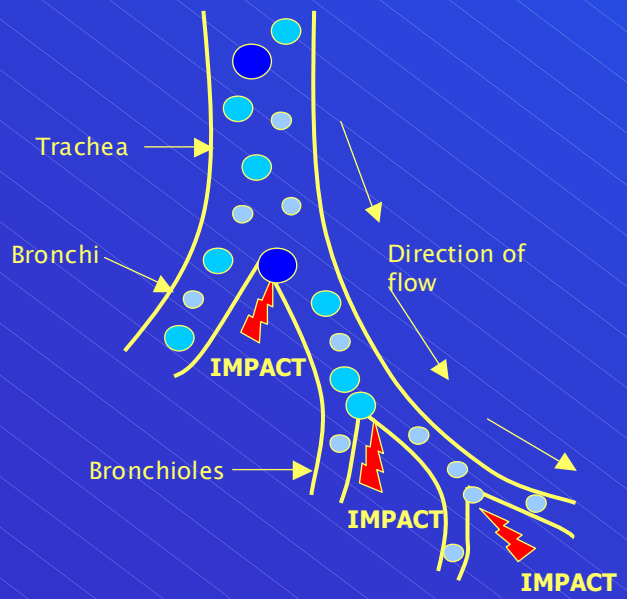


n.b. note the angles of the airways

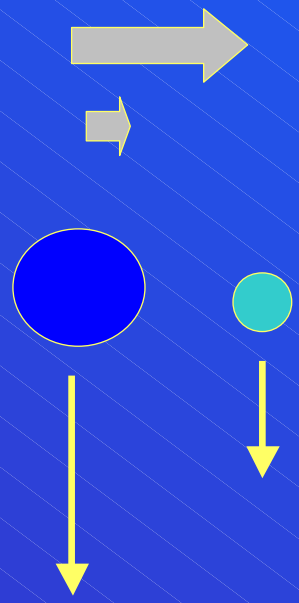
Particle Deposition In Respiratory Tract

Three mechanisms of aerosol kinetics govern the majority of particle deposition within the respiratory tract.

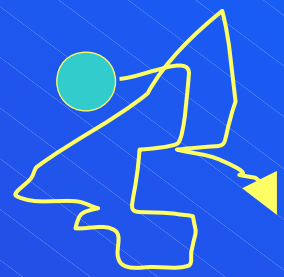
1. Inertial impaction
90%



2. Sedimentation
9%



3. Diffusion
1%



Particle Deposition In Respiratory Tract

Three mechanisms of aerosol kinetics govern the majority of particle deposition within the respiratory tract.

1. Inertial impaction
90%

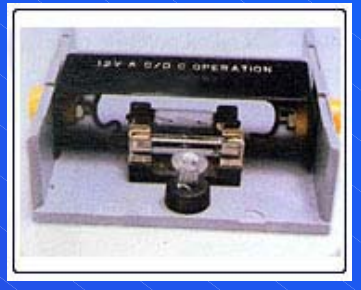
Mass

Speed

2. Sedimentation
9%

Gravity

3. Diffusion
1%



Brownian motion*

* Whitley Bay Smoke Chamber

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What have sherbet fountains got in common with inhalers …….

Twisthaler

pMDI

Turbohaler

Handihaler

Accuhaler

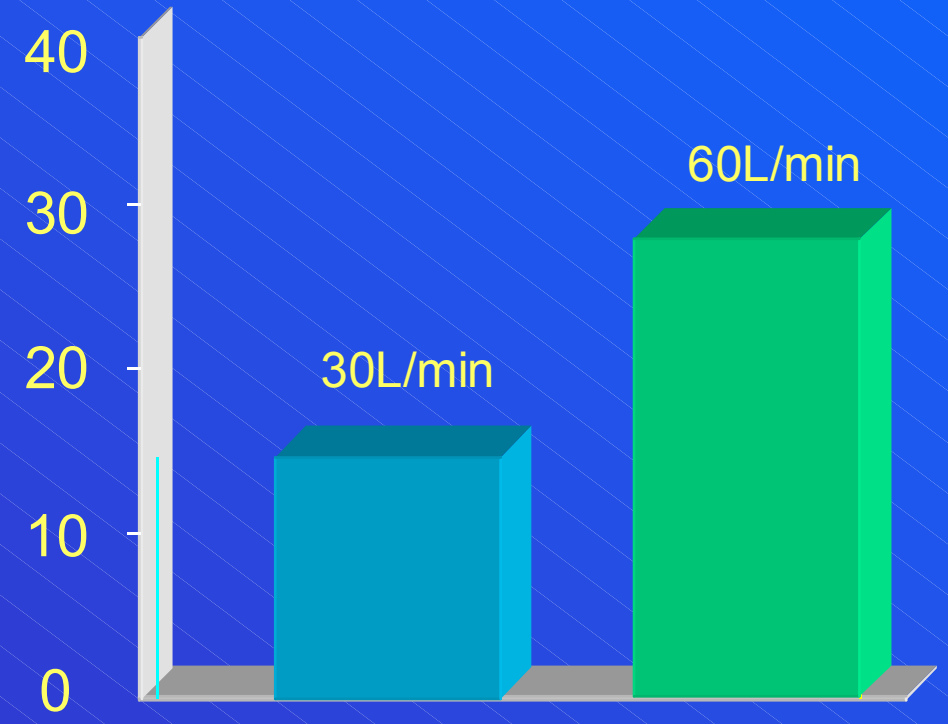
Common mistakes

Errors in Technique No. 7

Too slow an inhalation (Dry powder inhaler)

Lung deposition from a DPI is influenced by inspiratory flow

e.g. Turbohaler



Borgstrom et al Eur Respir J 1994;7:69-73

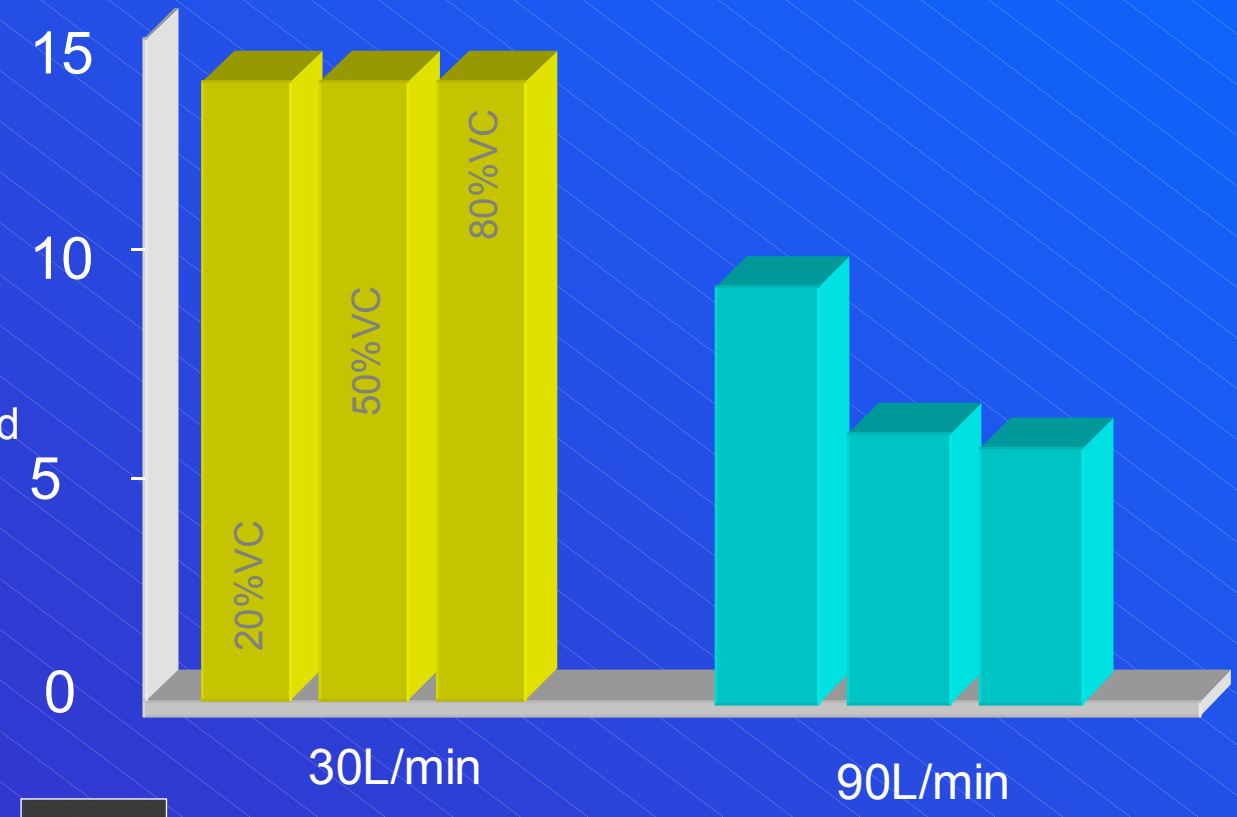
Dry Powder Inhaler (DPI)

Errors in Technique No. 6

Poor coordination (Inhaling too fast)

Metered Dose Inhaler

Lung deposition from pMDIs is influenced by inspiratory flow

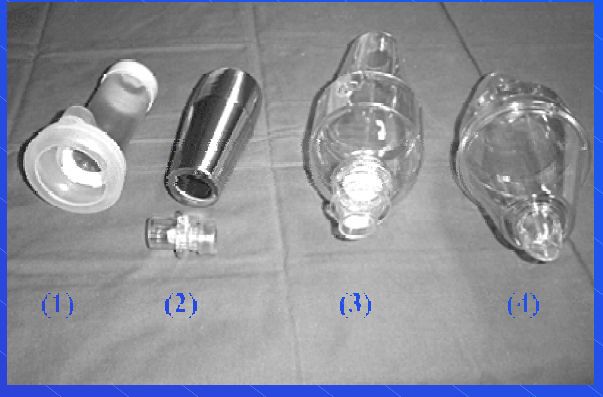


Metered Dose Inhaler (MDI)

Newman S et al, Eur J Respir Dis 1982;63: Suppl 119 57-65

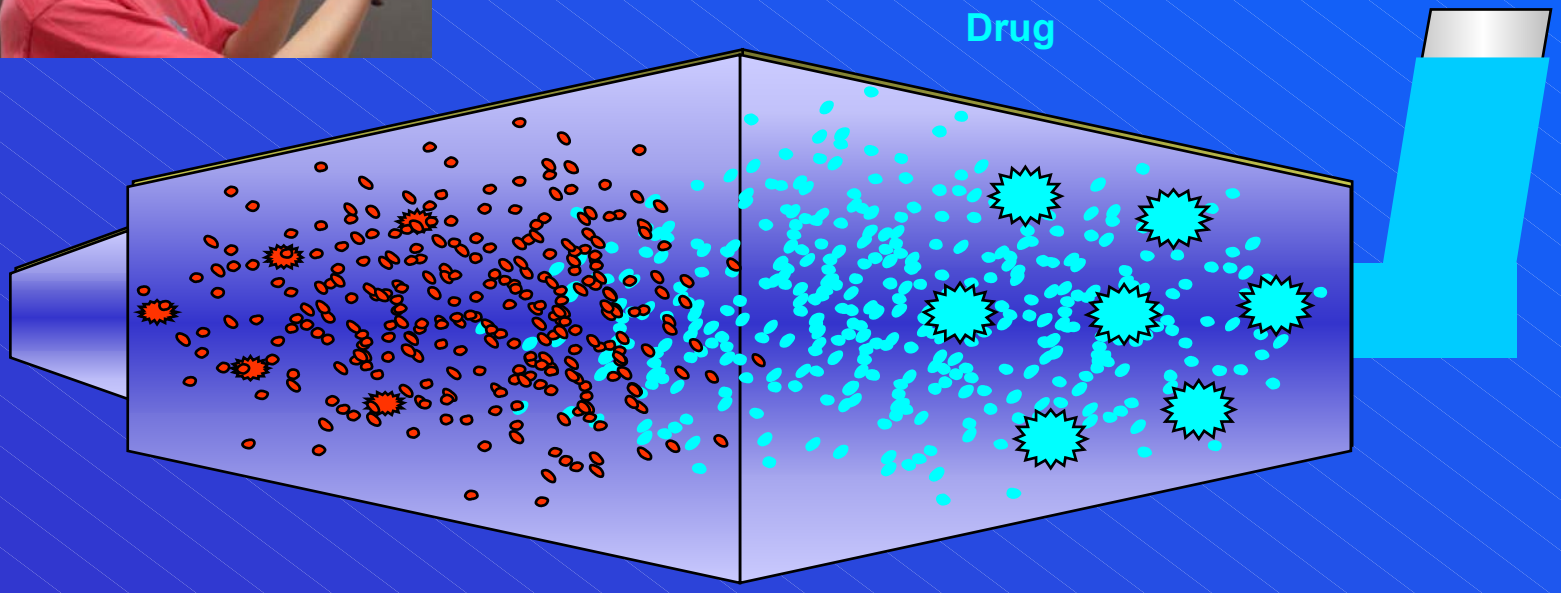
Errors in Technique No. 3

Not using a Spacer as directed



Spacer Devices – How they help

Metered Dose Inhaler (MDI)



1. Capture aerosol avoiding coordination problems
2. Reduces large aerosol particles (associated with s/e)

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Errors in Technique No. 2

Asthma patient audit : 1 patient, Male 55yr

28 salbutamol MDI Rx in last 12 months

2000 mcg BDP

Poor inhaler technique

L. Vol. Spacer repeatedly prescribed

Application of device information and ability to measure speed of inhalation

Please tell me the right technique for each of the inhalers below……

Aerosol produced for you –

inhale **SLOWLY**

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Please tell me the right technique for each of the inhalers below……

You create aerosol –

inhale FORCEFULLY

Respimat®

Boehringer Ingelheim's New Generation Inhaler "SMI" (Soft Mist Inhaler)

1. **Cloud duration** of 1.5 seconds
2. **Velocity of cloud** many times slower than pMDI
3. **High fine particle fraction** enables therapy to reach deep into lungs

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Tiotropium

Via HandiHaler (DPI) or Respimat "SMI" (Soft Mist Inhaler) ?

If they cost the same – which device is best for your patients ?

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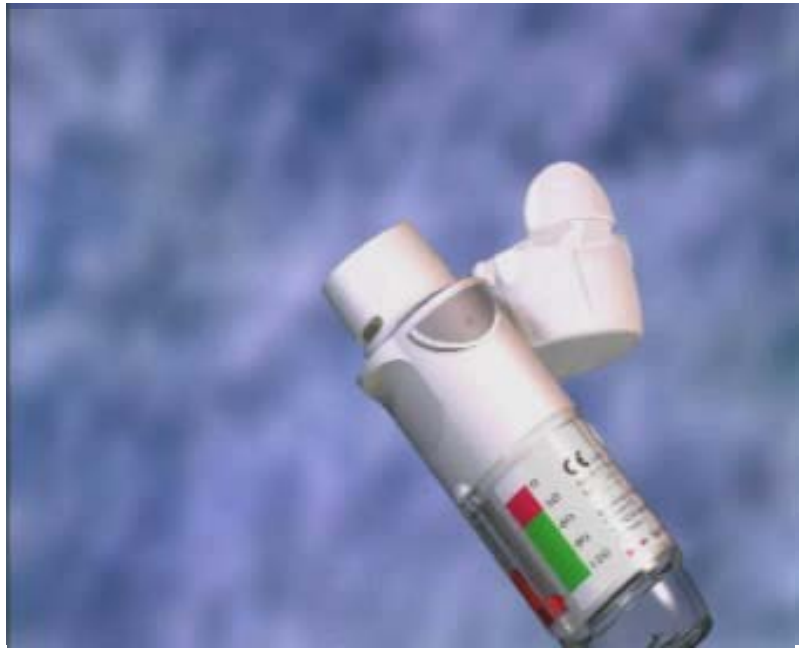
Respimat®

How to get the best from the new "SMI" (Soft Mist Inhaler)

1. Rotate lower housing through 180° until it clicks
2. Open lid to reveal mouthpiece
3. Exhale fully
4. Place mouthpiece in mouth, seal lips around (avoid blocking vents)
5. Start to breathe in SLOWLY, and press the dose-release button
6. Continue to breathe in SLOWLY for 2 seconds
7. Hold your breath for a count of 10 (or as long as is comfortable)
8. Breathe normally again



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Aerosol Generation

Inhaler Devices

Energy from device

Metered Dose Inhalers

- Threshold release — With or without Spacer
- Manual release — With or without Spacer

Nebulisers

- Compressed Air — Standard or "breath-enhanced"
- Ultrasonic — Direct or Indirect

Soft Mist Inhalers

- Coiled Spring
- Respimat

Aerosol produced for you – inhale **SLOWLY**

Energy from patient

Dry Powder Inhalers

- Passive release — Multiple or Single Dose
- Threshold release

You create aerosol – inhale FORCEFULLY

(Upper and Lower Sections of Case)

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Errors in Technique No. 5

Priming in the wrong position

MDI – priming for next dose occurs when canister is depressed

DPI – device designed to prime correctly when horizontal / vertical.

e.g. Accuhaler – hold horizontally
Turbohaler – hold vertically

Errors in Technique No. 5

How to use each device ?

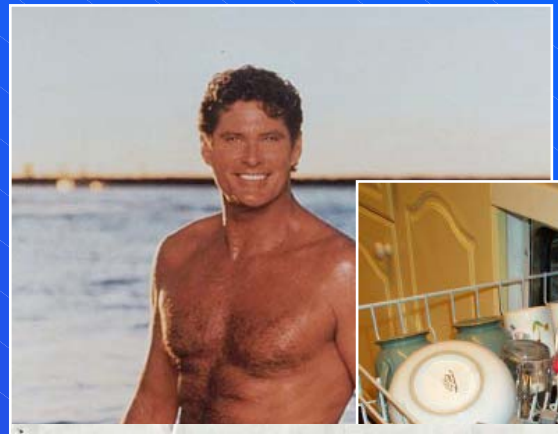
HandiHaler

Respimat

Errors in Technique No. 4

Misunderstandings

- Where the drug needs to go to work
- How to look after the inhaler
- What not to do



Errors in Technique No. 1

The way we teach

The way others learn

Our understanding of what's important

How much time we set aside

What we want to achieve

"Tell me and I'll forget.

Show me and I'll remember

Involve me and I will understand"

(Traditional Chinese Proverb)

Assessment & Training Devices

Monitoring inspiratory flow rate through the device

Independent

Vitalograph's Aerosol Inhalation Monitor (AIM)

Clement Clarke's In-Check and In-Check DIAL

Fyne Dynamic's MagFlo

Canday Medical's "2-Tone" Trainer

(www.2ToneTrainer.com)

Pharmaceutical Co.

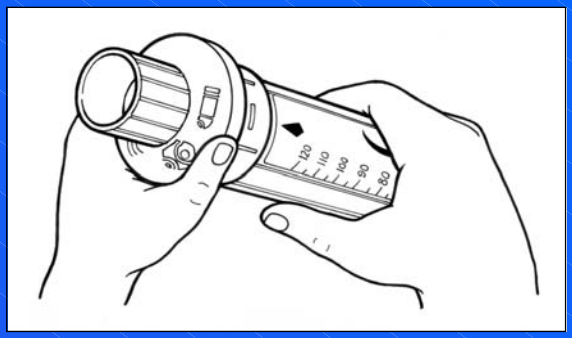
60 L/min

35 L/min

AstraZeneca's Turbohaler Usage Trainer & Turbutesters

Schering-Plough's Twisthaler Trainer

1. Turn the DIAL to select the inhaler resistance



(Diskus / Accuhaler)

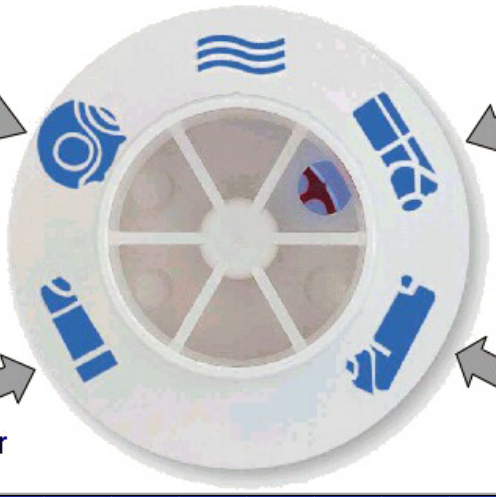
Multiple-dose powder inhaler

(Common pMDI)

Metered Dose Inhaler and MDI spacers with low resistance (e.g. AbleSpacer)

(Easibreathe)

Automatic pMDI



(Turbuhaler)

Turbulent flow inhaler

(Autohaler)

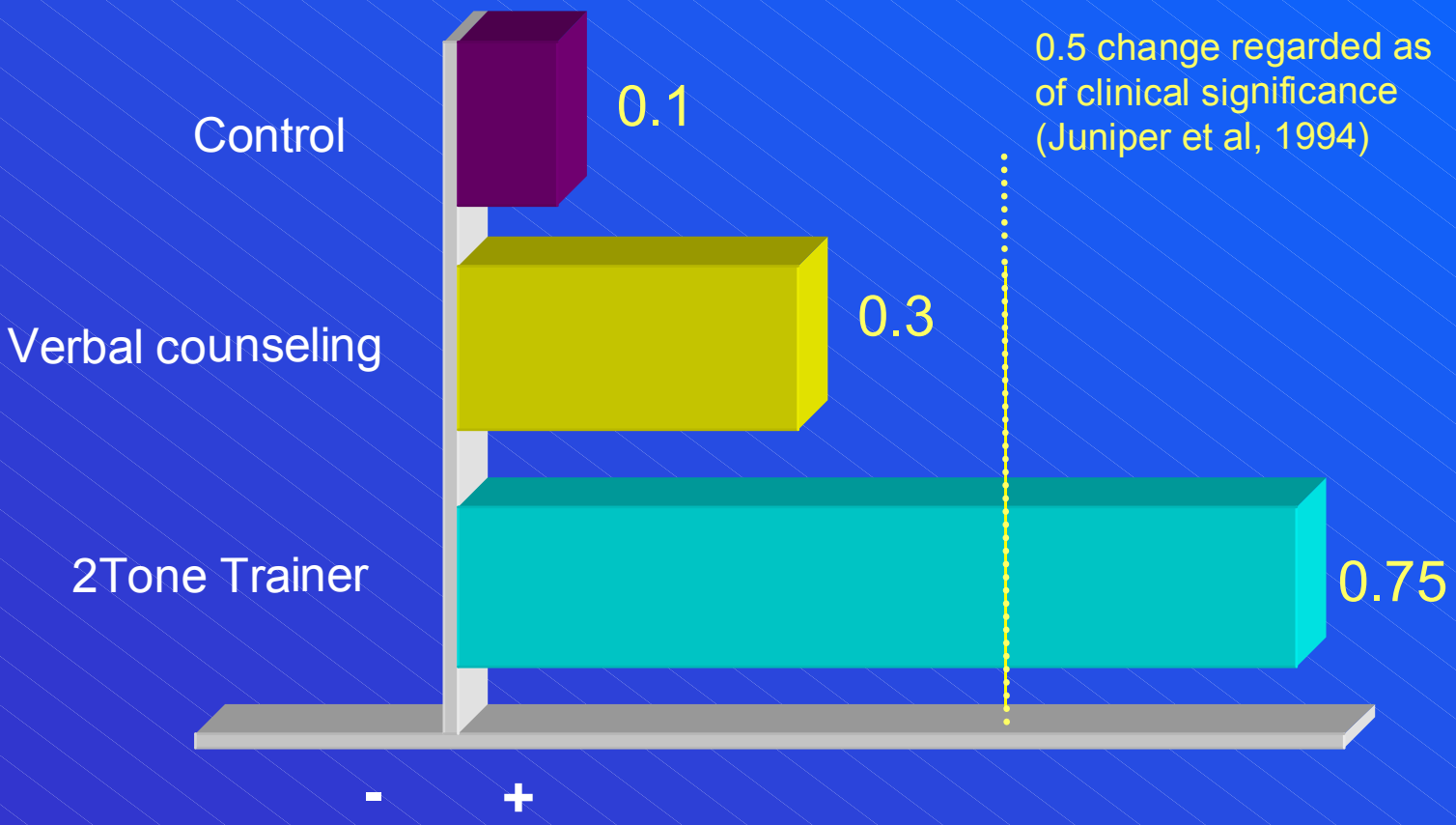
Automatic pMDI

2. Measure, then compare the inspiratory flow achieved with the optimum recommended for that device

In-check DIAL		Optimum Inspiratory Flow Range (l/min) 10 20 30 40 50 60 70 80 90 100 110
Multiple-dose powder inhaler **Accuhaler**		
Turbulent flow inhaler (old style) **Turbuhaler®**		
Turbulent flow inhaler (Symbicort®) **Turbuhaler®**		
Auto inhaler **Autohaler®**		
Auto inhaler **Easi-Breathe®**		
Multiple-dose powder inhaler **Clickhaler®**		
Low-resistance aerosol **pMDI**		

"Optimum"
Or
"Effective"
?

AQLQ improvement without therapeutic change

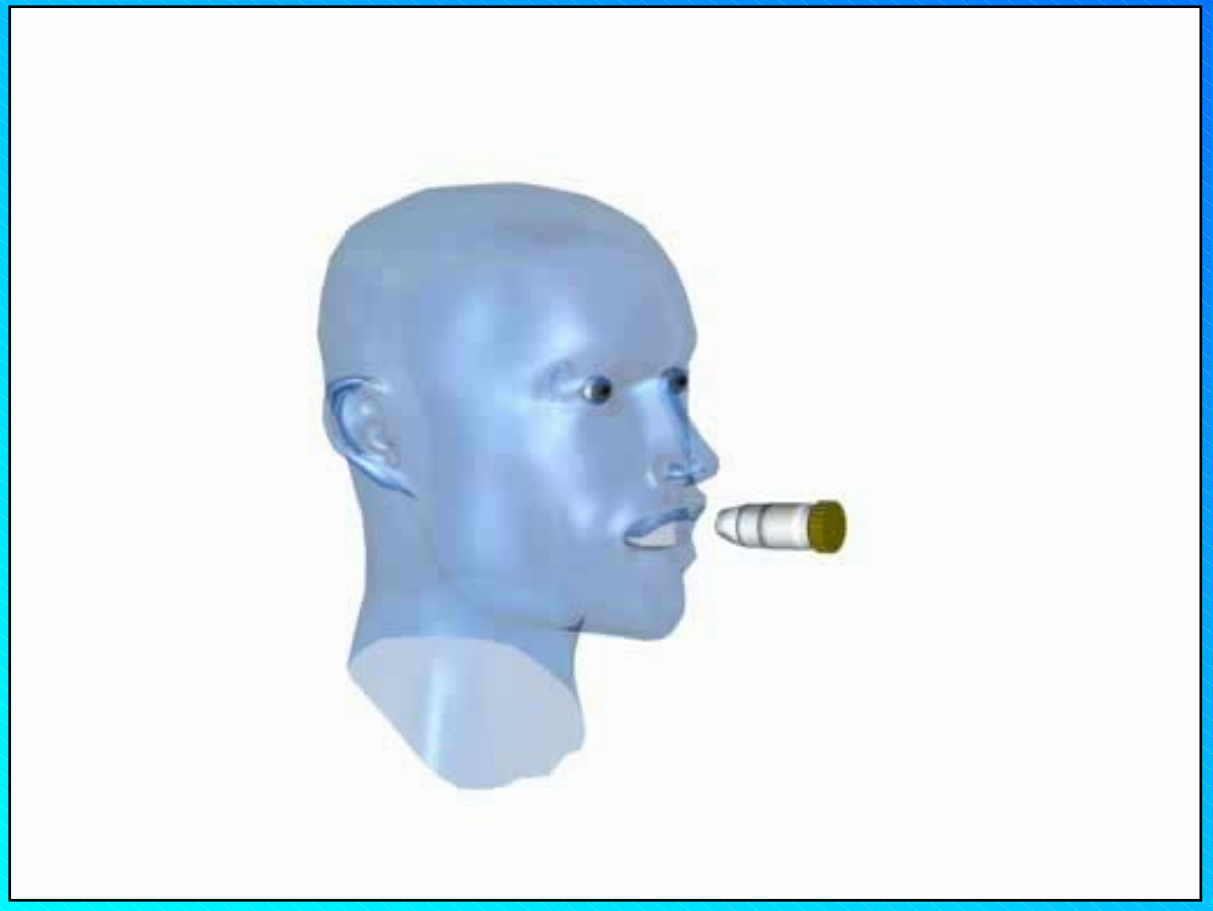


Al-Showair R, Pearson SB, Chrystyn H Eur Respir J 2005;26:S49 47s P416

Inhale Too Fast…. (e.g. pMDI)

High-speed aerosol cloud impacts in oropharynx

Inhale Too Slowly…. (e.g. DPI)



Reduced emitted dose and quality of aerosol at low speed

Inhale Optimally (e.g. pMDI)

Optimal PIF for inhaler efficiency and aerosol dynamics

Points to take away ?

1. **Different types of inhalers require different techniques** to get the full dose to the lungs, and minimise side-effects and waste.

2. **Speed of inhalation** changes device efficacy and deposition, and is affected by device resistance, effort of inhalation and disease.

3. **Many patients do not use their existing inhalers to best effect**; consider other inhaler designs and different ways of teaching technique to improve outcomes and reduce waste.

Poor Technique ?

Misunderstanding by patient ?
Could our explanation be better ?

Jon Bell
Canday Medical Ltd.

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www.2ToneTrainer.com

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