TECHNOLOGY REVIEW (MINI-HTA)

NASOJEJUNAL TUBE IN UPPER GASTROINTESTINAL CONDITIONS

Malaysian Health Technology Assessment Section (MaHTAS)
Medical Development Division
Ministry of Health Malaysia
002/2023

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EXECUTIVE SUMMARY

Background
Upper gastrointestinal conditions including the obstruction or ulceration of the pharynx, oesophagus, stomach and duodenum may prevent the ingestion of normal food. Patients who present with various upper gastrointestinal conditions develop serious nutritional compromise which necessitates prompt intervention. Establishing nutrition is of the utmost importance before definitive surgical intervention is possible.

There are various types of enteral feeding tubes available such as nasogastric tubes, nasojejunal tubes, jejunostomy tubes, radiologically inserted gastrostomy tube (RIG), and percutaneous endoscopic gastrostomy tubes (PEG). Feeding administered distal to the obstructions such as nasojejunal feedings reduces the risk of vomiting and aspiration caused by gastroesophageal reflux. Unlike others, nasojejunal feeding also does not stimulate pancreatic secretion. In recent years, nasojejunal tubes are invented with double lumen weighted nasojejunal silicone tubes or also known as nasogastrojejunal (NGJ) tube in enteral nutrition. The tube which had dual channels are useful with added benefit which was discussed further under Technology Features of this review.

This review evaluated the used of nasojejunal tubes in upper gastrointestinal conditions including the invented version of double-lumen weighted silicone nasojejunal tube which subjected to the availability of the scientific evidence.

Objective/ aim
To assess the efficacy/effectiveness, safety and cost-effectiveness of nasojejunal tubes in general in upper gastrointestinal conditions.

Results and conclusions:

Search results
A total of **280** records were identified through the Ovid interface and PubMed. After removal of duplicates and irrelevant titles, **72** titles were found to be potentially relevant and were screened using the inclusion and exclusion criteria. Of these, **12** relevant abstracts were retrieved in full text. After reading, appraising and applying the inclusion and exclusion criteria, **6** studies were included while the other **6** studies were excluded since the studies involved unrelated objective although the nasojejunal tube were also used in the study. **Six** full text articles finally selected for this review comprised of 2 systematic review, two RCT, one retrospective cohort and one cross-sectional study. The studies were conducted mainly in United States, India, Scotland, China, and Malaysia (cross-sectional study).

Conclusions
Overall, there was insufficient number of evidence retrieved on double lumen weighted nasojejunal silicone tube. However, based on the above review, nasojejunal tube in general

can be used for enteral feeding in various upper gastrointestinal conditions. The nasojejunal tube in general showed no difference in catheter efficacy, total duration of nutritional support, complications associated with the procedure, need for surgical intervention and exacerbation of pain compared to jejunostomy and nasogastric tube. However, it may improve rate of grade I and grade II complications, time of tube removal and postoperative hospital stay, rate of intestinal obstruction and delayed gastric emptying. As for safety, the complications reported on the use of nasojejunal tube were of sore throat, speech disorder, headache, cough and drying of the mucosa, anastomotic leakage, pneumonia, abdominal pain, vomiting and diarrhoea. No retrievable evidence on economic evaluation of nasojejunal feeding.

Methods

Literature search was conducted by an *Information Specialist* who searched for published articles on nasojejunal feeding tube. The following electronic databases were searched through the Ovid interface: Ovid MEDLINE® In-Process & Other Non-Indexed Citations and Ovid MEDLINE® 1946 to July 2023. Parallel searches were run in PubMed, US FDA and INAHTA database as well as CADTH. Some limitations applied during search (animal study). Additional articles were identified from reviewing the references of retrieved articles. The last search was performed on 12 July 2023.

TABLE OF CONTENTS

ABBREVIATIONS

DGE	Delayed gastric emptying
EN	Enteral feeding
GI	Gastrointestinal
JEJ	Surgical jejunostomy tube
MGOO	Malignant gastric outlet obstruction
NG	Nasogastric
NGJ	Nasogastrojejunal
NJ	Nasojejunal
PD	Pancreaticoduodenectomy
PEG	Percutaneous endoscopic gastrostomy
PEJ	Percutaneous endoscopic jejunostomy
RIG	Radiological inserted gastrostomy tube
RIJ	Radiologically inserted jejunostomy
WHO	World Health Organisation

1.0 BACKGROUND

Upper gastrointestinal conditions including the obstruction or ulceration of the pharynx, oesophagus, stomach and duodenum may prevent the ingestion of normal food.[1] Gastrointestinal obstruction occurs whenever the normal flow of swallowed content is interrupted. This interruption can occur at any place along the gastrointestinal tract. When it occurs in the upper gastrointestinal tract such as in the oesophagus, stomach or duodenum, it tends to have a less urgent presentation, whereas in the small bowel and colon it often presents as a medical emergency. Intestinal obstruction accounts for approximately 15 percent of all emergency department visits for acute abdominal pain.[2]

Patients who present with upper gastrointestinal obstruction develop serious nutritional compromise which necessitates prompt intervention. Besides, the patient rapidly becomes malnourished and burdened with the risk of aspiration of the undigested food particles and excessive secretions of the obstructed segment. Establishing nutrition is of the utmost importance before definitive surgical intervention is possible. Normally, these patients will require either enteral or parenteral nutrition. The parenteral nutrition is known to have significant morbidity associated from its use and risk of sepsis from the central line involved in administering parenteral nutrition which can be fatal.[1] Meanwhile enteral feeding is more physiological, simpler, cheaper, less complicated especially in avoiding central catheter-related complications which make it more preferred over parenteral nutrition.[3,4]

There are various types of enteral feeding tubes available such as nasogastric tubes, nasojejunal tubes, jejunostomy tubes (JEJ, PEJ or RIJ tubes), radiologically inserted gastrostomy tube (RIG), and percutaneous endoscopic gastrostomy tubes (PEG).[4] Feeding administered distal to the obstructions such as nasojejunal feedings reduces the risk of vomiting and aspiration caused by gastroesophageal reflux. Moreover, nasojejunal feeding does not stimulate pancreatic secretion unlike others. In recent years, nasojejunal tubes are invented with double lumen weighted nasojejunal silicone tubes or also known as nasogastrojejunal (NGJ) tube in enteral nutrition. The tube which had dual channels are useful with added benefit which was discussed further under Technology Features of this review.[3]

This review evaluated the used of nasojejunal tubes in upper gastrointestinal conditions including the invented version of double-lumen weighted silicone nasojejunal tube which subjected to the availability of the scientific evidence.

2.0 OBJECTIVE / AIM

To assess the efficacy/effectiveness, safety and cost-effectiveness of double lumen weighted nasojejunal silicone tubes.

3.0 TECHNICAL FEATURES

3.1 Types of Enteral Feeding Tubes

i. Nasojejunal tube

Nasojejunal tube is a type of enteral nutritional support used in various gastrointestinal disease. The tube is suggested if the patients' stomach cannot empty properly, or to get past a blockage in the small bowel as well as after pancreatic surgery.[4] The tip of the nasojejunal tube goes into the second part of the small bowel (the jejunum). The position of the tube in the jejunum is confirmed using fluoroscopy.[5]

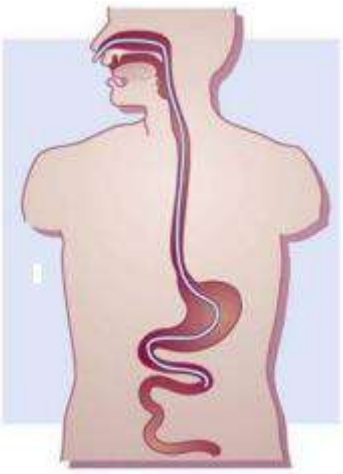

Figure 1: Nasojejunal Tube

ii. Double lumen weighted nasojejunal silicone tube with gastric decompression / nasogastrojejunal tube (NGJ)

According to the requestor, currently, they are using customised long nasojejunal tube as NGJ. The customised double lumen silicone tubes are produced by the Japanese manufacturing company Cliny. The tube has a weighted radio-opaque tip with a central opening that allows passage of a guidewire via the central lumen. There is a secondary lumen that opens at 45 cm from the tip. There is a radio-opaque marker at 40 cm that helps guide the insertion and allows localisation of the secondary channel openings on abdominal radiographs. The tubes are 16 Fr in thickness and 160 cm long.[3] There are other commercial double lumen weighted nasojejunal tubes available such as Medicina ENFit[6] and Freka-EasyIn.[7] The insertion of the double-lumen weighted nasojejunal tube must be performed by trained endoscopist to ensure the correct placement.

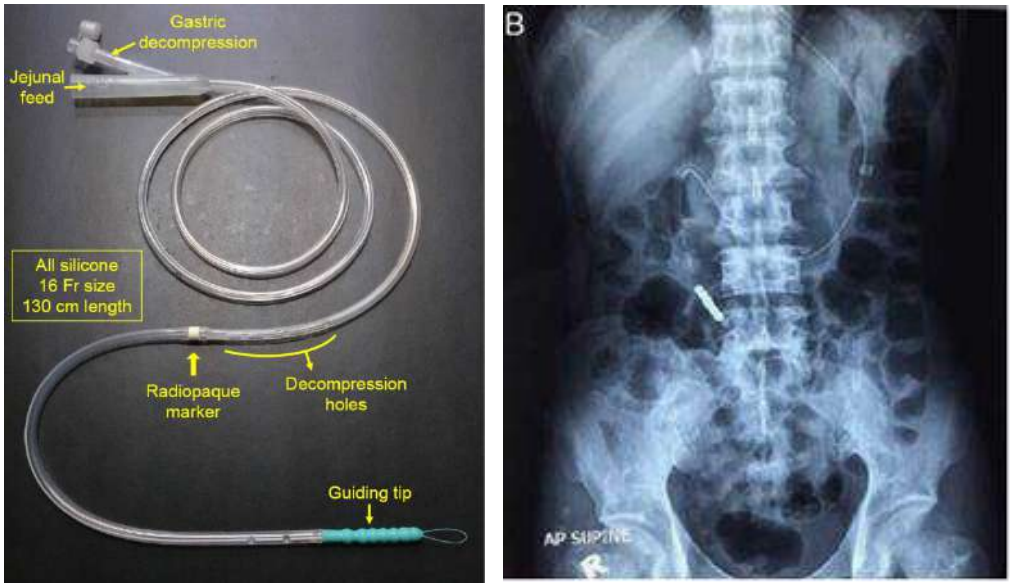

Figure 2.1: Double lumen weighted nasojejunal silicone tube by Cliny

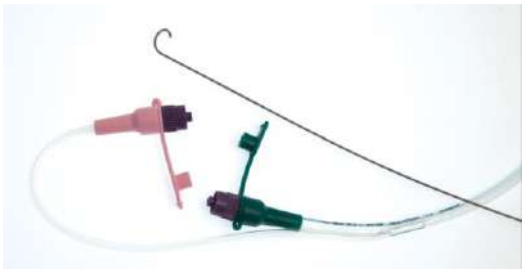

Figure 2.2: Medicina ENFit[6]

Figure 2.3: Freka-EasyIn[7]

iii. Nasogastric Tube

Thin tube that goes in through nose and down a throat into stomach. This tube is used if the feeding required for two to four weeks. The procedure to put the tube is a quick procedure. It does not affect the ability to breath or speak and patient can still eat as well as drink with the tube in place.[4]

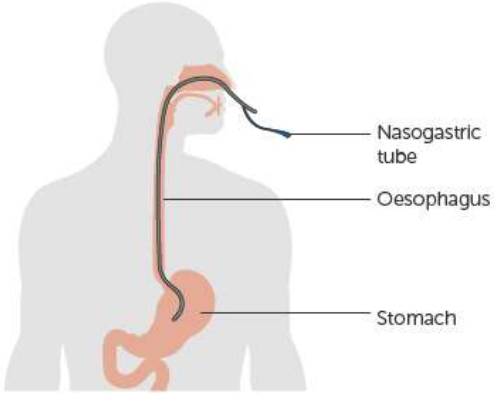

Figure 3: Nasogastric tube

iv. Jejunostomy tubes

a. Surgical jejunostomy (JEJ) tubes
This tube is used if patient have had stomach or oesophageal surgery.[4]

b. Percutaneous endoscopic jejunostomy (PEJ) tubes
The insertion procedure require endoscopy. The tube will go down the oesophagus and into stomach. Then the surgeon will insert the jejunostomy tube through an opening in the abdomen and into the jejunum. This procedure require sedation. With PEJ, the patient will be feed at slow rate and there will be a pump that controls the speed of the feed passing into the tube.[4]

c. Radiologically inserted jejunostomy (RIJ) tubes
The insertion of RIJ tube require guide from x-ray.[4]

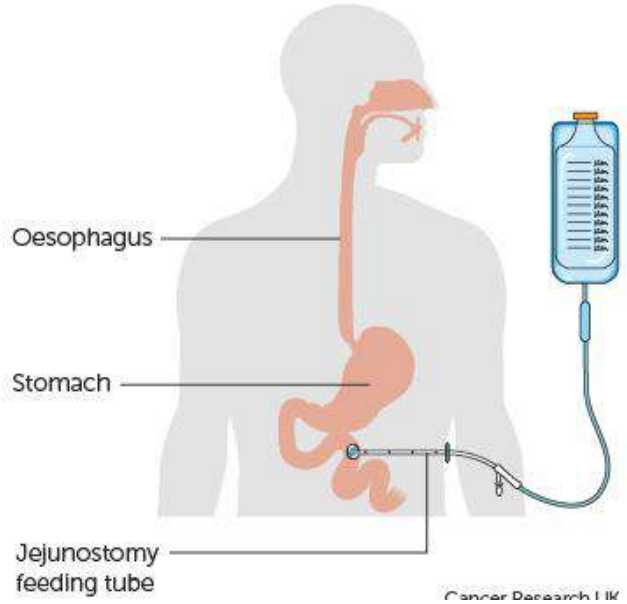

Figure 4: PEJ tube

v. Radiologically inserted gastrostomy tube (RIG)

It is a gastrostomy tube where a doctor inserts the tube directly into stomach under x-ray guidance. The procedure requires local anaesthetic and it is for patient who can't have an endoscopy such as in patient who had tumour in the oesophagus.[4]

vi. Percutaneous endoscopic gastrostomy tubes (PEG)

This tube is for patient with longer terms eating and swallowing problem such as cancer of the head and neck or oesophagus cancer. The tube will go into the stomach through an opening made on the outside of abdomen. To insert the PEG tube, the surgeon will require endoscopy to locate the place to put the PEG tube. The surgeon then inserts the tube through an opening in the abdomen and into the stomach. The procedure will require sedation. The feeds usually run for most of the day through a

pump and will have a break for a few hours to give the stomach a rest. Sometimes feeds can go in over 24 hours at a low rate. The feed can be done at home and a dietitian will guide on how much feed required as well the timing.[4]

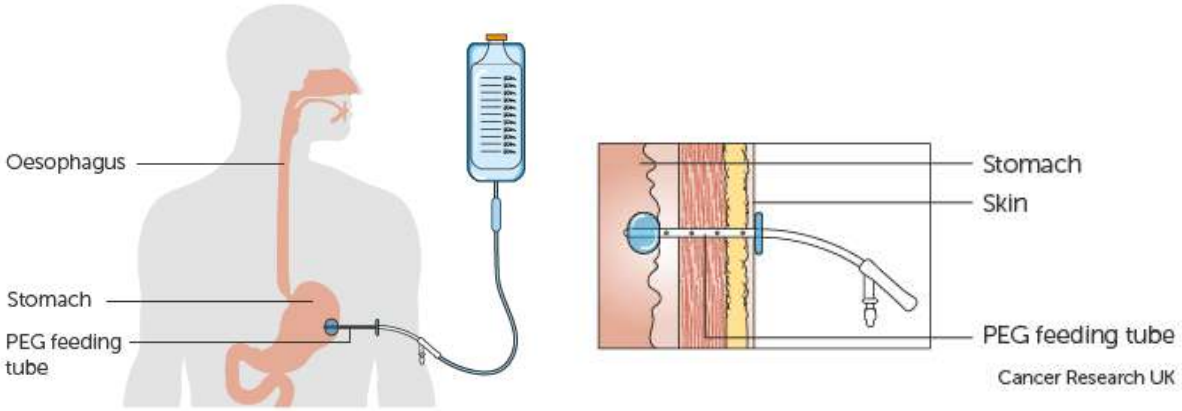

Figure 5: PEG feeding tube

3.2 Study Populations

Based on the included studies, nasojejunal tube was used in various study population. In one SR, the nasojejunal tube was used for early enteral feeding in patients who just underwent oesophagectomy. Another SR compared between nasogastric tube with nasojejunal tube among patients with severe acute pancreatitis. Meanwhile in one cross-sectional study and two RCTs, nasojejunal tube was used in patients with upper gastrointestinal obstruction, gastrectomy and pancreaticoduodenectomy (PD), respectively. One included cohort involved patients with malignant gastric outlet obstruction (MGOO).

3.3 Double lumen weighted nasojejunal silicone tube in Ministry of Health, Malaysia

According to National Head of Upper GI Surgery Service, the used of double lumen nasojejunal silicone tube was not widely used. Up to the December 2022, only few institutions had trained surgeon to perform insertion and had access to a slim neonate scope. Those institutions were:

- Hospital Sultanah Aminah Johor Bharu, Johor
- Hospital Enche Besar Hajjah Khalsom Kluang, Johor
- Hospital Melaka
- Institut Kanser Negara, Putrajaya
- Hospital Pulau Pinang
- Hospital Queen Elisabeth I, Kota Kinabalu, Sabah
- Hospital Umum Sarawak, Kuching, Sarawak

4.0 METHODS

Literature search was conducted by the author and an *Information Specialist* who searched for full text articles pertaining to nasojejunal feeding tube.

4.1 SYSTEMATIC SEARCH

The following electronic databases were searched through the Ovid interface:

- MEDLINE® In-Process and Other Non-Indexed Citations and Ovid MEDLINE® 1946 to July 2023

Other databases:

- PubMed
- Other websites: US FDA, INAHTA, CADTH

General databases such as Google and Yahoo were used to search for additional web-based materials and information. Additional articles retrieved from reviewing the bibliographies of retrieved articles. The search was limited to articles on human. There was no language limitation in the search. **Appendix 1** showed the detailed search strategies. The last search was conducted on 12 July 2023.

4.2 SELECTION

A reviewer screened the titles and abstracts against the inclusion and exclusion criteria. Relevant articles were then critically appraised using *Critical Appraisal Skills Programme (CASP) checklist* and graded according to *US/Canadian Preventive Services Task Force* (**Appendix 2**). ROB 2 also used for RCTs and ROBIS for SR. Data were extracted and summarised in evidence table as in **Appendix 3**.

The inclusion and exclusion criteria were:

Inclusion criteria:

a.	**Population**	Upper gastrointestinal obstruction, pancreatic tumour, distal duodenum obstruction
b.	**Intervention**	Double lumen nasojejunal silicone tube / nasojejunal feeding tube / with gastric decompression / nasogastrojejunal tube / double-

		lumen naso-enteric tube
c.	**Comparator**	i. No comparator ii. Others types of enteral feeding (nasogastric tube, jejunal tube etc.
d.	**Outcomes**	i. Safety ii. Efficacy and effectiveness
e.	**Study design**	SR, RCT, Control Trial, Cohort study
f.	Full text articles published in English	

Exclusion criteria:

a.	**Study design**	animal study
b.	Non-English full text articles	

5.0 RESULTS

Search results

An overview of the search is illustrated in **Figure 2**. A total of **280** records were identified through the Ovid interface and PubMed. After removal of duplicates and irrelevant titles, **72** titles were found to be potentially relevant and were screened using the inclusion and exclusion criteria. Of these, **12** relevant abstracts were retrieved in full text. After reading, appraising and applying the inclusion and exclusion criteria, **six** studies were included while the other **six** studies were excluded since the studies involved unrelated objective although the nasojejunal tube were also used in the study. **Six** full text articles were finally selected for this review comprised of two SRs, two RCTs, one retrospective cohort and one cross-sectional study. The studies were conducted mainly in United States, India, Scotland, China, and Malaysia (cross-sectional study).

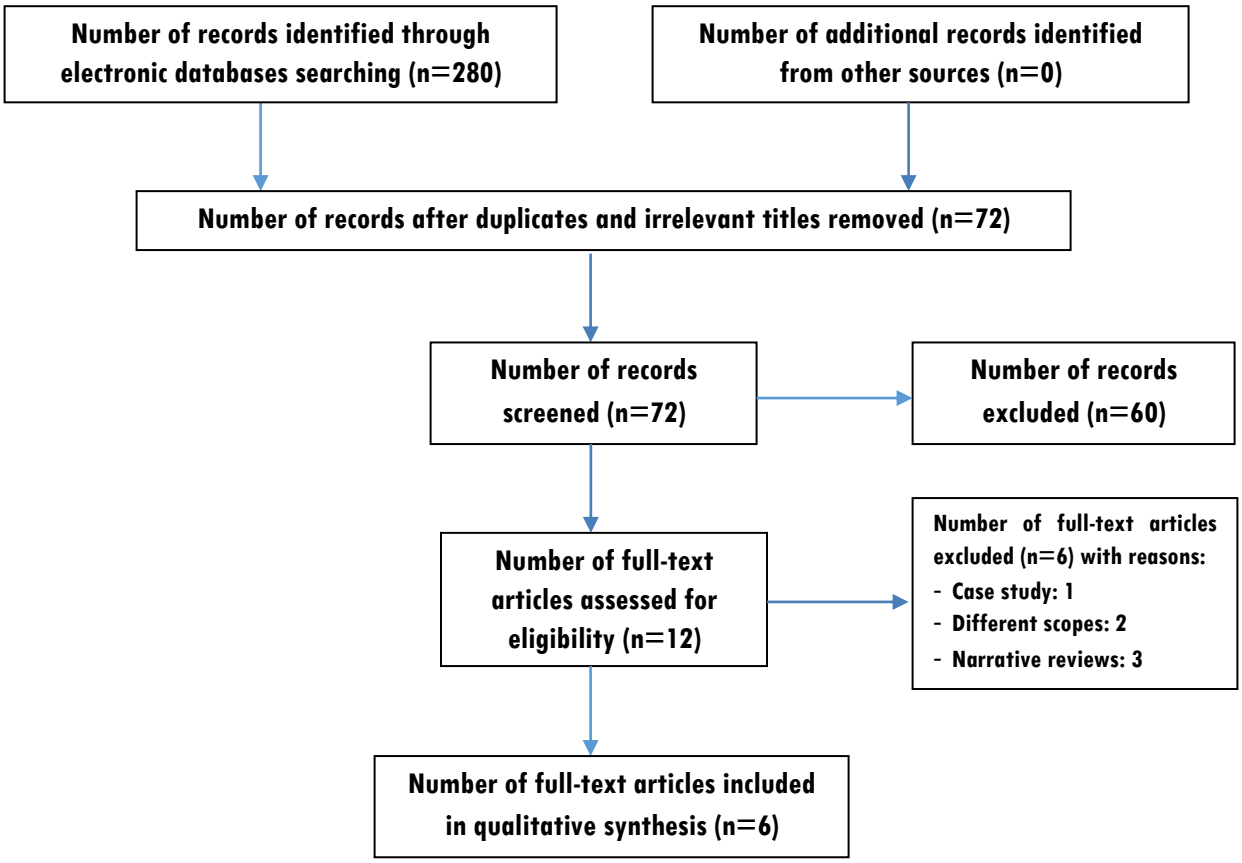

Figure 2: Flow chart of retrieval of articles used in the results

Quality assessment of the studies

The risk of bias in the included studies were assessed using domain-based evaluation. This is achieved by answering a pre-specified question of those criteria assessed and assigning a judgement relating to the risk of bias as either:

The risk of bias was high for one systematic review because the SR included two abstracts of RCTs in the final assessment. Meanwhile another SR showed low risk of bias. One cross-sectional study conducted in local setting and no information on confounding factors highlighted in the study. Both included RCTs had some issues in the process especially on the randomisation and allocation concealment part as well as the analysis part; lack of details

provided for further assessment with ROB 2. The results of risk of bias of included studies are summarised in **Figure 3.1 and 3.4**

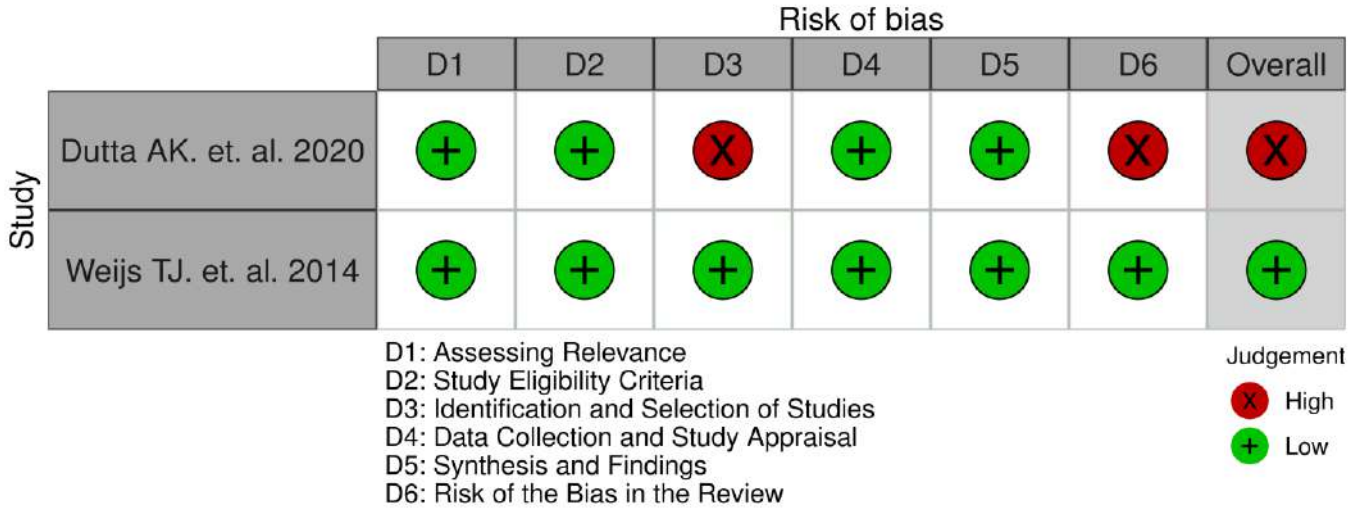

Figure 3.1: Risk of Bias of Systematic Reviews (ROBIS)

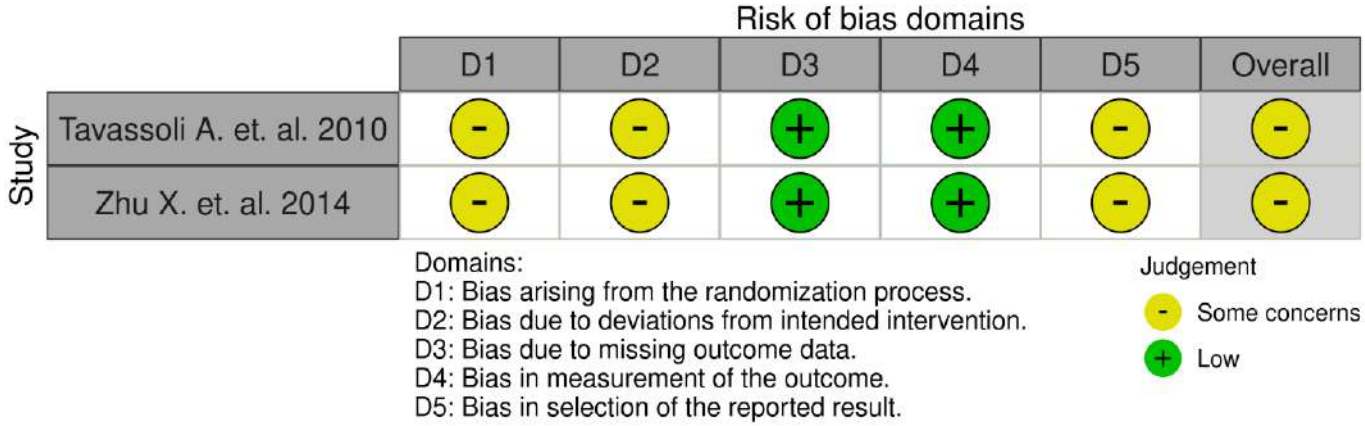

Figure 3.2: Risk of Bias of Randomised Control Trial (ROB-2)

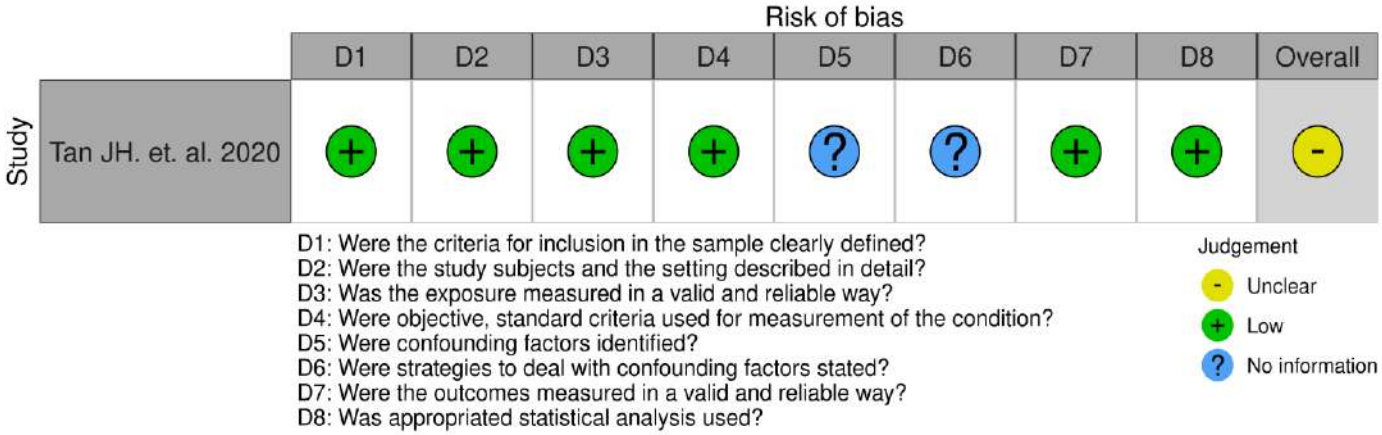

Figure 3.4: Risk of Bias of Cross-sectional Study

5.1 EFFICACY / EFFECTIVENESS

Weijs TJ et. al. conducted an SR in 2014 to determine the best route of early enteral feeding after oesophagectomy. Seventeen (17) studies were included in the SR. Out of 17 studies, two studies compared early feeding with tube feeding, one study compared early oral feeding with conventional nil-by mouth regimen, one study compared nasojejunal with jejunostomy feeding, eleven studies discussed the outcome of jejunostomy and two studies on the outcome of nasojejunal tube feeding. Only one nonrandomised study (N = 133) investigated early oral feeding specifically following esophagectomy. Generally, the early oral feeding was associated with a reduced length of stay, without increase in complication rates. In the study that compared nasojejunal tube feeding with jejunostomy tube feeding, a total of 150 patients who underwent a transthoracic or transhiatal esophagectomy with cervical anastomosis were included. The tube feeding was started on postoperative day one and gradually increased until nutritional requirements were met on postoperative day three. The authors reported that there were no significant differences between nasojejunal and jejunostomy regarding catheter efficacy. Patient satisfaction and post-admission nutritional outcome were not recorded, only the total duration of nutritional support was measured which was not significantly different between groups. In the two non-comparative studies (N = 64) on nasojejunal tube feeding, no data on patient satisfaction and long-term nutritional outcome were reported. The median length of hospital stay was 11 days in jejunostomy and 10 days in nasojejunal tube feeding.[8,] level 1

An SR with MA by Cochrane group compared the mortality, morbidity and nutritional status between nasogastric tube and nasojejunal tube in patients with severe acute pancreatitis. The included trials assessed the placement of nasogastric tube and feeding through nasogastric tube compared with placement of nasojejunal tube and feeding done through the nasojejunal tube. The primary outcome was mortality and the secondary outcomes observed were organ failure, rate of infection, success rate of the procedure, complications associated with the procedure, surgical intervention, requirement for parenteral nutrition, complications associated with the feeds, days taken to achieve full nutrition requirement, duration of tube feeding, duration of analgesic requirement after feeding tube placement, exacerbation of pain and length of hospital stay. The SR included five RCTs (consisted of 3 full-text articles and 2 abstracts) that randomised a total of 220 adult participants from India, Scotland, and the USA. After further assessment, the authors reported no significant difference in mortality between the two groups (risk ratio (RR) 0.65, 95% confidence interval (CI) 0.36 to 1.17; I^2 = 0%; 5 trials, 220 participants; very low-certainty evidence due to indirectness and imprecision). The common cause of mortality reported in the included studies were secondary to multi-organ failure. As for secondary outcome, organ failure was reported in three trials where respiratory failure was the most commonly reported. However, the pooled estimate did not favour either method of tube feeding (RR 0.99, 95% CI 0.79 to 1.25). Other secondary outcomes reported which also had no significant difference between both methods were success rate (RR 1.06, 95% CI 0.93 to 1.20), complications associated with the

procedure (RR 0.52, 95% CI 0.07 to 3.74), need for surgical intervention (RR 0.87, 95 CI 0.30 to 2.50), requirement of parenteral nutrition (RR 1.03, 95% CI 0.39 to 2.71), complications associated with feeds (RR 1.11, 95% CI 0.53 to 2.32), and exacerbation of pain (RR 0.85, 95% CI 0.31 to 2.29). For days taken to achieve full nutritional requirement, two studies reported that all study participants reached the required daily calorie intake by day 3 and 7 and one studies reported the failure which occurred in six out of eleven patients in nasogastric group who had to be switched to nasojejunal feeds. No meta-analyse were conducted for the remaining secondary outcome due to lack of suitable data; those outcomes were duration of tube feeding, and duration of analgesic requirement after feeding tube placement.[5, level 1]

Tan JH. et. al. conducted a cross-sectional study in Hospital Sungai Buloh and Hospital Sultanah Aminah, Malaysia to investigate the indications for nasojejunal (NJ) silicone tube insertion, insertion technique, and tube-related problems in 201 consecutive adult patients with upper gastrointestinal obstruction (72 patients (35.8%) with gastric outlet obstructions and tumours of the distal oesophagus in 65 patients (32.3%). The patients underwent the procedure between January 2015 and June 2018 and were prospectively reviewed. The procedure involved insertion of customised double lumen silicone tubes by Japanese manufacturing company (Cliny) based on the specification. The tube has a weighted radio-opaque tip with a central opening that allows passage of a guidewire via the central lumen. The insertions were performed by a trained endoscopist and before the feeding initiated, abdominal x-ray supine was performed to confirm the location of the tubes. The mean insertion time recorded was 18.3 minutes (SD ±4.33) and the mean duration of used of the tube was 44.4 days (SD ±27.42). The tubes were used before surgery and maintained during the postoperative phase until normal feeding could be resumed. No nutritional outcome was reported with the use of the feeding tube post-operatively.[3, II-2]

An RCT by Tavassoli A et al. (2010) in Iran evaluated the efficacy and necessity of the nasojejunal tube after gastrectomy. The trial involved 50 patients who underwent total gastrectomy from 2001 to 2008. The patients were divided into two groups; 25 patients were in group 1 and received nasojejunal tube and another 25 patients in group 2 post-operatively did not received nasojejunal tube. In the first group, the tube was removed at least 36 h after operation for continuous drainage until the passage of flatus or stool. In the second group, the tube was removed when the patient was in the recovery room. Post-operative course for each patient was closely monitored. Listed were several things recorded on the day of flatus passage and oral food intake; the duration of nasojejunal decompression, postoperative perfusions and length of hospital stay. Several outcomes were also monitored; mortality, abdominal complications, pulmonary complications, post-operative fever, nausea and vomiting and discomfort from the NJ such as pain, nasal soreness and painful swallowing. The degree of discomfort from NJ was graded on scale from 0 to 3; absence of discomfort or slight, moderate or severe discomfort. The mean score was 2.42 ± 1.57. The authors reported that for postoperative initial passing of gas, there was no significant difference

between patients who had nasojejunal tube and those who did not (2.6 ± 1.1 days and 2.83 ± 1.04 days, respectively). Other outcomes also showed no significant difference between the two groups; the mean time for the post-operative liquid diet (6.3 ± 0.4 in group 1 and 6.0 ± 1.4 days in group 2), and hospital stay duration (9.7 ± 1.3 days in group 1 and 9.3 ± 2 days in group 2).[9, II-1]

Zhu X. et. al. conducted an RCT to determine the efficacy and feeding-related complications of the 2 feeding strategies after pancreaticoduodenectomy (PD). The study included 68 patients who had undergone PD for periampullary tumours from January 2009 to October 2012 in Medical School of Nanjing University, China. The patients were randomised either to receive nasojejunal tube (in 34 patients) or jejunostomy (in 34 patients). The primary endpoint was the occurrence of a major complication and the secondary endpoint was 30 days after hospital discharge. Postoperative complications were graded according to the Clavien-Dindo classification system, which was validated in pancreatic surgery. Complications graded as III to V were considered as major. For nutrition assessment, Nutrition Risk Screening 2002 (NSR 2002) scoring system were used. After surgery, each patient received parenteral nutrition (PN) for five days as well as enteral feeding (nasojejunal or jejunostomy tube). On day six, the PN was stopped and the enteral feeding was stopped when the patients tolerated the oral diet with oral intake >1000 kcal/day. The assessments for clinical outcomes showed that there were no significant differences between nasojejunal and jejunostomy group in the score categorised in four risk classes ($P > 0.05$). The list of the predictive risk score of the major complications after PD were in Table 1. Another observation was on reoperation and readmission in both groups. The details of the observations as well as the complications grade were in Table 2. The authors reported that the rate of grade I complications, grade II complication and readmission in the nasojejunal group were significantly decreased ($P < 0.05$) and no hospital mortality occurred during study. The postoperative complications reported was the rate of infections, intestinal obstruction and enteral-feeding-related complications. However, only the rate of intestinal obstruction and delayed gastric emptying were significantly decreased in the nasojejunal tube group ($P < 0.05$) and no significant difference in the other two complications. Another observation reported was feeding-tube-related complications (dislodgement, blockage and leakage) where the complications was more common in the jejunostomy compared to nasojejunal group (35.3% versus 20.6%, $P < 0.05$). For indexes on feeding tube efficiency, the authors reported that there was no significant difference in time to full establishment of oral intake and duration of tube feeding in both groups. Meanwhile, for time of tube removal and postoperative hospital stay was significantly decreased in nasojejunal tube compared to jejunostomy.[10, level II-1]

Table 1: Predictive Risk Score for Major Complications after PD

Predictor	Categories	Risk Score	JT Group	NJT Group
Pancreatic texture	Hard	0	20	18
	Soft	4	14	16
Pancreatic duct diameter	>3mm	0	24	22
	≤3mm	1	10	12
Operative blood loss	<700mL	0	23	21
	≥700mL	4	11	13
ASA score	I	0	18	20
	II	2	15	12
	III	6	1	2
Score categorized in 4 risk classes	0-3		12 (35.3%)	14 (41.2%)
	4-7		10 (29.4%)	9 (26.5%)
	8-11		10 (29.4%)	10 (29.4%)
	12-15		2 (5.9%)	1 (2.9%)

ASA, American Society of Anesthesiologists; JT, jejunostomy tube; NJT, nasojejunal tube; PD, pancreaticoduodenectomy.
Data are number of patients (%).

Table 2: Postoperative Outcomes

Group	JT group	NJT group
Complication Grade		
No complications	13 (38.2%)	14 (41.2%)
Grade I	16 (47.1%)	9 (26.5%)*
Grade II	17 (50.0%)	11 (32.3%)*
Grade IIIa	4 (11.8%)	3 (8.8%)
Grade IIIb	2 (5.9%)	3 (8.8%)
Grade IVa	0	0
Grade IVb	0	0
Grade V (mortality)	0	0
Reoperation	3 (8.8%)	2 (5.9%)
Readmission	4 (11.8%)	1 (2.9%)*

Values are n, %. Numbers of single type of complications do not add up to the number of patients within the 2 groups, as it is possible for some patients to have >1 type of complication. JT, jejunostomy tube; NJT, nasojejunal tube.
*Signifies the results for the NJT group are significantly different from the results for the JT group ($P < .05$).

Lin CL et. al. conducted a retrospective cohort to compare the clinical outcomes of nasojejunal tube with duodenal stent in patients with malignant gastric outlet obstruction (MGOO). The study involved 38 patients with inoperable MGOO who were retrospectively reviewed at Taipei Veterans General Hospital from January 2007 to December 2011. Out of 38 patients, 18 patients received nasojejunal feeding replacement and the other 20 patients underwent duodenal stent placement. The primary outcome of the study was the improvement of food intake, measured by the gastric outlet obstruction score system (GOOSS). The GOOSS score is 0 referred to 'no oral intake', 1 for 'liquid diet', 2 for' soft diet'

and 3 for 'regular diet'. Based on GOOSS score, the clinical success was defined as relief of obstructive symptoms and improvement of oral intake. Other outcomes included technical success, complications, persistent and recurrent obstructive symptoms, reintervention and survival. The authors reported that both feeding techniques were successfully deployed in all the patients. For clinical success, both feeding techniques improved oral intake in patients. The 30-day followed-up of food intake was obtained from 8 out of 18 (44%) patients with nasojejunal tube and from 18 out of 20 (90%) duodenal stents patients. The authors reported that the patients treated with stent placement had better GOOSS scores than those who were treated with nasojejunal tube. A total of 17 obstructive episodes were reported either after nasojejunal or duodenal stent placement and only 14 of them received further intervention. It was reported that more recurrent obstruction developed in the nasojejunal group (12 recurrent episodes) than in duodenal stent group (5 recurrent episodes). In terms of duration of patency, the duration was shorter in nasojejunal groups than duodenal stent group (median: 40 days versus 130 days, p = 0.009). Besides, the time to reintervention was also modestly shorter in the nasojejunal group than in the duodenal stent group (median: 44 days versus 96 days, p = 0.266). As for survival, the 30-days mortality rate had no significant difference between nasojejunal groups and duodenal stent groups (16.7% versus 20%, p = 1.000, respectively). The median survival was 140 days versus 186 days, p = 0.61, respectively.[11, level II-2]

5.2 SAFETY

Tavassoli A et al. reported the incidence of sore throat, speech disorder, headache, cough and drying of the mucosal was significantly higher in nasojejunal group compared to those without. On the other hand, post-operative bloating (in five patients (20%) from group 1 and six patients (24%) in group II) and post-operative pain (on third and sixth day postoperatively) had no significant different between groups. One major complication reported in both groups was fistula resulted from oesophagojejunostomy anastomosis to the skin (enterocutaneous fistula ($p < 0.05$).[9]

Weijs T. et. al. reported in the only RCT that compared nasojejunal and jejunostomy no significant differences between nasojejunal and jejunostomy regarding postoperative complications. However, more anastomotic leakage developed in nasojejunal tube compared to jejunostomy; 8 patients (11%) and five patients (6%), respectively. Other reported incidence was pneumonia in 27 patients (34%) with jejunostomy versus 29 patients (41%) in nasojejunal tube. The mortality rate amounted to six (8%) versus 2 (3%) in jejunostomy and nasojejunal tube feeding, respectively. On the other hand, tube-related complications were reported in 31 (38%) patients with a jejunostomy and in 20 (29%) patients with nasojejunal tube. One major tube-related complication, necessitating relaparotomy occurred in a patient with jejunostomy. Meanwhile in the other two non-comparative studies on nasojejunal tube feeding, the authors reported that the main drawback of using nasojejunal tubes as feeding

route was a frequent dislocation which occurred in 20-35% of all patients during postoperative admission.[8]

Tan JH. et. al. reported that, none of the patients had immediate complications due to either sedation or sequelae to endoscopic insertion. However, there were two cases of malposition due to severe distortion gastric anatomy with floppy dilated stomach. Out of 201 subjects 54 patients (26.9%) required reinsertion as the most common reason for the reinsertion was unintentional dislodgement in 32 patients (15.9%) followed by tube blockage 20 patients (10. 0%).[3, II-2]

Lin CL. et. al. reported no significant difference between nasojejunal group and duodenal stents group in minor and major complications incidence. The minor complications were recorded after one-week followed-up in six patients from nasojejunal and seven patients in the stent group. The most common minor complications in both groups were abdominal pain and vomiting, except that in nasojejunal group, the patients experienced diarrhoea. Meanwhile for major complication, aspiration pneumonia was detected in both group and one patient experience stent migration after the duodenal stent placement.[11]

5.3 ORGANISATIONAL ISSUES

According to the requestor, the nasojejunal tubes require the use of slim endoscope which is not available in all hospitals in Malaysia. Furthermore, the endoscopist need to be trained for insertion of these tubes safely without malposition.

5.4 ECONOMIC IMPLICATION

There was no retrievable evidence retrieved on cost-effectiveness study of nasojejunal. According to the requestor, the size of the 131.5cm nasojejunal tubes are RM 250 per piece, as for the extra-long tubes, the cost will be more.

5.5 LIMITATIONS

We acknowledge some limitations in our review and these should be considered when interpreting the results. The selection of the studies and appraisal was done by one reviewer. Besides, only English full text articles were included.

6.0 CONCLUSION

Overall, there was insufficient number of evidence retrieved on double lumen weighted nasojejunal silicone tube. However, based on the above review, nasojejunal tube in general can be used for enteral feeding in various upper gastrointestinal conditions. The nasojejunal tube in general showed no difference in catheter efficacy, total duration of nutritional support, complications associated with the procedure, need for surgical intervention and exacerbation of pain compared to jejunostomy and nasogastric tube. However, it may improve rate of grade I and grade II complications, time of tube removal and postoperative hospital stay, rate of intestinal obstruction and delayed gastric emptying. As for safety, the complications reported on the use of nasojejunal tube were of sore throat, speech disorder, headache, cough and drying of the mucosa, anastomotic leakage, pneumonia, abdominal pain, vomiting and diarrhoea. No retrievable evidence on economic evaluation of nasojejunal feeding.

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8.0 APPENDIX

APPENDIX 1: LITERATURE SEARCH STRATEGY

Database: Ovid MEDLINE(R) ALL <1946 to July 12, 2023>

Search Strategy:

1 Intestinal Obstruction/
2 (intestine* adj2 obstruct*).tw.
3 (intestinal adj1 obstruction*).tw.
4 Upper gastrointestinal obstruction.tw.
6 Intestinal Obstruction/ or Gastric Outlet Obstruction/ or Duodenal Obstruction/ or Duodenal Neoplasms/
7 enteral feeding.mp. or Enteral Nutrition/
8 (enteral adj1 feeding).tw.
9 (enteral adj1 nutrition).tw.
10 (force adj1 feeding*).tw.
11 (feeding adj1 tube).tw.
12 (gastric adj2 feeding tube*).tw.
13 Enteral Nutrition/ or Intubation, Gastrointestinal/
14 double lumen nasojejunal silicone tube.tw.
15 (gastrointestinal adj1 intubation*).tw.
16 (nasogastric adj1 intubation*).tw.
17 Nasojejunal feeding tube.tw.
18 short slim* endoscop* tube*.tw
19 short slim endoscope tube.tw.
20 nasojejunal 135cm.tw.
21 nasogastrojejunal.tw.
22 double-lumen naso-enteric tube.tw.
23 medicina-enfit.tw. (0)
24 Freka-EasyIn.tw. (0)
25 limit 23 to (humans and yr="2000 -Current")

Other Databases

EBM Reviews - Health Technology Assessment
EBM Reviews - Cochrane database of systematic reviews
EBM Reviews - Cochrane Central Registered of Controlled Trials
EBM Reviews - Database of Abstracts of Review of Effects
EBM Reviews - NHS economic evaluation database

} Same MeSH, keywords, limits used as per MEDLINE search

PubMed
INAHTA
US FDA

} Same MeSH and keywords as per MEDLINE search

APPENDIX 2: HIERARCHY OF EVIDENCE FOR EFFECTIVENESS

DESIGNATION OF LEVELS OF EVIDENCE

I	Evidence obtained from at least one properly designed randomized controlled trial.
II-I	Evidence obtained from well-designed controlled trials without randomization.
II-2	Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one centre or research group.
II-3	Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940s) could also be regarded as this type of evidence.
III	Opinions or respected authorities, based on clinical experience; descriptive studies and case reports; or reports of expert committees.

SOURCE: US/CANADIAN PREVENTIVE SERVICES TASK FORCE (Harris 2001)

APPENDIX 3: EVIDENCE TABLE (Available upon request)