

Safe Practices for Using Multi-Chamber Bag Parenteral Nutrition

Curated Literature Search

This Curated Literature Search is intended to identify the most recent published literature that may address the following client question. A medical librarian conducted the research, and a clinical research analyst screened the results. This publication is not intended to provide a comprehensive assessment of the topic.

Evidence-based Practice Question: What is the most recent literature examining safe practices for multi-chamber bag parenteral nutrition (MCB-PN)?

Description: MCB-PN represents a complex medical and nutritional intervention defined as standardized PN formulations commercially available from a manufacturer. As a high-alert medical intervention, MCB-PN is associated with an increased risk of causing patient harm when used in error; consequently, the use of MCB-PN requires comprehensive policies, procedures, and practices as safeguards to ensure patient safety. In the United States, MCB-PN products are available as two-chamber (Clinimix or Clinimix E) and three-chamber (Kabiven or Perikabiven) bags, which allow for multiple preformulated macronutrient concentrations and dosages (e.g., dextrose, amino acid, lipid injectable emulsion, electrolytes). MCB-PN is an alternative to manually compounded PN intended to reduce handling and risk of errors or contamination.

Intended Use: MCB-PN is indicated for critically ill patients in whom oral ingestion or enteral feeding is not sufficient or is contraindicated. Patients require adequate and ongoing monitoring of their nutritional status during administration of MCB-PN therapy.

ECRI Perspective: Twenty reviewed studies, including 1 systematic review (SR), 1 randomized controlled trial (RCT), 6 cohort studies, and 11 general reviews may contribute information to facilitate evidence-based decision-making regarding the safe practices of using MCB-PN in critically ill patients who require parenteral nutrition. However, the appropriateness of study selection for health technology assessment (HTA) ultimately depends on the HTA's scope and key questions and the decisions it is intended to support.

Clinical Guidance	Key Takeaways
7 supporting documents (not supported by SRs) published in the United States and Europe, including: — 4 position statements — 2 clinical guidelines — 1 consensus statement	— MCB-PN involves a complex clinical process that includes patient nutritional assessment and nutrition plan development, prescription order and verification, therapy administration, and ongoing monitoring. Consequently, the use of MCB-PN is susceptible to errors that can substantially affect patient safety and lead to serious complications. — Several available clinical guidance documents report best practices regarding prescribing, administering, and monitoring of MCB-PN to optimize patient safety and efficacy. — If the scientific literature identified in this Curated Literature Search is of sufficient quality, a comprehensive review could potentially address or clarify the following topics: ▪ Determining the appropriate patient population across different care settings most likely to benefit from MCB-PN without compromising patient safety. ▪ As prescribers increasingly consider MCB-PN customization, determining the type and dose of components that may be added to MCB-PN without altering the integrity of the preformulated products. ▪ Determining best practices for transitioning patients to or from MCB-PN across different care settings.
Clinical Literature	
— 2 SRs — 1 RCT — 6 cohort studies — 11 narrative reviews	
Additional Resources	
— 3 web resources	

Guidelines, Position and Consensus Statements

We searched OVID Medline, Embase, CINAHL, ECRI Guidelines Trust®, and prominent specialty societies for clinical practice guidelines, consensus statements, and position statements published from January 1, 2015, through October 9, 2025. Our searches identified the following publications relevant to the safe practices for using MCB-PN products or similar technologies used for nutritional support. We have screened and condensed results to reduce redundancy. See Table 1.

Table 1. Guidelines, Position and Consensus Statements

Source	Key Recommendations or Statements
Clinical Guidelines	
Pironi et al. <i>ESPEN practical guideline: Home parenteral nutrition</i> . Clin Nutr. 2023.	“This guideline will inform physicians, nurses, dietitians, pharmacists, caregivers and other home parenteral nutrition (HPN) providers, as well as healthcare administrators and policy makers, about appropriate and safe HPN provision. This guideline will also inform patients requiring HPN. The guideline is based on previous published guidelines and provides an update of current evidence and expert opinion; it consists of 71 recommendations that address the indications for HPN, central venous access device (CVAD) and infusion pump, infusion catheter and CVAD site care, nutritional admixtures, program monitoring and management. Meta-analyses, systematic reviews and single clinical trials based on clinical questions were searched according to the PICO format. The evidence was evaluated and used to develop clinical recommendations implementing Scottish Intercollegiate Guidelines Network methodology. The guideline was commissioned and financially supported by ESPEN and members of the guideline group were selected by ESPEN. p.421: 6. Nutritional admixtures (Fig. 6) 6.1. PN admixture bag choice ... 44) Either commercially available ready-to-use admixtures or customized and tailored to the individual patient's requirements admixtures can be used for HPN.(R39, grade GPP, strong consensus 95.7%) ... 43) The HPN-admixture shall meet the patient's requirement.(S5, strong consensus 95.7%) ... 45) Customized and tailored HPN admixtures can be prepared either by individual compounding or by ready-to-use prepared and adapted commercial multi-chamber bags, according to the manufacturer instructions and using aseptic admixture technique preferably in a laminar flow cabinet.(R40, grade GPP, strong consensus 100%).”

CLINICAL EVIDENCE ASSESSMENT

Safe Practices for Using Multi-Chamber Bag Parenteral Nutrition

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Weimann et al. <i>ESPEN guideline: Clinical nutrition in surgery</i> . Clin Nutr. 2017.	“Early oral feeding is the preferred mode of nutrition for surgical patients. Avoidance of any nutritional therapy bears the risk of underfeeding during the postoperative course after major surgery. Considering that malnutrition and underfeeding are risk factors for postoperative complications, early enteral feeding is especially relevant for any surgical patient at nutritional risk, especially for those undergoing upper gastrointestinal surgery. The focus of this guideline is to cover nutritional aspects of the Enhanced Recovery After Surgery (ERAS) concept and the special nutritional needs of patients undergoing major surgery, e.g. for cancer, and of those developing severe complications despite best perioperative care. From a metabolic and nutritional point of view, the key aspects of perioperative care include: • integration of nutrition into the overall management of the patient • avoidance of long periods of preoperative fasting • re-establishment of oral feeding as early as possible after surgery • start of nutritional therapy early, as soon as a nutritional risk becomes apparent • metabolic control e.g. of blood glucose • reduction of factors which exacerbate stress-related catabolism or impair gastrointestinal function • minimized time on paralytic agents for ventilator management in the postoperative period • early mobilisation to facilitate protein synthesis and muscle function The guideline presents 37 recommendations for clinical practice. 4.1.3. Hyperglycaemia ... Recommendation 9: For administration of parenteral nutrition an all-in-one (three-chamber bag or pharmacy prepared) should be preferred instead of multibottle system (BM, HE). Grade of recommendation B – strong consensus (100% agreement) In two RCTs the cost benefits of using a three-chamber bag were better than a multibottle system [251], [252] (both 1+). A retrospective analysis of a US data bank showed a significantly lower rate of blood stream infections using a three-chamber-bag [253] (2+).”
Position Statements	
British Pharmaceutical Nutrition Group. <i>Use of filters during the administration of parenteral nutrition</i> . 2025 Aug.	“The aim of this position statement is to review the available evidence, international best practice guidance and to provide advice on best practice for UK healthcare professionals involved in the provision of PN. This guidance is applicable to PN administration in hospital and at home; for clarity, it will not differentiate between patient groups. p.1-2: “Different manufacturer SPCs for licensed multi-chamber bags and PN lipid and/or amino acid components vary in their statements around the use of filters for PN administration.⁸ Some omit any reference to filters, others advise if used should be $\geq 1.2 \mu\text{m}$ and permeable to lipids, or they recommend the use of a filter without reference to pore size. We found one product SPC that stated the use of a $1.2 \mu\text{m}$ filter recommended for administration.”
Robinson et al. Recommendations for photoprotection of parenteral nutrition for premature infants: An ASPEN position paper. 2021.	“Although crucial in improving health outcomes in the preterm infants, [PN] is not without risk, especially if handled improperly. A growing body of evidence suggests that components of PN admixtures, including lipid injectable emulsions (ILEs), are susceptible to degradation, including oxidation when exposed to light (ie, photo-oxidation), resulting in the production of reactive oxygen species. Infants, especially those born preterm, are considered more susceptible to consequences of oxidative stress than children and adults. Oxidative stress is associated with bronchopulmonary dysplasia, retinopathy of prematurity, necrotizing enterocolitis, and intestinal failure–associated liver disease. The American Society for Parenteral and Enteral Nutrition (ASPEN) assembled a working group to provide recommendations on clinical practice surrounding photoprotection of PN. This Position Paper reviews the scientific literature on the formation of quantifiable peroxides and other degradation products when PN admixtures and ILEs are exposed to light and reports adverse clinical outcomes in premature infants exposed to PN. Recommendations for photoprotection of PN admixtures and ILEs are provided, as well as the challenges in achieving complete photoprotection with the equipment, supplies, and materials currently available in the US. ASPEN and the authors understand that the full implementation of complete photoprotection may not currently be feasible given current product availability; recommendations provided in this paper serve to represent the goal to which to strive as well as to highlight the importance of product availability to achieve these practices. This paper has been approved by the ASPEN Board of Directors.”

CLINICAL EVIDENCE ASSESSMENT

Safe Practices for Using Multi-Chamber Bag Parenteral Nutrition

Source	Key Recommendations or Statements
Gunter et al. <u><i>Standardized Competencies for Parenteral Nutrition Administration: The ASPEN Model</i></u>. Nutr Clin Pract. 2018.	“[PN] is a highly complex medication and its provision can be prone to a variety of errors. Safe administration of this therapy requires that the competency of clinicians, particularly nurses, be demonstrated using a standardized process. In this document, a standardized model for PN administration competency is proposed based on a competency framework, the ASPEN-published interdisciplinary core competencies, discipline-specific standards of practice, safe practice recommendations, and clinical guidelines. ASPEN recognizes that all healthcare institutions may not currently meet the aspirational goals of this document. This framework will guide institutions and agencies in developing tools and procedures and maintaining competency of staff members around safe PN administration. The ASPEN Board of Directors has approved this document. ...PN admixtures are prepared and sent to the bedside in a variety of delivery systems, which can contribute substantially to staff member confusion. In a study by Boullata and colleagues conducted in 2011, PN was administered as compounded admixtures by 72% of institutions, while 21% used standardized commercially available multi-chamber PN products; the remainder of the respondents used both types. Forty-five percent used 2-in-1 (dextrose/amino acids admixtures with separate ILE infusions), while 28% used 3-in-1 (total nutrient admixtures [TNA]), with the remainder using both types.¹¹ Multi-chamber bag PN admixture systems have been associated with reported infusion errors caused by lack of activation of the individual chambers.¹² The variety of PN delivery types requires that the nurse be competent with all types of PN products in use by their institution or agency. Table 1. ASPEN Recommendations for Safe PN Administration ... 10. Policies regarding PN multi-chamber bags should be developed using a multidisciplinary approach.”
Boullata et al. <u><i>Standardized Competencies for Parenteral Nutrition Order Review and Parenteral Nutrition Preparation, Including Compounding: The ASPEN Model</i></u>. Nutr Clin Pract. 2016.	“[PN] is a high-alert medication with a complex drug use process. Key steps in the process include the review of each PN prescription followed by the preparation of the formulation. The preparation step includes compounding the PN or activating a standardized commercially available PN product. The verification and review, as well as preparation of this complex therapy, require competency that may be determined by using a standardized process for pharmacists and for pharmacy technicians involved with PN. An American Society for Parenteral and Enteral Nutrition (ASPEN) standardized model for PN order review and PN preparation competencies is proposed based on a competency framework, the ASPEN-published interdisciplinary core competencies, safe practice recommendations, and clinical guidelines, and is intended for institutions and agencies to use with their staff. .. Regardless of whether PN is prepared on site, is outsourced to a compounding vendor, or makes use of multichamber fixed-dose products, a standardized process for PN order review and preparation is an important safety process that can then be used to train and assist in privileging pharmacists, pharmacy residents, pharmacy students, pharmacy technicians, and technician students as appropriate. A secondary gain from this competency model might be more standardized patterns of order review and preparation that could help improve patient safety by decreasing related errors. ASPEN Model for PN Order Review and PN Preparation Competencies Based on the recommendations from the ASPEN Consensus Recommendations and Clinical Guidelines that addressed specific questions (Tables 2 and 3), the following competencies should be met for the institutions to privilege the pharmacist and/or pharmacy technician involved with PN: ... 4. The pharmacy technician should be certified and receive in-depth training in PN preparation to include the following: ... Scan and check barcodes, pump admixture, or activate multichamber bag”

CLINICAL EVIDENCE ASSESSMENT

Safe Practices for Using Multi-Chamber Bag Parenteral Nutrition

Source	Key Recommendations or Statements
Consensus Statements	
Ayers et al. <i>Expert consensus statements and summary of proceedings from the International Safety and Quality of Parenteral Nutrition Summit</i> . Am J Health Syst Pharm. 2024.	“PURPOSE: The International Safety and Quality of Parenteral Nutrition (PN) Summit consisted of presentations, discussions, and formulation of consensus statements. The purpose here is to briefly summarize the summit and to present the consensus statements. SUMMARY: There was a high degree of consensus, with all statements approved by all authors/summit experts. CONCLUSION: The consensus statements are the collective opinion of the panel members and form best-practice guidance. The authors intend that this guidance may help to improve the safety and quality of PN in a variety of settings by bridging the gap between published guideline recommendations and common practical issues. In recent decades, various approaches have led to increasing standardization, encompassing the compounding process, and/or greater use of market-authorized multichamber bags (MCBs). MCBs are available in two formats: either as a 2-chamber bag (2CB) containing glucose/dextrose and amino acids, or the more modern 3-chamber bag (3CB) containing glucose/dextrose, amino acids, and lipids.¹¹ Both standardized and customized process have their strengths and weaknesses. Determining the preferred option from a safety and quality point of view can be a complex decision, influenced by factors such as the presence or absence of organizational expertise, the market availability of MCBs, financial considerations, and patient-related factors. p.S78-79: Table 1. Consensus Statements Concerning the International Safety and Quality of Parenteral Nutrition p.S80: Table 2. Additional Consensus Statements Related to Parenteral Nutrition in the Home Infusion Setting/Long-Term Parenteral Nutrition”

Clinical Literature

We searched OVID Medline, Embase, CINAHL, and web-based resources for clinical literature published through October 9, 2025. We identified and reviewed abstracts of 2 SRs, 1 RCT, 6 cohort studies, and 11 narrative review articles that were hand-selected by a research analyst for relevancy from a broad set of search results. We included those studies which addressed the use of MCB-PN (also referred to as commercially available PN, or commercially available pre-mixed PN) in the study title or abstract. See Table 2.

Table 2. Clinical Literature

Study	Results Presented by Authors in Study Abstract
Systematic Reviews	
Jones et al. Outcomes for patients receiving multi-chamber Bags for the delivery of parenteral nutrition: A systematic review. <i>Nutrients</i> . 2024;16(22). PubMed Full text	“Parenteral nutrition (PN) is required by people with intestinal failure and can be delivered as multi-chambered bags (MCBs) or individually compounded (COM) bags. This systematic review aimed to examine the evidence base for clinical outcomes and/or quality of life (QoL) in adults receiving PN as MCBs compared to COMs in hospital and community settings. A systematic database search was conducted between January 2015 and May 2024. Studies assessing adults in receipt of MCBs were included. Quality was assessed using Joanna Briggs appraisal tools. A narrative synthesis was performed due to study heterogeneity. Ten studies including 87,727 adults were included, with 20,192 receiving PN from MCBs and 67,535 from COMs. Eight studies reported on PN given in hospital and two in the home. Five hospital-based and one home-based study reported that MCBs were well tolerated and provided adequate nutrition. Three hospital-based studies reported that MCBs had lower post-operative infections and a lower mean risk of catheter-related bloodstream infections (CRBSIs). Two home-based studies reported no difference in CRBSI. Five hospital-based studies reported no difference between groups in length of hospital stay. Three hospital-based studies reported the cost to be lower for MCBs than COMs, and no studies reported QoL. The studies included show that MCBs provided in hospital are safe and non-inferior to COMs and may be more cost-effective. There were few high-quality studies and no data on QoL; therefore, further work is required to improve the certainty of the evidence and to establish the level of QoL when using MCBs.”

CLINICAL EVIDENCE ASSESSMENT

Safe Practices for Using Multi-Chamber Bag Parenteral Nutrition

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Mena et al. Management of ready-to-use parenteral nutrition in newborns: Systematic review. <i>JPEN J Parenter Enteral Nutr.</i> 2018;42(7):1123-1132. PubMed Abstract	"Parenteral support has increased the possibility of neonatal recovery. However, complications associated with its use have been documented. One commercial method developed to decrease the complications of this type of support is the ready-to-use [PN], a 3-chamber bag that provides a complete nutrient mix. This systematic review seeks, through the Preferred Reporting Items for Systematic Reviews and Meta-Analyses methodology, to establish the benefits in newborns. Seven databases and gray literature were used. The search was limited to publications from 2007-2017 and to articles written in English, Spanish, and Portuguese. Articles that did not meet the inclusion criteria and studies with low quality evaluated with the Scottish Intercollegiate Guidelines Network guidelines, which were without information about the study or analytical methods, were excluded. A total of 24,193 articles were obtained, which were initially evaluated by title and abstract according to the inclusion criteria. A total of 24,167 articles were discarded, obtaining 27 eligible for follow-up evaluation. After a detailed evaluation of the full text, 13 articles were selected. It was found that ready-to-use PN has the potential benefit to reduce the risks for infections, provide an adequate supply of nutrients, generate growth within the expected range, provide ease of use, decrease prescription errors, and potentially reduce costs. It is necessary to evaluate the short- and long-term impact of its use."
Comparative Study	
Madill et al. Medical and nutritional outcomes are similar among autologous transplant patients on enteral nutrition when compared to parenteral nutrition. A randomized pilot study. <i>European Journal of Haematology.</i> 2025;115(2):117-124. Full Text	"Autologous hematopoietic stem cell transplantation (AH SCT) is the treatment for myeloma and lymphoma. posttreatment, significant nutritional and medical issues and malnutrition assessed by Subjective Global Assessment (SGA) arise. No established effective treatment for using either parenteral (PN) or enteral routes (EN) to improve nutritional status, reduce medical complications, and be cost-effective is available. We investigated the effectiveness of EN versus PN in terms of nutritional path of supplementation. AH SCT patients were randomized to either EN or PN and were followed at baseline, 15 and 30 days posttransplant. Age, body mass index, SGA, length of stay (LOS), medical complications, severity of complications, infections, overall survival (Day 100), albumin, random blood glucose, and C-reactive protein were evaluated. Descriptive statistics, Spearman's, chi square, correlations, and uni- and multivariate by type of feed, using SPSS v 29. Thirty-six patients with complete medical and laboratory data were followed. No significance in any of the medical or nutritional parameters between the two groups was found. No correlations between SGA at any time point and type of feeding were identified. No relationship between SGA, LOS, complications, albumin, CRP, or random blood glucose at all three time points was seen. EN is a safe, convenient, and cost-effective option for AH SCT patients since medical and nutritional outcomes were similar between those receiving EN compared to PN. Central venous catheters were placed for AH SCT treatment and also used for PN administration with a two-in-one premixed formula with 20% SMOF Kabiven lipid, as per hospital protocol."

CLINICAL EVIDENCE ASSESSMENT

Safe Practices for Using Multi-Chamber Bag Parenteral Nutrition

Study	Results Presented by Authors in Study Abstract
Cohort Studies	
Fernández-Argüeso et al. Ready-to-use multichamber bags in home parenteral nutrition for patients with advanced cancer: A single-center prospective study. <i>Nutrients</i> . 2024;16(3). PubMed Full text	“Home parenteral nutrition (HPN) is increasingly prescribed for patients with advanced cancer. This therapy improves free-fat mass, quality of life and survival, but it is not free from complications, especially catheter-related bloodstream infections (CRBSIs). The use of commercial multichamber bags in HPN has not been extensively explored in oncologic patients and their association with complications is not well known. In this prospective cohort study, we included 130 patients with advanced cancer and HPN. We compared the effects of individual compounded bags (n = 87) vs. commercial multichamber bags (n = 43) on complications. There were no differences in any complication, including thrombosis (p > 0.05). There were 0.28 episodes of CRBSI per 1000 catheter days in the individual compounded bag group and 0.21 in the multichamber bag group (p > 0.05). A total of 34 patients were weaned off HPN, 22 with individual bags and 12 with multichamber bags (p = 0.749). Regarding survival when on HPN, the group with individual bags showed a median of 98 days (95% CI of 49-147), whereas those with multichamber bags showed a median of 88 days (95% CI of 43-133 (p = 0.913)). In conclusion, commercial multichamber bags for HPN in patients with advanced cancer are non-inferior when compared to individual compounded bags in terms of complications.”
Hakeam et al. The rate of discontinuing ready-to-use multi-chamber bag parenteral nutrition secondary to high serum electrolyte levels. <i>Hosp Pharm</i> . 2023;58(3):263-271. PubMed Full text	“Multi-chamber bag with electrolytes (MCB-E) [PN] formulations are gaining acceptance for nutritional support for safety and economic advantages. However, their use is hampered by serum electrolyte abnormalities. No data exist regarding MCB-E PN interruption due to high serum electrolyte levels. We assessed the rate of MCB-E PN discontinuation in surgical patients secondary to persistently high serum electrolyte levels. This prospective, cohort study included surgical patients (aged ≥18 years) who received MCB-E PN at King Faisal Specialist Hospital and Research Centre-Riyadh, from February 28, 2020, until August 30, 2021. Patients were followed for 30-day for the discontinuation of MCB-E PN secondary to persistent hyperphosphatemia, hyperkalemia, hypermagnesemia, or hypernatremia for two consecutive days. The association of discontinuing MCB-E PN with various factors was assessed using univariable and multivariable Poisson regression analysis. Results: Seventy-two patients were enrolled in the study, 55 (76.4%) completed MCB-E PN, whereas 17 (23.6%) patients discontinued MCB-E PN due to a persistent hyperphosphatemia (n = 13, 18%) and persistent hyperkalemia (n = 4, 5.5%). Hyperphosphatemia and hyperkalemia were observed at a median of 9 (IQR 6-15) days and 9.5 (IQR 7-12) days of MCB-E PN support, respectively. According to adjusted multivariable analysis, developing an episode of hyperphosphatemia or hyperkalemia was associated with MCB-E PN discontinuation (RR 6.62, 1.95-22.49; P = .002) and (RR 4.73, 1.30-17.24; P = .018), respectively. Conclusion: In surgical patients receiving short-term MCB-E PN, developing hyperphosphatemia was the most frequent high electrolyte abnormality associated with MCB-E PN discontinuation, followed by hyperkalemia.”

CLINICAL EVIDENCE ASSESSMENT

Safe Practices for Using Multi-Chamber Bag Parenteral Nutrition

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Jandot et al. Supplementations of industrial multichamber parenteral nutrition bags in critically ill children: Safety of the practice. <i>Nutr Clin Pract</i>. 2023;38(3):698-706. PubMed PubMed Full text	"[PN] is sometimes required in critically ill children because of contraindication or intolerance to full enteral nutrition. European guidelines recommend favoring multichamber bag PN (MCB PN), when possible, for quality purposes and ease of use. The prescribers may adjust the MCB PN through supplementations to better fulfill patient needs. The objective of this study is to investigate the use and supplementations of MCB PN. This observational, single-center, retrospective study was conducted in a pediatric intensive care unit (PICU). We collected prescriptions of MCB PNs and their supplementations added directly into PN bags. A descriptive analysis and a comparison of electrolyte supplementations with the manufacturer's recommendations were undertaken. One hundred thirty-five children (median age 39.2 months [7.0-118.8]) were included, 1449 MCB PNs were administered, and 1652 supplementations were carried out in 736 PN bags. Thirty-two percent of supplementations were vitamins, 32.2% were trace elements, and 35.8% were electrolytes. Around 10% of electrolyte supplementations in PN bags were outside the manufacturer's recommendations. These nonconformities primarily concerned phosphate. This study showed the real-world clinical use of MCB PN in the PICU. Proper attention should be paid to septic risks and physicochemical risks to ensure efficient practice and safety of MCB PN use."
Goh et al. The use of standardized commercially available parenteral nutrition as a bridge to customized compounded bag in the acute hospital setting is safe and feasible. <i>Clin Nutr ESPEN</i>. 2022;47:321-324. PubMed Abstract	"The use of standardized commercially available parenteral nutrition (SCAPN) as a starter bag to bridge to customized compounded PN offers the advantage of starting PN on the same day of consult, avoiding delays in nutrition delivery. We aim to evaluate the safety and feasibility of using SCAPN as a bridge to compounded PN in the acute hospital setting. Retrospective review of patients on PN from Aug 2018 to Sep 2019 was performed. SMOFKABIVEN® Peripheral 800 kcal in 1206 ml was used. Electrolyte replacements on the day and the day after PN commencement were compared between SCAPN and compounded PN. Results were reported as means (95% confidence intervals). P value < 0.05 was considered statistically significant. RESULTS: 135 (78.5%) patients received SCAPN while 37 (21.5%) received compounded PN on the first day of PN. Baseline characteristics of both groups were almost similar with higher BMI in the SCAPN. Baseline serum potassium 4.0 (3.9, 4.1) vs 4.0 (3.8, 4.1), p = 0.46; phosphate 1.1 (1.0, 1.1) vs 1.1 (1.0, 1.3), p = 0.40 and magnesium 0.8 (0.8, 0.9) vs 0.9 (0.9, 1.0), p < 0.05 for SCAPN and compounded PN respectively. Follow-up serum potassium was 3.9 (3.8, 3.9) vs 3.9 (3.8, 4.1), p = 0.36; phosphate 0.9 (0.9, 0.9) vs 1.1 (1.0, 1.2), p < 0.05 and magnesium 0.9 (0.9, 0.9) vs 0.9 (0.9, 1.0), p = 0.18. Baseline calories and protein were lower in SCAPN group. Electrolyte replacements were similar in both groups at baseline and follow up. Using our in-house protocol, the use of a SCAPN as a bridge to customized compounded PN is safe and feasible."
Ferreira et al. Could commercial formulations replace individualized prescription in pediatric home parenteral nutrition? <i>J Pediatr Gastroenterol Nutr</i>. 2021;73(4):548-554. PubMed Abstract	"Standard [PN] solutions are safe and can meet the nutritional requirements of a significant number of pediatric patients. However, they may not always be adequate for those on long term PN. We aimed to compare the composition of individually tailored prescriptions in a pediatric population on home PN with that of available commercial PN formulations. Retrospective analysis of the individual prescriptions of metabolically stable pediatric patients on home PN over a 1-year period (March 2019 to March 2020). These were compared with commercially available solutions with electrolytes, and replacement was considered adequate if three successive criteria were met: non-protein calorie to volume ratio (maximum variation 15%); non-protein calorie to nitrogen ratio (NPC:N) (maximum variation either 20% for long term use or 35% for possible short term use); electrolyte concentration (maximum increase 20%). Twenty-four patients were included (67% male; median age 7.5 years). The most common diagnosis was short bowel syndrome (58%). Replacement with a standard formulation was considered appropriate for possible short term use (maximum variation of 35% in NPC:N) in 16 (67%) patients and for long term use (maximum variation of 20% in NPC:N), the number of patients decreased to 10 (42%). Standard PN solutions can be adequate for a significant proportion of pediatric patients on home PN. Their use in the short term may also be appropriate in holiday periods or in settings of limited resources or restricted access to hospital facilities, such as those imposed by the COVID-19 pandemic."

CLINICAL EVIDENCE ASSESSMENT

Safe Practices for Using Multi-Chamber Bag Parenteral Nutrition

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Cogle et al. Multicenter prospective evaluation of parenteral nutrition preparation time and resource utilization: 3-Chamber bags compared with hospital pharmacy-compounded bags. <i>JPEN J Parenter Enteral Nutr.</i> 2021;45(7):1552-1558. PubMed Full text	"[PN] is a complex and costly therapy that places significant demands on healthcare resources. Commercially manufactured 3-chamber bags (3CBs) offer potential time and cost advantages compared with hospital pharmacy-compounded bags (HCBs); however, no data are yet available from studies comparing these delivery systems in US hospitals. The primary aim of this study was to evaluate the PN preparation time and resource utilization required for 3CBs compared with HCBs in US hospitals. A prospective, multicenter, time and motion study was performed to evaluate the time from transcription to completion of PN preparation and costs for 3CBs compared with HCBs. The cost per bag included labor, PN products, medical consumables, and equipment. One hundred thirty-six PN prescriptions were prepared during the study (66 prescriptions for 3CBs and 70 prescriptions for HCBs). The mean $\pm$ standard deviation total time required for transcription, review, validation, and preparation of PN was 5.5 ± 1.3 minutes for 3CBs vs 14.3 ± 6.2 minutes for HCBs ($P < .001$). The mean total cost per PN bag was \$81.60 for 3CBs and \$131.17 for HCBs (mean difference, -\$49.57). Commercial 3CBs reduced staff time by 62% and direct costs by 37% compared with HCBs. The results demonstrate that 3CBs offer potential cost-savings for hospitalized patients who require PN in US hospitals."
Narrative Reviews	
Mays. Parenteral nutrition compatibility. <i>J Infusion Nursing.</i> 2025;48(3):197-199. Full text	"PN is a complex life sustaining therapy that is considered a high-risk medication by the Institute for Safe Medication Practices (ISMP). PN is a critical therapy for those who cannot take adequate oral or enteral nutrition. It contains a varying range of ingredients for each patient's PN formulation and can contain more than 40 ingredients in 1 PN bag. This variability and opportunity for errors led to ISMP considering PN a high-risk medication. There are different ways to deliver PN. Patient-specific PN can be compounded by a hospital or home infusion pharmacy. Multi-chamber bag PN is a commercially available PN product, but it requires the same considerations around compatibility and stability as compounded PN. PN can also be compounded by a 503B outsourced pharmacy for non-patient specific use (eg, neonatal starter PN). All formulations of PN have a risk of error during all steps of the PN process (assessment, prescription, order review, preparation, and administration due to the complex nature of this therapy. Health care providers must realize that PN is a medication, and that it should be treated as such."
Senterre et al. Safe and efficient practice of parenteral nutrition in neonates and children aged 0-18 years - The role of licensed multi-chamber bags. <i>Clin Nutr.</i> 2024;43(7):1696-1705. PubMed Full text	"PN is recognized as a complex high-risk therapy. Its practice is highly variable and frequently suboptimal in pediatric patients. Optimizing care requires evidence, consensus-based guidelines, audits of practice, and standardized strategies. Several pediatric scientific organizations, expert panels, and authorities have recently recommended that standardized PN should generally be used over individualized PN in the majority of pediatric patients including very low birth weight premature infants. In addition, PN admixtures produced and validated by a suitably qualified institution are recommended over locally produced PN. Licensed multi chamber bags are standardized PN bags that comply with Good Manufacturing Practice and high-quality standards for the finished product in the frame of their full manufacturing license. The purpose of this article is to review the practical aspects of PN and the evidence for using such multi-chamber bags in pediatric patients. It highlights the safety characteristics and the limitations of the different PN practices and provides some guidance for ensuring safe and efficient therapy in pediatric patients."

CLINICAL EVIDENCE ASSESSMENT

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Study	Results Presented by Authors in Study Abstract
Cogle et al. Parenteral nutrition in the hospital setting/short-term parenteral nutrition. <i>Am J Health Syst Pharm.</i> 2024;81(Suppl 3):S102-s111. PubMed Full text	“This article is based on presentations and discussions held at the International Safety and Quality of Parenteral Nutrition (PN) Summit concerning the acute care setting. Some European practices presented in this article do not conform with USP general chapter <797> requirements. Nevertheless, the purpose is to cover the challenges experienced in delivering high-quality PN within hospitals in the United States and Europe, in order to share best practices and experiences more widely. Core issues regarding the PN process within an acute care setting are largely the same everywhere: There are ongoing pressures for greater efficiency, optimization, and also concurrent commitments to make PN safer for patients. Within Europe, in recent years, the use of market-authorized multi-chamber bags (MCBs) has increased greatly, mainly for safety, cost-effectiveness, and efficiency purposes. However, in the US, hospitals with low PN volumes may face particular challenges, as automated compounding equipment is often unaffordable in this setting and the variety of available MCBs is limited. This can result in the need to operate several PN systems in parallel, adding to the complexity of the PN use process. Ongoing PN quality and safety initiatives from US institutions with various PN volumes are presented. In the future, the availability of a greater selection of MCBs in the US may increase, leading to a reduction in dependence on compounded PN, as has been seen in many European countries. The examples presented may encourage improvements in the safety and quality of PN within the acute care setting worldwide.”
Dettlaff et al. Y-Site compatibility studies of ketoprofen with parenteral nutrition admixtures for central and peripheral administration. <i>Pharmaceutics.</i> 2022;14(12). PubMed Full text	“Ketoprofen (KTF) is often used in hospital wards, especially in its intravenous form. According to the literature review, the compatibility of ketoprofen with [PN] admixtures has not yet been investigated. For this reason, we aimed to provide data contributing to physical compatibility to ensure the safe co-administration of these medications. In this study, we examined the compatibility of KTF with eight selected commercial PN admixtures intended for central (Lipoflex Special, Omegaflex Special, Kabiven, SmofKabiven) and peripheral (Lipoflex peri, Omegaflex peri, Kabiven Peripheral, Olimel Peri N4E) administration. The KTF solution for infusion was combined in three different volume ratios with studied PN admixtures reflecting the conditions in clinical practice. The evaluation of undesirable physical destabilization of oil-in-water system or precipitate formation involved the visual inspection and the determination of mean droplet diameter, zeta potential, pH, and turbidity changes. The results of compatibility of KTF with eight commercial PN admixtures showed that three of them: Kabiven, SmofKabiven, and Kabiven Peripheral, are incompatible with KTF and should not be concomitantly administered.”
Stawny et al. Safe practice of Y-site drug administration: The case of colistin and parenteral nutrition. <i>Pharmaceutics.</i> 2020;12(3). PubMed Full text	“A serious problem in everyday clinical practice is the co-administration of drugs using the same infusion line. Potential complications of co-administration of incompatible drugs include precipitation in the infusion line or central venous catheter leading to its occlusion. Administration of precipitate and large lipid droplets into the venous system may lead to the embolization of capillaries and local or systemic inflammatory reactions, with the consequences of venous thrombosis, chronic venous insufficiency, and even pulmonary embolism. The co-administration of drugs must always be confirmed and clearly defined. The study aimed to determine the interaction between colistin (COL) in the dose used during intermittent hemodialysis and five different ready-to-use PN admixtures (Kabiven, Smofkabiven, Olimel N9E, Nutriflex Lipid Special, and Nutriflex Omega Special). COL-PN compatibilities were tested by comparing physicochemical properties (pH, zeta potential, lipid emulsion particle size) of COL and PN at three time points: immediately after sample preparation, after ten minutes, and after four hours. No changes in the visual inspection were observed. Both PN without COL and COL-PN samples remained white, homogeneous oil-in-water emulsions with no signs of phase separation, precipitation, or color change. There were no significant changes in pH, and the mean droplet diameter remained below the acceptance limit of 500 nm. The zeta potential and osmolality of COL-PN samples ranged from -21.4 to -7.22 mV and from 567 to 1304 mOsm/kg, respectively. The COL does not influence the physical stability of studied PN admixtures. The co-infusion of COL with Kabiven, Nutriflex Lipid Special, Olimel N9E, Nutriflex Omega Special, and Smofkabiven is possible in the dose used during intermittent hemodialysis.”

CLINICAL EVIDENCE ASSESSMENT

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Nystrom et al. Parenteral nutrition drug shortages: A single-center experience with rapid process change. <i>JPEN J Parenter Enteral Nutr.</i> 2019;43(5):583-590. PubMed Abstract	“Disruptions in the medication supply chain and consequent drug product shortages, including shortages of parenteral products used for PN compounding, have become an increasingly common occurrence. The amino acid solution shortage that resulted from the devastating impact of Hurricanes Maria and Irma on manufacturing facilities in Puerto Rico in 2017 necessitated a rapid, coordinated shift from use of compounded PN to commercial multichamber-bag PN (MCB-PN) at our hospitals. We describe our experience operationalizing this intervention via a framework that may be adapted for addressing other drug product shortages to promote rapid yet safe use of therapeutic alternatives.”
Zhao et al. Comparison of effectiveness, safety, and costs of standardized and customized parenteral nutrition support among gastric cancer patients after gastrectomy: a retrospective cohort study. <i>Asia Pac J Clin Nutr.</i> 2018;27(4):818-822. PubMed Full text	“To compare the effectiveness, safety, and costs of commercial standardized multi-chamber bag and customized compounded total parenteral nutrition (TPN) among gastric cancer patients after gastrectomy. A retrospective cohort study was conducted among 64 gastric cancer patients who underwent gastrectomy from 2014 to 2016 in a tertiary teaching hospital in Beijing, China. Patients were categorized into standardized (s-TPN) and customized TPN (c-TPN) groups based on their TPN order after gastrectomy. Patients were followed up until discharge. The effectiveness measures (body mass index (BMI) and albumin) and safety measures (liver and renal functions and electrolytes) were compared before TPN started and after TPN finished within and between the two groups. The length of hospital stay and costs were compared between the two groups. RESULTS: There were no significant differences between the two groups in BMI preservation, metabolic complications, the length of hospital stay and costs, except that both total bilirubin (Tbil) and direct bilirubin (Dbil) were significantly higher in the s-TPN group than c-TPN ($p < 0.05$). There were no significant differences in effectiveness and safety measures, the length of hospital stay and costs between s-TPN and c-TPN groups, except that s-TPN group was more likely to lead to [PN]-associated liver disease (PNALD). More studies are needed to confirm the findings of this study in other healthcare settings and study populations.”
Staven et al. Development and evaluation of a test program for Y-site compatibility testing of total parenteral nutrition and intravenous drugs. <i>Nutr J.</i> 2016;15:29. PubMed Full text	“There is no standardized procedure or consensus to which tests should be performed to judge compatibility/incompatibility of intravenous drugs. The purpose of this study was to establish and evaluate a test program of methods suitable for detection of physical incompatibility in Y-site administration of total parenteral nutrition (TPN) and drugs. Eight frequently used methods (dynamic light scattering, laser diffraction, light obscuration, turbidimetry, zeta potential, light microscopy, pH-measurements and visual examination using Tyndall beams), were scrutinized to elucidate strengths and weaknesses for compatibility testing. The responses of the methods were tested with samples containing precipitation of calcium phosphate and with heat destabilized TPN emulsions. A selection of drugs (acyclovir, ampicillin, ondansetron and paracetamol) was mixed with 3-in-1 TPN admixtures (Olimel® N5E, Kabiven® and SmofKabiven®) to assess compatibility (i.e. potential precipitates and emulsion stability). The obtained compatibility data was interpreted according to theory and compared to existing compatibility literature to further check the validity of the methods. Light obscuration together with turbidimetry, visual inspection and pH-measurements were able to capture signs of precipitations. For the analysis of emulsion stability, light obscuration and estimation of percent droplets above 5 μm (PFAT5) seemed to be the most sensitive method; however laser diffraction and monitoring changes in pH might be a useful support. Samples should always be compared to unmixed controls to reveal changes induced by the mixing. General acceptance criteria are difficult to define, although some limits are suggested based on current experience. The experimental compatibility data was supported by scattered reports in literature, further confirming the suitability of the test program. However, conflicting data are common, which complicates the comparison to existing literature. Testing of these complex blends should be based on a combination of several methods and accompanied by theoretical considerations.”

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Blackmer and Partipilo. Three-in-one parenteral nutrition in neonates and pediatric patients: risks and benefits. <i>Nutr Clin Pract.</i> 2015;30(3):337-43. PubMed Full text	“PN is a life-sustaining therapy designed to deliver essential nutrients to patients unable to meet nutrition needs via the enteral route. PN may be delivered via a 2-in-1 system (one solution containing amino acids, dextrose, electrolytes, vitamins, minerals, and fluids and one solution containing intravenous fat emulsions [IVFEs]) or via a 3-in-1 system (all nutrients mixed in one container). Although the use of 3-in-1 PN solutions is not necessarily therapeutically advantageous, certain benefits may exist such as the potential to reduce the risk of contamination due to decreased manipulations; ease of administration, particularly in the home care setting; possible cost savings; and reduced IVFE wastage. However, the incorporation of IVFE in 3-in-1 solutions also presents unique risks for the neonatal and pediatric population such as decreased stability, increased lipid globule size, decreased sterility and the potential for increased microbial growth/infectious complications, the need to use a larger filter size, precipitation and compatibility risks, and an increased chance of catheter occlusion. This review outlines the unique issues and challenges to be considered when formulating neonatal and pediatric 3-in-1 PN admixtures. While 3-in-1 PN solutions may be advantageous for certain pediatric populations, specifically those dependent on home PN, the risks do not outweigh the benefits in neonatal patients, and use should be avoided in this population.”
Hall J. Safety, cost, and clinical considerations for the use of premixed parenteral nutrition. <i>Nutr Clin Pract.</i> 2015;30(3):325-30. PubMed Abstract	“Premixed [PN] can be used for PN therapy in place of traditional compounded or customized PN. Premixed PN may have a number of advantages over compounded PN such as decreased costs, decreased compounding time, reduced chance for error, and reduced incidence of bloodstream infections. However, premixed PN may not be appropriate for all patients and may have other additional costs associated with its use. This article discusses the data available with regard to the use of premixed PN, focusing on the potential advantages and disadvantages of using premixed PN, and also discusses the implementation of premixed PN in a large tertiary cancer center.”
Yi and Yang. Comparison of a three-in-one total nutrient mixture with conventional peripheral parenteral nutrition in children. <i>Asia Pac J Clin Nutr.</i> 2015;24(1):44-50. PubMed Full text	“The aim of this study was to compare clinical aspects of the application of three-in-one total nutrient mixture (TNA) for peripheral parenteral nutrition (PPN) with those of the conventional PPN (cPPN) method of providing short-term [PN] for pediatric inpatients. We conducted a retrospective study in children from 2 to 18 years old who were hospitalized and underwent PPN administration. We compared clinical aspects of two methods of PPN, cPPN (n=39) and TNA (n=57). RESULTS: The mean age was 6.5±3.1 years in the cPPN group and 8.2±3.4 years in the TNA group (p=0.015). In the TNA group, there was a significantly shorter period between the day of admission and the first day of PPN or oral feeding (p<0.0001 & p<0.0001, respectively). The TNA group also fasted for a shorter period before PN after admission, and the total duration of fasting was also shorter (p<0.0001 & p<0.0001, respectively). The TNA group showed a lower glucose infusion rate and fewer daily administered total calories per weight (p<0.0001 & p=0.001, respectively). However, there was no significant difference in the amount of administered amino acids and lipids (p=0.584 & p=0.650, respectively) and PPN-related complications. When providing nutrients to hospitalized children who cannot take in enough nutrients via the enteral route, TNA formula may be an easier and faster method than cPPN.”

Additional Resources

We searched the gray literature to identify any relevant web resources not indexed in the traditional bibliographic databases listed above. Gray literature consists of reports, studies, articles, and monographs produced by government agencies, private organizations, academic institutions, educational facilities, consulting firms, and corporations. Our findings were hand selected by a research analyst for relevancy from a broad set of search results published through October 9, 2025. See Table 3.

Table 3. Additional Resources

Source	Key Statements
American Society for Parenteral and Enteral Nutrition (ASPEN). <u>Practice tool. Multi-chamber bag parenteral nutrition: indications, product availability, and patient safety.</u> 2024.	“Commercially available multi-chamber bag parenteral nutrition (MCB-PN) products have recently seen an increase in use in the United States due to reduced staff time required for its preparation and, in part, due to recent PN product shortages. ASPEN defines MCB-PN as standardized, commercially available [PN] formulations from a manufacturer. These products require fewer compounding steps before administration. The term “premixed” should be avoided as bag activation and additives are required. This practice tool reviews indications for MCB-PN, current MCB-PN products available in the US, and safety considerations related to their use.”
Mays et al. <u>Importance of parenteral nutrition terminology.</u> Letter. <i>Nutr Clin Pract.</i> 2023 Aug.	“When using various terminology, nutrition support clinicians must be cautious. The ASPEN Safety Committee respectfully requests the elimination of the term premixed and ready-to-use when referring to commercially available MCB-PN and that all authors and journals ensure consistent use of preferred and approved terminology.”
Adams et al. <u>Safe care transitions for patients receiving parenteral nutrition.</u> <i>Nutr Clin Pract.</i> 2022.	“Transitions of care require coordination between inpatient healthcare providers, care managers, outpatient/ambulatory providers, and the patient/caregiver and family members. Poor communication during transitions of care can affect health outcomes and economic costs for patients/caregivers, healthcare providers, and healthcare systems. The goal of this paper is to identify risk-prone processes in the transition of care for patients requiring parenteral nutrition (PN) between healthcare environments, including the hospital, home, skilled nursing facility, and long-term acute care hospital settings. To facilitate the evaluation of the transition, a sequential series of steps in the transition process were identified: initial notification, assessment in preparation for transfer, identifying the receiving organization, identifying accountable providers at each sending/receiving organization, communicating the nutrition care plan, implementing the plan and additional considerations regarding PN preparation and readmissions. Safety concerns with risk-prone processes are identified and recommended best practices are proposed for improving processes at each step of the transition. Pediatric considerations are included in the evaluation of the various steps in the transition of care. This paper was approved by the [ASPEN] Board of Directors. The PN order ... As described in more detail elsewhere, the complete order will include amino acids, dextrose, and ILEs entered as grams per day (or per kilogram per day as appropriate), together with the opportunity to list the specific amino acids and ILE products.¹ It is important to indicate the brand of amino acids and ILE emulsion product as neither can be substituted without coordination. This is especially important to evaluate total electrolyte content, calcium-phosphate solubility, and emulsion stability. The determination of whether the PN can be prepared as a total nutrient admixture (TNA) or instead requires a container with a separate ILE bag for administration may need to be coordinated. Compatibility and stability issues for the PN formulation must be reviewed to ensure safety based on published data, manufacturer guidelines, and ASPEN standards. In adult patients, electrolyte salts are ordered as the total amount (milliequivalents or millimole) per day whereas in pediatric patients electrolyte salts are ordered as milliequivalents or millimole per kilogram per day. Trace elements and vitamins are also ordered per day, as are any additional individual nutrients or clinically appropriate and compatible non-nutrient medications. A separate but linked order may be required for patient additives, unless those components are clearly identified in the PN order and on the PN label. In cases where dual chamber bags are used to dispense the PN admixture, TNA-specific guidelines must still be followed.”

Selected Resources

ECRI. Available from: www.ecri.org. Subscription required.

- [Action needed to address risk with custom and multi-chamber bag parenteral nutrition—Part II.](#) Article. 2025 Mar 27.
- [Survey exposes risks with custom and multi-chamber bag parenteral nutrition—Part I.](#) Article. 2025 Mar 13.
- [Multi-chamber bag parenteral nutrition is not without risk.](#) News. 2022 Sep.

Embase. Elsevier B.V. Available from: www.embase.com. Subscription required.

- #1 'parenteral nutrition'/exp OR parenteral:ti,ab,kw
- #2 (3-in-1 OR "three-in-one" OR 2-in-1 OR "two-in-one").tw,kf.
- #3 (3CB? OR 3-CB? OR 2CB? OR 2-CB?):ti,ab,kw
- #4 #1 AND (#2 OR #3)
- #5 ('binary parenteral nutrition' OR 'binary PN' OR 'ternary parenteral nutrition' OR 'ternary PN'):ti,ab,kw OR ((multichamber* OR 'multi chamber*' OR multicompartment\$ OR multi-compartment\$ OR 'three chamber*' OR '3 chamber*' OR 'triple chamber*' OR three-compartment* OR 3-compartment* OR triple-compartment* OR tri-compartment* OR tricompartment* OR '3 port' OR 'three port' OR 'triple port' OR 'two chamber*' OR '2 chamber*' OR 'dual chamber*' OR 'double chamber*' OR two-compartment* OR 2-compartment* OR dual-compartment* OR double-compartment* OR bi-compartment* OR bicompartment* OR '2 port' OR 'two port' OR 'dual port' OR 'double port' OR 'all in one' OR premix* OR pre-mix*) NEAR/4 (bag* OR container* OR pn OR parenteral)):ti,ab,kw
- #6 (clinimix* OR kabiven* OR perikabiven):ti,ab,kw,tn
- #7 #4 OR #5 OR #6

Ovid MEDLINE. Wolters Kluwer. Available from: www.ovid.com. Subscription required.

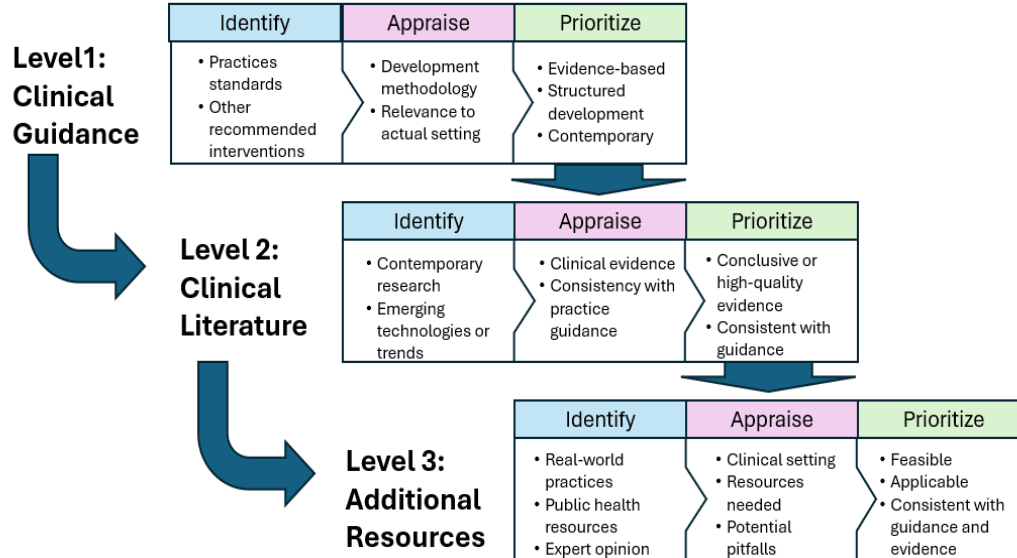
- #1 exp Parenteral Nutrition/ OR exp Parenteral Nutrition Solutions/ OR parenteral.tw,kf.
- #2 (3-in-1 OR 2-in-1).tw,kf.
- #3 (3CB? OR 3-CB? OR 2CB? OR 2-CB?).tw,kf.
- #4 #1 AND (#2 OR #3)
- #5 (binary parenteral nutrition OR binary PN OR ternary parenteral nutrition OR ternary PN).tw,kf. OR ((multichamber\$ OR multi-chamber\$ OR multicompartment\$ OR multi-compartment\$ OR three-chamber\$ OR 3-chamber\$ OR triple-chamber\$ OR three-compartment\$ OR 3-compartment\$ OR triple-compartment\$ OR tri-compartment\$ OR tricompartment\$ OR 3-port OR three-port OR triple-port OR two-chamber\$ OR 2-chamber\$ OR dual-chamber\$ OR double-chamber\$ OR two-compartment\$ OR 2-compartment\$ OR dual-compartment\$ OR double-compartment\$ OR bi-compartment\$ OR bicompartment\$ OR 2-port OR two-port OR dual-port OR double-port OR all-in-one OR premix\$ OR pre-mix\$) ADJ4 (bag\$ OR container\$ OR PN OR parenteral)).tw,kf.
- #6 (clinimix\$ OR kabiven\$ OR perikabiven).tw,kf.
- #7 #4 OR #5 OR #6

CINAHL (Cumulative Index to Nursing and Allied Health Literature). Available from www.ebscohost.com. Subscription required.

- #1 MH "Parenteral Nutrition+" OR TX parenteral
- #2 TX(3-in-1 OR "three-in-one" OR 2-in-1 OR "two-in-one")
- #3 TX(3CB? OR 3-CB? OR 2CB? OR 2-CB?)
- #4 #1 AND (#2 OR #3)
- #5 TX("binary parenteral nutrition" OR "binary PN" OR "ternary parenteral nutrition" OR "ternary PN") OR TX((multichamber* OR "multi chamber*" OR multicompartment* OR multi-compartment* OR "three chamber*" OR "3 chamber*" OR "triple chamber*" OR three-compartment* OR 3-compartment* OR triple-compartment* OR tri-compartment* OR tricompartment* OR "3 port" OR "three port" OR "triple port" OR "two chamber*" OR "2 chamber*" OR "dual chamber*" OR "double chamber*" OR two-compartment* OR 2-compartment* OR dual-compartment* OR double-compartment* OR bi-compartment* OR bicompartment* OR "2 port" OR "two port" OR "dual port" OR "double port" OR "all in one" OR premix* OR pre-mix*) N4 (bag* OR container* OR pn OR parenteral))
- #6 TW(clinimix* OR kabiven* OR perikabiven)
- #7 #4 OR #5 OR #6

Identify-Appraise-Prioritize Framework

The Identify-Appraise-Prioritize guidance framework considers the three levels of information provided by the CLS, in order of relevance.



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