Probiotics are still under investigation. The following are the most current guidelines.

**Indications:**
- Those at risk for developing antibiotic acquired diarrhea
- Those at risk for developing *Clostridium difficile* infection
- Prolonged mechanical ventilation lasting greater than 24 to 48 hours
- Those on enteral nutrition
- Safe for use in the following populations: general surgery, medicine, and ICU patients (1)

**Contraindications:**
- Immunosuppressed patients (neutrophil count <500)
- Neutropenic conditions
- Presence of gastrointestinal obstruction or prolonged lack of motility

**Dosage:**
No set dosage has been established though typical quantities of probiotics include 5-10 billion colony forming units (CFU) per day (1, 2). Below are common products and typical dosages used (3):

<table>
<thead>
<tr>
<th>Product</th>
<th>Type of Bacteria</th>
<th>Estimated CFU</th>
<th>Recommended dosage</th>
<th>Estimate of Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nancy’s Yogurt</td>
<td>L. acidophilus, L. casei, B. bifidum, L. rhamnosus</td>
<td>~9.6 billion/cup</td>
<td>8 ounces/day</td>
<td>$0.90</td>
</tr>
<tr>
<td>Nancy’s Kefir</td>
<td>L. acidophilus, L. casei, B. bifidum, L. rhamnosus, Prebiotic - inulin</td>
<td>~74 billion/cup</td>
<td>8 ounces/day</td>
<td>$1.00</td>
</tr>
<tr>
<td>Culturelle LGG</td>
<td>L. GG</td>
<td>~10 billion/capsule</td>
<td>2 capsules/day</td>
<td>$1.70</td>
</tr>
<tr>
<td>Danactive</td>
<td>L. casei</td>
<td>~100 million/g</td>
<td>2 bottles of 100ml/day</td>
<td>$0.66</td>
</tr>
<tr>
<td>Stonyfield Bifidus</td>
<td>L. casei</td>
<td>~ 10 billion/cup</td>
<td>8 ounces/day</td>
<td>$0.90</td>
</tr>
</tbody>
</table>

**Administration:**
Administration depends on the patient’s route of nutrition.
- PO route: probiotics by mouth
- Feeding tube route: probiotics through the feeding tube flushed with water
  - Optional: swab of probiotic yogurt in the mouth to increase surface area of probiotic colonization
Probiotic Products Available:

- **Regulations:** Most probiotics are considered dietary supplements and therefore are under the FDA’s “Center for Food Safety and Applied Nutrition”
  - They do not need FDA approval before being marketed
  - All claims must be supported by substantial evidence, including product contents (4)
  - However, studies show that 93% of probiotics are incorrectly labeled (5).

- **Product form:**
  - Probiotics foods such as yogurt (proven to be the most effective), kefirs and fermented milk
  - Probiotic pills
  - Probiotic liquids and powders

- **Quantities of probiotics:** Products have varying quantities per unit ranging from 10 million CFUs/capsule to 10 billion CFUs/cup (4, 5)

- **Type of probiotic strains:** Products contain varying strains with Lactobacillus and Bifidobacterium being the most common (5, 6). It is important to note that different probiotic strains have been shown to have different effects (7-9)

Benefits of Probiotics:

- Reduce antibiotic-associated diarrhea and Clostridium difficile infections (10-14)
- Support the host immune response
- Adhere to epithelial cells thereby preventing colonization of pathogenic bacteria and improving the gut barrier function (6, 15-17)
- Alter the enteric and autonomic nervous system, which may in turn effect their mechanisms of action (7, 9)
- Provide enzymes which will improve digestive symptoms for the host (6)

When to Take Caution and New Findings:

- Patients in the intensive care unit (and ventilator associated pneumonia)
  - Caution should be used with these individuals as any infections (including those caused by bacteria) could drastically change patient outcomes in such delicate states
  - Though recent studies indicate otherwise, low quality evidence reported by a cochrane review (18) and a meta-analysis (19) state that probiotics do not significantly reduce ICU or hospital mortality rates. They do reduce the rate of ICU acquired pneumonia and length of stay and remain inconclusive regarding the rates of diarrhea but indicated a decreased trend associated with probiotics. They have been found to be safe in this population and warrant more research to identify possible benefits (20).
- **Patients with neutropenic precautions**
  - There is not much research on probiotics use in patients with neutropenic precautions though they are known to be at increased risk of developing bacterial infections.
  - One review study showed that probiotics might have beneficial effects on toxicities related to anticancer treatments (especially radiation therapy) though these studies were inconsistence in their strand and dose use. They concluded that probiotics could be safely administered in the setting of neutropenic precautions. This only indicates the need for further research (21).

- **Immunocompromised patients**
  - Caution must be used with these patients because they are more susceptible to developing a bacterial infection (22).
  - A meta-analysis indicated that probiotics might actually be able to be used as a therapy to control for bacterial infections due to their expression of antimicrobial peptides and their presence hindering the development of possible pathogenic bacteria. Again, more research is needed before recommendations can be made (23).

**References**