

# **Resource set**

## **Initial placement checks for nasogastric and orogastric tubes**

**July 2016**



## About NHS Improvement

NHS Improvement is responsible for overseeing foundation trusts, NHS trusts and independent providers. We offer the support these providers need to give patients consistently safe, high quality, compassionate care within local health systems that are financially sustainable. By holding providers to account and, where necessary, intervening, we help the NHS to meet its short-term challenges and secure its future.

NHS Improvement is the operational name for the organisation that brings together Monitor, NHS Trust Development Authority, Patient Safety, the National Reporting and Learning System, the Advancing Change team and the Intensive Support Teams.

## Resource set: Initial placement checks for nasogastric and orogastric tubes

These resources support the 2016 NHS Improvement Patient Safety Alert: '[Nasogastric tube misplacement: risk of death and severe harm through failure to implement previous guidance](#)'. The alert requires trust boards, and their equivalents in other providers of NHS-funded care, to challenge themselves and examine how fully previous guidance on nasogastric tubes has been implemented and embedded in their organisations.

### Using this document

The resources in this document are not intended to be read in any particular order, although the foreword provides a useful starting point. They should be used in whatever way is most helpful and to help you navigate to each section you can click on the links in the table of contents on the following page. You can also click on the link at the bottom right of each page to return to the contents.

**NOTE:** Similar safety checks and clinical considerations apply to orogastric tubes and nasogastric tubes. For ease of reading this resource set will usually just refer to 'nasogastric tubes' except where there is a difference.

## Contents

- 1. Foreword: It's personal:** An introduction to past efforts to improve the safety of initial placement checks for nasogastric and orogastric tubes and the rationale for the 2016 alert. Includes patient and staff stories and can be used to influence 'hearts and minds' **5**
- 2. A layman's guide to nasogastric tube feeding:** Helps people without a relevant clinical background understand how and why these tubes are used, so they can play a full part in local improvement efforts **7**
- 3. Summary of safety-critical alert requirements:** Summarises the safety-critical requirements of the previous alerts and distinguishes between them and areas better addressed through the available wider clinical guidance **11**
- 4. Review of reported incidents:** Summarises key findings and common patterns, using examples from individual incidents **22**
- 5. Review of investigation summaries:** Insights into the approach to investigation in these incidents, including strengths and weaknesses **31**
- 6. Personal perspective: the best opportunity to promote safe care is before the tube is placed:** A personal perspective on the critical importance of thinking through decisions to feed via nasogastric tube. Includes patient and staff stories and can be used to influence 'hearts and minds' **36**
- 7. Suggested areas for self-assessment and commissioner assurance:** Table of implementation issues to help trust boards (or equivalent in other organisations providing NHS-funded care) and their commissioners to challenge themselves in relation to implementing safety-critical actions **37**
- 8. Links to clinical guidance and key literature:** Summary of current key guidance and literature **42**
- 9. Links to guidance to support incident investigation:** A summary of key policy, guidance and resources to support effective investigations **44**
- 10. Links to implementation resources:** Links to training materials and the BAPEN Special Interest Group for Nasogastric Feeding where local implementation approaches and resources can be accessed and shared **45**
- 11. Suggestions for further clinical guidance:** Areas where relevant national or professional bodies may wish to develop clinical guidance **48**
- 12. Future research needs:** Areas researchers or research funding streams may consider **50**
- 13. Notes on incident data** **52**

## Foreword: it's personal

In 2003, I was holding the bleep for my hospital, and woke to an early morning call from night staff explaining that during the attempted resuscitation of a patient they had realised he had been fed through a misplaced nasogastric tube. I drove through empty streets, and undertook the painful tasks of contacting the patient's family and breaking the news to the devastated doctor who had misinterpreted the x-ray. Those of you who've been in the same position may recognise how very heavy a phone feels in those circumstances, and the effort of will it takes to press dial, knowing neither the family nor the staff member's life will ever be quite the same.

Shortly after this, I moved into my first role in national patient safety and found I was not the only new arrival with a nasogastric tube death on my watch. The National Reporting and Learning System was in its infancy, but through clinical contacts we brought together staff involved in 11 incidents to undertake a combined root cause analysis, and issued the first National Patient Safety Agency (NPSA) alerts in 2005.

These alerts succeeded in replacing some traditional but unsafe testing methods with pH paper and x-ray. But after a further 100 incidents, an NPSA alert in 2011 emphasised the need for safe purchasing choices and for competency-based training and structured documentation to reduce the risk of error in pH paper and x-ray interpretation. An NPSA Rapid Response Report in 2012 and an NHS England alert in 2013 did not add new guidance, but emphasised aspects of the 2011 alert that appeared to be misunderstood or disregarded.

A somewhat over-used conference slide runs along the lines of 'patient safety isn't rocket science...it's much more complicated'. The phrase is used to make the point that changing training or policy or documentation may be simple, but ensuring sustained and reliable implementation can be very challenging indeed. As you will see from the [analysis in this document of the 95 incidents](#) of feeding through misplaced nasogastric tubes, all too often it has been at the simple end where failure to implement earlier alerts appears to have occurred. You cannot have staff with the right competencies for checking nasogastric tube placement if your organisation has not provided such training. There are of course incidents from the 'much more complicated' end of the spectrum too, but many more in the area where hindsight might reasonably have been expected to be foresight, such as the potential for new staff not to know local procedures, or for documentation that was never audited to become documentation that was rarely completed.

Given the unprecedented number of alerts on a single topic already issued, yet another alert on nasogastric tube placement could be considered to be taking hope over experience to an unreasonably optimistic level. So why have we done so?

Firstly, through these extra resources we hope to convey why it is vital to act on what has been learned the hard way through lost lives, damaged respiratory systems, and traumatised patients, families and staff.

Secondly, we hope to simplify. We have brought together all the safety-critical elements of the multiple earlier alerts, and drawn a clear line between those and the more general advice attached to earlier alerts that can and should fall into the zone of constantly evolving clinical guidance.

Thirdly, we want to make totally clear the executive responsibility for ensuring a systematic approach to implementation before signing this alert off as 'action completed'. I come to work each day because I passionately believe a national patient safety function can enable harm in one organisation to be acted on before being repeated in every individual organisation. But ultimately the responsibility for taking that shared learning forward lies with organisational leaders.

I'd never met our patient who died in 2003, but in the following weeks of investigation and inquest I felt like I had - it was very easy to picture what a warm and delightful husband, father and grandfather he had been, when encountering the forgiveness and understanding his family extended to us. I cannot picture as clearly the patients affected by the 100 incidents I reviewed in 2011 or the 95 incidents I reviewed for this alert, but I am not a detached party in the journey of improving nasogastric tube safety; it feels painful and it feels personal. Whether you also carry the burden of such memories, or have good practice in the implementation of earlier alerts you can share to help others, please make acting now personal for you too.

**Dr Frances Healey, RN, RN-MH, PhD**  
**Head of Patient Safety Insight, NHS Improvement**

## A layman's guide to nasogastric tube feeding

We hope key individuals without clinical backgrounds, such as patient and public representatives, trust non-executive directors and governors will be involved in local assurance of compliance with this alert. Here is some broad background to help them understand the detail in this resource set, but it can and should be supplemented by your local specialists and expertise.

### **Types of feeding tubes covered by the alert and this resource set**

It may be helpful to understand some of the clinical practice related to the use of nasogastric tubes to offer some context for the policy, alerts and incidents described in this resource set.

Different types of nasogastric and orogastric tubes are used in clinical practice:

- Fine-bore nasogastric tubes are passed through the nasal cavity down the back of the throat and through the oesophagus to the stomach and are used to deliver medication, fluid or liquid feed. This kind of tube is the main focus of this resource.
- Orogastric tubes are passed through the mouth down the back of the throat and through the oesophagus to the stomach and are used to deliver medication, fluid or liquid feed. Orogastric tubes are used primarily in newborn babies, as older infants, children and adults would tend to bite any tube sited through this route or displace it through tongue movement, but they may be used for these patients in very rare circumstances.

Similar safety checks and clinical considerations apply to both orogastric tubes and nasogastric tubes, but for ease of reading, this resource set usually just refers to 'nasogastric tubes' except where there is a need to point out any differences.

### **Types of tubes *not* covered by the alert and resource set:**

- Wide-bore nasogastric tubes (sometimes called Ryle's tubes). These tubes are used to drain fluids from the stomach, typically after surgery on the gastrointestinal tract or in cases of intestinal obstruction.
- Post-pyloric tubes. These tubes are used when feeding needs to be given directly into the small intestine and are passed beyond the stomach, through the pyloric sphincter, and into either the jejunum or duodenum (referred to as nasojejunal tubes and as nasoduodenal tubes). Placing post-pyloric tubes is a very different and much less common procedure than nasogastric or orogastric tube placement, usually done by specialist staff.

## **Reasons for using nasogastric feeding tubes**

Patients may need nasogastric feeding because:

- critical illness or unconsciousness leaves them unable to swallow at all;
- neurological conditions such as stroke leave them at risk of not being able to safely swallow food or drink normally by mouth; or
- they have conditions that mean they cannot take in enough food and drink by mouth to meet nutritional needs.

Nasogastric feeding is typically a short or medium term method of feeding. Where patients requiring long-term feeding are fit enough to undergo the procedure, they typically have their nasogastric tube replaced by percutaneous gastrostomy (a small direct port to the stomach sited through the skin of their abdomen).

## **Inserting nasogastric feeding tubes**

As nasogastric tubes are very soft and flexible, at initial insertion they usually contain a removable internal guidewire (sometimes referred to as a stylet), which although flexible, has enough rigidity to allow the tube to be passed. Nasogastric tubes are typically passed 'blind' as a bedside procedure by registered nurses. This means they can't see where the tube is going as it passes out of sight through the nose/throat, but the anatomy of the patient usually directs it towards the gastrointestinal tract. In contrast, when the intent is to place a ventilation tube in the respiratory tract (intubation), direct visualisation through a laryngoscope and very specific skills and techniques are needed to direct the tube away from the oesophagus.

A nasogastric tube accidentally inserted into the respiratory tract will not usually cause any pain or direct harm (although direct harm is possible). However, harm would always result if this misplacement was not detected and liquids were introduced into the respiratory tract via the tube. This is why the alerts and this resource set place great emphasis on the initial placement checks required to confirm that the nasogastric tube is correctly placed in the gastrointestinal tract before any liquids are put down the tube.

It may also be helpful to note that patients would not typically display the normal reflexes of choking or coughing if liquids were introduced into the respiratory tract via a misplaced nasogastric tube, even if they were conscious and alert. These reflexes result from the sensation of fluids at the back of the throat, rather than fluids introduced directly to a lower level of the respiratory tract. It is not always obvious if liquids were being introduced into the lungs, as the decline in a patient's condition is not always immediate and there may be no obvious symptoms for some hours in patients whose lung function was previously good.



Nasogastric tubes are usually secured to the skin around the nostrils with adhesive tape and may be removed by a patient who is confused or accidentally dislodged during nursing care. Some patients may therefore require repeated insertion of new nasogastric tubes.

Over 790,000 nasogastric tubes are used in the NHS each year.<sup>1</sup>

### Checking nasogastric tube placement

This resource focuses on two main types of tests for nasogastric tube placement – pH strips and x-ray:

- pH strips or pH paper are test strips that change colour in contact with acid or alkaline substances. They are used with drops of fluid sucked out of the nasogastric tube using a syringe. The test relates to the acidity of normal gastric secretions in contrast to secretions that are likely to be found in the respiratory tract. Sometimes no fluid can be obtained or the fluid sucked out with a syringe is not in the 'safe range' (particularly when patients are on medication intended to reduce gastric acidity). Testing pH is typically done by registered nurses.
- If fluid in the 'safe range' of pH cannot be obtained, an x-ray would be required to confirm nasogastric tube placement and may be routinely used for some patients in specialist settings. Interpretation of the x-ray would typically be done by medical staff or by radiologists (see safety-critical requirements for the training of nursing and medical staff involved in checking [nasogastric tube placement](#)).

In practice, this means the first line test of pH can indicate either 'tube is in the gastrointestinal tract' or 'unclear where tube is placed', while the x-ray will indicate which of those in the 'unclear' group are in the gastrointestinal or respiratory tract.

### Using the nasogastric tube

Once the checking procedures are complete, some nasogastric tubes require a 'flush' of water by syringe to release a lubricant that makes it easier to remove the guidewire or stylet that was used to aid insertion.

Medication is typically given through the nasogastric tube by a syringe, followed by a 'flush' of water to ensure the medication reaches the gastrointestinal tract rather than sits in the tube, and to ensure sticky medications do not cause blockages in the tube.

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<sup>1</sup> *These are the numbers of fine-bore nasogastric tubes delivered by a major supplier to the NHS (NHS Supply Chain) in 2015, and some organisations will use other suppliers or purchase directly from the manufacturer. Previously cited figures underestimated actual numbers as multi-packs were counted as though they were only single tubes.*

The correct type and amount of nasogastric feed are typically prescribed by a dietician, nurse specialist or doctor. Feeding through the nasogastric tube is usually controlled via a pump that delivers a set amount of millilitres per hour either continuously across the day and night or compressed into shorter periods. Water 'flushes' will usually be required several times a day to ensure the milky consistency of the feed does not create blockages in the tube.

Occasionally nasogastric feeding is through 'bolus feeding' (giving a set amount through a large syringe several times a day followed by a 'flush' of water).

### **Potentially confusing terminology**

The terms 'aspirate' or 'aspiration' may be used in different ways in relation to nasogastric incidents. They may be used to describe:

- fluid sucked out of a nasogastric tube (eg 'the pH of the aspirate was 4.5') or the action of sucking it out (eg 'I aspirated the tube');
- how a patient with an unsafe swallow could inhale food or drink taken by mouth (eg 'he might aspirate' or 'he would be at risk of aspiration if he ate normally') or to describe that food, fluid, or regurgitated stomach contents that have been inhaled (eg 'I think she may have aspirated'); or
- 'aspiration pneumonia' is used to describe the inflammation and infection that can result from this, and also sometimes to describe pneumonia as a result of feeding into the lungs through a misplaced nasogastric tube (although technically this is not an aspiration pneumonia, as the nasogastric feed was pumped in rather than inhaled).

## Summary of safety-critical alert requirements

The July 2016 NHS Improvement National Patient Safety Alert does not change the specific essential safety-critical requirements of the previous NPSA and NHS England alerts<sup>2,3,4,5,6</sup> about avoiding the introduction of substances into the respiratory tract through a misplaced nasogastric tube. This resource set summarises them and creates a clear distinction between these safety-critical requirements and areas that can be better addressed through the wider clinical guidance now available.

This distinction is needed because when the original alerts were produced, there was little guidance on clinically effective practice in nasogastric tube placement, so extra material was provided that reflected best practice at the time. The earlier NPSA alerts briefly covered issues such as decisions to start nasogastric feeding, techniques for nasogastric tube insertion, and how to plan discharge home, etc. These aspects of care remain just as vital, but clearly need far more extensive clinical guidance than can or should be included in an alert. See [Links to clinical guidance](#) for more appropriate sources.

At the time of the initial NPSA alerts, an absence of established UK evidence-based guidelines meant that the NPSA had to specify the 'safe range' of pH. Advice on the parameters of a clinical test would normally fall into the zone of clinical effectiveness ('the right thing to do') rather than patient safety ('how to do the thing right') and this was acknowledged by the NPSA which referred to the 'safe range' as interim guidance they hoped would be refined by further research. Although no accredited clinical guidelines have yet identified research that would change the 'safe range',

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<sup>2</sup> National Patient Safety Agency Alert 2005/PSA/05 *Reducing the harm caused by misplaced nasogastric feeding tubes* 2005

<http://www.nrls.npsa.nhs.uk/resources/type/alerts/?entryid45=59794&p=4>

<sup>3</sup> National Patient Safety Agency Alert 2005/PSA/09 *Reducing the harm caused by misplaced naso and orogastric feeding tubes in babies under the care of neonatal units* 2005

<http://www.nrls.npsa.nhs.uk/resources/?entryid45=59798>

<sup>4</sup> National Patient Safety Agency Alert 2011/PSA/02 *Reducing the harm caused by misplaced nasogastric feeding tubes in adults, children and infants* 2011

<http://www.nrls.npsa.nhs.uk/resources/type/alerts/?entryid45=129640>

<sup>5</sup> National Patient Safety Agency Rapid Response Report 2012/RRR/01 *Harm from flushing of nasogastric tubes before confirmation of placement* 2012

<http://www.nrls.npsa.nhs.uk/resources/type/alerts/?entryid45=133441>

<sup>6</sup> NHS England Patient Safety Alert PSA/W/2013/001 *Placement devices for nasogastric tube placement DO NOT replace initial placement checks* 2013

<https://www.england.nhs.uk/2013/12/05/psa-ng-tube/>

Table 1 on the page below sets out the circumstances in which such guidelines could and should take over from the current 'safe range'.

### **Note on repeat placement checks**

The following table focuses on **initial** placement checks (checks made before first use of any nasogastric or orogastric tube). Previous NPSA alerts provided suggestions in supporting information for when a nasogastric tube should be checked again following initial placement. The advice on repeat placement checks was based on expert opinion rather than research evidence and recognised the lack of definitive methods (for example, pH could be repeatedly checked, but feeding could continue even when pH was outside the 'safe range', as x-rays could not be repeatedly taken on a daily basis).

Checking the external tube marking for displacement remains vital (though a change in inserted length would more typically indicate partial removal from gastric placement to oesophageal placement, and an unchanged external tube length cannot in itself exclude the possibility of internal displacement). But as there are no other definitive safety-critical steps that could be taken, advice on repeat placement checks remains an area for local and professional clinical guidance.

**Note: The requirements below are the key safety-critical requirements aimed at avoiding the introduction of medication, feed or fluids through a nasogastric tube misplaced in the respiratory tract. They must be considered alongside wider clinical guidance and local expertise that covers all aspects of clinically effective and person-centred care for patients who cannot meet their own nutritional needs.**

**Table 1: Ongoing safety-critical requirements for confirming initial orogastric or nasogastric tube placement**

Ongoing safety-critical requirement	Rationale	Notes on interface with current and future local and national clinical guidance
DO NOT use the ‘whoosh test’ <sup>7</sup> or ‘bubble test’ <sup>8</sup>	Clinicians’ hearing cannot precisely locate the origin of a sound in the patient’s physiology; the lungs and stomach are in very close proximity. Absence of bubbles could occur even if the internal end was in the lungs, and bubbles could occur from air in the stomach compressed during breathing cycles.	No local or national clinical guidance should amend this requirement.
DO NOT test aspirate using blue litmus paper	Blue litmus paper is not sufficiently sensitive to distinguish between bronchial or gastric secretions.	No local or national clinical guidance should amend this requirement.

<sup>7</sup> Injecting air into a nasogastric tube and listening with a stethoscope for the location of the sounds of air exiting the tube, under the mistaken assumption this could accurately distinguish the location of the internal end of the tube

<sup>8</sup> A mistaken assumption that the external end of the tube would produce bubbles if the internal end was in the lungs

<p>DO NOT interpret absence of respiratory distress or the appearance of aspirate as an indicator of correct positioning</p>	<p>Observing for respiratory distress is ineffective in detecting misplaced nasogastric tubes as nasogastric tubes can enter the respiratory tract without causing any symptoms.</p> <p>There is no absolute distinction that can be made in the appearance of gastric, respiratory and pleural secretions that can easily be described and applied to normal variation in healthy people and to patients with a wide range of gastric and respiratory conditions.</p>	<p>No local or national clinical guidance should amend this requirement.</p>
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<p>pH in the 'safe range' of 1 to 5.5 can be used as the first line test to exclude placement in the respiratory tract</p>	<p>The normal human stomach has a pH of approximately 1-3 in an empty stomach and approximately 4-5 after food has been eaten.</p> <p>Patients on acid-reducing medication may have a stomach pH level of 6 or above</p> <p>The pH in healthy lungs is between 7.38 and 7.42.</p>	<p>No local or national clinical guidance should <b>widen</b> the safe range.</p> <p>The 'safe range' for excluding respiratory placement may need to be integrated in local guidance with use of different pH ranges for other purposes (eg tighter pH ranges to distinguish oesophageal from gastric placement).</p> <p>Any local clinical guidance that <b>narrows</b> the 'safe range' of pH used to exclude placement in the respiratory tract should be preceded by robust assessment that the safe systems described in this alert for x-ray interpretation are fully implemented and sustained, and should risk-assess the impact of this change of practice.</p> <p>Future evidence-based national clinical guidance (eg from NICE, Royal Colleges or other professional bodies) would be expected to respond to new research. To <b>narrow</b> the current 'safe range' of pH such clinical guidance would be expected to have followed NICE-accredited processes of guidance development, including risk-assessment of the impact of this change of practice. Local organisations adopting any such future accredited national clinical guidance should first ensure the safe systems described in this alert for x-ray interpretation are fully implemented and sustained.</p>
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<p>Nasogastric tubes are not flushed, nor are guidewires pre-lubricated, nor is anything introduced through the tube until initial placement has been confirmed</p>	<p>Any flush could cause aspiration pneumonia if the tube is misplaced in the lungs. pH testing for gastric placement relies on collecting aspirate via the tube; anything introduced down the tube will contaminate this aspirate, potentially leading to false positive pH readings.</p>	<p>No local or national clinical guidance should amend this requirement.</p>
<p>Purchasing policies are revised and old stock systematically removed to ensure all pH test strips are CE marked and intended by the manufacturer to test human gastric aspirate</p>	<p>Some pH papers are designed specifically for laboratory testing and so not appropriate for testing human gastric aspirate.</p>	<p>No local or national clinical guidance should amend this requirement, although the reference to requirements of pH test strips may be extended to alternative technology that has met relevant regulatory requirements and is CE marked and intended by the manufacturer to test human gastric aspirate (eg pH meters).</p>
<p>Each pH test (including failure to obtain aspirate) and test result is documented</p>	<p>To allow for an ongoing record of a patient's normal range. To assist in investigation in the event of respiratory feeding following initial placement.</p>	<p>No local or national clinical guidance should amend this requirement.</p>



<p>Radiology (x-ray) can be used to confirm placement but should not be used routinely for all patients</p>	<p>Minimising the number of x-rays reduces exposure to radiation, loss of feeding time and increased movement of seriously ill patients in hospital.</p> <p>These risks of radiation, loss of feeding time, and the effect of travel could be even greater for patients needing longer-term feeding via nasogastric tube in community settings.</p> <p>X-ray will be required if aspirate in the 'safe range' cannot be obtained, and for patients where not only exclusion of respiratory placement, but confirmation of optimum gastric placement is necessary. X-ray may be required in other specific scenarios and patient groups.</p>	<p>Local and national clinical guidance can define scenarios and patient groups where x-ray rather than pH would be required (eg patients where it is essential to exclude oesophageal placement)).</p> <p>Any local or national clinical guidance that <b>extends</b> the patient groups or scenarios where x-ray should be used instead of pH should be preceded by robust assessment that the safe systems described in this alert for x-ray interpretation are fully implemented and sustained, and should risk-assess the impact of this change of practice.</p>
<p>Purchasing policies are revised and old stock systematically removed to ensure all nasogastric tubes used for the purpose of feeding are radio-opaque throughout their length and have externally visible length markings</p>	<p>Tubes that are clearly visible on x-ray through radio-opaque materials throughout their length (rather than solely at the tip) are critical to being able to carry out the 'four criteria' for x-ray interpretation.</p> <p>Externally visible length-markings enable accurate measurement for insertion and identification of any subsequent tube displacement.</p> <p>Purchasing policies and stock control are required to ensure no unintended reversion to unsafe supplies.</p>	<p>No local or national clinical guidance should amend this requirement.</p>

<p>X-ray request forms clearly state that the purpose of the x-ray is to establish the position of the nasogastric tube for the purpose of feeding or the administration of medication</p>	<p>To ensure the radiographer provides an x-ray that allows for the interpretation of the four criteria for gastric placement described below.</p> <p>To ensure the radiologist's report gives a definitive view on the position of the nasogastric tube for this purpose.</p>	<p>No local or national clinical guidance should amend this requirement</p>
<p>Checking tube placement via x-ray includes confirming and recording in the patient record that any x-ray viewed was the most current x-ray for the correct patient, the four criteria for confirming gastric placement,<sup>9</sup> and clear instructions as to required actions</p>	<p>Evidence from <a href="#">Review of incidents</a> in this resource set suggests that errors have occurred as a result of previous x-rays in the same patients being mistakenly reviewed.</p> <p>Structured documentation of the correct patient/correct x-ray and the four criteria for confirming gastric placement reinforce recall of competency-based training and reduce the risk of error in experienced staff who may be inclined to make intuitive judgements.</p> <p>Structured documentation will assist in investigation in the event of respiratory feeding following initial placement.</p> <p>A clear instruction of whether it is 'safe to feed' or other required actions reduces the risk of communication error.</p>	<p>No local or national clinical guidance should remove the requirement for structured documentation of the x-ray checking process.</p> <p>The four criteria for confirming gastric placement can be expanded by local or national clinical guidance and training packages but should not be reduced or changed except on advice from the Royal College of Radiologists.</p>

<sup>9</sup> See Links to Clinical Guidance section but in brief: *Does the tube path follow the oesophagus/avoid the contours of the bronchi? Does the tube clearly bisect the carina or the bronchi? Does it cross the diaphragm in the midline? Is the tip clearly visible below the left hemi-diaphragm?*

Any unused tubes identified in the lung are removed immediately, whether in the x-ray department or clinical area <sup>10</sup>	To reduce the risk of the tube being used in error.	No local or national clinical guidance should amend this requirement.
pH in the 'safe range' or x-ray are the only acceptable methods of confirming initial placement of a nasogastric tube	To date there is no evidence that alternative devices or techniques equal or exceed the accuracy of pH or x-ray for confirming initial placement of a nasogastric tube.	No local or national clinical guidance should amend this requirement. NHS Improvement would issue specific advice if a new method or new technology had robust evidence of equalling or exceeding the accuracy of pH and x-ray.

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<sup>10</sup> While an unused nasogastric tube identified as in the respiratory tract should be immediately removed to eliminate the risk of it being used in error, a tube through which feeding into the respiratory tract has already occurred may need to be used to attempt to suction out the feed/fluid; senior advice should be sought before removing it

<p>Staff training, competency frameworks and supervision are reviewed to ensure that all healthcare professionals involved with nasogastric tube position checks have been assessed as competent. Competency training should include theoretical and practical learning.</p>	<p>A National Patient Safety Agency audit of 166 junior doctors identified that only 31% had received training or formal guidance on the use of x-ray for checking nasogastric tube placements.</p> <p>The <a href="#">Review of incidents</a> in this resource set suggests that x-ray checks or pH testing appear to have been carried out by staff who had not received competency-based training, and therefore did not follow the safety-critical requirements.</p> <p><a href="#">Elearning</a> is available for some aspects of confirming nasogastric tube placement, but uptake of this via NHS elearning platforms is very low.<sup>11</sup></p> <p>This requirement can be linked to the structured documentation required above by including in that a requirement to note that competency has been assessed.</p>	<p>No local or national clinical guidance should allow staff who have not been assessed as competent to confirm nasogastric tube placement.</p>
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<sup>11</sup> One elearning resource for interpretation of x-rays available through a standard NHS platform had only 1352 individuals complete the training between late 2011 and early 2016. Note completion of elearning would not in itself insure competency; the theoretical learning would need to be supplemented by practical learning and competency assessment.

<p>Nasogastric tubes should only be placed when senior support for placement and placement confirmation is readily available</p>	<p>Earlier NPSA advice referred to avoiding placement 'out-of-hours'. The rationale for this was the greater risk of error by junior and less experienced staff confirming nasogastric tube placement in evenings and at night. The rationale of not placing tubes except where there is relevant senior and experienced support (nursing, medical and radiology) remains, but it is recognised availability of senior staff will vary between organisations and services and so cannot be defined as simply as within or outside 'normal hours'.</p>	<p>No local or national clinical guidance should allow nasogastric tubes to be placed at times when staff cannot access relevant senior support for placement confirmation.</p>
<p>Clinical policies, protocols and patient documentation (whether paper or electronic patient records) are designed to help staff comply with these safety critical requirements</p>	<p>Structured documentation reinforces training and protocols and helps staff carrying out nasogastric tube placement checks to remember and follow the appropriate steps. Structured documentation helps the rest of the clinical team identify key safety information.</p>	<p>No local or national clinical guidance should amend this requirement.</p>
<p>An ongoing audit programme is put in place to monitor compliance and act on any identified gaps</p>	<p>Reliable implementation of safety-critical requirements can only be achieved if compliance is routinely monitored.</p>	<p>No local or national clinical guidance should amend this requirement.</p>

## Review of reported incidents

Data have been drawn from incidents reported to the Strategic Executive Information System (StEIS) database as Serious Incidents or to the National Reporting and Learning System (NRLS) occurring between 12 September 2011 (the 'action complete by' date of the 2011 NPSA alert) and 11 March 2016, reconciled to ensure no incidents were double-counted if reported to both databases. The methods used to routinely identify any such events and the databases used to record them have changed slightly over time, and detail of search strategies are given in the [notes on incident data](#) at the end of this document.

### Information available for review

The NRLS reports are typically in the words of the clinical staff first identifying that an incident has occurred and they may be updated after investigation. Available detail ranges from a single sentence to several hundred words.

The StEIS database is intended primarily for managing the process of investigation of Serious Incidents in England, including notifying commissioners a Serious Incident has occurred and seeking final approval from commissioners that the Serious Incident investigations have been satisfactorily completed and can be closed.

The main findings from investigation are kept locally and organisations vary as to whether they add summaries of investigation to the StEIS record. The Serious Incidents reviewed for this resource therefore ranged from short descriptions of incidents to several hundred words summarising the findings of investigations.

In addition to the information held on StEIS, some investigation reports have also been shared directly with the national patient safety team at NHS Improvement, and the team have explored specific areas of potential learning with some local investigators.

### Overall findings

In this period of four years and six months, 95 incidents describing fluid, medication or liquid feed being introduced into the respiratory tract were identified. In 32 of these reports the patient is described as having died, although it is not always clear whether the death was directly related, given many patients were critically ill before the nasogastric tube was introduced.

Almost all incidents affected adults in acute hospital settings where most nasogastric tube use takes place. One incident affected an adult in a nursing home, one an adult in mental health service care, and three affected children or infants in acute hospitals. One incident involved an orogastric tube; all other incidents involved nasogastric tubes.

Of these 95 incidents:

- 45 related to the use of x-rays
- 23 related to pH testing
- of the remaining 27 incidents:
  - 4 related to the use of electromagnetic devices
  - 2 appear to relate to the 'whoosh' test that the 2005 NPSA Alert said should never be used
  - 5 appear to have resulted from miscommunication meaning the tube placement was not checked at all.
  - 2 appear to relate to dislodgement after correct initial placement (one unexplained case in a patient with a tracheostomy, and one by displacement of the nasogastric tube during intubation)
  - 14 reports do not include a clear description of what checking method was used.

### **Incidents related to x-ray misinterpretation**

Of the 95 incidents, 45 incidents related to the use of x-rays. Of these 45 incidents, 40 related to apparent x-ray misinterpretation, with 5 incidents related to the x-ray being correctly interpreted but the wrong x-ray having been reviewed (an earlier nasogastric tube placement in the same patient).

The seniority of staff undertaking x-ray review is not always described but where it is it ranges from junior doctors to consultants. Some incident reports clearly describe that staff had not received competency-based training in checking nasogastric tube placement on x-ray:

“On-call junior doctor reviewed the x-rays misinterpreting the views – inexperience, unfamiliar task, lack of skills ....and did not appreciate that this type of x-ray interpretation was more problematic than a straightforward chest x-ray review.”

“We focused on [training] nurses and trainee doctors because these are the staff that would usually be involved in the placement and testing of a nasogastric tube. [We thought] consultant staff would very rarely be involved in this activity” [incident involving x-ray misinterpretation by a consultant].

Most incidents do not directly describe past training, but have content that implies that training had not taken place, for example, by referring to the doctor using an inadequate checking process or suggesting training as an action in response to the incident:

“The specialist trainee confirmed that the tip of the NG tube lay below the diaphragm and was safe to use” [reference only to tip placement rather than the ‘four criteria’ suggests competency-based training in line with the 2011 NPSA Alert had not been given].

“[We need to ensure that] the individual staff involved in the incident are aware of the correct procedure [to] follow with regard to nasogastric tube placement and assessment [and] ensure that all foundation year doctors are aware of how to radiologically assess nasogastric tubing placement.”

None of the incident reports describe a member of staff who had already received competency-based training misinterpreting an x-ray.

Some reports suggested the incidents occurred against a background where training in x-ray interpretation had been systematically provided by the organisation to most staff, with the staff involved in the incident an exception (for example, one report describes how a combination of a locum doctor and an agency nurse meant both staff were unaware only certain doctors should confirm x-ray placement). But most reports do not describe any systematic approach to ensuring staff had competency-based training, and some suggested reliance on staff to realise they needed training and to put themselves forward:

“Staff member did not complete training as required in the policy.”

“The doctor undertaking the X-ray review was new to [the trust] and [did not know they should not have] undertaken this role without consultant guidance.”

Several reports suggested that the training provided was unlikely to be competency based, and could be as limited as a requirement to read local policies:

“The current [local nasogastric tube placement guideline] needs clarity. It states a ‘competent doctor’ or radiologist should review the [chest x-ray] – what [do] we mean by the words ‘competent doctor’ in this situation?”

“The [junior doctor] had not completed the elearning.”

“Re-launch Adult Nasogastric Tube Policy [to ensure medical staff] are aware of correct procedure for interpretation.”

While one incident describes poor image quality and one a patient who was poorly positioned, the incident reports suggest that in most cases these were not unusual or difficult images for staff to interpret if they had the appropriate competencies.

Some incident reports clearly describe that staff had not documented how they had checked the x-ray in the structured way recommended in the 2011 NPSA alert, but had either briefly documented ‘safe to feed’ or verbally conveyed that message:



“Documentation in the medical notes was reviewed but it had not been documented the NG tube was in the correct position. Nursing staff received verbal information NG tube was in the correct position so had commenced feeding.”

“The patient’s medical records [were in use by another team] at the time of the incident which meant that there was no place for the written confirmation of correct NGT placement to be documented in the patient medical records. This contributed to the acceptance of a verbal confirmation by the nursing staff.”

No incident reports describe a structured checklist of how the x-ray was interpreted, although one report suggest such a format was available in the organisation:

“There was a clear lack of consistency both in awareness and usage of the NG Tube placement checklist.”

#### **Key points: x-ray interpretation and documentation**

- Forty incidents related to x-ray misinterpretation, with five more incidents related to the x-ray being correctly interpreted but an older x-ray showing a previous nasogastric tube being reviewed.
- Staff who misinterpreted x-rays ranged from junior doctors in their foundation year to consultants.
- Information on prior training was not always included, but none of these 45 incidents note that the member of staff who had misinterpreted the x-ray had undergone competency-based training. Few incidents described a systematic approach to ensuring staff had competency-based training prior to the incident.
- Information on documentation of checks was not always included, but none of the 45 incidents describe documentation structured as **correct patient, correct x-ray and the four criteria** for confirming gastric placement recommended in the 2011 alert. Few incidents described organisations that had provided structured checklists.
- Some incidents suggest verbal confirmation that a tube was ‘safe to feed’ was accepted practice prior to the incident.

#### **Incidents related to pH checks**

Of the 95 incidents, 23 related to pH testing.

Five of the 23 incidents describe a misleading pH being obtained after inappropriately ‘flushing’ the tube before testing pH. One further incident related to a

misleading pH apparently obtained by re-use (in the same patient) of a previously removed and flushed tube.

Two of the 23 incidents described a pH outside the 'safe range' of 1 to 5.5 being obtained but feeding began anyway:

“An NG tube was passed at [time] the pH was noted as 7 ... [three hours later] medication was given via the NG tube.”

Fifteen of the 23 incidents may describe a pH in the 'safe range' having been found even though the nasogastric tube was subsequently found to be in the respiratory tract. Of these 15 incidents:

- 10 incidents describe a pH in the 'safe range' of 1 to 5.5 having been obtained. The details of incident reports were not always sufficient to exclude failure to test correctly. Most reports have not been updated with great detail from the investigation, and even when updated, the investigations rarely describe type of pH paper, or if staff involved had had competency-based training, and rarely sought to exclude the possibility of anything having been introduced down the tube before testing. Two of the 10 incidents occurred in circumstances where there may have been a flush before pH testing, and three describe a gap of hours between an initial pH result outside safe limits and a later pH result apparently within safe limits. Some investigation reports imply training and procedural failings were found, but some trusts clearly believe the staff followed correct procedure (although the commissioners with investigation oversight do not always appear to agree with this assessment).
- Five of these 15 incidents describe what may have been a pH in the 'safe range' but do not specify the actual value, including two incidents where pH strips not suitable for testing nasogastric tube placement were used and one where the pH was not documented but was recalled as having been in the 'safe range'.

The 23 incidents related to pH testing do not always describe the seniority of staff undertaking pH checks, but where it is described, it includes ward sisters and charge nurses as well as staff nurses.

Although most incident investigations suggested there was some local provision of training for nursing staff within the organisation, only one of the incident reports describe a member of staff who had previously undergone competency-based training. In that incident it appeared that despite earlier training the tube was flushed prior to testing pH.

Direct discussions with trusts suggested that in some cases training programmes had omitted senior nursing staff on the assumption their experience meant training would not be required or omitted training for newly qualified staff on the assumption

competencies were automatically achieved when they were students. More typically, training provided was relatively unstructured and relied on an assumption that senior staff would be able to teach new staff correct techniques.

Some incident investigations suggest there were systematic gaps in the provision of competency-based training in checking nasogastric tube placement with pH:

“Human error is more likely in an environment where many staff were not adequately trained.”

“It would be helpful for the Policy to explicitly state that staff need to complete the competency assessment.”

“... the recommendation that ‘both medical and nursing personnel who insert NG tubes regularly should be trained and educated and competent with regards to their correct placement before use’ has not been implemented.”

“Unclear procedure for maintaining staff competency with updated guideline.”

Generally there did seem to be bedside documentation to record pH results, although some incident reports refer to lapses in availability or recording:

“Insufficient documentation at the patient’s bedside which provides information about the NGT, when it was inserted, details of checks carried out to determine the position of the tube.”

“...the tube was aspirated but no record was made of the pH.”

#### **Key points: pH checks**

- Twenty-three incidents related to use of pH tests.
- Staff involved ranged from senior sisters and charge nurses to staff nurses.
- Information on prior training was not always included, but only 1 of the 23 incidents described a staff member who had received competency-based training, and several investigations found widespread organisational gaps in training provision.
- Seven of the 23 incidents occurred in circumstances where existing safety-critical advice had clearly not been followed, including flushing tubes before obtaining pH or feeding even though pH was not in the ‘safe range’.
- Bedside documentation to support safe pH testing was usually provided by organisations and usually completed by staff, though lapses were identified in some incident investigations.

- Ten of the 23 incidents stated pH in the 'safe range' had been recorded. None appeared to have been investigated in a way that fully eliminated likely causes of incorrect pH readings (such as a flush to activate lubrication and remove the guidewire, or inappropriate types of pH test strips) but some trusts were sure staff had followed correct procedures and therefore aspirate from the respiratory tract had produced pH reading in the 'safe range.'

### Incidents related to other checking methods

Of the remaining 27 incidents, five appear to have resulted from knowledge gaps or verbal miscommunication meaning the tube placement was not checked at all. For example:

“Nasogastric tube passed to commence bolus feeds; nil aspirate following several attempts therefore acidity not tested at that point. Discussed with junior doctor who advised for 5mls milk to be given via the tube.”

“I note that [staff member] has recorded that during our conversation the previous day I had said that the tube was in place and feeding could commence. This was not the case.”

Four incidents related to electromagnetic devices being used instead of pH or x-ray to confirm initial placement. Two of these incidents were described in the [2013 NHS England Alert](#) 'Placement devices for nasogastric tube placement DO NOT replace initial placement checks'<sup>12</sup> and a third incident occurred shortly before the 2013 alert was published, with the fourth incident reported in 2015.

Two incidents appear to relate to the 'whoosh' test that the 2005 NPSA Alert said should never be used<sup>13</sup>:

“The position of the new tube was checked by medical staff using an out of date technique.”

“...the consultant also listened to the patient's torso while [injecting air].”

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<sup>12</sup> NHS England Patient Safety Alert *PSA/W/2013/001 Placement devices for nasogastric tube placement DO NOT replace initial placement checks* 2013  
<https://www.england.nhs.uk/2013/12/05/psa-ng-tube/>

<sup>13</sup> National Patient Safety Agency Alert *2005/PSA/05 Reducing the harm caused by misplaced nasogastric feeding tubes* 2005  
<http://www.nrls.npsa.nhs.uk/resources/type/alerts/?entryid45=59794&p=4>

A further two incidents appear to relate to dislodgement after correct initial placement; one appeared to be displacement of the nasogastric tube during intubation and one was unexplained:

“[ITU patient] had an existing NG tube in place which had previously had position confirmed by x-ray and being fed through. There were no issues previously with the NGT. A routine follow up chest x-ray confirmed position of NGT at 1730 on [date]. At 2:30am [next day ie 11 hours after routine x-ray], nurse called doctor to review as NG feed was being aspirated from tracheostomy. Doctor reviewed: patient stable, chest x-ray performed, showed NGT in right main bronchus and feed in situ”

Given how flexible fine-bore feeding tubes are after their guidewire/stylet has been removed, it is difficult to conceive of a mechanism whereby a tube previously placed in the gastrointestinal tract could be moved to the respiratory tract simply through partial removal and reinsertion by a confused patient or unintended dislodgement/reinsertion during patient handling (except possibly for neonates, where the short length of tube involved might make this possible). It is even more unlikely that could occur with no change in external length markings and with securing tape still fixed. However, the incidents above suggest that it is possible that intubation or some forms of respiratory suction could move a previously correctly placed nasogastric tube.

Fourteen reports give insufficient detail to understand what checking method was used. Generally the lack of clarity is due to limited information entered but three reports were complex summaries leaving the actual sequence of events unclear.

#### **Key points: other checking methods**

- Five incidents related to failure to check placement at all.
- Four incidents related to the use of magnetic tracking devices to confirm placement.
- Use of outmoded methods to confirm placement by medical staff are still seen, although very rarely.
- It is possible that intubation or some forms of respiratory suction could move a previously correctly placed nasogastric tube to the respiratory tract, although reports suggesting this are very rare.

## **Wider aspects of clinical decision-making**

Multidisciplinary discussion prior to a decision to feed via nasogastric tube was often mentioned, particularly for patients expected to have medium or long-term feeding issues, but at times tokenistic multidisciplinary decision-making appeared to be applied. One investigation described a medical decision to feed via nasogastric tube, a nurse inserting the tube, and a dietician visiting later as a multidisciplinary decision that tube feeding was appropriate. Involvement of patients and families in the decision to undertake nasogastric feeding was not always clear, although such detail would not necessarily be recorded in incident investigation summaries.

Multidisciplinary discussion was more rarely referred to in incidents affecting patients who were admitted acutely ill with conditions such as aspiration pneumonia, with some investigations suggesting the use of a nasogastric tube was seen as routine. Some investigations suggested that the patient should have been recognised as dying before the decision to feed had been made.

Many of the incidents describing feeding into the respiratory tract involved repeated insertions in patients who had dislodged previous tubes. In some cases this was despite special arrangements to reduce the risk (for example, one-to-one nursing for a patient with delirium) but often no measures to reduce this risk were described or avoidable problems were described (including unsatisfactory quality of the adhesive strips provided with nasogastric tubes).

Decisions on whether feeding via nasogastric tube remained in the patient's best interests did not always appear to be revisited when the patient repeatedly removed their tube.

### **Key points: wider aspects of clinical decision-making**

- Some incidents related to insertions of tubes that the patient had repeatedly pulled out. These may have been avoidable with better methods to secure the tube.
- Genuine multidisciplinary consideration of whether nasogastric tube feeding was appropriate did not always appear to occur, especially for acutely ill patients .
- For some acutely ill patients, investigations suggested that the patient could have been recognised as dying before the decision to feed via nasogastric tube and their needs could have been met differently.
- Reviews of whether nasogastric feeding continued to be appropriate did not always appear to occur after patients had repeatedly pulled out their tubes.

## Review of investigation summaries

Whilst the review of investigation summaries related to these incidents can give some insights into investigation quality, the observations on investigation summaries provided below need to be interpreted with care. The StEIS database only includes summaries of local investigations. Full investigation reports may contain much richer content, although typically StEIS content appeared to be cut and pasted from the full investigation and therefore represented its language and approach. Some investigations were not complete when this review was undertaken, and some organisations routinely noted only that the investigation and action plan had been agreed by commissioners.

### Good practice in investigation

Investigation reports usually recorded open communication with the patient and/or their families, for example:

“Duty of Candour: relatives [date] informed of deterioration and advised of nasogastric tube involvement and medical team have discussed with relatives. Director of Nursing and Chief Executive are identifying an appropriate person to make further contact with the family.”

“The patient’s family were informed of events by the duty consultant on [date] and an apology given. They will be informed of the investigatory process by ITU staff.”

Some summaries of key learning and planned actions showed they:

- appeared comprehensive, conscientious and were clearly undertaken by investigators willing and able to involve the patient and their family;
- engaged constructively with staff;
- identified underlying causes and described them honestly; and
- proposed action plans with benefits extending well beyond nasogastric tube safety.

For example:

“[There was] ineffective flow of communication up, down and across – dissemination of content of policy/agreement at Patient Safety Forum not cascaded to professional groups so unaware of their role in the management of nasogastric tubes used for feeding” [goes on to describe fundamental changes to communication of clinical policies to frontline staff].

“[We placed] too much reliance on individuals identifying their own training needs” [goes on to describe fundamental changes to training needs analysis, delivery and monitoring]

“Adherence to Trust policy is key to maintaining high standards of clinical care; however it is acknowledged that many policies are long and may be difficult to refer to during the normal clinical day. There should be consideration to provision of a one-side ‘key issues’ or ‘flow chart’ of main highlights for each clinical policy to provide a quick reference guide.”

However, even the most thorough investigations did not appear to have considered whether the failures to implement the actions of a past nasogastric alert might indicate more widespread issues affecting local governance systems for alerts on other topics.

### **Understanding of root cause analysis techniques**

Some language suggests a fundamental misunderstanding of root cause analysis (RCA) techniques, for example:

“The root cause of the incident is a misplaced nasogastric tube.”

“Root cause: hospital acquired pneumonia.”

Others used RCA ‘jargon’ and techniques but without apparent full understanding:

“In accordance with best practice for carrying out root cause analysis investigations, root causes were identified by use of the 5 why principles to drill down to the root cause of the problem, change analysis chart to identify where practice may have drifted from the norm, fishbone diagram to identify the contributory factors that impacted on the adverse event. Following a thorough investigation and with hindsight the following root causes have been identified; rotation of CXR not taken into consideration, lack of experience of this aspect of clinical practice, no senior review of CXR ..... Lessons learned: Correct NG tube position can be difficult to verify on CXR. Verifying your assumptions is critical for safe practice...”

These are very unlikely to be root causes as there are obvious further questions about why staff acted as they did. Although a correctly used change analysis or fishbone diagram would be expected to identify that competency-based training had not been provided, staff training does not appear to feature in the investigation summary or action plan.<sup>14</sup>

### **Approaches to investigation**

Although issues with investigation processes are described below, the style of most investigation summaries suggested a genuine wish to learn. However, there were

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<sup>14</sup> The fishbone diagram and contributory factors framework are now advocated as the more robust tools of choice to identify contributory and causal factors – see the [Links to guidance to support investigations section](#)



some suggestions that in the initial 72-hour fact-finding phases investigators could form a fixed view of how the incident occurred that appeared to affect the approach to the full investigation.

Versions of the Never Event Policy and Framework before 2015 had suggested that where policy had been followed this was not a Never Event. This clause appeared counterproductive in some investigations, with investigators apparently focused on compliance with local policy rather than considering if local policy could be improved to prevent future incidents.

Some investigators appeared to work from an assumption that experienced and respected staff could not have made an error. In some cases this appeared to lead to significant effort put into exploring unusual hypotheses even when more typical explanations had not been eliminated.

### **Identifying the full sequence of events**

While the incident investigation summaries in StEIS would not be expected to hold this level of detail, where investigations have been shared with the national team key areas are often omitted. For example, for any apparently misleading pH result it is critical to identify if anything has been put down the tube before aspiration and a key point when this can occur is when the tube is flushed to release the guidewire. However, investigation reports typically contain no information on when or how the guidewire was removed.

### **Identifying what should have happened**

In comparing what happened with ‘what should have happened’, investigation summaries almost never refer to NPSA alerts or actions required within them, and appear to rely on local policy or the investigators’ understanding of good practice. Some investigation summaries showed a lack of understanding by investigators of how nasogastric tube placement should be checked on x-ray, and one investigation report suggests the investigator thought it was acceptable to flush tubes before confirming placement if aspirate was difficult to obtain.

Typically commissioners did not appear to challenge a lack of reference to national guidance or alerts, although in one case a repeat investigation was required:

“The report does not appear to include critical analysis.... [It] should include a comparison of the NPSA guidance, [local] guidance & what actually happened to identify if any deviations occurred.”

### **Incident analysis**

Typically investigations focused on ‘care delivery problems’ but not ‘service delivery problems’ such as no local provision of competency-based training, and some did not drill down to contributory factors or root causes. The most worrying examples

included providing training only to the staff involved in the incident rather than considering whether any lack of skills or competency could be more widespread:

“The doctor who inserted the nasogastric tube undertook to refresh their training on nasogastric tube insertion and checking procedures. The doctor has also produced a reflective statement that described the circumstances that led to the incident.”

### **Action planning**

Action plans are typically developed in a table form indicating who is responsible for each action and timescales for delivery. They are therefore not usually entered in investigation summaries on StEIS in full. Where actions were mentioned in the text of investigation summaries, at times these appeared to be statements of what ought to happen, rather than the detailed actionable steps required to enable or ensure that good practice can and will be followed in all future procedures. For example:

“The Adult Nasogastric Tube Policy must be followed without deviation to ensure patient safety.”

“The practice of flushing tubes with water prior to obtaining aspirate should be avoided.”

Typically where specific actions were clearly described, they related to reminding staff of policies and protocols; it was rarer to see actions that would help embed safe practice. Training tended to be described as initiatives rather than ongoing programmes. While actions generally tended to be trust-wide, some were much more limited in scope, such as documentation audit only in the ward where the incident occurred, or training only for one group of doctors.

Several investigations identified important teamwork issues but clearly found it challenging to identify any action to address these. These included a recognition that junior doctors sought peer support rather than senior advice and that junior staff who had believed the tube was not safe to feed had felt unable to speak up effectively (examples included an agency nurse apparently over-ruled by permanent ward staff and a radiographer apparently over-ruled by a medical consultant).

#### **Key points: investigation and action-planning**

- Duty of candour conversations and apologies to the patient or their family were usually recorded in investigation summaries.
- There were encouraging examples of conscientious and insightful investigations identifying learning that could be applied to improve safety well beyond the area of nasogastric tube placement.

- Some reports suggested investigators fundamentally misunderstood root cause analysis techniques.
- Investigations did not always appear to take a full and complete timeline of what actually occurred. This was particularly likely to lead to gaps in establishing whether anything had been introduced down the nasogastric tube prior to pH testing.
- Investigations rarely appeared to use prior NPSA alerts to establish what should have occurred, but instead used local policy or more informal standards of what the investigator thought was acceptable practice. In some cases this led to investigations failing to recognise that safety-critical requirements had not been followed.
- Typically investigations focused on 'care delivery problems' not 'service delivery problems' and did not drill down to contributory factors or root causes. The most concerning examples included providing training only to the staff involved in the incident rather than considering whether any lack of skills or competency could be more widespread.
- Recorded actions typically focused on reminding staff to follow policy requirements rather than co-ordination of systemic initiatives to help them do so.
- Despite these incidents being designated as Never Events, investigations rarely considered whether there had been problems with the implementation of past guidance, and none appeared to consider that if that had occurred for nasogastric tube alerts, it might be symptomatic of wider issues in local governance of alerts on other topics.
- There were some encouraging examples of commissioners challenging the quality of fact-finding, analysis and action-planning where this appeared inadequate.

## Personal perspective: the best opportunity to promote safe care is before the tube is placed

Over the last five years I have spoken to some nurses from organisations that have had misplaced nasogastric tubes. The conversations are always very similar, in that they question if the advice in the NPSA alerts is necessary, and at the same time assure me that all the advice has definitely been followed.

As these conversations progress I have always asked about the patient involved and how they were prior to the insertion of the nasogastric tube. Perhaps unsurprisingly, I often learn of an individual who was extremely unwell with multiple clinical issues that needed to be addressed.

It is normally at this point of the conversation that I wonder to myself why my clinical colleagues believed it to be the right time to consider placing a nasogastric tube and I question, again to myself, if it would not have been better to wait for 24–48 hours to see if the patient's condition improved. I also wonder if there was any assessment of risks and benefits to inserting the nasogastric tube at the time. When I have actually asked the question I am often told 'the family wanted the tube inserted'. I ask myself would I have wanted that tube inserted if it was a member of my family; normally the answer is no.

The issue of providing nutrition and hydration is highly emotive in clinical care and I am very much aware of the pressure that clinical staff face when discussing a decision not to initiate nasogastric feeding. This was a conversation I had to have with many of my patients' families during my 22 years of clinical practice. However, I do believe that if people are truly made aware of the risks involved in the placement of nasogastric tubes when patients are so unwell, and reassured of plans for daily reassessment of their loved one's condition, they are far more likely to agree to that decision.

Back in 2011 I argued strongly for there to be reference within the supporting information of the alert to the need to undertake a clinical decision to establish if the placement of a nasogastric tube was the right thing for a patient and for the steps of that decision-making process to be documented. For me it has always been essential that the risks and benefits to the individual are understood and there is a rationale for the actions we take in clinical practice. The [review of incidents](#) included in this resource set makes me painfully aware that a requirement to document this can never be enough. An alert cannot enforce the need to have those honest and difficult conversations with ourselves, our colleagues, our patients and their families.

**Caroline Lecko, RN**  
**Patient Safety Lead, NHS Improvement**

## Suggested areas for self-assessment and commissioner assurance

The table below focuses on the main implementation issues identified as part of our review of local investigations into misplaced nasogastric tubes. The assessment questions are not a formal assurance framework or audit tool, but designed to assist trust boards (or their equivalent in other organisations providing NHS-funded care) and their commissioners to challenge themselves in relation to the implementation of safety-critical actions.

<b>Table 2: Suggested areas for self-assessment and commissioner assurance</b>		
<b>Safety-critical area</b>	<b>Implementation issues identified in incident review</b>	<b>Self-assessment questions/ commissioner assessment questions</b>
<p><b>Local policies and protocols</b></p> <p>These need to reflect all the <a href="#">safety-critical requirements</a> summarised in this resource.</p>	<p>Some incident investigations suggested that local policies and protocols omitted key aspects of the earlier alerts, or in some cases included practices that the alerts said should never be allowed.</p> <p>Some incident investigations suggested policies and protocols were unclear, or too lengthy for frontline staff to realistically be able to read or remember their content.</p>	<p>Are you confident local policies and protocols accurately reflect all the safety-critical requirements summarised in this resource?</p> <p>Are you confident policies and protocols are clear and accessible to frontline staff?</p>

<p><b>National safety guidance</b></p> <p>This needs to be referred to in any incident investigation</p>	<p>In comparing what happened with ‘what should have happened’, investigation summaries almost never refer to NPSA alerts or actions required within them, and appear to rely on local policy or the investigators’ understanding of good practice.</p> <p>Some investigations showed an apparent lack of understanding by investigators of how nasogastric tube placement should be checked on x-ray, and one investigation report suggests the investigator thought it was acceptable to flush tubes before confirming placement if aspirate was difficult to obtain.</p>	<p>Are you confident that investigators refer to formal sources of guidance, such as Patient Safety Alerts or NICE guidance to set the standard on ‘what should have happened’ as part of any investigation?</p>
<p><b>Safe equipment</b></p> <p>Nasogastric tubes used for feeding are radio-opaque throughout their length and have externally visible length markings.</p> <p>pH paper is CE marked for use on human aspirate.</p>	<p>In most trusts safe equipment appears to have been introduced at the time of the NPSA 2011 alert (if it was not already in use). But there were isolated cases when a later decision to change suppliers for cost effectiveness meant that non-compliant nasogastric tubes were re-introduced, and this was not recognised until after a Never Event had occurred.</p> <p>Other incident investigations found a range of pH paper, not all CE marked, was in use in different clinical departments in an organisation.</p>	<p>Are you confident that procurement decisions always include clinical advice on patient safety considerations?</p> <p>Are you confident clinical supply systems would ‘block’ any accidental ordering of non-compliant alternatives?</p> <p>Are you confident nasogastric tubes or pH paper not meeting these safety-critical requirements have been removed from all areas?</p>

<p><b>Competency-based training</b></p> <p>Training needs to reflect all the safety-critical requirements summarised in this resource set.</p>	<p>Not all trusts appear to have created ongoing training programmes, or levels of training completion had not been routinely monitored and had lapsed.</p> <p>Some incident investigations suggested that trusts had seen training as unnecessary for experienced or senior nursing staff, but the risks of them continuing to use incorrect techniques that predated the NPSA and NHS England alerts may be greater.</p> <p>In some trusts there seemed to be an assumption that consultants did not require training in x-ray interpretation, but investigations have demonstrated that errors are made by consultants and not just junior staff.</p> <p>Some trusts appeared to assume that newly registered nursing staff or junior doctors must already have had these competencies assessed in their training; this is not necessarily so.</p> <p>Some training programmes appeared theoretical rather than assessing competency.</p> <p>Organisations had not recognised that having an up-to-date register of staff who have the appropriate competencies is key to ensuring nursing staff avoid asking doctors not 'on the list' to confirm nasogastric tube placement.</p> <p>Investigation reports describe medical staff using the unsafe and outmoded 'whoosh test' or giving incorrect advice to nursing staff in relation to obtaining and testing the pH of aspirate; if training for medical staff is limited to x-ray interpretation this risk would not be eliminated.</p>	<p>Are you confident the content of your local training programme accurately reflects all the safety-critical requirements summarised in this resource?</p> <p>Are you confident that <b>all</b> clinical staff (regardless of profession or level of seniority) who confirm nasogastric tube placement by pH or x-ray have been assessed as competent through theoretical and practical learning?</p> <p>Are you confident there is a process to monitor and review competency?</p> <p>Can frontline staff easily identify staff who have (and who have not) been assessed as competent in the interpretation of x-rays for confirming nasogastric tube placement?</p> <p>Are you confident that locum, agency and newly recruited staff would know not to undertake nasogastric placement checks?</p>
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<p><b>Clinical documentation formats and checklists</b></p> <p>These need to reflect all the safety-critical requirements summarised in this resource.</p>	<p>From the investigations it was not clear if all trusts provided structured documentation or checklists to record nasogastric tube insertion and subsequent checking requirements.</p> <p>Investigations and learning were hampered by the lack of routine documentation on what checks were actually carried out.</p> <p>Of the incidents that involved x-ray misinterpretation or interpreting the wrong x-ray, none appeared to have followed a structured process for decision-making or documented each step of these checks. This included examples of nurses accepting a brief written or verbal 'safe to feed' confirmation before starting feeding.</p>	<p>Are you confident that bedside documentation helps staff to take and record all necessary checks? Are checklists, charts or pre-printed labels provided? Do staff find these helpful?</p> <p>Are you confident that nasogastric tube placement checks are documented in a structured way?</p> <p>Are you confident that brief written or verbal 'safe to feed' instructions are not occurring?</p>
<p><b>Ongoing audit of compliance</b></p>	<p>Some investigations suggested that some policies written after the 2011 alert had had little impact on clinical areas, with past custom and practice continuing, or new documentation never brought into routine use.</p> <p>Some investigations suggested that initially good compliance had lapsed over time, but these lapses were only noticed after a Never Event occurred.</p>	<p>Are you confident the current focus on compliance with safety-critical requirements will become 'business as usual'?</p> <p>Are you confident clinical audit and quality improvement teams have built this into their plans?</p>



<p><b>Implementation of Patient Safety Alerts</b></p>	<p>Following the review of nasogastric tube investigations, omissions in the implementation of safety critical guidance from previous nasogastric tube alerts has become apparent. If there were gaps in organisational systems for ensuring alerts were acted on, these could potentially apply to other alerts.</p>	<p>Are you confident that all Patient Safety Alerts have been implemented within your organisation?</p> <p>What mechanisms are in place to ensure that alerts are only signed off by your organisation once the 'actions required' have been completed?</p> <p>What mechanisms are in place to provide assurance that 'actions required' are taken and monitored on a regular basis?</p>
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## Links to clinical guidance and key literature

The guidance below is not an extensive list but highlights some of the key clinical guidance available to support healthcare professionals in their decision making in relation to the appropriate use of nasogastric tubes.

### **National Institute for Health and Care Excellence**

Nutrition support for adults: oral nutrition support, enteral tube feeding and parenteral nutrition (CG32) <https://www.nice.org.uk/guidance/cg32>

### **National Nurses Nutrition Group**

Good Practice Guideline 2016 – Safe Insertion and ongoing care of Nasogastric (NG) Feeding Tubes in Adults - 2nd Edition <http://www.nnng.org.uk/download-guidelines/>

### **British Association of Parenteral and Enteral Nutrition**

Decision Tree <http://www.bapen.org.uk/pdfs/decision-trees/naso-gastric-tube-insertion.pdf>

### **Royal College of Physicians**

RCP Top Ten Tips for nasogastric tube feeding in adults  
<https://www.rcplondon.ac.uk/projects/outputs/nutrition-top-ten-tips>

Oral feeding difficulties and dilemmas: A guide to practical care, particularly towards the end of life <https://www.rcplondon.ac.uk/projects/outputs/oral-feeding-difficulties-and-dilemmas>

National Clinical Guidelines for Stroke – 4<sup>th</sup> Edition

<https://www.rcplondon.ac.uk/guidelines-policy/stroke-guidelines>

### **Royal College of Psychiatrists**

MARSIPAN: Management of Really Sick Patients with Anorexia Nervosa (2nd ed)  
<http://www.rcpsych.ac.uk/usefulresources/publications/collegereports/cr/cr189.aspx>

Guidelines for the nutritional management of anorexia nervosa  
<http://www.rcpsych.ac.uk/usefulresources/publications/collegereports/cr/cr130.aspx>

### **General Medical Council**

End of life care: Clinically assisted nutrition and hydration [http://www.gmc-uk.org/guidance/ethical\\_guidance/end\\_of\\_life\\_clinically\\_assisted\\_nutrition\\_and\\_hydration.asp](http://www.gmc-uk.org/guidance/ethical_guidance/end_of_life_clinically_assisted_nutrition_and_hydration.asp)

## Key literature

Most research related to nasogastric tube placement checks is not recent or has been conducted on a relatively small scale. It will therefore usually be more helpful to refer to the clinical guidelines listed above, including those that have systematically identified and synthesised the relevant research literature. Some additional useful background reading includes:

- Metheny N (1988) Measures to test placement of nasogastric and nasointestinal feeding tubes: a review. *Nurs Res.* 1988 Nov-Dec;37(6):324-9  
<http://www.ncbi.nlm.nih.gov/pubmed/3054820>
- Metheny N (1994) pH testing of feeding tubes aspirates to determine placement. *Nutrition in Clinical Practice (ASPEN)*; 9:185-190
- R. Sorokin, J.Gottlieb (2006) Enhancing Patient Safety During Feeding-Tube Insertion: A Review of More Than 2000 Insertions *JPEN J Parenter Enteral Nutr* SEPTEMBER-OCTOBER 2006 vol. 30 no. 5 440-445  
<http://pen.sagepub.com/content/30/5/440.abstract>
- Hanna G, Phillips, L, Priest O & Zhifang N (2010) Improving the safety of nasogastric feeding tube insertion A Report for the NHS Patient Safety Research Portfolio July 2010 <http://www.birmingham.ac.uk/Documents/college-mds/haps/projects/cfhcp/psrp/finalreports/PS048ImprovingthesafetyofnasogastricfeedingtubeinsertionREVISEDHannaetal.pdf>
- Milsom SA1, Sweeting JA, Sheahan H, Haemmerle E, Windsor JA. (2015) Naso-enteric Tube Placement: A Review of Methods to Confirm Tip Location, Global Applicability and Requirements. *World J Surg.* 2015 Sep;39(9):2243-52. doi: 10.1007/s00268-015-3077-6 [www.ncbi.nlm.nih.gov/pubmed/25900711](http://www.ncbi.nlm.nih.gov/pubmed/25900711)
- Veiga de Oliveira Santos SC, Woith W, Pedreira de Freitas MI, Bargas Zeferino EB (2016) Methods to determine the internal length of nasogastric feeding tubes: An integrative review *International Journal of Nursing Studies* 61 (2016) 95–103  
<http://www.sciencedirect.com/science/article/pii/S0020748916300748>

## Links to guidance to support incident investigation

The key policy documents for NHS funded care in England are:

- NHS England Never Events Policy and Framework 2015  
[www.england.nhs.uk/patientsafety/never-events/](http://www.england.nhs.uk/patientsafety/never-events/)
- NHS England Serious Incident Framework 2015  
<https://www.england.nhs.uk/patientsafety/serious-incident/>
- NHS England Serious Incident Framework Frequently Asked Questions 2016  
<https://www.england.nhs.uk/patientsafety/serious-incident/>

All current resources to support staff trained in conducting Root Cause Analysis investigation can be accessed via the landing page at:

<http://www.nrls.npsa.nhs.uk/resources/collections/root-cause-analysis/>

The resources include presentations, templates, toolkits and guidance.

## Links to guidance on incident reporting and responding to patient safety alerts

On 1 April 2016 the statutory patient safety functions previously delivered within NHS England transferred to NHS Improvement. From the perspectives of providers of NHS-funded care, existing processes and policies for incident reporting and receiving and acting on national Patient Safety Alerts will not change.

A Stage 2 alert was issued to support patient safety incident reporting and responding to patient safety alerts.

<https://improvement.nhs.uk/news-alerts/patient-safety-incident-reporting-and-responding-patient-safety-alerts/>

Support with National Reporting and Learning System reporting can be accessed at:

<https://report.nrls.nhs.uk/nrlsreporting/>

## Link to the Medicines and Healthcare products Regulatory Agency (MHRA)

The MHRA regulates medicines, medical devices and blood components for transfusion in the UK and safety advice can be accessed at:

[www.gov.uk/mhra](http://www.gov.uk/mhra)

Suspected problems or incidents involving medications and medical devices can be reported to the MHRA by accessing the following link:

<https://yellowcard.mhra.gov.uk/>

## Links to implementation resources

This section provides links to a limited number of existing shared resources, and introduces a new special interest group hosted by British Association for Parenteral and Enteral Nutrition (BAPEN), which will provide a future forum where local implementation approaches and resources can be accessed and shared.

BAPEN is launching a new nasogastric (NG) specialist interest group, a multidisciplinary forum for professionals to share local materials and approaches, for example policies, protocols and resources. The specialist interest group will also provide an opportunity for members to raise awareness, debate complex issues and to advance practice by working collaboratively.

The NG Special Interest Group will launch on 3 August 2016, visit [www.bapen.org.uk](http://www.bapen.org.uk) for further information.

Some suggestions for sharing locally developed materials and approaches to training via the specialist interest group are listed below:

### Sharing locally developed materials

- Do you have examples of training materials, training approaches, competency frameworks or training logs for healthcare staff that other organisations might find useful, including materials for adults, children, babies and neonates, and materials for hospital, community and care home settings?
- Do you have examples of information or training materials for parents or carers that other organisations might find useful?
- Do you have examples of policies, protocols, job descriptions and bedside documentation that other organisations might find useful, including a focus on adults, children, babies or neonates, and for hospital, community or care home settings?
- Are you providing nasogastric tube feeding in an unusual specialist setting (eg an eating disorders unit)? Do you have resources that other specialist settings might find useful?

### Sharing approaches to training

- Organisations that have maintained competency-based training across a relatively wide range of staff (eg providing competency-based training for all or most junior doctors and all or most nursing staff) and how they manage this during major staff transitions
- Organisations that have restricted competency-based training to relatively few specialist staff (eg allowing only radiologists and consultant intensivists to confirm initial placement by x-ray, allowing only a team of nurse specialists to

undertake initial placements and placement confirmation via pH). How have they ensured other staff are aware that they cannot undertake these checks? Have they found wider benefits in terms of more senior input into decisions to feed via nasogastric tube? Have there been any delays in access?

- Approaches halfway between the two above (eg all staff with competency-based training on some wards and units, and only specialist teams or radiologist report elsewhere)

### Existing training resources

An elearning package on ***Reducing the risk of feeding through a misplaced feeding tube*** is currently available via the NHS Electronic Staff Record (ESR) at [www.esrsupport.co.uk/access.php](http://www.esrsupport.co.uk/access.php). This elearning was noted in the NPSA 2011 Patient Safety Alert as providing an example but not an endorsement of resources that could be used as part of local competency-based training in interpretation of x-rays

To access this resource staff members need to have an account and we recognise that not all organisations use the NHS Electronic Staff Record as a route for staff training; you may need to check local arrangements. If using this resource you must remain aware that **all healthcare professionals involved with nasogastric tube position checks must be assessed as competent. Competency training should include theoretical and practical learning.**

### Existing audit tools

The Royal College of Radiology has audit guidance available at <https://www.rcr.ac.uk/audit/chest-x-ray-confirmation-nasogastric-tube-placement-radiographer-responsibility> to assess technique compliance

## Examples of elearning content


The illustrations below **DO NOT** constitute training materials in themselves but illustrate content that can be accessed on the elearning platform. The source material must always be consulted, as the content illustrated below will be updated in light of new evidence and learning.

**All healthcare professionals involved with nasogastric tube position checks must be assessed as competent. Competency training should include theoretical and practical learning.**


**To confirm gastric position of the nasogastric tube, ask:**

- Does the tube path follow the oesophagus/avoid the contours of the bronchi?
- Does the tube clearly bisect the carina or the bronchi?
- Does it cross the diaphragm in the midline?
- Is the tip clearly visible below the left hemi-diaphragm?


**Proceed to feed only if all criteria are met. If in any doubt repeat x-ray or call for senior help.**



Radiograph 1



Radiograph 2



Radiograph 1 shows the tip of the nasogastric tube above the diaphragm and on the right-hand side of the thorax. The presence of ECG leads make interpretation of the radiograph more difficult.

Radiograph 2 shows the tip of the nasogastric tube apparently below the left hemidiaphragm but the tube clearly follows the contours of the left bronchus. In fact, the tube is positioned in the left lower lobe of the lung.

### Documentation following X-ray should include:

- Who confirmed the position of the nasogastric tube and evidence they are competent to do so
- Confirmation that any x-ray viewed was the most current x-ray for the correct patient
- How the position of the nasogastric tube was interpreted using the 'four criteria' e.g. *NG tube follows path of oesophagus, bisecting bronchi, remains midline to level of diaphragm and deviates to left thereafter. Tip is seen about 7cm below diaphragm*
- Clear instructions as to required actions e.g. *NG tube safe to use for feeding*

## Suggestions for further clinical guidance

The 2016 NHS Improvement alert and this resource set deliberately focus on the specific safety concern of initial placement checks. Wider clinical guidance is in the remit of other organisations and professional bodies that will have their own systems for prioritising their effort where they believe it can have the most benefit. The list below includes areas raised during incident investigations or consultation on this resource set. Professional bodies may wish to consider these when revising or developing guidance.

- **Patients for whom ‘blind’ nasogastric tube insertion is not appropriate**  
Factors such as altered anatomy, for example, oesophageal fistula or pharyngeal pouch, or certain clinical conditions (such as basal skull fracture), have been previously acknowledged, and the incidents reviewed suggest perforations have been reported in oesophageal cancer. A more definitive list of conditions that are contraindications or cautions for ‘blind’ placement (or contraindications for nasogastric placement via any means) could be helpful.
- **Potential for extra guidance on patients admitted with aspiration pneumonia**  
The incidents reviewed suggest that where patients are admitted apparently very ill with aspiration pneumonia but unlikely to be candidates for intensive care, more guidance may be required. This is partly because incident investigations suggest that some patients should have been recognised as dying and should receive treatment more orientated to comfort, and partly because if any plausible mechanism for misleading pH readings exists, it would theoretically relate to patients where the respiratory tract already contains a significant amount of aspirated stomach content or aspirated food or fluids taken by mouth.
- **Potential for extra guidance on securing nasogastric tubes**  
The incidents reviewed suggest tubes can frequently be dislodged accidentally or removed by patients either intentionally or because they are confused. The National Nurses Nutrition Group (NNNG) is currently in the early stages of developing guidance on the use of nasal bridles but issues included more everyday concerns such as adhesive tape not proving very adhesive.
- **Potential for additional guidance on revisiting decisions to feed via nasogastric tube**  
The incidents reviewed suggest best-interest decisions for patients without capacity did not always appear to be revisited when patients repeatedly removed their tubes. The balance of risks and benefits may change if repeated tube insertions are required, and the reasons behind the patient’s



behaviour and what that might mean for their experience of care may also need revisiting.

- **Integrated clinical and ethical guidance**

Current clinical guidance and decision-making support often relates to specific circumstances and disease conditions. The incidents reviewed and consultation feedback suggested there would be real benefits in over-arching multidisciplinary guidance, potentially led by combined royal colleges, that could be used for the complexity of real-life situations where patients will typically have both acute conditions and multiple long-term illnesses and could have needs and wishes that fall between full active treatment and end-of-life care.

- **Determining nasogastric tube length**

Advice on measuring tube length before insertion and how much to advance the tube if aspirate is not obtained appears to have been based mainly on clinical experience and judgement. Evidence reviews suggest some methods typically used to estimate required length before insertion may be inaccurate<sup>15</sup> and clinical guidance that draws on evidence for the best methods of matching tube length to the patient's anatomy in neonates, older infants, children and adults may be helpful.

- **Observation during feeding in the community**

Requirements for observation of nasogastric tube feeding for children and adults in their own home, including overnight feeding, has been raised as an area where clinical guidelines would be helpful.

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<sup>15</sup> Milsom SA1, Sweeting JA, Sheahan H, Haemmerle E, Windsor JA. (2015) Naso-enteric Tube Placement: A Review of Methods to Confirm Tip Location, Global Applicability and Requirements. *World J Surg.* 2015 Sep;39(9):2243-52. doi: 10.1007/s00268-015-3077-6

## Future research needs

The following were suggested during consultation on the 2016 NHS Improvement alert as areas where further evidence is needed. These areas might be of interest to researchers or research funding streams.

- **What are the normal pH ranges of respiratory tract and gastric aspirate?**  
Ranges referred to in the literature may not reflect the current patient population likely to require nasogastric tube feeding.
- **Innovations in pH strips**  
Can pH strips be better designed to support the key discrimination of the 'safe range' from other results? Would larger areas of colour matching or more distinct colour differentials help? Can the varying colour palettes used by different manufacturers be standardised?
- **Practice-based research into pH testing**  
Laboratory-based research suggests some brands of pH paper may be easier to interpret than others. Would the same results be found using aspirate from patients viewed under lighting conditions of clinical practice? Are there realistic methods of teaching and confirming the ability of clinical staff in colour discrimination? Are there viable technological alternatives (eg pH meters)? Use of external lubricants for inserting tubes has been discouraged because the risk of contaminating aspirate is unknown, and manufacturers have tested the pH of internal lubricants in laboratory conditions and tested whether re-use of cleaned and dried tubes (in the same patient) risks contamination. Do these studies need to be repeated under clinical conditions?
- **How often does nasogastric tube misplacement occur?**  
Although reported incidents give us some indication of how often misplacement may go undetected before feeding, the literature on how often 'blind insertion' may lead to respiratory placement overall (including appropriately detected misplacement where tubes are removed before feeding occurs) is not recent. It therefore may not be generalisable to current designs of nasogastric tube and the current patient population. Understanding how often misplacement occurs, and if it is particularly likely in any sub-groups of patients, is key information to underpin improvements in checking for misplacement. Information on rates of any direct harm from 'blind insertion' (eg plural perforation) would also be helpful.
- **Research methods for new technology**  
How feasible is it to research whether any new technology has an equal or lower error rate in detecting respiratory placement than current methods, given the relative rarity of error with current methods? (95 incidents in four

years and six months, during which period at least 790,000 nasogastric tubes were purchased annually by the NHS in England). What statistical power are studies likely to need?

- **Alternative technology for excluding respiratory placement**

If there are feasible research methods to prove any new technology or new application of technology has an equal or lower error rate in detecting respiratory placement than current methods, what alternative technologies could be explored? Are past pilot studies of CO<sub>2</sub> detection, human gastric lipase or pepsin detection worth reconsidering? Would innovations in micro-imaging technology make it feasible to collect direct images from the nasogastric tube tip? Can ultrasound technology be used to confirm placement?

## Notes on incident data

Data have been drawn from incidents reported to the Strategic Executive Information System (StEIS) database as Serious Incidents or to the National Reporting and Learning System (NRLS) occurring between 12 September 2011 (the 'action complete by' date of the National Patient Safety Agency (NPSA) Alert *Reducing the harm caused by misplaced nasogastric feeding tubes in adults, children and infants*) and 11 March 2016, cross-checked to ensure no incidents were double-counted if reported to both databases.

The methods used to routinely identify any such events and the databases used to record them have changed slightly during this period but in summary should identify any relevant incidents either reported to the StEIS database as Serious Incidents and containing nasogastric keywords (if reported before the addition of a 'never event' filed in the StEIS database), designated by their reporter as nasogastric Never Events on StEIS or reported to the National Reporting and Learning System (NRLS) with an outcome of 'death' or 'severe harm' and free text suggesting a misplaced nasogastric tube.

After the revised *Never Event Policy and Framework 2015* extended the Never Event definition to feeding into the respiratory tract regardless of whether death or severe harm resulted, only StEIS (rather than StEIS plus NRLS) was used to search for incidents. StEIS contains incidents only from England. The NRLS contains incidents from England and Wales.

For the purpose of these resources ambiguous incidents (where feed or medication unintentionally introduced into the respiratory tract via a misplaced nasogastric tube may conceivably have occurred, but there was no clear indication of this anywhere in the incident report) were excluded. While designation as a Never Event was one of the methods used to identify incidents, the 95 incidents described are included because they described feed, fluids or medication introduced into the respiratory tract, regardless of whether they met Never Event definitions in place when they occurred.

### Missing data

Incidents reported to the NRLS as lower levels of harm (moderate harm, low harm, or no harm) before 2015 would not be included, but feed or medication unintentionally introduced into the respiratory tract via a misplaced nasogastric or orogastric tube would normally be expected to cause more than moderate harm. A few reported incidents could have been missed from inclusion in this report by human error in the weekly review process that identifies relevant 'death' or 'severe harm' incidents from the NRLS or by reporter error in STEIS (failing to select the correct reporting category in drop-down menus).

Both STEIS and NRLS rely on healthcare organisations submitting reports. Declaration of incidents where patients had feed or medication unintentionally introduced into the respiratory track via a misplaced nasogastric tube causing serious harm is required by past and present national patient safety organisations and regulators.

Nine reviewers with clinical and patient safety expertise (Frances Wood, Frances Watts, Dagmar Luettel, Michael Surkitt-Parr, Jayne Wheway, Deborah Scotting, Nima Vekaria, Frances Healey, and Joan Russell) shared the process of identifying relevant incidents through weekly reviews of NRLS and STEIS data. One of these reviewers (Frances Healey) produced the final analysis and commentary.

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NHS Improvement is the operational name for the organisation that brings together Monitor, NHS Trust Development Authority, Patient Safety, the National Reporting and Learning System, the Advancing Change team and the Intensive Support Teams.

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