



**BAPEN**

*Putting patients at the centre  
of good nutritional care*

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# **A Position Paper on Nasogastric Tube Safety**

## **“Time to put patient safety first”**

**Prepared by the NGSIG  
(Nasogastric Tube Special Interest Group of BAPEN)**

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## Executive Summary

Misplacement and use of nasogastric feeding tubes leads to ongoing avoidable complications and deaths classified as Never Events despite multiple NHS Alerts since 2005. The most common cause relates to use of X-rays to confirm intragastric placement, followed by poor adherence to guidance on use of gastric aspirate pH, although the vast majority of nasogastric feeding tubes in the UK are passed safely and have their position confirmed using pH checks without issue.

The root cause of these problems is a failure by Hospital Trusts and Health Boards to implement guidelines through rigorous clinical governance over many years.

The perception of nasogastric feeding tube insertion as a “simple” procedure must be changed to that of a “complex” and dangerous procedure and limited to properly trained and competent healthcare professionals.

The ongoing incidence of nasogastric Never Events is symptomatic of a wider failure of NHS governance procedures centrally and at senior Trust level.

**It must be accepted that this method of feeding is associated with a risk of complications and death which requires new strategies to mitigate these risks and to place patient safety at the top of the agenda.**

## Summary of Position Paper Findings

- 1) The main complications related to NGT placement are:
  - i. Intrapulmonary placement with administration of feed, medication or fluid. This is a NEVER EVENT (NE).
  - ii. Pneumothorax or pleural placement due to NGT with administration of feed, medication or fluid. This is a NEVER EVENT.
  - iii. Pneumothorax or pleural placement with tube unused. This is NOT a Never Event.
  - iv. Intra-oesophageal placement with or without tube used. This is NOT a Never Event but predisposes to aspiration pneumonia.
  - v. Oesophageal or hypopharyngeal perforation. These are NOT Never Events and will not be addressed within this paper.
- 2) Whilst pH checking is not always perfect, the vast majority of NG tubes passed in the UK are passed safely and have their position confirmed using pH sticks without issue. What is important is that Organisations can and do demonstrate that their Health Care Professionals (HCPs) are following national and local guidance to the letter.
- 3) Failure to follow various aspects of present guidance is the commonest cause of NEs with X-ray misreading as the single most frequent cause, indicative of failure to implement actions in Alerts.
- 4) The underlying cause of failures to improve the safety of Nasogastric tubes for feeding, hydration and drug administration is failure by Organisations to implement the 5 comprehensive NPSA and NHSE/I Alerts disseminated to Wales, Scotland & Northern Ireland since 2005.
- 5) The first Alert in 2005 concerning multiple deaths and harms from misplaced NGTs was accompanied by excellent advice which if followed would have reduced the number of NEs considerably. Further alerts in 2011, 2012 and 2013 do not seem to have influenced the incidence of NEs related to NGTs.
- 6) The Alert in 2016 took notice of this failure and directed its latest actions towards Board Directors within organisations with clear and achievable instructions, the deadline for implementation being 21<sup>st</sup> April, 2017.
- 7) Continuing NEs have been recorded since 2017 but we can find little evidence that the action taken by NHSE/I in 2016 has been followed up to ensure implementation of all recommendations for Board involvement, audit and training. It is this ongoing systemic failure which highlights why no progress appears to have been made to date.
- 8) The cost implications of Alert 2016 are negligible as resources already exist except where Organisations have not implemented NICE 032 2017 guidance on appointment of Specialist Nutrition Nurses.

- 9) The recommendations by NHSE/NHSI, to ensure that all NGTs are inserted by personnel with the requisite training and competencies, use of correct materials (CE marked pH papers; radio-opaque NGTs) accompanied by ongoing audit, are the key measures required to improve safety and these must be fully implemented by ALL Organisations providing care to patients with NGTs.
- 10) Previous alerts highlighted the importance of considering the balance of risk over benefit for NGT insertion in obtunded patients. (Alert 2011 supporting information) BAPEN strongly supports this advice. Further work is required to identify these high-risk patients who are to be found almost exclusively in hospitals rather than the community where NEs are extremely rare.
- 11) The NG-SIG of BAPEN would also strongly support restriction of NGT insertion to registered nurses, dietitians, radiographers and medical staff (including radiologists and intensivists) who have undergone appropriate training and ongoing competency assessment. The present practice of training all nurses to place NGTs should be replaced by a 2-tier system. The insertion and reinsertion of NGTs should be restricted to selected staff (expert operators) as above but for practical reasons, the subsequent checking of tube tip position before each use by pH assessment and external length should still be the remit of all competent professional staff as above.
- 12) There should be an agreed national uniform training programme for pH and X-ray checks on NGT placement.
- 13) The committee finds that novel methods of assessing NGT tip position in the stomach do not currently replace or outperform the available methods using modified NEX measurement, aspirate pH and/or X-ray confirmation for initial or subsequent placements, or pH and external measurement before each subsequent use of a tube. It has been repeatedly shown that failure to implement these basic methods according to best practice is the root cause for failure to detect misplaced NGTs before use.
- 14) Never Events associated with aspirate pH  $\leq 5.5$  may indicate that aspiration of gastric contents has already occurred prior to tube placement. As described in Alert 2011, such cases are more likely to occur in obtunded patients in whom a specifically ordered X-ray should be employed before using the tube, provided that interpretation of the X-ray is conducted according to best practice using the "4 point" system. A reduction of the pH threshold to 5.0 or lower may provide additional protection but there is no formal evidence for this and such a change could face the same pitfalls to safe practice as a pH threshold of 5.5.
- 15) The underreported complication of pulmonary aspiration whilst being fed with an NGT misplaced in the oesophagus does not qualify as a Never Event but may be more common than direct infusion into the lungs. Adherence to guidance as in NPSA/NHSE Alerts would also greatly reduce this complication which promotes aspiration pneumonia.

- 16) There remains a pressing need for an accurate bedside device/technique to augment or replace pH paper and X-ray, provided it is validated for use in all settings and properly funded including training. Magnetic induction techniques come closest to satisfying this requirement but only when adequate expertise is available. Where pH is used, automated pH readers could eliminate inter/intra- observer error in pH reading.
- 17) In patients at high risk of aspiration, alternative routes of nutritional support should be considered including nasojunal tube placement. A 2-step procedure with initial insertion of NGT to 35cm followed by purposed X-ray correctly reported before advancing the tube to the stomach has been shown to eliminate misplacements in US studies but would be difficult to implement outside of critical care.
- 18) SAFETY FIRST must be at the core of all techniques used for NGT placement as part of a new culture of safety in the NHS. Our patients deserve nothing less.

# Position Statement of Nasogastric feeding tube safety by the NGSIG\* of BAPEN\*\* 2020

## Introduction

This document summarises the views of the multidisciplinary Nasogastric Special Interest Group (NGSIG) of BAPEN formed in 2017 in response to increasing concerns over the continuing number of NEs related to Nasogastric tubes (NGTs) as evidenced by NPSA data since 2005 and the designation of misplaced NGTs as “Never Events” in 2009. The Remit of the NGSIG is:

1. to review evidence and guidance available
2. to look at novel technologies which might improve safety
3. to examine forensically, the data accrued by NPSA on Never Events
4. to provide advice on how to improve safety of NGT feeding based on available evidence including experiential evidence

BAPEN was founded in 1992 to promote best use and safety of both parenteral and enteral nutrition which includes the nasogastric route. The charity PINNT, a core group member of BAPEN was founded to represent the interests of patients requiring parenteral and nasogastric tube nutrition.

## NPSA Never Event data definitions

A Never Event (NE) is defined as “wholly preventable where guidance or safety recommendations are available at national level, and should have been implemented by all healthcare providers” - (as found in “Never Events list, 2018” published by NHSI

[https://improvement.nhs.uk/documents/2899/Never\\_Events\\_list\\_2018\\_FINAL\\_v7.pdf](https://improvement.nhs.uk/documents/2899/Never_Events_list_2018_FINAL_v7.pdf))

The definition of nasogastric or orogastric tube misplacement (2016) is:

“Misplacement of a naso- or oro-gastric tube in the pleura or respiratory tract that is not detected before starting a feed, flush or medication administration”

## Organisations

The term “Organisations” includes Trusts, Health Boards (as in Wales, Scotland and Northern Ireland) and any body with responsibility for providing healthcare in the UK.

## Scope of this document

This document will consider only nasogastric (or orogastric) tubes used for gastric infusion of nutrients, hydration or drugs, and will exclude consideration of wide bore NGTs for gastric drainage (often termed Ryles Tubes). We have not addressed tube placement in neonates or paediatric practice. For the purposes of brevity, orogastric tubes will be encompassed by the term nasogastric tube. Again for brevity, the term “feeding NGT” encompasses hydration, drug

*\*NGSIG: Nasogastric tube special interest group. \*\*BAPEN: British Association for Parenteral and Enteral Nutrition*



administration and nutrition in accordance with the stated aim of NPSA Alerts. This document will focus on Never Events including misplacement into the pulmonary tree and into the pleural space with or without pneumothorax. It is not clear to us that there is evidence that fine bore feeding tubes contribute significantly to pneumothorax compared to the use of larger and stiffer drainage NGTs but some incidents have involved NGTs with feed having been infused into the pleural space. This complication is greatly outweighed by infusion into the bronchial tree. Oesophageal misplacement and misfeeding occur frequently so will also be considered in so much as they touch on NGT safety by promoting pulmonary aspiration. Finally, this document is based upon the experience of Never Events as reported in England and Wales but the conclusions apply equally to Scotland and Northern Ireland.

**National data on NGT Never Events**

The data available is shown in Table 1.  
**Table 1. Incidence of NGT related never events in England, 2005 -2019**

Year	Never Events	Centres re- porting NE	Annual incidence NE	Annual incidence centres	Comment
2003 - 2005	12	n/a	6	n/a	11 deaths
2005-2011	95	n/a	16	n/a	21 deaths
2012	20	n/a	20	n/a	7*
2013	16	n/a	16	n/a	7*
2014	10	10	10	10	7*
2015	40	29	40	29	7*
2016	26	24	26	24	7*
2017	22	20	22	20	No data
2018	29	24	29	24	No data
2019 (9/12)	18	17	24	23	No data
<b>Total</b>	<b>288</b>				<b>67 to 2016</b>

\*Figures derived as average of deaths September, 2011 to March, 2016 from 2016 Alert

Footnote: One Organisation had 5 in 2015 and another 3 in 2015. Data collection and definitions changed in 2015.

Data from Wales is available from 2012 to 2018 but in less detail on the internet, during which time 9 Never Events due to NGT misplacement are recorded. No such data for Northern Ireland or Scotland was identified during our searches. However, it is clear from NHSE/NHSI websites that all alerts have been disseminated to the devolved nations including versions in Welsh.

**Table 2. NGT related Never Events in Wales, 2012 – 2018**

Year	Never events
2012	1
2013	2
2014	0
2015	3
2016	3
2017	0
2018	0
<b>Total</b>	<b>9</b>

Analysis of NHSI data from England on their website reveals that approximately 85 Trusts reported NEs due to misplaced NGTs from 2015 to 2019 inclusive -i.e. 5 years data. Of these, 10 trusts appeared in more than one of those years and had multiple NEs of 3 or more. Of those 10 trusts, 6 appear not only in 2015 or 2016 but in 2019. The maximum NEs due to NGTs for a single trust between 2015 and 2019 was 9, followed by another with 5, two with 4 and the remaining 6 trusts on 3. This data shows that many Trusts have not yet had a NE, but 12% of those that have, have accrued 3 or more NEs and many more have 2 NEs. This would suggest possible failures to implement NPSA and NHSI Alerts in those Trusts and to ensure patient safety through a learning culture (NHSE Never Event policy 2015). It is possible that many of those Trusts yet to experience NGT NEs have been lucky in that their systems may be no better than those who have had NEs or may not have reported their NEs. As Wales has had no reported NEs in the last 2 years for which data is available, it is possible that implementation of NHSI/NPSA alerts is working there, perhaps following and because of the PSA008 Alert in Welsh in 2017.

The initial report by the NPSA of Deaths and harms from misplaced NGTs 2003 - 2005 revealed 11 deaths and 1 harm over the previous 2 years. Further analysis by NPSA on English data 2005 - 2011 indicated a significant mortality associated with NGT NEs and that use of radiology to confirm gastric placement was the dominant causative factor compared to the use of aspirate pH testing. From 2005 – 2011, there were 21 deaths and 76 harms overall but 12/21 deaths and 45/76 harms occurred despite misread X-ray position checks. From 2011 – 2016, 32 deaths were reported out of 95 incidents.

The initial alert in 2005 has been supplemented by those of 2011, 2012, 2013 & 2016

The detailed data of Never Events in the 2011 alert is summarised below:

## 2011 NPSA Alert

Appendix 1: Summary of reported incidents relating to misplaced nasogastric feeding tubes between issue of the NPSA Alert 2005 and 31 March 2010

Since the September 2005 NPSA Alert, Reducing the harm caused by misplaced nasogastric tubes, the NPSA has become aware of 21 deaths and 79 other cases of harm due to feeding into the respiratory tract through misplaced nasogastric tubes. In 45% of cases, the harm was due to misinterpreted X-rays.

**Table 3. Summary of all reported incidents relating to misplaced nasogastric feeding tubes between September 2005 and 31 March 2010 (Alert 2011)**

Checking method where error occurred	Number of incidents reported	Number of deaths
X-ray misinterpretation	45	12
Fed despite aspirate tested pH 6-8 *	7	2
Fed after apparently obtaining pH 1 – 5.5	9	1
Water instilled down nasogastric tube before testing pH *	2	0
Not checked at all *	9	1
Apparent migration after initially correct placement (e.g. after suction)	8	1
No information obtained on checking method used *	17	4
Placed under endoscopic guidance	1	0
Visual appearance of aspirate *	1	0
Bubble test *	1	0
<b>Totals</b>	<b>100</b>	<b>21</b>

(\*i.e. existing advice ignored)

The above table reveals that X-ray misinterpretation was the commonest single factor (45/100) with failure to observe various policies including pH checks identified in 37/55 remaining cases. Of concern is the finding that 8 NEs occurred after initially “correct” placement and 9 after apparently satisfactory pH readings between 1-5.5 (see also BAPEN survey below).

It is not clear from available data how many patients have died following or as a result of NGT NEs in recent years but there is no doubt that this complication can prove deadly. It has not always been possible to determine a causative link between misplaced NGT and death from the evidence provided to NPSA.

## Evidence from survey conducted by BAPEN NGSIG, 2018

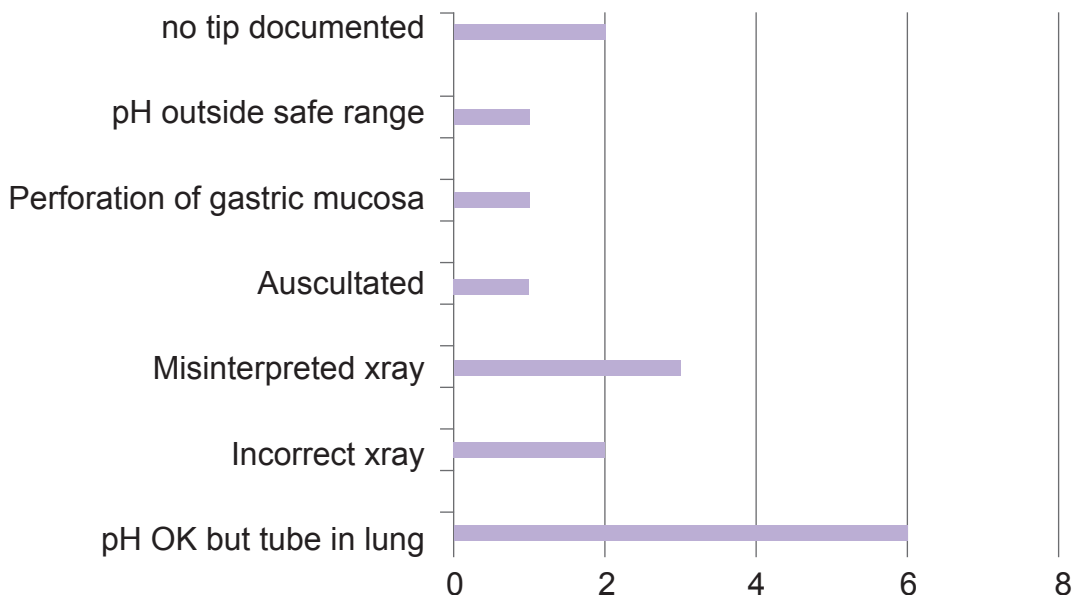
In 2018, The NG SIG conducted a Survey Monkey study of NEs over the previous 5 years with 11 responses covering 16 NEs in 8/11 respondent trusts. 2 trusts had 1 NE, 4 trusts had 2 NEs and 2 trusts had 4 NEs. Although a small cross section of Trusts, the details make for interesting reading.

There were 9 deaths from the 16 events. Major harm occurred in one case, moderate harm in 4 and no harm in 2. Deaths referred to the coroner recorded Accidental death in 1, Neglect in 1, Misadventure in 1 and Narrative in 3 with X-ray mandated if no aspirate in 1 case and recommended in another.

Analysis of the NEs is as follows in Figures 1 & 2:

Figure 1

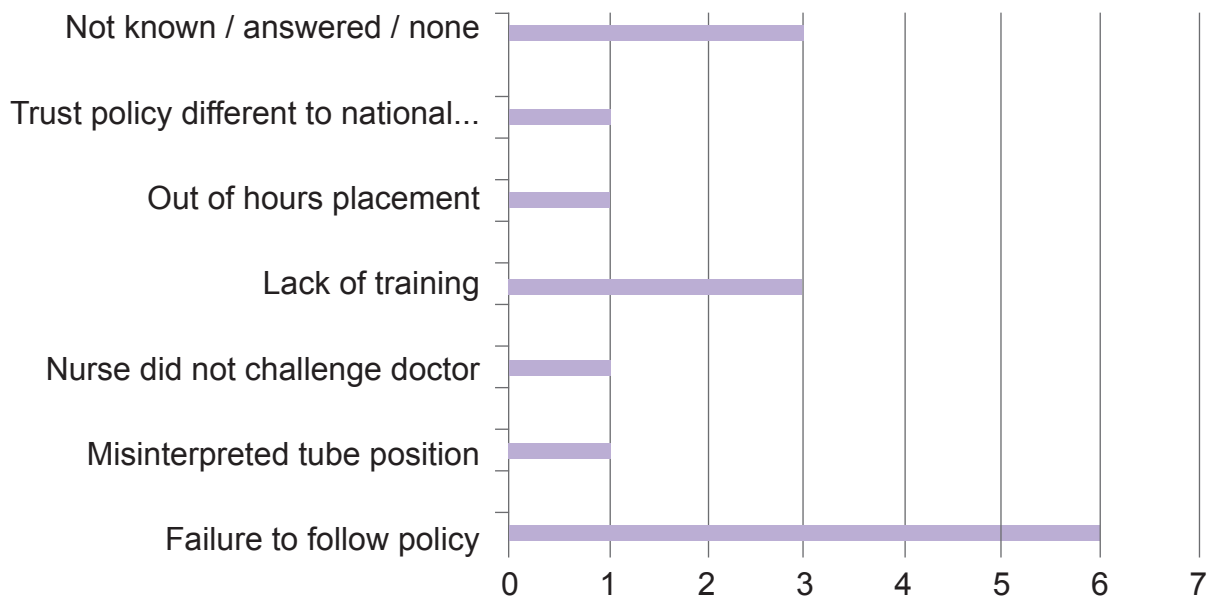
### MAIN reason for NE



From this data, several themes can be identified. Firstly, there were 6 cases in which a correct pH was obtained but the NGT was in the pulmonary tree. Three of these died. *This emphasises that an accurate pH test read correctly of pH  $\leq 5.5$  only identifies gastric juice, not where that juice is.* It is also important to consider why these situations should arise. We were struck by how many intrapulmonary misplacements were associated with apparently correct pH  $\leq 5.5$  in both NPSA data and our own survey. What was it about these patients that predisposed to gastric aspirate being already present in the lungs? It is also possible that failure of a pH strip to indicate accurately or to be read accurately, or an accurate pH  $> 5.5$  being ignored by the operator might contribute to some NEs. Note: Use of the term “tube tip” in this survey does not accord with the 4 point reporting system advised in NHSE/I Alerts.

Figure 2

## Contributing factors



In 6 cases (including 3 deaths), noncompliance with policies contributed to the NE. Failures included use of the obsolete and banned “whoosh” test (1), failure to obtain an acid pH (1), Wrong X-ray reported (2), misinterpreted X-ray (3), no tip position identified at all (2) and gastric mucosal perforation (1). Identifiable contributory factors were failure to follow policy, different local policy from national, lack of training, out of hours placement, placement in theatre without checking of position and misinterpretation of tip position. These findings echo those described in previous NPSA and NHSI reports/alerts.

Some Organisations have responded to NEs by changing their protocols for insertion and checking of position by a variety of measures (beyond the scope of this paper), sometimes as a result of coroners’ recommendations. Some of these changes run contrary to present national guidance.

### Incidence of NEs in England

Blind placement of an NGT results in misplacement in 1-3% of placements. Oesophageal placement occurs in 19% of blind intubations (Hanna 2010). This complication is not recorded as a Never Event but contributes to the risk of aspiration pneumonia.

Although it is possible to express the incidence of NGT NEs in terms of population, this is not a useful measure of the risk of NGT intubation. It would be more helpful to be able to express incidence in terms of numbers of NGTs used for feeding, hydration and drug administration. This cannot be accurately estimated as the number of tubes used in the UK for feeding compared to simple drainage is not known (see below). Historic data from BANS (British Artificial Nutrition Survey) indicates approximately 45,000 patients receive tube based nutritional support in the community per annum and that approximately 10% do so via the nasogastric route. This equates to 4,500 via NGT. We have no such data for hospital based NGT feeding. The incidence

of NGT related NE per tube placement is therefore uncertain. In the USA, 1.2 million fine bore nasogastric feeding tubes are used per annum (Ostedgaard KL et al, 2013). By extrapolation from population sizes, usage in England may amount to 200,000 per annum. With an average annual incidence of 20 NEs from 2005 - 2019, this gives an estimated incidence of 1 NE in 10,000 insertions or 0.01%.

### **Pneumothorax due to misplacement of NGT into pulmonary tree and pleural space**

Up to 40% of misplaced feeding NGTs are associated with pneumothorax according to Koopman et al. 2011 with a 3.2% chance of misplacement in their study in USA. Analysis of NE data from NRLS reveals that there were 59 pneumothoraces between 1/1/2015 and 26/11/2017 (20/year). NRLS has calculated that the incidence of pneumothorax during this period based on a total of 2 million nasogastric tubes used by the NHS for all purposes, equates to 1 in 30,000 (0.003%). These are not recorded as Never Events unless feeding was commenced before detection of the misplacement and no data on this is available to us. No conclusions could be drawn as to which type of tube was most likely to cause pneumothorax. Tubes used for drainage are of larger diameter and stiffer than those used for feeding and therefore more likely to cause forceful penetration of the visceral pleura into the pleural space (and perforation of the hypopharynx, oesophagus or stomach). Since inappropriate force applied to tube insertion is considered to be the main cause of pneumothorax once misplacement has occurred, it seems likely that many of these recorded events are due to larger and stiffer drainage tubes, not feeding tubes. The introduction of larger bore dual purpose Ryle's type tubes compatible with enteral feeding systems (ENFIT compatible) should be subject to review if evidence of pneumothorax is found to be more common with larger bore tubes. The picture is all the more confusing because the incidence rate for pneumothorax calculated by NRLS (1 in 30,000) is based upon the **total** number of NGTs purchased by the NHS over the same period (2 million) but there is no clarity on whether these are fine bore feeding tubes or larger bore drainage tubes. The incidence rate is thus invalid and may underestimate pneumothorax due to NG feeding tubes. If instead we calculate the annual number of pneumothoraces in England (20/year) and assume all were for feeding purposes, with a figure of 200,000 feeding NGTs (see above) the maximum incidence is 20/year giving an annual incidence of 1 in 10,000 or 0.01% compared to 1 in 6,666 or 0.015% for NEs *over the same period*. Allowing for some overlap of pneumothoraces with NGT NEs, the incidence is somewhat higher than calculated by NRLS.

BAPEN does not have a remit to advise on the use or safety of large bore drainage NGTs as used in surgical practice but our deliberations on NGT safety should apply to ALL types of NGT. It goes without saying that a pneumothorax cannot be caused by a tube if it is not misplaced. The literature reports a high incidence of pneumothorax resulting from drainage NGT placement during surgery or in Critical Care (Long et al, 2017).

There is no evidence to support the contention that millions of NGTs are used each year for feeding in hospitals and community in the UK.

## Oesophageal misplacement

There has been considerable concern that misleading pH readings between 4 – 5.5 can lead to oesophageal placement of a tube destined for the stomach (Hanna 2010). This may occur as often as 19% of blind intubations and may represent an unmeasured “iceberg”. National guidance still states that NEX should be used. However, more recent studies have shown that NEX measurements + 5-10cm may be helpful in preventing oesophageal misplacement, although doubt has been cast on this by Taylor (2014). Others have found NEX “plus” to be more accurate for intragastric placement (Torsy 2020) based on their randomised controlled trial (Torsy 2018).

Using X-ray, 17-23% of tubes were found to be in the oesophagus or at the gastro-oesophageal junction even without kinking (Rollins et al, 2012) These figures may be inflated by filtering out the pH ‘successes’, but it’s still a significant proportion of patients. Greater understanding of the variability in the safe insertion length of NGT is needed so this low-cost method can be made safer. Interestingly, policies based on X-ray of all tubes inserted to 35cm before advancement to the stomach or use of electromagnetic techniques (Contrak) have both been shown to virtually eliminate intrapulmonary misplacement and pneumothoraces but only when implemented by expert tube placement teams (Marderstein 2004, Koopman 2011 and reviewed by Ostedgaard 2013). Similar results were claimed for fine bore nasolaryngoscopy by specialists.

The risk of aspiration of gastric contents into the lungs from the oesophagus is not known and data on the association between aspiration pneumonia and oesophageal misplacement is not identified as a Never Event or collected centrally. Nevertheless, this complication occurring without the tube being in the pulmonary tree is potentially fatal and must also be the subject of our concerns over NGT safety. Theoretical models of the reduction in risk with a change in pH threshold to 5.0 or 4.0 are not supported by clinical evidence as yet. However, if all present guidance on NGT tip positioning was to be followed in compliance with the Alerts, it is probable that many or most tube related aspiration pneumonias would be avoidable as would intrapulmonary NEs. Whether an additional change in pH threshold would have further influence is not known but computations from Ni’s paper, 2017 suggests a residual risk of 2.9% intra-oesophageal placement.

Pulmonary aspiration whilst being fed with a NGT misplaced in the oesophagus usually goes unrecognised and unreported. This is in part because such patients are at great risk of aspiration due to gastro-oesophageal reflux, oronasal-pharyngeal secretions and oral intake. Nursing prone and non-invasive ventilation as during the Covid crisis also predispose towards reflux and aspiration. Anecdotally, there is little doubt that misplacement of NGTs in the oesophagus greatly increases these risks. Whilst it is therefore difficult to identify the exact causative factor in harms and deaths during oesophageal misplaced NGTs, attention to our recommendations on training and governance could greatly reduce this complication and enhance the overall safety of NGT feeding.



## **Risk of aspiration pre NGT placement and in Critical Care**

The observation that some NEs are associated with pH  $\leq 5.5$  raises the possibility that aspiration of gastric contents to the lungs may have occurred prior to tube placement. We believe this risk to be considerable in severely ill, obtunded, stuporose or comatose patients, particularly in Critical Care and those receiving non-invasive or invasive ventilatory support.

Aspiration appears to be more common than expected during the Covid crisis in patients in Critical Care according to preliminary audit data of deaths from at least one Trust in the S.E. of England. Aspiration occurs frequently in Critical Care patients whether gastric residual aspirate is high or not, but more so if high. 89/206 patients in one study had evidence of pulmonary aspiration of gastric contents in one study (Methany 2008).

The risks of acid being found in the oesophagus or lungs is greater in those ventilated invasively. Aspiration commonly occurs at the time of intubation (Warner 1993). If an NGT is passed around this time, position checks based on pH may mistakenly confirm correct placement. The presence of an endotracheal tube (ETT) or tracheostomy does not prevent passage of a nasogastric tube, whether large bore or narrow bore (Sparks 2011 & Long 2017), nor is aspiration of oropharyngeal secretions or refluxed gastric contents prevented by an inflated cuff (Hu 2014).

Further evidence that aspiration is a significant problem in Critical Care patients comes from a Cochrane Systematic Review. In this review, use of nasojejunal or duodenal feeding tubes was associated with a 30% reduction in pneumonias, presumably of aspiration origin. Interestingly, the SE England Trust mentioned above has taken the decision to alter their practice in accordance with the Cochrane review by placing bridled nasojejunal feeding tubes in preference to NGTs in critical care. Such a change will necessitate expert NJT tube placement and confirmation of position by magnetic induction imaging, endoscopy or radiological imaging, not pH. Not all Units will have access to magnetic induction which has itself been implicated in Never Events when used for gastric placement and is dependent on expert operators.

## **Hospital v Community NGT Never Events**

It has proved surprisingly difficult to find evidence of NGT related NEs in the community drawing on the experience of many clinicians who care for such patients in the community nationwide. NHSI have identified a few community acquired NEs in care homes but these are greatly outnumbered by those in hospitals. The largest commercial partner of the NHS in the care of such patients in the community has never had a NE in over 8 years' experience of community based NGT replacement (Jones 2017, Jones 2020).

Whilst it is not known how many patients are exposed to NGT placement for feeding in hospitals compared to the community, this raises the question as to what differences exist to explain this disparity between hospital and community NEs. We do know that approximately 4,500 adults and children receive NGT feeding in the community based on historic BANS data. (BANS – British Artificial Nutrition Survey, a subcommittee of BAPEN). In the community, tubes need replacement non- electively more than electively by nurses (Jones 2019) or patients/



parents/carers. Children require replacement more often, usually because of displacement of the tube (Jones 2019). Community based patients are fed for longer than those in hospitals so the exposure of each patient to tube replacement is probably greater than for those in hospital where NGT feeding is conducted for shorter periods of time limited by survival, disease improvement or transfer to alternative feeding route such as gastrostomy (PEG). Children are often discharged to the community with a short term NGT prior to substitution for a PEG placement but some are fed over longer term by NGT. Community patients are not only rarely affected by NEs but have a remarkably low requirement for referral to hospital for X-ray confirmation of tip position and the ease with which a satisfactory gastric aspirate pH can be obtained, often despite concurrent acid suppressing therapy (H2 blockers, PPI) contrasts greatly with hospital experience (Jones, 2017, Jones, 2020).

Training and competency assessments of doctors and nurses other than nutrition nurse specialists in NGT safety in hospitals (NHSE Alerts) is often less rigorous or uniform than in the commercial community sector where annual reassessment of competency is the norm for a major provider (Jones, 2017, Jones, 2020).

Finally, most community patients have already been self-selected for improved safety as they have already had a correctly placed NGT before discharge and first replacement.

### **Review of available, variant and novel techniques**

The presently recommended methods are NEX measurements, aspirate pH, external tube measurements and X-ray.

**Checks using pH:** *The use of aspirate pH does not ensure that an acid pH indicates gastric positioning of the NGT. Instead, it merely shows that the tip of the tube is in acid fluid which would have originated in the stomach but which is not necessarily in the stomach.* Thus oesophageal pH is frequently 4-5.5 (Hanna 2010. Ni, 2017) thus exposing patients with apparently satisfactory acid pH to oesophageal infusions of nutrients and consequent but unpredictable pulmonary aspiration. Fortunately, using pH as a surrogate for correct positioning works in the majority of cases since the NGT is correctly positioned in most instances.

All other methods of improving pH accuracy or obtaining juice containing alternative substances (enzymes) suffer from the same criticism.

However, automated readers of pH should eliminate inter and intra reader error which has been identified by NHSI and others as causes of NEs. One such technique is available as “pHX-act” (Enteral UK Ltd) which reads pH papers automatically.

A novel technique which identifies acid pH at the tip of the NGT without aspiration of juice is promising and undergoing multicentre studies in the UK (NGPOD -ngpodglobal.com).

Most importantly, use of non-CE papers or mixtures of pH Sticks has also led to NEs (HSIB Interim report 2020).

When gastric juices have been aspirated into the lungs via the trachea and bronchi, the pH is still acid and could be misleading. A number of anecdotal incidents have occurred in which a NE has been recorded despite aspirate having a pH  $\leq 5.5$  which could be interpreted as indicating that reflux of gastric contents and aspiration into the pulmonary structures has already occurred before the misplacement of the NGT (NHSI Alert 2011, BAPEN Survey above).

**pH threshold:** What if the threshold for pH is lowered as has been adopted by some and advocated by Ni (2017) and discussed in the critical evaluation of available techniques by Hanna (2010). Both these papers focused on prevention of oesophageal misplacement and misfeeding, not pulmonary NEs. They were both theoretical views of the improvement in safety afforded by reducing pH threshold to  $\leq 4.0$  (Hanna, 2010) or  $\leq 5.0$  (Ni, 2017) with a corresponding increase in X-rays. They concluded that reduction of pH threshold from  $\leq 5.5$  to  $\leq 4.0$  would avoid both oesophageal and respiratory misplacements but this was predicated on the assumption that X-ray confirmation for those falling between 4.0 and 5.5 would be conducted in accordance with guidelines. Given the impracticality of X-ray confirmation in the community, this change would result in missed feeds or medication doses where patients routinely have a gastric pH of greater than 4.0. There is no evidence that a reduction in pH threshold has reduced the incidence of Never Events that we are aware of but the sporadic nature of NEs makes it difficult to determine benefit except through a large study, preferably in a controlled trial. Ni et al. (2017) have calculated that a reduction in pH threshold to  $\leq 5.0$  would reduce NEs and oesophageal misplacement but leave a residual 2.9% NEs, a marked reduction overall, but assumes all NPSA Alerts have been fully implemented.

However, the theoretical paper by Ni (2017) presumed that X-ray was 100% accurate for the purposes of their arguments. As this is patently not the case in many NEs, it remains that no other techniques or modifications of present methods are superior to the guidance in NPSA/NHSE/I Alerts 2005 – 2016, if implemented correctly.

In addition, a pH of 4.0 or below does not exclude acid already in the oesophagus or pulmonary tree from reflux and aspiration.

Equivocal pH readings obtained in units opting for a lower pH threshold could lead to an increase in radiological confirmation of position (Ni 2017). However, this has not been the experience in North Wales to date (P Edwards, personal communication).

**Radiological confirmation of correct NGT placement.** As pointed out in NHSI Patient Safety Alerts, examination of incident reports by NHS clinical reviewers shows that misinterpretation of X-rays by medical staff who did not appear to have received or followed the competency based training required by the 2011 NPSA alert is the most common error type. Any safety system introduced to prevent NGT NEs must not rely on X-ray confirmation of position unless it can be shown that all involved personnel have the requisite skills.

However, many centres do rely upon radiology not only as a second line check, but as a first line check to establish the correct position of the NGT. Counterintuitively, this technique has been identified as the cause of many NEs many of which have proved fatal. Some of these patients may have been selected for X-ray after failing pH checks but many have been subject

to X-ray without prior pH check. The use of X-ray as an alternative to pH testing is expensive and poses radiation burdens on individual patients, it is also impractical in the community. Reliance on X-ray without strict governance places patients at risk of NE and induces a false sense of security in those caring for NGT patients.

Safe X-ray practice in accordance with NHSI Alerts has not been embedded in all hospitals. This is the root cause of many NEs. Despite excellent available training programmes designed to develop and confirm competencies in the technique of NGT placement/replacement and clear guidance in NPSA Alert 2011, many organisations do not have such programmes in place or implementation is patchy, poorly maintained or non-existent, reflecting failures of governance as defined in NHSI alert 2016. A video was produced by the NHSI on YouTube in 2017 about NGT safety and emphasises the importance of 4 point confirmation of NGT position on X-ray. ([https://www.youtube.com/watch?v=7dSEKQLMa18&index=3&list=PLHpuGzxwlagy6uRNGd\\_dWCtRRD-yROHPmF](https://www.youtube.com/watch?v=7dSEKQLMa18&index=3&list=PLHpuGzxwlagy6uRNGd_dWCtRRD-yROHPmF)). However, there is no agreed and uniform training package available nationally. This should be developed to produce a national training module for pH and X-ray critical safety checks for NGT placement and position confirmation. This should be linked to competency assessments for all involved in NGT insertion and subsequent care.

**NEX measurements:** Measurement of the Nose to Earlobe to Xiphisternum distance is used as a guide to initial placement of an NGT before pH or X-ray confirmation. However, this method is not reliable so modifications should be made by adding 5-10cm to the measured NEX although even this has been criticised (Taylor 2014). A randomised controlled trial of modified NEX (Torsy 2018) led to a further study demonstrating that a modified NEX method is extremely reliable (Torsy, 2020). Current national guidance (NNNG 2017) should be altered to take into account these findings.

**External measurements** are to be regarded as “vital” for repeat placement checks after the initial placement has been confirmed as stated in the Resource set accompanying the NHSI 2016 Alert. Displacement of the tube as judged by an increased external length indicates possible proximal displacement into the oesophagus or hypopharynx. An unchanged external measurement does not exclude proximal displacement through the tube curling in the oesophagus, so is not without risk.

**Timing of NGT insertion:** Pneumothoraces due to misplaced NGTs were more common when insertion occurred at night, presumably because fewer competent staff were available at night: (Marderstein 2004).

**Cortrak magnetic induction technique:** The magnetic induction technique (Cortrak) has been associated with at least 2 NEs (NPSA Alert, 2013), 4 deaths (NHSI Resource Set 2016 Alert) and 8 misplacements in the UK (Taylor 2019). Although the Cortrak equipment is capable of detecting such misplacements, adverse events have occurred even when fully trained personnel have operated this system. Misinterpretation of the traces produced during NGT placement can lead to misplacements (Taylor 2017 & 2019). Optimal use through training has been shown to provide some protection against intrapulmonary placement (Koopman 2011) as would be the case for correct use of X-ray confirmation. The cost and distribution of such

equipment will also mitigate against widespread uptake of this safety measure although it appears to be more reliable when used to assist jejunal placement of nasal tubes.

**Nasal retention devices:** A nasal retention device to anchor the NGT at the nose does not prevent regurgitation of the tube to the oesophagus and pulmonary tree, but can reduce accidental removal. Each new insertion carries a risk of misplacement and thus a nasal retention device can reduce the need for replacement NGTs and the risks this entails.

**Two step insertion technique:** One U.S. study showed that initial insertion of NGT to 35cm followed by a purposed X-ray correctly reported before advancing the NGT to the stomach eliminates misplacements and pneumothoraces (Marderstein, 2004). This method could be enhanced to counterbalance poor X-ray review technique by checks of gastric pH before feeding, but implementation into practice will be challenging outside critical care.

**IRIS technique:** This is an endoscopic technique enabling direct visualisation of the anatomical landmarks using a Kangaroo™ nasogastric tube (Carrera 2017; Fan 2017; Technology Alert 2014). This new technology requires some endoscopic expertise and has resource implications making it less likely to become widely available. Some concerns have been expressed about the reliability of images over time, but it may prove of value in selected environments such as critical care (Mizzi 2017).

**CO<sub>2</sub> detection technique:** The only non-radiological method still in use for assessing tip position not to use a gastric secretion is that of carbon dioxide measurement using a CO<sub>2</sub> monitor. Chau (2011) in a meta-analysis found capnography to be highly effective and its costs to be partly offset by savings in radiology. This technique is not widely available except in critical care where it could perhaps be deployed to good effect in conjunction with pH and X-ray.

Thus, use of CE pH paper, radio opaque NGTs, safe X-ray technique and proper training remain the cornerstones of best practice. The NGSIG of BAPEN concurs with these findings.

### **NHSI identified reasons for NEs**

Despite clear NPSA/NHSI guidance as recently as 2016, NHSI/NRLS have identified that NEs due to misplaced NGTs continue to occur due to the following:

1. Failure to follow available guidance on pH testing and radiological assessment of position (see HSIB interim report, 2020).
2. Failure to use CE-marked pH test strips for human gastric aspirates.
3. Procuring/ordering differing pH sticks within the same organisation.
4. Failure to use radio-opaque nasogastric tubes.
5. Failure to follow clear guidance that “whoosh” test is no longer permissible.
6. Failure to put in place the governance required to oversee the problem.

7. Tube displacement from correct position to incorrect position may occur between checks, especially if pH is not checked prior to each use of the tube.
8. Inappropriate flushing of tubes prior to confirmation of correct position (NPSA alert 2012).

### National Alerts – Actions to be taken

A total of 5 Alerts have been issued since 2005 by NPSA/NHSE and disseminated across the 4 nations of the UK. Very clear action plans were described with finite implementation dates for compliance.

**The 2005 Alert** stipulated deadlines for action to be complete on 1/9/2005. These actions were to be checked through the Safety Alert Broadcast System (SABS). What evidence exists to show that compliance occurred? What action was taken to compel Organisations to implement the actions?

**The 2011 Alert** elaborates on the clinical actions required within this revised Alert based on the following questions:

1. Is nasogastric tube feeding the right decision for this patient?
  - a) Before a decision is made to insert a nasogastric tube, an assessment is undertaken to identify if nasogastric feeding is appropriate for the patient, and the rationale for any decision is recorded in the patient's medical notes.

A decision must be made that balances the risks with the need to feed or administer medications. Patients who are comatose or semi-comatose, have swallowing dysfunction or recurrent retching or vomiting, have a higher risk of placement error or migration of the tube.

2. Is this the right time to place the nasogastric tube and is the appropriate equipment available?
3. Is there sufficient knowledge and expertise available at this time to test for safe placement of the nasogastric tube?
4. Have the actions required by Alert 2011 been implemented? These include:
  - a named clinical lead
  - review of all policies and documentation
  - ongoing audit
  - staff training and competency frameworks to be reviewed such that all healthcare professionals involved in NGT position checks have been assessed as having contemporaneous competencies for pH and X-ray checks.
  - revised purchasing policies with removal of old stock to ensure use of radio-opaque tubes with visible external markings and purchase of CE marked pH papers for human aspirates (but see HSIB interim report of mixed pH papers).
  - deadline for actions – 12/9/2011.

Interestingly, the Royal College of Radiologists issued guidance in compliance with the NHSI 2011 Alert but this did not specifically mention the “4-point” system, as defined in the 2011 Alert:

1. Tube follows path of oesophagus bisecting heads of clavicles
2. Tube bisects bronchi at carina
3. Tube remains midline at level of diaphragm
4. Tube deviates to left below diaphragm

**The 2012 Alert** cautioned against flushing NGTs before confirmation of placement. Deadline 21/9/2012

**The 2013 Alert** emphasised that aspirate pH and X-ray are the ONLY acceptable methods for confirming initial NGT placement and that use of placement devices (magnetic induction technique) do not replace these recommended initial placement checks. This alert also reiterated “all possible steps are taken to reduce the likelihood of human error, including competency-based training for staff interpreting X-rays or testing the pH of aspirate”.

**The 2015 NHSE Revised Never Events policy and framework** states: “Never Events are key indicators that there have been failures to put in place the required systemic barriers to error and their occurrence can tell commissioners something fundamental about the quality, care and safety processes in an organisation”, and

“...a patient safety incident cannot simply be linked to the actions of the individual healthcare staff involved. All incidents are also linked to the system in which the individuals were working. Looking at what was wrong in the system helps organisations to learn lessons that can prevent the incident recurring.”

Human factors are also recognised and this document quotes Sir Liam Donaldson, ex Chief Medical Officer, “**To err is human, to cover up is unforgivable, and to fail to learn is inexcusable.**”.

**The 2016 Alert** is absolutely clear that this is directed at **trust boards** (or their equivalent) and *not at frontline staff*. This document is brief but to the point and defines 5 action points:

1. Identify a named executive director or equivalent who will take responsibility for the delivery of the actions required in this alert.
2. Using resources supplied with this alert, undertake a centrally coordinated assessment of whether your organisation has safety-critical requirements for initial nasogastric and orogastric tube placement checks.
3. If the assessment identifies any concerns, use the resources supplied with this alert to develop and implement an action plan to ensure all safety-critical requirements are met.
4. Share this assessment and agree any related action plan within relevant commissioner assurance meetings.
5. Share the key findings of this assessment and the main actions that have been taken in the form of a public board paper or equivalent.



These action points arose because the NHSI had identified problems with organisational processes for implementing previous alerts. These problems included

1. Problems with systems to ensure staff who were checking tube placement had received competency-based training
2. Problems with ensuring bedside documentation formats include all safety-critical checks
3. Problems maintaining safe supplies of equipment, particularly radio-opaque tubes and CE-marked pH test strips

This report reiterated the findings of previous alerts that inaccurate interpretation of X-rays is responsible for NEs in majority of cases reviewed. Despite these observations, some Trusts have now insisted on using X-ray confirmation rather than aspirate pH. This is counterintuitive and carries cost implications and radiation exposure risks from repeated X-rays. Additionally this method, if not used in conjunction with pH testing prior to use of the tube on every occasion, does not identify tube migration between X-rays.

Adherence to the 4 point confirmation procedure for interpretation of X-rays is not utilised as widely as it should be which partially explains the failure of X-rays to detect misplacement. Effective clinical governance should promote this technique and provide audit confirmation of uptake and outcomes.

We have found it difficult to find evidence that there has been an assessment of progress made by the deadline date of 21/4/2017 or since. This view has been echoed by HSIB during their review of NGT safety (personal communication HSIB). We have now seen an unpublished document provided by NHSE/I summarising responses by Trusts to the 2016 Alert. It is clear that there is no central oversight of these responses which can only be found by interrogating the websites of about 150 individual Trusts in England for reference to audits into NGT safety and Alert implementation. The responses found do not inspire confidence that all Boards have fully implemented the Alert recommendations and followed them through to sustain any required changes.

There appears to be a systemic failure within the NHS to follow through the excellent Alerts produced by NPSA/NHSE. This can be regarded as a “missing link” at the end of an audit cycle or improvement plan and the following issues have not been fully scrutinised and addressed –

- Organisational issues of implementation and sustainability
- Patient assessment
- Competency based training and education
- Learning from human error
- Audit/reporting back to NHSI/NHSE/CQC/Commissioners

NHSE/NHSI websites also state “Compliance with alerts is a key safety indicator...and a focus of CQC inspections”. We are therefore particularly encouraged by the recent CQC publication “Opening doors” (CQC 2018) in which the faults identified by BAPEN in this Position paper

are confirmed. Indeed, an NGT Never Event is used as an exemplar of poor safety practice. The chair of CQC, Sir Ted Baker, stated that a focus on safety within the NHS similar to that prevailing in other industries such as aviation is required to ensure a change in culture within the NHS (Opening the door to change - NHS Safety Culture and the need for transformation, CQC 2018). NGT safety is therefore perhaps just one example of a wider problem within the NHS. It is to be hoped that future CQC inspections will focus on safety by looking more at outcomes than process. It seems that there is a disconnect between “actions” taken by NHSE/NHSI and ensuring that the actions have not only been taken but have led to improved outcomes. Further support for NHSE/I Alerts comes from NICE which reiterated its guidance on NGT safety in 2017 as follows:

“1.7.17: The position of all nasogastric tubes should be confirmed after placement and before each use by aspiration and pH graded paper (with X-ray if necessary) as per the advice from the National Patient Safety Agency (NPSA, 2011); further patient safety alerts for nasogastric tubes have also been issued in 2013 and 2016). Local protocols should address the clinical criteria that permit enteral tube feeding. These criteria include how to proceed when the ability to make repeat checks of the nasogastric tube position is limited by the inability to aspirate the tube, or the checking of pH is invalid because of gastric acid suppression”.

This lack of improved scrutiny for the various processes outlined within the important Nasogastric Safety Alerts and NICE (2017) is likely to be pivotal in improving patient safety as would NICE guidance on the requirement for each Trust to have at least one specialist nutrition nurse.

### **HSIB Interim Report, February, 2020**

This report was stimulated by an index case of a young man admitted to critical care after a road traffic accident. After inadvertent nasogastric tube removal, it was replaced, and its position checked by aspirate pH testing. He was fed 1450ml of enteral feed via the nasogastric tube. Subsequent X-rays performed to determine the cause of his deterioration showed intrapulmonary misplacement; this was initially missed. To compound this issue, it was found that both CE and non-CE marked pH papers were in use alongside each other which may have led to reading against the wrong reference colours. This case exemplifies the thesis of this Position Paper; the failure to perform assessments according to best practice standards is the cause of so many Nasogastric NE. A final version is to be published shortly but we understand our conclusions accord closely with those of HSIB with whom this Position Paper has been shared.

### **Identifying high risk patients**

The marked contrast between community and hospital experience of NEs suggests that patient characteristics differ and largely relate to varying levels of risk for NGT placement associated with the patient's clinical condition. Furthermore, within hospitals, those who are obtunded (Theodore 1984) due to head injury, stroke or other neurological causes (all of which can impair swallowing safety), are more likely to suffer misplacement of an NGT. This also applies



to those in critical/intensive care units where sedation, invasive ventilation, tracheostomy, prone nursing and delayed gastric emptying all contribute to increased risk. These conspiring factors influence safe passage of a nasogastric tube into the stomach and also predispose to gastric aspiration into the oesophagus or lungs, rendering pH unreliable. It follows that all such patients should be regarded as at high risk of a nasogastric NE and only those sufficiently expert and competent should be involved in placement of nasogastric tubes and the critical safety checks to confirm correct placement, complying fully with UK national guidance on pH testing, procurement, X-ray requesting and reporting (using the 4 point system). If magnetic induction technique can be provided by expert operators, this could be an additional safety factor. A fail-safe system which includes ALL NGT placements rather than selected high risk patients would be even safer.

### **Recommendations from BAPEN**

**NGT safety** should be made a special responsibility of a senior board member and Nutrition Steering Group(s) reporting to Organisation's Board at regular intervals on position of training and restriction of placement to properly trained and competent staff in accordance with NHSI Patient Safety Alert 2016. Such data should be centrally collected by NHSE and reported transparently. Ideally, this should be part of an all UK Organisation safety strategy in line with recommendations from the CQC (Opening the door to change, CQC 2018).

**Training and ongoing audit/clinical governance** structures are essential to ensure safety. The 2016 directive from NHSI clearly shows that implementation of practices, systems and structures had not been complied with across all organisations. Searching for better methods for assessing tube position will be futile unless the systemic failures identified by NHSI are corrected. The NHS must take full responsibility for ensuring this occurs as part of a new safety culture (CQC, 2018).

***Because implementation of Alert actions may not be sufficient alone to eradicate NEs, we believe a new approach to training and competencies is required.***

- (a) **NGT placement is a complex dangerous procedure.** Instead of trying to disseminate training in use of NGTs as a "simple procedure" to all nurses, dietitians or junior doctors, organisations should bear in mind the turnover of staff in any NHS hospital. ***The responsibility for placing tubes and confirming correct placement before use should be limited to "expert" operators; individuals who place sufficient numbers of tubes to maintain competence,*** having received appropriate training and confirmation of their competencies (Marderstein, 2004). Competence should be renewed at regular intervals, perhaps biannually but in line with the organisation's own time frame and measured standard.
- (b) **Registered nurses or dietitians tasked with placing NGTs** should be available on each ward and unit where NGT therapy will be required, or alternatively mobile teams analogous to the restrictions placed on placing intravenous access lines for parenteral nutrition (NCEPOD, 2010) and the MDT deliberations prior to insertion

of PEGs (NCEPOD, 2004). **Subsequent position** checks should be performed by any competent practitioner responsible for care of patient at ward or unit level using aspirate pH and recorded external length measurements as appropriate. Liaison with RCN/NMC/NNNG/BDA regarding how to implement a common standard training programme for these 2 levels of expertise and the differential competencies should be undertaken.

- (c) Although **Registered Nursing Associates** are also subject to NMC regulation (NMC, 2018), sub-serving the implementation of NPSA Alerts and our recommendations for NGT insertion should not be within in their remit at this time.
- (d) **Subsequent NGT** use must be preceded by critical safety checks EVERY TIME. These checks must be performed by appropriately trained and competent staff and may include Nursing Associates.
- (e) **X-ray competency** must be a prerequisite for requesting and reporting X-rays for confirmation of placement at all levels of medical training, including consultants. Even if pH is regarded as the first line check, X-rays will be requested for those with no aspirate or a pH outside the recommended threshold. Adherence to the 4 point reporting system (NHSE/I Alerts, 2012 and 2016) is essential.
- (f) **NEX alone** should be replaced by modified NEX (+5-10cm) in national guidance.
- (g) **Audit** of the individual organisation's NGT safety process should be fed back to the designated executive director at least annually and shared with commissioners and CQC as per NHSE/I Alert (2016).

**Community NGT placement** - Any approach which attempts to improve the governance of NGT placement should apply equally to those patients cared for in the community where NEs are rare. The primary technique for NGT position checking on insertion/reinsertion in the community is pH (Jones, 2017 & 2020). Radiological checks are rarely required (Jones, 2017). Published commercial homecare company nursing care of community NGT placement has been shown to be extremely safe with no NEs using only "expert" nursing operators whose competencies are reassessed annually (Jones, 2017 & 2020). The question of how to train and supervise non-professionals in the community is challenging. Many patients and parents already pass NGTs very successfully without complications after appropriate training with ongoing support from community and hospital-based teams. This should be undertaken using a standardised framework.

**Use of automated pH readers** or direct intragastric pH readers should be considered to eliminate intra and inter user error.

**Identification of a high-risk group of patients** would be a major step towards limiting the number of otherwise inevitable NEs due to NGT placement in hospitals. It is possible that such a high risk patients should have their procedure postponed or cancelled until their clinical status improves, OR that his group should only undergo NGT insertion under stringent

conditions requiring X-ray confirmation confirmed by an “expert operator” before use of the tube for medication, hydration or nutrition. Particular attention should be directed at obtunded and Critical Care patients. Such moves echo those taken to reduce death and complications following PEG insertion as investigated in the “Taking the tube home” enquiry (NCEPOD, 2004). NGT misplacement is more likely in obtunded patients with impaired consciousness, sedatives, analgesia, recumbency, swallowing difficulties, critical care, endotracheal tube in situ, tracheostomy or anatomical abnormalities. Such situations predispose not only to NGT misplacement but to an acid pH in aspirates from the misplaced tube in the lungs since such patients are liable to aspiration. In intensive care where NGT feeding is both common and desirable, patients are at risk of NGT misplacement even if an endotracheal tube is in situ with balloon inflated (Marderstein et al, 2004). Obtaining an acid pH from aspirates may be difficult due to use of acid suppressing therapies such as PPIs. The interpretation of X-ray confirmation in ITU may not be optimal as the indication for such X-rays may be for reasons other than tube position (see HSIB report, and Covid report below). Use of radio-opaque NGTs is essential but has still not been universally adopted throughout UK organisations.

**High risk patients** may be more safely fed via a trans-pyloric/nasojejunal tube (Cochrane review, 2015) or a NGT placed using the 2 step approach (Marderstein, 2004; Koopman, 2011; Ostedgaard 2013) in which the NGT is only advanced to 35 cm before a check X-ray confirms intra-oesophageal placement prior to advancing the tube to the stomach. A pH test may then be performed to ensure correct position. Both methods have practical difficulties associated with them.

**Nutrition Nurse Specialists:** The failure of some Trusts (as many as 25% respondents in recent BAPEN freedom of information enquiry) to implement NICE 2006 requirements for at least one nutrition specialist nurse in each trust means it is less likely that those Trusts will have in place adequate leadership for training of nurses in NGT safety. Leadership from a senior specialist nurse is regarded by BAPEN as a minimum essential for provision of safe nutritional care. This is supported by “Guidance – Commissioning Excellent Nutrition and Hydration 2015-2018” which states:

“Develop service specifications and management structures to ensure high standards of nutrition and hydration care are using food and drink, oral nutritional supplements, enteral tube feeding provision or intravenous support as necessary ensuring appropriateness and safe standards of practice in line with NICE Clinical Guidance CG32 (2004 reaffirmed 2017) and associated QS24 and CG 174”.

*BAPEN recommends that NICE guidance on nutrition nurse specialists be followed in all Trusts and that this should be audited through CQC.*

**The cost implications** of the above recommendations are minimal. Implementation of the 2016 Alert should be cost neutral as personnel are already in employment and tasked to respond to the Actions recommended in that Alert. Training programme alterations to fall into line with these recommendations should also not incur significant costs. The savings produced by improving safety would offset any costs – reduced costs of care for patients with NGT Never

Event pneumonia, and reduced liability litigation. Patients deserve to know that their treatment is safe.

**NCEPOD enquiry into enteral nutrition safety:** We would also like to reaffirm our wish to see an NCEPOD enquiry into enteral nutritional safety along similar lines to the NCEPOD enquiry into Endoscopy, 2004 which dramatically altered the approach to PEG (gastrostomy) insertion. A recent application for such an enquiry was rejected as too broad.

**Artificial intelligence- X-ray interpretation & digital platforms:** For the future, we are keen to consider development of AI (artificial intelligence) solutions to the problems of using X-ray confirmation which has been identified as the single greatest cause of missed misplacements (Alert 2011 & 2016). AI interpretation of chest X-rays taken to confirm NGT position may prove more reliable than human reporting as a long-term solution despite the Royal College of Radiologists issuing revised guidance in 2017.

Novel ways of restricting use of tubes to those confirmed to be in the correct position by use of a digital platform which blocks those without the correct training and competencies are being developed. These incorporate mandatory step by step safety measures which must be completed before the tube can be used safely.

**Other techniques:** Looking forward, there remains a need for an alternative technique to reliably and accurately detect intragastric placement and exclusion of oesophageal or intrapulmonary misplacement. At present, electromagnetic devices offer the best chance of achieving this aim but the use of this technique is very dependent on training and expertise which would point to restricting use to expert operators. This technique would also require additional funding in all settings.

### **Post Script: Covid-19 crisis 2020**

This document was completed immediately prior to the onset of the Covid-19 crisis. Since then, the NGSIG has produced several documents on NGT safety during the crisis and the response to it by the NHS.

We became extremely concerned that checking of NGT position in Critical Care Units and High Dependency Units would become dangerous. This was because of the possibility of unit capacity being overwhelmed by sheer numbers of patients requiring respiratory support, invasive or non-invasive. We anticipated that NGT or NJT feeding would be the commonest mode of nutritional support. The absentee rate of staff due to shielding, active Covid-19 and stress, together with decreased nurse to patient ratios and the employment of inexperienced staff especially in the new temporary Nightingale Hospitals made for a “perfect storm”.

In critically ill patients, misplacement of NGTs is common even when an endotracheal tube or tracheostomy was present, representing 2/3 of misplacements (Marderstein, 2004).

Furthermore, the risk of aspiration of gastric contents to the lungs was considered to be potentially greater in Covid-19 patients due to slower gastric emptying and nursing in the prone

position. This has been confirmed by an audit in SE England of deaths during the Covid crisis (personal communication, W-L Relph). This makes the use of pH testing more risky in that acid aspirate might be obtained from an intrapulmonary or intra-oesophageal position. Inability to obtain an acid aspirate would also necessitate X-ray confirmation, especially in those receiving acid suppressing therapy.

We also anticipated that X-rays not obtained for the purpose of checking NGTs would be used and that the 4-point checks advised in NHSE/I Alerts would not be followed due to time pressures and ignorance. This is all the more important because the typical chest X-ray of a Covid-19 pneumonia patient shows characteristic opaque ground glass appearances which makes interpretation of tube track very difficult unless the penetration of the X-ray is increased to permit visualisation of the tube in the thorax.

For these reasons, we advised that unless a unit could be absolutely certain that it could follow all aspects of current NHSI Alerts, X-ray should be used as their first line check for NGT position - but only on the proviso that the 4 point reporting system was used on X-rays ordered and exposed specifically for the purposes of detecting the course of an NGT. Together with NHSE/I, we formulated an Aide Memoire for distribution to all Trusts and temporary Hospitals for use in Critical Care Units. This received the support of the National Nurse Nutrition Group, The Faculty of Intensive Care Medicine, The Intensive Care Society, The Association of Anaesthetists and the Royal College of Anaesthetists, published 11<sup>th</sup> April 2020. A revision to clarify certain points was made 15<sup>th</sup> May 2020.

<https://www.bapen.org.uk/pdfs/covid-19/aide-memoire-ngt-placement-13-05-20.pdf>

We do not have any formal data on NGT related complications during the Covid-19 crisis but we do know of at least 3 NEs and one pneumothorax during this period in Critical Care. All appear to have been related to failure to follow the Aide Memoire advice on using specifically ordered X-rays and the 4 point reporting system. In one case, no aspirate could be obtained so an X-ray for lung field status was erroneously reported and the tube used to feed.

We have also determined that almost 100% of Covid-19 patients requiring invasive respiratory support, and many on non-invasive support, required NGT feeding, with a very small minority receiving parenteral nutrition. Thus, almost all Covid-19 patients nursed in critical care are at risk of NGT related Never Events.

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