# EARLY ECONOMIC MODELLING OF A SMART INHALER EXPLORING COST-EFFECTIVENESS IN A SEVERE ASTHMA SETTING

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## BACKGROUND

- Suboptimal adherence to inhaled corticosteroids is the most common reason for treatment failure in asthma[1]
- Recent treatment guidelines for severe asthma recommend that nonadherence to treatment should be considered, whilst also acknowledging this can be challenging to detect[2]
- Electronic monitoring devices such as smartinhalers can provide an accurate and objective measure of adherence and have been found to improve both adherence and clinically meaningful outcomes[3-5]
- Multiple studies have been published supporting the efficacy of smartinhalers in a variety of paediatric and adult settings, including primary, secondary and tertiary care, but their cost effectiveness in different settings has not been demonstrated[3-6]
- Early economic modelling could help determine which settings provide sufficient clinical and economic benefits to offset the additional costs of prescribing smartinhalers

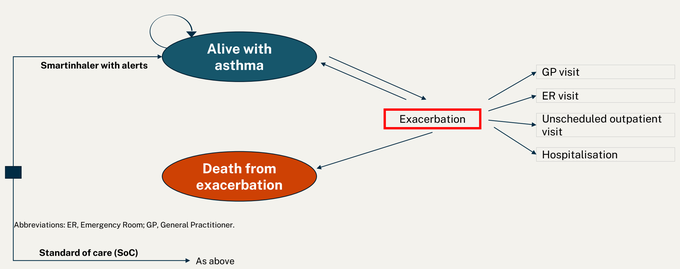
## OBJECTIVE

- The objective was to develop an early economic model to understand the drivers of value and to evaluate whether a smartinhaler could be cost effective at a price point of around £100, using current evidence and data

## METHODS

- A targeted literature review explored what models had been developed previously, as well as current asthma guidelines
- A range of conceptual models in different settings were developed and, following validation with clinical experts, a simple Markov model was developed and populated with data from a UK randomised controlled trial (RCT) (Morton et al., 2017)[3]
- The model had a 1-year time horizon, and explored the cost-effectiveness of the device vs SoC from the perspective of the UK NHS. Non-asthma mortality was excluded given the short time horizon
- A one-way sensitivity analysis was conducted to identify influential parameters

**Figure 1** Markov model




## RESULTS

- The smartinhaler with alerts in paediatric secondary care was found to be cost effective, and over one year was cost saving by £96 vs SoC
- Wherever the smartinhaler was cost saving it also had higher incremental QALYs, due to lower QALY losses from exacerbations, hence dominated SoC
- The device was cost-saving across a range of scenarios and at price of £100, and in different populations (including in adult secondary care)

**Table 1** Base case results for economic model investigating the cost-effectiveness of a smartinhaler vs SoC in a paediatric secondary care setting

**Costs**

| | Smartinhaler | GP | ER | Hospital | Outpatient | OCS | Seretide | Total | Discounted Total |
|---|---|---|---|---|---|---|---|---|---|
| Alerts | £156 | £73 | £32 | £55 | £540 | £2 | £280 | £1,138 | £1,138 |
| Standard of care | £0 | £82 | £36 | £280 | £554 | £4 | £280 | £1,235 | £1,235 |
| Difference | £156 | -£8 | -£4 | -£225 | -£14 | -£1 | £0 | -£96 | -£96 |

**QALYs**

| | Exacerbations | | | Discounted |
|---|---|---|---|---|
| | Health state | GP/ER | Hospital | Total | Total |
| Alerts | 0.959 | -0.003 | 0.000 | 0.956 | 0.956 |
| Standard of care | 0.959 | -0.004 | -0.002 | 0.953 | 0.953 |
| Difference | 0.000 | 0.001 | 0.001 | 0.003 | 0.003 |

**ICER**
*Smartinhaler dominates*

| Exacerbations | Severe exacerbations | Hospital admissions | Deaths |
|---|---|---|---|
| Alerts | 1.50 | 0.09 | 0.00 |
| Standard of care | 2.46 | 0.47 | 0.01 |
| Difference | -0.97 | -0.38 | 0.00 |

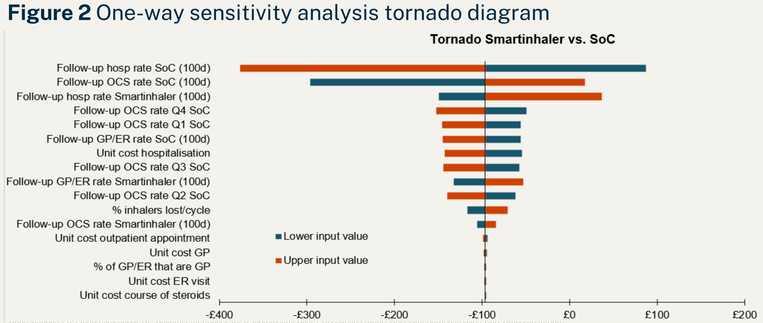
| Annalised Morton data | OCS courses | Hospital admissions |
|---|---|---|
| Alerts | 1.50 | 0.09 |
| No alerts (SoC) | 2.47 | 0.47 |

Abbreviations: ER, Emergency Room; GP, General Practitioner; ICER, Incremental Cost-Effectiveness Ratio; OCS, Oral Corticosteroids.

**Table 2** Summary of scenarios explored and cost savings realised

| Scenario | Cost savings |
|---|---|
| 1-year time horizon, as per trial (base case) | £96 |
| 2-year time horizon, sustained effect in Smartinhaler arm and no further decline in SoC arm | £392 |
| 2-year time horizon, sustained effect in Smartinhaler arm and continued decline in SoC arm | £632 |
| 2-year time horizon, declining effect in Smartinhaler arm after year 1 and no further decline in SoC arm | £84 |
| 1-year time horizon, as per trial but assuming NHS costs of adults | £19 |

**Figure 2** One-way sensitivity analysis tornado diagram




- The model was most sensitive to the hospitalisation rate in each arm, where the majority of the cost-savings were realised (Figure 2)
- The model was also sensitive to the oral corticosteroid (exacerbation) rate on SoC, which is split into GP visits, A&E and hospitalisations, the latter being the least frequent but most costly event

## DISCUSSION

- The smartinhaler was found to be cost saving in all scenarios explored, including when use was extended to a second year.
- This model looked at the minimum case with reminders only (no other functionality), once in place the smart inhaler can be used in a range of ways, including potential for supporting inhaler technique.
- Key value-drivers in both direction included loss of device, which would have a negative impact on costs, hospitalisation rate, and oral corticosteroid usage.
- Limitations of the reported economic model include:
  - Analysis based on one paediatric study, which lacked patient-level data
  - The data informing SoC outcomes were from patients using a smartinhaler without alerts, which has been found to increase adherence in other studies, thus improvements in the SoC arm of the model may have been overestimated

## CONCLUSIONS

- Smartinhalers have the potential to be cost saving when positioned in a paediatric population at high risk of hospitalisation.
- Smartinhalers also have the potential to be cost saving in an adult population, as long as the adults are also at high risk of hospitalisation.
- This model further supports use of smartinhalers in severe asthma.
- Further research may look to understand the impact of smartinhalers on adherence and clinical outcomes in a real-world setting.
- Further research should also aim to explore whether categorising and understanding patient characteristics will be able to further refine and enhance the value smartinhalers can offer.

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