### Risk Factors
- History of non-traumatic long bone/vertebral fracture (12)
- Rickets (12)
- Osteogenesis imperfecta (12)
- Previous osteopenia diagnosis (4)
- Glucocorticoids for > 3 days (4)
- Dialysis > 4 weeks (4)
- TPN > 2 weeks (4)
- Chemical immobilization (4)
- Severe malnutrition due to malabsorption (4)
- VACTERL or DiGeorge (3)
- Prematurity < 37 weeks (3)
- Prematurity < 34 weeks (6)
- Prematurity < 28 weeks (12)
- Current chylothorax (3)
- History of NEC requiring surgery/intestinal perforation (12)
- Antiepileptic drug use (3)
- Proton pump inhibitor >14 days (3)
- Patients less than 1 year (3)
- Osteopenia or bone demineralization on X-ray (12)
- Cystic fibrosis (4)
- Loop diuretics >14 days (3) or >30 days (12)
- >4 weeks 3x normal creatinine (4)
- Trisomy 13/18 (12)
- Gastroschisis (12)

### Screening Tests
<table>
<thead>
<tr>
<th>Goals:</th>
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<tbody>
<tr>
<td>• Alkaline Phosphatase &lt;500U/L</td>
<td>• Urine Calcium/Creatinine Ratio:</td>
</tr>
<tr>
<td>• Serum Total Calcium: &gt;9mg/dL</td>
<td>- &lt;7mo (&lt;0.86 mg/mg)</td>
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<tr>
<td>• Serum Phosphorus: 5-6.5mg/dL</td>
<td>- 7 mo to 18 mo (&lt;0.60 mg/mg)</td>
</tr>
<tr>
<td>• iPTH: 10-89 pg/mL</td>
<td>- 19 mo to 6 yrs (&lt;0.42mg/mg)</td>
</tr>
<tr>
<td>• Vitamin D 25(OH): &gt;32ng/ml</td>
<td>- &gt;19yrs (&lt;0.22 mg/mg)</td>
</tr>
</tbody>
</table>

### Precautions and Preventative Measures
- RN to initiate safe handling precautions (safe handling sign at bedside, fragile sign at door, apply cushion to side rail as applicable for age of child)
- RN to educate patient family regarding safe patient handling
- RN to notify ancillary staff of risk when patient off unit
- RT to discuss risk vs. benefit with attending if utilizing CPT
- Dietitian to ensure optimum Vitamin D, Calcium and Phosphorous intake
- Consider thiazide diuretic if giving loop diuretics to decrease overall need for loop diuretics
- Metabolic bone consultation if alkaline phosphatase is > 500 U/L

Consider PT evaluation if the following criteria are met:
- Patient is medically stable, able to begin out-of-bed activity and is not doing so on a regular basis
- Patient is older than 12 months and is not able to bear weight to lower extremities

Consider OT evaluation if the following criteria is met:
- Patient is medically stable, able to perform ADLs and has not been doing so without assistance

### Any patient scoring 12 pts or greater on the risk factors is at risk.
- Activate Osteopenia Risk order set in EMR
  - Alkaline Phosphate and Vitamin D 25 (OH) Lab order
  - Precaution and Preventative Measures Instructions

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If all labs are normal

- Dieticians to perform risk level on regular assessment
- Check Alkaline Phosphatase every two weeks
- If patient was previously at risk, remove from risk list and signage from room

>500 U/L Alkaline Phosphatase

- Check Urine Calcium, Serum 25(OH) D, Serum Calcium, Serum Phosphorus and iPTH
- Consult Metabolic Bone

Low Serum Calcium, Vitamin D, or Phosphorous level

- Dietitian to maximize nutritional supplementation

Elevated Ca/Creatinine Ratio

- Renal Ultrasound
  - If abnormal, consult Nephrology

Follow up

For patients who receive an Metabolic Bone consult during their stay, an outpatient metabolic bone follow-up visit should be scheduled before discharge.

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