



**Heartbeat**

Connecting health and care communities

**FeNO Testing**



## **Better Access Protocol**

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**At a glance**



## Background

Asthma is a chronic inflammatory disease of the airways, which results in widespread but variable airflow obstruction in response to a variety of stimuli. It is one of the most common long-term conditions and accurate diagnosis and good care can reduce hospital admissions and asthma deaths.

FeNO testing (Fractional Exhaled Nitrous Oxide) is a useful test in the diagnosis and management of asthma that is being made available to practices in Hambleton, Richmondshire and Whitby. The devices are being provided by the HCV ICS who have also developed a protocol that forms part of this document..

## Identifying Patients for Testing

As per the protocol FeNO testing can be used for diagnosing patients with a newly suspected asthma diagnosis but can also be used for identifying those already coded with suspected asthma or who may have been diagnosed during the pandemic and require follow-up testing.

There are a number of case finder searches available on Ardens that can identify patients who may be suitable for further investigation and FeNO testing. As each practice will have it's own policy around coding and diagnosis the most appropriate searches will need to be decided at practice (or possibly PCN) level.

## Training

For clinical staff carrying out FeNO testing (this will likely be HCAs and Practice Nurses) there is a module on the [eLFH platform](#) that outlines the requirements and best practice for testing. There is also a series of videos that can be accessed [here](#) which goes through the devices used in the service (you can ignore the FeNO chart software video).

For clinicians interpreting the FeNO result it is worth completing the relevant module on the [eLFH platform](#). There are also 2 very useful webinars available: one from [NObreath](#) that manufacture the device and one from the [ICS team](#).

## Booking

Patients can be booked in using remote booking through the existing Heartbeat System1 module.

## Sites

8 devices have been made available and will be allocated to locations around HRW. Initially 3 hub sites will be available at Harewood Medical Practice, Thirsk Health Centre and Whitby.



# FeNo Testing in Primary Care Protocol

## QOF requirements for asthma

Use a minimum of two diagnostic tests to confirm an asthma diagnosis. These should be performed up to 3 mth before or up to 6mth after the diagnosis is made.

Require a record of spirometry and one further test from:

- FeNO
- Reversibility (improvement in lung function after trial of treatment) either by:
  - Spirometry: FEV1/FVC <0.7 (or LLN) and an increase in FEV1 by >12% and >200 from baseline after salbutamol or after 4 weeks of treatment
  - OR
  - PEFr diary: Increase by >20% from baseline after 4 weeks of treatment
- Variability (peak flow chart)
  - Average daily diurnal PEF variability >20%

Daily diurnal PEF variability is calculated from twice daily PEF as  $(\text{Highest PEF} - \text{Lowest PEF}) / \text{Highest PEF} \times 100\%$ . Look for 20% change or more from baseline AND at least 60L/min on 3 or more days over 2 weeks.

## Asthma diagnosis

History is key, and **new possibilities for testing do not replace the need for a careful history and recognition of signs and symptoms**. Due to sensitivity and specificity of the available tests, a combination must be used for confirming a diagnosis of asthma.

- 41% of patients with asthma will have reversible airflow obstruction on spirometry (sensitivity)
- 71% of healthy people without asthma will have normal spirometry (specificity)
- 84% of patients with asthma will have a high FeNO level (sensitivity)
- 87% of healthy people without asthma will have a normal FeNO level (specificity)

NICE guidance advocates both spirometry and FeNO as the initial test in all suspected asthma cases, and diagnostic algorithms therefore reflect this.

Pragmatically, in primary care locally, it may not be possible to undertake spirometry due to capacity and ongoing backlog from the pandemic, or if available it may introduce delay. Given that the sensitivity and specificity of FeNO are higher, and the time required shorter, in the absence of readily accessible spirometry it would be reasonable to undertake FeNO first and proceed as below.

## Asthma initial assessment

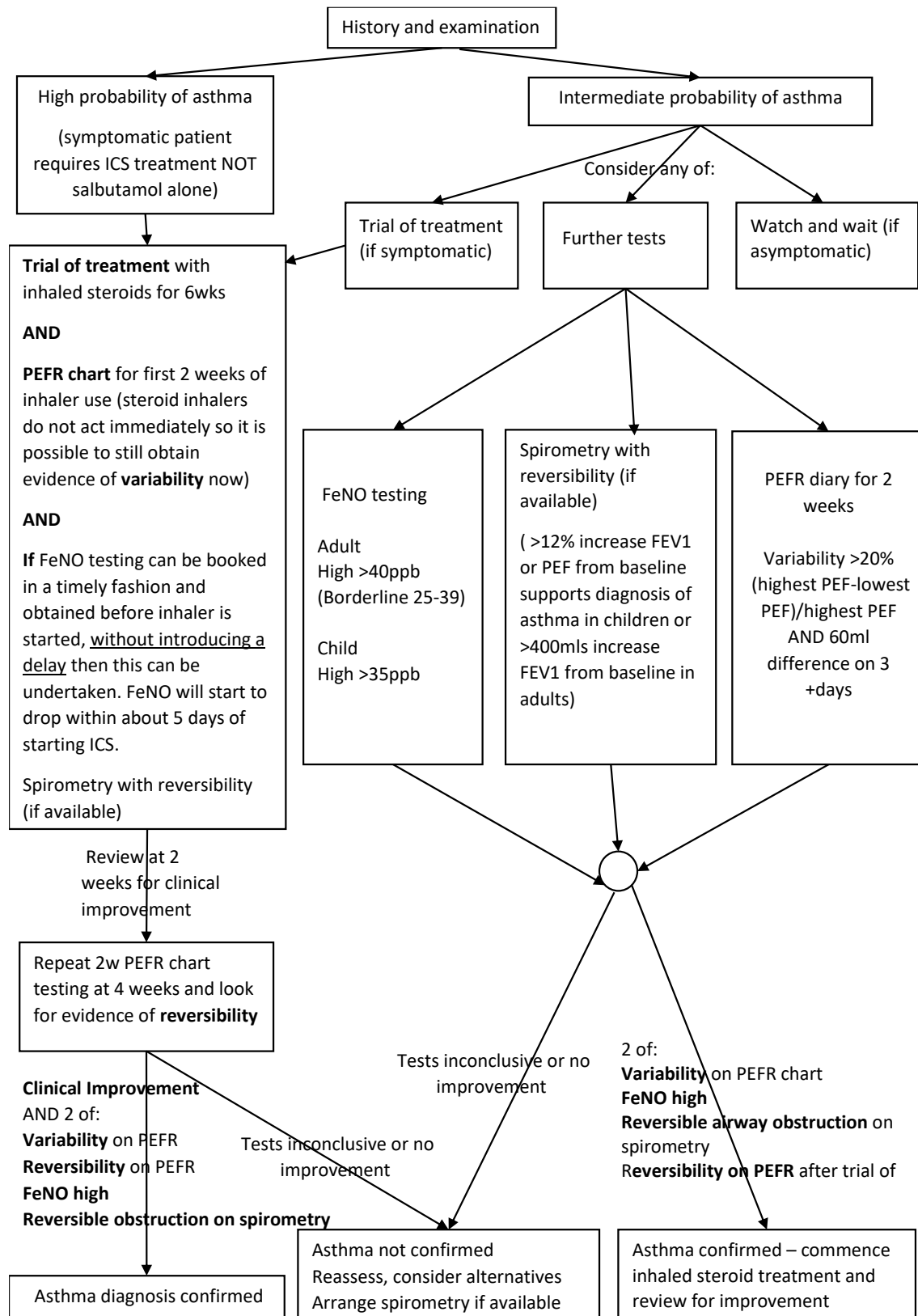
Based on history and clinical signs, patients should be categorised into probability of asthma diagnosis (as recommended in BTS SIGN Asthma guidelines) and managed accordingly:

If there is a high probability of asthma and the patient is symptomatic, inhaled steroid treatment should be started immediately and not delayed in order to obtain diagnostic tests.

Symptoms and signs that INCREASE the probability of asthma	Symptoms and signs that DECREASE the probability of asthma
<ul style="list-style-type: none"> <li>• Wheeze</li> <li>• Cough</li> <li>• Difficulty in breathing</li> <li>• chest tightness</li> </ul> <p>often:</p> <ul style="list-style-type: none"> <li>• frequent &amp; recurrent</li> <li>• worse at night and early morning</li> <li>• occur in response to triggers eg cold air, pets, exercise, laughter</li> <li>• occur apart from colds</li> <li>• occur after taking aspirin or beta blockers</li> </ul> <p>with:</p> <ul style="list-style-type: none"> <li>• history of atopy eg rhinitis, eczema</li> <li>• FH of atopy or asthma</li> <li>• Wheeze heard on auscultation</li> <li>• Improvement with treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Chronic productive cough without wheeze or SOB</li> <li>• Isolated cough without wheeze or difficulty breathing</li> <li>• History of moist cough</li> <li>• Prominent dizziness, light-headedness, peripheral tingling</li> <li>• Voice disturbance</li> <li>• Symptoms with colds only</li> <li>• Other coexistent conditions eg heart disease</li> <li>• Repeatedly normal physical examination of chest when symptomatic</li> <li>• Normal PEF or spirometry when symptomatic</li> <li>• No response to a trial of treatment</li> </ul>

## Initial Primary Care Management

(pragmatic recommendation based on availability of testing and capacity)



## Criteria for FeNo testing

1. New intermediate probability of asthma
2. New high probability of asthma (only if resources allow for this to be done without delay to treatment)
3. Complex asthma patients eg not improving with treatment, possible poor compliance to medication and ongoing symptoms. These presentations should all be discussed with respiratory lead nurse or GP prior to FeNO testing

## Understanding asthma tests

In asthma, symptoms arise from:

1. Variable narrowing of airways causing obstruction – detected by PEFR monitoring or spirometry (can be normal in asthma)
2. Inflammation of airways – detected using FeNO testing which measures eosinophilic inflammation

Eosinophilic inflammation (also known as Type-2 or T2 inflammation) is the most common type of inflammation seen in asthma and it usually responds very well to inhaled corticosteroids. Those with eosinophilic inflammation are more likely to experience asthma symptoms and asthma attacks. Sometimes eosinophilic airway inflammation can be found in the airways before airway narrowing can be detected. The FeNO level will go up if there is untreated eosinophilic inflammation in the airways eg in untreated asthma, or poorly controlled asthma.

Inflammation occurs in the airway epithelium in response to triggers which cause recruitment of eosinophils to the airways. Triggers cause 3 reactions in the airways:

1. Airway muscles constrict causing narrowing
2. The lining of the airways becomes inflamed and starts to swell
3. Mucus can build up, which can narrow the airways even more

Without current asthma symptoms, there may still be inflammation in the airways which can unpredictably react to triggers.

There is no single test that can accurately diagnose asthma and asthma symptoms, airway narrowing, and inflammation can vary a lot over time so tests can be normal even though a person has asthma and may need to be repeated over time when symptoms are present.



## Pre-test preparation

- Avoid eating, drinking (hot drinks, caffeine and alcohol), smoking and exercise for at least 1 hour prior to appointment.
- Avoid nitrate rich foods such as, green leafy vegetables (for example, celery, leek, beetroot, lettuce and spinach) at least 3 hours before their test.

Patients will be required to take a deep inhalation and then a slow, gentle breath out for 10 seconds. They may need to repeat the test. If other respiratory tests such as spirometry are being undertaken as part of the same appointment it is recommended that FeNO testing is performed first.

## Interpretation of results

	Low FeNO level  <25 ppb in adults <20 ppb in children)	High FeNO level  >40 ppb in adults >35 ppb in children or rise of 40% from prev stable level
<b>For diagnosis in symptomatic patient</b>	suggests NO significant allergic eosinophilic airway inflammation (but alone does not rule out asthma)  Unlikely to benefit from ICS  <u>Consider:</u> non allergic asthma, rhinosinusitis, bronchiectasis, CF, post viral bronchospasm, vocal cord dysfunction, breathing pattern disorder, GORD, cardiac disease, pul HTN, PE	suggests significant allergic eosinophilic airway inflammation  Likely to benefit from ICS  <u>Consider:</u> allergic asthma, atopic asthma, allergic bronchitis, COPD with inflammatory phenotype
<b>Known asthmatic</b>	<u>Asymptomatic:</u> suggests well controlled inflammation (FeNO levels are reduced by ICS treatment) Could consider ICS reduction and recheck FeNO in 4wk	<u>Asymptomatic:</u> suggests ongoing inflammation so ICS reduction may result in relapse. Check technique and compliance.

	<p>(25-50ppb is also adequate ICS dosing in asthmatic unless 40% rise from previous)</p> <p><u>Symptomatic</u>: consider other diagnoses eg non-allergic asthma (not ICS responsive), rhinosinusitis, bronchiectasis, CF, post viral bronchospasm, vocal cord dysfunction, breathing pattern disorder, GORD, cardiac disease</p>	<p><u>Symptomatic</u>: at risk of exacerbation - consider persistent allergen exposure, inadequate ICS or poor technique or compliance.</p>
<b>Confounding factors</b>	<p>FeNO levels can be <u>reduced</u> by:</p> <p>cigarette smoking obesity inhaled or oral steroids</p>	<p>FeNO levels can be <u>increased</u> by:</p> <p>consuming nitrate containing foods allergic rhinitis</p>

If the FeNO result is borderline (25-39 ppb in adults and 20-34 ppb in children) further tests are required to assess for obstruction in order to confidently diagnose asthma.

## Safety considerations and infection control

- FeNO is not considered an aerosol generating procedure.
- A disposable bacterial-viral filter should be used.
- Each mouthpiece can be used by the same patient 3 times.
- External surfaces of equipment should be cleaned with antimicrobial wipes that are not alcohol based between uses.
- Patient will have to remove facemask to use and should be facing away from clinician.
- Clinician should avoid positioning themselves in front of the exhaust port.

## Maintenance and cleaning of equipment

- External surfaces of equipment should be cleaned with antimicrobial wipes that are not alcohol based.
- Nobreath should be calibrated annually (or sensor replaced)
- Sensor should be replaced every 5 years
- NO scrubber should be replaced annually
- The breath drying cartridge should be replaced every 5 years
- The battery should not be allowed to run flat



## Resources

Contains links to training and further FeNO resources including NICE asthma algorithms  
<https://wessexahsn.org.uk/projects/439/resources-at-a-glance>

Patient leaflet available at

<https://wessexahsn.org.uk/img/projects/PSAS%20FeNO%20Leaflet.pdf>

Maintenance of NObreath monitor:

<https://wessexahsn.org.uk/img/projects/LAB766-ICMG-NObreath-Issue-3.pdf>

Asthma FeNO elearning modules

<https://portal.e-lfh.org.uk/>

BTS guidelines

<https://www.brit-thoracic.org.uk/quality-improvement/guidelines/asthma/>

NICE guidance

<https://www.nice.org.uk/guidance/ng80>

## References

1. NICE guideline NG80 Asthma: diagnosis, monitoring and chronic asthma management Last updated: 22 March 2021
2. NICE Diagnostics guidance [DG12] Measuring fractional exhaled nitric oxide concentration in asthma: NIOX MINO, NIOX VERO and NObreath 02 April 2014
3. eLFH elearning modules: Understanding FeNO and performing the test & Interpreting FeNO results
4. BTS SIGN Asthma guidelines 2019