

Systematic Review

A scoping review of clinical practices and adherence to UK national guidance related to the placement and position confirmation of adult nasogastric feeding tubes

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ABSTRACT

Introduction: The administration of nutrition or medication into the lungs or pleura via a misplaced nasogastric feeding tube is considered a never event. Despite guidance from the National Patient Safety Agency and NHS Improvement this never event is regularly reported. Confirmation of correct placement and correct use of nasogastric tubes requires appropriate actions and decisions by a multidisciplinary team.

Methods: A scoping review identified 43 records that discussed and supported nasogastric tube misplacement as a Never Event. Searches were completed using Web of Science, CINAHL, Google Scholar, British Nursing Index (BNI), as well as selected journals. A further manual search revealed 22 publicly available NHS Trust policies related to nasogastric feeding tube procedures. Items generated between 2011 and 2020 were considered eligible. A thematic analysis was completed to assess adherence to guidance and the practices in place across the NHS.

Results: Three key themes were identified as part of the review: referral and authorisation of radiography, examination description, and visualisation of the nasogastric tube tip. Large variations in practice were identified. While there is recognition of national guidance, records showed inconsistency and lacked the required detail to ensure patient safety.

Conclusion: Despite classification as a never event, it is apparent that there is still room for improvement and further guidance in ensuring patient safety with respect to nasogastric tube insertion.

Implications for practice: Practice requires further standardisation whilst also ensuring optimisation and safety. Guidance should address in depth imaging authorisation, language and exact standards of acceptability for imaging the full length of the nasogastric tube.

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Introduction

Introduced in 2009 by the National Patient Safety Agency (NPSA), a never event is defined as a patient safety incident that is preventable through adherence to guidance and safety recommendations.¹ The intention was to improve patient safety through monitoring and publishing data on safety incidents and action on learning from error.² The introduction of feed, medication, or saline

flush, through a misplaced nasogastric tube (NGT) remains a cause of harm and fatality in the NHS, with 18 never events in 2019 alone.³ This suggests that processes are still not fail-safe despite a long timeline of alerts and guidance issued by the NPSA and NHS Improvement, NHSI (2016)⁴ to enhance safety.

The NPSA NGT supporting information⁵ provides procedural guidance and is explicit about the importance of observing the guidance. Despite these efforts, investigations of prior never events suggests that there is a lack of adherence to these guidelines. Misinterpretation of radiographic imaging by junior medical staff was identified as a key theme linked to fatalities.⁵ Specifically, there have been failings in correctly stating the location of the tip and

Abbreviations: NGT, Nasogastric feeding tube; ScR, Scoping Review.

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assessing the correct radiograph. In addition, poor out of hours (OOH) practice is a contributory factor.^{3,6}

By nature of the procedure, it is not uncommon for a relatively broad range of professions to be involved in NGT placement, from the decision to place to the eventual safe use of the NGT. In the UK, insertion is usually performed blindly, following an initial pH assessment of gastric aspirate to determine whether the NGT is correctly sited in the stomach. Radiography is often relied upon as a second line method of confirmation where aspirate cannot be obtained or is unreliable due to the possibility of medication altering the pH. Radiographic imaging must optimally depict the path of the NGT using a correctly applied technique to enable correct interpretation and authorisation for feed or medication to commence.

To improve patient safety, we must understand how this never event is still able to happen. This scoping review identified three key areas contributing to this failure: adherence to national guidance, the working practices in place to minimise never events and documentation including consideration of the role of the radiographer.

Methodology

The scoping review (ScR) was conducted following the five-stage framework designed by Arksey and O'Malley.⁷ They are believed to be the first to have designed the ScR framework which consists of 5 principal stages. This framework has also been adapted by the Joanna Briggs Institute (JBI).⁸ In 2020, Peters et al.⁸ proposed an enhancement of the framework to enable alignment between stages so that each element is congruent and aligned to the research question. This recommendation was used alongside the Arksey and O'Malley⁷ framework (Fig. 1) as it supports transparency, focus and aligns with the PRISMA extension for scoping reviews (PRISMA-ScR).⁹ The Population/Problem, Concept, Context (PCC) research tool was used to determine the research questions (Table 1).

Search strategy & eligibility criteria

The focus of the investigation was NG tube practices, as represented through documentation, and adherence to the UK guidelines, so the search was restricted to literature considering English language and UK based work only. Searches were limited to records published between 2011 and 2020 to ensure that old documentation was not compared to current guidance.^{4,5} Records were retrieved from a variety of sources; literature included primary research, peer reviewed articles, educational work and conference abstracts related to nasogastric feeding tube procedures where radiographic imaging was mentioned. Databases were selected based on their coverage, their inclusion of related subject areas; and journals selected based on topic related disciplines. Conference abstracts based on clinical audits were included where they met the inclusion criteria. Searches were also conducted to identify relevant NHS policy documents and guidance, best practice guidance,

protocols, and standard operating procedures (SOPs). The search was limited to include documentation from 10% (n = 22) of UK NHS Trusts to make the data manageable and to capture a range of local practices.

Documents without a date of publication were also included if considered to make a valuable contribution. Documents accepted included those based on enteral feeding, orogastric feeding or nasogastric feeding tubes.

The search strategy used to identify relevant literature is identified in Table 2. Boolean operators were used to combine key words, to expand and refine the search appropriately.

After applying the search strategy, screening of results was undertaken systematically with alignment to the pre-defined inclusion criteria. Duplicates were removed, followed by review of titles and abstract eligibility screening. Remaining records underwent a full text analysis against the inclusion and exclusion criteria. The reference lists of the Web of Science Core Collection records were manually scanned to identify further relevant records. Although the quality of the records was considered, a scoring tool such as CASP was not applied as the review aimed to identify all relevant records available and aimed to capture and provide insight into what practices existed and how it correlated with guidance.

Key elements of the literature were extracted and collected using Microsoft Excel as the data collection tool. This enabled the development of key themes for analysis and cross-referencing to the NPSA and NHSI guidance.^{4,5}

Results & discussion

Records were screened according to the Scoping Review extension to PRISMA (PRISMA-ScR)⁹ using the defined eligibility criteria. The outcome of the screening process is identified in Fig. 2. After duplicates were removed, and the assessment of eligibility completed, this left 43 records for inclusion.

Demographics, aims of the literature, and themes aligned to the NPSA⁵ and NHS Improvement⁴ guidance were extracted. It was anticipated that some quantitative data would be collected, notably where quantitative research was analysed on topics such as sensitivity and efficacy. Separate documents were created to enable mapping of themes across policies and literature records. Thematic analysis was mainly deductive as the themes of national guidance were known. Although the quality of the records was considered, a scoring tool such as CASP was not applied as the review aimed to identify all relevant records available. The PCC grid identified the following key questions:

1. Does documentation and literature demonstrate adherence to national guidance?
2. What working practices and processes exist to minimise never events?
3. Do local procedures acknowledge the role of Radiographer within their documentation?

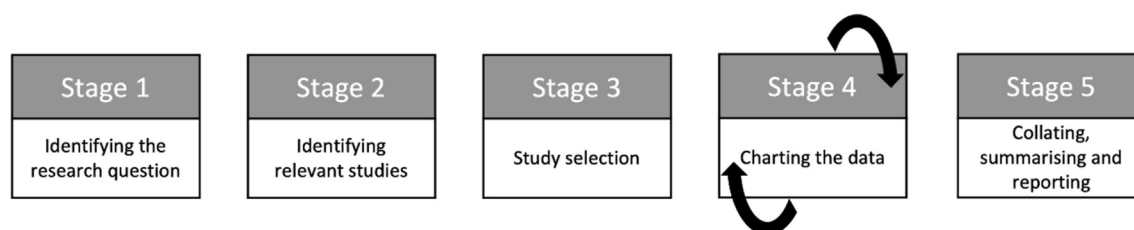


Figure 1. Arksey & O'Malley⁷ framework incorporated with Peters et al. (2020)⁸ methodological enhancement. Each stage was checked for alignment with the research question and aims as recommended.⁸ Stage 4 is considered an iterative and continuous process.

Table 1

The problem/population, concept and context (PCC) grid used to define the extent of the scoping review. The term ‘documentation’ is used as a collective term to represent local guidelines and protocols, and standard operating procedures.

Problem/Population	Concept	Context
Misplaced nasogastric feeding tubes in adult patients. Adherence of documentation to national guidance Diagnostic radiographers and multi-disciplinary team members involved in nasogastric tube procedures.	Patient safety and Never Events. Working practices and processes. The role of the radiology workforce and interaction with the multi-disciplinary team.	NHS hospital setting (UK) Adult in-patients: critical and non-critical care. Radiology/radiography

Table 2

The search strategy and search terms employed in this scoping review. Clinical Radiology and Radiography journals were searched manually via Science Direct.

Search/Database	Search terms
Google scholar	‘Nasogastric feeding tube never event NPSA’ ‘Nasogastric feeding tube protocol radiology NHS’
Web of science core collection & CINAHL	1. (Nasogastric feeding tube*) AND (Radiographer OR X-ray OR Imaging) 2. (Nasogastric Feeding tube*) AND (NPSA OR Never Event*) 3. (Enteral Feeding) AND (X-ray OR Imaging)
British nursing index (BNI), clinical radiology and radiography	Nasogastric feeding tube

Within this section the themes discussed provide insight into recent variations in adherence to guidance and perceptions of the capabilities of imaging; which exist years later following published guidance on this topic area.⁴

Theme: referral and authorisation of radiography

The need for documentation of the purpose of imaging is described within both key guidance documents.^{4,5}

“The request form must clearly state that the purpose of the x-ray is to establish the position of the nasogastric tube for the purpose of feeding”⁵

“X-ray request forms clearly state that the purpose of the x-ray is to establish the position of the nasogastric tube for the purpose of feeding or the administration of medication”⁴

The majority of Trust documents mention justification of the imaging referral, with a high frequency using identical or similar language to that in the NPSA document,⁵ thereby reflecting widespread consideration of national guidance to inform local practice. Most require information on the purpose of the NGT (i.e. feed, fluid or medication delivery). Omission of the purpose for feeding in 10 documents may be attributed to the fact that it is assumed.

In addition, the purpose of imaging should also be clear since there are differences in practice for a check of an NGT and a chest x-ray (CXR). Clear statement of purpose allows the Radiographer to demonstrate the tube length and tip.¹⁰ In their single centre retrospective review of imaging referrals, Snaith and Flintham¹¹ noted that 777 out of 1137 examinations (68.3%) were requests to solely check NGT position with only 91 (12%) stating feeding as the purpose as advised by the NPSA.⁵

The pH of aspirate should also be included to enable referral justification.¹² Analysis of the policy documents in this scoping review showed that there are variations in local practice. A small number of NHS documents noted the need to document aspiration attempts.^{13–17} Exclusion of aspirate attempts may be attributed to varying opinions regarding safe cut-offs amongst clinicians, as literature is heterogenous in terms of evidence of different upper limits of pH. 59% of policy documents (*n* = 13) adhere to the NPSA⁵ by stating pH with a cut-off of 5.5 as a first line method to confirm gastric placement, however this figure was reflected in only 38% of the literature reviewed. There is also debate regarding the reliability of the aspirate pH value, with the majority supporting a pH

of 5.5 or below, though 7 policy documents and 5 literature records refer to a lower threshold pH of 5. A single record applies a pH cut-off of 4.0¹⁸ which appears to be based on a NHS report¹⁹; advising that a cut-off of 4.0 would reduce the risk of feeding where the tube was misplaced in the oesophagus.

Some local policies also require citation of tube length at the nostril, with a length under 50 cm or over 60 cm not being justified for x-ray without a reason supporting it.²⁰ The NPSA⁵ does advise length documentation but does not explicitly require this information on imaging referral documents. This is also true of the need to document attempts or inability to apply pH verification, though clinicians are advised to document procedural details in patient notes or specifically designed NGT procedural forms.^{4,5} Providing information about tube length and pH value of aspirate on a request for imaging may enable faster vetting and justification, leading to provide more timely imaging.

Radiography is used as a first line investigation in some centres, if the patient has dysphagia, altered anatomy, or surgery to the head or neck.¹⁵ These are recognised as misplacement risks by the NPSA.⁵ Some policies permit radiography as an initial check method where there is doubt regarding pH,^{21,22} clinical judgement¹⁷ and concerns regarding pH readings^{21,22} and the patient's condition.^{23,15} Other documents permit first line use in critical care patients^{20,24} and those of reduced consciousness.²⁵ This could be associated with those patients requiring a chest x-ray to assess potential pathology and to image the NGT simultaneously. There are however differences in the technical criteria for chest x-ray and NGT position check x-ray and attempting to achieve an image that is diagnostic for both objectives may be problematic.

Since referral information impacts the interpretation of the clinical reasoning and consequential imaging considerations, this theme suggests future scope to develop more detailed referral guidance with relevant professional body input and inter-professional collaboration to address the areas noted. The evidence of varying levels of detail and requirements could pose delays to imaging at a local level due to conflicting perception of adequate justification, though this review cannot prove whether and how this is affecting clinical teams.

Theme: request for chest x-ray (CXR) or NGT check: What is the problem?

Approximately half of the literature records refer to the NGT radiographic verification procedure as a chest x-ray or CXR, with

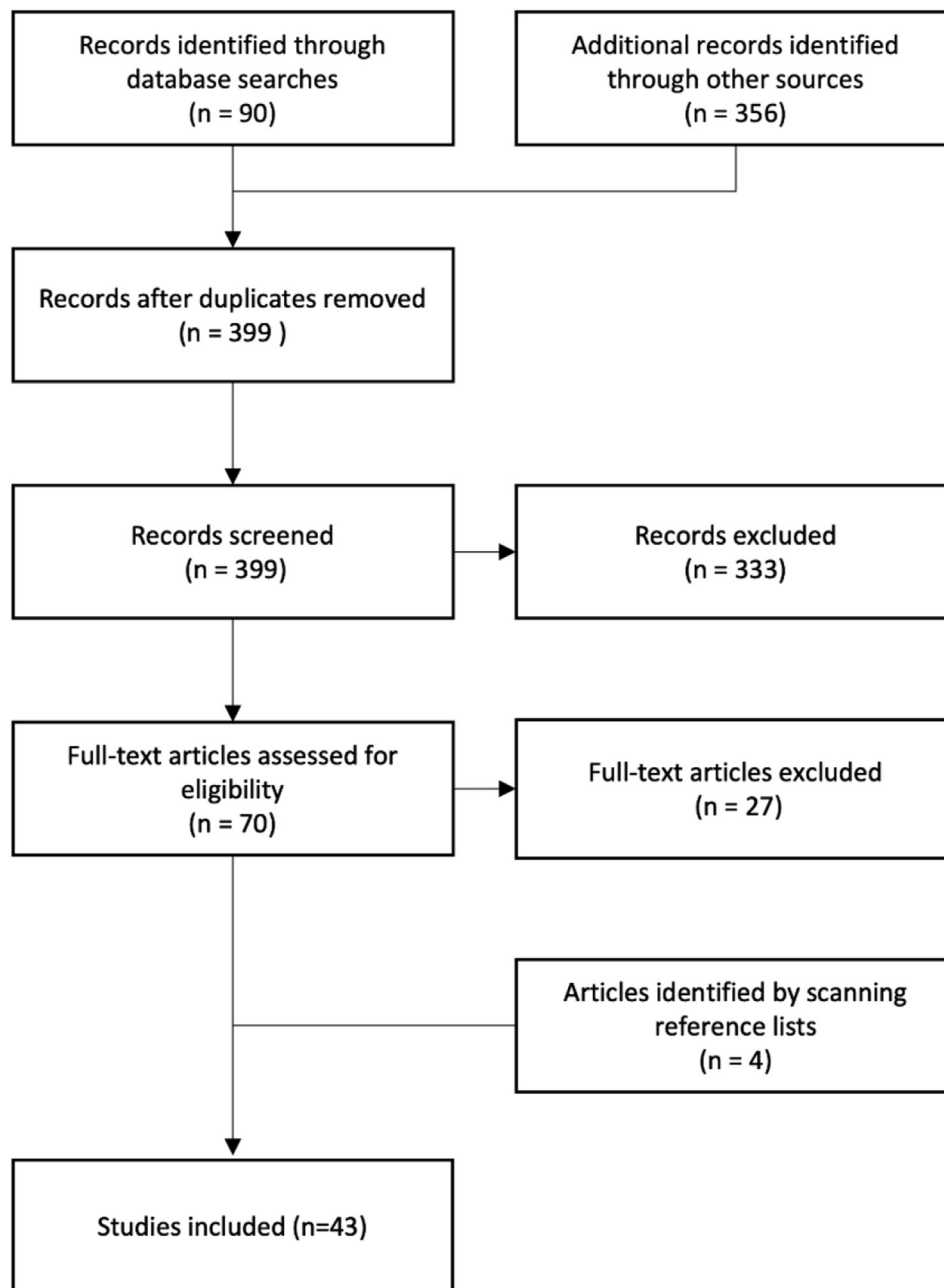


Figure 2. The PRISMA-ScR flowchart for this scoping review. The broad and manual nature of the scoping review resulted in some duplicate records; titles were generally misleading and a large number of records were removed following review of the abstract.

remaining records naming it a chest x-ray or NGT check. Analysis of the policy documents found a higher incidence of the use of chest imaging terminology ($n = 15$, 68%) which may be attributed to the term chest x-ray used by both the Royal College of Radiologists in audit templates as well as the SoR's 2012 NGT guidance.²⁶ All policies which note the need for a specific NGT verification code or form, do not use the term chest x-ray or CXR, with one particular local policy noting its difference.²² One exception is a single centre which uses the term chest x-ray in two of their policies^{13,14} despite requiring a unique exam code for the referral.

Variation in examination name or terminology was highlighted in an independent 2020 report by the Healthcare Safety Investigation Branch⁶ stating “the language and choice of image request matters”. The report⁶ came following the case of a patient who was

fed via a misplaced NGT, and comments on examinations wrongly associated with chest radiography within trust policies, thus recognising the potential for error. Literature suggests that there could be limited understanding of the technical differences between a chest x-ray and NGT check, with suggestion that *standard* chest x-rays and viewing screens can be used to detect Corflo tubes.²⁷ However other authors recognise the significance of terminology, exemplified via the implementation of a unique examination code for NGT checks.²⁸

Apart from one source, literature does not focus on the presence of additional clinical indications which accompany a NGT position verification request. This single source²⁹ expresses the efficiency of simultaneous NGT checks along with chest imaging upon ITU admission, noting it as more reliable than pH verification. Of

concern, there is no caveat explaining the requirement for clear aims of imaging to be stated such that imaging technique is adapted. Whilst it is acknowledged that the source used²⁹ was solely the conference abstract of a centre's audit, its content does highlight a need for further consideration into examination differentiation.

The NPSA guidance⁵ does not explore the common scenario where the referrer has additional clinical indications arising at the same time. Examples of this are follow-ups of a respiratory pathology or a line insertion. Since this scoping review did not identify how to safely manage such requests, it is recommended as an area for national and clinical guidance to address, since it may alter how the image is acquired and evaluated for diagnostic acceptability. Currently there are no image quality criteria for NG Tube check images.

Review of this theme has identified potential issues with the choice and consistency of language used in documentation, providing insight into why never events may still occur if the guidance is ambiguous or uses terms that can be misinterpreted. This theme highlights that there should be clear differentiation between the understanding and application of the use of the term NGT check as opposed to chest x-ray. The lack of information and guidance related to the context of additional clinical information related to the chest can be seen as an opportunity for radiography and radiology professional bodies to advise and collaborate with others to address this area and inform future practice.

Whilst using an examination code to identify NGT check referrals can facilitate reviewing imaging history and reporting; there is no evidence to suggest that its use guarantees application of the correct technique and communication of examination type inter-professionally. Education may play a part in demonstrating the role of language and potential issues related to referral clarity both within the radiography profession and inter-professionally.

Theme: visualisation of the nasogastric tube tip

A low number of records ($n = 7$) derived from literature note a definitive need to view the tip of the NGT. This may explain the guidance to include as much of the abdomen as possible⁵ as it may not be apparent how far the NGT extends beyond the diaphragm until imaged. Information about the length of the inserted NG tube and the length of the tube externally visible at the time of placement would be valuable additions to the imaging referral so that the radiographer may minimise unnecessary exposure of the patient if it is apparent that the tube has moved since insertion. Lamont et al.¹⁰ state the need to view the tip of the NG tube and provide a 10 point checklist for viewing radiographs including assessment of the tube length, checking for coiling in the oesophagus or pharynx. Another literature source found radiology reports noting the tip as being in the stomach despite it not being visible, where a third of images showed the tube length beyond the inferior limits of the radiograph.¹¹ Although it is a good indication of gastric placement when seen below the left hemidiaphragm, they also discuss some evidence for this being unreliable. Patient head position if flexed or extended may alter the observed location of the tube,¹¹ raising another potential image evaluation criteria. A publication by Roe et al., in 2017³⁰ and their Trust policy in 2019²² support assessing whether the tip is 5 cm below the diaphragmatic hiatus, to ensure it is not at the gastro-oesophageal junction, which poses a risk of aspiration. Other authors³¹ support this notion in a 2021 publication, stating a minimum distance of 10 cm below the distal oesophageal sphincter. Prior to the 2021 study, the same lead author explained that underestimating the tube distance can prevent successful gastric aspirate for pH checking and can cause feed to exit the lateral tube holes at a higher point and thus feed into the oesophagus.³² This

explains why the tube may appear to be in the stomach but will require repositioning to be deemed safe.

This theme reveals that there is little consensus from guidance or literature regarding a definitive correct location of the NGT tip; with little discussion of its inclusion and optimal location. The limited literature citing the need to include the tube tip suggests an area for guidance and education to address. Instruction to include as “much as the abdomen as possible”⁵ may be interpreted differently and so the measured distance cited in some literature and guidance could play a role in quantitative research and future guidance.

Limitations

Future work could consider the management of paediatric patients. A methodological improvement would introduce a quality assessment of the documentation that was included in the scoping review. There is scope for further work comparing the guidance from other professional bodies and their agreement with those representing the radiography profession and national guidance.

Conclusion

This scoping review has revealed variation in adherence to national guidance. Although some protocols go beyond the minimum standard recommended, this scoping review demonstrated that guidance may be interpreted and applied differently at a local level. There is variance in practice regarding imaging referral and authorisation, examination terminology and the visibility of the tube tip on acquired images. These variations may negatively impact cross discipline agreement and teamwork, potentially reducing efforts to avoid never events.

Insight provided by analysis of the data in this scoping review would suggest that there should be a review of the team working and protocols to ensure that NG placement is positioned and evaluated in a timely manner, that the radiographer is educated to acquire a diagnostic image and that the interpreter of the image is properly educated in terms of the technical and diagnostic criteria. A multidisciplinary approach to develop appropriate criteria for image evaluation would be worthwhile.

Recommendations

1. Standardisation of referral guidance is recommended, with more explicit instructions with regards to the information that should be provided on imaging referral documents. Cross professional agreement is important to minimise risks and inconsistencies.
2. There is a lack of clear differentiation between chest radiography and imaging for NGT position verification. Future local and national guidance should consider the issues with varied terminology and should consider the HSIB report⁶ related to examination terminology.
3. NGT checks are often requested alongside assessment of respiratory pathology. Flow charts, technique and image appraisal will all be affected by the referral type and so future guidance should differentiate between such requests and ensure that procedural expectations and roles are clear to all in each context.

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Conflict of interest statement

None.

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