

# THE SYSTEM COST OF DIARRHEA IN ENTERAL FEEDING

## A Clinical and Financial Reference for Nursing, Infection Control, Wound Care, Pharmacy, Supply Chain, and Finance

Diarrhea in the tube-fed ICU patient is not a single-department problem. It cascades across the ICU, the infection control department, the wound care program, the pharmacy, and the revenue cycle—generating costs that are rarely measured together and almost never attributed to their source. This document quantifies that cascade and makes the case for proactive soluble fiber supplementation as a measurable, multi-stakeholder cost avoidance strategy.

**Banatrol TF product cost example:** \$3.25/packet | \$6.50-\$13.00/day (2-4 packets) | Annual cost varies — example scenario below.

### THE CLINICAL EVIDENCE BASE

Banatrol TF's four-fiber, fermentable blend is supported by a preponderance of published clinical evidence:

- Banana flakes (a Banatrol TF component) produced diarrhea-free outcomes in 57% of tube-fed ICU patients vs. 24% of medically treated controls — even in the presence of a higher rate of *Clostridioides difficile infection* (CDI) positivity. (Emery et al., Nutr Clin Pract, 1997)
- Soluble fermentable fiber is safe and beneficial for reducing diarrhea incidence in all hemodynamically stable, critically ill patients. (S.McClave, et al. Nutrition. 2019. 60:100-105)
- The 2016 SCCM/ASPEN guidelines specifically recommend a fermentable soluble fiber additive for hemodynamically stable ICU patients receiving standard enteral formulas. (McClave et al., JPEN, 2016)
- RCT evidence (Spapen et al., Clin Nutr, 2001): Soluble fiber significantly reduces diarrhea incidence in septic patients receiving total enteral nutrition.

### Stakeholder #1: Nursing

## National average labor costs per year - \$167,535 / unit

Diarrhea management consumes nursing time at a rate that is rarely calculated and almost never attributed to a preventable source. The benchmarks below are published and represent costs that accumulate in ICU units across the country:

| 17 min                                       | 240-760 min                                          | \$459 / day                                                                                 |
|----------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Mean time to manage one liquid stool episode | Average nursing time/day managing fecal incontinence | National average nursing labor cost per 12-bed ICU unit attributable to diarrhea management |
| Heidegger et al., Int J Nurs Stud, 2016      | Langill et al., OWM, 2012                            | BLS wage data + AHA Hospital Statistics, 2025                                               |

### Proactive Monthly Product Cost

In a 12-bed ICU unit with 20% average tube-fed occupancy, the proactive monthly product cost is approximately \$470 (12 beds x 20% x 30 days x \$6.50). Nursing labor savings from avoiding one 3-day diarrhea episode per bed per month — using the published 17-minute clean-up benchmark at a national average wage — return \$1,377/month: a 3:1 return on product investment from nursing labor alone, before a single CDI workup, HAPI event, or FMS device is factored in.



## Stakeholder #2: Infection Control

### \$24,000 incremental cost per primary CDI case

CDI is directly linked to antibiotic-induced dysbiosis and fecal microbiome disruption — the same mechanism that drives diarrhea in tube-fed ICU patients. Proactive microbiome support with fermentable soluble fiber is not a reactive CDI treatment. It is a preventive strategy that supports the gut barrier before the dysbiosis cascade begins.

| 55%                                                                              | 77%                                                                | \$24,000                                                                                                                       | \$6.3B                                                                                                |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| longer hospital stay for patients with CDI<br><i>Vora, Am J Manag Care, 2025</i> | more likely to be readmitted<br><i>Vora, Am J Manag Care, 2025</i> | incremental cost per primary CDI case vs. non-CDI patients<br><i>Malone et al., Antimicrob Steward Healthc Epidemiol, 2023</i> | estimated total annual CDI-attributable cost in the U.S.<br><i>Zhang et al., BMC Infect Dis, 2016</i> |

For every CDI event attributable to the tube-fed ICU population that is avoided through proactive microbiome support, the facility avoids \$24,000 in incremental cost (Malone et al., Antimicrob Steward Healthc Epidemiol, 2023). A 12-bed ICU experiences approximately 3–7 CDI events per year, based on published incidence rates of 10–20 cases per 10,000 patient-days (APIC). The table below shows exactly how little prevention is required to break even on annual product cost at each occupancy scenario:

| Occupancy scenario   | Annual product cost | CDI events to break even | In plain terms              |
|----------------------|---------------------|--------------------------|-----------------------------|
| Low — 15% occupancy  | ~\$3,830            | 0.16 events              | 16% of one CDI case avoided |
| Mid — 25% occupancy  | ~\$6,384            | 0.27 events              | 27% of one CDI case avoided |
| High — 40% occupancy | ~\$10,214           | 0.43 events              | 43% of one CDI case avoided |

Even at the highest occupancy scenario, a facility breaks even on product cost by preventing less than half of one CDI event per year. A 12-bed ICU generates an estimated 3–7 CDI events annually at published incidence rates. The question is not whether the math works — it is what proportion of a unit's CDI events trace back to the tube-fed population.



## Stakeholder #2: Infection Control – CDI Testing Cascade

### \$925 – \$6,250 per avoided workup

Every tube-feeding diarrhea episode that resolves before meeting the clinical trigger for CDI testing avoids an entire diagnostic and isolation cascade. The cost of that cascade is far larger than the lab fee — and it is a cost the facility absorbs whether the test comes back positive or negative.

#### THE CLINICAL TRIGGER

Per IDSA/SHEA 2017 guidelines: CDI testing is indicated — and contact isolation must be initiated — when a patient has 3 or more unformed stools in 24 hours with no other clearly attributable cause. Tube-feeding diarrhea meets this threshold routinely.

**If Banatrol TF reduces tube-feeding diarrhea before that threshold is met, the entire testing and isolation cascade is avoided. This is a proactive, upstream intervention — not a diagnostic tool.**

| Cost Layer                                                                 | Cost Per Episode       | Source / Note                                                                     |
|----------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------|
| Lab Testing (2-step: GDH antigen + toxin EIA + PCR reflex)                 | <b>\$50 - \$150</b>    | CPT 87324, 87449, 87493; standard 2-step algorithm per IDSA/SHEA                  |
| Contact Precaution Isolation (private room differential, 48 hrs)           | <b>\$300 - \$800</b>   | J Clin Microbiol economic model; Arizona DHS cost-to-charge data                  |
| PPE per nursing contact (gown + gloves x 8-15 contacts/shift x 2 shifts)   | <b>\$48 - \$240</b>    | ~\$3-8/contact; 2017 IDSA/SHEA contact precaution protocol                        |
| Environmental Services terminal clean on room clearance                    | <b>\$75 - \$200</b>    | EPA List K sporicidal agent required; facility EVS labor estimate                 |
| Risk: unnecessary treatment if false-positive PCR (vancomycin/fidaxomicin) | <b>\$400 - \$5,000</b> | Fidaxomicin ~\$3,000-5,000/course; PCR detects colonization, not active infection |
| <b>Total avoided cost per workup</b>                                       | <b>\$925 - \$6,250</b> | Conservative to high-end; excludes downstream recurrence cost                     |

#### UNIT-LEVEL ANNUAL IMPACT – 12-BED ICU

**Assumption:** 3 diarrhea episodes/day in a 12-bed ICU. 1 suspected CDI workup avoided per week (conservative — ~33% of episodes trigger workup threshold).

52 avoided workups/year x \$925 (conservative) = **\$48,100 / year**

52 avoided workups/year x \$6,250 (high-end) = **\$325,000 / year**

This single cost center, at a conservative estimate, returns **9–47x the annual product cost** of Banatrol TF.

Three questions worth investigating at the unit level: How many CDI workups does the ICU run per month on tube-fed patients? What does the two-step algorithm cost in lab and isolation per episode? What percentage come back negative? These numbers exist in lab utilization and isolation log data. In most facilities, once isolated, the scale of these costs surprises the teams closest to it.



### Stakeholder #3: Wound Care

\$20,900 – \$151,700 per HAPI event

Unmanaged diarrhea in enteral feeding creates a well-documented clinical cascade that wound care teams encounter routinely — but one that is rarely connected back to its nutritional source. The financial consequence is the largest per-event cost in this document, and it falls entirely on the facility.

#### THE CASCADE

Diarrhea in enteral feeding

- Fecal incontinence
- Moisture-Associated Skin Damage (MASD)
- Incontinence-Associated Dermatitis (IAD)
- **Hospital-Acquired Pressure Injury (HAPI)**

#### THE FINANCIAL CONSEQUENCE

CMS stopped reimbursing Stage 3/4 HAPIs in 2008.

**Cost per HAPI: \$20,900 (Stage 2) to \$151,700 (Stage 4)**

Fecal incontinence increases HAPI risk 22-fold.

Padula WV, et al. Int Wound J. 2019; Maklebust J et al. Adv Wound Care, 1994.

Every Stage 3 HAPI that develops downstream of unmanaged tube-feeding diarrhea costs a facility more than four years of proactive fiber supplementation on the same unit — even at the highest occupancy scenario. One prevented HAPI event (\$43,180 mid-range) covers 4–11 years of annual product cost. CMS does not reimburse Stage 3 or Stage 4 HAPIs. The facility absorbs the cost entirely.

### Stakeholder #4: Revenue Cycle / Finance

Up to \$1.5M annual Medicare penalty exposure

CDI is an NHSN-reportable HAI that feeds directly into the CMS Hospital-Acquired Condition (HAC) score. Facilities in the bottom quartile on HAC composite performance face a mandatory 1% reduction across all Medicare DRG payments — not just CDI-related claims. That penalty affects every service line across the organization, not only the units where CDI originates.

**1%**

mandatory Medicare payment reduction for bottom-quartile HAC performers

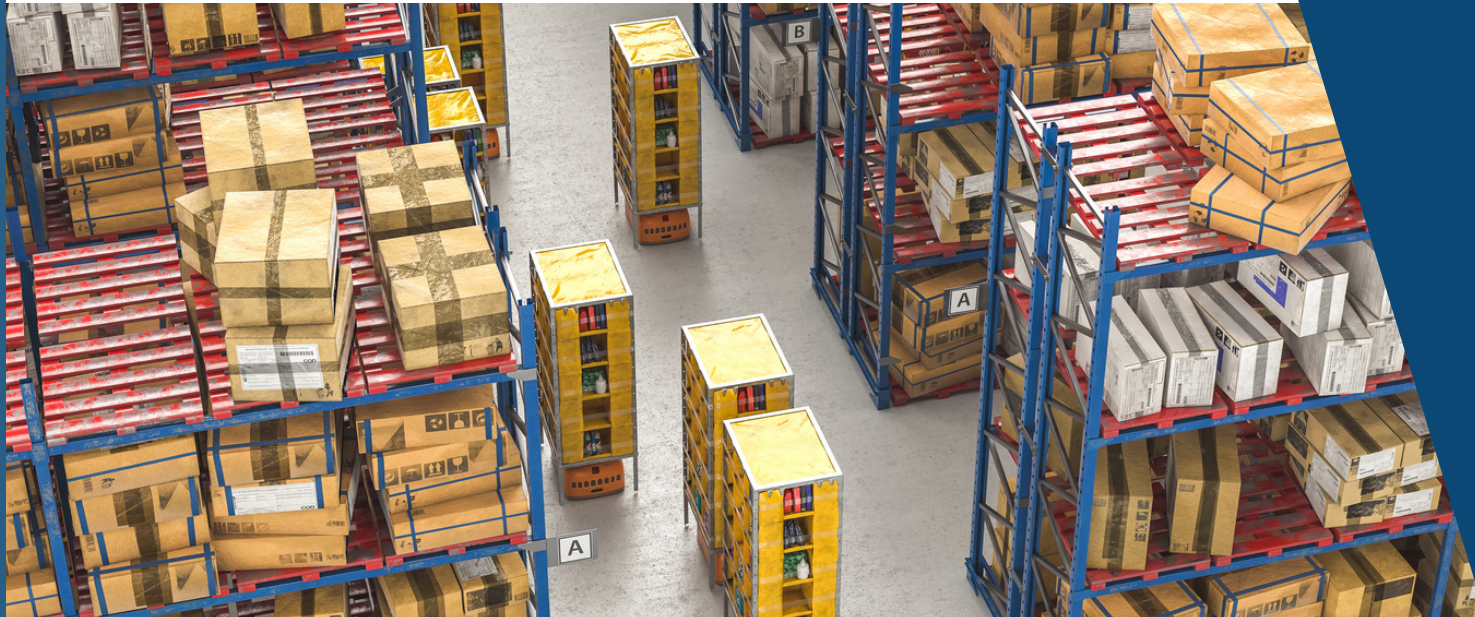
CMS HAC Reduction Program, FY2024

**\$1.5M**

annual penalty exposure for a 300-bed hospital with \$150M in Medicare revenue

CMS HAC Reduction Program data

Banatrol TF is not a CDI drug. But proactive diarrhea management in the tube-fed ICU population — the population most at risk for CDI — is a documented, guideline-supported component of any facility's HAI reduction strategy. If CDI rates are affecting HAC scores, the contribution of the tube-fed population is a logical starting point for investigation.



## Stakeholder #5: Supply Chain

### Facility-specific

Incontinence-associated supply costs — skin barriers, specialty dressings for IAD, linen replacement, cleaning materials — are real and attributable to diarrhea episodes in the ICU. These costs exist in facility-level data, not in the published literature, which is why they are not estimated here. They are the one cost center in this document that must be quantified from internal records.

Isolating incontinence-associated supply spend from the last fiscal year and attributing it to the tube-fed ICU population as a proportion of occupied bed-days is a straightforward analysis from existing data. In practice, this number — once isolated — is consistently larger than expected and often unattributed to its source.

### FMS: \$183 – \$243 per active patient per day

Fecal management systems (FMS) are a reactive, high-cost intervention triggered almost exclusively by diarrhea. Proactive fiber supplementation at \$6.50/day is the alternative — administered before the trigger event occurs.

**62%**

of rectal tube placements are due to diarrhea  
Butts et al., JIM, 2019

**\$93.74 – \$153.50**

daily FMS material cost per patient  
Langill et al., OWM, 2012

#### TOTAL DAILY BURDEN – ONE ACTIVE FMS PATIENT

FMS materials: \$93.74 – \$153.50 / day

Nursing time with FMS (120 min @ \$45/hr): \$90.00 / day

Total FMS burden per patient per day: **\$183.74 – \$243.50**

Banatrof TF proactive cost: \$6.50 - \$13.00/ day (2-4 packets/day) | Ratio: 31:1 to 42:1



## Return on Investment Summary

Per 12-Bed ICU Unit | National Average Benchmarks | Conservative Estimates

| Cost Center                                        | Conservative Annual Avoided Cost |
|----------------------------------------------------|----------------------------------|
| Nursing Labor (diarrhea management)                | <b>\$50,000 - \$83,000</b>       |
| Fecal Management System Avoidance                  | <b>\$10,980 - \$14,580</b>       |
| HAPI Prevention (1 Stage 3 event)                  | <b>\$43,180</b>                  |
| CDI Incremental Cost Avoidance (1 event)           | <b>\$24,000</b>                  |
| <b>Total avoided cost per workup (per patient)</b> | <b>\$925 - \$6,250</b>           |

Avoided-cost figures represent population-level estimates based on published peer-reviewed data and do not constitute a guarantee of outcomes for any individual facility. Facility-specific results will vary based on patient population, census, and clinical protocols.

### ANNUAL ESTIMATED PRODUCT COST – THREE OCCUPANCY SCENARIOS (EXAMPLES)

Occupancy = % of tube-fed ICU beds with a patient experiencing active diarrhea on any given day. This is the single assumption that most affects product cost. This document presents three scenarios so the appropriate figure can be applied based on unit census.

|                                                                   |                            |
|-------------------------------------------------------------------|----------------------------|
| <b>Low – 15% occupancy</b><br>2 patients/day avg. on 12-bed unit  | <b>\$8,000 - \$13,000</b>  |
| <b>Mid – 25% occupancy</b><br>3 patients/day avg. on 12-bed unit  | <b>\$20,000 - \$32,000</b> |
| <b>High – 40% occupancy</b><br>5 patients/day avg. on 12-bed unit | <b>\$55,000 - \$85,000</b> |

### BANATROL TF DOSING

2–4 packets per day in divided doses over 24 hours to help manage diarrhea while supporting overall microbiome health.

ENFit® compatible | Gluten Free | Dye Free

### NutriConnect™ Method

Remove cap → Connect to ENFit tube → Roll pouch to dispense

26% reduction in administration time vs. traditional powdered products.\*

\*Independent time study (full data available upon request)