Tall Tales From the Triple Aim to the Toilet: Infection Control from the Hospital to the Home

September 17, 2026 | 4:00 PM ET

This webinar explores how mucosal barrier injury and immunosuppression heighten vulnerability to environmental bio-aerosols and bloodstream infections.

Featuring Dr. David Nash, Dr. Rodney Rohde, Seth Eisenberg, and Dr. Kim LaBree, experts evaluate genomic evidence on gut-originating pathogens and toilet plume transmission pathways. The session reviews key clinical trials—including a multi-hospital study and the Baptist MD Anderson pilot—highlighting physical barrier controls that protect oncology and immunocompromised patients from hospital to home.

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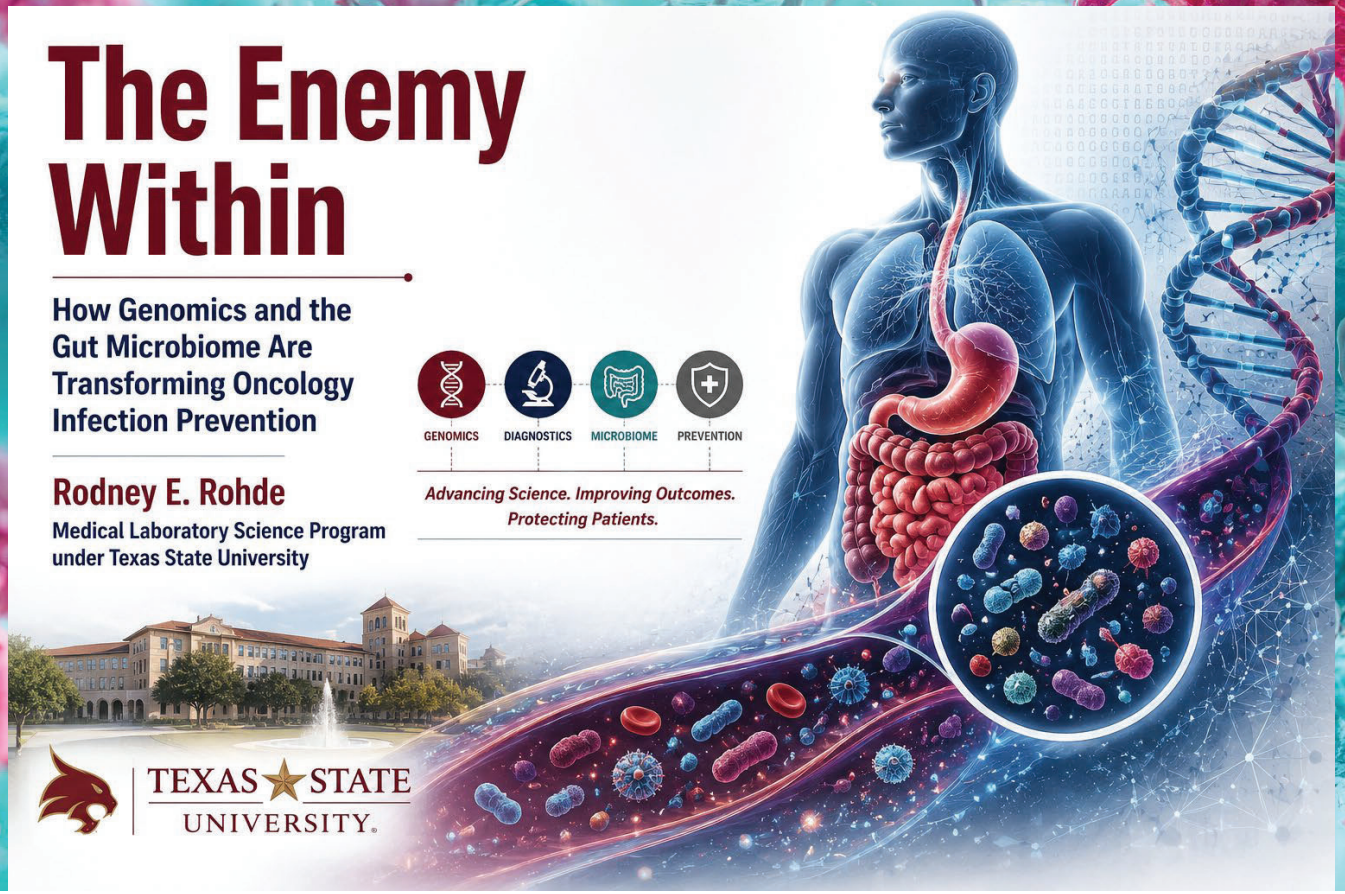
The Enemy Within: Autoinoculation, Gut Translocation, and the New Frontier of Oncology Infection Prevention



The Enemy Within

The traditional paradigm of healthcare-associated infections has focused on pathogens acquired from the hospital environment. Emerging evidence, however, demonstrates that many serious infections in patients with cancer originate from within the patient themselves. Damage to the intestinal barrier from chemotherapy, immunotherapy, stem cell transplantation, and critical illness can facilitate microbial translocation, allowing commensal organisms to enter the bloodstream and cause life-threatening infections.

This presentation will explore the evolving science of autoinoculation and gut translocation, examine the role of the intestinal microbiome in oncology patient outcomes, and discuss practical strategies—including diagnostic stewardship, infection prevention, antimicrobial stewardship, and multidisciplinary collaboration—to reduce preventable infections while improving patient safety and quality of care.

Opening

For decades, we've approached bloodstream infections in oncology patients with one central question:

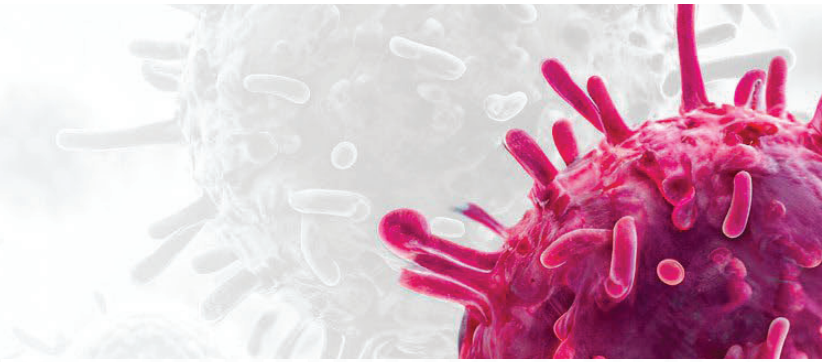
"What caused the infection?"

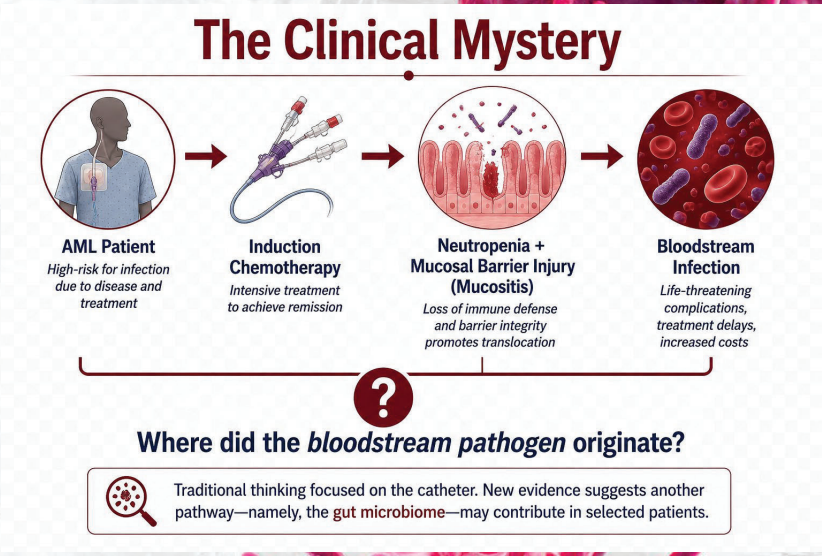
Today I'd like to suggest that genomics has allowed us to ask an even more important question:

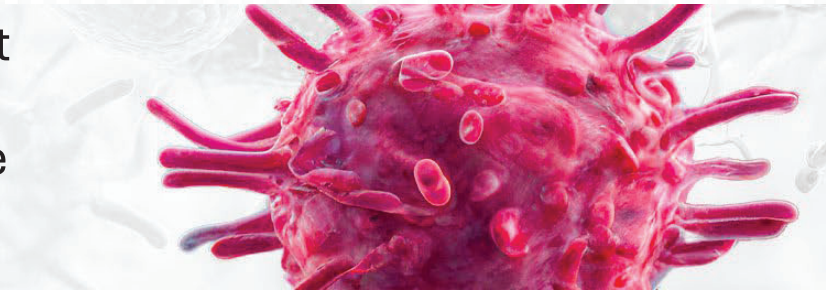
"Where did the infection actually come from?"

That seemingly simple question is reshaping infection prevention.

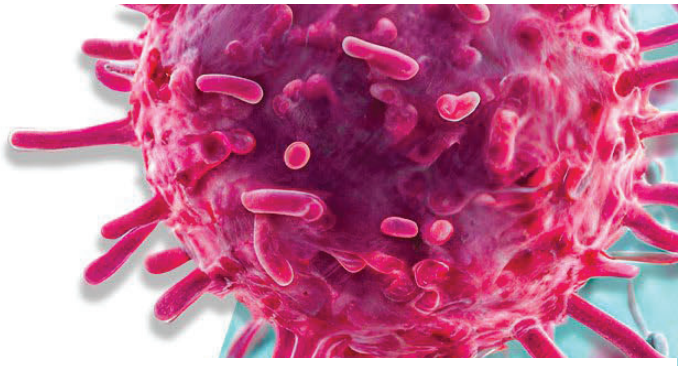
Over the next few minutes, I'll connect three important scientific advances that have changed our understanding of bloodstream infections in vulnerable oncology patients.







Act I - The First Discovery: The Gut May Be the Source



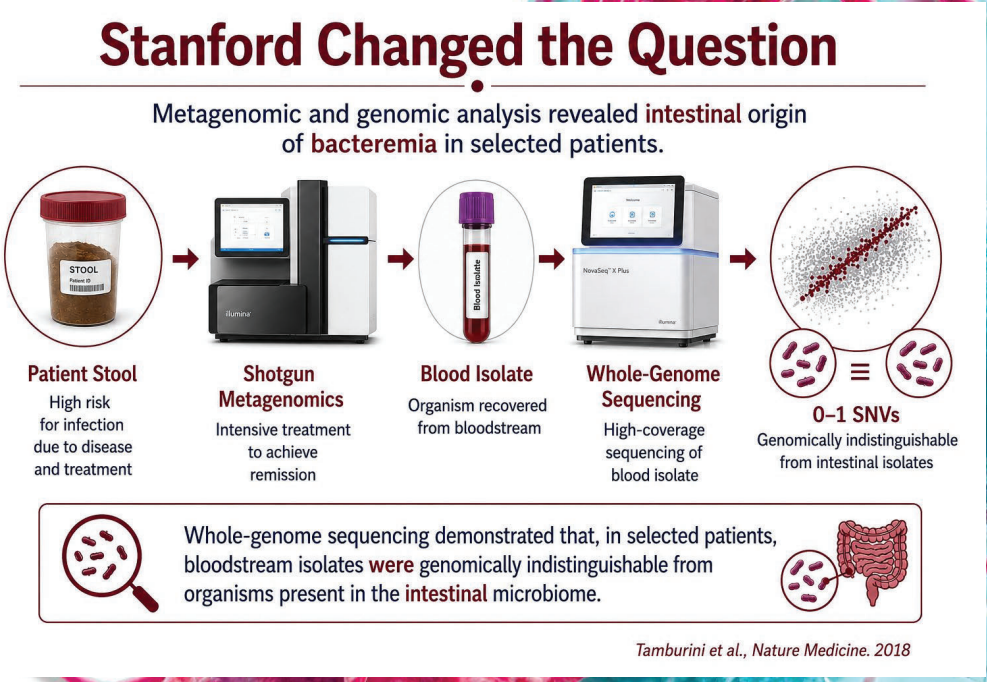
The first breakthrough came from Stanford investigators led by Ami Bhatt [Stanford – Nature Medicine 2018].

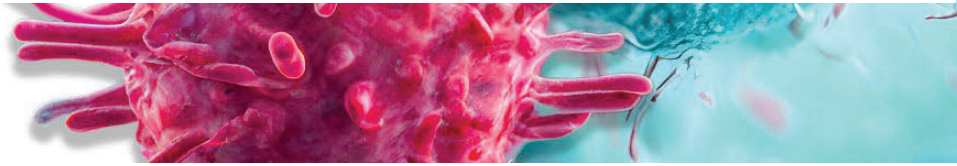
They followed hematopoietic stem cell transplant patients by collecting:

- serial stool specimens
- bloodstream isolates
- whole-genome sequencing

Rather than comparing bacterial species…

they compared bacterial **strains** using whole-genome sequencing and a bioinformatics pipeline called **StrainSifter**.





Act I - The First Discovery: The Gut May Be the Source

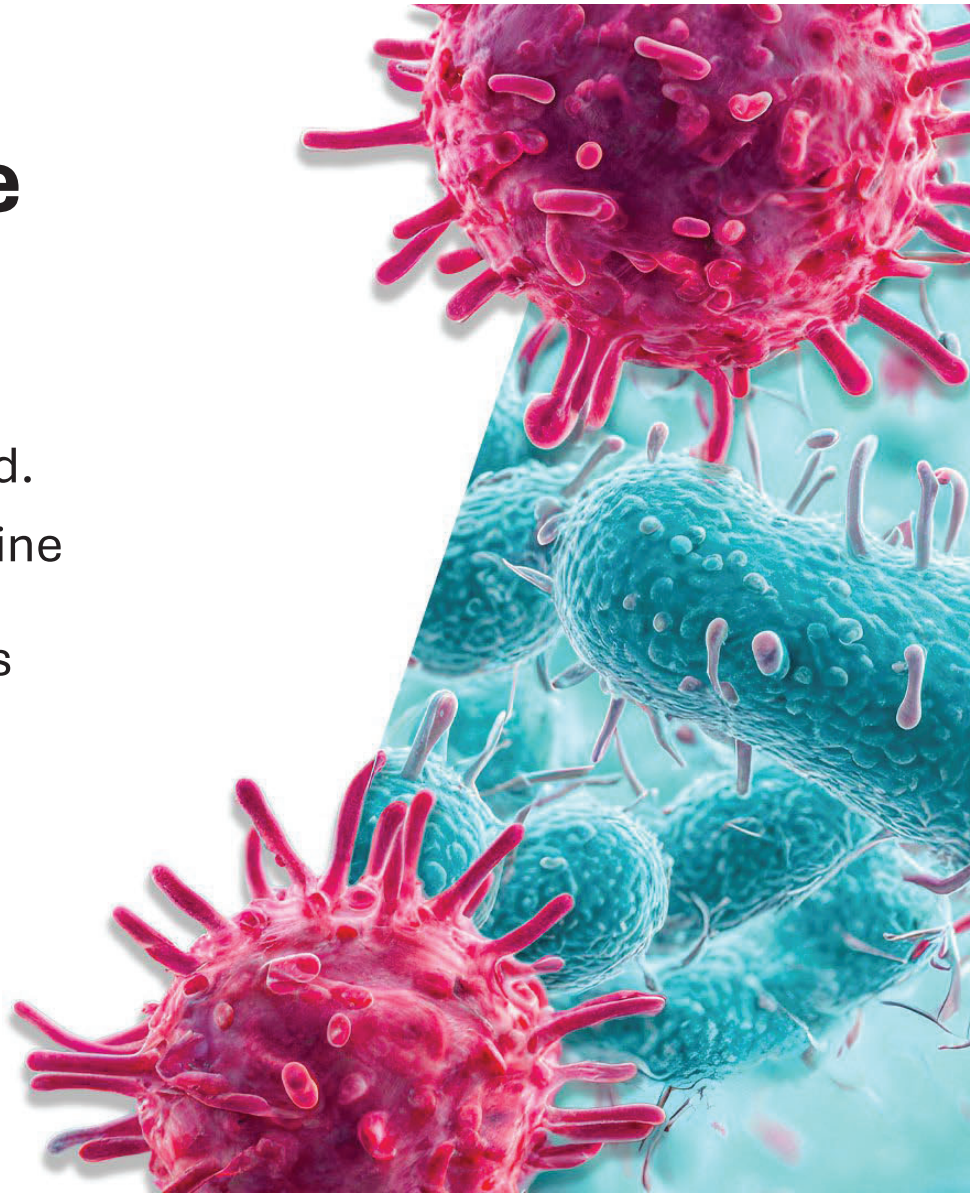
That distinction is incredibly important.

Two bacteria can both be identified as *E. coli*...

yet genetically they may be completely unrelated.

Whole-genome sequencing allows us to determine whether the bloodstream organism is actually identical to one already living inside the patient's intestine.

The results were remarkable.



Act I - The First Discovery: The Gut May Be the Source

Patients frequently carried genetically identical strains of:

- *Escherichia coli*
- *Klebsiella pneumoniae*
- *Enterococcus faecium*

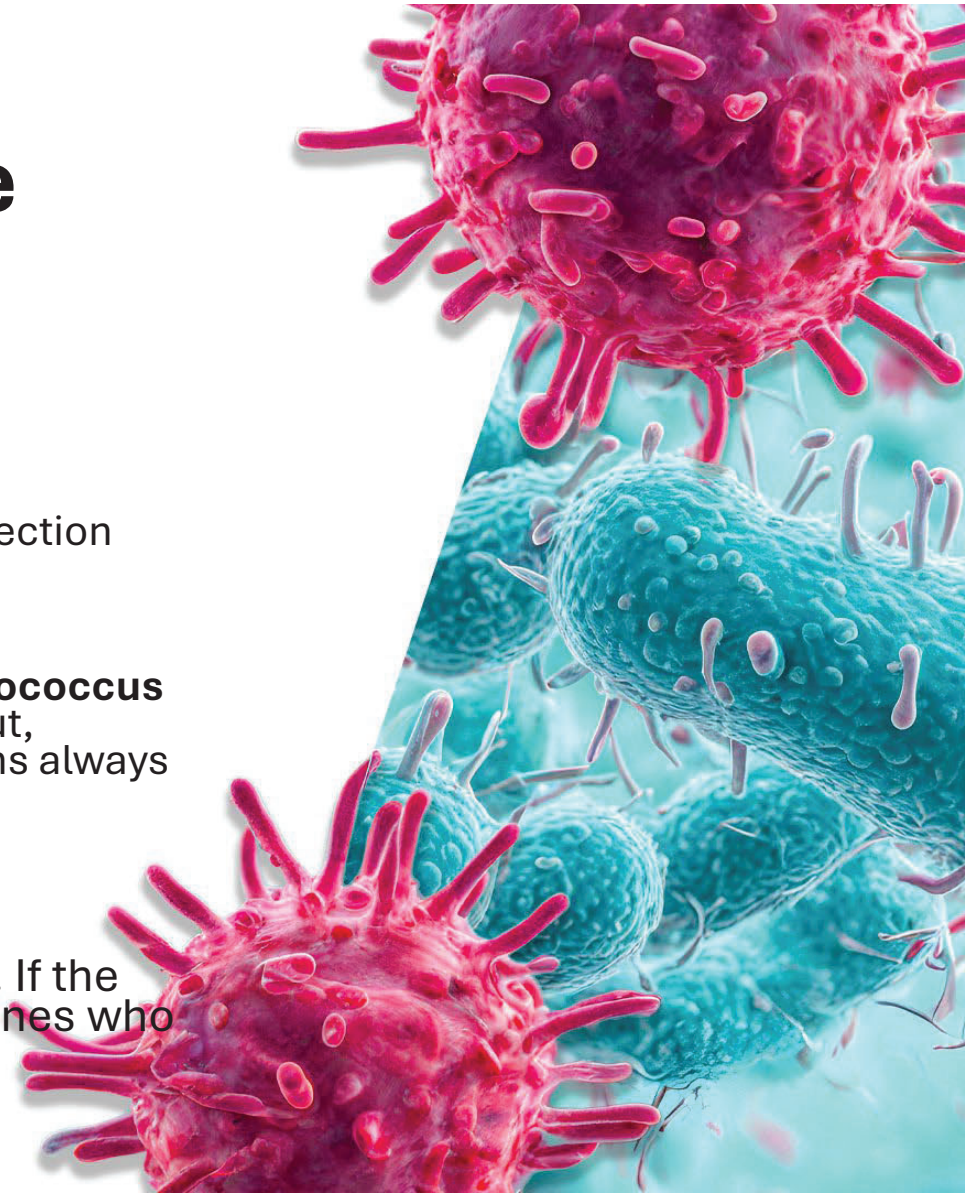
within their intestinal microbiome **before** bloodstream infection developed.

Even more surprising—

they found identical strains of organisms such as **Staphylococcus epidermidis** and **Pseudomonas aeruginosa** within the gut, challenging the long-held assumption that these organisms always originated from skin or central lines.

That was our first paradigm shift.

- But this discovery naturally led to another question. If the organisms are already living in the gut…what determines who actually develops bloodstream infection?



Act II- The Second Discovery: Loss of Microbiome Diversity

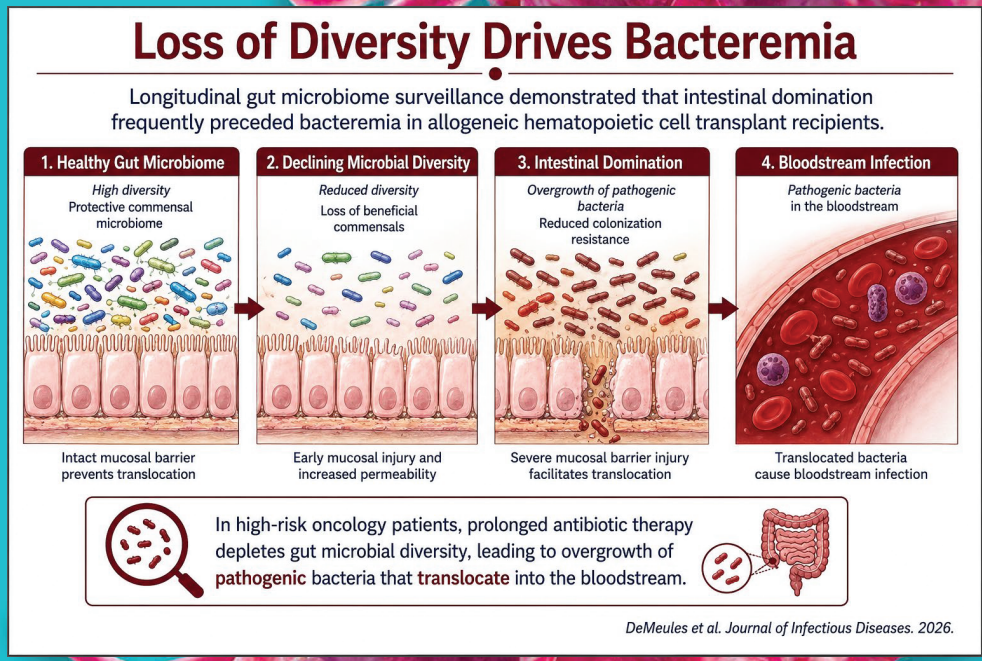
The second study built directly upon the Stanford work.

Rather than asking where pathogens originated...

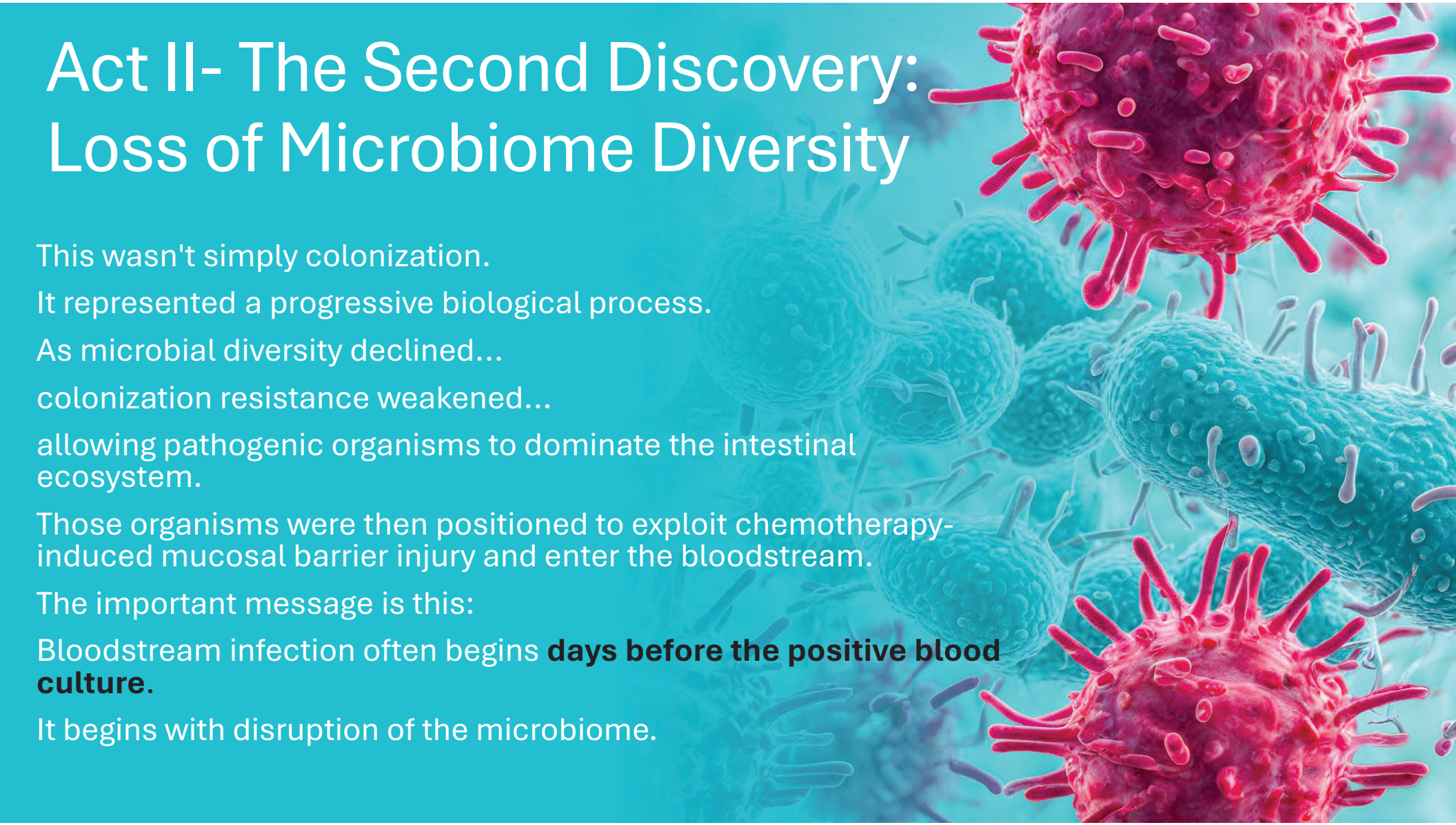
investigators examined **how the microbiome changes before infection develops.**

Their findings showed that many high-risk patients experience:

- profound loss of microbial diversity,
- intestinal domination by a single pathogenic organism,
- and subsequent bloodstream infection.



Act II- The Second Discovery: Loss of Microbiome Diversity



This wasn't simply colonization.

It represented a progressive biological process.

As microbial diversity declined...

colonization resistance weakened...

allowing pathogenic organisms to dominate the intestinal ecosystem.

Those organisms were then positioned to exploit chemotherapy-induced mucosal barrier injury and enter the bloodstream.

The important message is this:

Bloodstream infection often begins **days before the positive blood culture**.

It begins with disruption of the microbiome.

Hmmmm…

Now we know:

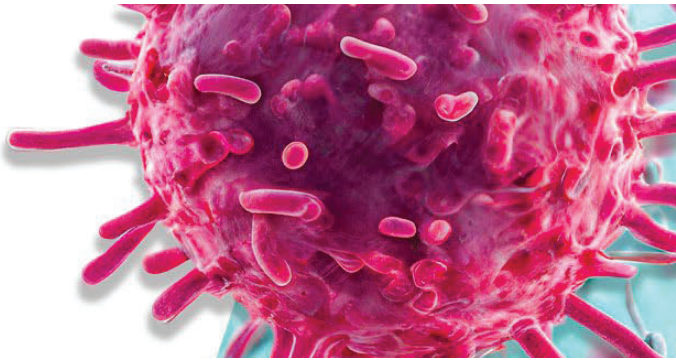
where the organisms come from…

and what biological changes precede infection.

The next logical question becomes:

How do we use that information to better protect patients?

Act III – The Third Discovery: From Genomics to Prevention



This is where the science becomes translational.

These studies collectively move us from:

Diagnosis

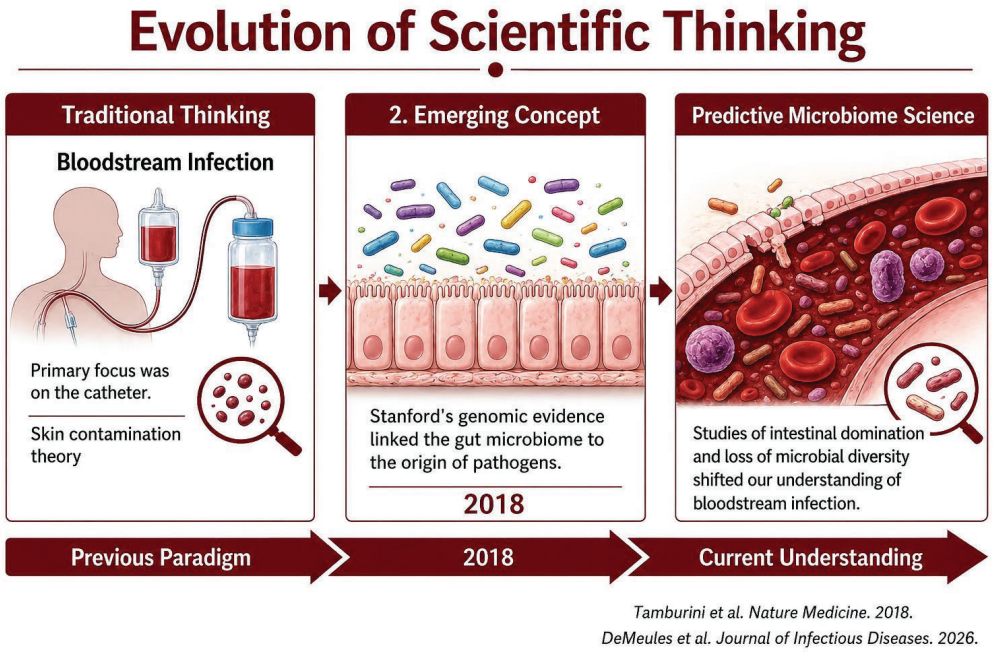
to

Source attribution

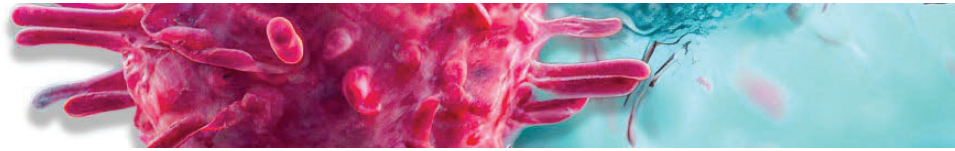
to

Prediction.

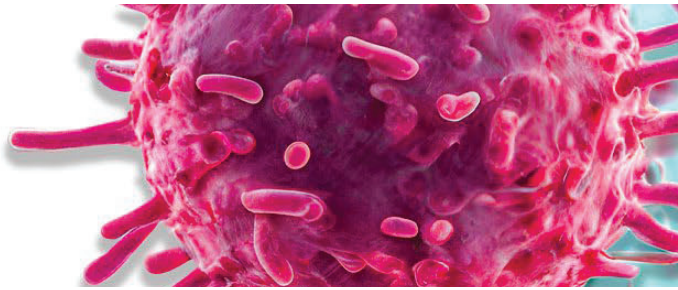
The laboratory is no longer simply identifying bacteria.



Tamburini et al. Nature Medicine. 2018.
DeMeules et al. Journal of Infectious Diseases. 2026.



Act III – The Third Discovery: From Genomics to Prevention



The laboratory is helping explain:

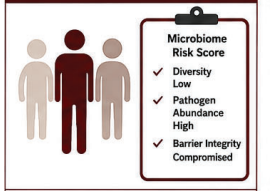
- where pathogens originate,
- how they evolve,
- which patients may be highest risk,
- and eventually how infections might be prevented.

That represents an entirely new role for clinical microbiology.

Clinical Implications

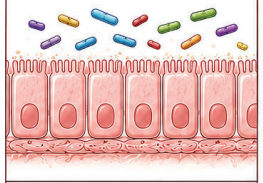
Integrating the microbiome into patient care creates new opportunities to prevent, detect, and reduce bloodstream infections.

1 Risk Stratification
Identify High-Risk Patients



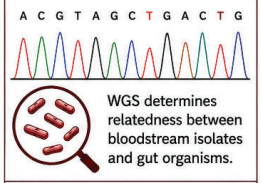
- Longitudinal microbiome monitoring identifies loss of diversity and pathogen expansion.
- Enables early identification of patients at highest risk for bacteremia.
- Supports personalized prevention strategies.

2 Targeted Prevention
Preserve the Gut Barrier and Diversity



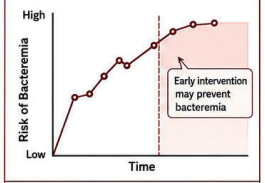
- Minimize unnecessary antibiotics and broad-spectrum agents.
- Promote microbiome-friendly interventions (e.g., nutrition, prebiotics, probiotics).
- Protect mucosal barrier integrity to reduce translocation risk.

3 Precision Diagnostics
Attribution with Genomic Resolution



- Whole-genome sequencing (WGS) links bloodstream pathogens to gut origin.
- Distinguishes translocation from exogenous sources.
- Informs infection control and therapeutic decisions.

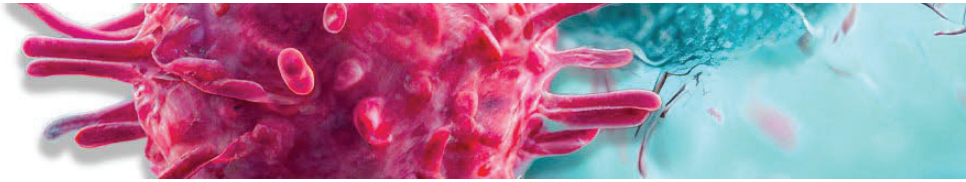
4 Predict and Prevent
Towards the Next Generation of Care



- Integrate microbiome data with clinical variables and machine learning.
- Predict bacteremia before onset and guide preemptive actions.
- Shift from reactive treatment to proactive prevention.

From **diagnosis** to **attribution** to **prediction**—microbiome-informed care has the potential to **reduce** bloodstream infections and **improve** patient outcomes.

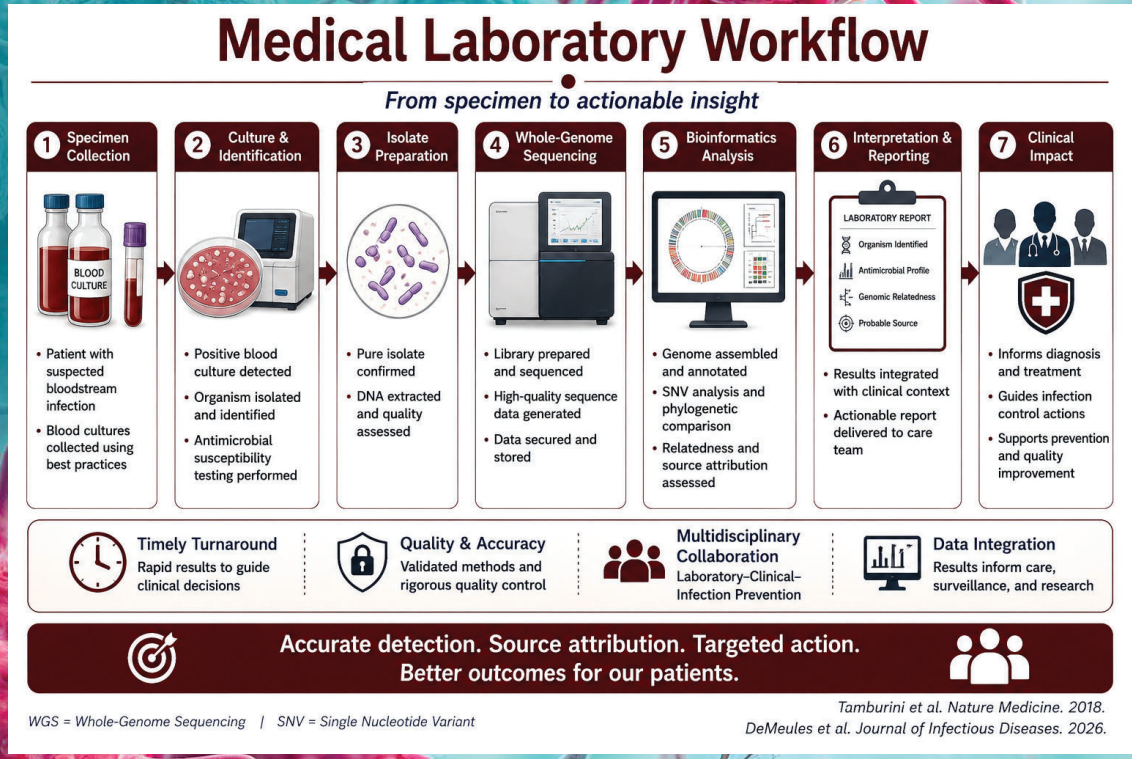
Tamburini et al. Nature Medicine. 2018.
DeMeules et al. Journal of Infectious Diseases. 2026.



Why This Matters for Infection Prevention

One important implication is that infection prevention cannot stop at the central line.

- Central-line bundles remain essential.
- Hand hygiene remains essential.
- Environmental cleaning remains essential.
- Antimicrobial stewardship remains essential.



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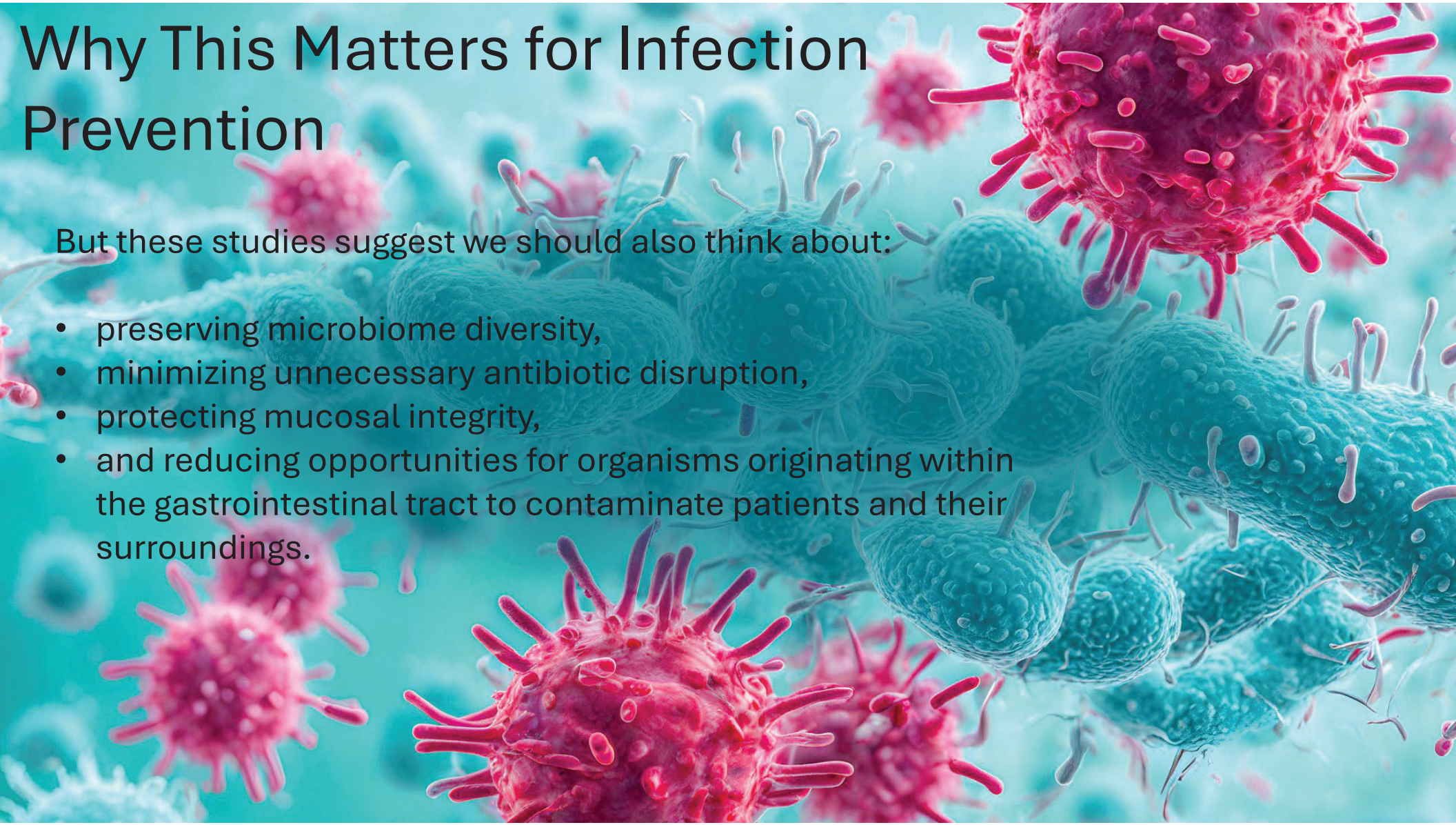


But these studies suggest we should also think about:

- preserving microbiome diversity,
- minimizing unnecessary antibiotic disruption,
- protecting mucosal integrity,
- and reducing opportunities for organisms originating within the gastrointestinal tract to contaminate patients and their surroundings.

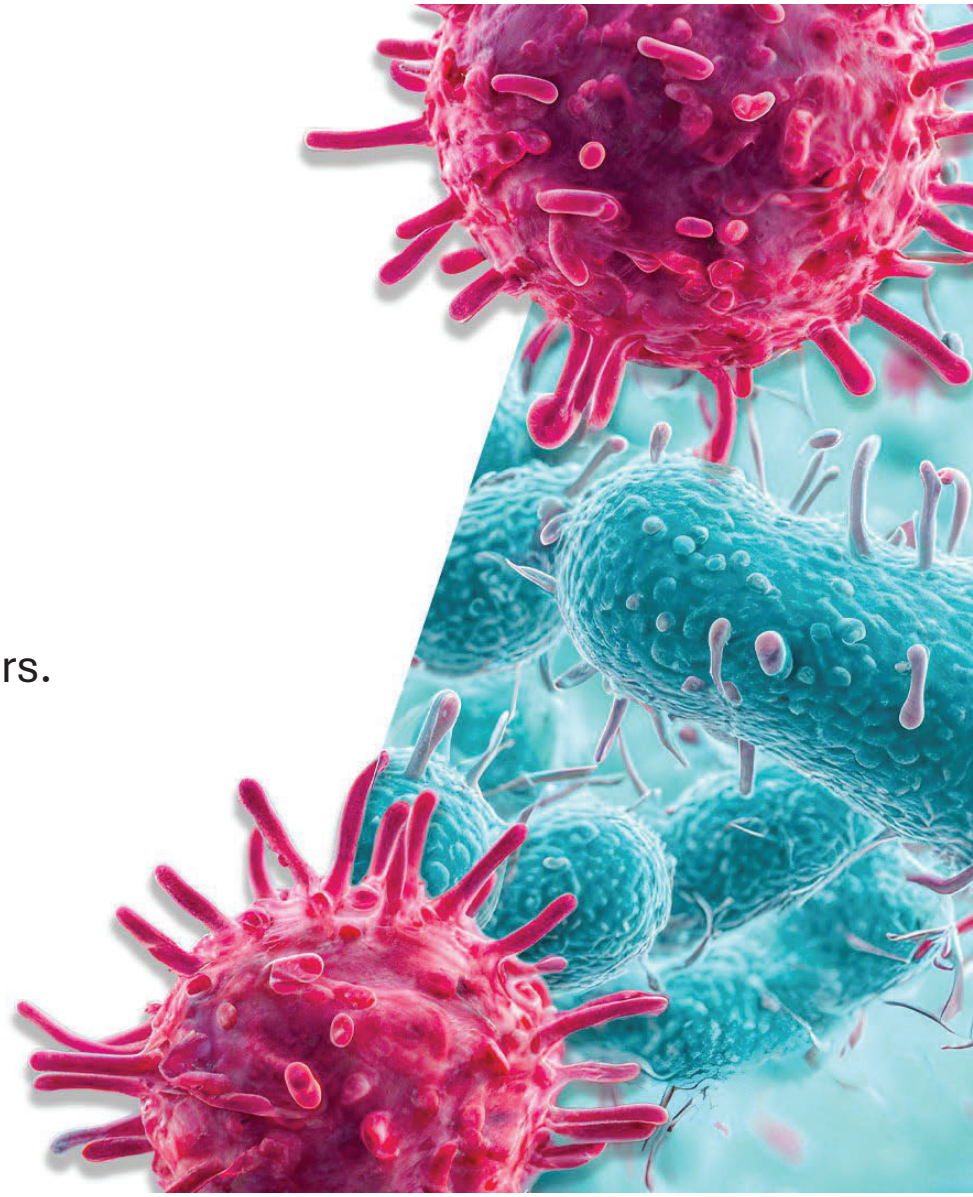
Closing

I'll leave you with one final thought.

Every bloodstream infection has a story.

For years we only read the last chapter—
the positive blood culture.

Today, genomics allows us to read the earlier chapters.
Colonization.
Loss of microbial diversity.
Mucosal barrier injury.
Translocation.
Bloodstream infection.



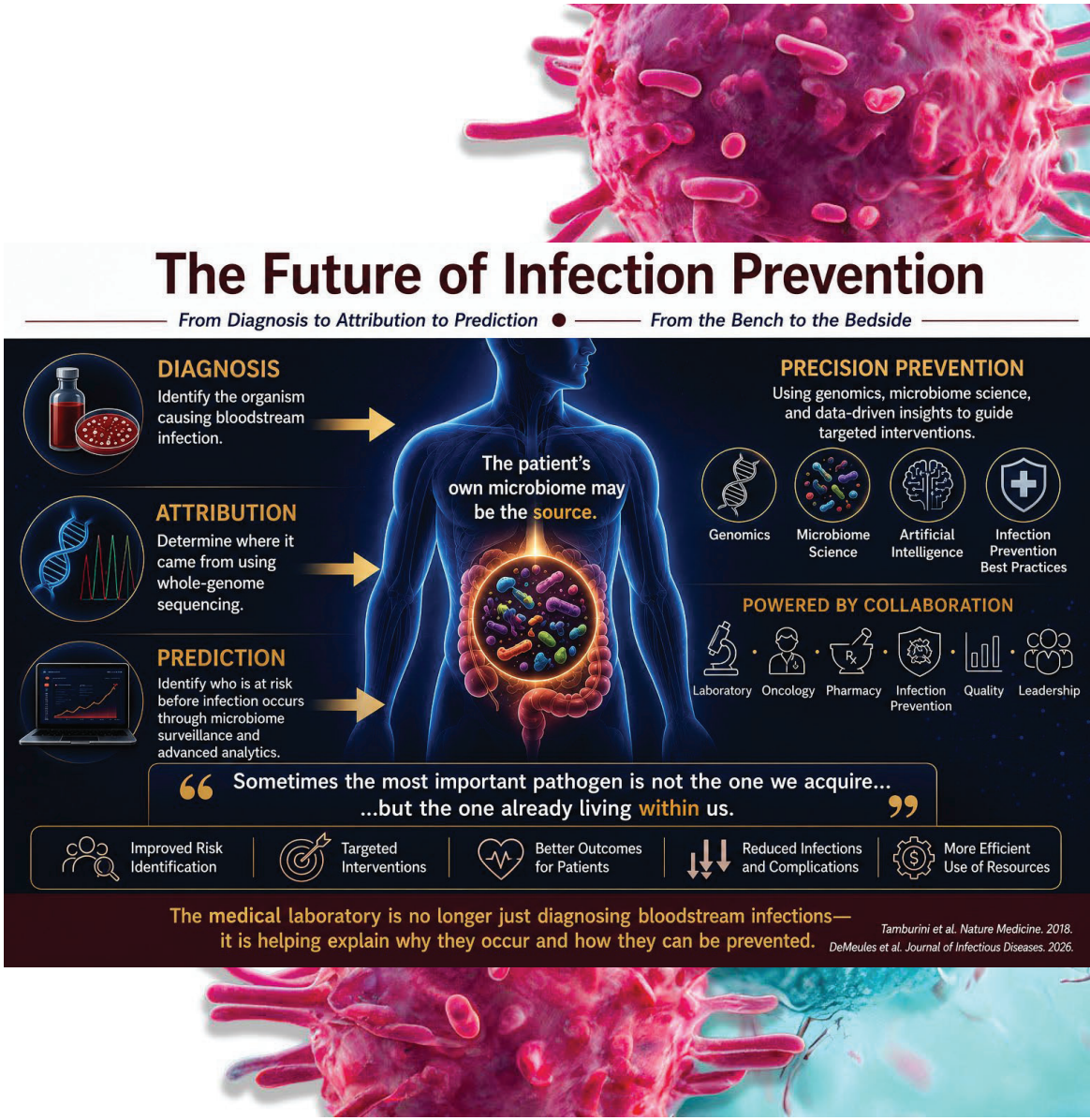
Closing

That broader understanding is transforming infection prevention from a reactive discipline into a predictive one.

Ultimately, improving outcomes for oncology patients will require collaboration among laboratorians, infectious disease physicians, nurses, infection preventionists, engineers, and—most importantly—patients and their families.

That is the future of precision infection prevention.

Thank you.



References

1. **Tamburini FB, Andermann TM, Tkachenko E, Senchyna F, Banaei N, Bhatt AS.**
Precision identification of diverse bloodstream pathogens in the gut microbiome.
Nature Medicine. 2018;24(12):1809–1814.
https://doi.org/10.1038/s41591-018-0202-8

2. **DeMeules MM, Proll SC, Hua X, Srinivasan S, Loeffelholz T, Liu C, Wu MC, Fiedler TL, Hoffman NG, Bourassa LA, Pergam SA, Fredricks DN.**
Gut Microbiota and Intestinal Monodomination as a Predictor for Bacteremia in Allogeneic Hematopoietic Cell Transplant Recipients.
The Journal of Infectious Diseases. Published online February 24, 2026.
https://doi.org/10.1093/infdis/jiag005

Kelly CR, *et al.*
Comparative genomics demonstrates that bloodstream infection isolates are most similar—and often identical—to fecal bacterial strains sampled immediately preceding bloodstream infection onset.

Note: This study is cited within the DeMeules *Journal of Infectious Diseases* paper as prior evidence supporting the gut as the source of bloodstream pathogens.

Thank You!

Rodney E. Rohde – Doc R Bio

TXST NEXT

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From Triple Aim to The Toilet: Autoinoculation & Safety

Bioaerosols, Hazardous Drug Exposure, and the New Frontier of Oncology Safety in Home and Hospital Settings

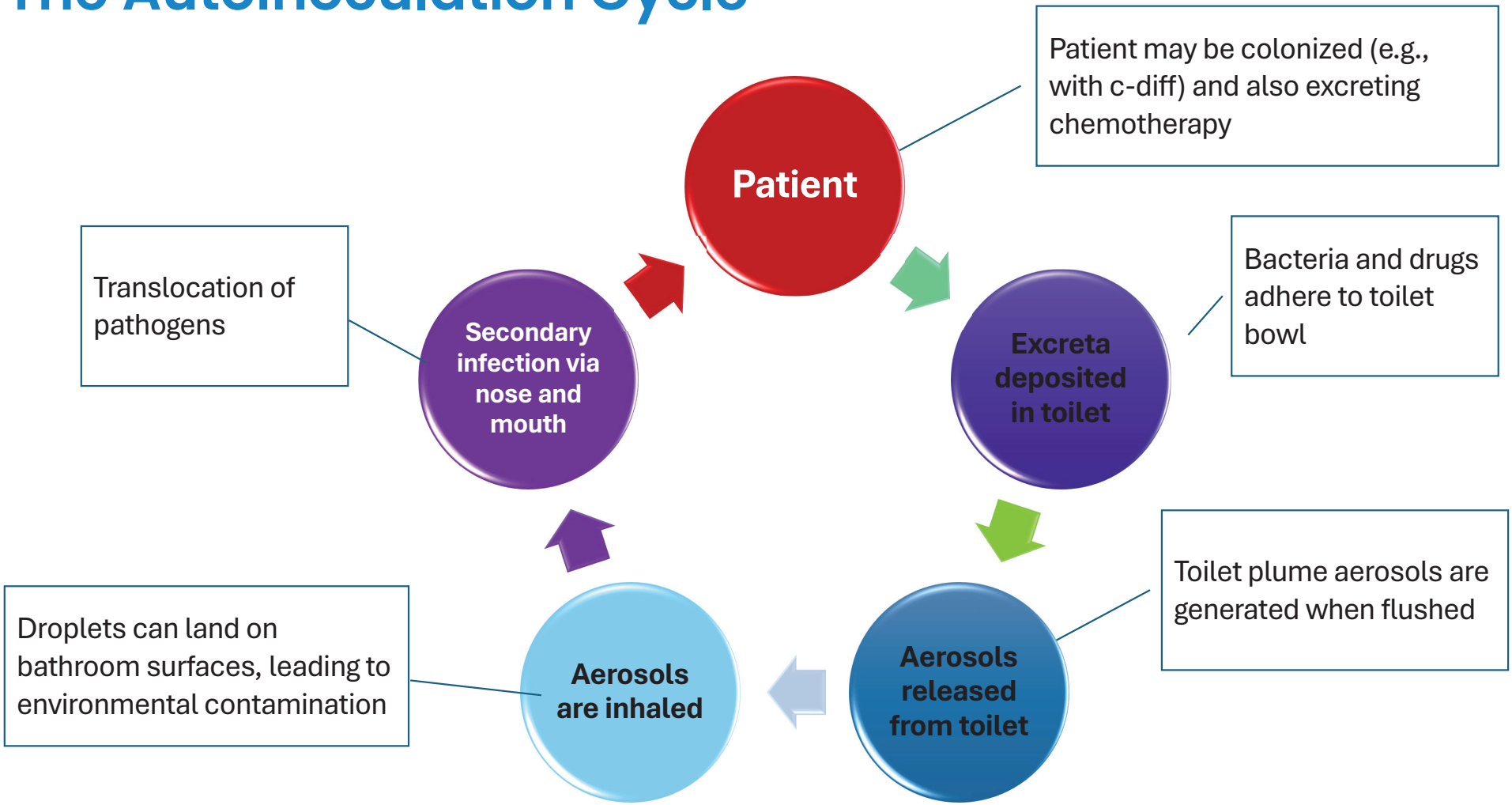
Seth Eisenberg RN OCN BMTCN
Oncology Nurse Consultant

09-17-26

The Frontline Sepsis Crisis

How do we protect our patients from their own bacteria?

The Autoinoculation Cycle



Failure of Passive Toilet Lids

- ☒ **The Hose Nozzle Effect:** Closing standard lids does NOT prevent particle escape.
- ☒ **Lateral Jetting:** Flush turbulence forces the plume sideways through seat gaps at high velocity.
- ☒ **Fine Mist Suspension:** Submicron particles remain suspended in the breathing zone for hours.

Simulated escape of invisible aerosols.

Goforth et al., 2024

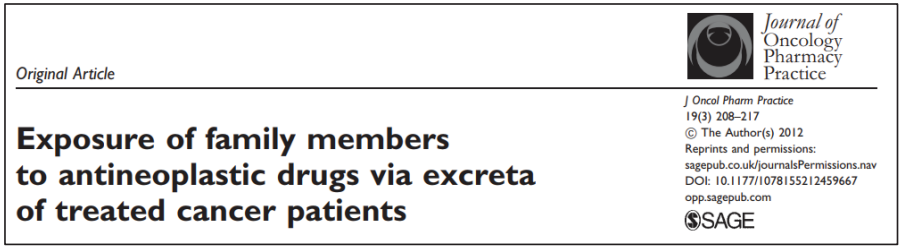
Hazardous Drug Concerns

- Exposure to chemotherapy can cause serious adverse health issues.
- IV and oral chemotherapy is excreted in urine and feces as unchanged drug or toxic metabolites.
- Widespread surface contamination has been well documented in hospital and home bathrooms.
- Inhalation and contact with toilet plume aerosols represents and unmanaged route of exposure for family members at home and healthcare personnel in clinical settings.

Hazardous Drug Concerns

It's Not Just A Hospital Problem

- Yuki et al reported widespread surface contamination in the home bathrooms of patients receiving chemotherapy.
- Chemotherapy was also found in the urine of the family members.



Original Article

Exposure of family members to antineoplastic drugs via excreta of treated cancer patients

Journal of Oncology Pharmacy Practice

J Oncol Pharm Practice
19(3) 208–217
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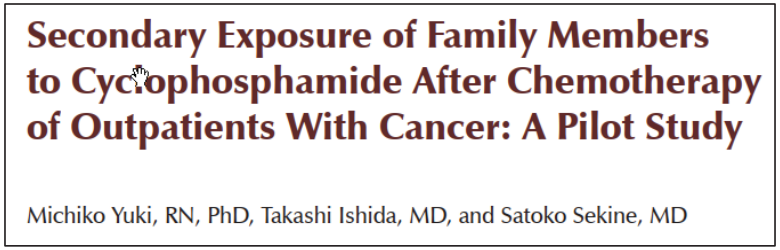
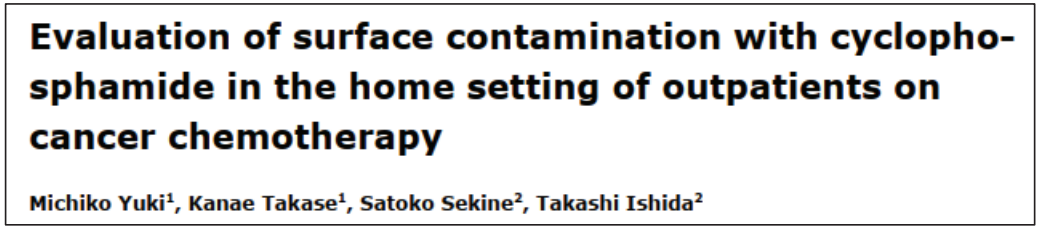


Secondary Exposure of Family Members to Cyclophosphamide After Chemotherapy of Outpatients With Cancer: A Pilot Study

Michiko Yuki, RN, PhD, Takashi Ishida, MD, and Satoko Sekine, MD



Evaluation of surface contamination with cyclophosphamide in the home setting of outpatients on cancer chemotherapy

Michiko Yuki[1], Kanae Takase[1], Satoko Sekine[2], Takashi Ishida[2]

The Guideline Vacuum

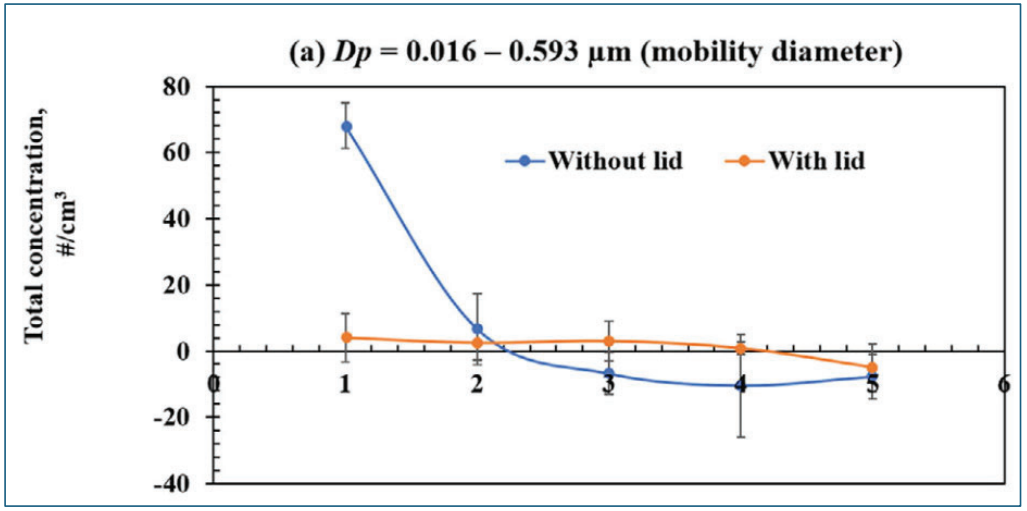
- The Oncology Nursing Society identified toilet plume aerosols as a risk more than 30 years ago.
- Historically, they have recommended covering hospital toilets with disposable plastic-backed pads (i.e., Chux) when flushing excreta to protect staff from chemotherapy exposure.
- However, **this recommendation was omitted** from the 2024 ONS 4th *Safe Handling of Hazardous Drugs* due to **lack of clinical evidence and operational non-compliance**.
- Additionally, a 2025 study* subsequently showed that plastic-backed pads **do not** significantly reduce hazardous drug surface contamination in clinical use.

*Walton et al. (2025, CJON)

Splashblocker Efficacy: Laboratory

Controlled Chamber Validation

- Cai et al. conducted a laboratory study of the effectiveness of Splashblocker on a hospital toilet. Measurements were taken using with a scanning mobility particle sizer and an aerodynamic particle sizer.
- **Results**: Significant reduction of total particle surface area and particle mass during the first 90 seconds post-flush compared to the uncovered flush.



Cai et al. (2022, JOEH)

Splashblocker Efficacy: Clinical Wipe Testing

- Orange Coast Medical Center pilot study in inpatient oncology bathrooms during a multi-drug chemotherapy (EPOCH).
- Wipe testing revealed that flushing uncovered toilets resulted in measurable chemotherapy contamination on seats, flush handles, and doorknobs.
- Chemotherapy residue was found on the underside of the Splashblocker, which was subsequently eliminated after recommended cleaning.

Vieira et al., poster presentation 2025 ONS Congress

Pre-publication data

Sample #	Doxorubicin ($ng/100cm^2$)	Etoposide ($ng/100cm^2$)	Vincristine ($ng/100cm^2$)
1	159	8,680	6.4
2	163	9,490	6.5
3	330	35,700	15.9
4	202	21,300	707

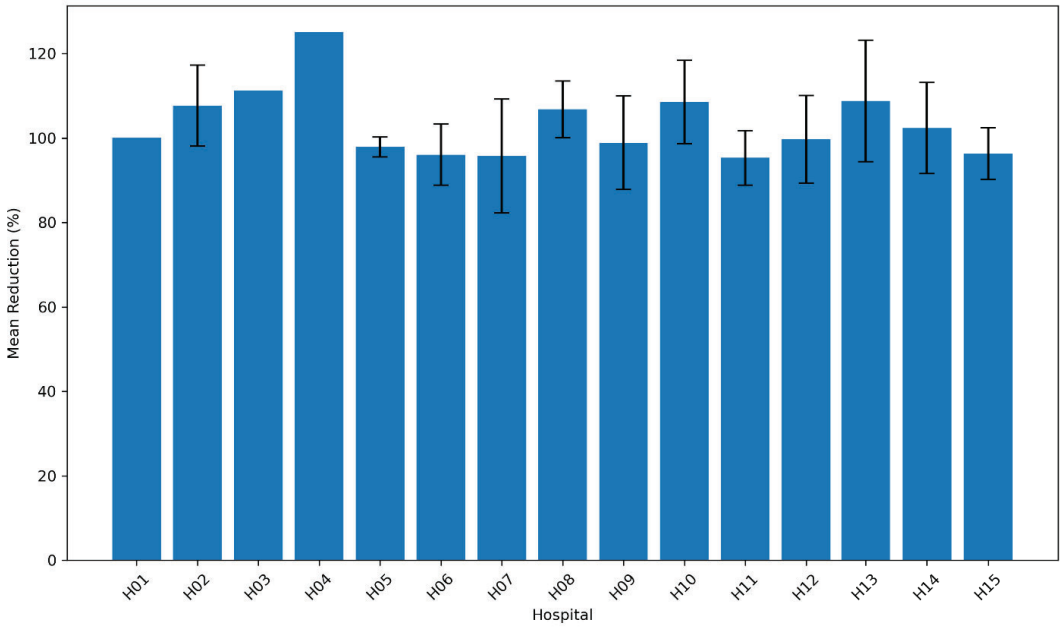
Patient receiving EPOCH regimen (April 2023)
Used with permission.

Splashblocker Efficacy: Multi-Center Clinical Study

Winner of James D'Arcy Research Award (JOEH 2024)

- 15 U.S. hospitals in 9 states, including 7 NCI-designated comprehensive cancer centers.

- **Results**: Covering the toilet with the Splashblocker produced a **mean particle reduction of 99.98% (p<.0002).**



Percent reduction in toilet plume aerosols from each of the 15 study sites.

Eisenberg & Cai, 2024 JOEH)

Unbroken Continuum of Safety

Infection prevention and staff safety cannot stop at the clinic door. A durable engineering control like the Splashblocker bridges care from the hospital to the home, interrupting autoinoculation for vulnerable oncology patients preventing chemotherapy contamination for family members in the home.

Questions & Discussion

Seth Eisenberg, RN, OCN, BMTCN | Oncology Nurse Consultant

Closing the Gap with the "Keep Me & My Family Safe" Program

Autoinoculation, Bioaerosols, and the New Frontier of Outpatient Oncology Safety

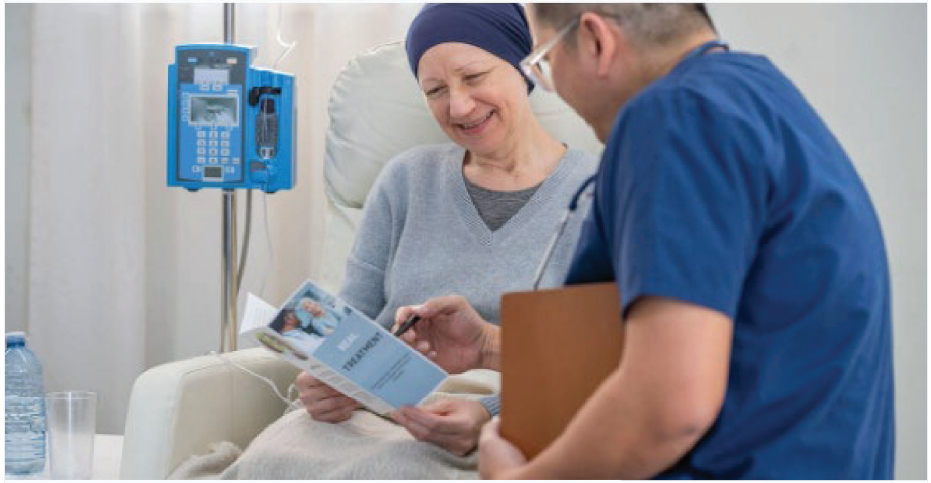
Kim LaBree, DNP, APRN, ANP-BC, NEA-BC, OCN

Assistant Administrator, Patient Care Services | Baptist MD Anderson Cancer Center

The Unrecognized Outpatient Hazard

Outpatient Care & Environmental Risk

- **Complex Discharges:** Patients receiving cytotoxic chemotherapy (ICD-10 Z51.11) are discharged home with comprehensive instructions on medication and hydration.
- **Unmanaged Residential Hazard:** Routine toilet flushing forces hazardous antineoplastic metabolites and opportunistic pathogens into residential bathroom air.
- **The Systemic Blind Spot:** Lacking a viable containment tool, healthcare systems accepted toilet plume aerosolization (TPA) as an unfixable byproduct of treatment.
- **Clinical Duty to Act:** Now that a proven physical engineering control exists, unmanaged exposure is no longer acceptable.



Mucositis & Autoinoculation Risk

The Dual Biological Vicious Cycle

Cytotoxic cancer therapies routinely induce mucosal barrier injury (mucositis, K12.31), severely breaching the patient's biological defenses.

Simultaneously, patients excrete toxic drug metabolites and opportunistic pathogens. Flushing generates dense bioaerosols in the residential environment.

Inhaling and ingesting these sub-micron particles re-seeds the compromised GI tract, driving systemic translocation in severely neutropenic hosts (D70.18).

> ⚠ Break the Cycle: Environmental controls physically interrupt aerosolized autoinoculation pathways.

Multi-Center Program Results

Baptist MD Anderson

Full clinical feedback data completed, demonstrating 100% patient adherence and usability metrics.

Georgetown Lombardi

Completed independent evaluation protocol; while hard feedback survey metrics were not fully returned, qualitative response confirmed the devices were very well received, highly intuitive, and easy to use.

City of Hope & Orange Coast

Validated device utility across high-volume outpatient settings. Feedback confirms splashblockers were easy to use, making patients feel significantly safer and more empowered.

100%

Patient Adherence & Usability (Baptist MD Anderson)

Deployment Across Premier Centers: The *Keep Me and My Family Safe Program* successfully deployed the Splashblocker device across multiple prominent oncology environments.

Universal Usability Consensus: Across Georgetown, City of Hope, and Orange Coast, qualitative reports confirm the splashblockers were intuitive, highly praised, and exceptionally easy to use.

Patient Empowerment: Patients consistently reported feeling safer and more empowered when equipped with this essential home containment tool during active chemotherapy.

Key Patient & Clinical Outcomes

- **Primary Barrier Vector Interrupted:** Serves as a physical barrier to contain toilet plume particles that can transport hazardous drugs and pathogens at the point of origin.
- **Profound Psychological Peace of Mind:** Qualitative feedback revealed immediate reductions in patient anxiety regarding family exposure.
- **Protection for Caregivers & Household:** Prevents secondary exposure to hazardous waste for family members and immunocompromised housemates.
- **Sustainable Residential Device:** Durable equipment with a permanent reusable lifespan, backed by a lifetime residential guarantee.

Efficacy & Usability Metrics

BAPTIST MD ANDERSON

Key Finding: Baptist MD Anderson clinical field data confirms that near-total bioaerosol containment is matched by 100% patient adherence and satisfaction.

*** Data from the Splashblocker multi-center 15 hospital study published in JOEH, 2024**

Engineering Controls at Home

Bridging the Safety Gap

- **Targeted Physical Barrier:** Modern portable barrier tools achieve 99.98% median aerosol particle reduction during flushing.
- **Beyond Short-Term Consumables:** Engineered specifically as reusable medical equipment for the full duration of therapy.
- **Empowering Lay Caregivers:** Simple design allows laypersons to maintain strict clinical safety protocols at home without complex training.
- **Non-Pharmaceutical Intervention:** Reduces infection risk factors without added systemic pharmaceutical toxicity.

Clinical & Safety Alignment

Domain Metric	Traditional Outpatient Practice	Modern Safety Continuum
Care Boundary	Terminates at infusion center discharge	Extends unbroken into the home environment
Residential Bioaerosol Risk	Unmanaged hazard (Accepted blind spot)	Contained at source via engineering controls
Patient Role	Passive exposure to toxic waste	Empowered active participant in safety
Administrative Classification	Optional facility supply / consumable	Prescribed medical supply / HCPCS code A9720

Closing the Safety Continuum

"With proven, validated engineering controls available, failure to protect our cancer patients in their own homes is no longer an option."

Kim LaBree, DNP, APRN, ANP-BC, NEA-BC, OCN

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