Topic Exploration Report [1]

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	TER 507
Topic	Automated pH testing to verify placement of nasogastric feeding tubes
Summary of findings	Nasogastric tubes (NGTs) are used to provide medication, nutrition, and fluids but if placed incorrectly, they can cause serious complications. An aspirate pH test is used as a first test to verify NGT placement, but human reading of such a test may be a source of error and it is not always possible to obtain aspirate. In such cases X-ray is often used as a second line test to verify NGT placement. Automated devices might avoid human error in reading pH strips. The NGPOD device can detect the pH at the tip of the NGT using a fibre optic sensor, removing the need for NGT aspirate. We identified an individual study and a service evaluation which indicate that NGPOD reduces the need for second-line X-ray tests when compared with standard human reading of pH strips of NGT aspirate. The evidence for automated pH strip readers was lacking.

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[1] [Cyfieithu dogfennau HTW wedi'u cyhoeddi o'r Saesneg i'r Gymraeg](#)
[Translation of published technical HTW documents from English into Welsh](#)

Introduction and aims

Nasogastric tubes (NGTs) are used to provide medication, nutrition, and fluids to people unable to swallow. By extrapolation from English estimates (Jones 2020) NGT usage in Wales may amount to over 11,000 per year. These tubes are typically inserted 'blind' and can end up in the pulmonary tree or oesophagus instead of the stomach, leading to serious complications and even death. Misplacement of NGTs is classed as an NHS 'never event' but in the period 2012-2018 there were 9 such 'never-events' in Wales (Jones, 2020). In more recent years (2019-2022) there was only 1 such NGT related 'never-event' reported in Wales (NHS Wales Delivery Unit, 2022).

Guidelines (NICE 2017) state that nothing should be put down a NGT prior to verification of its placement. Guidance is that placement is initially assessed through a pH test of NGT aspirate: pH < 5.5 is taken as indicating gastric fluid and therefore correct placement. A chest X-ray is used where testing of pH aspirate is not successful. Patient safety alerts indicate that 45% of incidents relating to misplaced NGTs are due to misinterpretation of X-ray results, however failure to observe various policies including pH checks were identified in 37% of incidents (Jones, 2020). Devices to automate pH tests aim to remove subjective judgement as a source of error.

The NGPOD device aims to identify whether the NGT is correctly located. The NGPOD system is a handheld point of care device used in conjunction with a single-use fibre optic sensor (NGPOD sensor) which measures the pH at the tip of the NGT, without requiring aspirate. The fibre optic sensor is inserted down the placed NGT, a test button is pressed, and the resulting red or green light identifies whether the tube is correctly located. The sensor is removed and discarded. NGPOD could reduce the number of confirmation X-rays required which may reduce costs and speed up treatment processes.

Other devices, such as aspHirate-check and pHX-act, can automatically read pH strips as part of the NGT aspirate pH test. The topic proposer also suggested the DoubleChek device which uses both pH and CO_2 measurement to confirm NGT placement, however this was considered too different to the other devices to include in this topic exploration report.

Health Technology Wales researchers searched for evidence on devices which automatically test pH to verify nasogastric feeding tube placement.

Evidence overview

This topic was the subject of a previous HTW topic exploration report: TER-275. We identified one individual study, a service evaluation and a cost effectiveness study not included in the previous report.

Individual Studies
Early et al (2022) compared the NGPOD device to standard care to confirm NGT placement in a UK study of 174 patients. They found that NGPOD reduced the need for second line tests (either X-ray or subjective clinical assessment) by 21.2%.

Cost effectiveness studies
McFarland (2017) conducted a cost-utility analysis of pH paper testing of NGT aspirate and chest x-ray for determining NGT placement. This found the strategy of pH testing followed by X-ray only as a second line test the most cost-effective approach to NGT confirmation. Although automated pH testing was not modelled the results were sensitive to the rates of

Evidence overview

tube aspiration success, which suggests that devices such as NGPOD which do not require aspiration have the potential to be cost effective.

Service evaluations
Lawrence (2023) conducted an evaluation of NGPOD use in a real-world setting in 29 patients in Morriston and Glangwili Hospitals in Wales. The report concluded that NGPOD was effective when used as per the manufacturer's instructions. It took as long as standard aspirate testing and reduced the need for X-rays. The evaluation indicated that implementation of NGPOD would require development of a training program.

Areas of uncertainty

No evidence was found on the impact of automated pH measurement devices on NGT related serious adverse events or deaths.

No direct evidence was found on the cost-effectiveness of automated pH measurement devices.

No evidence was found for devices which automatically read pH strips.

It is unclear what the reference standard test for NGT placement is. Although X-ray is often used as a second line test, interpretation of X-rays may also be a source of error (Jones, 2020).

It is debatable whether automated pH strip readers and the NGPOD device are similar enough to warrant inclusion in a single evidence appraisal report.

Literature search results

Health technology assessments and guidance
NICE. (2017). Nutrition support for adults: oral nutrition support, enteral tube feeding and parenteral nutrition. National Institute for Health and Care Excellence. Available at https://www.nice.org.uk/guidance/cg32 [Accessed 13th October 2023]. TER-275 NGPOD: Nasogastric tube. Health Technology Wales 2021

Evidence reviews and economic evaluations
McFarland A. (2017). A cost utility analysis of the clinical algorithm for nasogastric tube placement confirmation in adult hospital patients. Journal of Advanced Nursing. 73(1): 201-16. https://doi.org/10.1111/jan.13103

Individual studies
Earley T, Young A, Pringle S, et al. (2022). Fibre-optic, electronic pH test device compared with current NHS guidance to confirm nasogastric tube placement. BMJ Nutrition, Prevention & Health. 5(2): 306-12. https://doi.org/10.1136/bmjnph-2022-000506

Reports
Lawrence JM. (2023). NGPOD real world evaluation. Tritech Institute. Available at: https://tritech.nhs.wales/wp-content/uploads/2023/04/HD047095-TRITECH-NGPOD-REPORT-v9.pdf. Jones JM. (2020). A Position Paper on Nasogastric Tube Safety: Time to put patient safety first. Nasogastric Tube Special Interest Group of BAPEN. Available at: https://www.bapen.org.uk/pdfs/ngsig/a-position-paper-on-nasogastric-tube-safety-v2.pdf. NHS Wales Delivery Unit. (2022). Never Events. Patient Safety. [Accessed 18/10/2023]

Date of search	October 2023
Concepts used	nasogastric, tube placement, NGPOD, aspHirate-check, pHX-act

Proposed research question and evidence selection criteria (if selected)

Proposed Research question	What is the effectiveness of automated pH measurement to confirm nasogastric tube (NGT) placement?

	Inclusion criteria	Exclusion criteria
Population	People with blind newly inserted NGT (before administration of any food or liquid)	
Intervention	Automated measurement of pH at the tip of the NGT Measurement of NGT aspirate pH using automated interpretation of pH strips	
Comparison/ Comparators	Measurement of tube aspirate pH using human interpretation of pH strips	
Outcome measures	Proportion needing X-ray confirmation of NGT placement Number of test failures Diagnostic accuracy to distinguish gastric vs pulmonary/oesophageal placement of NGT Time from insertion of NGT to commencement of feeding Test related adverse events NGT related serious adverse events or death	
Study design	Cross-sectional diagnostic accuracy study	

Proposed specialities	**Digestive system; Endocrine, nutritional and metabolic**