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'Gut health' and the microbiome in the popular press: a content analysis

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ABSTRACT

Objective Extensive research and important discoveries on the microbiome have led to a growth in media coverage. This study explores how the microbiome has been portrayed in press sources popular among American and Canadian audiences.

Design Content analysis.

Methods Using the FACTIVA Database, we compiled a finalised data set of (N=830) articles from press sources popular among American and Canadian audiences which were published between 1 January 2018 and 11 October 2019 and which contained at least one of the following search terms: 'microbiome', 'microbiota', 'gut health', 'healthy gut', 'unhealthy gut', 'gut bacteria', 'probiotic' or 'probiotics.' We performed content analysis on the articles to determine how often ideas of the microbiome were presented as beneficial, in which health contexts, and whether actions could be taken to reap stated benefits. We compared this portrayal of benefits with critical portrayals of the microbiome.

Results Almost all of the articles (94%) described health benefits associated with the microbiome with many (79%) describing actions which could be taken to reap stated benefits. Articles most often described health benefits in more broad, general context (34%) and most commonly outlined actions related to food/drug (45%) as well as probiotic (27%) intake. Only some articles (19%) provided microbiome-related critiques or limitations. Some of the articles (22%) were focused on highlighting specific research developments, and in these articles, critiques or limitations were more common.

Conclusions Articles discussing the microbiome published for American and Canadian audiences typically hype the microbiome's impact and popularise gut health trends while only offering a little in the way of communicating microbiome science. Lifestyle choices including nutrition, taking probiotics, stress management and exercise are often promoted as means of reaping the microbiome-related health benefits. The trend of actionable 'gut health' is foregrounded over more evidence-based descriptions of microbiome science.

Strengths and limitations of this study

- ► The study included a large data set of microbiome-related articles from media sources popular among Canadian and American audiences.
- ► Analysis was able to provide a detailed examination of how ideas around the microbiome are being portrayed for audiences.
- ► The data set represented only one kind of media output (articles in the popular press).
- ► The data set represented only English-language media.

INTRODUCTION

The term microbiome (derived from the Greek for 'small life') encompasses the microbial community that lives in and on our bodies, as well as the genes these microorganisms express and their metabolic activity. Over the past decade, technological advances in genetic sequencing have greatly accelerated our understanding of the human microbiome in health and disease. Fuelled by extensive research, important discoveries about the microbiome have steadily increased resulting in a growth in coverage by the popular media.[1–6] Researchers have been examining the roles that diverse microorganisms play in shaping our environments and impacting our health.[7 8] This includes exploration of how the microbiome may influence, for example, risk of obesity,[9] cancer[10] mental health outcomes,[11 12] and cardiometabolic and chronic disorders.[13] Other research has been investigating the microbiome's role in childhood asthma[14–16] as well as the how the use of antibiotics alters gut microbiota.[16–18] Currently, however, there are only a few microbiome-related interventions in use,[19 20] and critiques have been made around the hyping[21] of gut microbiome's potential impact in various contexts.[1 4 22–27] In particular, while research has indicated benefits for the use of probiotics in the context of paediatric antibiotic-associated diarrhoea,[28] critiques have also been raised about the exaggerated benefits attributed to probiotics.[29–31]

Concerns have also been raised around the popularisation and commercialisation of microbiome-related research, particularly with regard to its portrayal in the popular press and on social media.[3 4 6 12 22 32] Searches on Google, for example, yield an extensive assortment of microbiome-related discourse detailing products, therapies and research

developments, including gut makeovers, gut health diets, cleanses, microbiome reboots, probiotic products, skin regimens, cures for disease, and treatments such as colonic hydrotherapy or colonic reflorastation. It was also observed during the COVID-19 pandemic that ideas of gut health circulated often when immune-boosting was discussed.[33] In the case of faecal transplants, for example, while clinical research is progressing and showing signs of promise,[34] there has already been a case of a Canadian naturopath using the procedure to treat children with autism.[35] Research has shown that in the context of microbiota–gut–brain axis, articles in popular press simplify research and potential health impacts by highlighting 'dietary change (including probiotics) as a 'natural' means of changing the microbiome, and thus host health status.'[4] Further media research has indicated that microbiome coverage tends to focus on observational studies with less coverage given to clinical trials and systematic reviews.[32] Indeed, as noted by Reid *et al*[30] 'on a consistent basis scientists, media and industry misrepresent probiotics or make generalised statements that illustrate a misunderstanding of their utility and limitations.'

This project analysed portrayals of the microbiome in popular English-language news sources for American and Canadian audiences. We mapped out how often, and for which health topics and conditions, microbiome ideas were portrayed as beneficial. We then determined how often, and which actions were presented in order to obtain stated benefits. Lastly, we examined how often ideas of the microbiome were presented critically—that is, whether microbiome benefits or actions were presented as unproven, uncertain, ineffective or exaggerated.

METHODS

To examine how the microbiome was portrayed in the popular press, we performed directed content analysis[36] on articles published in newspaper sources popular among English-speaking American and Canadian audiences.[37] We used the FACTIVA Database to search for and download all articles published on a popular source list between 1 January 2018 and 11 October 2019 (the day of data collection), which contained at least one of the following search terms: 'microbiome', 'microbiota', 'gut health', 'healthy gut', 'unhealthy gut', 'gut bacteria', 'probiotic' or 'probiotics.' The search terms were chosen to capture microbiome-related media content created for general audiences without excluding the presence of more specific, research-focused content. The terms were finalised after various reviews of sample searches were performed. The time frame was selected as it was observed through FACTIVA searches and analysis on Google trends that the topics of 'microbiome' and 'gut health' had been steadily and increasingly receiving media attention from 2010 onwards with no apparent deviations. See online supplemental material 1 for search summary and list of sources including article counts.

After the removal of duplicates by FACTIVA, our initial dataset totalled 1395 articles, which were downloaded into and made accessible for analysis through the creation of customised platform. We then developed a coding frame using the inductive and deductive methods established by our team from previous studies,[38 39] which involved creating an initial coding frame, applying it to a large sample of the data, and modifying it as necessary to accurately capture the reality of the content. The coding frame had three primary objectives: (1) to determine if claims of health benefits were made in relation to the microbiome (including ideas captured with associated rhetoric, 'gut health', 'gut bacteria', 'probiotics', 'microbiota', etc), and if so, which health topics these benefits were described in relation to (ie, allergies, cancer, skin health, general health ('wellness'), etc); (2) to determine if the article described actions that could be taken to reap the claimed benefits, and if so, what these actions were (ie, eat certain foods, take probiotics, perform faecal transplants, etc); and (3) to determine if any benefits or research related to the microbiome might be portrayed as unproven, uncertain, ineffective or exaggerated. Through the sample analysis, specific categories to classify health benefits and related actions were developed, and three further coding categories were established: (1) whether the article's principal focus was on scientific research, either pertaining to a particular project or summarising a body of work; (2) whether the article discussed babies or children in relation to the microbiome; and (3) whether an article portrayed taking probiotics as beneficial without describing or connecting that probiotic intake to health benefits associated with the microbiome. See online supplemental material 1 for complete coding frame.

During coding, articles that were coded as irrelevant were removed, and the finalised total data set resulted in (N=830) articles. Articles were deemed irrelevant if they were duplicates, incomplete (eg, a 'gut health' headline embedded in an unrelated article), television show transcripts, or focused exclusively on animal biology or business developments. All articles were coded by two coders who met periodically to discuss any irregularities and reach consensus on disagreements. This process, as outlined and enacted in other research projects,[36 40 41] entailed coders being instructed to flag any articles which posed coding ambiguities, and on each meeting collaboratively coding these uncertainties through discussion and consensus. Once all articles had been coded, each coder performed an audit on a sample of articles coded by the other coder to ensure no significant issues were present.

Patient and public involvement

This research was done without patient or public involvement. Patients or members of the public were not invited to comment on the study design and were not consulted to interpret the results. Patients or members of the public were not invited to contribute to the writing or editing of

Figure 1: Microbiome benefits, critiques, research focus and baby/child focus in press articles popular among Canadian and American audiences (N=830)

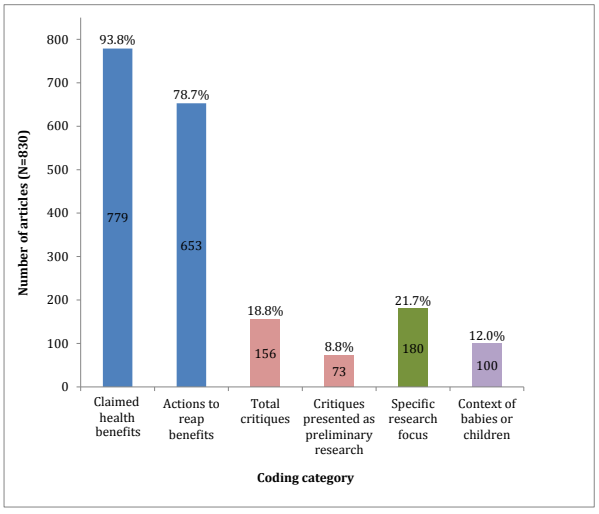

Figure 1 Microbiome benefits, critiques, research focus and baby/child focus in press articles popular among Canadian and American audiences (N=830).

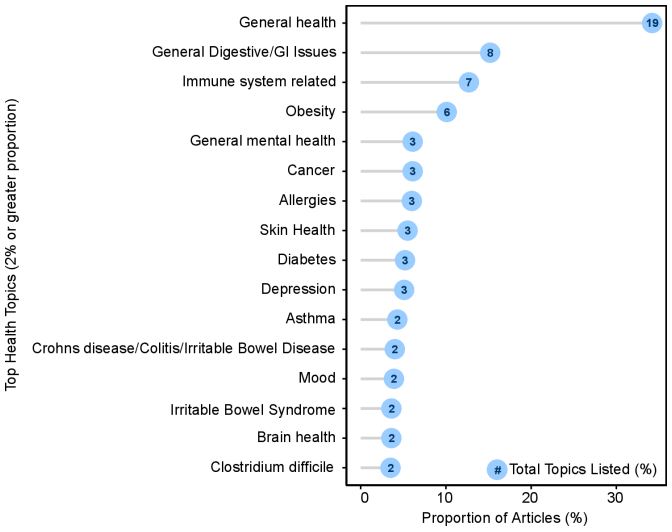

Figure 2 Health topics associated with the portrayal of the microbiome. GI, gastrointestinal.

this document for readability or accuracy. Funders had no input on the decision to publish nor the content.

RESULTS

The 830 articles were published in a total of 41 sources of which 143 (17.2%) came from 18 Canadian sources, 244 (29.4%) came from 18 American sources, and 443 (53.4%) came from the 5 sources based in the UK. Of the 830 articles, 439 (52.9%) were published in 2018, and 391 (47.1%) were published in 2019 (before 11 October). In describing the findings, we will use the term 'microbiome' as an all-encompassing term for all associated rhetoric.

It was considerably more common for articles to discuss the microbiome in a non-research-specific context (n=650, 78.3%) than to focus on specific research (n=180, 21.7%) (figure 1). In total, 779 articles (93.8%) discussed health benefits in relation to the microbiome. The vast majority (n=732, 88.2%) did so including (detailed) descriptions of gut health, the microbiome, gut bacteria, etc, while some articles (n=47, 5.7%) did so simply portraying probiotics as beneficial without mentioning 'gut health' or the 'microbiome.' Articles of this nature, for example, described probiotic-based health regimes of athletes, bars and restaurants offering probiotic health drinks, spas providing probiotic shots and raw water products containing beneficial probiotics.

Actions one could take to reap the health benefits associated with the microbiome appeared in n=653, 78.7% of all articles, and 89.2% of all articles that discussed microbiome benefits (figure 1). Some articles discussed the microbiome in the context of babies or children (n=100, 12%), with approximately half of these 100 articles (n=46) focused on specific research developments. Articles discussing the microbiome in the context of babies or children made up a quarter (25.6%) of all research-focused articles. A total of 156 articles (18.8%) provided critiques, suggesting that either generally or in specific contexts, the health benefits and/or current research of the microbiome might be unproven, uncertain, ineffective or exaggerated (figure 1).

In total, there were more than 135 different health topics for which the microbiome was portrayed as beneficial (see online supplemental material 1 for complete list). The health topics most commonly associated with the microbiome are presented in figure 2 and table 1. Some topics appearing in fewer than 4.0% of articles included anxiety (n=24, 3.3%), Alzheimer's disease (n=15, 2.0%), Parkinson's disease (n=14, 1.9%), autism (n=12, 1.6%), dementia (n=8, 1.1%) and menopause (n=8, 1.1%). The majority of the articles discussed the microbiome in relation to one health topic (n=455, 62.2%), while 86 (11.8%) connected the microbiome with four or more health topics in the same article. Some singular articles, for example, discussed the microbiome in relation to a wide range of health topics such as allergies, diabetes, obesity, Parkinson's disease, asthma, autism, Alzheimer's disease, etc.

The health topic of 'general health' was categorised in cases where an article would state, for example, that certain foods were 'more beneficial for our gut health than other sources,' that certain foods 'maintain a health balance of gut bacteria,' that a particular vitamin product 'boosts gut health,' or that helpful health plans could be 'built on a person's gut microbiome.' In cases such as these, there was typically no further reference to what, or how, the microbiome assists, with the articles instead simply stating that 'gut health' or the 'microbiome' was something valuable and beneficial to one's health and should therefore be 'maintained,' 'balanced,' 'strengthened,' etc.

Of articles describing these microbiome-related health benefits (n=732), the vast majority described actions which

Table 1 Health topics where microbiome benefits were portrayed (min 4.0% of articles with health benefits)

Health topics	# of articles	% of total health topics listed (n=1502)	% of total articles (n=830)
General health	284	18.9	34.2
General digestive/GI issues	126	8.4	15.2
Immune system related	105	7.0	12.7
Obesity	84	5.6	10.1
Cancer	51	3.4	6.1
General mental health	51	3.4	6.1
Allergies	50	3.3	6.0
Skin health	46	3.1	5.5
Diabetes	43	2.9	5.2
Depression	42	2.8	5.1
Asthma	36	2.4	4.3
Crohn's/colitis/ inflammatory bowel disease	33	2.2	4.0
Mood	32	2.1	3.9
Brain health	30	2.0	3.6
Irritable bowel syndrome	30	2.0	3.6
Clostridium difficile	29	1.9	3.5

GI, gastrointestinal.

could be taken to reap said benefits (n=653, 89.2%). In total, there were more than 85 unique actions listed in the articles (see online supplemental material 1 for complete list). The five most common actions included food/drink intake (n=373, 44.9%), taking probiotics (n=174, 21.0%), avoiding certain foods/drink (n=85, 10.2%) and avoiding antibiotics (n=55, 6.6%). The most common actions are presented in figure 3 and table 2. Incorporating the additional articles which detailed the beneficial qualities of probiotics without making an explicit link to gut health or the microbiome resulted in a total of 221 (26.6%) articles portraying probiotics intake as beneficial (figure 3). It was not the goal to identify all of the specific foods and drinks listed to improve gut health, but some commonly listed foods included fermented foods such as kombucha, yoghurt, kefir, kimchi, etc as well as lentils, fresh fruits and vegetables.

The actions of 'avoidance' were illustrated both implicitly and explicitly, with implicit cases typically detailing the potentially harmful effects of certain actions. For example, with food avoidance, links were made between artificial sweeteners and unhealthy gut bacteria and their

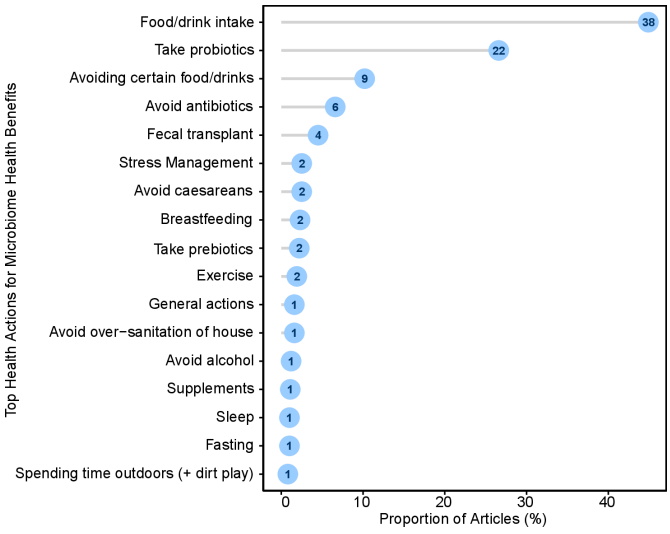

Figure 3 Health actions one can take to reap microbiome benefits.

associations with obesity and other diseases. Similarly, negative emotions were linked to being triggered by gut health issues stemming from too much sugar or caffeine. Having caesareans, and thus not having babies exposed to the healthy bacteria of vaginal birth, were portrayed as

Table 2 Most commonly mentioned actions that could be taken to reap microbiome health benefits (n=653)

Actions	# of articles	% of total actions listed (n=983)	# of total articles (n=830)
Food/drink intake	373	37.9	44.9
Take probiotics*	174	17.7	21.0
Avoid certain food/drinks	85	8.6	10.2
Avoid antibiotics	55	5.6	6.6
Faecal transplant	37	3.8	4.5
Avoid caesareans	21	2.1	2.5
Stress management	21	2.1	2.5
Breast feeding	19	1.9	2.3
Take prebiotics	18	1.8	2.2
Exercise	16	1.6	1.9
Avoid oversanitation of house	13	1.3	1.6
General actions	13	1.3	1.6
Avoid alcohol	10	1.0	1.2
Supplements	9	0.9	1.1
Fasting	8	0.8	1.0
Sleep	8	0.8	1.0
Spending time outdoors (incl. dirt play)	7	0.7	0.8

*Excluding additional 47 articles where probiotics were portrayed as beneficial without mentioning gut health ideas.

negatively influencing a baby's gut microbiome, exposing them to an increased risk of, for example, obesity, asthma, allergies and diabetes. Regarding antibiotics, it was claimed that they could cause, for example, 'irreversible damage to crucial gut bacteria,' or that increasing rates of colorectal cancer were potentially a result of altering the gut microbiome with antibiotics.

There was a considerably smaller percentage of articles which stated the health benefits or current research related to the microbiome might be unproven, uncertain, ineffective or exaggerated (n=156, 18.8%). Of these 156 articles, nearly half (n=73, 46.8%) critiqued microbiome developments on the grounds of developments or findings being preliminary research, thereby noting that research was still developing and, in some cases, that more evidence would be needed to translate findings into practice. The remaining 83 (53.2% of the critical articles, and 10.0% of the total articles) critiqued ideas around the microbiome more broadly, illustrating a lack of scientific evidence and countering perceived hype around the concepts. There were articles, for example, which referenced studies showing how 'adjusting the composition of the microbiome is a complex matter,' articles stating that 'probiotics are useless,' articles doubting that autism could be treated with 'microbes or pills,' or articles casting doubt on the ability of probiotic-rich yoghurt to alter vaginal flora.

There were a few notable distinctions between the articles primarily focused on specific research (n=180, 21.7%) and the remaining articles which did not (n=650, 78.3%). First, as previously mentioned, articles discussing the microbiome in the context of babies/children constituted 25.6% of articles focused on research, but were present in only 8.3% of other articles not specifically focused on research. Both research-focused articles and more general articles described health benefits in relation to the microbiome with similar frequency (90.6% and 87.5%, respectively), and non-research-specific articles detailed microbiome-related actions (80.9%) only slightly more often than research-focused articles (70.6%). Research-specific articles, however, discussed critical perspectives of the microbiome (30.0%) approximately twice as often as general articles (15.7%).

DISCUSSION

The findings from this research demonstrate the presence of microbiome hype[3 25 30] in the popular press of American and Canadian audiences. The overwhelming majority of articles (93.8%) either describe health benefits associated with the microbiome or list health benefits associated with taking probiotics. When detailing health benefits, the vast majority of these articles (89.2%) list actions that can be taken to obtain these claimed benefits. As there is demonstrable public interest in the relationship of the microbiome to one's health, and with considerable interesting research underway, it is unsurprising that numerous health benefits are detailed in articles. Still, a weakness in the way this science is being communicated is the fact that less than 19% of the articles suggest that current microbiome science or applications are unproven, ineffective, exaggerated or requiring more research. This occurs with even less frequency in general articles where the central focus is not detailing specific research. And, as noted in the introduction, despite the abundance of promising research, there are still few microbiome-related clinical applications ready for use.

This research finds the popular press portraying the microbiome as influential in over 135 health conditions/diseases including digestive issues, obesity, cancer, allergies, skin health, diabetes, asthma, irritable bowel syndrome, and a range of mental health topics including depression, mood, 'brain health', as well as behaviour and attention deficit hyperactivity disorder in children. It was linked to discussions of colds, headaches, health during pregnancy, tooth decay, blood circulation, jet lag, eating disorders, sleep, menopause, dementia and athletic performance. *Clostridium difficile*, one of the few ailments for which microbiome treatments are in practice (specifically faecal microbiota transplant) and supported by evidence,[42] is also discussed, but only in a small number of articles (3.5%).

Most often, the benefits of a 'healthy gut' are simply presented as a given. Certain foods (eg, yoghurt, kombucha) and particular practices (eg, taking probiotics) are presented as being beneficial to 'gut health,' though typically no details are provided (eg, research showing benefit in some contexts[28]) about why this is so or what the particular health benefits might be. In this regard, the ideas around the microbiome, particularly when expressed as 'gut health,' appear oversimplified and function like rhetorical products, signalling and bolstering the microbiome trend, generating attention, attracting readers and promoting products. This phenomenon, sometimes referred to as a 'health halo,'[43] has been similarly observed in other topics like 'immune boosting'[31] and in other research on portrayals of the microbiome in the media.[4]

Actions most commonly described to reap the health benefits associated with the microbiome typically focused on lifestyle topics, including nutrition, stress management, general actions ('maintaining', 'strengthening', 'balancing', 'boosting', etc), exercise and sleep. Additionally, health benefits associated with probiotic intake had a large presence in the data set, in 27% of all articles. It was common in these contexts, as well as when promoting faecal transplants and breast feeding or when problematising the impact of antibiotic use on the microbiome, to highlight research or take quotes from healthcare professionals. Research of this precise nature is being conducted in numerous institutions, whereby faecal transplants are showing signs of effectiveness in particular circumstances,[32] and antibiotic intake can negatively influence the microbiome.[44–47] Further, some lifestyle activities, such as nutrition, can play a role in altering the microbiome even though accurately determining

the impact remains a challenge.[48 49] In sum, however, while the articles often mention research projects and quote scientists and healthcare practitioners, the overall portrayal of the microbiome science appears to be either oversimplified or greatly exaggerated, serving instead as a means to promote and validate the lifestyle ideas and products contained in the articles. Indeed, less than 19% of all articles provided any critique of the microbiome, with general articles doing so even less frequently (15.7%) than articles focused on specific research developments (30.0%).

Further, in cases where a critique was evident, nearly half (46.8%) portrayed limitations to the microbiome as being simply a case of preliminary research, which may or may not influence how the diverse readership of the popular press interprets the realistic state of the scientific developments.[50–54] Specifically, it may give a false impression of a potential application's readiness, for example, in cases of the microbiome's influence on autism or mental health.[4] The hyping of science, however, typically involves numerous participants[21 48] and it is therefore misguided to isolate singular actors as the propagators of information distortion such as the authors of the articles in the popular press. Indeed, extensive research has shown how information dissemination through social media creates an abundance of information accuracy challenges.[55–58]

Limitations

This study was limited in its ability to capture and analyse all of the microbiome discourses relevant to audiences. Covering the popular press's portrayal of the microbiome during a period when the topic was popular has provided insights into how microbiome science is being communicated. Future research could replicate this study in other regions to see whether the same trend persists or whether some press sources, in some contexts, portray the microbiome in significantly different manners. Additionally, other research projects could explore whether these portrayals are similar or different on popular social media platforms such as Instagram, Twitter or TikTok.

CONCLUSION

Microbiome articles published for North American audiences typically popularise gut health trends while only offering a little in the way of communicating the science. It is promising to see cases where some complexities of the research were presented alongside ongoing applications, but the overall number of articles which did this were few. The ongoing communication of accurate science will require a more concerted effort from all of those involved in the process.

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Contributors ARM and TC designed the study with input from ST. ARM collected the data and performed the analysis. ARM and TC interpreted the data. ARM, TC and ST were involved in drafting and revising the manuscript. All authors approved the final version to be published and agreed to be accountable for all aspects of the work.

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Provenance and peer review Not commissioned; externally peer reviewed.

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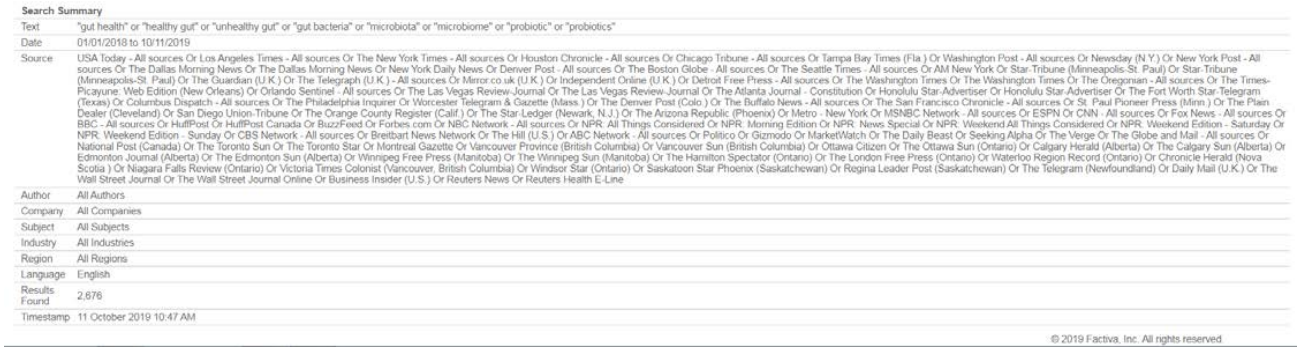
Supplementary Materials

FACTIVA search summary



Search Summary	
Text	"gut health" or "healthy gut" or "unhealthy gut" or "gut bacteria" or "microbiota" or "microbiome" or "probiotic" or "probiotics"
Date	01/01/2018 to 10/11/2019
Source	USA Today - All sources Or Los Angeles Times - All sources Or The New York Times - All sources Or Houston Chronicle - All sources Or Chicago Tribune - All sources Or Tampa Bay Times (Fla.) Or Washington Post - All sources Or Newsday (N.Y.) Or New York Post - All sources Or The Dallas Morning News Or The Dallas Morning News Or New York Daily News Or Denver Post - All sources Or The Boston Globe - All sources Or The Seattle Times - All sources Or AM New York Or Star-Tribune (Minneapolis-St. Paul) Or Star-Tribune (Minneapolis-St. Paul) Or The Guardian (U.K.) Or The Telegraph (U.K.) - All sources Or Mirror.co.uk (U.K.) Or Independent Online (U.K.) Or Detroit Free Press - All sources Or The Washington Times Or The Washington Times Or The Oregonian - All sources Or The Times-Picayune: Web Edition (New Orleans) Or Orlando Sentinel - All sources Or The Las Vegas Review-Journal Or The Las Vegas Review-Journal Or The Atlanta Journal - Constitution Or Honolulu Star-Advertiser Or Honolulu Star-Advertiser Or The Fort Worth Star-Telegram (Texas) Or Columbus Dispatch - All sources Or The Philadelphia Inquirer Or Worcester Telegram & Gazette (Mass.) Or The Denver Post (Colo.) Or The Buffalo News - All sources Or The San Francisco Chronicle - All sources Or St. Paul Pioneer Press (Minn.) Or The Plain Dealer (Cleveland) Or San Diego Union-Tribune Or The Orange County Register (Calif.) Or The Star-Ledger (Newark, N.J.) Or The Arizona Republic (Phoenix) Or Metro - New York Or MSNBC Network - All sources Or ESPN Or CNN - All sources Or Fox News - All sources Or BBC - All sources Or HuffPost Or HuffPost Canada Or BuzzFeed Or Forbes.com Or NBC Network - All sources Or NPR: All Things Considered Or NPR: Morning Edition Or NPR: News Special Or NPR: Weekend All Things Considered Or NPR: Weekend Edition - Saturday Or NPR: Weekend Edition - Sunday Or CBS Network - All sources Or Breitbart News Network Or The Hill (U.S.) Or ABC Network - All sources Or Politico Or Gizmodo Or MarketWatch Or The Daily Beast Or Seeking Alpha Or The Verge Or The Globe and Mail - All sources Or National Post (Canada) Or The Toronto Sun Or The Toronto Star Or Montreal Gazette Or Vancouver Province (British Columbia) Or Vancouver Sun (British Columbia) Or Ottawa Citizen Or The Ottawa Sun (Ontario) Or Calgary Herald (Alberta) Or The Calgary Sun (Alberta) Or Edmonton Journal (Alberta) Or The Edmonton Sun (Alberta) Or Winnipeg Free Press (Manitoba) Or The Winnipeg Sun (Manitoba) Or The Hamilton Spectator (Ontario) Or The London Free Press (Ontario) Or Waterloo Region Record (Ontario) Or Chronicle Herald (Nova Scotia) Or Niagara Falls Review (Ontario) Or Victoria Times Colonist (Vancouver, British Columbia) Or Windsor Star (Ontario) Or Saskatoon Star Phoenix (Saskatchewan) Or Regina Leader Post (Saskatchewan) Or The Telegram (Newfoundland) Or Daily Mail (U.K.) Or The Wall Street Journal Or The Wall Street Journal Online Or Business Insider (U.S.) Or Reuters News Or Reuters Health E-Line
Author	All Authors
Company	All Companies
Subject	All Subjects
Industry	All Industries
Region	All Regions
Language	English
Results Found	2,676
Timestamp	11 October 2019 10:47 AM

Sources and count table

Calgary Herald	CAN	12	
Edmonton Journal	CAN	2	
Montreal Gazette	CAN	13	
National Post	CAN	2	
Regina Leader Post	CAN	1	
Saskatoon Star Phoenix	CAN	1	
The Globe and Mail	CAN	27	
The Hamilton Spectator	CAN	30	
The London Free Press	CAN	2	
The Ottawa Sun	CAN	2	
The Toronto Star	CAN	11	
The Toronto Sun	CAN	3	
The Winnipeg Sun	CAN	1	
Vancouver Province	CAN	5	
Vancouver Sun	CAN	6	
Victoria Times Colonist	CAN	15	
Waterloo Region Record	CAN	4	
Winnipeg Free Press	CAN	6	
Daily Mail	UK	82	
Independent Online	UK	53	
Mirror.co.uk	UK	68	
Telegraph	UK	170	
The Guardian	UK	70	
Business Insider	USA	16	
CBS News: Evening News	USA	1	
CNN Wire	USA	20	
Forbes.com	USA	7	
MarketWatch	USA	4	
New York Daily News	USA	1	
New York Post	USA	19	

New York Times	USA	21	
Reuters News	USA	23	
Star-Tribune	USA	13	
Tampa Bay Times	USA	7	
The Atlanta Journal - Constitution	USA	4	
The Boston Globe	USA	17	
The New York Times	USA	30	
The Philadelphia Inquirer	USA	10	
The Wall Street Journal	USA	13	
The Washington Post	USA	33	
USA Today	USA	5	
*			
	USA	18	
	CAN	18	
	UK	5	
			41
TOTALS	CAN	143	17.2%
	USA	244	29.4%
	UK	443	53.4%
		830	100.0%

**with a large number of articles coming from one source (The Telegraph), analysis was conducted to conclude that the singular source was not displaying a trend of findings different from that of the remaining sources*

Gut Health/Microbiome Coding Frame October 2019 / HLI, University of Alberta

Overview coding for context

1. Choose1: Is the article Relevant or Irrelevant? (Irrelevant articles include: one of the search terms appearing in text with no supporting text or elaboration; transcripts of radio or tv shows; one of the search terms used solely in the context of animal health; duplicate of previously read article)

2. Is the article's main focus highlighting research? Yes/No

3. Does the article include a discussion of babies/children in relation to gut health (including all search terms included)?

Principle content coding

1. Does the article make claims of health benefits related to gut health (gut bacteria), probiotics, or the microbiome (microbiota)? Yes/No

   1b. If yes in #1, what health benefits are listed? [choose all that apply – always code a specific benefit if possible before coding for a more general category]

- Brain health (memory, learning, cognitive abilities, etc.)
- General health (no specific items listed but seen as valuable for health, and also, general phrasing such as “optimal gut health”; “optimal health”; “improve wellness”; “manage stress”, “good wellbeing, etc.)
- General mental health (“mental health”, but no specifics mentioned, etc.)
- General Digestive/GI Issues (bloating, gas (flatulence), diarrhea, acid reflux, leaky gut also “aiding”, “helping with”, etc.)
- Skin health (including cosmetic and more serious issues like eczema, psoriasis or other forms of dermatitis)
- Allergies
- Alzheimer’s disease
- Anorexia
- Anxiety
- Arthritis
- Behaviour (children)
- Cancer
- Clostridium difficile (C. diff)
- Colds (“common colds”, etc.)
- Colic
- Crohn’s disease/Colitis/Irritable Bowel Disease
- Dementia
- Depression
- Diabetes
- Energy related (including fatigue, and Chronic Fatigue Syndrome (CFS))
- Fibromyalgia
- Headaches
- Heart related (including heart disease and artery issues)
- Immune system related (“boosting”, improving, fighting off infection, etc.)
- Irritable Bowel Syndrome (IBS)
- Menopause (including hormonal imbalances)
- Mood (improving)
- Multiple Sclerosis
- Obesity (including weight management (weight loss, etc.)
- Oral disease
- Parkinson’s disease
- Pain (including chronic pain, joint pain)
- Pharmaceutical drug development
- Pharmaceutical drug metabolizing
- Pregnancy health (including avoiding premature delivery)
- Other [fill in]

2. Does the article provide information (actions one can take) regarding how an individual can reap benefits related to gut health (gut bacteria), probiotics, or the microbiome (microbiota)? Yes/No

   2b) If yes in #2, what actions are mentioned? [list] (e.g. eating certain foods, fecal transplants, etc.)? [choose all that apply]

- Food/drink intake (including fostering diversity, and eating schedule/advice related to food timing, chewing, etc.)
- Avoiding certain food/drinks
- Breastfeeding
- Take probiotics
- Take prebiotics
- General actions ("monitor", "look after"; "take care of", etc.)
- Avoid antibiotics
- Avoid caesareans (including be wary of; benefits lost if, etc.)
- Avoid over-sanitation of house (including avoiding chemicals in cleaning products)
- Avoid smoking (including stop smoking)
- Exercise
- Fecal transplant (including pills (i.e. "poop pills"))
- Massage
- Sinus microbiome transplant
- Sleep related (get more, get better, etc.)
- Weight management ("control", etc.)
- Yoga
- Vaginal seeding
- Other [fill in]

3. Does the article state, in any form, that the benefits or current research related to gut health (gut bacteria), probiotics, or the microbiome (microbiota) might be unproven, ineffective or exaggerated? Yes/No

   3a) If yes, is this rhetoric described as "(only) preliminary research", "developing research", "early stage research", etc.

4. (ADDITION TO #1, attached to coding platform) Does the article portray probiotics as beneficial without making links to ideas of the microbiome/gut health? Yes/No

Complete list of Health Topics

	Health topics	# of articles	(n=732)	n=830	1502
1	General health	284	38.8%	34.2%	18.91%
2	General Digestive/GI Issues	126	17.2%	15.2%	8.39%
3	Immune system related	105	14.3%	12.7%	6.99%
4	Obesity	84	11.5%	10.1%	5.59%
5	Cancer	51	7.0%	6.1%	3.40%
6	General mental health	51	7.0%	6.1%	3.40%
7	Allergies	50	6.8%	6.0%	3.33%
8	Skin Health	46	6.3%	5.5%	3.06%
9	Diabetes	43	5.9%	5.2%	2.86%

10	Depression	42	5.7%	5.1%	2.80%
11	Asthma	36	4.9%	4.3%	2.40%
12	Crohns disease/Colitis/Irritable Bowel Disease	33	4.5%	4.0%	2.20%
13	Mood	32	4.4%	3.9%	2.13%
14	Brain health	30	4.1%	3.6%	2.00%
15	Irritable Bowel Syndrome	30	4.1%	3.6%	2.00%
16	Clostridium difficile	29	4.0%	3.5%	1.93%
17	Inflammation	26	3.6%	3.1%	1.73%
18	Anxiety	24	3.3%	2.9%	1.60%
19	Inflammatory Bowel Disease	21	2.9%	2.5%	1.40%
20	Heart related	18	2.5%	2.2%	1.20%
21	Alzheimers disease	15	2.0%	1.8%	1.00%
22	Energy related	14	1.9%	1.7%	0.93%
23	Parkinsons disease	14	1.9%	1.7%	0.93%
24	Autism	12	1.6%	1.4%	0.80%
25	Metabolism	11	1.5%	1.3%	0.73%
26	Metabolic Disorder	10	1.4%	1.2%	0.67%
27	Autoimmune Diseases (disorders)	9	1.2%	1.1%	0.60%
28	Diarrhea	9	1.2%	1.1%	0.60%
29	Intestinal Permeability (leaky gut)	9	1.2%	1.1%	0.60%
30	Sleep	9	1.2%	1.1%	0.60%
31	Weight management	9	1.2%	1.1%	0.60%
32	Dementia	8	1.1%	1.0%	0.53%
33	Menopause	8	1.1%	1.0%	0.53%
34	Multiple Sclerosis	7	1.0%	0.8%	0.47%
35	Stress	7	1.0%	0.8%	0.47%
36	Athletic Performance/Recovery	6	0.8%	0.7%	0.40%
37	Liver Disease	6	0.8%	0.7%	0.40%
38	Vitamin Absorption	6	0.8%	0.7%	0.40%
39	Antibiotic resistance (and recovery)	5	0.7%	0.6%	0.33%
40	Arthritis	5	0.7%	0.6%	0.33%
41	Metabolic Syndrome	5	0.7%	0.6%	0.33%
42	Constipation	4	0.5%	0.5%	0.27%
43	Diverticulitis	4	0.5%	0.5%	0.27%
44	Eczema in Children	4	0.5%	0.5%	0.27%
45	ADHD	3	0.4%	0.4%	0.20%

46	Appetite	3	0.4%	0.4%	0.20%
47	Bipolar Disorder	3	0.4%	0.4%	0.20%
48	cardiovascular disease	3	0.4%	0.4%	0.20%
49	Colds	3	0.4%	0.4%	0.20%
50	Headaches	3	0.4%	0.4%	0.20%
51	Influenza	3	0.4%	0.4%	0.20%
52	Lyme Disease	3	0.4%	0.4%	0.20%
53	Oral Hygiene	3	0.4%	0.4%	0.20%
54	PKU	3	0.4%	0.4%	0.20%
55	Pregnancy health	3	0.4%	0.4%	0.20%
56	Preventative measures (disease)	3	0.4%	0.4%	0.20%
57	Tooth decay	3	0.4%	0.4%	0.20%
58	Vaginal issues	3	0.4%	0.4%	0.20%
59	Aging	2	0.3%	0.2%	0.13%
60	Behaviour	2	0.3%	0.2%	0.13%
61	Blood circulation	2	0.3%	0.2%	0.13%
62	Bone Health (density)	2	0.3%	0.2%	0.13%
63	Cholesterol	2	0.3%	0.2%	0.13%
64	Eating disorders	2	0.3%	0.2%	0.13%
65	E-coli	2	0.3%	0.2%	0.13%
66	Fibromyalgia	2	0.3%	0.2%	0.13%
67	Gene Activity	2	0.3%	0.2%	0.13%
68	General Beauty and Apperance	2	0.3%	0.2%	0.13%
69	HIV	2	0.3%	0.2%	0.13%
70	Immunity	2	0.3%	0.2%	0.13%
71	Infections (general)	2	0.3%	0.2%	0.13%
72	Jet lag	2	0.3%	0.2%	0.13%
73	Migraine	2	0.3%	0.2%	0.13%
74	Motor Nueron Disease	2	0.3%	0.2%	0.13%
75	Oral disease	2	0.3%	0.2%	0.13%
76	Pain	2	0.3%	0.2%	0.13%
77	Seratonin Levels	2	0.3%	0.2%	0.13%
78	ulcers	2	0.3%	0.2%	0.13%
79	Urea Cycle Disorders	2	0.3%	0.2%	0.13%
80	Urinary Tract Infections	2	0.3%	0.2%	0.13%
81	Polycystic Ovary Syndrome	2	0.3%	0.2%	0.13%

82	Alcohol Cravings	1	0.1%	0.1%	0.07%
83	Anemia	1	0.1%	0.1%	0.07%
84	Antioxidant Status	1	0.1%	0.1%	0.07%
85	Appendicitis	1	0.1%	0.1%	0.07%
86	Appetite	1	0.1%	0.1%	0.07%
87	artery health	1	0.1%	0.1%	0.07%
88	bloodstream infections	1	0.1%	0.1%	0.07%
89	Celiac Disease	1	0.1%	0.1%	0.07%
90	Chemotherapy Recovery	1	0.1%	0.1%	0.07%
91	Childhood Development	1	0.1%	0.1%	0.07%
92	Cholera	1	0.1%	0.1%	0.07%
93	Cognitive Disorder	1	0.1%	0.1%	0.07%
94	Dental Health/Gingivitis	1	0.1%	0.1%	0.07%
95	Emotional Responses	1	0.1%	0.1%	0.07%
96	Flu vaccine effectiveness	1	0.1%	0.1%	0.07%
97	Gluten Intolerances	1	0.1%	0.1%	0.07%
98	Glycemic Control	1	0.1%	0.1%	0.07%
99	Gonorrhoea	1	0.1%	0.1%	0.07%
100	Gum Disease	1	0.1%	0.1%	0.07%
101	H. Pylori Eradication	1	0.1%	0.1%	0.07%
102	Hair loss	1	0.1%	0.1%	0.07%
103	Hairy tongue	1	0.1%	0.1%	0.07%
104	Healing system	1	0.1%	0.1%	0.07%
105	Heartburn	1	0.1%	0.1%	0.07%
106	Hepatic Encephalopathy	1	0.1%	0.1%	0.07%
107	Hormonal Bloating	1	0.1%	0.1%	0.07%
108	Hyperammonemia	1	0.1%	0.1%	0.07%
109	Hypertension	1	0.1%	0.1%	0.07%
110	Improve focus	1	0.1%	0.1%	0.07%
111	Infant Breastfeeding	1	0.1%	0.1%	0.07%
112	Infertility	1	0.1%	0.1%	0.07%
113	Interstitial Cystitis	1	0.1%	0.1%	0.07%
114	Iron Deficiency	1	0.1%	0.1%	0.07%
115	Kidney Disease	1	0.1%	0.1%	0.07%
116	Kidney Stones	1	0.1%	0.1%	0.07%
117	Medication Rashes	1	0.1%	0.1%	0.07%

118	Melanoma	1	0.1%	0.1%	0.07%
119	Menstral health	1	0.1%	0.1%	0.07%
120	motor neurone disease	1	0.1%	0.1%	0.07%
121	Mucus Colitis	1	0.1%	0.1%	0.07%
122	Nervous system related	1	0.1%	0.1%	0.07%
123	Osteoarthritis	1	0.1%	0.1%	0.07%
124	Osteoporosis	1	0.1%	0.1%	0.07%
125	Pharmaceutical drug development	1	0.1%	0.1%	0.07%
126	Pharmaceutical drug metabolizing	1	0.1%	0.1%	0.07%
127	phenylketonuria	1	0.1%	0.1%	0.07%
128	Pnemonia	1	0.1%	0.1%	0.07%
129	Pouchitis	1	0.1%	0.1%	0.07%
130	Premature Births	1	0.1%	0.1%	0.07%
131	psoriasis	1	0.1%	0.1%	0.07%
132	rehab	1	0.1%	0.1%	0.07%
133	Respiratory infections	1	0.1%	0.1%	0.07%
134	Schizophrenia	1	0.1%	0.1%	0.07%
135	Sore Tongue	1	0.1%	0.1%	0.07%
136	Thyroid Condition	1	0.1%	0.1%	0.07%
137	Transplant Success	1	0.1%	0.1%	0.07%
138	UTIs	1	0.1%	0.1%	0.07%

Complete list of actions

	Health Action	# articles	out of 653 articles with actions	830	983
1	Food/drink intake	373	57.1%	44.9%	37.9%
2	Take probiotics	174	26.6%	21.0%	17.7%
3	Avoiding certain food/drinks	85	13.0%	10.2%	8.6%
4	Avoid antibiotics	55	8.4%	6.6%	5.6%
5	Fecal transplant	37	5.7%	4.5%	3.8%
6	Avoid caesareans	21	3.2%	2.5%	2.1%
7	Stress Management	21	3.2%	2.5%	2.1%
8	Breastfeeding	19	2.9%	2.3%	1.9%
9	Take prebiotics	18	2.8%	2.2%	1.8%
10	Exercise	16	2.5%	1.9%	1.6%
11	Avoid over-sanitation of house	13	2.0%	1.6%	1.3%
12	General actions	13	2.0%	1.6%	1.3%
13	Avoid alcohol	10	1.5%	1.2%	1.0%
14	Supplements	9	1.4%	1.1%	0.9%
15	Fasting	8	1.2%	1.0%	0.8%

16	Sleep	8	1.2%	1.0%	0.8%
17	Spending time outdoors (+ dirt play)	7	1.1%	0.8%	0.7%
18	Medications	5	0.8%	0.6%	0.5%
19	Yoga	4	0.6%	0.5%	0.4%
20	Avoid acid-suppressing drugs	3	0.5%	0.4%	0.3%
21	Colonics	3	0.5%	0.4%	0.3%
22	Detoxes	3	0.5%	0.4%	0.3%
23	Avoid Pollution	2	0.3%	0.2%	0.2%
24	Avoid proton-pump inhibitors	2	0.3%	0.2%	0.2%
25	bacteriophages	2	0.3%	0.2%	0.2%
26	Medication Research and Development	2	0.3%	0.2%	0.2%
27	Raw water	2	0.3%	0.2%	0.2%
28	Use Eco-Friendly Household Cleaners	2	0.3%	0.2%	0.2%
29	Mayr Method	2	0.3%	0.2%	0.2%
30	Personalized diet	2	0.3%	0.2%	0.2%
31	Vaginal Seeding	2	0.3%	0.2%	0.2%
32	Monitor poo (and schedule)	2	0.3%	0.2%	0.2%
33	Avoid Stomach Acid Blockers	2	0.3%	0.2%	0.2%
34	Gut Health Clinics	2	0.3%	0.2%	0.2%
35	Eat breakfast	2	0.3%	0.2%	0.2%
36	Eat slowly	1	0.2%	0.1%	0.1%
37	Hydration	1	0.2%	0.1%	0.1%
38	IV/Drip therapy	1	0.2%	0.1%	0.1%
39	Vaginal Birth	1	0.2%	0.1%	0.1%
40	CBD Oil	1	0.2%	0.1%	0.1%
41	Adult Consumption of Breast Milk	1	0.2%	0.1%	0.1%
42	Pilates	1	0.2%	0.1%	0.1%
43	Liver Treatments	1	0.2%	0.1%	0.1%
44	Animal Saliva	1	0.2%	0.1%	0.1%
45	Anti-microbials	1	0.2%	0.1%	0.1%
46	Appendix Removal	1	0.2%	0.1%	0.1%
47	Pepperment Oil	1	0.2%	0.1%	0.1%
48	Avoid Childhood Vaccination	1	0.2%	0.1%	0.1%
49	Avoid Endocrine Disruptor Exposure	1	0.2%	0.1%	0.1%
50	Avoid Giving Infants Scented Baths	1	0.2%	0.1%	0.1%
51	Avoid glysophate fertilizers	1	0.2%	0.1%	0.1%
52	Avoid Herbicide Exposure	1	0.2%	0.1%	0.1%
53	Avoid intense scrubbing, shaving, waxing and exposure to sun (skin)	1	0.2%	0.1%	0.1%
54	Avoid Limiting Transmission of Maternal Microbiota	1	0.2%	0.1%	0.1%
55	Avoid Mouthwash	1	0.2%	0.1%	0.1%
56	Avoid NSAID painkillers	1	0.2%	0.1%	0.1%
57	Avoid smoking	1	0.2%	0.1%	0.1%
58	Avoid taking opioids for long periods of time	1	0.2%	0.1%	0.1%
59	Hormones	1	0.2%	0.1%	0.1%
60	Azithromycin use	1	0.2%	0.1%	0.1%
61	Bioengineered Bacteria	1	0.2%	0.1%	0.1%
62	City stop spraying glyphosate in city parks	1	0.2%	0.1%	0.1%

63	Colon Cancer Screening	1	0.2%	0.1%	0.1%
64	Cryotherapy	1	0.2%	0.1%	0.1%
65	Drugs Containing Human Gut Microbes	1	0.2%	0.1%	0.1%
66	E. Coli Derivative	1	0.2%	0.1%	0.1%
67	Electrical Stimulation of the Vagus Nerve	1	0.2%	0.1%	0.1%
68	Engineered Genes	1	0.2%	0.1%	0.1%
69	Eradicate Gut Health Following Cardiac Arrest	1	0.2%	0.1%	0.1%
70	Freeze-Dried Healthy Gut Bacteria	1	0.2%	0.1%	0.1%
71	Skin-to-Skin Contact Between Mother and Baby	1	0.2%	0.1%	0.1%
72	Gardening	1	0.2%	0.1%	0.1%
73	Gargling and Singing Loudly	1	0.2%	0.1%	0.1%
74	Gratitude Journalling,	1	0.2%	0.1%	0.1%
75	Hormonal Therapy	1	0.2%	0.1%	0.1%
76	Injecting Antibiotics Rather than Ingesting Them	1	0.2%	0.1%	0.1%
77	Interactions with Other Children	1	0.2%	0.1%	0.1%
78	Intestinal Absorbent (Enterosgel)	1	0.2%	0.1%	0.1%
79	Lower glycemic load	1	0.2%	0.1%	0.1%
80	microbiome drug	1	0.2%	0.1%	0.1%
81	migration	1	0.2%	0.1%	0.1%
82	more holisitic approach to health	1	0.2%	0.1%	0.1%
83	Psychobiotics	1	0.2%	0.1%	0.1%
84	Relationships	1	0.2%	0.1%	0.1%
85	Sinus microbiome transplant	1	0.2%	0.1%	0.1%
86	treatments, diagnostic testing	1	0.2%	0.1%	0.1%
87	Use of probiotic cleaning	1	0.2%	0.1%	0.1%