



Topic Exploration Report

Topic explorations are designed to provide a high-level briefing on new topics submitted for consideration by Health Technology Wales. The main objectives of this report are to:

- Determine the quantity of evidence available for a technology of interest.
- Identify any gaps in the evidence.
- Inform decisions on topics that warrant fuller assessment by Health Technology Wales (HTW).

Topic exploration report number:	TER444
Topic:	Smart peak flow meters for monitoring asthma.
Summary of findings:	<p>Digital (smart) peak flow meters are designed as an alternative to mechanical peak flow meters, and can be used with a mobile app or internet-based platform in order to monitor asthma. They may be used as part of a system which includes other smart devices. HTW has produced a separate topic exploration report (TER) on smart inhalers (TER440).</p> <p>The National Institute for Health and Care Excellence (NICE) produced a Medtech innovation briefing (MIB) on Smart Peak Flow in 2022. Experts advised that Smart Peak Flow could replace mechanical peak flow meters, but evidence is needed on its validation against the current gold standard in peak flow meters, asthma-related outcomes, use and adherence, and the effect on clinical decision making and resource use. There were no studies evaluating the effect of the device on clinical or patient-reported outcomes, clinical decision making, or user satisfaction.</p> <p>A Cochrane review on digital interventions (including smart peak flow meters) was identified, but evidence regarding the use of these devices interacting with apps was not specifically reported. The Cochrane review did include an RCT in Taiwan which reported that an internet-based asthma tele-monitoring program (including an electronic peak flow device) improves adherence and asthma outcomes in children. HTW researchers did not identify any further primary studies on smart peak flow meters (interacting with apps or internet-based platforms) and no ongoing trials were identified that were expected to complete in the next 6-12 months.</p> <p>There is a lack of clinical evidence specifically assessing the use of smart peak flow meters that interact with apps and/or internet-based platforms. No economic evaluations were identified.</p>

Introduction and aims

Digital (smart) peak flow meters are designed as an alternative to mechanical peak flow meters, and can be used with a mobile app or internet-based platform in order to monitor asthma. They may be used as part of a system which includes other smart devices. HTW has produced a separate topic exploration report (TER) on smart inhalers (TER440). Peak flow meters measure how fast people can blow out after a deep breath (peak expiratory flow; PEF), a test of lung function. PEF readings play an important role in managing asthma and because of this, self-monitoring is often prescribed.

Smart Peak Flow (Smart Respiratory Products) is a smart peak flow meter which is associated with the Smart Asthma app. This app records PEF measurements as well as symptoms and inhaler use. It also automatically charts the recorded measurements. This information can be used to give reminders and share data between patients and clinicians.

Health Technology Wales researchers searched for evidence on the clinical effectiveness and cost-effectiveness of smart peak flow meters (and associated apps/internet platforms) for monitoring asthma.

Evidence overview

NICE quality standard and guidance

NICE's quality standard on asthma (QS25; NICE 2018) states that people aged 5 years and over with asthma should discuss and agree a written personalised action plan, that they should be regularly involved in reviewing and updating their plan, and that they should be helped to self-manage their asthma. NICE guideline (NG80) provides guidance on asthma: diagnosis, monitoring and chronic asthma management (NICE 2022) and in 2017 recommended research into the long-term (more than 12 months) clinical and cost-effectiveness of using tele-healthcare (including smart-phone based) as a means to monitor asthma control in adults, young people and children.

Evidence reviews

HTW researchers identified a NICE Medtech innovation briefing (MIB282) on Smart Peak Flow published in 2022. The innovative aspects of the technology were reported to be the automatic recording and charting of PEF values in the Smart Asthma app, and calculating colour coded peak flow zones that indicate a person's asthma control. Experts advised that Smart Peak Flow could replace mechanical peak flow meters, but evidence is needed on its validation against the current gold standard in peak flow meters, asthma-related outcomes, use and adherence, and the effect on clinical decision making and resource use. There were no studies evaluating the effect of the device on clinical or patient-reported outcomes, clinical decision making, or user satisfaction. The conclusions were drawn based on five studies (total of 1,181 people), of which only two were comparative.

A Cochrane review by Chan et al. (2022) considered digital interventions to improve adherence to maintenance medication in asthma. However, evidence regarding the use of smart peak flow meters interacting with apps was not specifically reported. One RCT (n=164) included in the review (Jan et al. 2007) considered an internet-based interactive tele-monitoring system (including an electronic peak flow device) for improving childhood asthma outcomes in Taiwan. At the end of the trial, the intervention group (compared to the conventional management group) had decreased night time (-0.08 ± 0.33 vs. 0.00 ± 0.20 , $p = 0.028$) and daytime symptoms (-0.08 ± 0.33 vs. 0.01 ± 0.18 , $p = 0.009$); improved morning (241.9 ± 81.4 vs. 223.1 ± 55.5 , $p = 0.017$) and night PEF (255.6 ± 86.7 vs. 232.5 ± 55.3 , $p = 0.010$); increased adherence rates ($p < 0.05$); improved well-controlled rates (70.4% vs. 55.3%,

$p < 0.05$); improved knowledge regarding self-management (93.2% vs. 70.3%, $p < 0.05$); and improved quality of life (6.5 ± 0.5 vs. 4.3 ± 1.2 on a 7-point scale, $p < 0.05$).

No further primary studies on smart peak flow meters interacting with apps or internet-based platforms were identified and no ongoing trials were identified that were expected to complete in the next 6-12 months.

The topic proposer reported that compliance with self-monitoring of PEF is promising and that there is potential for machine learning algorithms to predict next-day peak flow measurements, although research is required.

Economic evidence

No economic evaluations were identified. However, MIB282 reported that the cost of Smart Peak Flow (per device, excluding VAT), the optional Bluetooth adapter and the Smart Asthma app were £9.87, £6 and £0, respectively. Mechanical peak flow meters reportedly costed between £4.25 and £9.50 per device. The Smart Peak Flow meter has a two-year life expectancy compared to some mechanical peak flow meters which are recommended to be replaced after three years. It should be noted that initial setup of the device and guidance for use should be provided by a healthcare professional. Adult supervision is needed when used by children and young people, and some disabled people.

Areas of uncertainty

There is a lack of clinical evidence specifically assessing the use of smart peak flow meters that interact with apps and/or internet-based platforms.

Whilst the topic proposer reports that compliance with self-monitoring of PEF is promising and that there is potential for machine learning algorithms to predict next-day peak flow measurements, research is required to evidence this.

There is potential for smart peak flow meters to be used with numerous smart devices and numerous apps and internet-based platforms, from different companies, creating different systems moving forwards.

Apps and internet-based platforms may be desirable and help with compliance, for example in young people. However, there may be barriers to some people accessing and utilising technology, for example due to age or disability. Additional guidance and support may be required for these people.

Literature search results

Health technology assessments and guidance

Health Information and Quality Authority. (2015). HTA of chronic disease self-management. Technology appraisal. Available at: <https://www.hiqa.ie/reports-and-publications/health-technology-assessment/hta-chronic-disease-self-management> [Accessed 11 January 2023].

Includes self-management of asthma, but does not refer to smart peak flow meters.

NICE. (2021). Asthma: diagnosis, monitoring and chronic asthma management. NICE guideline (NG80). National Institute for Health and Care Excellence. Available at: <https://www.nice.org.uk/guidance/ng80> [Accessed 11 January 2023].

NICE. (2018). Asthma. Quality standard (QS25). National Institute for Health and Care Excellence. Available at: <https://www.nice.org.uk/guidance/qs25> [Accessed 11 January 2023].

SIGN. (2019). British guideline on the management of asthma. SIGN guideline (SIGN158). Healthcare Improvement Scotland. Available at: <https://www.sign.ac.uk/our-guidelines/british-guideline-on-the-management-of-asthma/> [Accessed 11 January 2023].

Guideline does not refer to smart peak flow meters, but does include a section on tele-healthcare generally.

Evidence reviews and economic evaluations

Chan A, De Simoni A, Wileman V et al. (2022). Digital interventions to improve adherence to maintenance medication in asthma. Cochrane Database of Systematic Reviews 2022, Issue 6. Art. No.: CD013030. doi: <https://doi.org/10.1002/14651858.CD013030.pub2>.

Unclear how smart peak flow meters that interact with apps and internet-based platforms impact adherence and/or asthma control.

NICE. (2022). Smart Peak Flow for monitoring asthma. NICE Medtech innovation briefing (MIB282). National Institute for Health and Care Excellence. Available at: <https://www.nice.org.uk/advice/mib282> [Accessed 11 January 2023].

Individual studies

Jan RL, Wang JY, Huang MC, et al. (2007). An internet-based interactive telemonitoring system for improving childhood asthma outcomes in Taiwan. *Telemedicine Journal and e-Health* 2007. 13(3): 257-68. doi: <https://doi.org/10.1089/tmj.2006.0053>.

Ongoing research

No ongoing trials investigating smart peak flow meters in asthma were identified that were expected to complete in the next 6-12 months.

Date of search:

January 2023

Concepts used:

Asthma monitoring app; Breathesmart; Cohero; digital; eHealth; mHealth; mobile; peak flow meter; Propeller Health; self-manage; self-monitor; sensor; Smart asthma app; smart devices; tele-monitoring.

Proposed research question and evidence selection criteria (if selected)

Proposed research question	Are smart peak flow meters that interact with apps and/or internet-based platforms clinically and cost-effective for monitoring asthma?
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	Included	Excluded
Population	People with asthma	
Intervention	Smart peak flow meters that interact with apps or internet-based platforms to monitor asthma	Peak flow meters that do not interact with apps or internet-based platforms. Apps or internet-based platforms that do not interact with smart peak flow devices. Spirometers Virtual education Text reminders / calls
Comparison/ comparators	Standard asthma monitoring; mechanical peak flow meters	
Outcomes	Reduced short-acting beta-agonists (SABA) refill rates, Reduced secondary care appointment number and quicker referral-to-discharge times, Reduced oral corticosteroid use, Adherence, Peak expiratory flow (PEF), Asthma control questionnaire (ACV)	
Study design	Any. Ideally systematic reviews/RCTs. Economic studies.	