

# Design of Connected Devices with High Functionality, Good Usability and Low Environmental Impact



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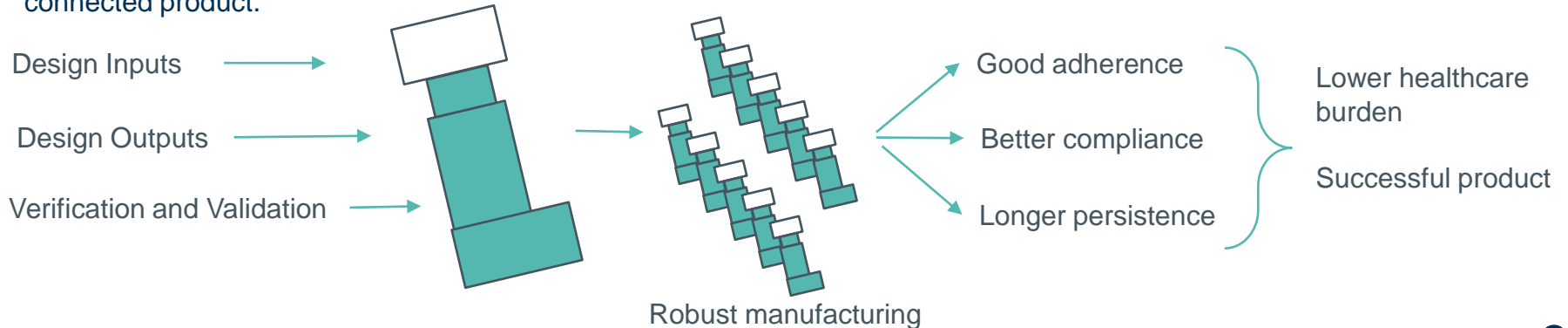
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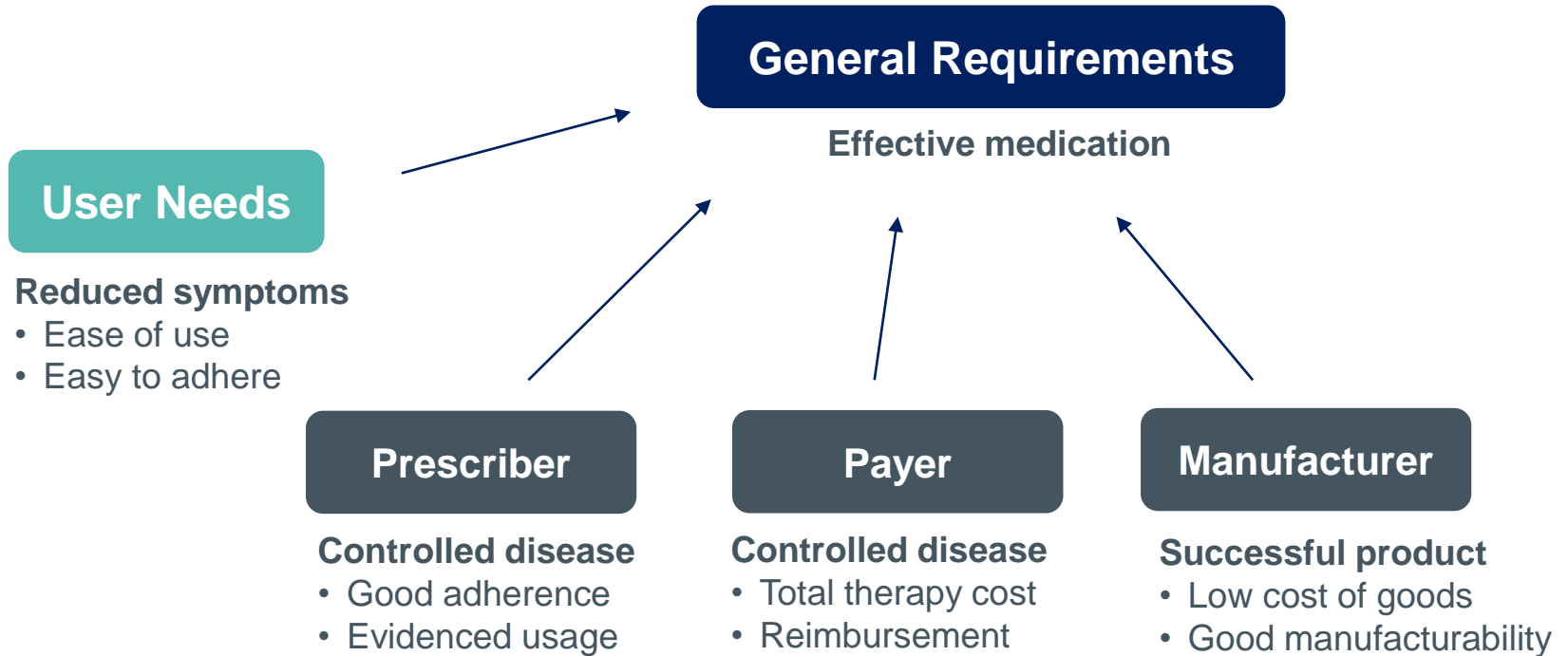
# Introduction

- The problems of poor **adherence**, **compliance** and **persistence** with inhaler usage are well known and widespread.
- Ultimately they can lead to
  - non-optimal disease management and worsening symptoms
  - increasing healthcare costs
- It is possible to improve patient use by good, intuitive design of the device, well defined user inputs, and effective implementation both in design and manufacturing of the devices.
- The use of connected devices which monitor and provide feedback have been shown to improve these aspects further.

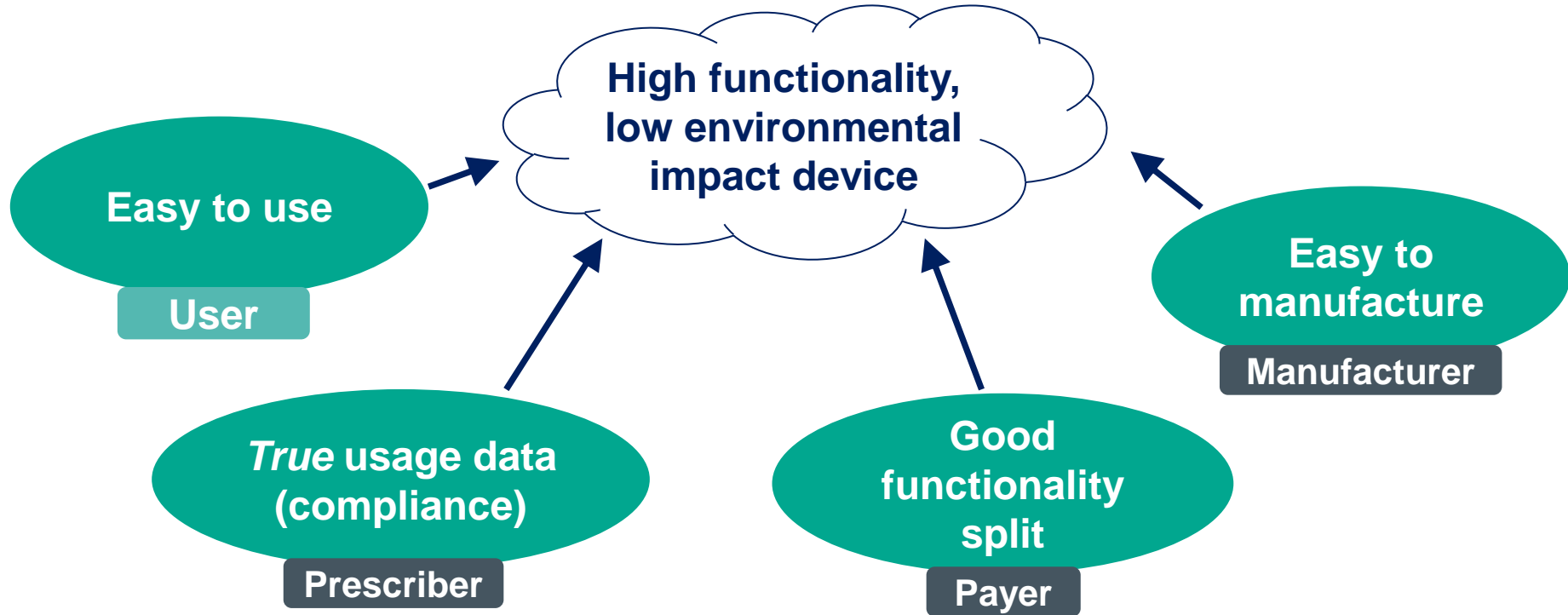
This presentation will discuss the key considerations that should improve the likelihood of achieving a successful connected product.



# User needs remain at forefront, but consider needs of other stakeholders

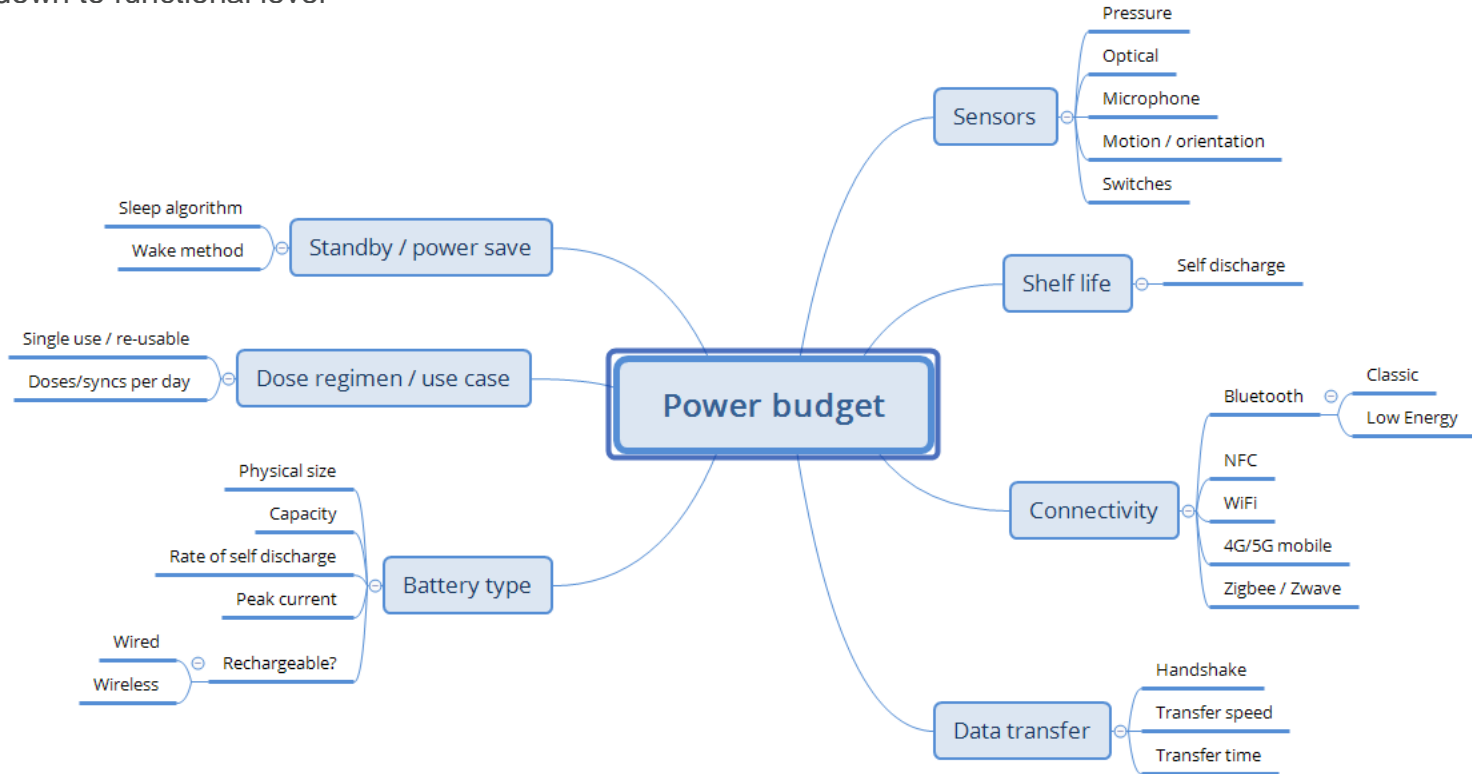


# Functional requirements leading to an optimised connected device

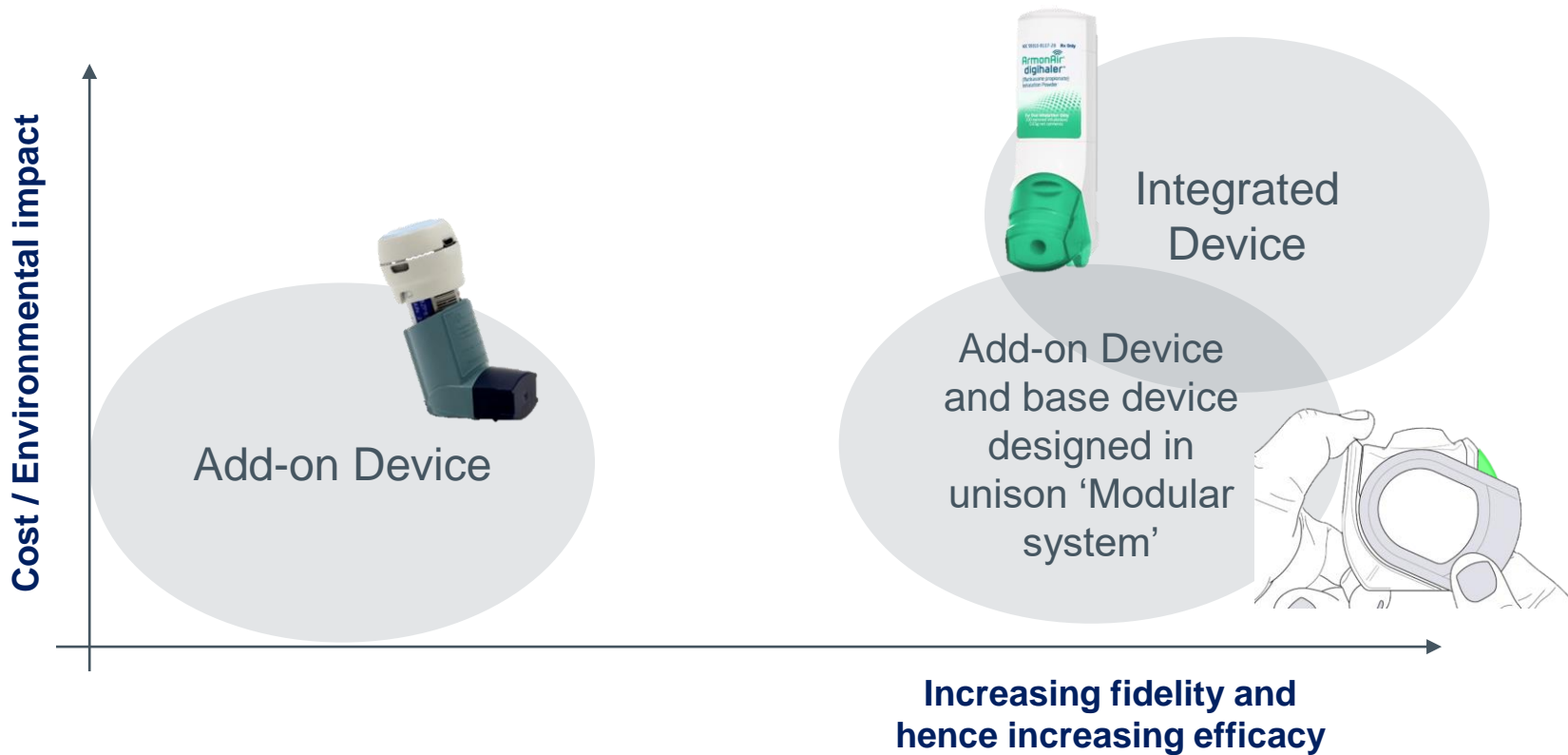


# Example Design Considerations

Drilling down to functional level



# Conflict between functionality and cost / environmental impact

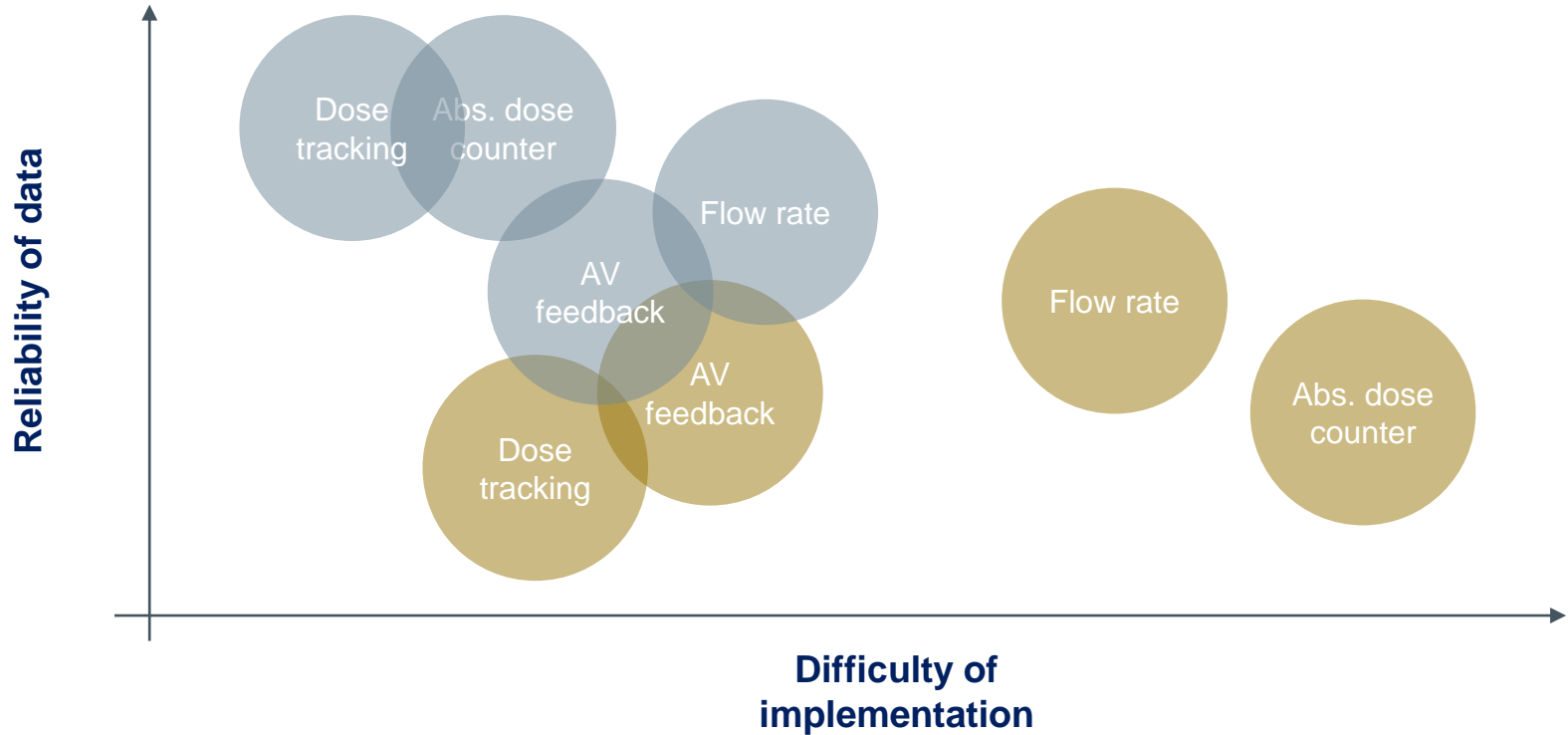


# Add-on vs integrated systems

Function / attribute	Add-on	Add-on designed as a modular system	Integrated	Value
User pressed button		Button press $\equiv$ adherence		Device preparation adherence data
User inhaled (binary)		Reliable implementation		Inhalation adherence data
User inhaled (measurement)		Reliable implementation		Physiological information
Doses remaining		Reliable implementation		Ability to monitor usage
Orientation	Easy implementation			Compliance /technique data
Inhaler usability	Impact on usability			Better compliance and persistence
Cost / Environmental impact	Lower		Higher	More cost effective and sustainable medicines

# Implementing Connected Device Features

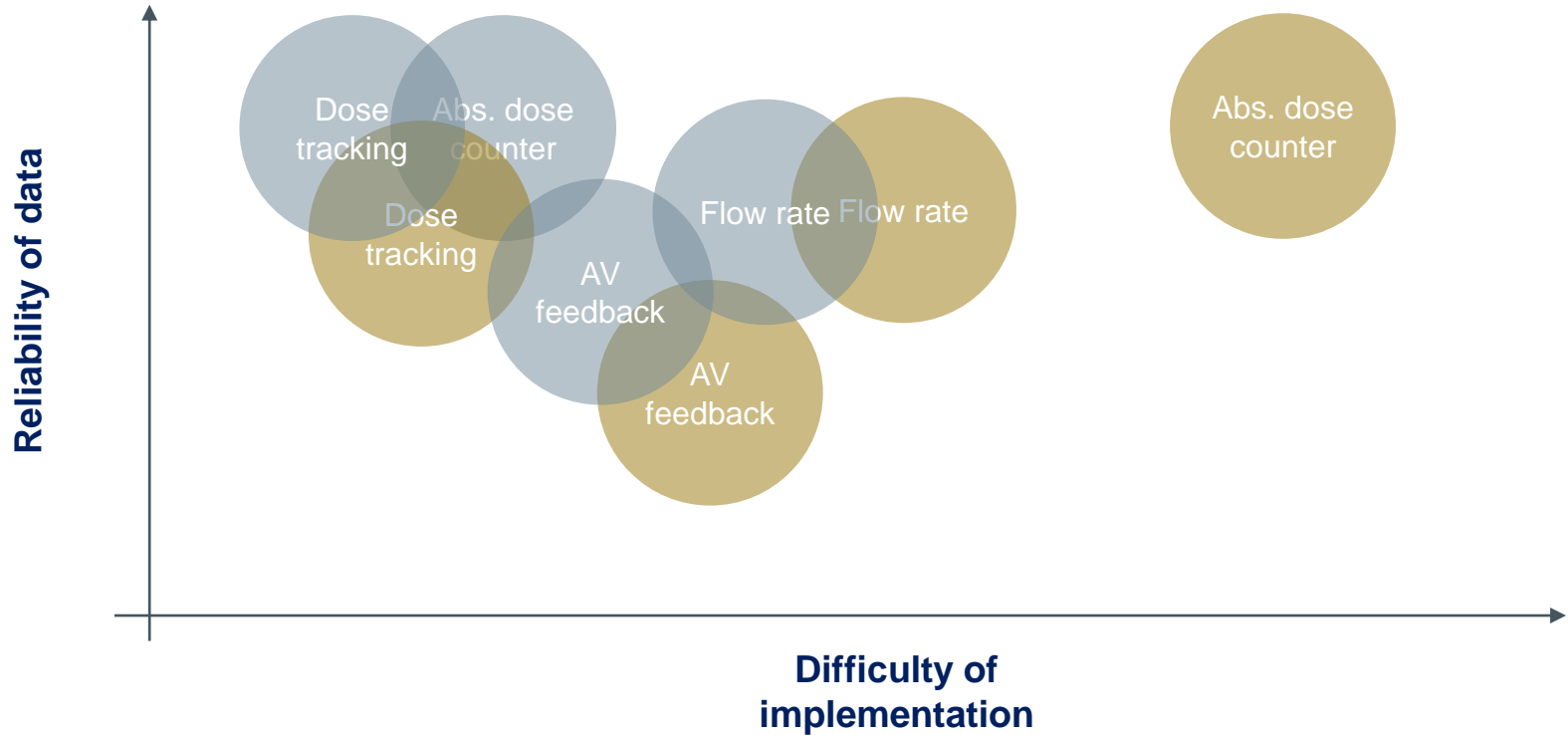
Add-on vs integrated





# Implementing Connected Device Features

Add-on vs integrated  
as a modular system



## Example:

### DPI design with connectivity in mind, maintaining ease of use of device

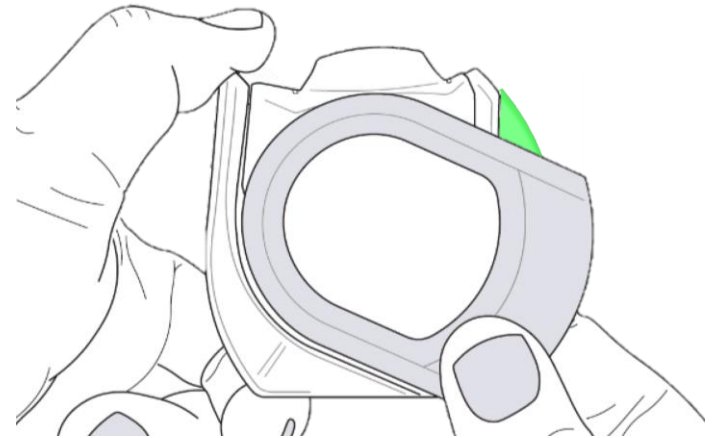
#### Simple user interface

- 3-step operation (Open – Inhale – Close)

#### Placing the connectivity module in a position which does not interfere with the normal patient grip surfaces

- Areas under the sweep locus of moveable components, and not where a patient would hold

Ensures the patients' ability to use the device is not compromised



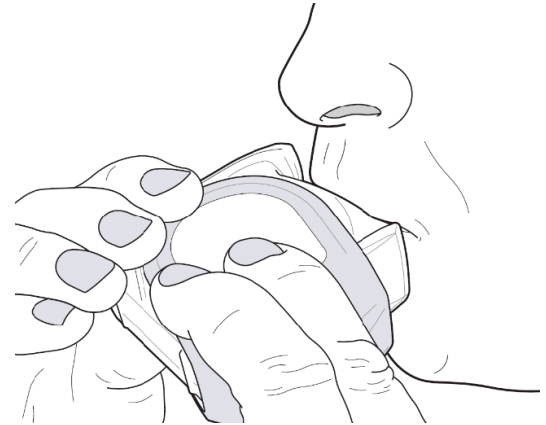
## Example:

### DPI design considering user operation and connectivity requirements

#### Connectivity requirements for “true” compliance

Monitoring all critical use steps:

- Checking that doses are left in the device
- Actuating the device correctly
- Inhaling at the optimum flowrate
- Holding the device in the correct orientation
- Closing the device when finished



**Aim to maintain simplicity, high level of functionality whilst minimising the environmental impact**

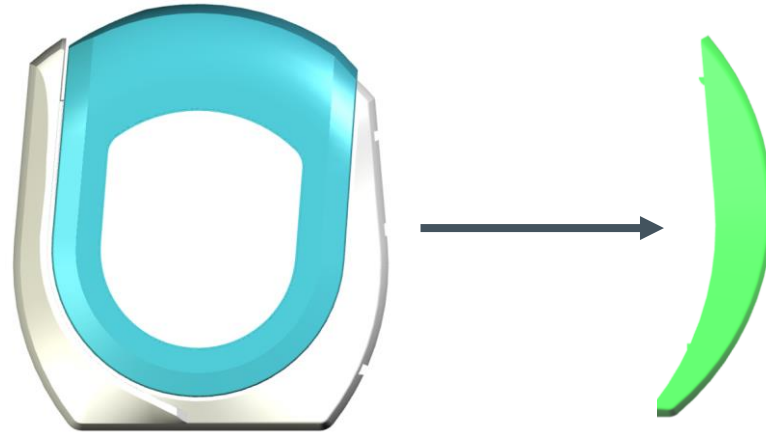
## Example:

### Split functionality across base DPI and connectivity module

Design allows the connectivity module to sense information through specifically designed ports that do not add complexity to the base device

#### Enhanced sensing

- Mouthpiece cover position
- Dose number
- User flow rate
- Other physiological factors

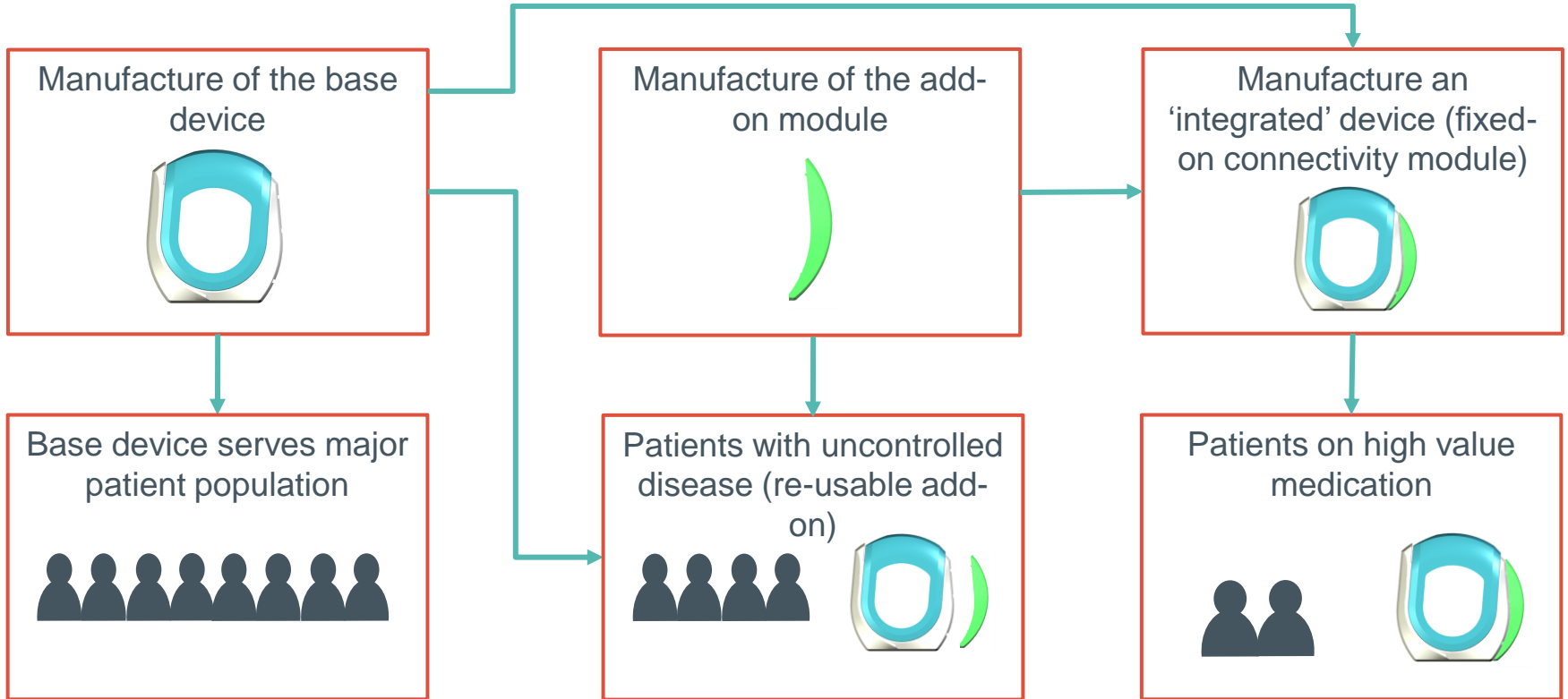


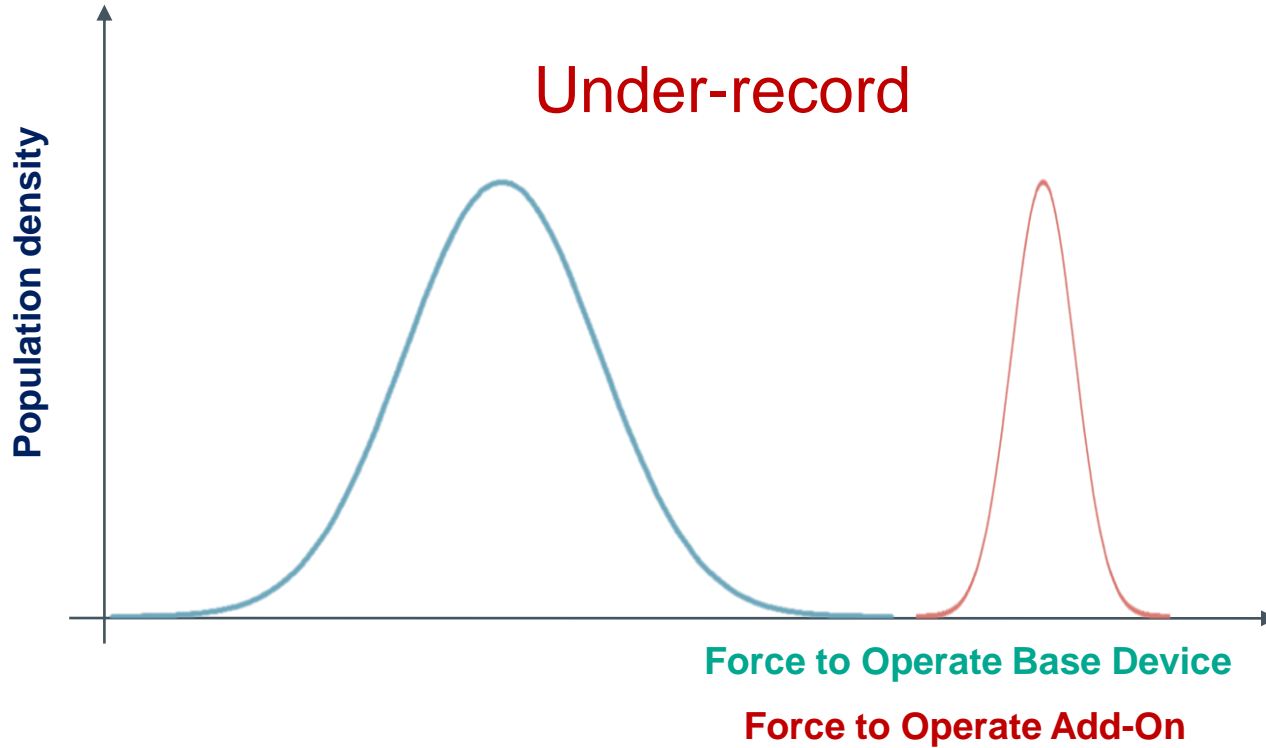
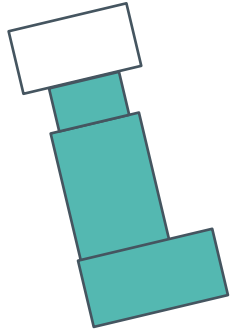
Sensing of mechanical,  
light and air signals

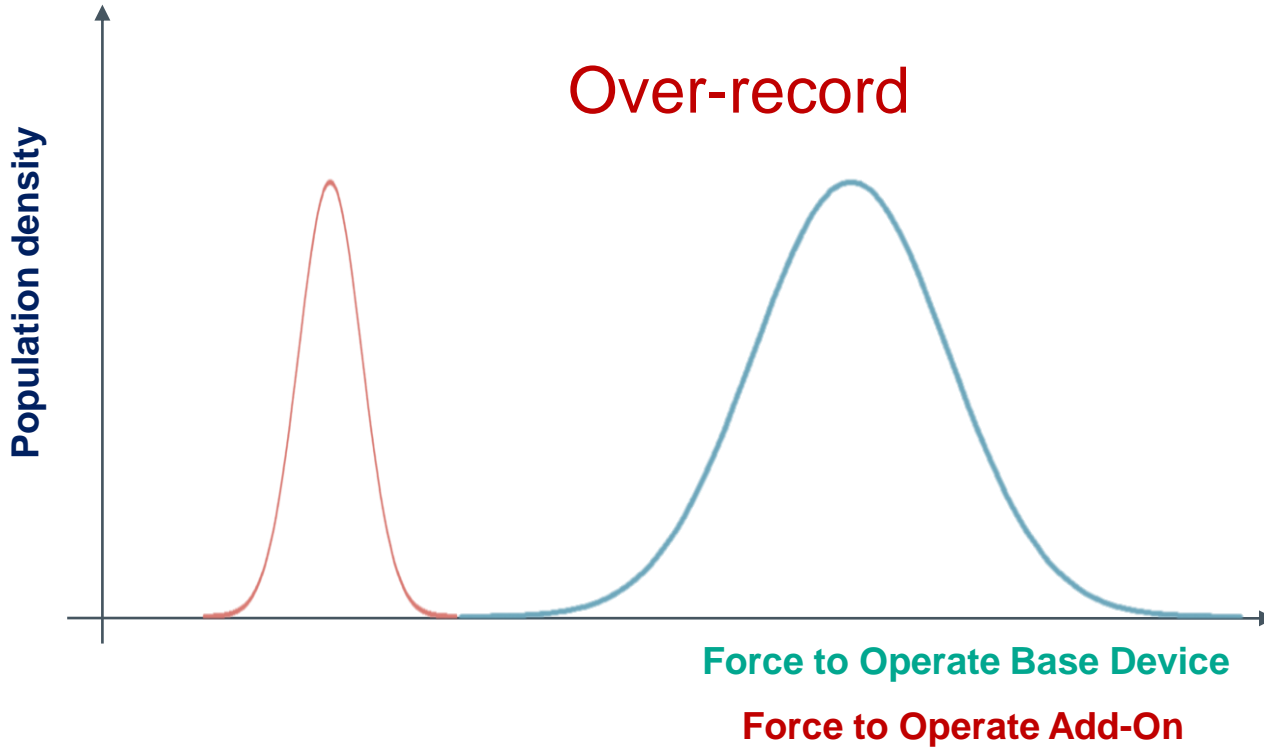
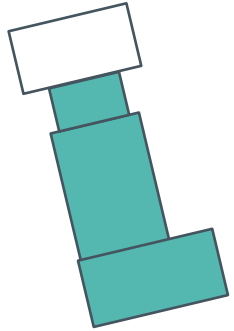
# Manufacturing Strategy

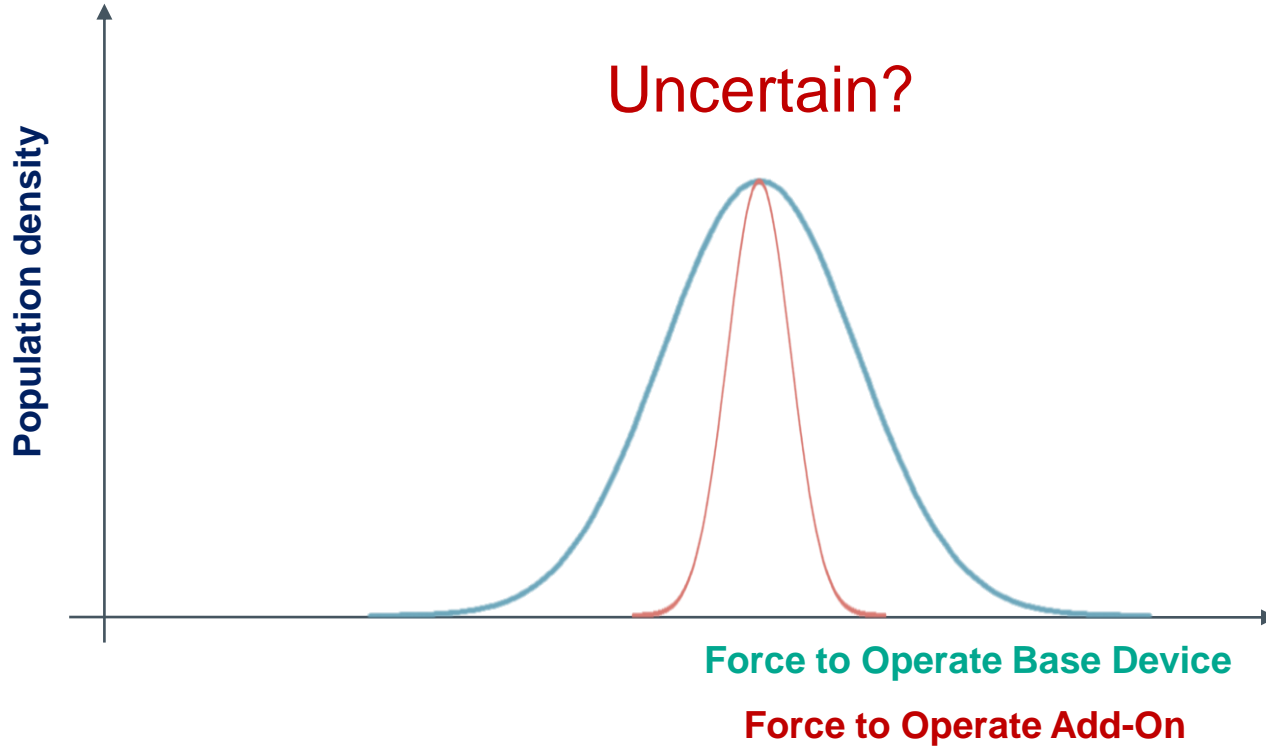
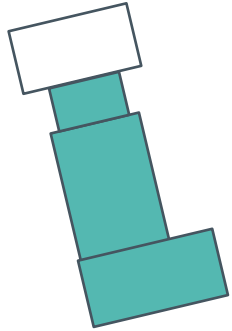
Payer

Manufacturer







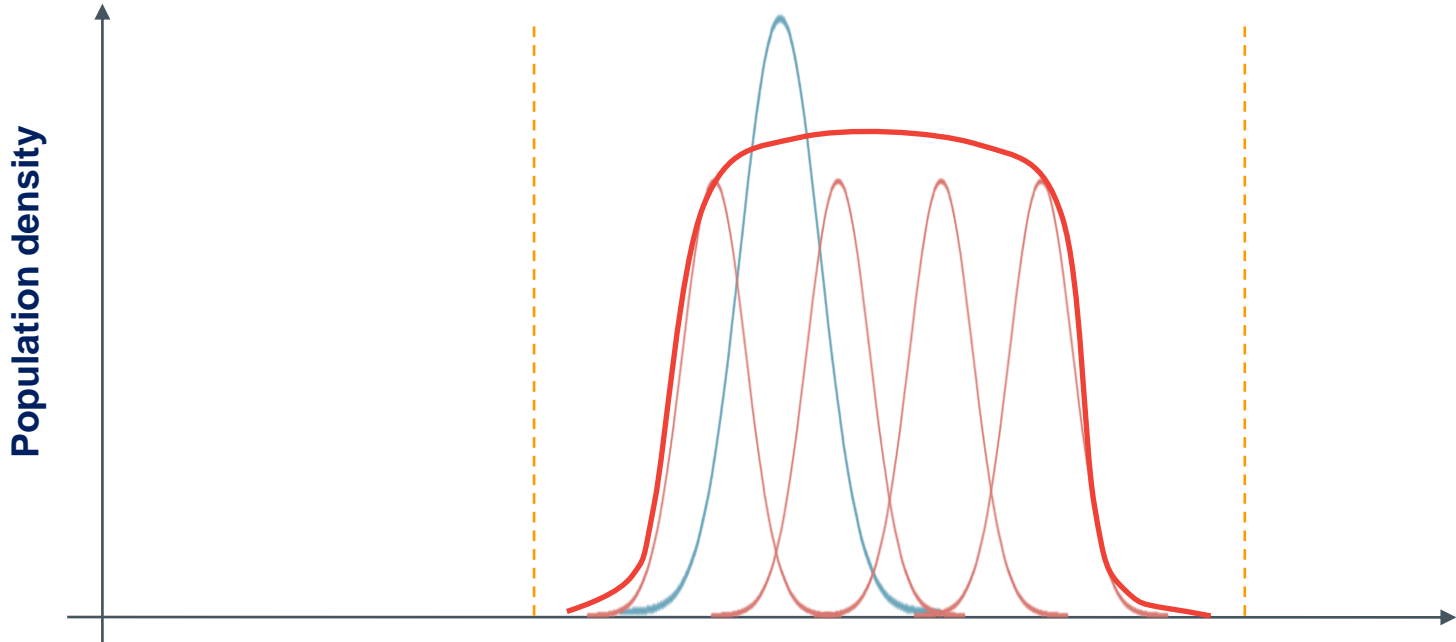
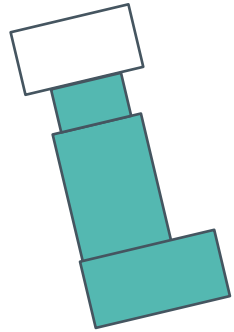




# Design and Manufacturing Considerations

Equivalent performance from Clinical to Commercial

Manufacturer



**Development/Clinical: Low cavitation pilot tooling / low sample size electronics**

**Commercial: Multi-cavity production tooling / high sample size multi-batch electronics**

# Summary

Inhaler design and connected health has the ability to improve medication outcomes and disease control

Carefully considering user and stakeholder needs early can improve ease of use, optimise usage data collection whilst 'designing out' complexity

Design and manufacturing approaches combine to minimise environmental impact

- Building-in simplicity at a conceptual level
- Splitting device functionality to retain key components and minimise waste
- Understanding energy use and implementing efficient manufacturing processes



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