

Smart asthma:

Real-world implementation of connected devices in the UK to reduce asthma attacks



Foreword

My first major event as Chief Executive at Asthma UK was the launch of the National Review of Asthma Deaths (NRAD) in 2014.

This seminal report highlighted the tragedy of two out of three deaths from asthma attacks being entirely preventable if simple routine care was implemented. After six months in post, having attended many meetings with the respiratory community, policymakers, and industry, it felt inevitable that basic care could not be consistently delivered by the NHS. But when hardened journalists at the press conference were shocked by the findings of the NRAD report, I resolved never to accept that people with asthma will have their care compromised and their lives put at risk.

Of course, nobody wants poor care to be the norm. However, we haven't yet found the best ways of making the basics of asthma management and self-management clinically effective, accessible to those without expert knowledge, affordable in a system of stretched resources, and acceptable to the wide variety of people with asthma. Continuing with the refrain of "if only" – if only GPs had more time in appointments, if only there was more training, if only patients did exactly what they were told, if only people had a spare five minutes a day – is pointless. We need to design around reality, not aspiration.

The reality of managing asthma is that it is messy, unpredictable, complicated, delivered at huge scale, yet entirely personal to each person with asthma. And crucially, unless someone is struggling for breath, it's unlikely to be the most important thing on the to-do list of their life. These are the underpinning principles for any redesign of how we deliver basic asthma care – solutions need to be discreet, personalised and intuitive, and need to require less from the person with asthma, rather than more.

Without newly available technologies and the ubiquity of smartphones, significant change would likely be just a pipedream. However, with new sensors, cloud data services, risk algorithms, telehealth solutions and mobile apps we have the opportunity to radically redesign asthma care.

Asthma UK is determined to play a pivotal role in speeding up the adoption of such technologies – and, conversely, slowing them down if there are dangers

they bring new care challenges or will not deliver real benefits for the majority of people with asthma. How we choose to implement asthma digital health in the NHS in the next five years is likely to set the direction for the next 20 to 30 years. In the same way, the model used to introduce inhalers in the 1980s – asthma reviews – is still the model dominant today, although it is sub-optimal in practice.

We need to design around reality, not aspiration.

This report sets out the opportunities and possible pitfalls as we digitise asthma. We have consulted industry, expert clinicians, eminent academics and policy specialists in the course of developing this report. We know that to make new technology stick it must help health-care system efficiency and allow providers to make a fair profit. However, our overriding and unapologetic duty is driving improvement for the 5.4 million people in the UK with asthma, and the families who have lost a loved one as a result of a failure in asthma care.

It is for these people's sake that the recommendations in this report should be seriously debated and considered, and the future implementation of digital asthma care taken up at the highest levels of the NHS.

Kay Boycott
Chief Executive



Executive summary

Care for the 5.4 million people with asthma in the UK has seen no significant improvement in recent years, despite the widespread availability of treatments that are effective for the majority. New ways of delivering asthma care are urgently needed.

Asthma technology to drive NHS innovation

Connected devices for asthma are becoming increasingly available – particularly smart inhalers which can objectively track, monitor and prompt medication use. Initial research suggests a willingness among the asthma population to carry a connected device. There is therefore a major opportunity for people with asthma, healthcare professionals and the NHS to use data from these devices over the coming decade to improve asthma outcomes in the UK. However, there could be adverse and costly effects if these technologies are not developed and rolled out thoughtfully.

Smart inhalers for an evolving NHS have the potential to support:

- Digital transformation of health services
- Management of long-term conditions at scale
- Enhanced supported self-management
- Risk stratification and management according to need
- Personalised approaches to care
- Reductions in avoidable emergency admissions
- Improvements in patient safety
- Improvements in patient quality of life
- New discoveries through data-driven academic research

Challenge 1: *The technical capability to introduce connected devices to address key issues in asthma care (such as adherence) is already here, though this does not imply that ideal care pathways, processes and devices yet exist.*

A focus on new approaches for asthma

Asthma is very common, total medication costs are high, and adverse outcomes are largely preventable. The use of digital technologies like smart inhalers could save the NHS time and resources at a time of unprecedented financial pressure. In contrast, continued suboptimal asthma management will have long-term effects in failing to

reduce preventable harm. Tailoring treatment to manage an individual's asthma "pattern" requires significantly greater monitoring than is currently achieved through infrequent healthcare practitioner review.

Challenge 2: *Asthma represents an ideal opportunity for the thoughtful widespread rollout of connected technologies.*

Realising the UK's competitive innovation model

The UK is a global leader in academic and commercial research, and through the NHS can co-develop, test and commercialise innovation at scale. Given that 85% of asthma cases are treated within primary care, there is significant potential to develop connected technologies that utilise the electronic health records provided through primary care. Smart inhaler developers have initially focused on the United States market, which risks these connected devices evolving without seizing on the benefits of the UK's health system and expertise.

Challenge 3: *The UK is ideally placed to lead on the development and strategic implementation of connected technologies for asthma.*

Future-proofing connected devices for asthma

The persistent and successful use of connected devices will rely on modernisation of clinical and administrative practice. As devices like smart inhalers become increasingly used, clinicians will need to adapt to use the data collected as a core part of their assessment and monitoring – helping to support their management of patients and informing face-to-face consultations. This will also require different approaches to procurement. Commissioners will no longer be purchasing just medication in the form of inhalers, but also other components to make the whole system work – such as the sensors, cloud services, user mobile apps and clinical support systems. How these are sold and priced from the start could have far-reaching impacts on models of implementation.

Challenge 4: *Widespread use of connected technologies will happen very soon. We must have a clear plan to ensure they are safe, effective and good value for money for all, and to enable rapid access and uptake.*

User-centred design of technology

Digital devices to support self-management have experienced setbacks in being accepted by users.⁴¹ The development of connected technologies for asthma must ensure the variety of the patient population is reflected.

Challenge 5: *Involving people with asthma in the development of connected technologies and related systems will result in greater use and longevity of products.*

Supporting clinician care

Asthma is a variable condition, and people with asthma often do not seek support or assessment at times of need or increased risk. Annual asthma reviews are not always of use to patients,¹¹ and their volume currently contributes substantially to the already-stretched provision of primary care services. The use of data from connected devices will challenge this current approach and could enable fewer face-to-face consultations and more personalised care according to need. Connected devices will allow clinicians to manage asthma at scale and facilitate true risk stratification. By alerting patients and clinicians when symptoms require specific action, smart inhalers could help reduce the complacency that current systems encourage, and facilitate a shift to greater self-care and self-activation. Engagement with clinicians is crucial in helping ensure that the data collected through connected devices to help inform asthma care are appropriate, timely, robust, and correctly interpreted.

Challenge 6: *Developing technologies with clinicians will result in more useful and efficacious products, and potentially better use of clinician time.*

Ensuring compatibility across the NHS

Little work has been done to determine how apps and devices will link to NHS systems in a standard manner and make interoperability the norm. This is crucial for data to be used to make clinical decisions or to automate management steps. With over 90 inhalers on the market and many people with asthma prescribed at least two, people with asthma must also be able to switch between their inhaled treatments (or use multiple treatments) seamlessly, and without being tied to a particular mobile health offering or needing multiple apps.

Challenge 7: *Accounting for the needs of healthcare providers and current systems when developing new technologies will increase their volume and breadth of use.*

Research opportunities and challenges

Current research on connected technologies in asthma to date suggests:

- There is clear imperative to undertake a programme of research relating to newer connected technologies.
- People with airways disease appear to generally accept and interact with connected devices.
- Data from smart inhalers can provide clinically relevant insights.

However, key research gaps are yet to be addressed and could hinder success unless addressed in full. Filling these gaps will require industry, the NHS, and academia to work together in partnership.

Challenge 8: *Realising the potential of connected technologies will require investment in a significant programme of research – including basic information such as accuracy, robustness, user experience and clinical outcomes.*

Main action points

For government and decision-making bodies



There is an overall need to prioritise this area. Creating facilitative conditions for connected technologies has the potential to create wealth and employment in the UK.



The health technology appraisal system across the UK needs to be efficient to ensure that it is an attractive first market destination for smart inhaler companies looking to introduce their products.



The promise of connected technologies will not be realised unless substantial work is done on data standards and interoperability with NHS systems. It is crucial this work starts as soon as possible.



An industrial grand challenge for asthma management could seek to harness device and drug-based monitoring technologies, combined with patient data, aimed at automating asthma care where this could be appropriate.



Clear technical standards for smart inhalers will ensure consumers receive devices that are robust and accurate, and collect clinically meaningful data. The creation of standards against which organisations like NICE can appraise new products is overdue.



Researchers will need access to data-enabled populations at sufficient size and representation to enable cost-effectiveness testing and development of implementation models for smart inhalers.



There is currently a lack of clarity over the funding structure for connected devices in the UK and limited understanding of how this will align with developers' business models. The elucidation of this by NHSE will facilitate innovation and allow healthcare providers to co-ordinate their plans for future services to maximise progress and minimise waste.

For healthcare organisations

- Connected devices will form an essential component of systems in the UK that reduce the burden on care settings. Healthcare providers need to come to a consensus as to what data they require about and from new technologies to effectively deploy them.
- “Internet of Things” technologies generate very large amounts of data in a continuous stream. Healthcare providers need to plan how these data are to be stored and meaningfully integrated into electronic patient records, and settle questions about who owns the data.
- Deploying new technologies is likely to increase short-term costs. Providers will need to work with health economists to determine what models are likely to be sustainable and where initial priorities for asthma lie.

For healthcare professionals

- Developers often lack an understanding of the measurements useful to clinicians and how they are best presented. Therefore, healthcare professionals and their professional bodies should begin the process of agreeing the desirable attributes of clinically useful connected devices for asthma.
- Smart inhalers and other connected devices are available, and may soon be in widespread use in the UK. Clinicians should give thought now as to how these new data streams can be most usefully and safely integrated into their usual schedule and how resources may be redeployed to maximise their use.
- Clinicians should also consider how these new data streams can be included into existing clinical decision-making systems for asthma.

For industry

- The effectiveness and longevity of connected technologies depends on their co-creation with end-users, clinicians, and providers. Developers will need to demonstrate clear engagement with these groups before products are considered for use in the UK.
- People with asthma usually have more than one medicine, and drugs or devices are often changed because of asthma’s variability. Stand-alone solutions that are not readily compatible with other systems will not be successful.
- The provision of connected devices and related devices is costly and potentially harmful. The standard of evidence required before their deployment in the UK is much higher than for lifestyle products such as activity monitors. Developers must consider building studies into their budgets and timelines.

For researchers and research funders

- The efficiency and effectiveness benefits of deploying connected technologies for asthma will not be realised in a safe and timely manner without co-ordinated, high-quality research. Research funders can provide leadership in this area and should consider directed calls.
- In a competitive UK marketplace, it is likely that specific products for asthma will be tested against standard care. Additional research is therefore required to investigate the underlying principles of what elements of connected technologies are beneficial for which measures in which populations.
- The healthcare value of incorporating data from connected devices into self-management, risk scoring, and clinical decision making is uncertain. Future research should include consideration both effectiveness and cost-effectiveness.

Smart inhalers and other connected devices are available, and may soon be in widespread use in the UK. Clinicians should give thought now as to how these new data streams can be most usefully and safely integrated into their usual schedule