TITLE PAGE

TITLE: Barriers to delivery of enteral nutrition in pediatric intensive care: a world survey

AUTHOR LIST: Tume LN, Eveleens RD, Verbruggen SCAT, Harrison G, Latour JM, Valla FV ***on behalf of the ESPNIC Metabolism, Endocrine and Nutrition section***

Lyvonne N Tume RN, PhD

Reader in Child Health (Critical Care Nursing)

University of Salford, Manchester

Frederick Road campus, M6 6PU

Phone +44(0) 7710 412 142

L.N.Tume@salford.ac.uk

Orchid ID 0000-0002-2547-8209

Renate D Eveleens, MD

PhD candidate Pediatric Intensive Care

Intensive Care, Department of Paediatrics and Pediatric Surgery, Erasmus Medical Centre - Sophia Children's Hospital, Dr. Molewaterplein 40, 3015 GD, Rotterdam, the Netherlands.

r.eveleens@erasmusmc.nl

Orchid ID 0000-0003-1793-8057

Sascha CAT Verbruggen MD, PhD

Consultant in Pediatric Intensive Care

Intensive Care, Department of Paediatrics and Pediatric Surgery, Erasmus Medical Centre - Sophia Children's Hospital, Dr. Molewaterplein 40, 3015 GD, Rotterdam, the Netherlands.

s.verbruggen@erasmusmc.nl

Orchid ID 0000-0003-4866-9865

Georgia Harrison

Year 3 Student Nurse (Child)

University of the West of England

Blackberry Hill, Bristol

BS16 1DD

geharrison10@hotmail.co.uk

Jos M. Latour RN PhD

Professor of Clinical Nursing

School of Nursing and Midwifery, Faculty of Health and Human Sciences,

University of Plymouth, 8-11 Kirkby Place, Room 205, Drake Circus,

Plymouth PL4 8AA, United Kingdom

jos.latour@plymouth.ac.uk

Orchid ID: https://orcid.org/0000-0002-8087-6461

Frédéric V Valla MD MSc

Consultant in Pediatric Intensive Care

Pediatric Intensive care unit, Hôpital Femme Mère Enfant,

CarMEN INSERM UMR 1060

Hospices Civils de Lyon, Lyon-Bron, France

Frederic.Valla@chu-lyon.fr

Phone +33(0)472 129735

Orchid ID 0000-0001-5285-1104

Corresponding author: Lyvonne Tume, Reader in Child Health (Critical Care Nursing)

University of Salford, Manchester, Frederick Road campus, M6 6PU

Phone +44(0) 7710 412 142

L.N.Tume@salford.ac.uk

Dr. Verbruggen's institution received funding from Nutricia BV, and she received funding from Sophia Research Foundation and an ESPEN research grant. Dr. Valla received funding from Baxter and Nutricia. The remaining authors have disclosed that they do not have any potential conflicts of interests

Abstract

Objective

To explore the perceived barriers by pediatric intensive care healthcare professionals (nurses, dieticians and physicians) in delivering enteral nutrition (EN) to critically ill children across the world.

Design

Cross-sectional international online survey adapted for use in pediatric settings.

Setting and subjects

Pediatric Intensive Care physicians, nurses and dietitians across the world

Interventions

The 20-item adult intensive care 'Barriers to delivery of enteral nutrition' survey was modified for pediatric settings, tested and translated into ten languages. The survey was distributed online to pediatric intensive care nurses, physicians and dieticians via professional networks in March – June 2019. Professionals were asked to rate each item indicating the degree to which they perceived it hinders the provision of EN in their pediatric intensive care unit (PICUs) with a 7-point Likert scale from 0 ''not at all a barrier'' to 6 ''an extreme amount''.

Measurement and Main Results

920 pediatric intensive care professionals responded from 57 countries; 477/920 (52%) nurses, 407/920 (44%) physicians and 36/920 (4%) dieticians. Sixty-two percent had more than five years PICU experience and 49% worked in general PICUs, with 35% working in combined cardiac and general PICUs. The top three perceived barriers across all professional groups were: (1) enteral feeds being withheld in advance of procedures or operating department visits, (2) none or not enough dietitian coverage on weekends or evenings, (3) not enough time dedicated to education and training on how to optimally feed patients.

Conclusions

This is the largest survey that has explored perceived barriers to the delivery of enteral nutrition across the world by physicians, nurses and dietitians. There were some similarities with adult intensive care barriers. In all professional groups, the perception of barriers reduced with years PICU experience. This survey highlights implications for PICU practice around more focussed nutrition education for all PICU professional groups.

Keywords: child; infant; critical care; enteral nutrition; feeding; practices

Article tweet:

PICUs should identify barriers to delivering enteral nutrition in their PICU using a newly adapted quality improvement tool for pediatrics

https://espnic-online.org/Education/Professional-Resources

Introduction

Successfully achieving delivery of enteral nutrition (EN) to critically ill children is associated with improved clinical outcomes (1,2). Yet, multiple barriers remain to achieving adequate nutrition enterally in the critically ill child. Some of these are common to all pediatric intensive care units (PICUs), but for some, the barrier is organisation and unit specific (3,4). Recently, a survey instrument was developed and validated for adult intensive care units (AICUs) (5-7) to assess EN barriers in an ICU. This tool allowed clinicians to directly assess and address the perceived barriers in their ICU, with an aim to optimise enteral nutrition delivery. In the adult survey, 20 known barriers to delivering EN identified in the literature are rated on a Likert scale relating to the perception of the item being a barrier. The aim of our study was to explore the barriers in providing optimal nutrition to children in PICU settings worldwide as viewed by nurses, doctors and dieticians using this survey tool, modified for the pediatric setting.

Materials and methods

A cross-sectional electronic survey design was used. The 20-item adult survey instrument (5-7) was examined and modifications were made based on previously identified pediatric barriers from the literature. The modified survey was then pilot tested in a single UK PICU with 62 PICU staff (physicians, nurses and dieticians). All items from the adult survey were considered relevant and therefore no items were deleted; however, the wording of some items was revised for clarification. Four additional barrier items specific for PICU population were identified and added to the survey. Afterwards, pilot testing with nine professionals in a second PICU (in France) using the same method yielded one additional barrier item, resulting in a new 25-item barrier of enteral nutrition in PICU survey (Supplemental Figure 1). Added items were: 1) Severe fluid restriction; 2) conservative PICU feeding protocol; 3) Feeding tube or pomp delivery problems; 4) Enteral feeds withheld for bedside procedures; and 5) Lack of staff knowledge and support around breastfeeding mothers.

In addition to the 25 barriers, basic demographic data was collected; PICU experience, PICU type and country, with one open ended question asking if there were any other barriers not listed. The survey was translated from English by bi-lingual clinicians into ten languages (French, Italian, Dutch, German, Latvian, Chinese, Spanish, Arabic, Polish and Portuguese) using a recognised cultural adaptation process (8) and tested by local clinicians for face validity. SurveyMonkey™ was used for distribution. Given the nature of distribution of this survey, there was no anticipated survey response. However, we aimed for an equal spread across continents and near equal amongst professional groups (acknowledging that the dietician numbers would be lower based on the number of dietitians compared to physicians and nurses). The inclusion criteria were: nurses, assistant nurses, dieticians and doctors who are working in a PICU and make decisions around feeding in critically ill children. The exclusion criteria were: non-clinical nurses or staff who worked permanently outside clinical PICU setting. Neonatal and adult intensive care staff were excluded. If PICUs were mixed (neonates or adults), the introduction letter made it clear that the questions were to be answered regarding feeding in children aged 0 (term infants) to 17 years.

Data collection

The e-survey was sent out via established professional networks to PICU nurses, doctors and dieticians via country leads and via organisational newsletters (The European Society of Pediatric and Neonatal Intensive Care (ESPNIC), the UK Pediatric Intensive Care Society (PICS) and the World Federation of Pediatric Intensive Care Societies (WFPICS) in March -June 2019. Reminders were sent to country leads with low responses to improve response rates. No identifiable staff, patient or PICU data was collected, and consent was implied by completing the survey. Country leads were responsible for ensuring ethical requirements were obtained according to their country regulation. In the UK, (where data were gathered and analysed) this study was approved by the Pediatric Intensive Care Society (PICS) Study group and was approved as an audit by University Hospitals Bristol. Ethical approval was

provided in the Netherlands by the Institutional Review Board of the Erasmus Medical Centre [MEC-2019-0065].

Data analysis

The datasets (one for each language version) from SurveyMonkey were downloaded, checked and combined into one dataset and imported into IBM SPSS version 25 (IBM Corp., Armonk, NY, USA) for analysis. All data were categorical data or ordinal data (Likert scale) and were first analysed descriptively and then inferential analysis undertaken to test relationships between categorical variables including continents/geographical regions, professional groups, PICU type regarding perceived barriers using chi square tests. The Likert scale ranged from 0 (not at all) to 6 (an extreme amount). Median [IQR] refers to the full Likers scale. However, barriers were further categorised as not a barrier (respondents who scored 0), moderate barrier (respondents who scored 1-3) and important barrier (respondents who scored score 4-6) consistent with the adult survey analysis (5,6). For subgroup analysis, the Europe countries were classified into three European regions as in the ETHICUS study (9); northern (Ireland, Latvia, Lithuania, the Netherlands, Sweden, and United Kingdom), central (Austria, Belgium, Germany, France, Luxembourg, Poland, and Switzerland), and southern (Bulgaria, Italy, Portugal, Spain). When a statically significant level was obtained using Chi square, differences between the variable were further compared using a z-test with Bonferroni correction. A p-value of <0.05 was considered significant and two tailed tests were used.

Results

There were 920 survey responses from 57 countries (Figure 1). Most respondents were nurses (52%), and physicians (44%) followed by dieticians (4%). Sixty-two percent of respondents had more than five years PICU experience, and half (49%) worked in a general PICU with 32% in a mixed cardiac and general PICU (Table 1).

Top Barriers

The top five perceived barriers were: 1. Enteral feeds being withheld in advance of procedures or operating department visits (43%), 2. No dietician coverage on weekends, evenings or holidays (38%), 3. Not enough time dedicated to education and training on optimal feeding of patients (34%), 4. In stable resuscitated patients, other aspects of care taking priority over nutrition (33%) and 5. Delays in obtaining small bowel access in patients intolerant of nutrition (31%). Table 2 presents the perceived importance of all barriers. However, these perceived barriers differed by professional group (Table 3 and Table 4). Importantly, dietitians perceived severe fluid restriction as the most significant barrier (69%), whereas for physicians it was withholding feeds before procedures (46%) and for nurses it was insufficient dietician coverage on weekends, evenings and holidays (44%).

Comparing different PICU types: general PICUs compared to units which admitted cardiac surgical children and combined PICU-NICUs showed little differences in perceived barriers (Table 5) with severe fluid restriction being rated highly as a barrier across all PICU types (General 27% vs General & Cardiac 31% vs PICU and NICU 26% p= 0.354). The two highest perceived barriers were consistent among the PICU types: Not enough (or no) dietician coverage during weekends, evenings and holidays (p=0.664) and not enough time dedicated to education and training on how to optimally feed patients (p= 0.701). When we examined perceived barriers by years of PICU experience, in all groups we found a reduction in perceived barriers as PICU experience increased (Supplementary file 2). This was statistically significant for seven barriers.

Within Europe (with the largest number of respondents; n=517), there were several significant differences in perceived barriers between northern, central and southern Europe (Table 6). Four barriers were perceived as a significantly greater barrier in northern Europe compared to southern or central Europe, these were: nutrition therapy not discussed on ward rounds (p=<0.001), waiting for the dietitian to assess the patient (p=0.004), not enough dedicated time for training and education on how to optimally feed patients (p=<0.001), and lack of familiarity with current guidelines for nutrition in the PICU (p=0.001).

There were also significant differences in 14 perceived barriers when comparing continents (Supplement file 3). Across all continents the biggest perceived barrier was enteral feeds being withheld for procedures and operating department visits, and this was the highest perceived barrier in Southern America. A lack of knowledge around breastfeeding mothers was also significantly different between continents with the barrier perceived almost three times more in Northern America (48%) compared to Australasia (17%) (p=0.001). Most strikingly, was the perceived lack of dietician support and coverage in PICUs, which varied across countries, but even in units with a dietician (many had no dietitian input at all).

Discussion

This is the largest survey undertaken to identify perceived barriers to the delivery of enteral nutrition in PICU settings across the world. It is also only the second survey to include all three professional groups responsible for the delivery of EN in the ICU (nurses, physicians and dieticians). With permission, we adapted and tested a new pediatric version of the survey tool validated for adult intensive care (5-7), providing a new pediatric version of this quality improvement tool.

We identified the main perceived barriers of enteral nutrition in PICU that were related to fasting for procedures, dietician coverage, inadequate education, care priorities and delays in gained small bowel access. However, there was variability in perceived barriers between the professional groups. In PICU, the first observational study to describe barriers to EN (10) found severe fluid restriction in children with congenital heart disease (CHD) the main barrier, followed by the interruption of feeds for procedures. In our study, only the dieticians perceived this as the most important barrier, and overall it ranked sixth. Interestingly, we did not find any significant difference between PICUs that admitted cardiac surgical children and those that did not, even though the fluid restriction for post-operative cardiac children is greater.

Cahill et al., (5) used the adult barriers survey to explore the views of 138 critical care nurses across five adult intensive care units in the USA and Canada. Three of these are consistent with our top five

PICU perceived barriers but ranked differently. However, another adult ICU survey (11), found different barriers: with the main barrier being insufficient nursing staff to deliver EN (60%) followed by a fear of adverse events by feeding aggressively (56%).

The problem of feed interruption is well recognised (3,4,12). Mehta et al., (12) in a prospective observational study of 117 children, found interruptions occurred in 30% of PICU patients, and 58% of these interruptions were classed as avoidable. A Canadian survey of physicians and dieticians (3) also found fasting for procedures a major barrier. Fasting for procedures, both in the PICU (such as for extubation) or outside the PICU (for radiological procedures) and to the operating department, are considerable problems for most intensive care patients. No evidence exists regarding 'safe' fasting times for critically ill children and specifically which procedures require fasting for. The fear driving the fasting, is potentially having a 'full stomach' and the risk of pulmonary aspiration associated with emergency reintubation (if the endotracheal tube became dislodged). Despite recent ERAS recommendations for 'well' children being fasted preoperatively, which have considerably reduced fasting times (13), there is no evidence for fasting times in critically ill children, being fed, often minimally and already intubated. New techniques, such as gastric antral ultrasound (14,15), need to be examined in the PICU population, to determine a more accurate way to individualise fasting times to critically ill children, with a view to avoiding the blanket 6 hour fasting rule.

In a UK-wide survey of PICU physicians, nurses and dieticians (4), the top five barriers were: severe fluid restriction (60%), the child being 'too ill' to feed (17%), surgical post-operative orders (17%), nursing staff being slow in starting feeds (7%) and hemodynamic instability (7%). However, despite the paucity of randomized trial evidence to support enteral feeding during critical illness states, a substantial body of observational study evidence exists (16,17,18,19,20) indicating early EN is both feasible and improves clinical outcomes.

More recently, a retrospective study of 444 children in 6 PICUs in the USA (21), identified the biggest risk factors for delayed EN were non-invasive ventilation (NIV), followed by invasive ventilation,

increasing severity of illness, impending procedures and gastrointestinal disturbances within the first 48 hours. Interestingly, non-invasive ventilation was not listed as barrier in our survey (nor is it in the adult survey), and only two people mentioned being on NIV as a barrier in free text responses. Children requiring non-invasive respiratory support are at risk of requiring escalation of care to intubation. Many early guidelines recommended avoiding or limiting enteral nutrition in respiratory distress (American Bronchiolitis Guidelines), however NIV is no longer a barrier to enteral feeding, in accordance with recent updated guidelines (22).

Only 4% of the respondents were dieticians, and, the perceived inadequacy of dietician coverage in PICUs was identified by dieticians and physicians. Specialist dieticians and their educational level vary significantly across countries. Additionally, there are relatively few of these individuals compared to other healthcare professionals, with many European units reporting having no dietician at all (23). Nutritional support teams (including a dietitian) have been shown to be beneficial in optimising nutrition in PICUs (24). This has been shown in a Latin American and Spanish survey on nutrition in paediatric intensive care where 68% of the participant PICUs had a nutritional support team (NST) and the availability of a NST was associated with better nutritional practices (24). A perceived lack of education around nutrition (and the optimal feeding of critically ill patients) is concerning. In the UK, 'nutrition' is a required component of both specialist PICU nursing education and PICU medical trainees, however, how it is taught is variable. In some countries, specialist PICU training programs for doctors or nurses do not exist, and individuals train in adult critical care or anaesthesia, further contributing to their lack of knowledge around pediatric nutrition. In this context, the European Society of Pediatric and Neonatal Intensive Care (ESPNIC) and its nutrition section, has a major role to play in providing education for all professionals.

The lack of prioritisation of nutrition over other aspects of care, has been identified as a problem in a recent Australian adult ICU nursing survey (25). In this study, nurses identified their main perceived role related to EN was the care, maintenance and management of EN and being an advocate for EN.

When asked to rank their care priorities however, nutrition support and management ranked sixth after physiological monitoring of other systems, but before hygiene and psychological support. They concluded that education (as well as reducing other barriers) could improve nurses' understanding of the importance of nutrition and thus improve the prioritisation of nutrition within the competing demands of their workload. Additionally, a survey investigating barriers in an Israeli hospital found the time it takes to prescribe nutritional therapy, lack of protocols, and awareness of the staff of the nutritional therapy as the main barriers and highlighted the importance of collaboration between the clinical specialities (26). The role of a nutrition support nurse could also be a valuable aspect in a nutritional support team, especially in PICUs without a dietician. This nurse can act as an important player for patients and the healthcare organisation by having enough knowledge, attitudes and competences to fulfil the role of a clinical nutrition expert (27).

We found delays in obtaining small bowel access, was also reported as a barrier. Although the pediatric evidence does not show superiority in post-pyloric feeding as the primary feeding method, some units do utilise this method successfully in all patients (28-30). However, most units reserve this method for children intolerant of gastric feeding (23). In the only RCT of EN via gastric versus post-pyloric feeding (30) there was significant crossover and drop out reported in the post-pyloric arm because of inability to place the pyloric tube. Newer devices (31) may assist in ease of correct placement of these tubes in larger children, but others have simply implemented intensive nurse-training to achieve high placement success.

One of the most common reasons for failure to deliver enteral nutrition in PICUs is that of feed intolerance (3,12), yet this was not a survey item, and its definition remains problematic (32,33). In our pilot work this item was not suggested to be added, however several free text responses in this worldwide survey did suggest this as an item. Therefore, in future versions of this tool we will consider adding this item.

The Canadian Critical Care Nutrition network (https://www.criticalcarenutrition.com/resources/strategies-for-improving) who developed the barriers survey as part of a larger nutrition improvement program which focusses around: auditing your own practice, standardising care, identifying barriers, improving nutrition knowledge and having nutrition champions. They argue that this quality improvement survey sought to identify modifiable ICU organisational and healthcare team barriers to the delivery of enteral nutrition, rather than patient-related and subjective factors such as feed intolerance.

The differences in perceived barriers by professional groups is interesting and has not been examined before. All three groups perceived fasting prior to procedures and operating department visits as a significant problem. The lack of dietician input was identified by both physicians and dieticians (in the top three barriers), but not nurses. This shows some consistency amongst the three professional groups but reflects their specific professional role around nutrition. Future education and interventions to improve enteral nutrition in PICUs must involve all three of these professional groups. This freely available survey (available in eleven languages on the ESPNIC website https://espnic-online.org/Education/Professional-Resources can now be used by PICUs to firstly identify barriers in their unit, and then target these barriers to improve the delivery of enteral nutrition, as part of a unit-based quality improvement program. This survey tool was adapted to a paediatric ICU population and deliberately excluded neonatal wards, as the organizational, behavioural, clinical and pathophysiological aspect could be different. It would be interesting to evaluate these aspects in future research.

There are some limitations of our study that warrant highlighting. Firstly, due to our distribution method via professional networks and organisational websites and newsletters we are unable to know a denominator and thus calculate a response rate or rule out possible selection bias. Secondly, because of this we were also unable to control for the variation in response rates from different countries, thus we had significantly more European responses. As we adapted the adult survey for

pediatric use, we did not add questions to the survey regarding nutritional protocols or nutritional teams available in the PICU, nor did we ask whether the respondents felt the perceived barriers to actually causing inadequate feeding. However, the strengths of our study are our extensive responses (920 across 57 countries) and in our inclusion of all three professional groups involved in the delivery of enteral nutrition. Unfortunately, the responses from dietitians were lower, which prevented us making firm conclusions regarding this group. Furthermore, our translation into multiple languages ensured the survey did not just reach an English-speaking group, a bias in many other surveys.

Conclusions

This study has demonstrated that many perceived barriers to enteral feeding remain in pediatric intensive care units internationally. These are similar, but not the same as those in adult ICUs. These barriers relate to organisational and staff factors as well as patient factors relating to their clinical status. Whether the barrier is real or not, if clinicians believe these, then this still inhibits the delivery of enteral nutrition. Generating evidence to support or refute these perceived barriers is ongoing, but further education to improve awareness of the existing evidence and facilitate the implementation of best evidence into local unit guidelines is required. The use of local feeding guidelines with or without nutrition support teams, have been shown to be effective in promoting enteral nutrition and as such should be encouraged. Physicians, nurses and dieticians must all be involved in this process and in actively addressing barriers in their PICU.

Acknowledgements: We acknowledge with gratitude the translations done by our bi-lingual clinician collaborators: Irene Harth and Karl Reiter (Germany), Anna Zanin (Italy), Izabella Andrzejewska (Polish); Daifallah Dakhl D Al-thubaity (Arabic); Maria José Solana and Mireia Garcia Cusco (Spanish); Ying Gu (Chinese); Katrina Belousko and Reinis Balmaks (Latvian); Larissa Perez Pardo (Portuguese)

And for those additional people involved in distribution of the survey within their country: Alejandro Floh (Canada), Jorge CrossBu (USA), Orsola Gawronski and Anna Zanin (Italy), Aleksander Wisniewski (Poland); Jesus Lopez-Herce (Spanish and Latin American Network); Ying Gu (China); Karl Reiter (Germany); Jan Hau Lee (Singapore); Fenella Gill (Australia); Fahad Alsohime (Saudi Arabia).

353 **Author contributions**

354 Study concept and design: Lyvonne Tume and Frederic Valla

355 Acquisition of data: Georgia Harrison and Lyvonne Tume

356 Analysis and interpretation of data: Lyvonne Tume, Renate Eveleens, Frederic Valla, Jos Latour,
357 Sascha Verbruggen

358 Drafting of the manuscript: Lyvonne Tume

359 Critical revision of the manuscript for important intellectual content: Frederic Valla, Sascha
360 Verbruggen, Jos Latour, Renate Eveleens

361 Statistical analysis: Lyvonne Tume and Renate Eveleens
362

363

Table and Figure legends

Table 1: Characteristics of the responders

Table 2: Descriptive statistics of Barriers for Enteral Nutrition survey

Table 3: Top 3 barriers to deliver enteral nutrition in the PICU reported by professional group

Table 4. Differences in perceived important barriers by professional group

Table 5. Differences in perceived important barrier by PICU type

Table 6. Differences in perceived important barrier across Europe

Figure 1: Countries of which the survey correspondents work

Supplementary Files

Supplemental Figure 1: Barriers to Delivery of Enteral Nutrition in PICU survey

Supplement file 2: Differences in perceived barriers by years' experience

Supplementary file 3: Differences in perceived important barrier across the world

References

1. Mehta NM, Bechard LJ, Zurakowski D et al. Adequate enteral protein intake is inversely associated with 60-d mortality in critically ill children: a multicentre, prospective, cohort study. Am J Clin Nutr. 2015 May 13;102(1):199–206.
2. Mehta NM, Bechard LJ, Cahill N et al. Nutritional practices and their relationship to clinical outcomes in critically ill children--an international multicenter cohort study*. Crit Care Med. 2012;40(7):2204-11.
3. Leong AY, Cartwright KR, Guerra GG et al. A Canadian survey of perceived barriers to initiation and continuation of enteral feeding in PICUs. Pediatr Crit Care Med. 2014;15(2):e49-55.
4. Tume L, Carter B, Latten L. A UK and Irish survey of enteral nutrition practices in pediatric intensive care units. Br J Nutr. 2013;109(7):1304-22.
5. Cahill NE, Murch L, Cook D et al. Barriers to feeding critically ill patients: a multicenter survey of critical care nurses. J Crit Care. 2012;27(6):727-34.
6. Cahill NE, Jiang X, Heyland DK. Revised Questionnaire to Assess Barriers to Adequate Nutrition in the Critically Ill. JPEN J Parenter Enteral Nutr. 2016;40(4):511-8.
7. Critical Care Nutrition at the Clinical Evaluation Research Unit [Available from: https://www.criticalcarenutrition.com/resources/barriers-questionnaire} accessed July 2019.
8. Endacott R, Benbenishty J, Seha M. Preparing research instruments for use with different cultures. Intensive Crit Care Nurs. 2010;26(2):64-8.
9. Sprung CL, Cohen SL, Sjokvist P et al. End-of-life practices in European intensive care units: the Ethicus Study. Jama. 2003;290(6):790-7.
10. Rogers EJ, Gilbertson HR, Heine RG et al. Barriers to adequate nutrition in critically ill children. Nutrition. 2003;19(10):865-8.
11. Darawad MW, Alfasfos N, Zaki I et al. ICU Nurses' Perceived Barriers to Effective Enteral Nutrition Practices: A Multicenter Survey Study. Open Nurs J. 2018;12:67-75.
12. Mehta NM, McAleer D, Hamilton S et al. Challenges to optimal enteral nutrition in a multidisciplinary pediatric intensive care unit. J Parenter Enteral Nutr. 2010;34(1):38-45.
13. Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures 2017; Anaesthesiology, V 126 • No 3 376-393.
14. Bouvet L, Bellier N, Gagey-Reigel A et al. Ultrasound assessment of the prevalence of increased gastric contents and volume in elective pediatric patients: A prospective cohort study. Pediatric Anesthesia 2018; 28: 906-913.
15. Schmitz A, Schmidt A, Buehler P et al. Gastric ultrasound as a preoperative bedside test for residual gastric contents volume in children. Pediatric Anesthesia 2016; 26: 1157–1164

16. King W, Petrillo T, Pettigano R. Enteral nutrition and cardiovascular medications in the pediatric intensive care unit. JPEN 2004; 28(5):334-8.

17. Khorasani EN, Mansouri F Effect of early enteral nutrition on morbidity and mortality in children with burns. Burns 2010; 36(7):1067-71. doi: 10.1016/j.burns

18. Srinivasan V, Hasbani NR, Mehta NM et al. Early Enteral Nutrition Is Associated with Improved Clinical Outcomes in Critically Ill Children: A Secondary Analysis of Nutrition Support in the Heart and Lung Failure-Pediatric Insulin Titration Trial. PCCM 2019; doi: 10.1097/PCC.0000000000002135.

19. Mikhailov TA[1], Kuhn EM, Manzi J et al. Early enteral nutrition is associated with lower mortality in critically ill children. JPEN 2014; 38(4):459-66.

20. Leroue MK, Good RJ, Skillman HE, Czaja AS. Enteral Nutrition Practices in Critically Ill Children Requiring Noninvasive Positive Pressure Ventilation. PCCM 2017; 18(12):1093-1098

21. Canarie MF, Barry S, Carroll CL et al. Risk Factors for Delayed Enteral Nutrition in Critically Ill Children. Pediatr Crit Care Med. 2015;16(8):e283-9.

22. Valla FV, Baudin F, Demaret P et al. Nutritional management of young infants presenting with acute bronchiolitis in Belgium, France and Switzerland: survey of current practices, and concordance with national and international guidelines. Eur J Peds 2018 doi: http:/ /doi.org/10.1007/s00431-018-3300-1/

23. Tume LN, Balmaks R, da Cruz E et al. Enteral Feeding Practices in Infants With Congenital Heart Disease Across European PICUs: A European Society of Pediatric and Neonatal Intensive Care Survey. Pediatr Crit Care Med. 2018;19(2):137-44.

24. Campos-Miño S, López-Herce Cid J, Figueiredo Delgado A et al. The Latin American and Spanish Survey on Nutrition in Pediatric Intensive Care (ELAN-CIP2) Pedr Crit Care Med 2019; Jan;20(1):e23-e29. doi: 10.1097/PCC.0000000000001761.

25. Bloomer MJ, Clarke AB, Morphet J. Nurses' prioritization of enteral nutrition in intensive care units: a national survey. Nurs Crit Care. 2018;23(3):152-8.

26. Papier I, Lachter J, Hyams G, Chermesh I. Nurse's perceptions of barriers to optimal nutritional therapy for hospitalized patients. Clinical Nutrition ESPEN 2017; 22: 92-96.

27. Boeykens K Van Hecke A. Advanced practice nursing: Nutrition Nurse Specialist role and function. Clinical Nutrition ESPEN 2018; 26: 72-76.

28 Lopez-Herce J, Santiago MJ, Sanchez C et al. Risk factors for gastrointestinal complications in critically ill children with transpyloric enteral nutrition. Eur J Clin Nutr. 2008;62(3):395-400.

29. Sánchez C, López-Herce J, Carrillo A et al. Transpyloric enteral feeding in the postoperative of cardiac surgery in children. Journal of Pediatric Surgery. 2006;41(6):1096-102.

30. Meert KL, Daphtary KM, Metheny NA. Gastric vs small-bowel feeding in critically ill children receiving mechanical ventilation: a randomized controlled trial. Chest. 2004;126(3):872-8.

31. Goggans M, Pickard S, West AN et al. Transpyloric Feeding Tube Placement Using Electromagnetic Placement Device in Children. Nutr Clin Pract. 2017;32(2):233-7.

32. Tume LN**,** Valla FV A review of feeding intolerance in critically ill children. Eur J Peds 2018; DOI: 10.1007/s00431-018-3229-4

33. Eveleens RD, Joosten KFM, de Koning BAE et al. Definitions, predictors and outcomes of feeding intolerance in critically ill children: A systematic review. Clin Nutr. 2019. Mar 30. pii: S0261-5614(19)30140-2. doi: 10.1016/j.clnu.2019.03.026.

463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484