

To Probiotic or Not Probiotic?

Joy Engblade, MD, MMM, FACP

Heartland Hospital Medicine Conference

August 2024



9 Surprising Benefits of Kimchi

Kimchi is a traditional Korean dish made with salted, fermented vegetables. It is nutrient-dense, contains probiotics, and may help support the immune system and reduce inflammation, among many possible benefits.



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Nutrition of Kimchi

Kimchi is a healthy food option. It is low in calories and high in many key nutrients. The process of making it gives it a high amount of good bacteria known as probiotics.

Gut health

There's a growing body of research that backs the positive impact of fermented foods on gut health. Roberta Baldo, registered nutritionist and co-founder of Baldo and Mason, says: 'Kimchi is a ferment which contains natural probiotics. Probiotics are amazing for populating the good bacteria in your gut which helps to aid digestion, regulate bowel movements, reduce inflammation and enhance absorption of nutrients,' she says.

VOGUE

The August Issue The August issue is here featuring Ji

Why has kimchi become popular?

Not only is it delicious, it also contains natural probiotic bacteria, which appeals to the vast numbers of people becoming increasingly aware of the associated benefits for their gut health. “Probiotic-rich foods such as kimchi, sauerkraut, live yogurt, and kefir support our gut health, which has been made much more mainstream recently thanks to resources and experts in the field such Tim Spector, the co-founder of Zoe,” says Shand.



Contains Gut-Friendly Bacteria



It's no secret that yogurt is good for your gut, but you may not know that kimchi is also a source of [probiotics](#), which are friendly bacteria that offer a number of health benefits.



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NUTRITION Evidence Based

9 Surprising Benefits of Kimchi

Kimchi is a traditional Korean dish made with salted, fermented vegetables. It is nutrient-dense, contains **probiotics**, and may help support the immune system and reduce inflammation, among many possible benefits.

Women's Health FITNESS HEALTH BEAUTY NUTRITION THE EDIT



Kimchi health benefits

Fermented foods are well known to contain lots of lovely gut-friendly bacteria and a plethora of health benefits, so we called on the expertise of registered nutritionists to weigh in on the potential health benefits of kimchi, from improved gut health to blood sugar and weight management.

Gut health

There's a growing body of **research** that backs the positive impact of fermented foods on gut health. Roberta Baldo, registered nutritionist and co-founder of **Baldo and Mason**, says: 'Kimchi is a ferment which contains natural **probiotics**. Probiotics are amazing for populating the good bacteria in your gut which helps to aid digestion, regulate bowel movements, reduce inflammation and enhance absorption of nutrients,' she says.

VOGUE

FASHION BEAUTY CULTURE LIVING WEDDINGS RUNWAY SHOPPING ▾

The August Issue The August issue is here featuring Jill Bide

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Not only is it delicious, it also contains natural **probiotic** bacteria, which appeals to the vast numbers of people becoming increasingly aware of the associated benefits for their gut health. "Probiotic-rich foods such as kimchi, sauerkraut, live yogurt, and kefir support our gut health, which has been made much more mainstream recently thanks to resources and experts in the field such **Tim Spector**, the co-founder of **Zoë**," says Shand.

LIVESTRONG.com EAT BETTER GET FIT MANAGE WEIGHT LIV

14 grams per 1,000 calories. Based on a 2,000-calorie-per-day diet, 100 grams of kimchi v provide a little more than 7 percent of the daily recommended value of dietary fiber.

Contains Gut-Friendly Bacteria

It's no secret that yogurt is good for your gut, but you may not know that kimchi is also a source of **probiotics**, which are friendly bacteria that offer a number of health benefits.

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Nutrition of Kimchi

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Dictionary

Definitions from [Oxford Languages](#) · [Learn more](#)



pro·bi·ot·ic

/ˌprɒbɪˈædɪk/

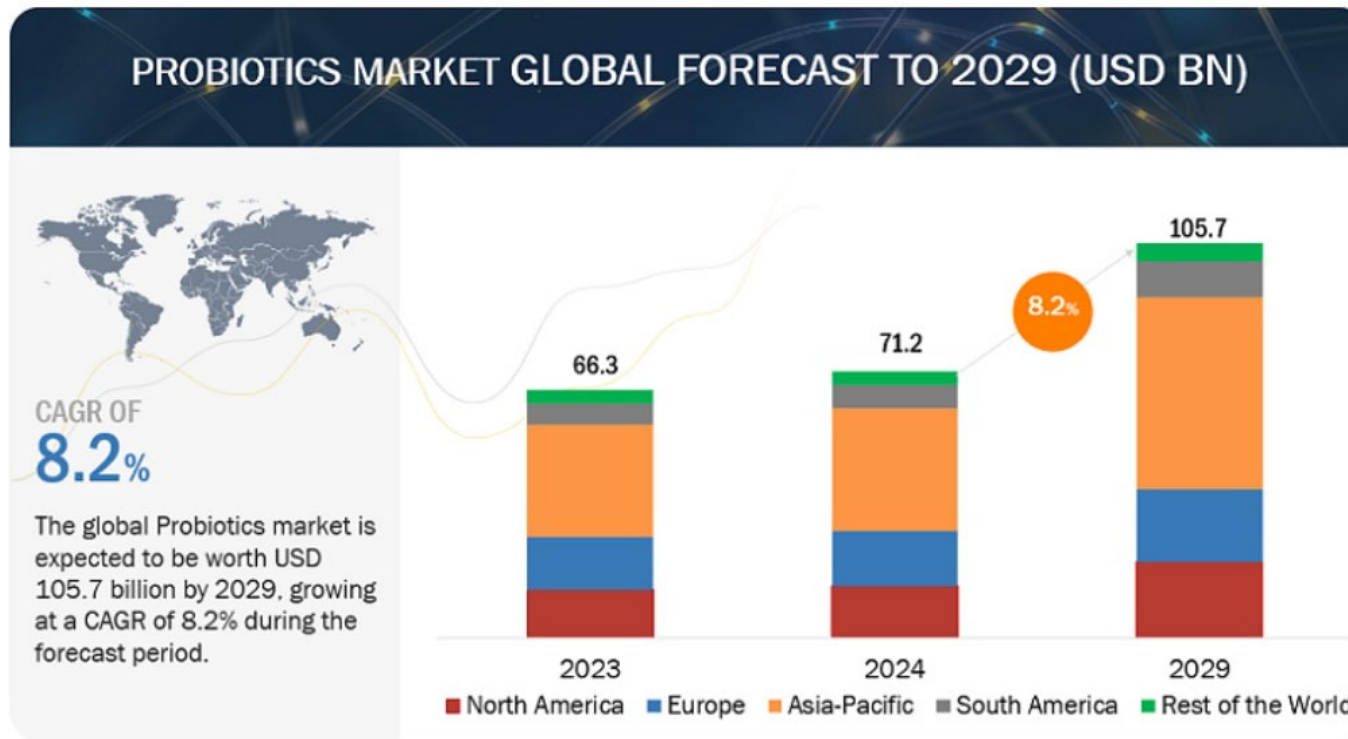
adjective

denoting a substance which stimulates the growth of microorganisms, especially those with beneficial properties (such as those of the intestinal flora).

noun

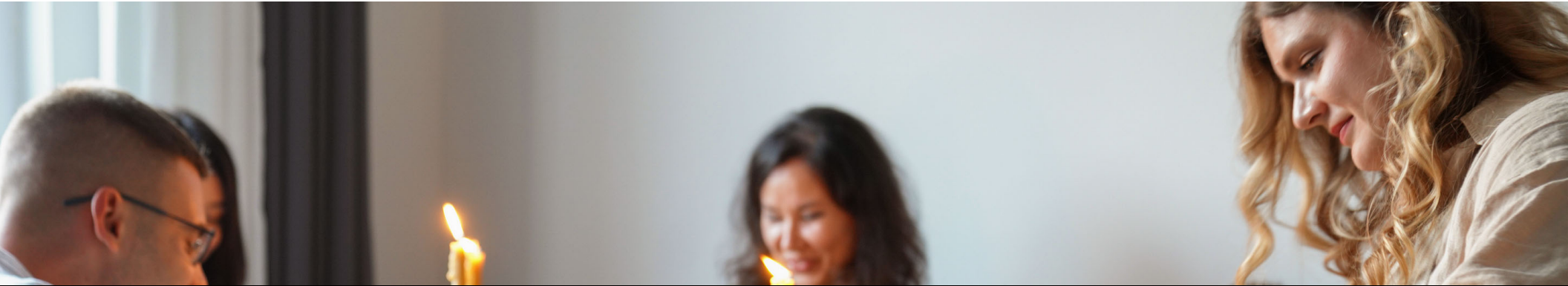
a probiotic substance or preparation.

Probiotic Market



[Global Probiotics Market Size & Forecast \[Latest\] \(marketsandmarkets.com\)](https://marketsandmarkets.com)





SHOULD I TAKE PROBIOTICS?



Physician Recommendation?

Healthy patient

Overall healthy patient
with medical issue

- GI related illness
- Mental health
- Dementia

Patient who needs
antibiotics

- No history of C diff

Patient who needs
antibiotics

- History of C diff

Physician Recommendation?

Healthy patient

Overall healthy patient
with medical issue

- GI related illness
- Mental health
- Dementia

Patient who needs
antibiotics

- No history of C diff

Patient who needs
antibiotics

- History of C diff

Learning Objectives

- Upon completion of this activity participants should be able to provide an evidence-based recommendation regarding probiotic use for patients who require antibiotic therapy with no history of C. diff.
 - (And answer all medical questions posed by family members during holiday dinners)
- No financial disclosures

Clostridium Difficile



Discovered
1935,
identified as
cause of colitis
1978, peaked
early 2010's,
decline 2011 to
current



2011 US: 500K
cases,
associated 29K
deaths (5.8%
mortality rate)



2015 US: \$6.3
billion
annually, 2.4
million days IP
stay

Bartlett JG. Narrative review: the new epidemic of Clostridium difficile-associated enteric disease. *Ann Intern Med.* 2006 Nov 21;145(10):758-64. PMID: 17116920

Lessa FC, et al, Burden of Clostridium difficile infection in the United States. *N Engl J Med.* 2015 Feb 26;372(9):825-34. PMID: 25714160; PMCID: PMC10966662

Zhang S, et al, Cost of hospital management of Clostridium difficile infection in United States-a meta-analysis and modelling study. *BMC Infect Dis.* 2016 Aug 25;16(1):447. PMID: 27562241; PMCID: PMC5000548

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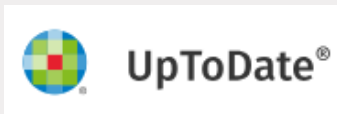
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“An ounce of prevention is worth a pound of cure” –Benjamin Franklin

Bartlett JG. Narrative review: the new epidemic of Clostridium difficile-associated enteric disease. Ann Intern Med. 2006 Nov 21;145(10):758-64. PMID: 17116920

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First Search

- We do not favor administration of probiotics for prevention of CDI
- [Clostridioides difficile infection in adults: Treatment and prevention - UpToDate](#)
(updated March 2024)

Real First Search – Professional Societies

- Recommend against probiotics for primary prevention of CDI
- (conditional recommendation, moderate quality of evidence) 2021



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Real First Search – Professional Societies

Make no recommendation for probiotics in C
diff 2020

(article was supposed to be updated 2023,
pending)



Real First Search – Professional Societies

- There are insufficient data at this time to recommend administration of probiotics for primary prevention of CDI outside of clinical trials (*no recommendation*). 2017



Real First Search – Professional Societies

- Update on C. diff in 2021, no mention of probiotics



Real First Search – Professional Societies

- Not for or against probiotics for healthy people but may help alleviate symptoms for certain conditions
- [Probiotics - Health Professional Fact Sheet \(nih.gov\)](#); 2023



Based on this, wouldn't we just say, no probiotics and call it a day?



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National Institutes of Health
Turning Discovery Into Health



ELSEVIER

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American Journal of Infection Control

journal homepage: www.ajicjournal.org



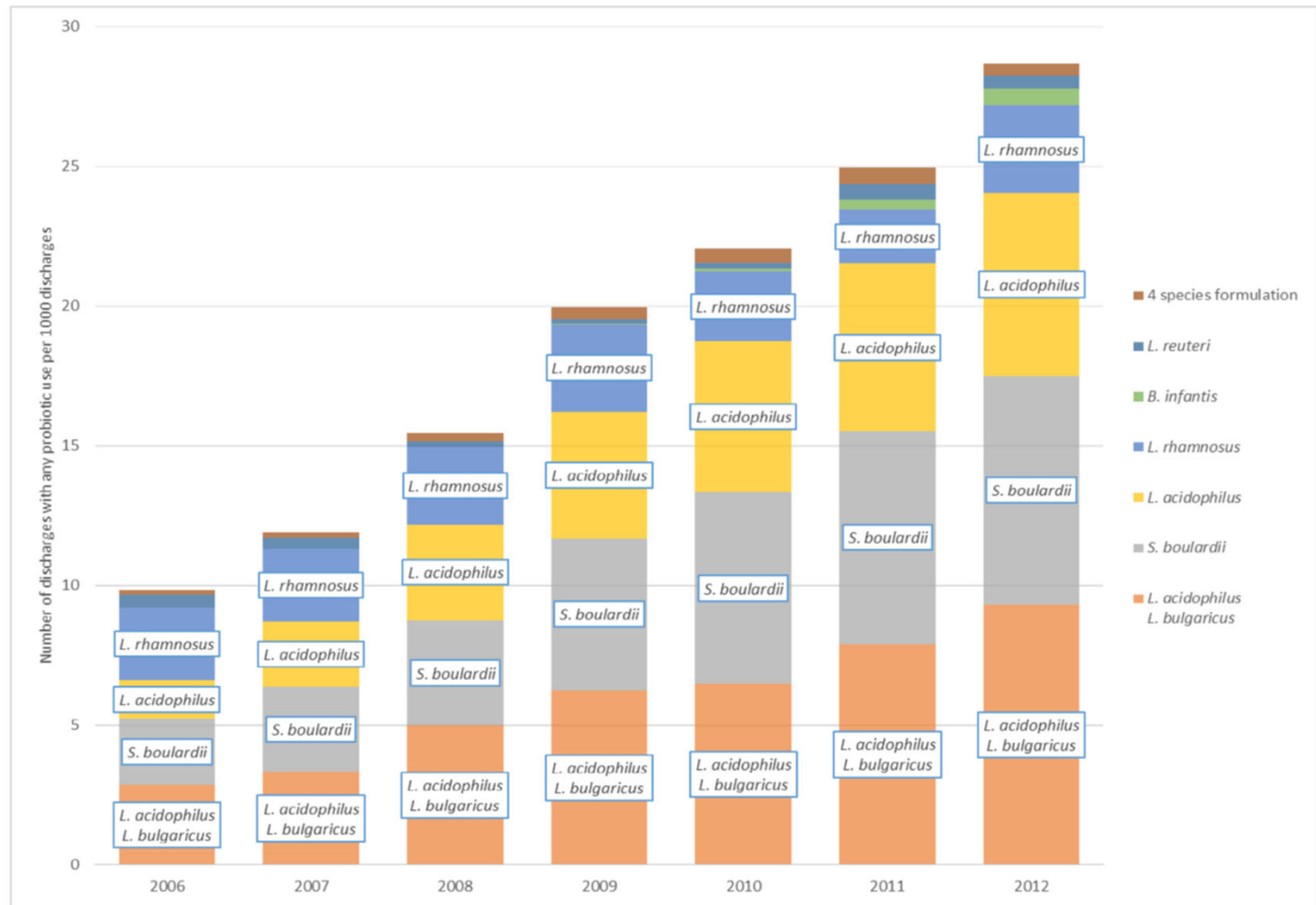
Major article

Prevalence of probiotic use among inpatients: A descriptive study of 145 U.S. hospitals

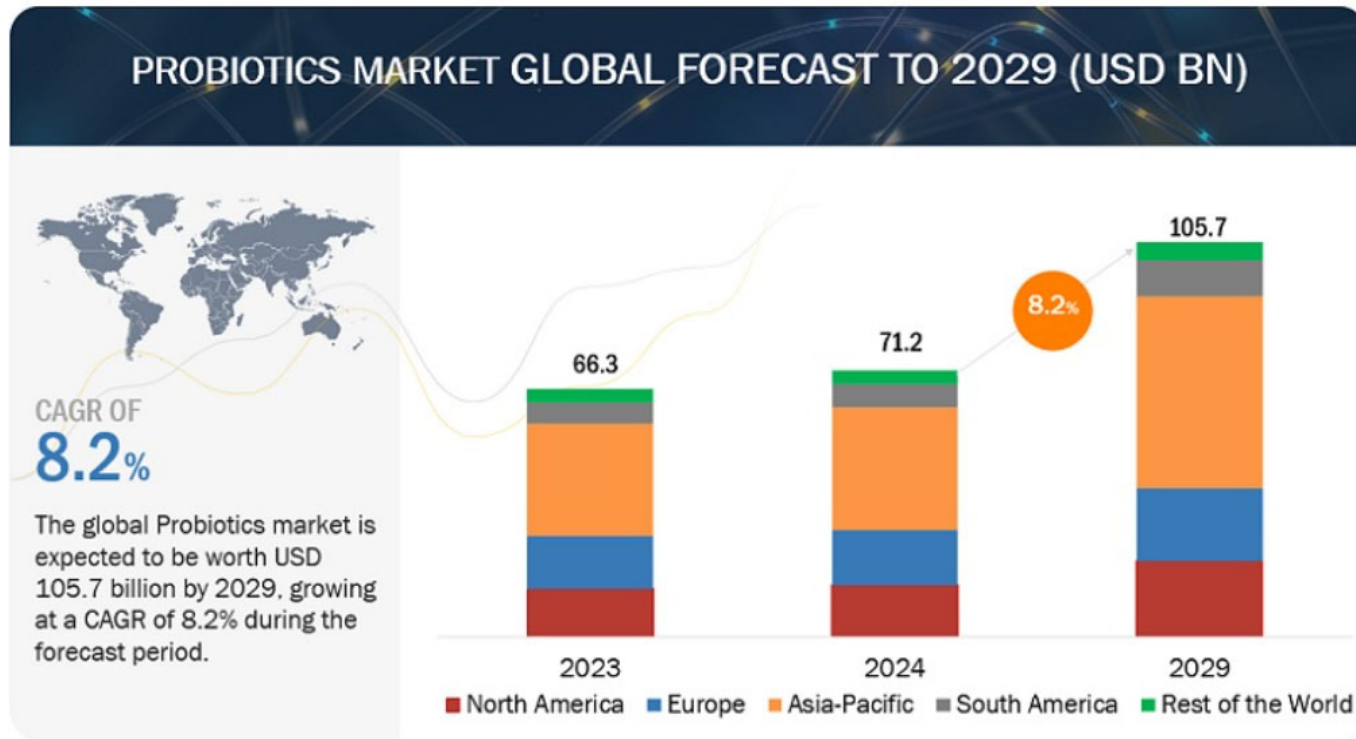
Sarah H. Yi PhD, RD *, John A. Jernigan MD, MS, L. Clifford McDonald MD

Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, GA





Probiotic Market



[Global Probiotics Market Size & Forecast \[Latest\] \(marketsandmarkets.com\)](https://marketsandmarkets.com)

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics

IBS

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics

IBS IBD

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics

IBS

IBD

Radiation Enteritis

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics

IBS IBD
Radiation Enteritis
Allergies/Atopy

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics

Chronic Constipation

IBS

IBD

Radiation Enteritis

Allergies/Atopy

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics
- But what about Skilled Nursing Home patients?

Define the population

- Prevent C. diff in patients with no history of C. diff who need antibiotics
- But what about Skilled Nursing Home patients?
 - Represent about quarter of C. diff cases in US (2012 data)

JAMA | **Original Investigation**

Effect of Probiotic Use on Antibiotic Administration Among Care Home Residents A Randomized Clinical Trial

Christopher C. Butler, MD; Mandy Lau, BSc; David Gillespie, PhD; Eleri Owen-Jones, PhD; Mark Lown, PhD; Mandy Wootton, PhD; Philip C. Calder, PhD; Antony J. Bayer, BM ChB; Michael Moore, MSc; Paul Little, MD; Jane Davies, PhD; Alison Edwards, MSc; Victoria Shepherd, PhD; Kerenza Hood, PhD; F. D. Richard Hobbs, MBChB; Mina Davoudianfar, BA; Heather Rutter, BSc; Helen Stanton, BSc; Rachel Lowe, PhD; Richard Fuller, BMBS; Nick A. Francis, PhD

JAMA | Original Investigation


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Conclusions

Among care home residents in the UK, a daily oral probiotic combination of *Lactobacillus rhamnosus* GG and *Bifidobacterium animalis* subsp *lactis* BB-12 did not significantly reduce antibiotic administration for all-cause infections. The findings do not support the use of probiotics in this setting.

***Clostridioides difficile* infection in a skilled nursing facility (SNF): cost savings of an automated, standardized probiotic antimicrobial stewardship programme (ASP) policy**

Bridget Olson ^{1*}, Noam Ship², Michael L. Butera³, Kenneth Warm³, Roger Oen³ and John Howard¹

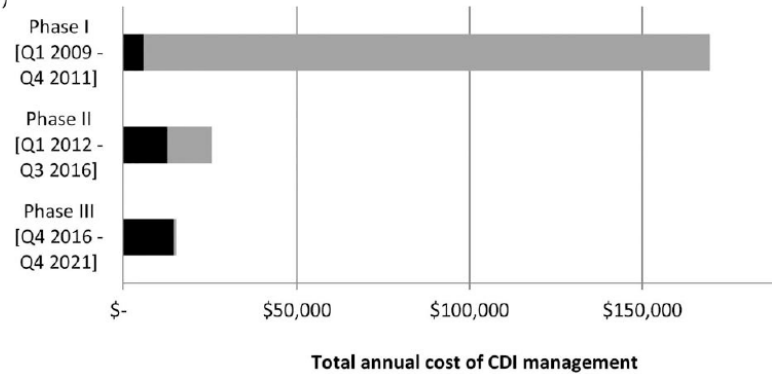
¹Department of Pharmacy, Sharp Coronado Hospital & Villa Long Term Care, Sharp HealthCare, 250 Prospect Place, Coronado, CA 92118, USA; ²Research and Development, Bio-K Plus International Inc., 495 Armand-Frappier Boulevard, Laval, Quebec H7V4B3, Canada;

³Medical Staff, Sharp Coronado Hospital & Villa Long Term Care, Sharp HealthCare, 250 Prospect Place, Coronado, CA 92118, USA

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(a)



■ Prevention costs (probiotic, protocol management)

■ Internal failure costs (CDI hospitalization, isolation, case management)

What about timing?

Timely Use of Probiotics in Hospitalized Adults Prevents *Clostridium difficile* Infection: A Systematic Review With Meta-Regression Analysis



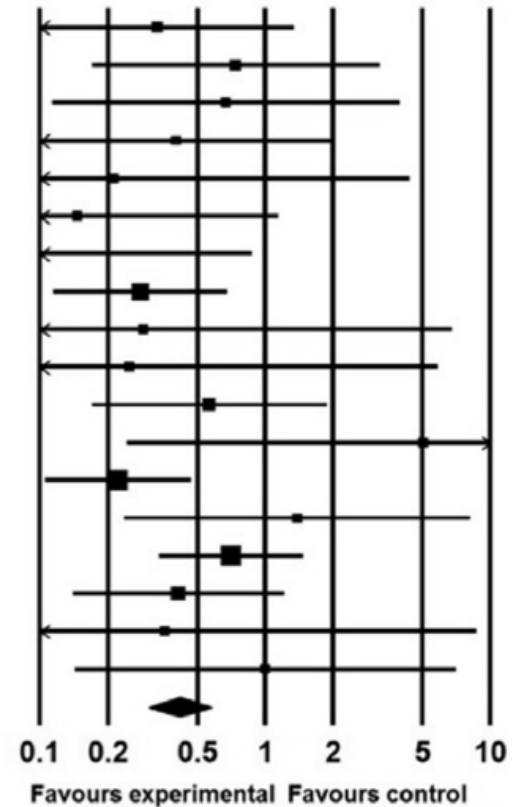
Nicole T. Shen,¹ Anna Maw,² Lyubov L. Tmanova,³ Alejandro Pino,⁴ Kayley Ancy,⁴ Carl V. Crawford,¹ Matthew S. Simon,^{5,6} and Arthur T. Evans⁵

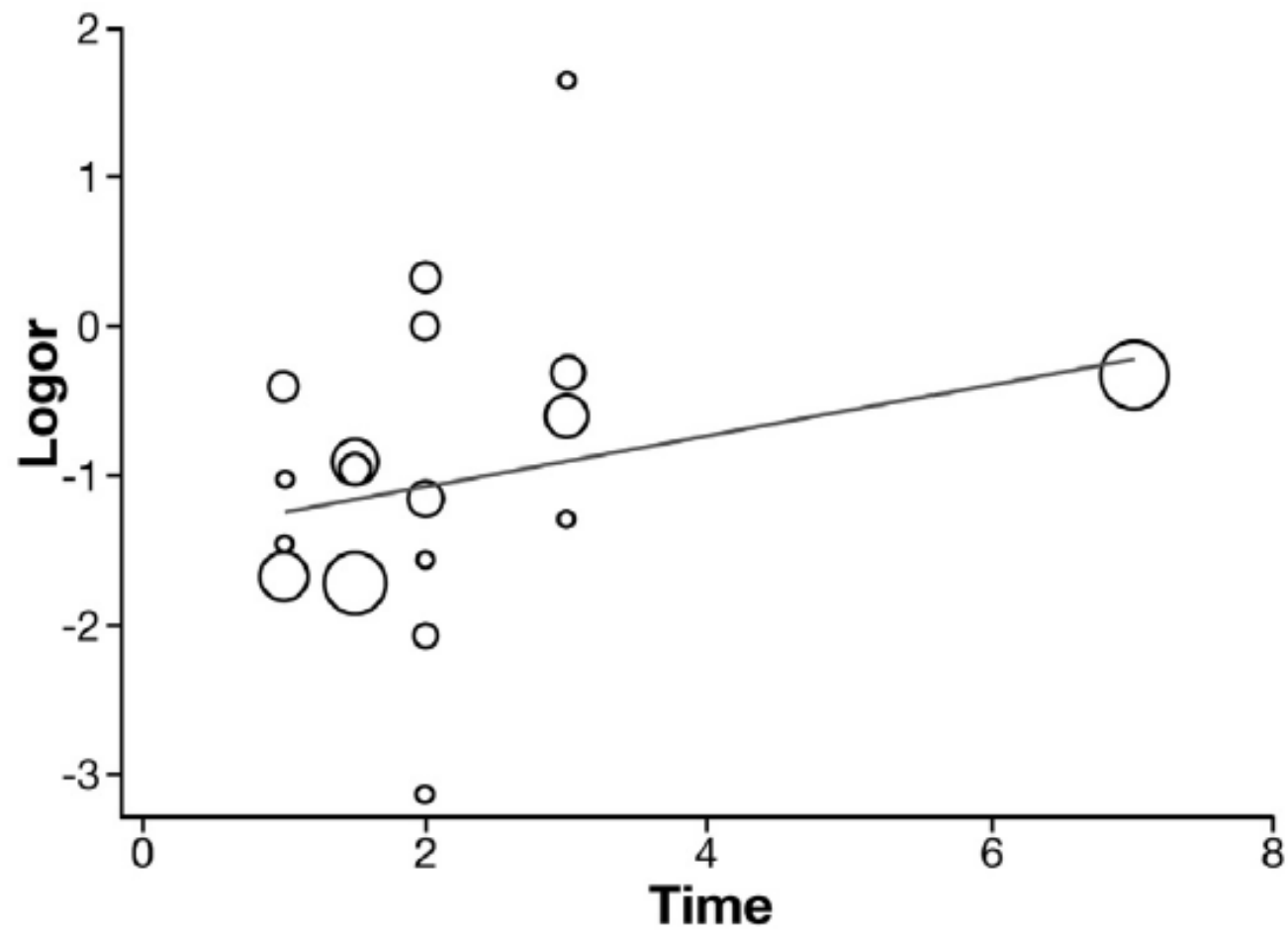
¹Division of Gastroenterology and Hepatology, Weill Department of Medicine, Weill Cornell Medicine, New York, New York; ²Hospitalist Medicine Section, Division of General Internal Medicine, Department of Medicine, University of Colorado, Denver, Colorado; ³Samuel J. Wood Library and CV Starr Biomedical Information Center, Weill Cornell Medical College, New York, New York; ⁴New York-Presbyterian-Weill Cornell Medical Center, New York, New York; ⁵Section of Hospital Medicine, Division of General Internal Medicine, Weill Department of Medicine, Weill Cornell Medicine, New York, New York; and ⁶Division of Infectious Diseases, Weill Department of Medicine, Weill Cornell Medicine, New York, New York

Shen NT, et al, Timely Use of Probiotics in Hospitalized Adults Prevents *Clostridium difficile* Infection: A Systematic Review With Meta-Regression Analysis. *Gastroenterology*. 2017 Jun;152(8):1889-1900

A Study name Events / total Risk ratio and 95% CI

Study name	Events / total		Relative weight	Risk ratio
	Probiotics	Control		
Surawicz 1989	3 / 116	5 / 64	5.30	0.33
McFarland 1995	3 / 97	4 / 96	4.80	0.74
Thomas 2001	2 / 133	3 / 134	3.30	0.67
Plummer 2004	2 / 69	5 / 69	4.02	0.40
Can 2006	0 / 73	2 / 78	1.14	0.21
Beausoleil 2007	1 / 44	7 / 45	2.46	0.15
Hickson 2007	0 / 57	9 / 56	1.30	0.05
Rafiq 2007	5 / 45	22 / 55	13.16	0.28
Wenus 2008	0 / 34	1 / 29	1.04	0.29
Safdar 2008	0 / 23	1 / 17	1.05	0.25
Miller 2008a	4 / 95	7 / 94	7.26	0.57
Miller 2008b	2 / 157	0 / 159	1.13	5.06
Gao 2010	9 / 171	20 / 84	18.82	0.22
Pozzoni 2012	3 / 106	2 / 98	3.32	1.39
Allen 2013	12 / 1470	17 / 1471	19.16	0.71
Ouwehand 2014	6 / 304	7 / 146	9.01	0.41
Wong 2014	0 / 76	1 / 82	1.02	0.36
Ehrhardt 2016	2 / 146	2 / 146	2.74	1.00
Summary estimate				0.42





What kind is best?

Dietary Supplement Label Database

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Products

Browse Products

Browse products **by keyword:**

probiotics

OR

Browse products **by letter:**

A B C D E F G H I J K L M N O P

Displaying 677 product names that match "probiotics".

What kind is best?



NIH National Institutes of Health
Office of Dietary Supplements

Dietary Supplement Label Database

Home Search Browse Resources API Guide

Products

Browse Products

Browse products **by keyword**:

OR

Browse products **by letter**:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
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Displaying 677 product names that match "probiotics".



Review

Primary prevention of *Clostridium difficile* infections with a specific probiotic combining *Lactobacillus acidophilus*, *L. casei*, and *L. rhamnosus* strains: assessing the evidence

L.V. McFarland^{a,*}, N. Ship^b, J. Auclair^b, M. Millette^b

^a Department of Medicinal Chemistry, School of Pharmacy, University of Washington, Seattle, WA, USA

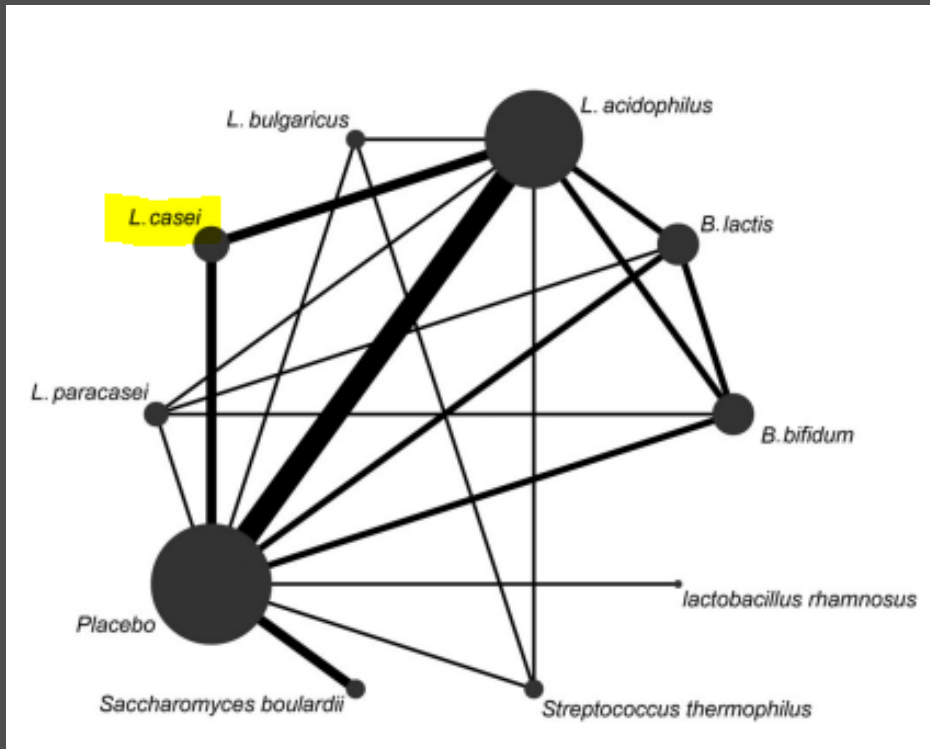
^b Research and Development, Bio-K Plus International Inc., Laval, Quebec, Canada

META ANALYSIS

Journal of
Digestive Diseases WILEY

Which probiotic has the best effect on preventing *Clostridium difficile*-associated diarrhea? A systematic review and network meta-analysis

Yan Ma¹  | Jing Yu Yang¹ | Xia Peng¹ | Ke Yi Xiao² | Qing Xu¹ | Chen Wang³



META ANALYSIS

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Which strain is best?



Make no recommendation for probiotics in C diff 2020

(article was supposed to be updated 2023, pending)

Which strain is best?

The AGA suggests the use of certain strains and strain combination of probiotics in the prevention of *C difficile* infection

Make no recommendation for probiotics in C diff 2020

Overall quality of the evidence is rated as
(article was supposed to be updated 2023, pending)

Low

W 1-species *S boulardii*

2-species combination of *L*

acidophilus CL1285 and *L casei* LBC80R

3-strain combination of *L acidophilus*, *L*

delbrueckii subsp *bulgaricus*, and *B*

bifidum

M Foundation for probiotics in C diff 2020

(a) 4-strain combination of *L acidophilus*, *L*

delbrueckii subsp *bulgaricus*, *B bifidum*,

and *S salivarius* subsp *thermophilus*





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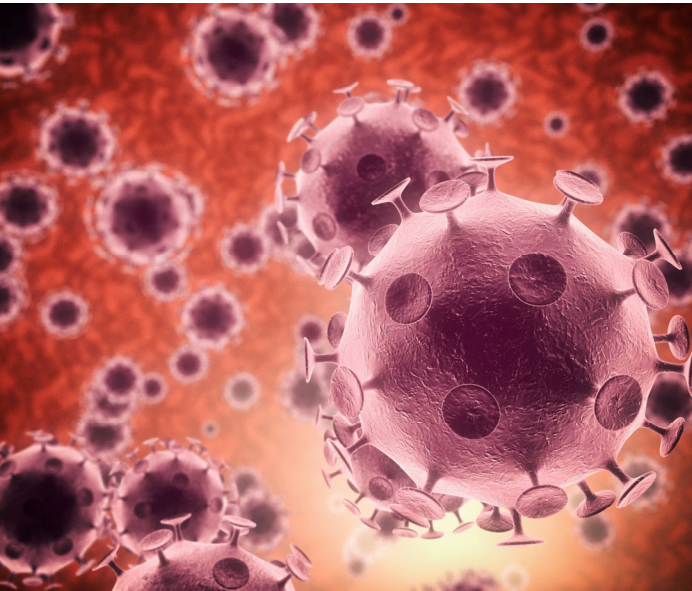
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Are Probiotics Safe? Yes, but.....

Cell

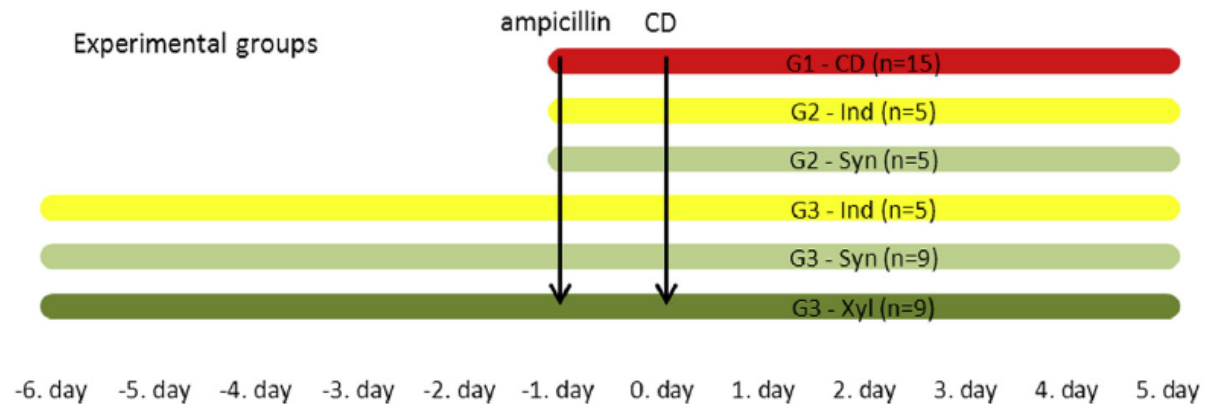
**Post-Antibiotic Gut Mucosal Microbiome
Reconstitution Is Impaired by Probiotics and
Improved by Autologous FMT**



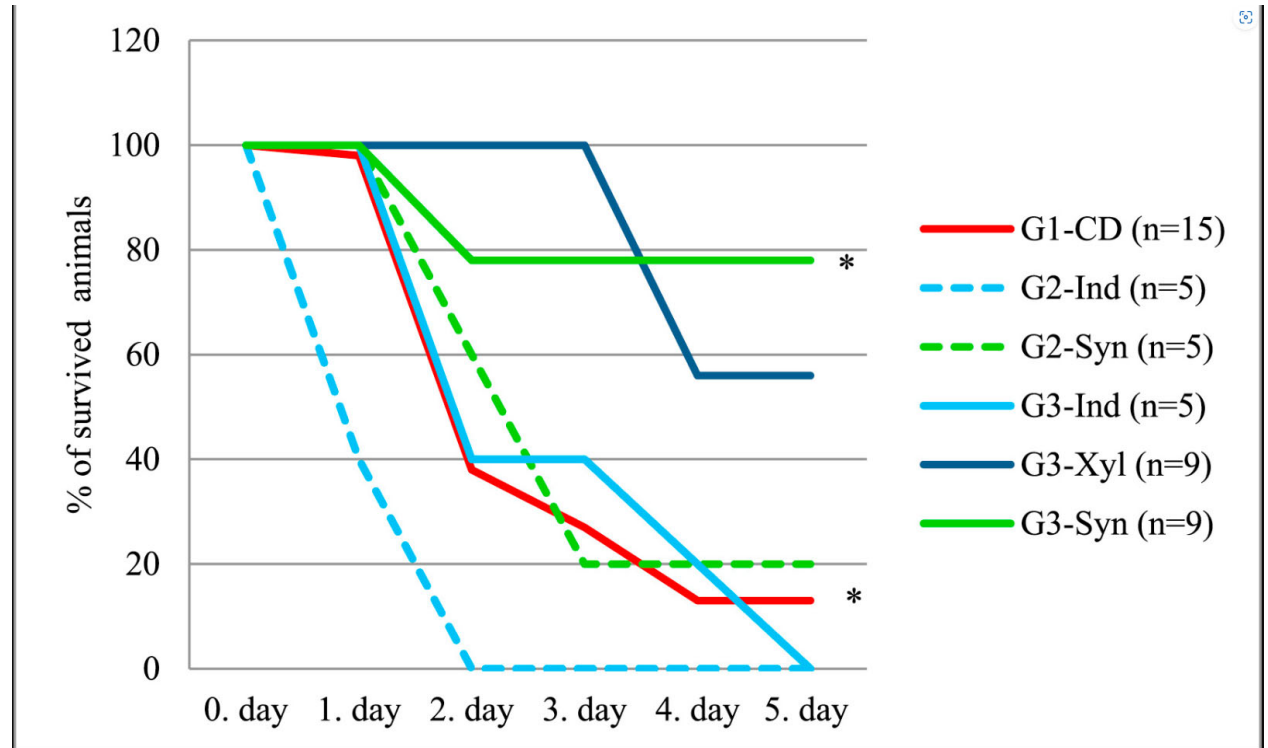
Suez J, et al Post-Antibiotic Gut Mucosal Microbiome Reconstitution Is Impaired by Probiotics and Improved by Autologous FMT. Cell. 2018 Sep 6;174(6):1406-1423.e16. doi: 10.1016/j.cell.2018.08.047. PMID: 30193113.



SYNBIOTICS



SYNBIOTICS



Neutralize
the toxin



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Antimicrobial Agents
and Chemotherapy




Secreted Compounds of the Probiotic *Bacillus clausii* Strain O/C Inhibit the Cytotoxic Effects Induced by *Clostridium difficile* and *Bacillus cereus* Toxins

Gabrielle Ripert, Silvia M. Racedo, Anne-Marie Elie, Claudine Jacquot, Philippe Bressollier,  Maria C. Urdaci

Université de Bordeaux, UMR 5248, Bordeaux Sciences Agro, Laboratoire de Microbiologie, Gradignan, France

Direct Inhibition of *C. diff*


Next-Generation Probiotics Targeting *Clostridium difficile* through Precursor- Directed Antimicrobial Biosynthesis

 Jennifer K. Spinler,^{a,b} Jennifer Auchtung,^c Aaron Brown,^{a,b}
Prapaporn Boonma,^{a,b} Numan Oezguen,^{a,b} Caná L. Ross,^{a,b} Ruth Ann Luna,^{a,b}
Jessica Runge,^{a,b} James Versalovic,^{a,b} Alex Peniche,^d Sara M. Dann,^d
Robert A. Britton,^c Anthony Haag,^{a,b} Tor C. Savidge^{a,b}

Department of Pathology & Immunology, Baylor College of Medicine, Houston, Texas, USA^a; Texas Children's Microbiome Center, Department of Pathology, Texas Children's Hospital, Houston, Texas, USA^b; Alkek Center for Metagenomics & Microbiome Research, Department of Molecular Virology & Microbiology, Baylor College of Medicine, Houston, Texas, USA^c; Department of Internal Medicine, University of Texas Medical Branch, Galveston, Texas, USA^d

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Department of Pathology & Immunology, Baylor College of Medicine, Houston, Texas, USA^a; Texas Children's Microbiome Center, Department of Pathology, Texas Children's Hospital, Houston, Texas, USA^b; Alkek Center for Metagenomics & Microbiome Research, Department of Molecular Virology & Microbiology, Baylor College of Medicine, Houston, Texas, USA^c; Department of Internal Medicine, University of Texas Medical Branch, Galveston, Texas, USA^d

lactobacillus reuteri

Direct
Inhibition of
C. diff

Inhibition of MRSA and of *Clostridium Difficile* by Durancin 61A: Synergy with Bacteriocins and Antibiotics

Hasna Hanchi, Riadh Hammami [✉](#), H  l  ne Gingras, Rim Kourda, Michel G Bergeron, Jeannette Ben Hamida, ...show all

Pages 205-212 | Received 09 Jun 2016, Accepted 03 Oct 2016, Published online: 20 Feb 2017

Direct
Inhibition of
C. diff

Inhibition of MRSA and of *Clostridium Difficile* by Durancin 61A: Synergy with Bacteriocins and Antibiotics

Hasna Hanchi, Riadh Hammami [✉](#), H  l  ne Gingras, Rim Kourda, Michel G Bergeron, Jeannette Ben Hamida, ...show all

Pages 205-212 | Received 09 Jun 2016, Accepted 03 Oct 2016, Published online: 20 Feb 2017

enterococcus durans

The Future – mechanisms

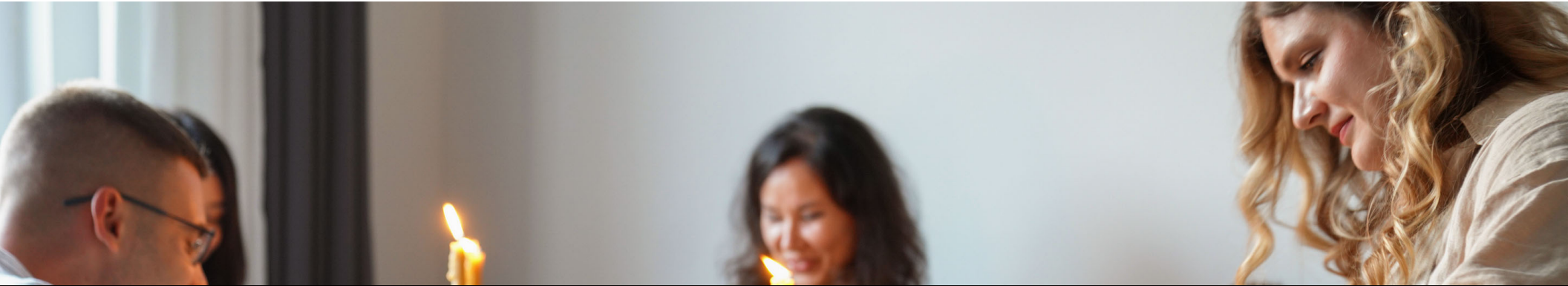
Not probiotic related

Restoration of bile acid homeostasis

Competition for resources

Refining fecal transplant

Bacteriophage therapy



SHOULD I TAKE PROBIOTICS?



Bottom Line



No evidence that probiotics help prevent primary infection with C.diff while receiving antibiotics.



They are unlikely to hurt patients but may slow down GI flora recovery.



Lots of room for research:
Patient populations, timing, strains, synbiotics, neutralizing the toxin, direct toxin inhibition, etc





Thank you!

Joy Engblade, MD, MMM, FACP
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