Gastrostomy guidelines: a rapid review

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An **Evidence Check** review brokered by the Sax Institute for the NSW Agency for Clinical Innovation

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This rapid review was brokered by the Sax Institute for the NSW Agency for Clinical Innovation.

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Contents

1 EXECUTIVE SUMMARY

This Evidence Check review is a summary of existing evidence of specific questions related to gastrostomy tube care in adults and paediatrics. The review was conducted by The Alfred Hospital's Nutrition and Gastroenterology Departments on behalf of the NSW Agency for Clinical Innovation's (ACI) Gastroenterology and Nutrition networks. Government and key agency guidelines were reviewed and a literature review was conducted on relevant papers from the past 10 years. Most evidence was of a low grade or in some cases not available. Few randomised control trials have been conducted likely due to ethical constraints and research challenges. Despite the lack of high grade evidence sound recommendations can still be, and have been, made as they are based on consistent expert opinion obtained from the literature and will ensure best practice that is safe. Further research is required in most aspects of gastrostomy tube care especially after care.

The insertion of a gastrostomy tube is overall a safe procedure with rates of complication estimated in the range of 8–30% depending how a complication is defined. Serious complications occur in less than 5%.

Commercially prepared formulas are recommended for enteral tube feeding. Home-made formula including blenderised, pureed and vitamised foods are not recommended due to increased risk of bacterial contamination and nutritional inadequacy.

A gastrostomy tube should be moved in and out and rotated 24 hours post initial insertion in order to avoid adhesion. Excessive tension between the skin and the external flange should be avoided as this can increase risk of stoma site complications. A distance of 2–5mm is recommended from external flange to skin level. The minimum period of time from initial insertion of a gastrostomy to commence administration of enteral feed is 2–4 hours in adults and 4-6 hours in paediatrics. Patients should be positioned at greater than 30-45^0 from horizontal during enteral feeding and for 30–60 minutes post cessation of feed.

Initial gastrostomy tubes should not be replaced before 30 days post insertion. In the case of accidental dislodgement, tubes should be urgently reinserted under endoscopy or image guidance. Replacement of a gastrostomy tube with a mature tract (>30 days) can be done blindly at the bedside by an adequately trained health care professional. Gastrostomy tubes (initial and replacement) should be monitored and changed as deemed necessary by the treating health care professional. Programmed tube changes are not necessary.

The gold standard to confirm the position of a gastrostomy tube is gastrograffin radiocontrast study or endoscopy. As this is not cost effective or always practical, confirmation of replacement gastrostomy tube position in a mature stoma should ideally be done by using a combination of methods including pH and aspiration. If there is any concern or doubt about replacement tube position or the tube is accidently pulled and/or partial displacement is suspected, a gastrograffin radiocontrast study must be performed.

All patients and their carers should receive pre-discharge education from members of the multidisciplinary team (MDT), including verbal and written information. A specialist MDT should monitor patients regularly (minimum 3–6 monthly once stable or more frequently if there is any change in clinical condition or transitioning to oral nutrition).

2 Background and introduction

The objective of this Evidence Check review by the NSW Agency for Clinical Innovation (ACI) was to critically appraise and summarise existing evidence on gastrostomy tube care for the purpose of standardising care for children and adults with a gastrostomy tube. The aim of the review was to answer specific policy questions, and provide a short report including relevant recommendations and gaps in the evidence. The Sax Institute, on behalf of the ACI's Gastroenterology and Nutrition networks, commissioned the Alfred Hospital's Nutrition and Gastroenterology departments to conduct the Evidence Check review.

3 Description of search and selection criteria

Prior to commencing this review, government and key agency guidelines were examined. This included:

- American Society for Parenteral and Enteral Nutrition (ASPEN): Enteral Nutrition Practice Recommendations 2009
- Australasian Society of Parenteral and Enteral Nutrition (AuSPEN): Clinical Practice Guidelines for Home Enteral Nutrition in Australia
- British Association of Parenteral and Enteral Nutrition (BAPEN): Guidelines for enteral feeding in adult hospital patients 2003
- Dietetic Association of Australia (DAA): Enteral nutrition manual for adults in health care facilities 2011
- European Society of Enteral and Parenteral Nutrition (ESPEN): ESPEN guidelines on artificial enteral nutrition – Percutaneous endoscopic gastrostomy (PEG) 2005
- European Society for Paediatric Gastroenterology Hepatology and Nutrition (ESPGHAN): A practical approach to paediatric enteral nutrition 2010
- National Institute for Health and Care Excellence (NICE): Nutrition support in adults: oral nutrition support, enteral tube feeding and parenteral feeding 2006
- NSW Agency for Clinical Innovation (ACI) Nutrition Network: Guidelines for Home Enteral Nutrition (HEN) Services 2nd Edition 2012.

A search was conducted on MEDLINE, CINAHL and Cochrane databases with the search limited to the English language and those dated between 2003 and current. A keyword search was conducted using the following search terms:

- Medline: Gastrostomy OR gastrointestinal intubation AND enteral nutrition
- CINAHL: Gastrostomy OR gastrostomy tube AND enteral nutrition
- Cochrane: Gastrostomy.

A total of 698 abstracts were reviewed and considered for retrieval (623 from Medline, 60 from CINAHL excluding Medline, 15 from Cochrane including two reviews and 13 articles). Fifty five were related to the review questions and were retrieved in full text and reviewed against the questions being asked. The reference lists of the relevant full text papers were reviewed and any papers that appeared applicable were also retrieved and assessed against the relevant questions. Although it was suggested to exclude case studies, case series and commentaries/reviews the researchers felt it was necessary to include some of these when reviewing the literature due to the poor body of evidence. Each paper was read and where relevant to the questions asked summarised in table form indicating the study methods, findings and commentary (see Appendix 1). The summary of each paper was reviewed by two dietitians and the gastroenterology fellow for the medically relevant questions and evidence quality graded against the NHMRC evidence hierarchy available in the 'NHMRC additional levels of evidence and grades for recommendation for developers of guidelines' (Appendix 2). Recommendations were then formed by clinicians and graded according to the NHMRC grades of recommendations. The definitions used by the NHMRC are as follows:

- Grade A: Body of evidence can be trusted to guide practice

- Grade B: Body of evidence can be trusted to guide practice in most situations
- Grade C: Body of evidence provides some support for recommendation(s) but care to be taken in its application
- Grade D: Body of evidence is weak and recommendation must be applied with caution
- Recommendations were made with the Australian context in mind. Referencing was done using Endnote in Vancouver HQ style.

4 Question 1

Recommendations	NHMRC Grade	References	Page(s)
What are the main risks associated with gastrostomy in relation to:			
1a. the insertion of a gastrostomy tube?			
• The insertion of a gastrostomy tube is overall a safe procedure including in the paediatric population. The most common complications include abdominal pain, peristomal infection (11%) and leakage (10%)	C	(1–8)	n/a
• A single shot of prophylactic antibiotics is effective for decreasing peristomal infection post gastrostomy tube insertion	C	(9,10)	
• Percutaneous method of gastrostomy tube insertion is overall safer than surgically inserted gastrostomy	C	(6,7,9,10)	
• Radiologically and endoscopically inserted gastrostomy tubes are equally safe	C	(11,13)	
• Radiologically inserted gastrostomy (RIG) tube insertion carries a higher morbidity and mortality in head and neck patients ineligible for a endoscopically inserted gastrostomy tube	C	(12,13)	
1b. the formation of a gastrostomy?			
• The rates of complication with the formation of gastrostomy are estimated in the range of 8–30% depending how a complication is defined. Acute and severe complications such as perforation, serious abdominal haemorrhage or peritonitis requiring significant surgical intervention is less than 0.5	C	(11,14,15,16,17)	n/a
• Free air visible on X-ray is observed in up to 38% but significant intervention is needed in less than 5%. Pneumoperitoneum is not regarded as a complication unless there is evidence of adverse consequences	C	15	
• Buried bumper syndrome, a progressive impaction of the inner bumper of the tube in the mucosa of the gastric wall, is a rare long term complication of percutaneous endoscopic gastrostomy (PEG) insertion	C	(18–21)	

Recommendations	NHMRC Grade	References	Page(s)
What are the main risks associated with gastrostomy in relation to –			
1c. feeding method (blenderised feeding versus commercial enteral formula)?			
• Home-made formula including blenderised, pureed and vitamised foods are not recommended in adults and paediatrics patients due to increased risk of bacterial contamination and nutritional inadequacy. Home-made formula has been shown to have a higher viscosity , higher osmolality and inconsistent and uncertain nutrient composition when compared with commercially prepared formula	B	(15,22–300)	15–18
• Commercially prepared formulas are recommended for enteral tube feeding	B		
• Commercially prepared liquid enteral nutrition formulas should be used in preference to reconstituted powdered formulas whenever possible as it reduces the risk of contamination	C		
• Dilution of enteral formula may affect osmolality and delay achieving nutritional targets	C		
• Do not dilute or mix anything into an enteral formula as it increases the risk of bacterial contamination	B		
• Avoid flushing a gastrostomy tube with substances other than those prescribed, including acidic fluids (fruit juices or carbonated drinks) due to increase chance of blockages.	D		
• Sterile water is advised for water flushes in immune compromised patients and patients in critical care. Tap water is acceptable for use in all other patient groups	C		

5 Question 2

Recommendations	NHMRC Grade	References	Page(s)
What is the evidence for best practice in the following aspects of use of gastrostomies:			
2a. Anatomical position/site of gastrostomy tube placement? • Gastrostomy site selection is based on identification of transillumination at the skin surface. Although there is limited evidence, most experts favour placement on the anterior wall in the left upper quadrant towards the antrum. This theoretically lowers the risk of reflux	D	14	
2b. Frequency and method of checking the position of a gastrostomy tube? **i. In the first 1–2 days after insertion** **ii. Ongoing** • It is recommended that prior to the administration of anything via the gastrostomy tube that the external length of the tubing (markings at skin level) is checked to ensure it has not changed since initial insertion. If the tube position has changed significantly, use the other methods of confirming the position outlined in Question 2h	C	(30)	n/a
2c. Optimal time frame from initial insertion to rotation of the gastrostomy tube (for different tube types)? • A gastrostomy tube should be moved in and out and rotated 24 hours post initial insertion in order to avoid adhesion	D	(14,27)	n/a
2d. Optimal level of 'tightness' (or tube fit) of gastrostomy tubes? • A distance of 2–5mm is recommended from external flange to skin level • Excessive tension between the skin and the external flange should be avoided as this can increase risk of stoma site complications	C B	(14,15,22,27,28, 31–38)	19–22

Recommendations	NHMRC Grade	References	Page(s)
What is the evidence for best practice in the following aspects of use of gastrostomies:			
2e. Minimum period of time from initial insertion that the gastrostomy tube be used? **i. For water flushes** **ii. For enteral feeding** • The minimum period of time from initial insertion of a gastrostomy to commence administration of enteral feed is: o 2–4 hours in adults o 4–6 hours in paediatrics • No evidence exists to support water (sterile or non-sterile) trials prior to the administration of enteral formulae It should be noted that most studies are done with percutaneous endoscopic gastrostomy tube insertion versus radiologically or surgically inserted gastrostomy	 B B	(14,22,27,30,34–36,38–45)	23–26
2f. Positioning of patients from enteral feeding via a gastrostomy tube (adults and paediatrics)? • Patients should be positioned at greater than 30-45^{o} from horizontal during enteral feeding and for 30–60 minutes post cessation of feed	B	(15,22,28,30,38,46–50)	26–28
2g. Optimal timeframe for replacing (a) initial and (b) subsequent tubes in patients needing ongoing tube feeding? • Initial gastrostomy tubes should not be replaced before 30 days post insertion. In the case of accidental dislodgement, tubes should be reinserted as soon as possible under endoscopy or image guidance. Gastrostomy tract maturation usually occurs within 7–10 days or up to 30 days in compromised patients i.e. malnutrition, steroid treatment etc • Replacement of a gastrostomy tube with a mature tract (>30 days) can be done blindly at the bedside by an adequately trained health care professional • Gastrostomy tubes (initial and replacement) should be monitored and changed as deemed necessary by the treating health care professional. Programmed tube changes are not necessary i.e. elective change at fixed period of time • Planned change of a PEG to a low profile device in paediatric patients is recommended 6–12 weeks post	 C C C	(30,33–35,38 44, 47, 51–55)	

Recommendations	NHMRC Grade	References	Page(s)
What is the evidence for best practice in the following aspects of use of gastrostomies:			
2h. Method of confirming the position of a replacement gastrostomy tube?			
• The gold standard to confirm the position of a gastrostomy tube is gastrograffin radio contrast study or endoscopy	A	(22,28,33–36,38,47,52, 55–62)	33–38
• As the gold standard is not cost effective or always practical, confirmation of replacement gastrostomy tube position in a mature stoma (>30days) should ideally be done by using all of the following methods in combination			
o Aspiration of gastric content however this may be limited as the inability to obtain an aspirate does not always indicate tube is in incorrect position	D		
o Flush with 30–50mLs of water and ensure no resistance/pain	D		
o pH testing of aspirate (where available) with universal indicator paper to ensure pH <5. This method is unreliable if the patient is on gastric acid suppression medication or continuous enteral feeding	D		
o Confirmation of external length (if not low profile device)	D		
o Rotate tube and perform in out play to ensure free movement of tube in the tract	D		
• If there is any concern or doubt about replacement tube position, a gastrograffin radiocontrast study must be performed. This would include if firm resistance is encountered or several attempts are required to reinsert the tube	C		
• Air insufflation to confirm tube position is unreliable and should not be used	B		
2i. Method of removing a gastrostomy tube when no longer needed?			
• A gastrostomy tube should not be removed until the tract is mature (>30 days)	C		
• Always confirm the method of removal with the tube manufacturer via product information or contacting the company directly	D	(14,15,22,33,34,38,63)	38–41
• Gastrostomy tubes with a collapsible internal flange can be removed safely by external traction/vigorous pulling at the bedside. However in paediatric patients, these tubes are commonly removed by endoscope to reduce trauma	D		
• Gastrostomy tubes with a rigid internal flange should be removed via endoscopy. There is a risk of small bowel obstruction with the cut and pass method, so it should not be used	C		
• Gastrostomy tubes with a balloon retention device can be removed gently using external traction at the bedside once balloon deflated	C		

Recommendations	NHMRC Grade	References	Page(s)
What is the evidence for best practice in the following aspects of use of gastronomies:			
2i. Method of removing a gastrostomy tube when no longer needed?			
• Gastrostomy feeding tube introducers should not be re-inserted into the feeding tube while the tube is in the patient due to risk of tube perforation and serious injury	D		
2j. Management of a gastrostomy tube that has been dislodged or accidently removed?		(15,22,33,34,38,53,58,59, 64–66)	42–48
• Foley catheters are not recommended as a replacement feeding tube. They do not have an external retention device increasing risk of migration and obstruction and are not designed to withstand gastric acid	D		
• If the gastrostomy tube is accidentally pulled and/or partial displacement of the internal bumper is suspected in an immature stoma tract, a gastrograffin radiocontrast study or endoscopy should be performed	D		
• If displacement is confirmed the device will need to be removed (as per recommendations in Question 2i) and replaced with the appropriate gastrostomy tube			
• For gastrostomy tubes with a mature stoma tract, preservation of the tract is the priority by replacing the tube as soon as possible and securing with tape. If the tube is not available a Foleys catheter can be used for this purpose	D		
• For replacement of a gastrostomy tube with a mature stoma, a balloon gastrostomy tube can be inserted at the bedside within the recommended window of 12–24 hours (before the stoma closes). This avoids the need for further endoscopy	D		
• Low profile replacement gastrostomy should be considered in patients who are at high risk of inadvertent tube dislodgement	D		
• There is no evidence to support recommendations for the bedside confirmation of partially dislodged tubes that may require replacement			

Recommendations	NHMRC Grade	References	Page(s)
What is the evidence for best practice in the following aspects of gastronomies:			
2k. Optimal timing, content and method of patient education of patients with new gastrostomy tubes?		(15, 22, 27, 34, 41, 47, 52, 53, 67–70)	
• All patients and their carers should receive pre-discharge education from members of the multidisciplinary team (MDT), including verbal and written information, on the management of their gastrostomy feeding tube	D		
• It is recommended that a standard checklist is used for education of patients before discharge. Hospitals should have a local policy to facilitate safe discharge of a patient with a new gastrostomy	D		
• Gastrostomy tube training and information should include: o Tube type including how it is held in place, balloon volume where applicable, how often it needs to be changed, how it will be changed and by whom o Checking stoma site daily to ensure no infection/redness/gastric leakage o Checking tube position daily (length at skin level) to ensure tube has not migrated into stomach o Tube rotation and gently move in and out daily o Check balloon water (where applicable): if deemed necessary and/or suitable according to local policy o Tube flushing to avoid blockage o Gastrostomy tube and stoma cleaning: wash daily with warm soapy water, rinse and dry thoroughly o No dressing is required o Infection control recommendations including hand washing o How to prevent and recognise complications including infection, tube blockage, tube dislodgement o Contact details including who to contact 24 hours per day and in an emergency o Follow-up arrangements o Community support group information for paediatric patients and their families			

6 Question 3

Recommendations	NHMRC Grade	References	Page(s)
What is the evidence that supports the use of the following in gastrostomy use:			
3a. Undertaking 'water trials' before starting enteral feeds via a gastrostomy tube? • There is no evidence regarding undertaking water trials before starting enteral feeds via a gastrostomy tube			
3b. Checking gastric residual volumes to identify feed intolerance? • The evidence for checking gastric residual volumes (GRVs) in patients with a gastrostomy tube is lacking. Most research on GRVs is conducted in mechanically ventilated patients with nasogastric feeding tubes in the critical care setting • Checking of GRVs in patients with a gastrostomy feeding tube in the critical care setting should be managed according to local hospital policy. There is no evidence to recommend checking GRVs in patients with a gastrostomy tube outside of the critical care setting	D	(15, 30, 38, 44, 71–75)	56–59

7 Question 4

Recommendations
The researcher is to provide an expert opinion on:

4a. The key principles for managing patients with a gastronomy tube

- Insertion of a gastrostomy feeding tube should be considered if long term enteral nutrition is anticipated for greater than 4–6 weeks (14, 15, 27, 30, 41)
    - Insertion of a gastrostomy feeding tube should be considered early in those conditions that commonly require long term enteral nutrition including neurological disorders (e.g. motor neurone disease, dysphagia post cerebrovascular accident or acquired brain injury, cerebral palsy, slow recovering vegetative state), chronic pulmonary disease (e.g. cystic fibrosis), upper GIT cancers (e.g. head and neck, oesophageal), failure to thrive (paediatrics)and metabolic disorders
- Informed consent for a gastrostomy tube insertion should include information on after care requirements. It should not be limited to the procedure alone
- Primary goals of long term enteral nutrition are to maintain body weight or facilitate weight gain where clinically appropriate, correct nutritional deficiencies, rehydrate, promote growth in children with growth retardation and prevent deterioration and/or improve QOL
- People requiring gastrostomy tube feeding should have their tube inserted and replaced by health care professionals with relevant skills and training
- Patients with a gastrostomy tube should receive coordinated care and be monitored regularly (minimum 3–6 monthly once stable or more frequently if there is any change in clinical condition or transitioning to oral nutrition) by a specialist multi-disciplinary team. A review should encompass all aspects of the patients nutrition management including anthropometry, nutritional requirements, biochemistry, clinical condition(s) including bowels / medications, psychosocial status including QOL, nutritional intake (oral and/or enteral), gastrostomy feeding tube and stoma. The management of the gastrostomy tube and nutrition are not independent of each other and therefore should be managed concurrently
- Permanent removal of a gastrostomy feeding tube (i.e. termination) should be considered when the patient is clinically stable and able to consume adequate oral intake in order to maintain their goal weight and other nutrition parameters. The time frame for removing the tube is variable and needs to be decided on an individual basis by the MDT. Consideration should be given to the patient's underlying condition, nutritional status, possible future needs for nutrition support and personal wishes
- Prior to discharge, a patient and/or their carer must be deemed competent, by an appropriately trained health care professional, to independently perform the required tasks associated with gastrostomy tube feeding
- Health care professionals caring for patients with a gastrostomy tube should have adequate training and experience in order to be competent with the tasks required of their role

Recommendations
The researcher is to provide an expert opinion on:

- Bedside gastrostomy tube changes should only be performed by health care professionals who have adequate skills and training. This should include a formal extended scope of practice training program for clinicians where gastrostomy tube changes are not considered a basic core competency. Competencies should include: tube identification including removal method; identification and management of complications post initial insertion; risks and complications associated with tube removal and replacement and their management; and when escalation of care is required
- Prior to the administration of anything down a gastrostomy tube, confirmation that the markings at skin level are consistent with usual reported length is recommended to ensure no tube migration (in or out)
- Discharge/transfer information should include date of initial tube insertion, date of last replacement (where applicable) current tube type, brand, french size, markings at skin level and follow up arrangements. This information should be provided to all care givers including treating physician, GP, community nurse and allied health clinicians
- Health care organisations providing care to patients with a gastrostomy tube should have local policies and guidelines in place to ensure best practice across the continuum of care including patient selection, selection process for optimal access route where options available i.e. PEG versus RIG, immediately pre and post gastrostomy tube placement guidelines (i.e. prophylactic antibiotics, oral care, wound care), education pre and post insertion, systems for routine monitoring and review and tube termination
- The insertion of a gastrostomy feeding tube in Australia is considered a medical treatment for the purposes of the Medical Treatment Act (1988). A competent patient, or an agent or guardian acting on behalf of an incompetent patient, can therefore refuse insertion, replacement and/or use of a gastrostomy feeding tube
- As there is no evidence to support recommendations for the bedside confirmation of partially dislodged tubes that require replacement, the following is suggested to be done by an adequately trained clinician to confirm if a tube is dislodged:
  - Check if the balloon is intact via aspiration of balloon contents
  - Confirm external markings with usual position
  - Rotate the tube and perform in out play to ensure no resistance
  - If tube position is still unclear arrange a gastrografin radiocontrast study or endoscopy

Recommendations

The researcher is to provide an expert opinion on:

4b. The main indications and contra-indications for enteral feeding via gastrostomy tubes
Indications:

- Functional gastrointestinal tract(GIT)
- Inability to take adequate nutrients orally for greater than 4–6 weeks
- Common conditions requiring a gastrostomy feeding tube include:
  - Neurological disorders e.g. motor neurone disease, dysphagia post cerebrovascular accident or acquired brain injury, cerebral palsy, slow recovering vegetative state
  - Chronic pulmonary disease e.g. cystic fibrosis
  - Upper GIT cancers e.g. head and neck, oesophageal
  - Failure to thrive (paediatrics)
  - Metabolic disorders

Contraindications:

- Non functioning i.e. ileus, bowel ischaemia
- Incurable disease in terminal phase (prognosis less than three months)
- Advanced dementia
- Anorexia nervosa
- Severe ascites
- Extensive tumour infiltration of stomach
- Incorrectable coagulation disorders
- Inability of patient and/or carer to comply with required care including appropriate home environment
- Competent and fully informed patient refusing insertion

References: 14,15,27,30,35,41,70

Other:

- Consideration should be given to each individual patient's clinical situation, likely effect on quality of life and the patient's wishes
- Algorithms to guide decision making on gastrostomy tube insertion should be used with caution in order to allow for individual assessment and variation between patients

Recommendations

The researcher is to provide an expert opinion on:

4c. The main indications and contraindications for replacing gastrostomy tubes

Indications:

- Tube dislodged including balloon failure
- Tube not functioning adequately including if it is leaking, blocking regularly or blocked and unable to restore patency
- Tube showing signs of significant deterioration such as cracked, flattened, discoloured, split
- Probability that tube is causing stoma site complications i.e. skin level device too tight and causing pressure necrosis
- Patient factors such as replacement with a skin level device for aesthetic reasons in children and adolescents, growth in children with a skin level device that becomes too tight

Contraindications:

- Immature stoma (less than 30 days)
- Where an advanced care plan is in place that states that tube replacement is not to occur
- Competent, fully informed patient refusing replacement

Other:

- A system for routine and regular gastrostomy tube review should be in place in all settings where gastrostomy tube patients are managed
- Whenever a gastrostomy tube is changed, consideration should be given to the optimal tube type for the patient. For example, skin level device for patients who are agitated, collapsible or rigid internal fixation device versus balloon retention device when very long term nutrition therapy is anticipated
- In our opinion/experience, if gastrostomy tube dislodgement occurs and replacement cannot occur immediately, where possible the stoma tract should be maintained via insertion of a Foley catheter by an adequately trained health care professional until the tube can be replaced. This must not be used for administration of any nutrition, hydration or medication
- In our opinion/experience, if the internal retention device breaks off during tube removal it should be removed during the procedure where possible i.e. endoscopy. If this is not possible, it can be left to pass in stool. The patient should be monitored closely for signs of bowel obstruction until the fragment is seen in the stool

Recommendations

The researcher is to provide an expert opinion on:

4d. Who should be involved in the care of patients with gastrostomy tubes across all stages from pre-insertion to permanent removal?

	Dietitian	Specialist nurse	Gastroenterologist	GP	Pharmacist	Speech pathologist	Paediatrician
Assessment	√	√	√	√		√	√
Planning	√	√	√				√
Implementation	√	√	√		√		
Supply and delivery	√						
Monitoring	√	√	√	√		√	√
Termination	√	√	√	√		√	√

- A social worker may be required in some circumstances

Recommendations

The researcher is to provide an expert opinion on:

4e. Algorithms/clinical pathways that could be followed when deciding on the need to remove a gastrostomy tube

The use of an algorithm to decide on the need to remove a gastrostomy feeding tube is not recommended as it risks not providing individualised care that meets the patients care needs.

When considering gastrostomy tube termination the following questions should be considered by the MDT:

- Does the patient have a mature stoma (greater than 30 days)? If no, tube should not be removed
- Can the patient eat and drink safely?
- Is the patient consuming adequate oral intake in order to maintain:
  - Goal weight
  - Hydration
  - Micronutrients (with or without supplementation)?
- Is the patient clinically stable?
- What are the patient's likely future health care needs that could impact their ability to meet nutritional requirements?
- Does the patient and/or their carer understand the implications of tube removal and the process including risks if reinsertion is required?
- What are the patient's wishes?

Other considerations not covered in this review:

- Fasting times pre gastrostomy insertion and replacement
- Gastronomy tube material i.e. silicone versus polyurethane
- How to unblock a gastrostomy tube
- Management of stoma site complications such as excoriation, infection, hyper granulation tissue
- Medication administration
- Re-use of hardware i.e. giving sets, syringes
- Frequency of hardware i.e. giving sets, syringes
- Closed system versus decanted enteral formulae
- Hang times of enteral formulas

8 Appendix 1: Summaries of evidence

Question 1C

What are the main risks associated with gastrostomy in relation to: feeding method (blenderised feeding versus commercial enteral formula)?

Source of evidence	Summary	Grading
ASPEN (2007)[30]	**Water:** • The acute or chronically ill patient with any presumed alteration to their GI barrier function may be at higher risk from exposure to non-sterile products including water • Nosocomial infections from contaminated tap water sources have been demonstrated in critically ill and immune compromised patients and are best avoided • For infants, the recommendation is to flush the enteral access device with sterile water before and after administration of enteral formula and medication • All water supplied for feeding preparation must meet federal/national standards for drinking water and be sterile • Contamination of enteral formula with micro-organisms can occur at any point throughout the production, preparation, storage or administration process posing a significant risk to the patient – particularly if immune compromised, at either end of the age spectrum or with an alteration of GI barrier function **Contamination of enteral nutrition (EN) formula:** • There is a high risk of microbial contamination of powdered formula (infant), especially once these products are reconstituted with water at room temperature • Risk associated with preparation and storage of EN formulas (liquid or powder). As many as 30–57% of enteral formulas prepared at home have been found to be contaminated with bacteria • Closed EN systems/formulas reduce the risk of contamination **Practice recommendations:** • Sterile, liquid EN formulas should be used in preference to powdered, reconstituted formulas whenever possible (A) • Use a purified water or sterile water for irrigation supply for formula reconstitution and medication dilution. Consider purified water for enteral access device flushes in at-risk patients(B)	Best practice guidelines

Source of evidence	Summary	Grading
DAA (2011)[22]	• Water is considered the accepted flushing fluid and there is no evidence presented that tap water flushes pose any risk to humans • Sterile water for irrigation, commercially filtered or cooled boiled tap water have been suggested for use in particular patients who may be at increased risk including immune compromised patients • Avoid flushing with acidic fluids (fruit juices or carbonated drinks like cola/soda water/mineral water), which can make the chances of blockages more likely • Diluting an enteral feed, or mixing anything into the feed, is not recommended as it increases the risk of bacterial contamination of feed • No evidence exists to suggest that diluting feeds is helpful in tolerating tube feeding; in fact, absorption of the formula may be less effective if it is hyperosmolar. Diluting the formula may simply delay achieving nutritional targets • Avoid flushing with other substances. Ideally only enteral feeding formula should be used. Any other foods or fluids should be of a smooth consistency and well diluted, and the tube well flushed with water before and after • Home-made tube-feeding formulae are not recommended. They are time-consuming to prepare, and it is very difficult to ensure that such a formula is nutritionally adequate • Recipes for formulae made from whole foods with a blender, are more likely to cause tube blockage and tube deterioration, are usually not nutritionally complete, and pose a markedly increased risk of bacterial contamination • 'Closed system' or 'ready-to-hang' formulae are available, where the formula is presented in a container that can be used as a reservoir and connects aseptically to the giving set by a recessed spike. Closed feeding systems have been found to have a lower risk of bacterial contamination compared with an open system, where the formula is decanted into the administration reservoir	Best practice guidelines

Source of evidence	Summary	Grading
BAPEN (2003)[15]	• Diluting feeds risks infection and osmolality difficulties • Careful measures are needed to avoid bacterial contamination of feeds which can give rise to sepsis, pneumonia and urinary tract infections, as well as gastrointestinal problems. (grade A) • Producing feeds locally by using a liquidiser is not recommended due to the high infective risks and potentially poor nutritional quality in terms of micronutrient provision	Best practice guidelines
ESPGHAN (2010)[27]	• Use of pureed (blenderised) normal foods for tube feeding is not encouraged because of risk of nutritional inadequacy and microbial contamination. Microbiological contamination of enteral tube feeds given to children at home and in hospital is common • Children who are immune compromised, such as those undergoing chemotherapy or when the gastric acid barrier is impaired, may be more vulnerable	Best practice guidelines
Mokhalalati et al. (2004)[26]	• Blenderised tube feedings (BTF), typically containing normal and natural foodstuffs such as milk, eggs, meat, soft fruits and vegetables, are compared with commercially prepared formulas in regards to microbial safety, nutritional content and physical properties • 18 samples of BTF from hospitals collected (six samples from three hospitals) • Nutrient content of BTF varied significantly within and between sites (16–50%) versus 4–7% in commercially prepared (CPF). The mean concentration of most nutrients varied by 2–3 fold • BTF had considerable differences between actual and expected nutrient concentrations, reaching statistical significance in 12 nutrients. CPF were within 10% of expected • BTF samples had higher viscosity and osmolality than CPF • All samples of BTF had a detectable plate count that increased significantly over four hours. No plate counts were detected in the CPF samples • CPF should replace BT	III - 3

Source of evidence	Summary	Grading
Klek et al. (2011)[25]	• Home enteral tube feeding by a nutrition support team reduces morbidity and is cost effective • 203 (164 adult and 39 paediatric) patients from 12 centres in Poland. 154 (61%) gastrostomies • All patients who had received homemade blenderised diets for 12 months prior to starting and continuing commercial formula for the following 12 months were selected for the study population • During first 12 months (retrospective analysis): Bolus 50–100mL 5–6 times daily and supervision by their GP and no special nutrition • Second 12-month period (Prospective analysis): complex nutritional care by a nutrition support team, initial home visit by team for assessment & advice, routine review every 2–3 months plus emergencies. Diets were bolus and continuous • Outcomes: number of hospital and intensive care unit (ICU) admissions decreased, decreased length of stay in hospital and ICU and associated costs. Increased feeding tube occlusion in second period – how this was reported/recorded unclear Decreased prevalence of pneumonia, respiratory failure, urinary tract infection (UTI) and anaemia • Hypothesise the reasons for this were use of commercial preparations were nutritionally complete, diet intake tightly controlled, improved monitoring	IV
Sullivan et al. (2004)[29]	• Analysis of nutritional quality and viscosity of blenderised enteral feed from four hospitals in Philippines • Two samples of blenderised feeds (one standard and one modified) were collected from each hospital on three occasions and analysed for macronutrients, micronutrients (vitamin A, riboflavin, pyridoxine, calcium, magnesium, sodium, iron, potassium, zinc) and viscosity • Two of four hospitals used Ensure powder as standard formula. Two used whole foods only. All used whole food(s) for specialised formulas • Significant variability for most nutrients within hospitals and between them however carbohydrates only were statistically significant. Eleven of 17 had undetectable levels of vitamin A, riboflavin, zinc or pyridoxine • Measured values were lower than expected for all values but calories only were statistically significant • Viscosity was 2.3–45060, mean viscosity (2617 counts per second more than 43 times higher than typical formulas (60 cps). Three samples were too viscous for analysis. Viscosity was lower and more consistent when powdered formulas were used versus blenderised whole foods • Results may be due to poor adherence to recipe or losses during preparation and storage	IV

Source of evidence	Summary	Grading
Giacomini et al. (2009)[24]	• 297 adult PEG patients in multiple centres with experience across sites in Italy. Prospective enrolment • Vital status and onset of complications (redness/irritation, skin lesion, bleeding, infection, hyper-granulation, nausea, vomiting, abdominal distension, diarrhoea, constipation) assessed via phone call at one week, one month and 6 months post insertion • The risk of complications were significantly lower in patients receiving industrial preparations versus homemade solutions (6.7% v 41.9%, p=0.0027) • No details in article about per cent on homemade versus commercial solutions or complication types	IV
Campbell (2006)[23]	• Poor outcomes from feeding microbial contaminated formulas include the following: diarrhoea, GI colonisation, pneumonia, infection, prolonged hospital length of stay and mortality. • Aside from high microbial load, homemade or institutionally prepared blenderised feedings have been found to be unsatisfactory because of their uncertain nutrient composition, poor homogeneity and high viscosity that impedes flow through feeding tubes (13–17)	Review/expert opinion
Shepley J (2008)[28]	• Cooled, freshly boiled water or sterile water from a freshly opened container must be used for patients who are immune compromised	Expert opinion
Manufacturers recommendations[78]	• **Abbott Nutrition:** Blenderised/vitamised/pureed foods down the feeding tube is not recommended as it can increase the risk of tube blockage	n/a

Question 2D

What is the evidence for best practice in the following aspects of use of Gastrostomies :
What is the optimal level of 'tightness' of gastrostomy tube? (Distance between skin and external flange, physical signs)?

Source of evidence	Summary	Grading
DAA (2011)[22]	• The external fixation plate or flange keeps the tube from rubbing around the PEG site, protecting the skin from damage, and also prevents the tube from being drawn further into the gut by peristalsis. It should not be removed, and should be replaced if faulty • Generally the PEG tube is rotated for the first time 24 hours after insertion, and the external flange left in its initial (quite tight) position for the first 5–7 days to encourage tract formation, after which it can be loosened to allow 1–2mm movement in and out	Best practice guidelines
BAPEN (2003)[15]	• Loosening and rotating a gastrostomy tube may prevent blockage through mucosal overgrowth and may reduce peristomal infection (grade C)	Best practice guidelines
ESPGHAN (2010)[27]	• PEG aftercare, including wound cleansing, change of first dressing and adaptation of external fixation (loosening of the external fixation plate to allow free movement of the tube of at least 5mm) is performed by a specialist nurse after 24 hours	Best practice guidelines
ESPEN (2005)[14]	• Directly post initial gastrostomy placement: The external fixation plate should initially be subjected to very low traction, without tension, overnight • The tube must have at least 5mm of free movement when the Y-compress is inserted under the external flange	Best practice guidelines

Source of evidence	Summary	Grading
Westaby D et al. (2010)[38]	• The final position of the internal and external bumper of the PEG tube is important to prevent local site complications such as infection and buried bumper. These complications are more likely if the fit is too tight. Animal studies suggest play of 10mm is optimum • The safe and accurate placement of PEG tubes requires strict adherence to surface marking recognition, the use of a safe-tract technique and optimal positioning of the retaining bumpers • Avoid excessive tightening of the external fixator, which may cause local ischaemia and encourage infection • Repeated lateral movement of the tube is thought to contribute to enlarging the stoma (contributing to leakage) so this should be avoided by ensuring the external fixator is fitted at no more than 1 cm from the skin. • Temporary tightening of the external fixator may help manage leakage but in the long term, this is likely to cause pressure necrosis and exacerbate the problem • The position of the external fixator should be adjusted as the thickness of the anterior abdominal adipose tissue layer increases with improved nutrition • A buried bumper can be prevented by avoiding excessive tension on the internal bumper. This can be achieved by maintaining at all times a 1 cm degree of 'play' between the external fixator and the skin site	Best practice guidelines
Itkin et al. (2011)[35]	• To prevent buried bumper syndrome in trans-oral gastrostomy tubes, the external bolster should be positioned in a manner such that the tube can be pushed in and out at least 1cm. One retrospective study demonstrated a significant reduction in tube-related complications in a group of patients with a loose external bolster	Evidence based guidelines
DeLegge et al. (2006)[32]	• Eight mongrel dogs each with 3 x 24Fr PEG tubes inserted each with external fixation device 0, 1 and 4cm from abdominal wall • Partial migration of one of eight PEG tubes with external bolster at 0cm. Tissue inflammation was worse in dogs with bolster at 0cm. Nil leakage • Tract formation can occur without direct apposition of the gastric wall to the abdominal wall	III-3

Source of evidence	Summary	Grading
McClave & Jafri (2006)[36]	• Excessive tension between the internal and external bolster is the biggest factor in generating buried bumper syndrome. Excess tension between the bolsters reduces blood flow to the tissue and leads to pressure necrosis and mucosal ischaemia • Prospective, randomised control trial by Chung allowed endoscopists to place the external bolster with either a tight fit where external bolster opposed the anterior abdominal wall or loose fit. Mean length between the bolsters on radiograph was 4.9 +/- 1.1cm v 11.6 +/- 2.3cm. Eleven of the 12 who developed cellulitis, myositis and peristomal drainage were in the tight-fit group • Normally the fibromucoid tract matures within 1–2 weeks of PEG placement. This maturation process may be delayed for as long as 3–4 weeks in patients who are malnourished or receiving concurrent steroids	Review
Warriner L, Spruce P (2012)[37]	• The external fixator should be managed according to the manufacturer's guidelines, with a daily check to ensure that it is positioned approximately 2mm away from the skin. It should be rotated once per week if it is not sutured in place (Best 2004) • Management of the external fixator varies according to the type of device insitu. With a PEG the external fixator should be uncoupled and moved away from the skin. The tube should then be advanced and rotated weekly before the external fixator is repositioned correctly. If a balloon gastrostomy is used, the flange will need to be moved away from the skin. The tube should then be advanced and rotated, and the flange repositioned correctly • Over-granulation is a common complication found in gastrostomy exit sites which is thought to be caused by friction from a poorly secured tube and with excess moisture from fluid leakage causing skin breakdown in the area	Review/expert opinion

Source of evidence	Summary	Grading
Best C (2004)[31]	• There is greater evidence on the implications of tightly fitting external devices and the development of buried bumper syndrome • External fixation device should be 2–3mm away from the abdominal wall, after the PEG is gently pulled back out of the abdomen until resistance is felt • If the patient gains weight, it may be necessary to adjust the position of the external fixation device • Where the PEG is positioned in a fold of skin and irritation or 'digging in' is a problem, a dry keyhole gauze dressing placed under the fixation device may provide relief. The fixation plate will need adjusting to accommodate the dressing and the site needs cleaning and monitoring daily • Recommendations based on expert opinion and manufacturers guidelines: range 2mm to 1cm. Manufacturers range from no advice to 1–2mm • Evaluation of the patient in both a sitting and standing position to ensure that the fixation device does not cause deep indentation in the skin • The Winchester and Eastleigh NHS trust has adopted 2–3mm away from the abdomen but each patient is monitored so it is not too tight (to avoid tissue necrosis and ulceration) or too loose (to avoid excess movement in and out of the stomach) • It should not be moved for five days following PEG insertion except if the patient is dehydrated at the time of insertion as rehydration will cause the tissue to expand resulting in tightening • When a PEG is inserted, it takes 2–3weeks for development and healing of the fistula. During this time the external fixation device should not be released unnecessarily as it may delay the formation of the fistula	Review/expert opinion
DeLegge (2006)[33]	• After initial placement the external bolster of the PEG tube is maintained 1–2cm from the anterior abdominal wall to avoid tissue compression and wound breakdown • Excessive tightening of the external bolster against the abdominal wall can cause tissue ischemia, wound leakage and necrotising fasciitis	Review/expert opinion

Source of evidence	Summary	Grading
Haywood S (2012)[43]	• There is no consensus on exactly how far from the abdominal wall the external bolster should be positioned. The ideal is that the tube cannot move freely in the fistula tract nor fit too tightly. Haywood states that in her experience if the external flange sits 1cm from the abdominal wall (including post procedure) it usually meets these requirements but local policies may differ. If the tube is held in place too tightly there is a risk of pressure damage, which can result in necrosis, haemorrhaging, buried bumper syndrome and/or leakage of gastric contents. If it is held too loosely and the tube moves freely, the tract may not form properly; this can give rise to leakage of gastric contents, peritonitis, infection or over-granulation at the site • Once the fixation plate is in the correct position it should not be moved for the first seven days, unless clinically necessary	Review/expert opinion
El-Matary et al. (2008)[34]	• An external bolster should be placed loosely on the skin. Too much traction on the tube or pushing the external bolster too tight on the skin surface, may lead to buried bumper syndrome	Review/expert opinion
McClave & Neff (2006)[59]	• The PEG tube should be able to be pushed in and out 1cm if the external bolster has been placed properly • Excessive tension, with compression of the tissue between the internal and external bolsters, is the most critical factor in development of mucosal pressure necrosis, buried bumper syndrome, and the breakdown of the PEG tract. • A prospective study by Chung and Schertzer 1990, compared one group of PEG patients with tight placement of the external bolster (mean PEG tube tract length 4.9 ± 1.1cm), to a group of similar patients with loosely placed external bolster (mean PEG tube tract length of 11.6 ± 2.3cm). Nearly all the complications of cellulitis, fasciitis, myositis, GI bleeding and catheter extrusion were seen in 13 of the 48 patients with the tightly fit traction group. Only one out of 67 developed complications in the loosely fitted PEG group • Animal studies have confirmed that although a loosely fit bolster may delay maturation of the tract slightly, a fibrous pseudotract does form even with longer length tubes • The bolster should be set to allow 1 cm of movement to and fro. A more loosely set bolster allowing greater movement may cause subtle breakdown of the PEG tract	Review/expert opinion
Shepley J (2008)[28]	• NICE (2006) recommend: the tube is rotated and pushed gently into the stoma each week to prevent buried bumper syndrome; for tubes retained by a balloon the water volume of the balloon should be checked weekly	Expert opinion

Question 2E

What is the evidence for best practice in the following aspects of use of gastrostomies:
Minimum period of time from initial insertion that the gastrostomy tube be used: for water flushes, for enteral feeding?

Source of evidence	Summary	Grading
NICE (2006)[41]	• Percutaneous endoscopic gastrostomy (PEG) tubes which have been placed without apparent complications can be used for enteral tube feeding four hours after insertion (A) o Four randomised controlled trials (RCTs) met the inclusion criteria: Enteral nutrition 24 vs. four hours. No significant differences for mortality or complication rates	Best practice guidelines
DAA (2011)[22]	• After the insertion of a gastrostomy feeding tube, a water trial is sometimes used to check for leaks before feed is given. Feeds are usually commenced 12–24 hours after insertion of the tube, but there is no evidence to support delaying feeds for more than 3–4 hours after PEG placement. • Early feeding may help to reduce the risk and/or duration of ileus.	Best practice guidelines
ESPGHAN (2010)[27]	• After PEG insertion, the recommended time for resumption of feeding (adults and children) is inconsistent and varies from 1 to 24 hours • In adults, early (3–6 hours) feeding is safe as next day feeding, is well tolerated, and decreases length of hospital stay • Early re-feeding starting after 6 hours and resumption of full feeding within 24 hours is also safe in children.	Best practice guidelines
ASPEN (2009)[30]	• A PEG tube may be utilised for feedings within several hours of placement: current literature supports within two hours in adults and six hours in infants and children (B)	Best practice guidelines
ESPEN (2005)[14]	• Delivery of nutrients via the tube can commence within 1–2 hours after placement of a PEG system	Best practice guidelines
Westaby et al. (2010)[38]	• To optimise feed provision post-procedure it is important to establish a post-procedural protocol • The timing of feed commencement after tube placement has been the subject of a number of randomised studies and, with the proviso that there are no overt complications of placement, feeding can be safely introduced four hours post procedure (McCarter 1998) • The total calculated nutrient supply can be provided from the outset unless the patient is considered at risk of refeeding syndrome • In the absence of complications, feeding can be started four hours after tube insertion (Ib, strength A)	Best practice guidelines

Source of evidence	Summary	Grading
Bechtold et al. (2008)[40]	• Meta-analysis to analyse the effect of early feeding (≤4 hours) after PEG placement • Rationale for delayed feeding was to decrease risk of significant GRV's during the first day that may lead to aspiration and to decrease the risk of peritoneal leakage that may lead to peritonitis • Six RCT's (n=467) on adults that compared early (range 1–4 hours) versus delayed feeding after PEG placement included for complications, death <72 hours and significant increase in post procedural GRV's (60mL, 100mL, 50% of last volume administered) during day one • Complications were local infections, diarrhoea, bleeding, GERD, fever, vomiting, stomatitis and death. Aspiration NOT included. • Nil significant differences between complications (OR 0.86, 95%CI 0.47–1.58, P=0.63) or death (OR 0.56, 95%CI 0.18–1.74) Statistically significant increase in GRV's during day one was noted (OR 1.80, 95% ci 1.02–3.19 P=0.04) • Conclusion: Early feeding (<4hours) after PEG placement in adults may represent a safe alternative to delayed or next-day feedings. Although an increase in significant GRV's at day one was noted, overall complications were not affected	I
Szary et al. (2011)[45]	• Meta-analysis of RCTs regarding early <3 hours v delayed (>3 hours) feeding after placement of PEG tube in adults only • Five RCTs included in meta-analysis and graded with a Jadad score • Overall complication rate between early and delayed/next day feeding was not statistically significant [OR 0.78; 95% confidence interval (CI), 0.39–1.53; P=0.47] • No statistically significant difference was observed for death ≤ 72 hours after PEG placement between early and delayed/next day feeding (OR 0.60; 95% CI, 0.18–1.99; P=0.40) • No statistically significant difference was noted in the number of gastric residuals between early and delayed/next day feeding in the first 24hours)OR 1.46;95% CI, 0.75–2.84; P=0.27) • Initiating tube feeding in a timely manner reduces complications of poor caloric intake and nutritional deficiencies. Early feeding for those in intensive care units or severely malnourished is particularly important • Conclusion: Early tube feeing ≤3 hours after PEG placement has no significant differences to delayed or next day feeding in respect to complications, death in ≤72 hours or number of significant GRV's at day one	I

Source of evidence	Summary	Grading
Corkins et al. (2010)[42]	• Prospective, randomised trial, children (single site-hospital outpatients) • Compare feeding at three and six hours after PEG placement (60mL bolus) • Outcomes: change in abdominal girth before and one hour post initial feed, any vomiting, GRV before next feed • 40 patients: 20 in each group • Nil significant difference in any outcome • Two studies (Brown et al. 1995; Choudhry 1996) with >20 patients in each group found no difference in complication rates in patients fed three hours after placement compared with those fed the following day • Two studies (Nolan et al. 1994; Yarze et al .2001) infused water-soluble contrast into PEGs three hours after placement and found no leakage on x-ray of the abdomen • McCarter et al. 1998, found no differences in the incidence of complications or in GRV's when comparing more than 50 patients in two groups randomised to receive formula feeding four hours versus 24 hours after PEG placement • Kirby et al. 1986 reviewed their first 55 PEGs in adults and stated that they began a trial infusion of water at 2 hours after the procedure without increased complications	III-3
McCarter et al. (1998)[76]	• Randomised prospective study: assess the safety of early feeding after PEG placement • 112 patients referred for PEG insertion were randomised to begin tube feeding at four hours or 24 hours post placement. • The endoscopic technique, type of enteral formula, formula delivery method and evaluation of early and late complications were strictly controlled • Both groups were similar in age, gender, baseline nutrition and indications for PEG • Conclusion: Early initiation of PEG feedings is safe, well tolerated and reduces cost by decreasing hospital stay	III-3
Haywood (2012)[43]	• Patients are usually kept nil by mouth and PEG tube for fours after insertion to allow sedation to wear off. The tube should then be flushed with 50mL of sterile water. If flushing causes pain it should be stopped and the medical team informed immediately. If flushing does not cause pain it is safe to start using the tube	Review / expert opinion
Roche (2003)[44]	• PEGs can be used as soon as bowel sounds return; outpatients can begin PEG tube feeds six hours after placement	Review / expert opinion

Source of evidence	Summary	Grading
McClave et al. (2006)[59]	• Delivery of enteral nutrition with infusion of formula should be initiated within four hours of tube placement (Kirby, 1995) • Studies have shown that early initiation of feedings is well tolerated and minimises the duration of ileus after PEG placement • Feedings should be advanced quickly to goal over the first 24–48 hours • Appropriate tube flushes with water should be instigated immediately with feeding	Review/expert opinion
El-Matary et al. (2008)[34]	• There is convincing evidence that delayed use of the tube has no advantages over early feeding • The Stollery Children's Hospital, Alberta, US recommends use of the tube four hours after insertion, first sterile water and if tolerated, proceeds to formula	Review/expert opinion
Itkin et al. (2011)[35]	• Several prospective randomised trials have clearly demonstrated that early initiation of feeding after PEG (three hours, four hours and even immediately) is safe. Similar studies for transabdominal gastrostomy placement have not been performed however in some studies transabdominal access with endoscopic guidance initiation at 4–6 hours appeared to be safe	Evidence based guideline
Ali et al. (2011) [39]	• 1474 (28%) gastroenterologists returned the questionnaire • 41% participants aware of current literature • 8.8% initiated <3hours, 32.56% initiated 4–6 hours in general ward patients • Those aware of current literature more likely to initiate early feeding	Questionnaire on current practice

Question 2F

How should the patient be physically positioned for enteral feeding via a gastrostomy tube (adults and paediatrics)?

Source of evidence	Summary	Grading
DAA (2011)[22]	• Patient's head and shoulders must be elevated 30–45° above chest level and this should be monitored via observation continuously in acute care or at least every shift in stable patients • Upright positioning (head and shoulders >30° from horizontal) during feeds and >30 minutes after ceasing feeds • If patient physically agitated (e.g. during showering or patient transfers) stope feeds at least 30 minutes before transfers or vigorous physiotherapy	Best practice guidelines
BAPEN (2003)[15]	• To minimise aspiration, patients should be fed propped up by 30° or more and should be kept propped up for 30 minutes after feeding	Best practice guidelines
Westaby et al. (2010)[38]	• Gastrostomy-fed patients should be fed sitting upright or in a semi-recumbent position (propped 30° or more) and should maintain this position for 60 minutes after feeding	Best practice guidelines

Source of evidence	Summary	Grading
ASPEN (2009)[30]	• There is evidence that a sustained supine position (with flat head-of-bed) increases gastro-oesophageal reflux and the probability of aspiration • Torres et al.'s study in 1992 suggests that although aspiration is significantly more likely when patients are supine, it also occurs when they are semi recumbent • A similar study by the same research team found that gastro-oesophageal reflux occurred irrespective of body position; however a semi recumbent position protected against pulmonary aspiration of gastric content.(Note the latter study was with NG feeding) • A study of critically ill, mechanically ventilated, tube-fed patients found that 137 patients with a mean head of bed <30° had a significantly greater incidence of aspiration of gastric contents (as defined by finding pepsin in tracheal secretions) than did the 224 patients with a head-of-bed elevation ≥30° (34.7% vs 24.3% respectively, P<.001) • Another finding from this study was that the risk of pneumonia was more than four times greater in patients who were frequent aspirators compared with those who aspirated infrequently **Practice recommendations**: • Elevate the backrest to a minimum of 30°, and preferably to 45°, for all patients receiving enteral nutrition unless a medical contraindication exists (A) • Among the recognised contraindications to a semi-recumbent position are an unstable spine, haemodynamic instability, prone positioning and certain medical procedures (such as a central venous catheter insertion) • Use the reverse Trendelenbuerg position to evaluate the head of bed, unless contraindicated, when the patient cannot tolerate a backrest-elevated position (C) • If necessary to lower the head of bed for a procedure or a medical contraindication, return the patient to a head of bed position as soon as feasible (C)	Best practice guidelines
Castel H et al. (2005)[46]	• Cross-over, prospective trial in gastro ward • 16 stable adult PEG patients (requiring EN for >6 weeks) mostly with neurological disease • Reflux measured in supine and semi recumbent (45°) position with endpoint per cent time under pH 4 as most frequent complication of reflux is aspiration • Two subgroups: refluxers and non-refluxers • Outcome: position did not influence reflux based on time under pH4 in either subgroup	IV

Source of evidence	Summary	Grading
Scolapio (2007)[50]	• The supine position during enteral feeding has been shown to be a risk factor for gastric aspiration and pneumonia compared with the semi-recumbent position (in which the head of the bed is elevated at 45°)	Review/expert opinion
Metheny (2006)[49]	• Aspiration of gastric contents occurs to a significantly greater degree when patients are in a supine position than when in a semi recumbent position (45° backrest elevation) • Low head-of bed position (<30–40°) in critically ill patients with mechanical ventilation increased aspiration	Review/expert opinion
Roche (2003)[44]	• During feeds the patients should be sitting upright or lying down with the head raised 30–45°	Review/expert opinion
Metheny (2011)[48]	• Torres et al. 1992 demonstrated that a supine position increases risk of aspiration; the longer a patient is supine, the greater the risk of aspiration • Because of a variety of treatment needs, most patients cannot remain in a bed with the head elevated to a 30° or 40° angle every minute of the day. The goal is to minimise the amount of time a patient is positioned flat in bed • Recommendation: It is unnecessary (and even counter-productive) to turn feedings off during the brief period of time the bed is lowered to reposition a patient • This conclusion is supported by recent practice recommendations for enteral nutrition published by ASPEN 2009 • After the patient is repositioned it is imperative to quickly elevate the bed to the desired angle (30°, preferably 45°)	Review/expert opinion
Khair (2003)[47]	• To minimise the risk of reflux and aspiration, infants and older children should be tube fed using appropriate seating/chair. The child's head and torso should be elevated/propped up to 30° with pillows while tube feeding • Ambulatory pumps should be used wherever possible	Review/expert opinion
Shepley (2008)[28]	• Patients should be sitting up or semi recumbent (at least 30 degrees) during feeding. This position should be maintained for at least half an hour after feeding is completed to prevent reflux into the oesophagus, which can lead to aspiration pneumonia	Expert opinion

Question 2G

What is the optimal timeframe for replacing (a) initial and (b) subsequent tubes in patients needing ongoing tube feeding?

Source of evidence	Summary	Grading
ASPEN (2009)[30]	• Routine removal and replacement of a PEG tube is not necessary as patients have used the same PEG system for more than 10 years without complications	Best practice guidelines
Joanna Briggs Institute (2010)[53]	• Programmed tube changes are no more effective than changing as needed in preventing complications associated with PEG tubes (Grade D)	Best practice guidelines
Westaby et al. (2010)[38]	• Well cared for PEG tubes can remain clean and functional for a number of years; however, each manufacturer will give guidance about longevity and it is advisable to plan for an elective replacement rather than risk interruption of feeding as a consequence of tube malfunction • If the indwelling tube is removed, it is replaced by a new PEG tube or a balloon-retained device. Balloon-retained devices have the advantage of avoiding the need for further endoscopy; however this must be balanced against the reduced durability of these tubes	Best practice guidelines
Itkin et al. (2011)[35]	• Preventative maintenance of gastrostomy tubes that includes elective change at fixed period of time (3–6 months) is the standard practice in some places. This is more common in balloon tipped tubes because of the potential for balloon failure • Gastrostomy tract maturation usually occurs within the first 7–10 days but may be delayed as long as four weeks in the presence of malnutrition, ascites or corticosteroid treatment. A gastrostomy that is accidently removed during this period should be replaced by using endoscopy or image guidance, as the tract may be immature and the stomach and anterior abdominal wall can separate from each other, resulting in free perforation. If recognised immediately a new gastrostomy tube may be placed through or near the original gastrostomy site sealing the stomach against the anterior abdominal wall. If recognition is delayed, management consists of NG suction, broad spectrum antibiotics, and repeat gastrostomy placement in 7–10 days. Surgical exploration is reserved for patients with signs of decompensation or peritonitis	Evidence based guideline

Source of evidence	Summary	Grading
Graham et al (1996)[77]	• A prospective, randomised, non-blinded crossover study • Compared six months of routine PEG monthly changes with six months as needed in 26 patients • The study was conducted in a long term care facility in Canada. Study participants were initially assigned to either routine monthly tube changes or the PRN changes, based on randomisation schedule developed from a random numbers list • After six months they were crossed over to the alternate frequency of tube changes, the frequency of tube changes, presence of stoma site infection, antibiotic courses, episodes of fever and episodes of emesis for study participants was compared for each of the six-month periods • The only significant difference between the two study periods was 2.9 times more tube changes in the monthly changes group compared with the PRN change period • Programmed tube changes appear to have no benefit in preventing complication associated with PEG tubes. There were no statistically significant differences reported between groups in the occurrence of site infection, blockage and inadvertent removal	III-a

Source of evidence	Summary	Grading
Michaud L et al. (2004)[54]	• Prospective study: evaluation of tube longevity in children • Over a 2.5 year period, 165 balloon-type skin level devices were inserted in 84 children, adolescents and young adults aged seven months to 20 years • In all patients, the first skin-level device replaced a standard gastrostomy tube. The first skin-level device was usually inserted under general anaesthesia during removal of the initial gastrostomy tube, at least two months after its insertion • Additional replacement of the balloon-type skin-level device was performed without sedation or endoscopic procedure • No patient received a balloon-type skin-level device without a previous matured gastrostomy stoma • The mean longevity of the balloon-type skin-level device was five months (range 14 days to 14months), with 75% of devices removed within seven months • The most common reason for device removal was inner balloon rupture frequently associated with accidental removal or leak around the gastrostomy stem • No relationship was found between longevity of the gastrostomy and underlying disease, anti-secretory drug use or patient age **Discussion:** • Longevity of balloon may be influenced by several factors including volume of water used to inflate the balloon; gastric acidity; type of nutrition; number of daily uses; and candidiasis • Other factors that may influence longevity include location of the device, spasticity of the child, and gastric emptying time. These factors need to be assessed in future studies • No comparisons were made with other devices such as mushroom etc, however the longevity of the Bard mushroom-type button with an enlarged disc stabiliser was 8.5 months (Gauderer et al.) • The absence of pain and the ability to replace the balloon-type skin-level device without sedation is of great benefit. Replacement can be performed by the parents or even by the child without the need for hospital admittance	IV

Source of evidence	Summary	Grading
Kobak et al. (2000) [63]	• Retrospective review of 397 patient records for complications post gastrostomy removal • Initial PEG tube was removed after 4–6 weeks by traction, unless there was an internal crossbar present, in which case, the PEG was removed endoscopically. The PEG was then replaced with a Foley catheter or gastric button of appropriate size	IV
Taheri et al. (2011)[55]	• The PEG tract begins to mature 7–10 days after PEG placement but, in malnourished or immunosuppressed patients, this process can take much longer • If the gastrostomy dislodges in the first 7–10 days after insertion, possible approaches to management include immediate reinsertion, laparotomy or conservative treatment (cessation of oral intake, nasogastric suction and antibiotics) followed by reinsertion in 7–10 days • If dislodgement occurs after the tract is mature (>30 days), prompt replacement with a percutaenously placed replacement gastrostomy (G)-tube is recommended • There are few reports of intraperitoneal placement of a G-tube once the tract is mature. In this case series, three cases of peritonitis after replacement of an established PEG tube (tract present >1 month) are described: o Case 1: 67 year old, PEG for 12 months, tube dislodged and replaced by inexperienced caregiver o Case 2: 62 year old with MS, 18 month hospital stay, dislodged PEG replaced by surgical team with a balloon gastrostomy without issue, three months later tube dislodged and replaced 10 hours later and position not confirmed by any method o Case 3: 75 year old, PEG for dementia/cerebrovascular accident, PEG removed via traction removal method and replaced with balloon 48 days after initial insertion to allow caregiver to change in future. Unable to aspirate	Review
DeLegge(2006)[33]	• Replacement PEG tubes usually have a balloon-type internal bolster (or alternatively a distensible internal bolster that is stretched with a stylet) and can be inserted/pushed blindly through the gastrostomy site into the gastric lumen • With a distensible internal bolster, it is important to know the direction of the gastrostomy tube tract so that damage or rupture of the gastrostomy tract does not occur with the use of the stylet	Review/expert opinion
Roche (2003)[44]	• We replace tubes only when they develop problems such as frequent leakage	Review/expert opinion

Source of evidence	Summary	Grading
El-Matary (2008)[34]	• Change of the tube to a skin-level device is an easy and safe procedure • Buttons are easy to use and more socially acceptable, so many patients' families request this change as soon as possible • The change can happen once the tract around the tube is formed. It is completed in some centres as early as six weeks post PEG insertion • Generally it is recommended that skin devices are placed 12 weeks post insertion of primary PEG in paediatrics	Review/expert opinion
Burd A et al. (2003)[51]	• In children, the initial insertion is a tube-type gastrostomy but this may be converted to a skin-level device in about 6–12 weeks without forcibly separating the stomach from the abdominal wall	Review/expert opinion
Goldberg E et al. (2005)[52]	• Children's Hospital Philadelphia: Review of Service • 12 weeks post gastrostomy placement, the patient may return to radiology for the placement of an appropriate low-profile device • A dye study is completed to confirm intragastric placement after the first changing of the tube • The patient or caregiver is taught how to change balloon replacement gastrostomy tubes in the Family Learning Centre. If the family is uncomfortable with performing the routine changes of these tubes, they are referred to the Paediatric Enteral Access Clinic (PEAC) • All patients are advised to return to PEAC at least yearly for remeasurement of gastrostomy tube size. Any problems related to the gastrostomy are managed in this clinic • In growing children, failure to resize low-profile gastrostomy tubes and change length accordingly can result in too short a tube, causing the balloon (or internal bumper) to ride up into the stoma tract. This may result in buried bumper syndrome • All children should have their gastrostomy tubes measured at least yearly and tube replaced as the stoma tract changes in length. When in doubt as to the correct size of a gastrostomy tube, a dye study may be helpful • The tube may need to be replaced with a more suitable tube depending on complications eg. leakage of gastric contents may require upsizing	Review/expert opinion

Source of evidence	Summary	Grading
Khair J (2003)[47]	• In children, a percutaneous endoscopic gastrostomy is the preferable method for gastrostomy formation • This will eventually form a stable stoma which can then be fitted with a balloon tube or button • PEG devices should not be replaced in the community until the stoma has healed completely (6–8 weeks) because there is a risk of detaching the stomach from the abdominal wall • In addition, although some of these devices are advertised as being 'traction removable', in children the procedure is usually performed with an endoscope to reduce trauma. After the stoma has healed completely, it may be appropriate to change the original tube for a button or G-tube	Review/expert opinion
Abbott Nutrition[78] Cook Medical[79] (Manufacturers recommendations)	• *"A gastrostomy tube should be replaced when it is showing signs of wear and tear, or is not functioning as it should be. If you notice any of the following: The tube has become flattened, discoloured, cracked, or split. Or the tube is leaking or blocking regularly. Speak to you Healthcare Professional about replacing your tube"* • PEG replacement is recommended every three months or at the discretion of the physician	n/a

Question 2H (Gastro & nutrition)

Method of confirming the position of a replacement gastrostomy tube?

- Contrast x-ray versus pH, both, none?
- Different settings (hospital, home, clinic etc.)

Source of evidence	Summary	Grading
DAA (2011)[22]	• X-ray confirmation is considered the most reliable way to confirm tube position[9,10] but still has limitations • Other common methods for checking the position of gastric feeding tubes includes air insufflation with auscultation of the stomach, and aspiration of gastric contents with pH testing • The tube should not be used if there is any doubt about its position	Best practice guidelines
Preetha (2009)[60]	• Aim to evaluate auscultation and testing pH as a method of assessing the placement of feeding tube in adults (90% stroke) • Medical centre in Kanya-kumari district of India • 50 subjects. Selected where tube feeding was indicated and used stethoscope, pH (<5 considered gastric placement and >6 considered intestinal placement) and x-ray • Auscultation: 96% gastric placement but only 90% on x-ray. Other studies showed 34.4–45% sensitivity for this method • Testing pH: 90% gastric placement and 10% intestinal placement on both pH and x-ray • Auscultation: 100% sensitivity, 40% specificity. pH: 100% specificity. pH more reliable and accurate • Significant relationship between the experience of staff who introduced feeding tube and gastric placement of tube	III-2

Source of evidence	Summary	Grading
Burke et al. (2006)[56]	• Retrospective case series comparing two radiographic procedures used for PEG tube verification at a rehabilitation hospital • The first series reviewed studies of patients over one year with air insufflation as PEG tube verification. The second series reviewed studies of patients over the subsequent year, during which the method of choice for PEG tube placement verification was with gastrograffin • 19 Patients and 29 PEG replacements were identified that used air insufflation and 17 patients and 19 PEG tube replacements were identified that used gastrograffin • The main outcome measure was medical complications in a two week follow up period • There were no cases in either of the replacement procedures in which PEG tube was found to not be in the gastrointestinal system. There were no complications on follow up • The air contrast procedure appears to be relatively safe alternative procedure for PEG tube replacement verification	IV

Source of evidence	Summary	Grading
Showalter et al. (2012)[61]	• Retrospective review of the medical records of patients presenting to the Emergency Department (ED) of a tertiary care paediatric institution in Cincinnati US with G-tube dislodgement and for replacement • Immature tract was defined as <60 days. Physician's level of training and speciality was recorded • Outcomes: o Incorrect G-tube position after replacement in the ED defined on confirmatory radiograph as extra gastric termination of the G-tube or G-tube balloon. For patients without imaging, a chart review was conducted to evaluate return ED or clinic visits within 72 hours of visit with clinical evidence of a misplaced G-tube such as feeding intolerance o Frequency of complications after G-tube misplacement in the ED defined as tract disruption, obstruction leading to vomiting, or any injury to an intra-abdominal organ via chart review of any ED or clinic visits within 72 hours o Frequency of confirmatory imaging after replacement o ED length of stay • 237 paediatric patients over 16 months, most had a mature G-tract (93%). Most replacements were by a resident (65%) • 35% had confirmatory imaging (more common when tract immature). Mean ED length of stay was 265 v 142 minutes for imaged versus non-imaged group (p<0.001) • 1.2% (3) has incorrect g-tube position after replacement all confirmed via imaging; one had obstruction due to overfilled balloon, two had post pyloric tubes • Only 68% had documentation of some clinical confirmation of position; none of these had subsequent evidence of misplacement • Conclusion: limited to no evidence for confirmatory imaging when replacing G-tubes when mature tract and increases length of stay. Limited by poor documentation	IV
Itkin et al. (2011)[35]	• In circumstances in which a gastrostomy is replaced blindly at the bedside, confirmation of the correct placement by using auscultation and gastric content aspiration is imperative. If correct position is in question, a post replacement radiograph with contrast medium should be performed	Evidence based guideline

Source of evidence	Summary	Grading
Westaby et al. (2010)[38]	• If the tube comes out 2–4 weeks after placement, 'blind' bedside replacement using balloon-retained tube may be possible, but should only be undertaken by an experienced member of the specialist enteral tube feeding team • Correct positioning of the internal balloon must be confirmed before inflation • For those not receiving acid suppressive medication this can be achieved by testing the tube aspirate with Universal Indicator paper. A pH<5 confirms correct gastric placement	Evidence based guidelines
Simons & Abdallah (2012)[62]	Evaluation/review of confirming placement of nasogastric enteral feeding tubes: **X-ray:** • *Advantages*: Most reliable method currently available • *Limitations*: costly, undesirable patient exposure to repeated x-rays, not always practical **pH texting of aspirate:** • *Advantages*: Ease of use, reliable, can be used to distinguish between gastric and intestinal tube placement • *Limitation*s: Continuous gastric feeding and medications for ulcers and reflux raise gastric pH, possible falsely indicating that the tube is not in the stomach **Visual assessment of aspirate:** • *Advantages*: Useful in distinguishing between gastric and intestinal tube placement • *Limitations*: Colour and consistency of aspirate varies, of little value in differentiating between gastric and respiratory placement (nasogastric tubes only) **Visualisation of external tube length:** • *Advantages*: Ease of use, may indicate if tube placement has shifted • *Limitation*s: Doesn't indicate location of tube, should never be used as sole means of determining placement **Auscultation of air insufflated through the feeding tube for whooshing sounds:** • *Advantages*: None • *Limitations*: Highly unreliable **Conclusion:** • During the blind insertion of **any feeding tube**, the American Association of Critical-Care Nurses(AACN) recommends using several methods to assess tube location. These include watching for signs of respiratory distress (NG), visually assessing aspirate and using pH testing, if available	Evidence Based Guidelines

Source of evidence	Summary	Grading
Taheri (2011)[55]	• Methods to confirm proper placement include flushing air and/or water through the replacement tube and noting resistance or pain and aspirating the tube for gastric/thesebilious contents. Unfortunately aspiration is frequently not obtained despite proper tube insertion and therefore in the absence of gastric aspirate cannot be used to indicate improper tube insertion • The gold standard to confirm G-tube position is to obtain gastrograffin radiocontrast study through the replacement tube. An alternative would be gastroscopy, with visualisation of the internal balloon or bolster. Unlikely to be cost effective or practical to perform either for replacement tubes • The technique to facilitate safe G-tube replacement is the Seldinger technique, which is useful for dilating narrowed stomas and at present is not recommended for routine replacement of G- tubes • One study compared air insufflation followed by plain radiograph assessment to gastrograffin radiocontrast with no complications in either group. (17 v 19) • Recommend: 50mL of sterile water be infused in all patients post PEG replacement – if any abnormal resistance/ pain or difficulties / concerns with the insertion, a gastrograffin contrast study should be performed to confirm position. • There are limitations with the water injection where patient has lack of pain sensation • Medical personnel changing gastrostomy tubes must also be trained to recognise potential complications of replacing G-tubes before they are allowed to perform replacements of their own • The longer duration between PEG removal and reinsertion, the greater likelihood of stoma stenosis. If the tube has been removed/dislodged for greater than 6–8 hours, additional care should be undertaken in G-tube replacement, and endoscopic insertion should be considered • Added caution should be employed when replacing tubes in people with cognitive impairment as they are unable to communicate pain or discomfort	Review

Source of evidence	Summary	Grading
Shepley (2008)[28]	• The position of the tube can be checked by testing aspirate with pH indicator paper. The pH should be ≤5. Frequency of checking depends on local policy	Expert opinion
DeLegge (2006)[33]	• After replacement of a PEG tube with a bedside replacement gastrostomy tube, appropriate placement in the gastric lumen must be confirmed using a combination of auscultation of the stomach for air rapidly infused by a syringe through the PEG tube and visualisation of gastric contents aspirated by an attached syringe • If there is any question of the location of the tip of an enteral access device, a water soluble contrast radiographic study through the tube should be obtained to identify the tube tip location before use. This is especially important when the originally placed PEG tube has been in position for one month or less	Review/expert opinion
Huffman S et al. (2004)[57]	• There is no research to support the use of the following methods to confirm position: auscultation of insufflated air; checking the appearance of the aspirate; observing the patient; looking for bubbling of the end of the tube when in water • One study (Neumann et al 1995) found that using auscultation incorrectly predicted 15/16 tubes were correctly positioned. • Excluding radiographic confirmation, the most reliable indicator of gastric feeding tube placement in adults is an aspirate pH of 4 or less. Although not studied extensively, this also holds true in children. However, there may be limitations to using pH of aspirate to predict tube location, such as when patient receiving acid suppressant medications or continuous feeding • If pH >5, clinicians should employ supplemental methods to confirm tube position such as confirmation of external length, aspirate appearance, tolerance. Radiographic confirmation is appropriate where required	Review article
Lohsiriwat (2013)[58]	• There are several ways to confirm a proper PEG tube replacement such as: ◦ aspirating gastric or bilious fluid from the tube ◦ listening to a gurgling sound when flushing air through the replacement tube, ◦ performing a water/saline irrigation test (no resistance or pain when filling the tube with sterile water/saline) • These methods are simple but somewhat unreliable to indicate whether or not the tube insertion is getting in to the stomach. • The gold standard is to obtain a water soluble contract examination through the replacement tube or to visualise the internal bolster or balloon via an upper GI endoscopy	Review/ expert opinion

Source of evidence	Summary	Grading
McClave & Neff (2006)[59]	• Anytime a tube is placed blindly back into a PEG tract, a contrast study with an abdominal (flat plate) film to confirm positioning in the stomach is necessary	Review/expert opinion
El-Matary (2008)[34]	• There have been a few reports of patients who suffered from peritonitis because the end of the button was not in the stomach • It is a safe approach to endoscopically confirm placement of the gastric end of the button	Review/expert opinion
Goldberg E et al. (2005)[52]	Children's Hospital of Philadelphia: • 12 weeks post gastrostomy placement, the patient may return to radiology for the placement of an appropriate low-profile device • A dye study is completed to confirm intragastric placement after the first changing of the tube	Review/expert opinion
Khair J (2003)[47]	• Aspiration is required to check the correct position of the tube • It is important to use the correct size of syringe • Concern with applying too much suction when aspirating as this may damage the gastric mucosa	Review/expert opinion

Question 2l (Gastro & nutrition)

What is the method of removing a gastrostomy tube if no longer required?

- Different tubes
- External flange cut, remainder passes through gastrointestinal tract
- Balloon deflated and tube removed
- Other procedure

Source of evidence	Summary	Grading
DAA (2011)[22]	• After initial insertion, it is generally recommended that a gastrostomy tube should remain in place for at least 2–3 weeks to allow time for the tract to heal fully	Best practice guidelines
BAPEN (2003)[15]	• In patients with no risk of distal adhesions or strictures, gastrostomy tubes with rigid internal fixation devices can be removed by cutting them off close to the skin, pushing them into the stomach, allowing them to pass spontaneously (grade A) • Percutaneous gastrostomies should not be removed for at least 14 days after insertion to ensure a fibrous tract is established that will prevent intraperitoneal leakage • Gastrostomy tubes held in place by a balloon usually come out with gentle traction after the balloon is deflated whereas those held in place by a deforming advice may need vigorous pulling. Tubes with rigid fixation devices are usually removed endoscopically, although recent evidence suggests that if they are cut close to the skin and pushed through into the stomach, they will pass through the gut spontaneously. This method should not be used if there is any suspicion of distal structuring and overall 2% will not pass	Best practice guidelines

Source of evidence	Summary	Grading
ESPEN (2005)[14]	• It has been demonstrated in clinical studies that PEG systems can be removed by simply cutting away the external catheter and allowing the internal fixation plate to pass from the body by the natural route without complications in adults • However, it is still recommended to remove the fixation plate endoscopically by catching it with a snare, since there are several reports of subsequent ileus, need for operation, and even fatal outcome • In children PEG tubes must be removed by endoscopic means in any way • It is recommended not to remove PEG tubes within the first 10 days after initial placement because of a possibly higher risk of local complications as for peritonitis during this period • There are now commercially available PEG systems with internal fixation plates which can be released from the outside so that these tube systems can simply be removed percutaneously without further endoscopy. These PEGS are suitable for shorter-term/supplementary enteral feeding	Best practice guideliness

Source of evidence	Summary	Grading
Kobak et al. (2000)[63]	• Retrospective review of 397 patient records for complications post gastrostomy removal at All Children's Hospital from September 1993–1998, focusing on the clinical course of 54 children with traction or endoscopic PEG tube removal • The only complication identified was persistent leaking through a gastrocutaneous fistula in 13 patients (24%). Surgical closure was required for seven patients. Comparison of these children with those who did not require surgery revealed they had a longer duration of tube placement • No child with a PEG removed before 11 months post insertion required surgery whereas seven of 31 with a PEG tube removed after 11 months required surgery • Age at insertion, type of feeding device removed, and patient diagnosis were not different between the two groups. • Major complications after traction or endoscopic PEG tube removal in children should rarely occur. However, the longer the PEG tube is in place, the more likely a permanent fistula tract will be formed. The clinician should be mindful of the length of time since tube insertion when removing a PEG tube and attempt to remove before 11 months of use if adequate oral intake is achieved • Techniques for removal include cutting the tubing at skin level and allowing the internal components to pass through the gastrointestinal tract • This method is commonly used in adults, but multiple complications have been reported in children related to retained internal components, including oesophageal perforation and even death • PEG tubes at this centre were removed by traction, or if an internal booster is present by endoscopy. However tract ion removal has the potential to injure the gastrocutaneous stoma or tract. Their experience has been free from perforation, peritonitis or other major sequelae • Similar results to the above study were found in 2004 by El-Rifai et al., where the mean duration of gastrostomy placement was significantly longer in patients who went on to require surgical closure of their stoma post PEG removal	IV

Source of evidence	Summary	Grading
Westaby D et al. (2010)[38]	• PEG tube removal cannot be considered until the tract is mature. This is usually the case by 14 days post-insertion but may be as long as 28 days in patients with risk of poor healing • If return to oral nutrition has been anticipated, a 'traction-removable' PEG tube may have been employed • It is essential to confirm that the tube is designed for percutaneous withdrawal before any attempt at traction removal is made. If there are any doubts, the manufacturer should be contacted to obtain this information or an alternative technique of removal used • For non-traction removable devices, the choice is between endoscopic retrieval of the internal bumper or cutting the tube and allowing the internal bumper to pass via the gastrointestinal tract • The latter approach is widely used and is considered a safe alternative by many (Merrick *et al,* 2008) • However there is an associated small but recognised risk of bowel obstruction (Coventry, 1994). If this approach is considered (usually to avoid a further endoscopic procedure) a risk assessment for possible bowel obstruction should be carried out and the patient consented for the process • PEG tubes can only be safely removed when a tract is fully established. This can only be assumed after a minimum of 14 days and up to four weeks in patients with impaired healing (IV, D)	Evidence based guideline
DeLegge (2006)[33]	• Most internal bolsters are soft and designed to fold up such that these tubes can be removed with external traction. It generally will take 8–10 pounds (lbs) of external pull pressure to remove tubes • Once a PEG tube malfunctions, degrades or is no longer required for use it can be removed at the bedside with a traction pull force of approximately 8–10 lbs. These tubes are labelled 'traction removal'. Some PEG tubes has a stiff internal bolster and can only be removed with an endoscopy, they are labelled 'endoscopic removal' • Some authors have suggested cutting the PEG tube at the abdominal wall and allowing the internal bolster to pass through the GI tract. Unfortunately there have been reported cases of these internal bolsters becoming retained in the small intestine leading to a small bowel obstruction • Early PEG removal may result in the stomach separating from the abdominal wall because the PEG tract has not completely formed. In these cases blind, bedside tube replacement may result in the replacement PEG tube being placed in the peritoneal cavity	Review/expert opinion

Source of evidence	Summary	Grading
El-Matary W (2008)[34]	• Simple cutting of the tube and leaving the internal bolster to be excreted with stools is unsafe and may lead to intestinal obstruction. • Yaessen et al. recommended against non-endoscopic removal of PEG tubes, especially in small children. There are tubes available with relatively floppy internal bolsters that can be pulled out • Normally the tract starts closing immediately and in the majority of patients, takes 48– 72 hours to close • Occasionally a persistent gastrocutaeneous fistula may need surgical closure. In a recent paediatric series, delayed closure (greater than one month) was reported in 10 out of 21 children (48%) • Three of these children required surgical closure. Time from PEG insertion to removal was not predictive of delayed closure	Review/expert opinion
Cook Medical[79] [Manufacturers recommendation]	• The PEG tube has been designed for removal using external traction method. If this method of removal is not possible, another method such as endoscopic or surgical should be utilised	n/a

Question 2J

If a patient has a gastrostomy tube that has been dislodged or accidently removed, how should the tube be replaced?

- New versus long term tubes
- Different setting (hospital, home, clinic etc)

Source of evidence	Summary	Grading
DAA (2011)[22]	• Urinary catheters (e.g. Foley's catheters) are designed for urinary drainage and are not recommended for use as feeding tubes. As they do not have external flange, there is a much greater risk of tube migration and duodenal obstruction. They are also not designed to withstand gastric acid. In an emergency, they may be useful as a cheap, short term replacement when a PEG falls tube falls out, but this is temporary only. A proper replacement gastrostomy tube should be inserted as soon as practical • Feeding tube guide wires or introducers should never be reinserted into a feeding tube while the tube is in the patient. They can perforate the tube and cause serious injury • Migration of feeding tube can lead to obstruction of the gastric outlet or small intestine. Ensure the tube has a flange or retaining bar (at the tube exit site on the skin) to prevent migration, and mark the feeding tube on the outside to indicate skin level.	Best practice guidelines
BAPEN (2003)[15]	• In patients where cosmetic considerations are important, low-profile 'button' PEGs which contain a built in anti-reflux valve to prevent leaks when feeding extension tubes are disconnected can be used	Best practice guidelines

Source of evidence	Summary	Grading
Westaby et al. (2010)[38]	• The indwelling tube is removed and replaced by a new PEG tube or a balloon-retained device. Balloon-retained devices have the advantage of avoiding the need for further endoscopy but this must be balanced against the reduced durability of these tubes • PEG tubes are, by design, bulky and have adverse cosmetic effect, particularly in mobile patients. In such patients, the PEG tube may be replaced by a low-profile ('button') replacement when the tract is fully developed • Such low-profile devices have also been employed in patients who are at high risk of inadvertent tube displacement. Commercially available PEG tube kits allow the placement of a low-profile tube from the outset **Early/initial dislodgement/displacement:** • Accidental removal of the PEG within 2–4 weeks of placement may result in peritonitis because the fistula is not fully mature and gastric contents can leak into the peritoneum • The external bumper should be kept secure during this period so that the stomach does not fall away from the abdominal wall. If close apposition with the abdominal wall is not maintained, the fistula may not form properly and intraperitoneal leakage can result • Excessive traction on the tube during this early period may pull the internal bumper through the gastric wall so that it comes to lie in the peritoneal cavity • If this is unrecognised, feed will be delivered into the peritoneum. The risk of this is greater with traction-removable devices • In the event of the tube becoming completely displaced within the first two weeks, 'blind' replacement by the bedside is best avoided because the fistula is unlikely to be mature and will be easily disrupted. Urgent replacement should be attempted either endoscopically or radiologically. A radiological technique is probably preferable because it minimises air insufflation. If endoscopic replacement is tried, air insufflation is kept to a minimum to avoid further disruption of the tract. It is helpful to pass a floppy-tipped guide wire through the fistula to re-establish the tract prior to passage of a plastic cannula. If this is not possible then an attempt to pass it into the fistula internally via the endoscope may be more successful, probing the tract gently with a cannula and guide-wire in ERCP style until the guide-wire emerges through the abdominal wall • If replacement is not possible and the patient remains well, conservative therapy (nil by mouth and broad-spectrum antibiotics) will usually prevent serious sequelae while the fistula is allowed to close spontaneously. If peritonitis ensues, surgery will usually be required	Best practice guideliness

- If the tube comes out between 2–4 weeks after placement, 'blind' bedside replacement using balloon-retained tube may be possible but should only be undertaken by an experienced member of the specialist enteral tube feeding team
- Correct positioning of the internal balloon must be confirmed before inflation
- For those not receiving acid suppressive medication, this can be achieved by testing the tube aspirate with Universal Indicator paper. A pH<5 confirms correct gastric placement
- If the tube is accidentally pulled and partial displacement of the internal bumper is suspected, a 'tubogram' or endoscopy should be performed. If displacement is confirmed, the device will need to be removed completely. A non-traction removable device will require surgical removal. For traction removable tubes, a second PEG should be placed prior to traction removal of the displaced tube to prevent the stomach falling away from the abdominal wall
- Avoid traction-removal tubes in confused patients who are likely to pull at them
- Recognition of a displaced internal bumper before the tract is fully established should be managed by an urgent attempt at either endoscopic or radiological replacement. If this fails and free leakage is confirmed a laparotomy is indicated

Late displacement

- If displacement occurs after the fistula has matured (four weeks), peritoneal leakage cannot occur
- The tract will close very quickly (within 12–24 hours), so the priority is the preserve it
- Late displacement is most commonly seen in balloon-retained devices when the balloon has burst or leaked. A regular weekly check on the volume of water in the balloon will alert the patient or carer to such problems
- If possible preserve the fistula by replacing the tube or button as soon as possible and securing with tape. If the tube is not available or the fistula has begun to close and the original tube cannot be passed, efforts should be made to keep the fistula open until a new balloon-retained device can be placed. Foley urinary catheters are sometimes used for this purpose, but this practice cannot be recommended except as a last resort where no alternative exists
- Passing a replacement tube may require gentle dilatation of the tract (under conscious sedation) using a balloon dilator. Whenever a tube is replaced, especially if the tract has been dilated, correct positioning should be confirmed before the balloon is inflated
- Carers should not attempt to pass anything through the stoma unless it is certain that the tract is properly mature
- Following tube displacement, an established tract will close within 12–24 hours
- During this window a replacement balloon tube or button tube should be inserted to maintain the tract. (Level IV, D)

Source of evidence	Summary	Grading
Nishiwaki et al. (2011)[64]	• Retrospective analysis of patients with PEG or jejunostomy (over 2000 to 2010) who underwent device replacement including frequency, type and outcomes of complications • All tubes were replaced with a transcutaneous internal bumper device (not balloons) using an obturator after checking angulation of stoma every 4–8 months routinely or if accidental dislodgement. PEG removed using external traction. Position confirmed using gastrograffin imaging • 1126 PEG replacements, 0.7% fistula disruption. Four cases involved haemorrhage and all were taking anticoagulation or antiplatelet agents and presented with haematemesis from three hours to three days afterwards	IV
Saavedra et al. (2009)[66]	• Retrospective cross-sectional descriptive study of paediatric patients who received care at an urban children's hospital (Charleston) ED for G-tube related complaints • 77 patients with 181 ED presentations over 23 months (88% G-tube, 12% gastro-jejunostomy tube) • 62% G-tubes (adjustable length tubes most common, 78% PEG or surgical) presentations were due to dislodgement. 119 G-tubes required replacement • 97% per replaced successfully in the ED; of these 74% by the paediatric emergency physician and 26% paediatric surgery service, 33% of G-tube replacements had a dilatation of the gastrostomy site • Four unsuccessful replacements: three referred to surgical clinic the next day after Foley catheter placed in stoma and one admitted for replacement via operating theatre • To confirm intragastric location: aspiration of gastric contents or infusion of fluids was documented in 41% • Most common major G-tube complication was gastric outlet obstruction who represented with vomiting • Poor documentation	IV

Source of evidence	Summary	Grading
Novotny N et al. (2009)[65]	• Retrospective study: 110 tubes versus 113 buttons and follow up • PEG tubes are often replaced with low-profile PEG button for ease of use, cosmetic appeal, and less potential for dislodgement • This study found a statistically significantly higher risk for dislodgement among children with PEG tubes versus PEG buttons (15% versus 4% P .046). The mechanism for this is likely because of the low-profile nature of the button versus the much longer tube. Therefore buttons required fewer exchanges. Other authors have found similar results in the adult population • The decrease in dislodgements did not translate to a decrease in ED visits or fewer reoperations (related to the gastrostomy)	IV
Joanna Briggs Institute (2010)[53]	• Inadvertent removal may lead to serious complications, and tube replacement must be done promptly to prevent the stoma tract closing and therefore the need for another endoscopic procedure • Finocchiaro et al. study included 128 patients and describes four out of 18 patients in the study who had minor complications, pulling their tubes out accidentally. As a consequence the tube was replaced. • One study reported PEG tube changes in long term facilities and the episodes of tubes falling out by each group. In the monthly change group, 31 episodes of tubes falling out were reported (n=15), and in the PRN group there were 50 episodes (n=11). All were managed by replacing the tube	Evidence based guidelines
DeLegge & HPEN working party (2006)[33]	• All clinicians inserting or providing maintenance care of enteral tubes should be familiar with the spectrum of products available and associated complications • All physicians replacing gastrostomy tubes should be familiar with the recognition and treatment of associated complications	Review/expert opinion

Source of evidence	Summary	Grading
Lohsiriwat V (2013)[58]	• The tract of PEG begins to mature in 1–2 weeks after placement and it is well formed in 4–6 weeks however the process could take longer in patients with severe malnutrition, immunosuppression, or ascites • If a PEG tube is dislodged within a month after placement, it is advised that a repeat endoscopy be performed to replace the tube since the stomach may not well adhere to the abdominal wall, thus resulting in free perforation • Blindly replacing a tube in this scenario could cause intra peritoneal placement and consequent peritonitis • When PEG tubes need a replacement (e.g. occlusion or breakage of the tube or accidental dislodgement of PEG tube) clinicians must realise that the gastrocutaneous tract of PEG is more friable than that of surgical gastrostomy because there is no suture fixation between gastric wall and abdominal wall in PEG • Although the incidence of intraperitoneal tube placement in patients with mature gastrocutaneous tract (PEG performed >30 days) remains unknown, peritonitis after PEG tube placement has been reported sporadically and it is associated with significant morbidity and mortality	Review/expert opinion

Lohsiriwat V (2013)[58] continued	**Principles of gastrostomy tube replacement:** • Good control of the replacement tube along a well formed gastrocutaneous tract • Minimal insertion force during the replacement • Reliable method for confirmation of intragastric tube insertion • Replacing a new tube along the proper tract can be achieved by using a leveller to measure the depth and direction of the tract, exchanging a PEG over tube over a relatively short guide wire with or without the assistance of fluoroscopy (the railroad technique, or the modification of Seldinger technique) • Additional caution should be used when replacing PEG tubes in individuals who have non-straight gastrocutaneous tract, who have narrow site, and who have less co-operation • When intraperitoneal tube placement is suspected, prompt investigation should be performed, either with a water soluble contract study or computed tomography scan of the abdomen, and tube feeding must be discontinued immediately • If the investigation reveals gastrostomy tube in the peritoneal cavity, surgical intervention, such as an exploratory laparotomy with peritoneal lavage for chemical peritonitis, is usually required • The initial site of gastrostomy may be reused, or closed and a new gastrostomy site be created distal to the former one • Broad-spectrum antibiotics should be given intravenously until clinical grounds and laboratory parameters of infection/inflammation return to normal, mostly within 5–7 days • In a lesser extent of the consequences (i.e. a stable patient with minimal symptoms and signs of peritonitis), non-operative management may be justified • This conservative approach includes the removal of the gastrostomy tube, nasogastric decompression, intravenous administration of broad-spectrum antibiotics, and close monitoring of haemodynamic and abdominal signs • A new PEG tube may be placed by endoscopy at a new site in the stomach whenever the patient is completely stabilised • Each institution should have an optimal protocol for PEG tube replacement to prevent, or to minimise, serious complications	

Source of evidence	Summary	Grading
McClave S et al. (2006)[59]	• Inadvertent displacement of the PEG tube can occur in stable coherent patients, however it is more of a concern in any patient with altered mental status, dementia or delirium • An option may be to replace the gastrostomy with a skin-level button in patients who pull at their tubing • Inadvertent removal occurs in 4.4% of cases and half of those cases occur in the acute setting in which the PEG tract is immature. In this situation, inadvertent displacement results in the stomach falling away from the anterior abdominal wall and the patient is left with acute perforation. The patient may go to endoscopy to have the tube replaced through the same tract if possible. If the tube has been out for hour, the management involves placement of a nasogastric tube, initiating intermittent suction and giving the patient broad-spectrum antibiotics. Within a short period of time (usually 7–10 days), a new PEG can be placed (often at the same site) • In the other half of cases of inadvertent displacement, the tract is mature and management of the displacement is simpler. Maturation of the tract should occur over 10–14 days. However, this may take longer (up to four weeks) in patients who are malnourished, diabetic, elderly, going through radiation therapy etc • Efforts should be made to replace the feeding tube quickly to avoid closure of the tract (which can occur in as little as 12–24 hours). If a commercial replacement tube is not available, a Foley catheter with the addition of a homemade external bolster can be placed through the tract and used effectively for continued feeding • Anytime a tube is placed blindly back into a PEG tract, a contraset study with an abdominal (flat plate) film to confirm positioning in the stomach is necessary	Review/expert opinion
El-Matary W (2008)[34]	• If the tube falls out early in the postoperative period, there is a risk of peritonitis because the tract around the tube may not be well formed, especially in the first few days. It is recommended that patients' families go to the nearest emergency room as soon as possible if this complication occurs and avoid inserting another tube at home • If this problem occurs later in the postoperative period (e.g. six weeks or more after PEG tube insertion), families are advised to insert a Foley catheter to keep the tract open until they are seen. The Foley catheter is supplied to them post PEG placement	Review/expert opinion

Question 2K

When and how should patients be educated about the care of their newly inserted gastrostomy tube?

Source of evidence	Summary	Grading
NICE (2006)[41]	• All patients and their carers should receive pre-discharge education on the management of their feeding regimen, which would include self-monitoring of their enteral feeding tube and how to deal with problems that may occur • Patients in the community having enteral tube feeding and their carers should receive training and information from members of the MDT on [D-GPP]: o The management of tubes, delivery systems and the regimen, outlining all procedures related to setting up feeds, using feeding pumps, the likely risks and methods for troubleshooting common problems and be provided with an instruction manual (and visual aids if appropriate) o Both routine and emergency telephone numbers to contact a healthcare professional who understands the needs and potential problems of people on home enteral tube feeding o The delivery of equipment, ancillaries and feed with appropriate contact details for any homecare company involved • Monitoring of a gastrostomy should include: o Checking stoma site daily, to ensure no infection/redness/gastric leakage o Check tube position (length at external fixation) daily, to ensure tube has not migrated from/into stomach and external over granulation o Rotation and insertion weekly, to prevent internal over-granulation and prevent buried bumper syndrome o Check balloon water volume (where applicable) weekly, to prevent tube falling out	Best practice guideline
DAA (2011)[22]	• PEG should be washed daily with warm soapy water, rinsed and dried thoroughly • The external flange will need to be lifted to clean around the tube • Unless the tube has been stitched into place, it should be gently pulled in and out (1–2mm only) and rotated through one full turn daily • The PEG site should not be covered with a dressing, as this can cause dampness, skin damage and infection	Best practice guideline

Source of evidence	Summary	Grading
AusPEN (1997)[70]	• There shall be written guidelines to educate patients and carers • Upon discharge from hospital, the patient/carer will know: how the function of GIT has changed and reason for EN; how to change malfunctioning parts of tube; how to manage the delivery system/method, storage/hang time and means of provision of feeds; the principles of hygiene; how to prevent and recognise complications such as infection, aspiration and mechanical complications such as occlusion or misplacement of the tube; name of personnel to contact 24 hours per day; follow up arrangements; how to irrigate a blocked tube • The patient/carer will be able to: check tube position; administer a bolus feed down the tube; prepare feed ready for administration; administer medication down a tube; connect feed to feeding tube; disconnect feed and flush water down the tube; program feeding pump	Best practice guidelines
BAPEN (2003)[15]	• When patients are discharged to the community on continuing enteral tube feeding, care must be taken to ensure all community carers are fully informed and that continuing prescription of feed and relevant equipment is in place (grade C) • Prior to discharge it is the duty of the hospital care team to ensure there is adequate liaison with the community to ensure that prescription feeds and feeding equipment is available • The patient, carers, district nurses, community dietitians and GPs should all be fully informed and adequate training in pump use, infection control, feeding stoma care etc. must have been provided before discharge • The hospitals should follow written protocols to ensure that discharge goes smoothly • The patient or carer should have a list of expert contacts	Best practice guidelines

Source of evidence	Summary	Grading
ESPGHAN (2010)[27]	• Before PEG placement, the advantages and disadvantages should be assessed by an MDT nutrition support team, with caregivers being fully involved • Family training of PEG use and care are taught during the days before discharge • Good communication between patient, family and health care professionals is a prerequisite for effective discharge planning. It is also essential that continuing care arrangements are in place with coordinated action from all agencies involved. Equipment supplies should be arranged before discharge • Parents who are caregivers and children should receive training and information from members of the MDT on the following topics: reasons for home tube feeding; likely duration; safety aspects of care, checking tube placement, infection control issues, hand washing techniques, feed preparation (use ready-made whenever possible), familiarity with feeding equipment, advice regarding social and practical implications, problem solving advice and what to do in an emergency, importance of maintaining oral stimulation; telephone contacts for hospital and community staff; detailed information about how to obtain equipment and supplies	Best practice guidelines
Jordon S et al. (2006)[68]	• Study of 20 patients' experiences of living with long-term gastrostomy tubes • Since most potential problems with PEGs are known, patients with PEGs might benefit from routine administration of standard questions relating to functional status and adverse treatment reactions • Administration of symptom checklist with management guidelines would minimise the burden of treatment. Education around monitoring of symptoms is recommended for both the patient and carer(s)	IV

Source of evidence	Summary	Grading
Kurien et al. (2012)[69]	• Evaluation of the benefits of a dedicated dietetic home enteral feed team in 2010/11 in comparison with data from 1998 (when there was not a dedicated service) • Aftercare varied dependent upon the underlying condition and the patient's residency status • Increased aftercare was required for individuals residing in their own home versus residential homes where care or nursing staff is available • Early identification of gastrostomy-related complications can reduce the risk of serious harm and death (Healry *et al* 2010) • Most complications will first present within the community setting (versus hospital) • Dedicated gastrostomy aftercare services reduced hospital readmissions (due to gastrostomy related problems) from 23% to 2% • This study highlights the potential psychological benefits for the patients and their carers * NOTE Study didn't go into detail about when and how patients should be educated	IV

Source of evidence	Summary	Grading
Joanna Briggs Institute (2010)[53]	• Provide patients and/or carer(s) with verbal pre-discharge instructions together with written material regarding care of the PEG tube, the PEG site and what to do in the event of any complications (Grade B) • Two studies included in this systematic review utilised pre discharge verbal instructions and written material: o First study (Finocchiaro et al.) instructed all 128 patients and their families about all aspects of PEG feeding and management of complications, especially tube occlusion, by a dietitian, prior to discharge. Patients and carer(s) were all provided with an instruction booklet explaining use of the PEG and given a hotline number available 12 hours per day to contact the nutrition team. There were eight tube blockages reported among the 18 (14%) patients who had complications o Another study also described the above, a verbal explanation and a standard instruction sheet covering nursing care of the PEG was given to the accompanying nurse from the patient's ward after the procedure. No further training was given to hospital nursing staff. Outpatients were admitted for 1–2 days after PEG insertion for training in the care of the PEG. Instruction was provided to patients and/or their families in the care of the gastrostomy puncture site and handling and flushing of the tube. There were 13 outpatients in the sample of 76 patients who had PEGs inserted. There were nine episodes of tube blockage in six patients, all hospital inpatients or resident of nursing home. No blockages occurred in any of the cases where care was provided by a family member or in patients who cared for the PEG themselves • The only intervention that can be recommended to prevent complications associated with PEG tubes is pre discharge instructions in written material; however the contents of this cannot be detailed from the available literature. • The studies that report the use of pre discharge instructions and written material provide no detail on the contents of this material nor if these were considered to have contributed to the prevention and/or management of any complications • The study by Panos implies that providing information regarding site care, handling and flushing to the patients and/or their families who will be caring for the tube prevents tube blockage. No direct comparisons were made with other study participants, but it was suggested that blockage occurs less frequently in those who are not inpatients • Placement of the gastrostomy tube is often the last barrier to discharge. Parents often feel anxious and frustrated in this situation. Families may perceive the surgery and postoperative recovery as a setback for their child rather than a needed procedure to move towards discharge (Thorne 1997) • Provide parents/carers with multiple opportunities to ask questions and clarify expectations	Evidence based guidelines

	• Answer questions such as the following before gastrostomy placement to put the parent/carer at ease:
	  o How soon can I see my infant after the procedure?
	  o How will my infant look after the procedure?
	  o Will my baby be in pain/require pain medication?
	  o How long will the tube stay in place?
	  o How long will my baby need to stay in hospital post procedure?
	  o How soon will we use the tube?
	  o How will I learn to use it?
	  o Who do I follow up with after discharge?
	• Parents/carers require a lot of emotional support post gastrostomy placement. Emphasise their role in recovery and the transition to home. Also focus on how the gastrostomy tube may alleviate stress and anxiety by eliminating the need for time-consuming attempts at feeding, thus reducing the chance of developing an oral aversion.
	• Refer parents/carers to web based resources for education and support
	• It is imperative to know which type of tube is in place so that that appropriate education is provided. Document tube type, length and balloon volume (Bordewick 2001)
	• In the immediate postoperative period, include parents in routine gastrostomy care. Teach them how to assess the site, as well as bathe and feed
	• Teach troubleshooting complications
	• Check cm marking/length
	• What to do if tube falls out/dislodged
	• Assess the skin for redness and skin breakdown. Use ordinary soap and water to clean around the tube site to prevent build-up of debris. A small amount of drainage around the tube is normal
	• The use of hydrogen peroxide is no longer recommended and may be cytotoxic
	• Tube rotation
	• Granulation tissue
	• Tube blockage/flushing/medication
	• Research suggests that parents who have children who require gastrostomy feedings have a number of specific concerns during the first year, including adequate growth, lack of interest or enjoyment about food, oral aversion, slow progression to feeding, reflux and gagging, medically related costs, and day-care related concerns	

	• Prior to discharge, discuss the family's concerns and develop consistent goals and strategies to anticipate and address them. It is imperative to include nurses, neonatologists, gastroenterologists, surgeon, paediatrician, dietitian, social worker, case manager, home care personnel, durable medical equipment companies, therapists, and the extended family in developing these plans • The Family Teaching Toolbox, '"*Guide for home gastrostomy care*", is a useful tool to organise, guide and document teaching • Other ways to facilitate a successful transition to home with a gastrostomy include: o Show trust in the parents' ability to care for their child o Attempt to reduce the pressure and stress of feeding o Offer a rooming-in experience o Provide ongoing information to parents and to home care colleagues during and after hospitalisation o Provide reading materials about feeding issues, including what to expect in the first few months o Offer developmental and behavioural guidance o Offer referrals or resources for nutritional care (home health care companies will provide monthly supplies, including formula) o Coordinate care between the hospital and community services (insurance, equipment, supplies, home care nursing etc.) o Supply community or support group information for families who have children with feeding tubes o Help family to develop coping strategies to adapt, problem solve and negotiate for the support and services they will continue to need post discharge • More research is required on the families' experience after discharge. This will help health care professionals to provide the appropriate support required	

Source of evidence	Summary	Grading
Best (2012)[67]	• Patients should be encouraged to care for their enteral tube feeding while on-hand support and encouragement can be provided in hospital • As a minimum patients should be provided the following information: o Tube care: tube type, how it is held in place, how often does it need to be changed, how it will be changed and by whom, do they need daily or weekly care o Feed regime: formula type, how it is to be delivered and over what time period, any additional fluids required. o How to set up pump and feed system o How to flush and administer medications o How to manage blockages or stoma soreness o Who to contact if they need assistance and for what purpose o How to obtain supplies: feed, sets, syringes o Storage space required • Must have written advice provided	Review/expert opinion
El-Matary W (2008)[34]	• Normally keep children overnight post gastrostomy placement for observation and for teaching of caregivers	Review/expert opinion
Goldberg E et al. (2005)[52]	• Post gastrostomy tube placement, the patient stays in hospital/or is admitted (usually for about 24hours) for IV antibiotics, pain control, initiation of feedings, and patient and family teaching • A standardised format for teaching gastrostomy tube care is used at the Family Learning Centre, where anyone caring for a gastrostomy tube can learn how to maintain the tube and discover other relevant hospital resources • Within two weeks of gastrostomy tube placement, patients return to hospital for a wound check • After 12 weeks, the patient may return to radiology for the placement of an appropriate low-profile device • The patient or caregiver is taught how to change balloon replacement gastrostomy tubes in the Family Learning Centre. If the family is uncomfortable with performing the routine changes of these tubes, they are referred to the Paediatric Enteral Access Clinic (PEAC) • All patients are advised to return to PEAC at least yearly for remeasurement of gastrostomy tube size. Any problems related to the gastrostomy are managed in this clinic	Review/expert opinion

Source of evidence	Summary	Grading
Khair J (2003)[47]	• Begin planning for discharge as soon as the child commences artificial feeding • Use a comprehensive checklist to ensure that the correct procedures are followed • Liaison is an essential component of discharge so that the community team are aware of the discharge plan and also so that correct equipment, feeds and support are in place • The dietitian is responsible for calculating nutritional requirements and choosing the appropriate feed. The feeding regime should define the type, volume, method, rate, duration and timing of feeds. This must also include water flushes. The dietitian is responsible for explaining the feeding regime • Education around handling of the feed and storing feeds must be provided before discharge • Designing a safe, practical and effective regimen requires a collaborative approach. • Additional advice may be required from other healthcare professionals: speech and language therapist, pharmacist, physiotherapist etc • The regimen should have been tried and evaluated before discharge • Referral made to appropriate company: feed/equipment/pump • Training with pump pre discharge (may get the company involved depending on local policy) • All instructions should be backed up with written instructions on managing failure or displacement of the feeding device	Review/expert opinion

Question 3A

What is the evidence that supports the use of the following in gastrostomy use?
Undertaking 'water trials' before commencing enteral feeds via a gastrostomy tube? (feeding only water through the tube for a period of time before formula)

Source of evidence	Summary	Grading
DAA 2011[22]	After the insertion of a gastrostomy feeding tube, a water trial is sometimes used to check for leaks before feed is given. Feeds are usually commenced 12–24 hours after insertion of the tube, but there is no evidence to support delaying feeds for more than 3–4 hours after PEG placement	Best practice guidelines

Question 3B

What is the evidence that supports the following in gastronomy use: Checking gastric residual volumes to identify feed intolerance?

Source of evidence	Summary	Grading
BAPEN (2003)[15]	• In patients with doubtful gastrointestinal motility, the stomach should be aspirated every 4 hours. If aspirates exceed 200ml, feeding policy should be reviewed (grade C). There is an increased risk of aspiration if gastric residues accumulate • Aspiration through fine bore tubes may be unreliable	Best practice guidelines
ASPEN (2009)[30]	• Measurement of GRV is one technique used to prevent aspiration. Research regarding the efficacy of this technique has provided conflicting results as no adequately powered studies to date have demonstrated a relationship between aspiration pneumonia and GRV. In addition no adequately powered studies have demonstrated that elevated GRVs are reliable markers for increased risk of aspiration pneumonia • GRV cannot be correlated with pneumonia, ICU mortality or hospital mortality. McClave et al 2005 suggests that the elevated residual volumes by themselves have little clinical meaning and that only when combined with vomiting, sepsis, sedation or the need for pressor agents does the correlation with worsening patient outcome emerge • If serial measurements reveal a change in GRV, other potential causes must be investigated instead of simply holding the enteral feedings • Research regarding the association between aspiration and GRV has been hampered by the use of unreliable methods to detect aspiration and inaccurate measurement of GRVs. The practice of measuring GRVs is poorly defined • Standardisation of how to measure GRVs, when to measure them, definition of a high GRV and what a high GRV actually implies remains controversial and confusing to clinicians • Many variables can affect bedside GRV measurements, including the type of feeding tube and patient positioning • The acceptable range for GRVs can vary significantly. Research to date has not been able to define this number nor identify the precise level of GRV which places the patient at greatest risk • The Canadian Clinical Practice Guidelines concur that in critically ill, mechanically ventilated patients a higher GRV of 250mL or more should be accepted to improve delivery of EN in this patient population	Best practice guidelines

Studies that support GRVs

- Studies by Methany et al. in 2004 and 2008 in critically ill, mechanically ventilated patients found no direct relationship between aspiration and GRVs, however when GRVs were high, patients aspirated significantly more. The following values were found to be significant when entered into a regression model: two or more >200mL and one or more >250mL. The authors recommend that serial GRV measurements be made when gastric feedings are administered
- Mayer et al. 2002 concluded that the use of GRVs to define feed intolerance in critically ill children is justified
- Mentec et al. 2001 observed critically ill patients for upper GI intolerance and clinical signs of pneumonia. Patients identified with upper GI intolerance had a significantly higher incidence of pneumonia than did those without upper GI intolerance

Studies that don't support GRVs

- Cohen et al. 2000 study found no difference in GRVs when comparing a group with normal gastric emptying to a group with abnormal gastric emptying based on paracetamol absorption test
- McClave et al. 2003 reports that GRV measurement may impede nutrition support
- Lukan et al. 2005 found no difference in the incidence of aspiration in a group of patients with high GRVs versus low GRVs
- McClave et al. 2005 recommends that feeds are not stopped for GRVs below 400–500mL, in the absence of other clinical signs of intolerance

Majority of studies have been done in the critical care setting using nasogastric feeding tubes

Practice recommendations

- Evaluate all enterally fed patients for risk of aspiration (A)
- Ensure that the feeding tube is in the proper position before initiating feeds (A)
- Keep the head of the bed elevated at 30–45° at all times during the administration of enteral feeding (A)
- Check GRVs every four hours during the first 48 hours for gastrically fed patients. After enteral feeding goal rate is achieved, GRVs monitoring may be decreased to every 6–8 hours in non-critically ill patients. (C) However measurements every four hours are prudent in critically ill patients (B)
- If GRV is ≥250mL after a second gastric residual check, a pro-motility agent should be considered in adult patients (A)

	• If GRV >500ml should result in holding EB and reassessing patient tolerance by use of an established algorithm including physical assessment, GI assessment, evaluation of glycaemic control, minimisation of sedation and consideration of pro-motility agent (B) • In acutely ill paediatric patients receiving continuous drip feedings, the GRVs may be checked every four hours and held if the volume is greater than or equal to the hourly rate. If feedings are bolus, then the GRV may be checked before the next feeding and held if the residual volume is more than half of the previous feeding volume (C)	
McClave et al. *(*2005)[73]	• Prospective, randomised • Critically ill mechanically ventilated adults • NG (21) and PEG (19) • 200mL v 400mL GRV • Four hourly for three days • Frequency of regurgitation was significantly less for PEG patients • No difference in aspiration occurrence between 200mL v 400mL GRVs • No relationship between regurgitation and aspiration • When the discontinuation threshold of GRV's was raised from 200mL to 400mL there was no significant difference in the incidence of aspiration or regurgitation	III-b
Metheny (2008)[75]	• Objective of study was to describe the association between gastric residual volumes and aspiration of gastric contents • Prospective study of 206 critically ill patients (adults) with tracheal intubation receiving gastric tube feedings for three consecutive days. GRVs were measured with 60mL syringes every four hours. Measured volumes were categorised into three overlapping groups: at least 150mL, at least 200mL, and at least 250mL. Patients were categorised as frequent aspirators if 40% or more of their tracheal secretions were positive for pepsin and as infrequent aspirators if less than 40% of their secretions were positive for pepsin. GRVs were compared between the two aspiration groups • No consistent relationship was found between aspiration and GRVs. Although aspiration occurs without high GRVs, it occurs significantly more often when volumes are high • Recommendations: It is important to measure GRVs at four hour intervals in critically ill patients in an effort to determine which patients are at greatest risk of aspiration	III-b

Source of evidence	Summary	Grading
Chang et al. (2004)[71]	• The use of GRV as a clinical monitor for patients receiving enteral tube feeding is based on presumptions that are not physiologically sound and practice that is poorly standardised • Little data exists to support a correlation of GRV with gastric emptying, volume of gastric contents, or changes in the infusion of enteral tube feeding • GRVs do not correlate with regurgitation or aspiration, and their use cannot be relied on to protect patients against aspiration pneumonia • The practice of GRVs may in fact impede delivery of enteral tube feeding by promoting inappropriate cessation and reducing potential infusion time • Application of the BV measurement of gastric contents might be useful for clinical practice, complementing the use and interpretation of GRVs	IV
Westaby et al. (2010)[38]	• A minority of patients tolerate intra-gastric feeding poorly with nausea, vomiting or reflux. Poor gastric emptying may be manifest by high gastric residual volumes. In such cases there is evidence of the benefit from the introduction of pro-kinetics (NICE: Nutrition support in adults). If there is no response to this treatment, it is recommended that the feed is delivered into the jejunum	Evidence of best practice
Metheny(2006)[49]	• Withdrawal of gastric contents via a syringe may not remove the total volume of fluid present in the stomach. A number of variables may affect GRV measurements: o Type of feeding tube: small bore tubes with few port =underestimation o Position of ports of the tube in the stomach: i.e. ports resting near gastro-oesophageal junction (GOJ) less likely to rest in pool of gastric fluid especially if patient sitting up. Known as the cascade effect o Patients position: unclear if supine or side lying has effect in adults • GRV's used in critically ill as theory that high GRV's predispose to reflux and subsequent aspiration	Review/expert opinion
DeLegge & HPEN Working Party (2006)[33]	• Gastric feeds should not be held for gastric residual volumes of 300mL or less unless there are clinical signs of intolerance such as significant abdominal distension, nausea or vomiting. Gastric residual volumes should be monitored at home 2–3 times a day in the neurologically impaired patient who cannot communicate symptoms of nausea, abdominal pain or fullness. If there is no change clinically in the patients status, decrease monitoring to once daily for 5–7 days then stop	Review / expert opinion
Roche (2003)[44]	• Residuals should be checked four times per day. Residuals less than 200mL are acceptable and tube feeds can be advanced. Stop checking residuals 48 hours after tube feeds have reached target volumes unless there is a change in clinical status	Review / expert opinion

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