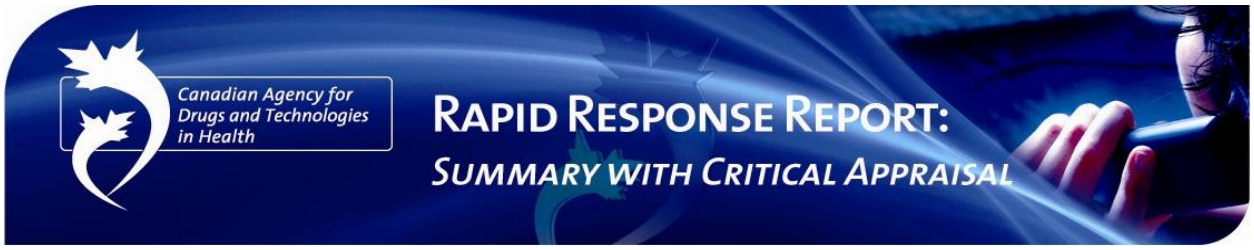

TITLE: Extension Tubing Changes for Peripherally Inserted Central Catheters: A Review of the Clinical Evidence and Guidelines

DATE: 21 October 2015

CONTEXT AND POLICY ISSUES

Vascular access devices (VADs) are routinely used in clinical practice to administer parenteral fluids, nutrients, medications, and blood products.[1] VADs vary in their catheter type, placement location, and placement duration.[2] For example, central VADs are catheters with their tip placed into the central venous circulation, ideally the lower third of the superior vena cava (SVC) or at the SVC-right atrial junction.[3] Central VADs include peripherally-inserted central catheters (PICCs), which enter via a peripheral, usually deep, vein of the upper extremity (e.g., upper arm), but the tip of which is in the central venous circulation.[3]

PICCs have been associated with a lower rate of bloodstream infection (BSI) than other types of intravenous (IV) catheters among outpatients and can be left in place for months.[2] Nevertheless, infection generally remains a problem with IV catheters. For example, a systematic review of 200 prospective studies reported that the rates of BSI in adults, expressed as the number of infections per 100 IV devices, ranged from 0.1% for peripheral IV catheters to 3.1% for PICCs and 22.5% for central venous catheters.[4] One prevention measure is to change catheter administration sets, which include extension tubing, at appropriate time intervals.[2]

For patients in community settings (e.g., at home or as outpatients who require and are able to self-administer intermittent IV medications), the frequency of changing extension tubing on PICCs can be a salient issue from the perspectives of both patients and providers. If too frequent, it may present a time and resource burden. If too infrequent, it may lead to increased risk of infection and downstream costs. The appropriate frequency may also vary with the type of infusates administered (e.g., whether they contain lipids, blood, or blood products).[2]

The purpose of this report is to summarize clinical evidence as well as evidence-based guidelines regarding the frequency of changing extension tubing on PICCs for patients in community settings.

RESEARCH QUESTIONS

1. What is the clinical evidence regarding the frequency of changing extension tubing on peripherally-inserted central catheters (PICCs) for patients in community settings?

2. What are the evidence-based guidelines regarding the frequency of changing extension tubing on PICCs for patients in community settings?

KEY FINDINGS

No relevant clinical studies were identified regarding the frequency of changing extension tubing on PICCs for patients in community settings. Two evidence-based guidelines were retrieved and suggested replacing administration sets for all vascular access devices (VADs), including PICCs, no more frequently than at 72-hour intervals if in continuous use. One of the guidelines suggested replacing VAD administration sets every 24 hours if in intermittent use. Both guidelines suggested more frequent replacing of VAD administration sets (e.g., every four to 24 hours) for infusates that contain lipid emulsions, blood, or blood products, or immediate replacing if contamination is suspected or if the integrity of the system has been compromised.

METHODS

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, EBSCOhost CINAHL, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2005 and September 21, 2015.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed, and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria	
Population	Adults in community settings (i.e., home or outpatient and not in long-term care), with PICCs requiring extension tubing
Intervention	Changing the extension tubing on PICCs approximately every 24 hours
Comparator	Changing the extension tubing on PICCs less frequently
Outcomes	Q1: clinical effectiveness and safety (e.g., increased infection rates, complications) Q2: guidelines and recommendations regarding the frequency of changing extension tubing on PICCs (e.g., how often it should be done, under what conditions)
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials (RCTs), non-randomized studies, and evidence-based guidelines

Exclusion Criteria

Studies were excluded if they did not meet the selection criteria outlined in Table 1, if they were duplicate publications, or if they were published prior to 2005. Guidelines were excluded if they were not evidence-based or if there was incomplete or no reporting of methods.

Critical Appraisal of Individual Studies

The quality of the included guidelines was assessed with the Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument.[5] Each included guideline was evaluated on the following six domains: scope and purpose; stakeholder involvement; rigour of development; clarity of presentation; applicability; and editorial independence. Summary scores were not calculated for the included guidelines; rather, a review of the strengths and limitations of each included guideline was described narratively.

SUMMARY OF EVIDENCE

Quantity of Research Available

A total of 320 citations were identified in the literature search. Following screening of titles and abstracts, 314 citations were excluded, and six potentially relevant reports from the electronic search were retrieved for full-text review. Five potentially relevant publications were retrieved from the grey literature search. Of these 11 potentially relevant articles, nine publications were excluded for various reasons, while two guidelines met the inclusion criteria and were included in this report.[1,6] No relevant studies were identified to speak to the clinical evidence. Appendix 1 describes the PRISMA flowchart of the study selection.

Additional references of potential interest that did not meet the selection criteria are provided in Appendix 5.

Summary of Study Characteristics

Study Design

Two evidence-based guidelines were identified.[1,6] Published in 2012[6] and 2005,[1] the guidelines included recommendations regarding the optimal time interval for replacing administration sets for all VADs, including PICCs.

Country of Origin

One of the two guidelines was developed in the United Kingdom by the National Clinical Guideline Centre, commissioned by the National Institute for Health and Clinical Excellence (NICE).[6] The other guideline was developed in Canada by the Registered Nurses' Association of Ontario (RNAO).[1]

Patient Population

The NICE guideline included all adults and children in primary and community health care settings that require standard infection control precautions,[6] while the RNAO guideline included all adults requiring the care and maintenance of VADs.[1]

Interventions and Comparators

The two guidelines provided recommendations on the optimal frequency of replacing administration sets for all VADs, including PICCs.[1,6]

Outcomes

The two guidelines provided recommendations on the optimal frequency of replacing administration sets for VADs for different types of use (i.e., continuous or intermittent) and infusates (e.g., whether they contain lipid emulsions, blood, or blood products).[1,6] Both guidelines rated the quality of evidence supporting their recommendations using four grades or levels: NICE used Grade A to D,[6] and RNAO used Level I to IV.[1] The highest rating (i.e., Grade A or Level I) indicated evidence from meta-analyses of RCTs or at least one RCT, while the lowest level (i.e., Grade D or Level IV) indicated evidence from expert committee reports or opinions.[1,6]

Appendix 2 provides the details of the guideline characteristics.

Summary of Critical Appraisal

The two guidelines[1,6] explicitly stated their scope and purpose. During development, both guidelines involved various stakeholders, including patients and providers, and used systematic methods to search for evidence. The NICE guideline reported in detail on its rigourous approach in evidence selection, quality appraisal, and recommendation formulation,[6] while the RNAO guideline was not clear on its approach.[1] Neither guideline described in details the areas of disagreement and methods for resolving them in formulating recommendations. Both guidelines provided unambiguous and specific recommendations, identified tools and resources for implementation as well as measures for monitoring/auditing adherence, and proposed a procedure for future updates. Indeed, the 2005 RNAO guideline was updated in 2008, but no

revisions were made in 2008 to the 2005 recommendations on the optimal frequency of replacing administration sets for VADs.[1] However, neither guideline identified facilitators or barriers in implementing the recommendations. In both guidelines, funding sources were disclosed, and potential conflicts of interest declared. Appendix 3 provides the details of the critical appraisal.

Summary of Findings

What is the clinical evidence regarding the frequency of changing extension tubing on PICCs for patients in community settings?

No relevant clinical studies were identified regarding the frequency of changing extension tubing on PICCs for patients in community settings.

What are the evidence-based guidelines regarding the frequency of changing extension tubing on PICCs for patients in community settings?

Two evidence-based guidelines, one by NICE[6] and the other by RNAO,[1] suggested replacing administration sets for all VADs, including PICCs, no more frequently than at 72-hour intervals if in continuous use. NICE rated the quality of evidence supporting this recommendation as high at Grade A (i.e., evidence from meta-analyses of RCTs or at least one RCT),[7] whereas RNAO rated it as low at Level IV (i.e., evidence from expert committee reports or opinions).[1] The RNAO guideline suggested replacing VAD administration sets in intermittent use every 24 hours.[1] Both guidelines suggested more frequent replacing (e.g., every four to 24 hours) for infusates that contain lipid emulsions, blood, or blood products or immediate replacing if contamination is suspected or the integrity of the system has been compromised. Both NICE and RNAO rated the quality of evidence supporting these recommendations as low at Grade D or Level IV (i.e., evidence from expert committee reports or opinions), respectively.[1,6] Appendix 4 provides the details of the findings.

Limitations

No relevant clinical studies were identified regarding the frequency of changing extension tubing on PICCs for patients in community settings.

The two evidence-based guidelines included in this report were not specific to adults in community settings with PICCs but rather general to all children[6] and adults[1,6] requiring any VADs and not PICCs specifically.[1,6]

While both guidelines provided recommendations for replacing administration sets in continuous use,[1,6] only one of the guidelines (i.e., from RNAO) provided recommendations for replacing them in intermittent use.[1] The RNAO guideline lacked details in the reporting of its guideline development methods.[1]

Both guidelines generally rated the quality of evidence supporting their recommendations regarding the frequency of changing extension tubing as low.[1,6]

Therefore, in general, evidence regarding the frequency of changing extension tubing on PICCs for patients in community settings was limited, assessed from both the limited number of

available guidelines as well as the generally low quality of evidence supporting the existing recommendations.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING

No relevant clinical studies were identified regarding the frequency of changing extension tubing on PICCs for patients in community settings. Two evidence-based guidelines on the care and maintenance of VADs suggested replacing administration sets no more frequently than at 72-hour intervals if in continuous use, every 24 hours if in intermittent use, or more frequently for cases of increased risk of infection. However, both guidelines generally rated the quality of evidence supporting their recommendations as low. No evidence-based guidelines were identified regarding the frequency of changing extension tubing on PICCs specifically.

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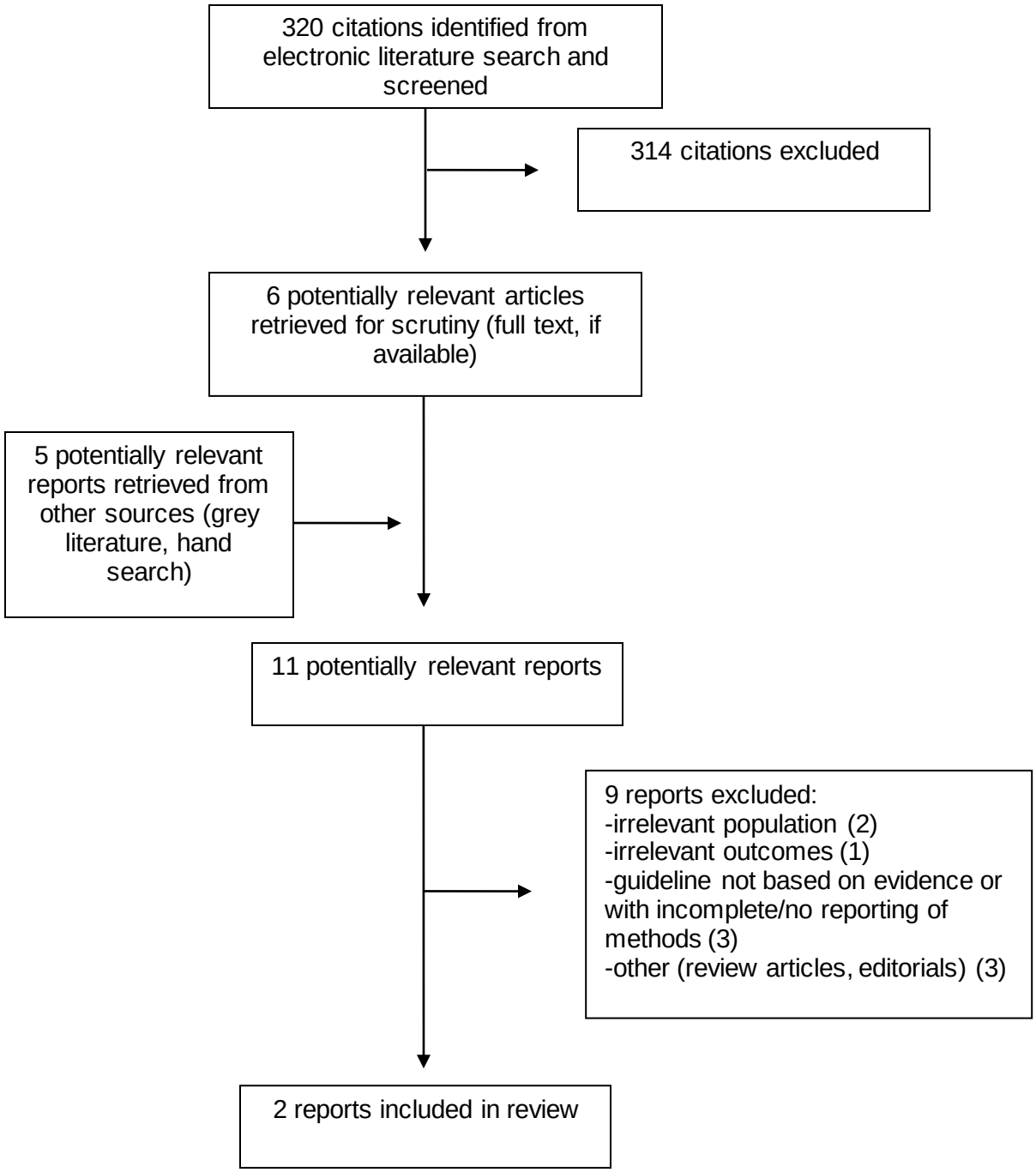
APPENDIX 1: Selection of Included Studies



APPENDIX 2: Characteristics of Included Publications

Table A1: Characteristics of Included Guidelines

Objectives			Methodology			
Intended Users, Target Population, and Development Country	**Intervention and Practice Considered**	**Major Outcomes Considered**	**Evidence Collection, Selection, and Synthesis**	**Evidence Quality and Strength**	**Recommendations Development and Evaluation**	**Guideline Validation**
NICE, 2012[6,7] *(Update of 2003 guideline)*						
Intended users: all health care workers employed in primary and community care settings as well as informal carers and family members Target population: all adults and children receiving health care in primary and community care settings where standard infection control precautions apply	Changing IV administration sets for all VADs including peripheral venous catheters	Optimal interval for the routine replacement of IV administration sets	Systematic literature searches for clinical and health economic studies in English Syntheses through MA and appraisals of pooled outcomes using GRADE	Quality of evidence was rated using grades as: • A: evidence from MA of RCTs or at least 1 RCT • B: evidence from at least 1 well-designed controlled study without randomization or quasi-experimental study or extrapolated from Grade A evidence • C: evidence from well-designed non-experimental descriptive	Recommendations were developed by a multidisciplinary Guideline Development Group of key stakeholders and a patient representative, with expert advisors and considerations for benefits, harms, costs, and quality of evidence	A draft guideline was subject to eight weeks of public and stakeholder consultation

Table A1: Characteristics of Included Guidelines

Objectives			Methodology			
Intended Users, Target Population, and Development Country	**Intervention and Practice Considered**	**Major Outcomes Considered**	**Evidence Collection, Selection, and Synthesis**	**Evidence Quality and Strength**	**Recommendations Development and Evaluation**	**Guideline Validation**
Development Country: UK				studies or extrapolated from Grade A or B evidence • D: evidence from expert committee reports or opinions or extrapolated from Grade A, B, or C evidence		
RNAO, 2005[1] *(Updated in 2008)*						
Intended users: nurses, other health care professionals, and administrators Target population: all adult clients requiring the care and maintenance of VADs	Care and maintenance of VADs, with the focus on central VADs but also including peripheral VADs	Clinical practice recommendations for VAD add-ons including administration sets	Systematic literature searches for guidelines related to care and maintenance of VADs in English Screening and review of identified guidelines	Quality of evidence was rated using levels as: • I: evidence from MA or SR of RCTs (Ia) or at least 1 RCT (Ib) • II: evidence from at least 1 well-designed controlled study without	Recommendations were developed by the Development Panel members through subgroup activities and then as a whole to discussed gaps and available evidence	A draft guideline was submitted to external stakeholders (representing various health care disciplines, clients and families, and professional associations) for review and

Table A1: Characteristics of Included Guidelines						
Objectives			**Methodology**			
Intended Users, Target Population, and Development Country	**Intervention and Practice Considered**	**Major Outcomes Considered**	**Evidence Collection, Selection, and Synthesis**	**Evidence Quality and Strength**	**Recommendations Development and Evaluation**	**Guideline Validation**
Development Country: Canada			using a set of criteria and appraisals of each included guideline using AGREE	randomization (IIa) or quasi-experimental study without randomization (IIb) • III: evidence from well-designed non-experimental descriptive studies • IV: evidence from expert committee reports or opinions		feedback

AGREE = Appraisal of Guidelines for Research and Evaluation; GRADE = Grading of Recommendations Assessment, Development and Evaluation; IV = intravenous; MA = meta-analysis; NICE = National Institute for Health and Clinical Excellence; RCT = randomized controlled trial; RNAO = Registered Nurses' Association of Ontario; SR = systematic review; UK = United Kingdom; VAD = vascular access device

APPENDIX 3: Critical Appraisal of Included Publications

Table A2: Strengths and Limitations of Guidelines using AGREE II[5]

Strengths	Limitations
NICE, 2012[6,7]	
Scope and Purpose • Objectives were explicit. • Health questions were explicit. • Target populations were explicit. *Stakeholder Involvement* • The guideline was developed by a multidisciplinary group that represented all key stakeholders and included a patient representative and methodologists. • Target population input was sought from patients and staff. • Targets users were explicit. *Rigour of Development* • Systematic search methods were used. • Evidence selection criteria were described. • Appraisals on the quality of included evidence were provided. • Methods for formulating recommendations were described. • Recommendations considered benefits, harms, costs, and quality of evidence, and their links to supporting evidence tables were explicit. • A procedure for updating the guideline was described. *Clarity of Presentation* • Recommendations were unambiguous, specific for different types of infusates, and easily identifiable. *Applicability* • The guideline provided links to tools and resources including a summary document. • The guideline considered resource implications through a review of cost-effectiveness studies. • The guideline described time intervals for replacing administration sets as a process measure for monitoring/auditing adherence. *Editorial Independence* • Funding sources were disclosed. • No conflicts of interest were reported.	*Rigour of Development* • Areas of disagreement and methods for resolving them in formulating recommendations and how the process influenced the recommendations were not described. • The external review process did not explicitly describe who provided feedback, what information was collected, and if/how any feedback was addressed/incorporated. *Applicability* • Facilitators and barriers to implementing the guideline were not described.

Table A2: Strengths and Limitations of Guidelines using AGREE II[5]

Strengths	Limitations
RNAO, 2005[1]	
Scope and Purpose • Objectives were explicit. • Health questions were explicit. • Target populations were explicit. *Stakeholder Involvement* • The guideline was developed by a multidisciplinary group that represented various clinical groups. • Target population input was sought from various health care disciplines, clients and families, and professional associations. • Targets users were explicit. *Rigour of Development* • Systematic search methods were used. • The external review process explicitly described who provided feedback, what information was collected, and if/how any feedback was addressed/incorporated. • A procedure for updating the guideline was described in detail. *Clarity of Presentation* • Recommendations were unambiguous, specific for different types of infusates, and easily identifiable. *Applicability* • The guideline provided links to tools and resources including implementation strategies. • The guideline described process and outcome measures for monitoring/auditing adherence. *Editorial Independence* • Funding sources were disclosed, and independence declared. • Declarations of interest and confidentiality were made.	*Stakeholder Involvement* • It is unclear whether the multidisciplinary group that developed the guideline included any methodologists. *Rigour of Development* • The search strategy included only clinical guidelines and no other literature. No last search date was reported. • The description of the evidence selection criteria was minimal. • Appraisals on the quality of included evidence were not provided. • The description of the methods for formulating recommendations was not clear. • Areas of disagreement and methods for resolving them in formulating recommendations and how the process influenced the recommendations were not described. *Applicability* • Facilitators and barriers to implementing the guideline were not described. • The guideline did not consider resource implications.

AGREE = Appraisal of Guidelines for Research and Evaluation; NICE = National Institute for Health and Clinical Excellence; RNAO = Registered Nurses' Association of Ontario

APPENDIX 4: Findings of Included Publications

Table A3: Summary of Findings of Included Evidence-Based Guidelines

Recommendations	Key Messages
NICE, 2012[6,7]	
From 4. Guideline summary, 4.2. Full list of recommendations, 4.2.4. Vascular access devices (pages 49-50): • "In general, administration sets in continuous use need not be replaced more frequently than at 72 hour intervals unless they become disconnected or if a catheter-related infection is suspected or documented." • "Administration sets used for total parenteral nutrition infusions should generally be changed every 24 hours. If the solution contains only glucose and amino acids, administration sets in continuous use do not need to be replaced more frequently than every 72 hours." • "Administration sets for blood and blood components should be changed every 12 hours, or according to the manufacturer's recommendations."	From 12.8. General principles for management of vascular access devices, 12.8.11. Change intravenous administration sets appropriately (page 201): • "Replacing administration sets no more frequently than 72 hours after initiation of use is safe and cost-effective. (grade of evidence: A)" • "When a fluid that enhances microbial growth is infused, e.g., lipid emulsions, blood products, more frequent changes of administration sets are indicated. (grade of evidence: D)"
RNAO, 2005[1]	

From Practice Recommendations (page 36):
• "All primary and secondary continuous IV administration sets should be replaced at a minimum every 72 hours or changed immediately if contamination is suspected or the integrity of the system has been compromised."
• "Intermittent administration sets should be changed every 24 hours or immediately upon suspected contamination or when the integrity of the product or system has been compromised."
• "The type of solution administered can dictate the frequency of administration set changes." Change times are as follows:
  ○ Parenteral nutrition containing amino acids: 72 hours
  ○ Lipid products: 24 hours
  ○ Whole blood or blood components (e.g., platelets, RBC concentrate, plasma, cryoprecipitate): 4 hours or 2 units
  ○ Fractionated products (e.g., IvIG, clotting factors, albumin): upon completion of infusion
	From Summary of Recommendations (page 10):
	• "Nurses will change all add-on devices a minimum of every 72 hours. (level of evidence: IV)"

IV = intravenous; IvIG = intravenous immunoglobulin; NICE = National Institute for Health and Clinical Excellence; RNAO = Registered Nurses' Association of Ontario

APPENDIX 5: Additional References of Potential Interest

No methods for guidance development were reported in the following guidelines.

Infusion Nurses Society. Infusion Nursing Standards of Practice. J Infus Nurs. 2006 Jan-Feb;29(1 Suppl):S1-S92.

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