

Dragon's Den: Connected Inhaler Platform

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Disclosures

- Consultancy fees from 3M and Anaxsys
- Scientific conference travel expenses from Teva UK Limited, GSK and Chiesi
- Honoraria from Teva UK Limited

Adherence: a key problem in asthma

- Inhaled corticosteroids have been the mainstay of asthma treatment since their introduction in 1972
- Non-adherence is common – less than half of adults and children with asthma take their treatment as prescribed
- Non-adherence is associated with reduced symptom control and FEV₁ as well as increased exacerbation frequency

Gamble J *et al.* *Am J Respir Crit Care Med* 2009;180:817–22

Murphy A *et al.* *Thorax* 2012;67:751–3

Engelkes M *et al.* *Eur Resp J* 2015;45:396–407

I'm worried
about the side-
effects

I'm too busy to
take it

I don't need this
inhaler any
more

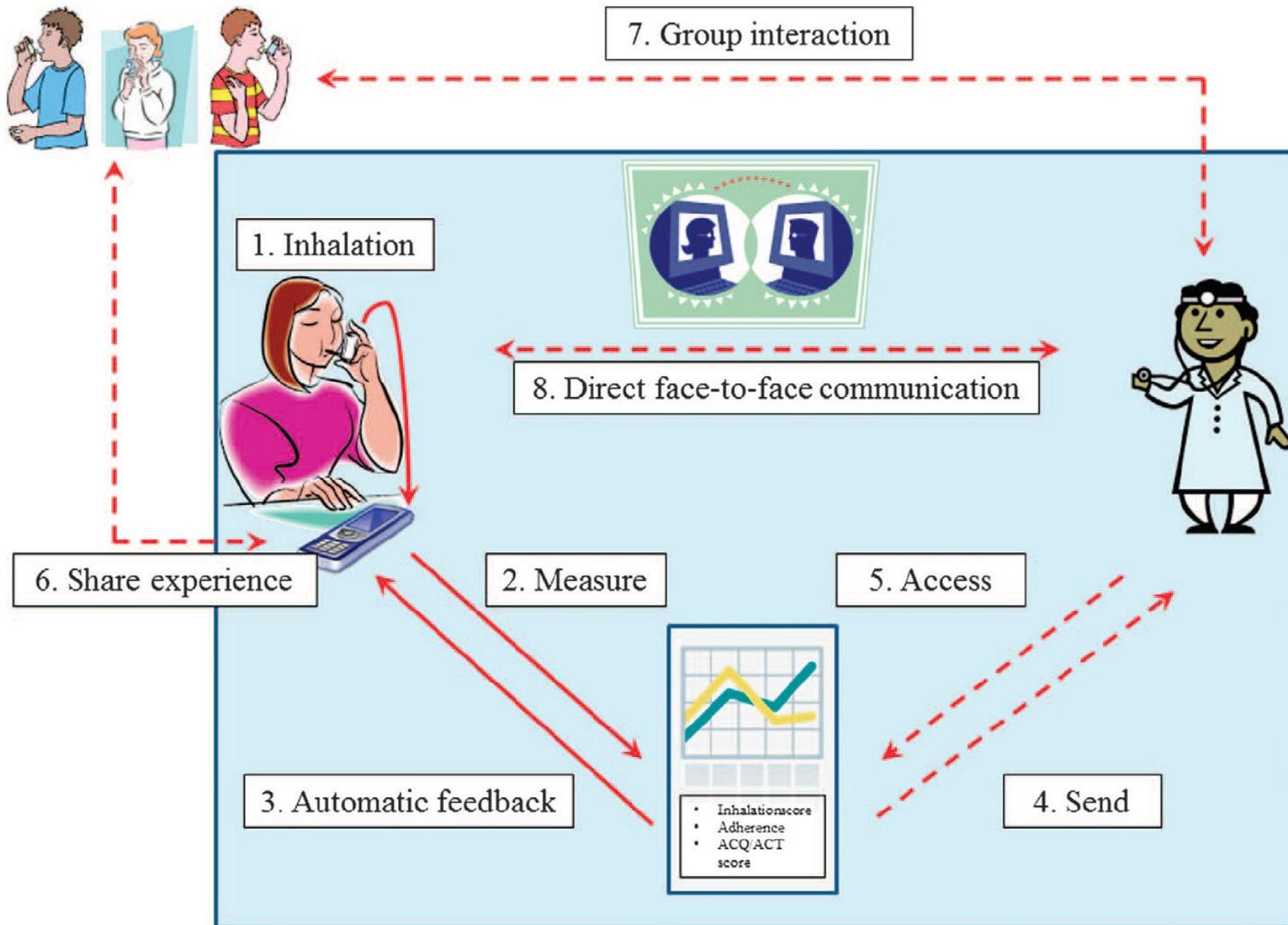
I can't afford it



Benefits of connected inhalers

- Objective assessment of adherence
- Starting point for discussions about adherence
- Real-time feedback for patients and clinicians
- Audio-visual reminders





Evidence for connected inhalers

Reference	Trial design	Outcome
Charles T <i>et al.</i> J Allergy Clin Immunol 2007;119:811-6	RCT of audio-visual reminder feedback (AVRF) vs monitoring without reminder in adults	Proportion of medication taken in the last 12 weeks was greater in the AVRF group (93%) compared with the control group (74%), $p < 0.0001$
Foster J <i>et al.</i> J Allergy Clin Immunol 2014;134(6):1260-1268	Cluster RCT with GP as unit of cluster, comparing inhaler reminders and feedback (IRF) and/or personalised adherence discussions (PADs) with active usual care alone in adults	Proportion of medication taken over 6 months was greater in the IRF group than in non-IRF groups (73% vs 46% of prescribed daily doses, $p < 0.0001$)
Morton R <i>et al.</i> <i>Thorax</i> 2017;72(4):347-354	RCT of electronic adherence monitoring with daily reminder alarms together with feedback in the clinic vs usual care with adherence monitoring alone in children age 6-16	Adherence in the intervention group was 70% vs 49% in the control group ($p \leq 0.001$)
Chan A <i>et al.</i> <i>Lancet Respir Med</i> 2015;3:210-19	RCT of audio-visual reminder feedback (AVRF) vs monitoring without reminder in children age 6-15	Median percentage adherence was 84% in the intervention group, compared with 30% in the control group ($p < 0.0001$)

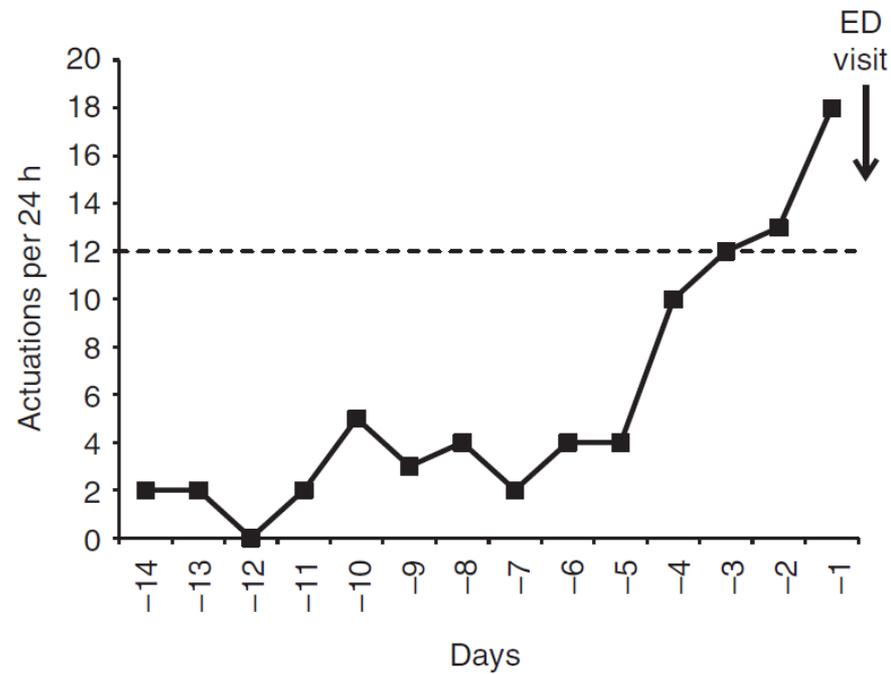
Cost-effectiveness of adherence interventions

- Cost-effectiveness analysis shows that an intervention which improves adherence by 50% should cost less than £75 *per* patient annually at a willingness to pay of £30,000 *per* QALY
- Taking into account productivity benefits results in the full adherence scenario being cost-saving

Zafari Z *et al.* J Allergy Clin Immunol 2014;134:908-15

Detecting poor control

- Baseline short-acting β_2 agonist use measured over a two-week period predicts a future asthma exacerbation during the next six months
- Short-acting β_2 agonist use increases in the days leading up to a hospital attendance



Population health

- AIR Louisville study enrolled over 1000 patients with asthma in Louisville, Kentucky
- Participants were given connected attachments to monitor short-acting β_2 agonist (SABA) use
- The attachments contained GPS receivers to monitor the location of SABA usage
- Data on over 250,000 medication puffs were collected and mapped
- In conjunction with environmental data this led to policy recommendations including enhancing tree canopies, tree removal mitigation and recommended truck routes
- In a subsequent nationwide study the same methodology was used to show that a 12% increase in particulate matter exposure is associated with a 0.82% increase in SABA use

www.airlouisville.com

Barrett M *et al.* Health Affairs 2018;37:525-34

Williams *et al.* Proc Natl Acad Sci U S A 2019;116:5246-53

Conclusion

"Our last major breakthrough was the inhaler and we are hugely excited by the prospect of smart inhalers coupled with mobile devices.

We believe mHealth solutions are the future for asthma care and the key to reducing highly preventable deaths."

Kay Boycott, Asthma UK