**Parenteral Nutrition Recommendations for Pediatric Patients**

*(Calculated for normal organ function and normal caloric requirements)*

**PN orders are due by 11 AM daily**

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Infant up to 10 kg</th>
<th>10 – 40 kg</th>
<th>&gt; 40kg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Newborn (Premature and Full Term)</strong></td>
<td>Maintenance or as medical condition indicates in ml/kg</td>
<td>Maintenance or as medical condition indicates in ml/kg</td>
<td>Maintenance or as medical condition indicates in ml/kg</td>
</tr>
</tbody>
</table>
| **Dextrose**  | Initiation: 60-80 ml/kg/Day  
24 – 48 hrs: advance by 1-2 mg/kg/min if BG < 110mg/dL  
Goal: as needed to achieve goal kals | Initiation: 6-7 mg/kg/min  
Advancement: 1-2 mg/kg/min | Initiation: 10-12.5%  
Advancement: 3-5% per day | Initiation: 8-12.5%  
Advancement: 3-5% per day |
| **Amino acid** | 0 – 24 hrs of life: 2 – 3 gm/kg/Day  
24 – 48 hrs: advance by 1 – 1.5 gm/kg/Day  
Goal: 3 – 4 gm/kg/Day | Initiation: 1.5-2 gm/kg/Day  
Advancement: 0.5-1 gm/kg/Day | Initiation: 1.5-2 gm/kg/Day  
Advancement: 0.5-1 gm/kg/Day | Initiation: 0.8-1.5 gm/kg/Day  
Advancement: 0.5-1 gm/kg/Day |
| **Lipid**     | 0 – 24 hrs of life: 0 – 1 gm/kg/Day  
24 – 48 hrs: advance by 1 – 2 gm/kg/Day  
Goal: 2 – 3 gm/kg/Day | Initiation: 1.5-2 gm/kg/Day  
Advancement: 0.5-1 gm/kg/Day | Initiation: 1.5-2 gm/kg/Day  
Advancement: 0.5-1 gm/kg/Day | Initiation: 0.5-1 gm/kg/Day  
Advancement: 0.5-1 gm/kg/Day |
| **Goal Calories** | 90 – 110 kcal/kg/Day | 85 – 100 kcal/kg/Day | 55 – 90 kcal/kg/Day | 20 – 45 kcal/kg/Day |
| **Na**        | 0 – 24 hrs of life: None  
24 – 48 hrs: 1 – 3 mEq/kg/Day  
Goal: 2 – 5 mEq/kg/Day | 2 – 5 mEq/kg/Day | 1 – 2 mEq/kg/Day |
| **K**         | 0 – 24 hrs of life: None  
24 – 48 hrs: 0 – 1 mEq/kg/Day  
Goal: 2 – 4 mEq/kg/Day | 2 – 4 mEq/kg/Day | 1 – 2 mEq/kg/Day |
| **Mg**        | 0 – 24 hrs of life: 0.3 mEq/kg/Day (if mom given Mg, hold until pt stools)  
24 – 48 hrs: According to labs  
Goal: 0.3 mEq/kg/Day | 0.3 – 0.5 mEq/kg/Day | 0.3 – 0.5 mEq/kg/Day | 10 – 30 mEq/kg/Day |
| **Ca**        | 0 – 24 hrs of life: Max  
24 – 48 hrs: Ca solubility varies with PN component advancement.  
Goal: 3 – 4.5 mEq/kg/Day  
60 – 90 mg/kg/Day | 0.5 – 4 mEq/kg/Day  
10 – 80 mg/kg/Day | 0.5 – 4 mEq/kg/Day  
10 – 80 mg/kg/Day | 10 – 20 mEq/kg/Day  
200 – 400 mg/kg/Day |
| **Phos**      | 0 – 24 hrs of life: Cannot be added without Na or K.  
24 – 48 hrs: Max for solubility. Discuss with pharmacy when low amounts of Na, and K in PN.  
Goal: 1.3 – 2 mol/L/kg/Day | 0.5 – 2 mol/L/kg/Day | 0.5 – 2 mol/L/kg/Day | 10 – 40 mol/L/kg/Day |
| **Cl/Acetate**| 0 – 24 hrs of life: Cannot be added without Na or K.  
24 – 48 hrs: Start with max acetate in infants <1.200gm  
Goal: As needed to achieve acid base balance | As needed to achieve acid base balance | As needed to achieve acid base balance | As needed to achieve acid base balance |

**JHH policy dictates that peripheral PN is limited to < 1000 mOsm/L. Central access is required for osmolarity > 1000 mOsm/L.** *(Osmolarity is automatically calculated by EPIC.)*

**NICU Only:** Starter PN only available for JHH born neonates < 1800gm, and < 24hrs old, neonate from OSH <1800gm and <72hrs old, (neonates from OSH <1000gm and <120 hours old with attending/fellow approval).

*Updated May 2018*
<table>
<thead>
<tr>
<th>PN Additives</th>
<th>Indications for Use</th>
<th>Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace Elements</td>
<td>All patients, unless direct hyperbilirubinemia or otherwise indicated.</td>
<td>Auto defaults in EPIC to weight based dosing. You will need to modify dosing if hyperbilirubinemia (Dbili &gt;2). See Trace Element Dosing Tables Below.</td>
</tr>
<tr>
<td>Heparin</td>
<td>Central line only. Used in all patients except oncology, ECMO, and those fully heparinized.</td>
<td>0.25 – 0.5 units/ml&lt;br&gt;*Premies &lt;32 weeks gestational age keep TOTAL daily dose from all sources to &lt; 70 Units/kg per 24 hours.</td>
</tr>
<tr>
<td>Carnitine</td>
<td>Patients on long term PN; hypertriglyceridemia; premature infants, carnitine deficiency, certain genetic disorders.</td>
<td>5 – 20 mg/kg/Day&lt;br&gt;*All infants &lt;28wks gestation: 10 mg/kg/Day&lt;br&gt;*Cardiac and Genetics patients may require 100 -300 mg/kg/Day</td>
</tr>
<tr>
<td>Albumin</td>
<td>Persistent hypoalbuminemia.</td>
<td>Individualized according to patient assessment. General dosing 0.5-1 gm/kg/Day.</td>
</tr>
<tr>
<td>Famotidine</td>
<td>Consider adding when NPO, GI surgery and patients on steroids. D/C existing EPIC order if ordered. Not routinely added in NICU- may increase the risk of sepsis, NEC.</td>
<td>0.25 – 0.75 mg/kg/Day&lt;br&gt;HD/PD 0.125mg/kg/dose Q 24 hours&lt;br&gt;CRRT 0.5mg/kg/dose Q 24 hours&lt;br&gt;*Adjust dose for renal impairment CrCl &lt;50 ml/min</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>Bleeding disorders, liver dysfunction.</td>
<td>2 – 5 mg/Day in pediatric patients; (1-2 mg/kg/Day in NICU infants)</td>
</tr>
<tr>
<td>Insulin</td>
<td>Impaired glucose control.</td>
<td>Must consult Endocrine</td>
</tr>
<tr>
<td>Multivitamin</td>
<td>All patients, unless otherwise indicated.</td>
<td>Auto defaults in EPIC to weight based dosing:&lt;br&gt;&lt;2.5 kg: 2ml/kg/Day Peds-MVI&lt;br&gt;2.5 - &lt;40kg: 5ml/DAY Peds-MVI&lt;br&gt; &gt;40 kg: 10ml/DAY Adult-MVI</td>
</tr>
</tbody>
</table>

**EPIC Default Trace Element Dosing (Standard dosing)**

<table>
<thead>
<tr>
<th>Trace Element</th>
<th>&lt;2.5 kg</th>
<th>2.5 – 15 kg</th>
<th>15 – 20 kg</th>
<th>20 – 40 kg</th>
<th>&gt;40 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peds Trace Element (Cr-Cu-Mn-Zn)</td>
<td>0.2 ml/kg/dose</td>
<td>0.2 ml/kg/dose</td>
<td>3 ml</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MTE-5 (Cr-Cu-Mn-Zn-Se)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3 ml</td>
<td>3 ml</td>
</tr>
<tr>
<td>Selenium</td>
<td>3 mCg/kg/dose</td>
<td>3 mCg/kg/dose</td>
<td>30 mCg/Day</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Zinc</td>
<td>200 mCg/kg/dose</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Trace Element Dosing During Hyperbilirubinemia (Dbili >2)**

When Copper and Manganese are removed, add Selenium, Zinc, and Chromium back in as follows:

<table>
<thead>
<tr>
<th>Trace Element</th>
<th>&lt;2.5 kg</th>
<th>2.5 – 15 kg</th>
<th>15 – 20 kg</th>
<th>20 – 40 kg</th>
<th>&gt;40 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>0.2 mCg/kg/dose</td>
<td>0.2 mCg/kg/dose</td>
<td>0.2 mCg/kg/dose</td>
<td>0.2 mCg/kg/dose</td>
<td>10 mCg/Day</td>
</tr>
<tr>
<td>Selenium</td>
<td>3 mCg/kg/dose</td>
<td>3 mCg/kg/dose</td>
<td>30 mCg/Day</td>
<td>30 mCg/Day</td>
<td>30 – 60 mCg/Day</td>
</tr>
<tr>
<td>Zinc</td>
<td>400 - 600 mCg/kg/dose</td>
<td>200 – 600 mCg/kg/Day</td>
<td>200 – 600 mCg/kg/Day</td>
<td>200 – 600 mCg/kg/Day</td>
<td>2.5 – 5 mg/Day</td>
</tr>
</tbody>
</table>

Updated May 2018
Additional Topics (click the hyperlink)

PN Lab Recommendations

Consulting a Dietitian/Pharmacist

Glucose Infusion Rate (GIR)

PN Cycling

PN Cycling Calculator

Ordering PN in EPIC

Ordering a Cycled PN in EPIC

Ordering Preemie/NICU Starter PN in EPIC

Ordering Lipids only in EPIC

How to add Heparin to a bag that has already been ordered in EPIC
PN Lab Recommendations:

- Daily CMP, Mg, Phos and TG are recommended prior to initiating PN. Once on PN, CMP, Mg, Phos should be rechecked daily until at goal PN regimen.
- TG should be checked 2-3 times per week while titrating fat emulsion to goal and then weekly when at goal daily dose.
- Dextrose levels should be monitored with D-sticks when cycling PN (see cycling section for additional details).

Consult a Dietitian If:

- All patients ordered for PN should have a pediatric nutrition consult
- Severe fluid and electrolyte abnormalities, organ dysfunction
- Abnormal calorie, fluid, and electrolyte requirements
- Cycling PN

Consult a Pharmacist If:

- PN and medication compatibility questions
- Before making changes to a PN solution that has already been finalized for that day
- Abnormal fluid, electrolyte requirements
- Cycling PN (Kim Conner)
**Glucose Infusion Rate (GIR) Equation:**

Please refer to PN Cycling Calculator for auto calculation.

To manually calculate Glucose infusion rate (mg glucose/kg/minute) = \[
\frac{\text{Fluid rate (ml/hr) } \times \text{dextrose } \%}{(\text{Weight in kg} \times 6)}
\]

Example: 10 kg patient receiving D 15% running at 20ml/hr

\[
\begin{align*}
a.) & \quad \frac{20 \text{ ml/hr} \times 15}{10 \times 6} \\
b.) & \quad \frac{300}{60} = 5 \text{ mg/kg/min}
\end{align*}
\]

**PN Cycling:**

If indicated, central PN can be cycled once pt tolerating goal PN calories with stable fluid and electrolytes. **Peripheral PN cannot be cycled!**

**Possible indications include:**

- PN cholestasis
- Home or long-term PN (>2 weeks)
- Medication administration and incompatibilities- discuss with pharmacy

**Initiating Cycling:**

- **Please discuss cycling plan with Dietitian or Pharmacist before ordering.**
- Check D-sticks one hour into the highest rate of the cycle, then once more when off PN for one hour.

**Day 1 Cycle:**

- PN should always start from a constant rate and cycled down at the end of an infusion.

**Day 2 Cycle:**

- PN infusion times reduced by 2 hours for infants, toddlers and patients with poor glucose tolerance.
- PN infusion times reduced by 4 hours for adolescents.
**PN CYCLING CALCULATOR**

**Day 1, Two-Step Cycle Equation:** Solve for $X$, then plug $X$ in to the equation to determine the appropriate rates to enter into EPIC order:

\[
X \text{ (rate in ml/hr)} = \frac{\text{Total PN volume in ml}}{\text{(Total hours of PN infusion - 1.25)}}
\]

\[
1^\text{st day of cycle} \quad X \quad \frac{\text{Previous day's PN (running continuous)}}{\text{Total hours PN running - 2}} \quad \frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}} \quad \frac{X}{2} \text{ 1 hr}
\]

**Day 1, One-Step Cycle Equation:** Solve for $X$, then plug $X$ in to the equation to determine the appropriate rates to enter into EPIC order:

\[
X \text{ (rate in ml/hr)} = \frac{\text{Total PN volume to infuse in ml}}{\text{(Total hours of PN infusion - 0.5)}}
\]

\[
1^\text{st day of cycle} \quad X \quad \frac{\text{Previous day's PN – running continuous}}{\text{Total hours PN running - 1}} \quad \frac{X}{2} \text{ 1 hr} \quad \text{PN off}
\]

**Subsequent days: Two-Step Cycle Equation:** Solve for $X$, then plug $X$ in to the equation to determine the appropriate rates to enter into EPIC order:

\[
X \text{ (rate in ml/hr)} = \frac{\text{Total PN volume to infuse in ml}}{\text{(Total hours of PN infusion - 2.5)}}
\]

\[
\frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}} \quad \frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}} \quad \frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}} \quad \frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}}
\]

**Subsequent days: One-Step Cycle Equation:** Solve for $X$, then plug $X$ into the equation to determine the appropriate rates for entering the PN rates into the EPIC order.

\[
X \text{ (rate in ml/hr)} = \frac{\text{Total PN volume to infuse in ml}}{\text{(Total hours of PN infusion - 1)}}
\]

\[
\frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}} \quad \frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}} \quad \frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}} \quad \frac{\frac{X}{2} \text{ 1 hr}}{\text{PN off}}
\]
Ordering PN in EPIC

**Step 1:** Go to the “Orders” tab and choose “Go to Order Sets”

**Step 2:** Type “PN” in the textbox and select “JHH-BMC Peds PN and Lipids”

**Step 3:** Select “Open Order Sets”
Step 4: Choose the appropriate order set according to pt’s weight, lipids or no lipids, and continuous vs cyclic PN

<table>
<thead>
<tr>
<th>Order Sets</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous PN and Lipid Options for patients &lt; 2.5 kg</td>
<td>JHH</td>
</tr>
<tr>
<td>Ph only for patients &lt; 1 kg</td>
<td>Standard Ca and Phos</td>
</tr>
<tr>
<td>Ph + Lipids for patients &lt; 0.5 kg</td>
<td>Max Ca and Phos</td>
</tr>
<tr>
<td>Cyclic Ph + Lipids for patients &lt; 2.5 kg</td>
<td>Standard Ca and Phos</td>
</tr>
<tr>
<td>Cyclic Ph only for patients &lt; 0.5 kg</td>
<td>Max Ca and Phos</td>
</tr>
</tbody>
</table>

| Cyclic PN and Lipid Options for patients < 2.5 kg | JHH |
| Cyclic Ph + Lipids for patients < 0.5 kg | Standard Ca and Phos |
| Cyclic Ph only for patients < 0.5 kg | Max Ca and Phos |

| Continuous PN and Lipid Options for patients | 2.5 up to 15 kg | JHH |
| Ph only for | 2.5 up to 15 kg | Max Ca and Phos |
| Ph + Lipids for | 2.5 up to 15 kg | Standard Ca and Phos |
| Cyclic Ph + Lipids for patients | 2.5 up to 15 kg | Max Ca and Phos |

| Cyclic PN and Lipid Options for patients | 2.5 up to 15 kg | JHH |
| Cyclic Ph + Lipids for patients | 2.5 up to 15 kg | Standard Ca and Phos |
| Cyclic Ph only for patients | 2.5 up to 15 kg | Max Ca and Phos |

| Lab and Lipid Options for patients | > 15 up to 20 kg | JHH |
| Ph only for | > 15 up to 20 kg | Cyclic Ph + Lipids for patients | > 15 up to 20 kg |
| Cyclic Ph only for patients | > 15 up to 20 kg |

| Lab and Lipid Options for patients | > 20 up to 45 kg | JHH |
| Ph only for | > 20 up to 45 kg |
| Cyclic Ph + Lipids for patients | > 20 up to 45 kg |
| Cyclic Ph only for patients | > 20 up to 45 kg |

| Lab and Lipid Options for patients | > 40 kg | JHH |
| Ph only for | > 40 kg |
| Cyclic Ph + Lipids for patients | > 40 kg |

Step 5: Lab orders will be available when ordering from PN order set

- Normal labs: daily CMP, Mg, Phos, TG at baseline and with lipid dose advancements
- Timing defaults to 1700 (PN change time to reduce potential CLABSI), NICU labs to be drawn around midnight
Step 6: Select the appropriate dose of fat emulsion per dietitian’s recs and/or use the “Parenteral Nutrition Recommendations for Pediatric Patients” document, the rate will auto calculate in ml/hr, hit “accept”.

Step 7: Select the appropriate fluid, dextrose, amino acid, electrolytes, and additives for the PN solution per the dietitian’s recs, and/or use the “Parenteral Nutrition Recommendations for Pediatric Patients” document.
Ordering a Cycled PN in EPIC:

*On day one of cycling you cannot reorder using the existing PN order. You must open a new order set.

**Step 1:** Go to the “Orders” tab and choose “Go to Order Sets”

**Step 2:** Type in “PN” in the textbox and select “JHH-BMC Peds PN and Lipids”

**Step 3:** Select “Open Order Sets”

**Step 4:** Choose the appropriate cyclic order set according to pt’s weight.

**Step 5:** For fat emulsion order: Select the appropriate dose per dietitian’s recs. You will need to manually change the “frequency” and “administer over” hours to match the same total hours as the PN infusion. If you do not see “administer over”, please click on “additional order details.” See below:
**Step 6:** You will need to manually enter the total hours for the PN infusion in “frequency” and “administer over” sections EACH DAY that a change is made to the duration of the PN infusion.

**Step 7:** Once you have determined if you are using a one hour or two hour taper, click the ‘TPN dosing guidelines’ link with in the order set, once in the guidelines use the PN Cycling Calculator to auto calculate the rates for the cycled infusion. Copy the infusion rates from the calculator, then delete and paste information into the administration instructions.

You must scroll down in the “Admin. Inst” box to be able to see all of the SmartText for the cycle rates.
Ordering Premie/NICU Starter PN in EPIC *Starter PN only available for JHH born neonates < 1800gm, and < 24hrs old, neonates from OSH <1800gm and <72hrs old, (neonates from OSH <1000gm and <120 hours old with attending/fellow approval).

Step 1: Go to the “Orders” tab.

Step 2: Choose “Manage Orders” (Starter PN is not part of an order set, it is its own order)

Step 3: Type “starter” in the textbox and select “starter parenteral nutrition.”

Step 4: Select the appropriate dose button (48 ml/kg/day or 67 ml/kg/day). 67ml/kg/day is the default dose which provides 3gm protein/kg/day ml/kg/hr” is the dose used at JHH for starter PN.

Step 5: Enter the dosing weight.

Step 6: Enter in “24hrs” for the frequency.
Ordering Lipids Only in EPIC

Step 1: Go to the “Orders” tab

Step 2: Search “Fat”

Step 3: Select “fat emulsion 20% infusion” and click “Accept”.

Step 4: On the next screen select the dosing consistent with goals for lipid infusion per dietitian’s recs and/or use the “Parenteral Nutrition Recommendations for Pediatric Patients”.

Updated May 2018
How to add Heparin to a bag that has already been ordered in EPIC

**Step 1:** Go to “Manage Orders” and search “PN rate change”, then add an admin instruction that says “Pharmacy: please add 0.5 unit/ml of heparin to PN”.

Note: Modifying “admin instructions” will not change the order number or the bar code on the bag. The RN will be able to scan the order. If you select the “Reorder” button by mistake it will create a new order number, therefore the barcode will not be able to be scanned.

**Step 2:** Call pharmacy to notify of the changes made to the current PN order.

**Step 3:** Contact dietitian to let them know that heparin needs to be added to the PN order the following day and admin instruction removed.

Updated May 2018