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Second Position Paper on Nasogastric Tube Safety

"Nasogastric Feeding tube safety: A holistic approach to reduce deaths and harms"

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

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Summary

Our first Position Paper (BAPEN, 2020) focused primarily on Never Events and their prevention. Complications associated with nasogastric tube (NGT) intrapulmonary placement with subsequent administration of feed, medication, or fluid constitute Never Events (NEs), which have not reduced despite national guidance and our first Position Paper. We did not address prevention of additional complications including pneumothorax (without use of the tube) and contamination-associated pneumonia on tube insertion, and the risks associated with intra-oesophageal placement or displacement was not addressed. We concluded our first position Paper with this statement: "*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".*

This second Position Paper deals with ALL common adult nasogastric feeding tube related complications and Never Events (NEs) and will include larger bore dual purpose tubes. Whilst large bore (Ryles) drainage tubes can also cause insertion related complications, these are beyond the remit of NGSIG. Building on the first Position Paper and maintaining the fundamentals of pH testing and X-ray, it reflects the need to continue to improve the safety of NGT insertion and in addition, now covers complications occurring during insertion (pneumothorax, pleural placement, contamination pneumonia and intra-oesophageal placement) as well as Never Events. As such, this second paper is designed to replace the first. It again emphasises the central role of current first and second line checks for NGT position. It aspires to ensure maximum efficacy of the current guidance whilst advocating for innovative supplementary approaches to enhance and augment the current guidance. Avoidance of NEs is still an essential aim of improving NGT safety, but many more complications not classed as NEs could and should be prevented by introduction of supplementary techniques.

Although pH testing is not infallible, the overwhelming majority of NGTs placed in the UK are inserted safely, with position confirmed without difficulty using pH indicator strips. In the absence of an aspirate with a pH<5.5, X-rays provide the necessary information to permit safe feeding provided that they are performed according to strict guidelines. However, X-rays are often used as the first line check in many centres or units, contrary to current guidance. Moreover, patients are still dying or being harmed despite attempts to optimise current guidance over the last 20 years [BAPEN 2020 & Annex 1].

There are 2 fundamental reasons for the lack of progress in improving the safety of NGT use for feeding, hydration, and medication administration:

1.The persistent failure of organisations to implement the five comprehensive NPSA and NHSE/I Alerts issued across England, Wales, Scotland, and Northern Ireland since 2005. This systemic failure continues to impede meaningful improvement in accordance with CQC recommendations on NHS safety culture [Care Quality Commission, 2018].

2. The failure to integrate checks to avoid in-procedure complications.

It remains essential that organisations demonstrate that their Health Care Professionals (HCPs) adhere rigorously to national and local guidance. Failure to do so is still the most common cause of NEs, with misinterpretation of X-rays representing the single most frequent error—reflecting a broader failure to implement the actions outlined in previous national Alerts [BAPEN 2020; HSIB 2020].

A national programme to improve Xray checks of NGT position is now available to include empowerment of radiographers and the correct implementation of current Xray guidance for all

involved in NGT placement for any indication. All involved with passing NGTs should be both trained and competency assessed with Trusts and Health boards holding registers of up to date competency.

As above, NEs are not the only complications of NGT insertion which require measures to avoid them. In procedure complications of pneumothorax, pulmonary trauma and introduction of pulmonary infection are in fact more common than Never Events, but all are avoidable with use of additional measures over and above those required for avoidance of NEs. Such complications are not exclusively related to fine bore feeding tubes but occur with large bore tubes, some of which have dual purposes.

Additional in-procedure checks (compared to blind placement with post-procedure checks) have been shown to reduce complications whilst maintaining aspirate pH as a first line check for intragastric position, with Xray as a secondary check. Where expertise and equipment is available, endoscopy, fluoroscopy, Cortrak™ or IRIS™ can be used in all settings but particularly in critical care and theatres and for anatomical oesophageal abnormalities or placement of NJTs. For more general use in all settings, an integrated CO_2 based technique (DoubleChek™) is now available to detect and prevent in procedure complications as well as NEs. Lastly, securement with a nasal retention device, where assessed as appropriate, can significantly reduce premature tube loss and therefore risk from complications during repeated tube replacements.

Aims

Never Events as currently defined may be deprioritised by the NHS but NGT related complications will remain a significant cause of morbidity and mortality. This PP has been prepared to challenge the concept that only Never Events can or should be prevented. We again drawn attention to the need to improve implementation of current guidance on use of aspirate pH and particularly Xray. The role of supplementary techniques already in use will be discussed, including real time imaging (real time X-ray screening, Cortrak™, IRIS™) or CO_2 detection (Double Chek™).

Introduction

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[1], a core group member of BAPEN, was founded to represent the interests of patients requiring parenteral *and nasogastric tube* nutrition. BAPEN espouses the delivery of high-quality nutritional care ideally via properly constituted Nutrition Teams which are a pre-requisite for safe and appropriate NGT feeding.

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 (Figure 1; Annex 1).

With around 1 million NGTs purchased by the NHS annually, the potential for complications is considerable. Although we have no accurate data on the proportions of these tubes used for feeding or drainage purposes, we know that a significant proportion are used for feeding. We also have no data on how many large bore NGTs cause harm or worse. Despite over 20 years of national alerts, guidance and our first Position Paper in 2020, Never Events associated with nasogastric tubes have continued. (Figure 1; annex 1)

[1] PINNT: Patients on Intravenous & Nasogastric Nutrition Treatment

In this paper, we propose that further measures are required to enable a more holistic "fail-safe" approach to NGT (or orogastric) placement. Getting the basics of aspirate pH and post insertion X-ray right is a fundamental and necessary objective. Trusts/Health Boards should have access to the national radiographer-led nasogastric tube position check pathway (see below). Current guidance on prevention of NEs focusses entirely on *post insertion* checks. However, these do not and cannot prevent complications from full insertion of the tube as they occur. We propose that any future new guidance should consider detection of intrapulmonary placement *before* full insertion to reduce in-procedure risk and misplacement. This can be achieved by mid-procedure CO_2 checks, guided tube placement or mid-procedure X-ray and could eliminate almost all lung complications. Guided placement would also reduce aspiration pneumonia associated with intra-oesophageal misplacement [Taylor 2025]. There is clearly a need to augment current guidance with a different approach.

The findings of our 1st Position Paper still stand:

- In acute settings, NGT placement is not a "simple" or low risk procedure. NGTs would be inserted only by personnel with appropriate training and competencies. NGT insertion be restricted to registered nurses (acute and community), parents/carers, dietitians, radiographers, and medical staff (including radiologists and intensivists) who have completed appropriate training and maintain ongoing competency assessment. This includes appropriately trained carers within the community setting helping to prevent hospital admissions.
- NGT insertion for feeding purposes would be based on risk-benefit assessment, consent and best interest decisions [BAPEN 2020]. Guided placement (e.g. endoscopic, Cortrak™ [Taylor 2022] or IRIS™ [Taylor et al 2024]) should be undertaken only by professionals trained in evidence-based interpretation of tube position.
- Correct materials should be used (CE-marked pH paper and radio-opaque NGTs),
- All NG tubes should be inserted to (NEX[2] or XEN[3]) +10cm and this distance confirmed before each use of the tube.
- Continuous audit is required to ensure compliance with guidelines and satisfactory outcomes.
- As recommended in NHS/I Alert 2016, all organisations providing care to patients requiring NGTs should be compliant with guidelines and have a responsible officer at Board level.
- A commitment to SAFETY FIRST must underpin every aspect of NGT placement as part of a renewed culture of safety within the NHS. Our patients deserve nothing less.

Rationale for augmentation of current guidelines with a new paradigm

- The incidence of NG feeding tube related pneumothorax was discussed in our first Position Paper [BAPEN 2020]. Recent literature reveals that during blind (i.e. non-guided) tube placement, 1.65% (0.8-10.4%) of tubes enter the respiratory tract resulting in pneumothorax (0.43%: 0.3-1.7%), contamination-associated pneumonia (0.20%: 0.1-2.8%) and death (0.07%: 0-0.5%) [Taylor, 2026; See Annex 3 for detailed evidence and literature].

[2] NEX: Nose-ear–xiphisternum distance;
[3] XEN: Xiphisternum–ear–nose distance according to local policy. Measuring from the xiphisternum may be more accurate, particularly in the obese.

- It is not well known that of a 0.65% risk of major complication during blind NGT placement, only 0.017% are Never Events, therefore >97% of lung complications occur in-procedure [Taylor 2026 – Annex 2]; NEs are a serious minority.
- This data may not accord with the perceived experience of many clinicians involved in NGT placement and feeding. This may be due to a lack of routine surveillance or audit of post NGT insertion pneumothoraces. World literature over the last 20 years has documented a sizeable complication rate when prospectively or retrospectively sought. Even if the ratio of pneumothoraces to NEs is not as great as it would appear to be from the literature, pneumothoraces still constitute a significant cause of morbidity, mortality and prolonged hospital stays which should be considered as worthy of prevention.
- Many tubes which have already caused an as yet unrecognised pneumothorax may be correctly detected as being misplaced when inadequate aspirate or a pH>5.5 are obtained. Subsequent attribution of that pneumothorax to the original tube insertion may not be made especially if a subsequent correct NGT placement has occurred and been assessed at Xray. Multiple reinsertions pose an increased risk of undetected pneumothorax [Hayward and Singh 2024]
- Whilst pneumonia is a common occurrence in the patients requiring NG feeding, pulmonary misplacement of NGTs is also a potential source of infections including empyema and lung abscess. Although spontaneous reflux and aspiration all occur in NGT fed patients, they become more likely when the tube is placed in the oesophagus rather than the stomach. Avoidance of initial intra-pulmonary placement would prevent such contamination as well as pneumothoraces.
- As noted in our first position Paper, a reduction in enteral tube related pneumonia is found with post pyloric feeding [Cochrane Review 2018; Liu et al 2025]
- Avoidance of oesophageal placement or displacement would also be beneficial but hard to detect using current methods, hence the importance of the insertion distance at first insertion and before subsequent usage. In-procedure direct or indirect visualisation also obviates this problem.
- X-rays used to confirm correct placement of NGTs continue to be identified as the root cause of 50% Never Events. We propose changes to this practice involving empowerment of radiographers as well as educational improvements for all involved in NGT placement.
- Aspirate pH from within the trachea in intubated patients can be <5.5, resulting in NGT misplacements being missed using pH alone [McNally-Reilly 2022]. Oesophageal pH often reflects intragastric pH and predisposes to failure to prevent oesophageal placement or displacement.

  Out of Hours (OOH) (re)placements by ANY method should be avoided unless a clear urgent indication exists such as need for vital medication or carbohydrates to balance insulin dosage. Even then, the NGT should be placed by a competent person (including parents/carers in the community) since OOH placement exposes patients to risks associated with less competent practitioners [Mardestein 2004]. Application of this restriction will depend on local definitions of OOH.

Scope of 2nd Position Paper

The scope of this document will focus on nasogastric (or orogastric) tubes used for gastric infusions of nutrients, hydration or drugs, but wide-bore tubes (often called Ryles tubes) of ≥6mm in diameter used for dual purposes should also be considered as these may also reach the visceral pleura. We have not addressed large bore drainage tubes or fine-bore tube placement in neonates or paediatric

practice but we will briefly mention this in the context of CO_2 detection. Although not dealing with transpyloric tube placement specifically, many of the findings in this paper will apply to passage of such tubes to the stomach.

Whilst drainage tubes inserted via the nasal or oral cavity into the stomach for the purpose of gastric aspiration or decompression are associated with many of the same insertion-related risks, these tubes are not strictly within the remit of NGSIG and this paper, but the distinction between tubes used for feeding and drainage can be blurred.

For example, the increasing use of Gastrografin® in small bowel obstruction uses dual purpose tubes, providing both gastrointestinal decompression and a route for water-soluble contrast administration. (Klingbeil *et al.*, 2022 & Chatzopoulou *et al.*, 2026) it is therefore reasonable to consider many of the same principles and governance arrangements discussed for NG feeding tube placement in the management to large bore tubes with dual purposes.

It should, be noted that certain drainage devices, including Ryles and transnasal/transoral gastric drainage tubes, are licensed solely for gastric drainage and decompression. Administration of medicines, feed, water or contrast media through such devices may therefore constitute off-label use. In addition, these devices do not typically incorporate ENFit® connectors and may require the use of legacy enteral administration systems, introducing further risks associated with equipment compatibility and potential wrong-route administration. Where dual-purpose use is contemplated, organisations should ensure that appropriate controls, staff training, and device-specific guidance are in place to mitigate these risks.

Community placement of NGTs

Data on the prevalence of NGT feeding in the community is no longer collected via The British Artificial Nutrition Survey (BANS) but the last substantial report in 2011 recorded 17% of all home enterally fed adults received NGT feeding with a further 4% via nasal feeding beyond the pylorus. The same report recorded up to 70% of newly discharged children as receiving NGT feeding [BANS report 2011]. The final adult enteral BANS report [BANS 2018] recorded 10% of all home enterally fed patients fed via the NGT route with a further 9% beyond the pylorus. . It should be noted that not all Trusts or Boards have the resources to discharge and support NGT feeding in the community.

We can find no evidence that NEs or pneumothoraces occur with significant incidence in the community [Jones 2017, Jones 2020]. This may reflect the differing characteristics of patients in the community versus hospitals and also the level of expertise available for community NGT placement [Jones 2017; Jones 2020]. Community NGT feeding can be safe provided that there is a multidisciplinary individualised care plan [Williams 2016] and NPSA guidance is complied with [Best 2013]

Hospital referrals for replacement should be avoided if possible, particularly out of hours but are rarely required (Jones 2017, Jones 2019). More complex community cases are now being seen and in future may require the same level of caution as advised for hospital patients. The often successful practice of waiting several hours when no aspirate can be obtained may differ from in hospital practice and obviates the need for X-ray confirmation which is rarely required in the community [Jones 2017; Jones 2020].

Complications of NGT insertion (see Table 1)

A holistic approach to NGT complications should include those complications arising as a direct result of trauma caused on insertion by the position of the NGT tip. Thus pneumothorax occurring as a result of misplacement into the pulmonary tree is by far the most frequent complication which causes both morbidity and mortality [Taylor 2026]. Pneumonia can be caused by a Never Event, by direct contamination of the pulmonary tree, by a misplaced NGT, by aspiration of gastric contents independent of tube in situ, or by intra-oesophageal infusion of feeds when the NGT tip is sited in the oesophagus.

As noted in our rationale for augmentation of current guidance, pneumothoraces greatly exceed NEs. Pneumonias following oesophageal placement and aspiration, or from contamination of the pulmonary tree with NGT misplacement is a significant complication but attribution to misplacement is not always made. The incidence of pneumonia resulting from detected pulmonary misplacement almost doubled in one study [Mansour 2014].

Table 1.

NGT complication	**Never Event**
Pneumothorax or pleural placement with tube unused. This is the most common complication.	NO
Pneumothorax or pleural placement due to NGT with administration of feed, medication or fluid.	YES
Intra-oesophageal placement with tube used. This predisposes to aspiration pneumonia.	NO
Other intrapulmonary misplacement complications include pneumonia, lung abscess , empyema and pulmonary haemorrhage	NO
Intra-cranial, vascular, oesophageal, gastric or hypopharyngeal penetration are uncommon and will not be addressed within this paper.	NO

Current safety protocols

Current guidance is directed at avoidance of Never Events [NPSA 2016a/b, NNNG 2023] 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*" [NHSE/I, 2018].

The definition of nasogastric or orogastric tube misplacement [NPSA 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*"

NPSA and NHSE/I guidance has been based upon prevention of NEs by use of gastric aspirate pH and X-ray confirmation of NGT tip position. Both have been shown to have room for error (see Annex 1), and neither can prevent complications due to full insertion since they are only used after full insertion has been achieved or attempted. Compliance by NHS providers with NHSE guidance has been

incomplete or lacking [HSIB 2020; BAPEN 2020] and as assessed via Freedom of information sources [Jones et al 2023].

Whilst some have regarded X-ray as the "gold standard" for NGT checks [Metheny 2007], this view cannot be supported in light of the UK experience. *The use of X-ray as the first line check should be avoided and is not compliant with current guidelines.* Aspirate pH is the correct first line check although aspirated gastric contents within the pulmonary tree often have a pH<5.5, rendering pH testing via a misplaced tube misleading [McNally-Reilly 2022]. An objective of this paper is that use of X-rays should be reduced to a minimum whilst optimising the process of ordering, performing and reporting the X-ray, and acting upon the information so obtained. X-ray costs for NGT checks are considerable and radiation exposure to repeated X-rays need to be considered.

The inclusion of a complication in the Never Event list presumes that the complication is preventable. It is BAPEN's contention that it is not only NGT related NEs as currently defined that are preventable, but also the more common occurrence of pneumothoraces. The aim of any safety guidance should be to eliminate complications to the greatest degree reasonably possible, whether regarded as a Never Event or not. If NGT insertion is withdrawn from the NE list, this makes our new Position Paper all the more important if patient safety is to be protected.

Use of aspirate pH has been shown to fail to correctly identify the gastric position on occasion [BAPEN 2020; HSIB 2020] and may produce false positive acid pH when the tube is sited in the oesophagus or pulmonary tree [MacNally-Reilly 2022]. This in turn promotes reliance on X-ray confirmation of tube position. However, failure to identify NGT tube position correctly by radiological means has been shown by NPSA data to be responsible for approximately half of all NEs. Whilst measures to ensure accurate pH measurement, improved gastric aspiration and X-ray interpretation are all important objectives, they can only improve the safety of NGTs once fully inserted. They cannot prevent insertion related complications such as pneumothoraces.

We will firstly examine potential improvements in existing NGT check X-ray pathways, (see below) which could help eliminate NEs associated with failures identified in use of X-ray checks by NHSI/NPSA

We will then examine the potential and practicalities of alternative available methods to dynamically detect misplacement as it occurs so as to avoid both insertion complications AND those caused by subsequent use of the tube giving rise to an NE.

Improving outcomes using current guidance (post procedure pH & X-ray)

No post-procedure check can detect in-procedure respiratory misplacement in real time. To increase the likelihood of the tube tip reaching the stomach a tube should be placed to a measured distance: (NEX or XEN) + 10cm or the alternative formula (NEX x 0.38696)+30.37+6cm [Torsy 2022]. Coiling of the NGT in the oesophagus can never be excluded even without anatomical abnormalities [Metheny et al 1994].

NGPOD

This technique uses a pH sensor on the tip of an introducer passed through an NGT on initial insertion or for post insertion follow up checks. This device enables a reduction in observer errors and the need for X-rays to confirm gastric placement [Early 2022]. This device has now been withdrawn from the UK market as of 24/08/2026 and is subject to a FSN (Field Service notice) NGPod pH testing device: quarantine and dispose of all devices (DSI/2026/009) - GOV.UK

pH readers

Readers help eliminate observer error and increase reliability and would be helpful with those with colour blindness [Zambetti 2026]. Reading pH papers can be difficult for those with colour blindness so pH readers should help avoid this issue.

Lowering the threshold for pH detection

We discussed this in detail in our first position paper [BAPEN 2020]. Theoretical studies suggest that a pH of 4.0 [Ni 2014] or 5.0 [Ni 2017] when misplacements were 30%, (a somewhat excessive estimate) would be more effective at minimising intra-oesophageal misplacement and preventing never events. They assumed 100% compliance with X-ray guidance which is clearly not the case in real life. Their aim was to reduce aspiration, not NEs. It was assumed that oesophageal pH is always >4.0 which is also incorrect as oesophageal pH can be even lower on oesophageal pH monitoring, and in particular recumbent, obtunded and elderly patients where acid reflux is common. Oesophageal aspirates from misplaced NGTs were found to yield a wide range of pH from 2.67 to 7.57 [Metheny et al 1994]. The reliability of reducing the pH threshold has not been convincingly demonstrated to detect intra-oesophageal placement or exclude it. In studies of infants [Gilbertson et al 2011]. it was assumed that a pH<4.0 meant intra-gastric placement but this was not confirmed by X-rays which were only deployed for higher aspirate pH. Reducing threshold pH is unlikely to be any more sensitive or specific in clinical practice than the current <5.5 threshold which itself has been subject to reader error and colour blindness. A reduction in pH threshold to 4.0 from 5.5 was estimated to lead to a rise in demand for Xray from 24% to 35% [Ni et al 2014] and hence a greater risk of erroneous reports in the absence of full compliance with X-ray guidance as defined in NPSA Alerts. Furthermore, reliance on pH of any threshold value after blind insertion cannot prevent in-procedure complications. Studies to date have been on blind insertions and not following in-procedure checks. The pH threshold utilised in DoubleChek™ is 5.5. Further studies are required to establish benefit from a change in pH threshold from that recommended in national guidance, particularly with the additional checks proposed in this paper. We can therefore make no recommendation on changes to threshold pH. For more details of this topic in our First Position Paper see Annex 3. It should be noted that detection of acid indicates the NGT tip is in acid, not where that acid is- for example in the lungs following aspiration.

Identifying high risk patients

In our first position Paper, we said the following which still applies: *"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".* The changes recommended in this paper should help avoid complications in these high risk patients.

X-ray protocols and radiographer empowerment

X-ray is required where gastric pH is unobtainable or does not meet the threshold for safety. Despite 20 years of guidance, misinterpretation of NGT check X-ray is associated with approximately 50% of NEs. [BAPEN 2020; NHSI 2016a; NHSI 2016b]

The novel insertion technologies discussed in this paper may reduce the number of NGT check X-rays routinely needed. However, there will remain a requirement for these X-rays in significant volume when aspirate is unobtainable or has a pH greater than the pH threshold. Therefore the safety of X-ray interpretation should be addressed as in the 2020 HSIB report following the index case of a NE identified a number of NGT safety factors including variability in NGT management, and lack of a consistent process for assessing and recording competency in interpreting NGT placement on X-ray. [HSIB 2020]

Radiographer empowerment and workforce training is a highly effective strategy to reduce NGT related NEs. Radiographers can highlight misplaced NGTs and initiate actions to rectify this at the time they acquire the X-ray. [Law 2008; Law 2012; Roe 2017; Roe 2019]

The HSIB recommended a national standardised competency-based training programme for X-ray interpretation, with the interpretation being recorded and communicated before NGT use. [HSIB 2020]

As a result of this recommendation a training program has been created for radiographers to use their skills and knowledge to improve outcomes for patients needing NGT feeding as follows:

- The Royal College of Radiologists (RCR), Society of Radiographers (SoR) British Society of Gastrointestinal and Abdominal Radiology (BSGAR), BAPEN and Intensive Care Society (ICS) worked with Report and Image Quality Control (RAIQC) to develop a national education and training package as part of a new radiographer-led NG tube position check pathway
- Training and assessment via e-learning resource hosted by RAIQC
- Template SOP to support governance approvals
- Implementation support available via project management group, including through shared resources and regular drop-in/mentoring sessions
- Pre- and post-implementation audit

Successful implementation of this pathway in one large NHS Trust has proven long term results in preventing NGT related NEs.

Service transformation at this large NHS Trust was triggered by 4 adverse events in a 762-day period in 5 hospital sites covering 2,500 beds related to NGT X-ray interpretation and miscommunication. Since the introduction of the local pathway in this large NHS Trust 12 years ago there have been 0 never events relating to NGT check X-rays. Consistent twice-yearly audits demonstrate 98% accuracy of the radiographer interpretation (compared with radiologist review) with sensitivity 96% and specificity 99%, PPV 96% and NPV 99%.

This pathway has further consolidated the use of NG check radiograph as the second line method in assessing NG tube placement, further reducing the likelihood of X-ray interpretation errors (Razak et al, 2025). It is anticipated that NHS wide adoption will help reduce the number of NGT related NEs nationally.

Information regarding this training package can be obtained via email: guidance@rcr.ac.uk

Review of techniques for prevention of insertion related complications plus NEs

In-procedure checks of tube position

Whilst these initially add time and expense, overall cost can be lower through obviated X-ray, prevented complications and improved treatment through tube access availability.

All methods of guided tube placement should enable operators to prevent respiratory or oesophageal misplacement in real time. Guided placement should only be performed by experts trained in evidence-based interpretation of that guidance. Such experts should be able to confirm safe tube position, usually without the need for further post-procedure checks. Guided tube placement *per se* is expensive, but overall cost can be offset by reduced X-ray requirements and faster NGT access. An ideal bedside device should be easy to use and teach, relatively inexpensive, applicable in all settings and a reliable indicator of the position of the NGT tip.

Ultrasound

Point of care ultrasound (POCUS) has been associated with more accurate gastric confirmation than pH but, similarly, has false positive confirmations, likely from tubes in the distal oesophagus [Ong et al 2025]. Although a bedside procedure is possible when expertise is available, this is not practicable for regular follow up position checks or out of hours checks and is not yet a supported method of NGT position check within the NHS. Future developments may enable differentiation between lung and GI tract.

Real time X-ray screening(fluoroscopy)

This is usually reserved for difficult insertions due to anatomical abnormalities of the oesophagus and stomach. We have no recommendations or reservations regarding this approach.

Endoscopic placement (direct vision)

Endoscopic methods (including nasendoscopy and micro-endoscopy) with or without fluoroscopy should be limited to patients with high-risk pathology [e.g. hiatus hernias, benign or malignant oesophageal strictures, pharyngeal pouch, trachea-oesophageal fistulae or post bariatric surgery) and when ward-based placement or fluoroscopy have failed. There is a risk of displacement on withdrawal of the endoscope depending on technique. Aspirate pH, or X-ray if pH not sufficient, should then be performed before use of the tube.

IRIS™ (direct vision)

Expert placement is associated with 0% pneumothorax risk and can often detect a tube's position pre-entry into the respiratory tract and always at the level of the trachea, reducing contamination risk [Taylor 2025]. Original references are to be found in Annex 4. Manufacturer operator guidance requires improvement, but an evidence-based guide is available [Taylor et al 2024] and the manufacturer plans to provide an image library for teaching purposes.

CORTRAK™ (electromagnet tracking)

Expert placement reduces pneumothorax risk to 0.005% (cf. 0.52%). Non-expert placement resulted in increased NEs (0.1% vs 0.013%), possibly because manufacturer guidance may be considered inadequate and not evidence-based [Taylor and White 2025; Taylor et al 2025; Taylor, 2022]. Original references can be found in Annex 5.

Mid-procedure CO_2 check

General considerations of the CO_2 technique:

Capnography (CO_2) or colourimetric capnography to detect pulmonary tract misplacement was first advocated in 1994 [D'Souza et al 1994]. Despite interest in North America, China and Singapore, there has been little interest in Europe or UK. CO_2 detection indicates an intrapulmonary source if the aspiration site is beyond the larynx and is routinely used by anaesthetists on endotracheal intubation. Applied to NGT insertion, a lack of CO_2 at the nose-ear-sternal notch distance implies that the sample has been taken from a non-pulmonary source distal to the larynx, i.e. the oesophagus. Detection of CO_2 at that level requires withdrawal of the NGT [Chou et al 2021] which reduces pneumothorax risk to 0.021% (Taylor 2025). Full insertion to (NEX or XEN)+10cm and post-procedure checks (pH, and/or X-ray) are still required to ensure gastric placement. False positive detection of CO_2 at the sternal notch may be due to subjective errors in calculating the distance to the sternal notch. This should be seen as an error erring on the side of safety.

Sensitivities and specificities of 80% and 86% respectively have been documented historically in ward settings [Mordiffi 2016]. More recent evidence from metanalysis of 16 studies of high risk critically ill adults suggests 100% accuracy for CO2 detection with sensitivity of 0.96 and specificity 0.99 [Chau et al 2021] False negative CO_2 detections may be attributable to respiratory secretions blocking the NGT or CO_2 produced by food fermentation in the gastrointestinal tract. Detection of tracheal CO_2 can not only minimise risk of pneumothorax but may reduce pneumonia risk (Taylor 2025) and X-ray cost [MacElhinney-West 2024]. If CO_2 detection is reliable, then this would reduce the chance of a misleading acid pH being obtained from an intrapulmonary aspirate. The errors associated with X-ray checks would also be minimised since fewer tubes would be misplaced prior to reporting.

Recent experience of CO_2 testing during NGT insertion:

Early colourimetric CO_2 studies used kit designed for endotracheal tubes (Easy Cap® or PediCap®) but these require EnFit adapters. More recent experience in the UK, USA and Italy has used the novel device (Double Chek™ Enteral Access Technologies UK) which is ENFit compatible and incorporates both colourimetric CO_2 and pH detection in the same device, enabling compliance with current guidance on use of pH. Using this device across many settings, 11.5 – 19% of primary insertions were associated with CO_2 detection indicating possible intrapulmonary placement at or below the level of the larynx [Jones 2025]. During the 2 years in which this new product has been in use in UK & USA, there have been no reported NEs or pneumothoraces (Jones et al 2025). Obtaining an aspirate sufficient to measure pH is highly efficient (90%) [Jones et al 2025]. This technique significantly reduces the delays between insertion, confirmation of correct position and commencing enteral feeding [MacElhinney-West 2024]. Given that about 1/3 of aspirates yield a pH>5.5 (Jones et al 2025), those patients will still need an X-ray for confirmation of the correct intra-gastric position. Education and training for use of the Double Chek™ device appears to be relatively uncomplicated and acceptable to those providing and receiving the training. The device has been successfully trialled in clinical practice in a variety of settings (Intensive care, stroke and neurology, gastroenterology, medicine rehabilitation, surgery, paediatrics and in the USA in neonatal care).

Further large-scale studies are needed to confirm the hypothesis that this device enables a reduction in X-ray demand (McElhinney et al 2024) and to determine sensitivity and sensitivity levels. Direct validation against current guidance or X-ray has not yet been conducted.

Post-procedure securement

Up to 54% of tubes are prematurely removed or partially displaced by inadvertent or deliberate patient traction, in most cases requiring tube replacement with its associated risks [Taylor et al 2018; Hayward and Singh 2024]. However, nasal retention devices are contraindicated in refused consent, where anatomically unsafe or the patient is violently agitated. Compared to adhesive tape, securement with a pre-emptive nasal retention device (a loop around the septum to which the tube is secured) reduced overall tube loss by 40%. This would significantly reduce complication risk from tube replacement and loss of treatment time for feed, fluid and drugs [Seder et al 2010]. Overall, bridle use was associated with a reduction in tube-associated complications from 41% to 28% and a 2:1 ratio of savings: cost [Ribeiro et al 2025].

Additionally, the National Nurses Nutrition Group (NNNG) good practice guidance recommends securing to the cheek as this also reduces the risk of nasal erosion or ulceration (NNNG 2023)

Educational requirements

- A national roll out of a formal educational programme for current and new techniques (where applicable to the setting) leading to demonstration of competency requires central four-nation NHS support if NGT-related complications are to be reduced. This should include a Trust/Health Board mandated, protected face-to-face educational programme delivered away from the clinical environment for any healthcare professionals who practice NG tube insertion and management, supported by backfill arrangements that enable staff to be released from ward duties to fully engage in learning, skills development and reflection. Given the significant patient safety risks associated with misplaced nasogastric tubes, education must extend beyond theoretical knowledge and isolated technical skill acquisition to ensure practitioners develop the critical thinking, clinical judgement and situational awareness required for safe practice.
- A blended approach of e-learning, simulated practical training and competency assessment in clinical practice is required, as advised and emphasised by the NMC (2023). Whilst simulation and manikin-based training provide a safe and effective environment in which to practise technical skills, demonstrating a procedure on a manikin in front of a class is fundamentally different from performing the same procedure with a patient in a busy clinical setting, where factors such as patient condition, communication challenges, competing clinical demands and the need for clinical decision-making influence performance. Consequently, successful completion of simulation-based training should be regarded as preparation for practice rather than evidence of full clinical competence.
- Following completion of the off-ward educational programme, practitioners should be supported through a structured competency-based programme in practice, allowing them to consolidate learning, apply knowledge in real clinical situations and reflect on their experiences under appropriate supervision. Protected time for learning and supervised practice is essential to support the transfer of knowledge and skills from the simulated environment to clinical care, promote practitioner confidence and reduce the risk of unsafe variation in practice. Competencies should be prioritised and completed within a defined timeframe to minimise skill fade, as described by Hayward (2024).

Guidance on supervision and assessment of students on NMC-approved programmes can be found within the *Standards for Student Supervision and Assessment* (SSSA).

Discussion

NGT safety requires further attention and adherence to current guidelines. Avoidance of out of hours placements, post insertion securement and enhanced use of X-ray confirmation checks by radiographers would greatly improve outcomes which remain unacceptably high.

To reduce in-procedure complications, particularly pneumothorax, both IRIS™ direct vision guidance and Cortrak™ indirect visualisation provide potentially safer insertion; provided that the operator is sufficiently trained. It is acknowledged however that there are significant training and cost associated with safe implementation with these devices. Alternatively, Double Chek™ (the only commercially available device at present) can be used in most settings, due to its portability where trained operators are available. Prevention of NEs and lung trauma, together with avoidance of unnecessary X-rays should offset the costs of any of the devices discussed although cost-benefit studies are still needed.

The status quo has not proved to be acceptable in terms of outcomes and the measures recommended below would enable improved outcomes.

Recommendations

- National guidance on the use of X-rays for NGT position confirmation should be introduced.
- We recommend that data on all NGT-related complications, both in-procedure and Never Events should be collected nationally and locally. The new audit tool available through BAPEN's NGSIG may provide such data (NGSIG 2025 https://www.bapen.org.uk/wp-content/uploads/2025/07/bapen-ng-audit-tool.docx).
- The utility and cost-effectiveness of novel techniques require national resourcing for adequately powered clinical trials under field conditions. Such studies will require support from national funding bodies but changes to current practice should not wait for these studies to become available.
- A national roll out of a formal educational programme for current and new techniques leading to demonstration of competency requires central 4 nation NHS support if NGT complications are to be reduced.
- Consider integration of CO_2 into current guidance utilising aspirate pH and X-rays plus (NEX or XEN) + 10cm.
- Post insertion securement reduces risk from multiple replacements.
- Introduce training of experts in guided tube placement, using evidence-based methods of interpreting tube position, with independent accreditation.
- All of the above are ideally best delivered by a fully functional well led team to ensure that pathways are established and followed in accordance with the principles underlying BAPEN.

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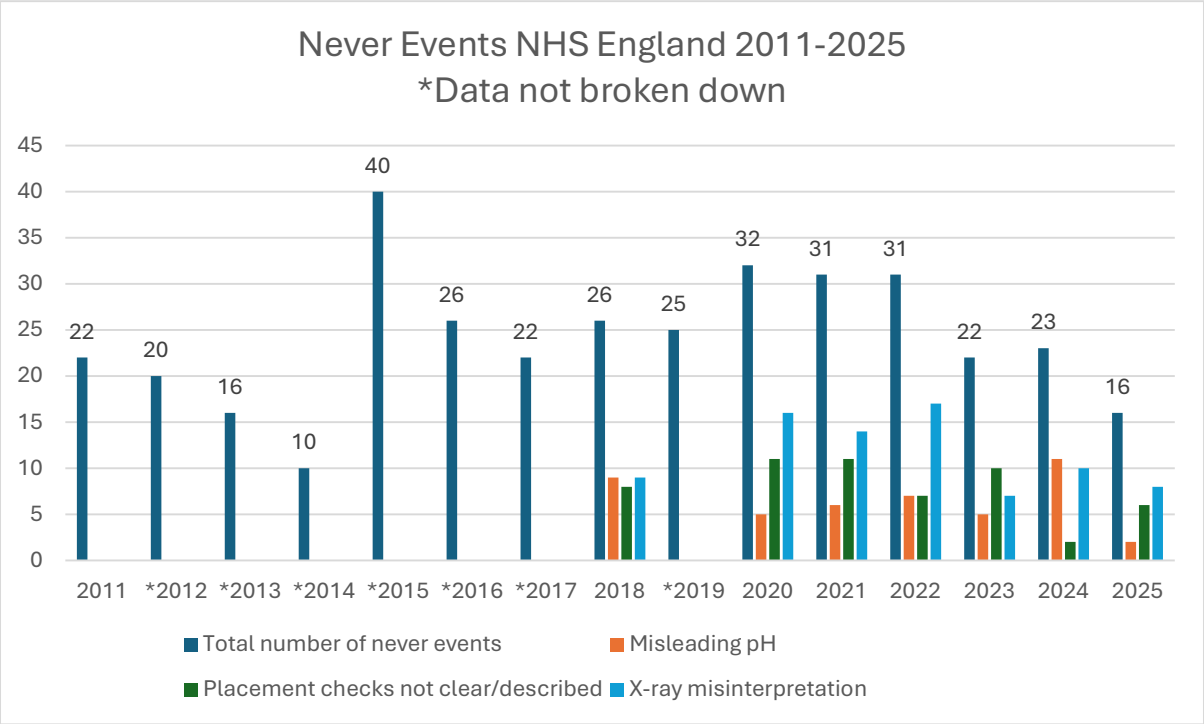
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Annex 1: Table 2; National data on Never Events over the years with attribution of contributory factors



Note: 2003-2005: 12 Never Events with 11 deaths notified to NPSA

2005-2011: 95 Never Events with 21 deaths.

Annex 2: Lung complications associated with blind tube placement

From: Taylor SJ. Feeding tube safety: National guidance is unsafe and must change. Int J Risk Saf Med. 2026 :9246479261442065. doi: 10.1177/09246479261442065. Epub ahead of print. PMID: 41974051.

Feeding tube-related risk was reviewed between 1985-January 2026. Respiratory tract misplacement, lung trauma (predominantly pneumothorax, plus haemothorax, hydropneumothorax) and infection

(predominantly pneumonia, plus empyema) were recorded (Table A1). Overall, 1.65% of blindly placed tubes entered the lung. Undetected misplacement where the tube was used was rare, causing pneumothorax/ hydrothorax in 0.017% and death in 0.0006%. In-procedure related complications were far more common: Trauma 0.43%, infection 0.2% and death 0.07%. Nearly 97% of lung complications occur in-procedure. The ratio of in-procedure to NEVER events for major complications and death is 36 and 12: 1, respectively. Total risk of complications is 0.65% and death 0.075%, or 1 in 154 and 1330: 1. Hence, while NEs are usually more severe per complication, the far greater frequency of in-procedure complications makes them a higher population burden of morbidity and mortality.

Complications occurring in-procedure or undetected until tube use. [Updated from Taylor, 2025]

Patient type	Tubes	In-procedure				Undetected		Reference – see Appendix 6
		Lung	Trauma	Infection	Died	Trauma	Died	
mixed	1633	27	9	.	4	0	0	de Aguilar-Nascimento and Kudsk, 2007
icu	1700	14	4	4	0	0	0	Bankier et al, 1997
mixed	340	7	1	.	0	0	0	Ghahremani and Gould, 1986
icu	71	.	1	2	0	.	.	Harris and Huseby, 1989
mixed	240	4	.	.	.	.	.	Keyte et al, 2021
mixed	299	31	2	3	.	.	.	Kimmel et al, 2018
mixed	1822	27	11	.	4	0	0	Koopmann et al, 2011
mixed	143	3	2	.	0	0	0	Koopmann et al, 2011
mixed	1847	26	7	.	0	0	0	Marderstein et al, 2004
mixed	1100	13	4	2	0	1	0	McWey et al, 1988
ward	192	5	.	.	.	.	.	Mordiffi et al, 2016
stroke	250	20	5	.	0	0	0	Rabaut et al, 2022
ICU	740	14	4	.	2	1	1	Rassias et al, 1998
ICU	275	14	4	.	0	0	0	Ryu et al, 2016
mixed	3789	50	9	5	2	0	0	Sorokin and Gottlieb, 2006
mixed	1934	43	7	2	0	0	0	Taylor and Manara, 2021
icu	1652	.	5	.	0	1	0	Valentine and Turner, 1985
All	**18027**	**298**	**75**	**18**	**12**	**3**	**1**	
%		**1.65**	**0.43**	**0.202**	**0.07**	**0.017**	**0.006**	

Patient-specific risk

Risk of pneumothorax and pneumonia was estimated as pooled averages from mostly mixed ward and ICU populations, but risk may differ depending on patient group. Reduced consciousness, dysphagia and presence of an artificial airway are considered risk factors for tube misplacement and subsequent pneumothorax and pneumonia.

Pneumonia

Only 5 studies, 8893 tube placements, recorded pneumonia. 18 of 151 misplacements resulted in pneumonia, 10.6%. However, pneumonia resulting from tube contamination will relate to the rate of misplacement. This sub-group had a misplacement risk of 1.698%. To make **risk of contamination** consistent with a tube misplacement risk of 1.65% it was **adjusted down from 0.202% to 0.2%**.

Taylor SJ. Feeding tube safety: National guidance ignores the 'elephant in the room'. Int J Risk Saf Med. 2025; 36: 85-97. doi: 10.1177/09246479241295560. Epub 2024 Nov 5. PMID: 39973429.

Study	**Placements**			**Respiratory**	
		Detected		**Undetected**	
	Analyzed[4]	**Lung**	**Pneumothorax**	**Lung**	**Pneumothorax**
Cardona and Mehta, 2021	20	0	0	0	0
Karpasiti and Shepherd, 2022	12	1	0	0	0
Khan and Shepherd, 2019	8	0		0	0
May et al, 2017	16	3	0	0	0
Mizzi et al, 2017	20	7	0	0	0
Phillips et al, 2023	50	2	0	0	0
Slingerland et al, 2021	31	8	0	0	0
Taylor et al, 2021	45	12	0	0	0
Taylor et al, 2023	100	19	0	0	0
Taylor et al, 2024 + See Appendix 5	49	7	0	0	0
Wischmeyer et al, 2018	48	10	0	0	0
Total	**400**	**69**	**0**	**0**	**0**
%		**17.3**	**0.0**	**0.0**	**0.0**

[4]

Annex 3: Reducing the pH threshold- as discussed in Position Paper 1 [BAPEN 2020]

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 ≤4.0 (Hanna, 2010) or ≤5.0 (Ni, 2017) with a corresponding increase in X-rays. They concluded that reduction of pH threshold from ≤5.5 to ≤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 ≤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).

Annex 4: IRIS tube respiratory misplacement.

Taylor SJ. Feeding tube safety: National guidance ignores the 'elephant in the room'. Int J Risk Saf Med. 2025; 36: 85-97. doi: 10.1177/09246479241295560. Epub 2024 Nov 5. PMID: 39973429.

Study	**Placements**			**Respiratory**	
		Detected		**Undetected**	
	Analyzed	**Lung**	**Pneumothorax**	**Lung**	**Pneumothorax**
Cardona and Mehta, 2021	20	0	0	0	0
Karpasiti and Shepherd, 2022	12	1	0	0	0
Khan and Shepherd, 2019	8	0		0	0
May et al, 2017	16	3	0	0	0
Mizzi et al, 2017	20	7	0	0	0
Phillips et al, 2023	50	2	0	0	0
Slingerland et al, 2021	31	8	0	0	0
Taylor et al, 2021	45	12	0	0	0
Taylor et al, 2023	100	19	0	0	0

Taylor et al, 2024 + See Appendix 5	49	7	0	0	0
Wischmeyer et al, 2018	48	10	0	0	0
Total	**400**	**69**	**0**	**0**	**0**
%		**17.3**	**0.0**	**0.0**	**0.0**

Annex 5: Cortrak tube respiratory misplacement.

Taylor SJ. Feeding tube safety: National guidance ignores the 'elephant in the room'. Int J Risk Saf Med. 2025; 36: 85-97. doi: 10.1177/09246479241295560. Epub 2024 Nov 5. PMID: 39973429.

Study	**Tubes**	**Detected**		**Undetected**	
		Lung	**Pneumothorax**	**Lung**	**Pneumothorax**
Beale et al, 2020	16	0	0	0	0
Bear et al, 2016	51	9	0	0	0
Bear et al, 2017	40	5	0	0	0
Bing et al, 2021	17	0	0	0	0
Boyer et al, 2014	74	.	0	0	0
Brown et al, 2017	43	.	0	0	0
Bryant et al, 2015	188	.	0	4	2
Carter et al, 2018	280	.	0	0	0
Deane et al, 2009	60	.		.	.
Dolan et al, 2012	12	.		.	.
Elliot, 2010	51	.	.	.	.
Gao et al, 2018	81	.	0	0	0
Gerritsen et al, 2014	249	.	0	0	0
Gerritsen et al, 2016a	80	.	0	0	0
Gerritsen et al, 2016b	36	.	0	0	0
Goggans et al, 2017	40	0	0	0	0
Gray et al, 2007	81	2	0	0	0
Hemington-Gorse et al, 2011	44	.	0	0	0
Holzinger, 2011	44	.	0	0	0
Jha et al, 2020	28	.	0	0	0
Kaffarnik et al, 2013	70	.	0	0	0
Kappelle, 2018	82	.	0	0	0
Kenar et al, 2009	25	0	0	0	0

Kline, 2011		22	.	0	0	0
Koopman et al, 2011		1154	11	0	0	0
Koot, 2016		49	.	0	0	0
Mathus-Vliegen, 2010		260	0	0	0	0
McCutcheon et al, 2018		6290	.	0	0	0
McWhirter et al, 2011		250	.	0	1	1
October & Hardart, 2009		50	.	0	0	0
Powers et al, 2011		176	11	0	0	0
Powers et al, 2011		18	4	0	0	0
Powers et al, 2013		904	.	0	0	0
Powers et al, 2018b		7081	1	1	0	0
Rivera et al, 2011		860	.	0	0	0
Romesberg et al, 2015		106	.	0	0	0
Shadad et al, 2017		53	2	0	0	0
Stecher et al, 2021		56	.	0	0	0
Stockdale et al, 2007		483	4	0	0	0
Stockdale et al, 2007b		572	.	0	0	0
Tan et al, 2023		65	0	0	0	0
Taylor, 2010		69	8	0	0	0
Taylor, 2014		127	9	0	0	0
Taylor, 2017a&b		402	67	0	0	0
Taylor et al, 2020		185	21	0	0	0
Trottier, 2011		25	.	0	0	0
Trottier, 2010		200	10	0	0	0
Wang et al, 2014		149	2	0	0	0
Wathen et al, 2021		45	0	0	0	0
Windle et al, 2010		39	3	0	0	0
Yandell et al, 2018		19	0	0	0	0
Placements		**21401**	**10877**	**21350**	**21278**	**21278**
	• <500 tubes	**3024**	**1182**	**2973**	**2901**	**2901**
	• ≥500 tubes	**18377**	**9695**	**18377**	**18377**	**18377**
Events	**• All**		**169**	**1**	**5**	**3**
	• <500 tubes		**33**	**0**	**5**	**3**
	• ≥500 tubes		**136**	**1**	**0**	**0**

% risk per tube	**• All**	**1.6**	**0.0005**	**0.023**	**0.014**
	• <500 tubes	**2.8**	**0**	**0.17**	**0.10**
	• ≥500 tubes	**1.4**	**0.0005**	**0**	**0**
	• P-value	**0.004**	**ns**	**0.0002**	**0.009**

*pneumonia or other major complications.

Annex 6: References for Appendix 2.

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