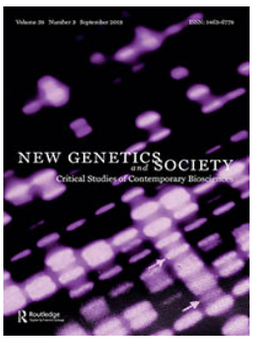

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Fecal microbiota transplants: emerging social representations in the English-language print media

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This study investigates how English-language news sources have represented fecal microbiota transplants (FMT). FMT involves transferring stool from a healthy donor to a recipient with a dysfunctional intestinal flora in order to repopulate their gut microbiome. FMT applications are increasingly moving into mainstream clinical care. We investigate press coverage of stool transplants, as well as broader themes associated with health and the gut microbiome, in order to uncover emerging social representations. Our findings show that print media focused in particular on creating novel, mainly hopeful, social representations of feces through wordplay and punning, side-lining issues of risk and fear. We also identify changing metaphorical framings of microbes and bacteria from "enemies" to "friends", and ways in which readers are familiarized with FMT through the depiction of the process as both mundane and highly medicalized.

Keywords: fecal microbiota transplantation; metaphorical framings; human-microbial relations

Introduction

The year 2003 saw several seminal scientific developments, such as the complete sequencing of the human genome and the emergence of epigenetics and microbiomics (Nerlich and Hellsten 2009). Moreover, scientists, doctors and patients began to consider a more rudimentary health intervention, namely "fa(e)cal microbial/microbiota transplants", "stool transplants", "fecal transplants", or FMT for short. As we will demonstrate, conversations involving FMT have grown into a topic of global interest.

The Fecal Transplant Foundation (2017)[1] defines FMT as "a procedure in which fecal matter, or stool, is collected from a tested donor, mixed with a saline or other solution, strained, and placed in a patient, by colonoscopy, endoscopy, sigmoidoscopy, or enema." The purpose of FMT is to replace a healthy gut microbiota that have been damaged due to an infection and antibiotic treatments, or a chronic intestinal disorder.

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We are in what has been called a "microbial moment" (Paxson and Helmreich 2014). Since 2012 microbiome studies have accelerated (see Nerlich 2017) and with them "post-Pasteurian" forms of "microbiopolitics" (Paxson 2008). The rapidly changing field of metagenomics has expanded knowledge about microbial life, with a corresponding widening of research on the human microbiome (Microbiology Society 2017).

A well-known example is the Human Microbiome Project (HMP), funded by the US National Institutes of Health (NIH) in 2007, which has collected and mapped microorganisms living in human bodies, exploring their role in human health and disease (University of Maryland 2019). Similar research is now taking place across the world. Within Europe, the European Commission funds a variety of projects, including the Metagenomics of the Human Intestinal Tract (MetaHIT) study, which is mapping gut microbiota and their associated health conditions (European Commission 2010).

Social science literature in this area is also growing, especially geographies and anthropologies of the microbiome (e.g. Benezra, DeStefano, and Gordon 2012; Helmreich 2016; Lorimer 2016; Lorimer *et al.* 2019; Maroney 2017; Nading 2016); to name but a few. A key example of interdisciplinary work on the microbiome can be found in Rhodes, Gligorov, and Schwab's (2013) edited volume *The Human Microbiome: Ethical, Legal and Social Concerns*, which provides insights from natural scientists, health professionals, and social science and humanities scholars. A further area of research worth mentioning in relation to our study is that which explores the intersection between the human microbiome and biobanking (including feces) through the lens of an ELSI framework (Hawkins and O'Doherty 2011; Chuong *et al.* 2017).

There has also been a large increase in new therapies involving bacteria, which can be explained as "using microbes to reorganize ecologies to secure desired systemic properties" (Lorimer 2016, 58). Some scientists have also highlighted that with these hopes, there is also hype, and that media coverage of novel microbial therapies risk presenting potential benefits as if they were actually being achieved (e.g. Niederhuber 2015).

While media coverage of genomics and post-genomics has attracted sustained attention from those interested in developments around new genetics and society (McLeod and Nerlich 2017; Nerlich and Hellsten 2005), only one study so far has explored media framings of FMT in one country (Chuong, O'Doherty, and Secko 2015).

This article provides the first analysis of global coverage of FMT in English-language newspapers between 2003 and 2017. It offers a snapshot of patterns of the developing global "conversation" about FMT. It can, however, not deliver in-depth analyses of such patterns for every country where FMT is introduced. Rather, as patients, are increasingly looking to media sources for information about health and medicine (e.g. Diaz *et al.* 2002), we have sought to survey some of the current global conversations about FMT, in order to get an overview

of what they may come across. In addition, several studies converge in showing low levels of awareness of FMT and erroneous perceptions that FMT is unsuccessful and carries a risk of infection, which may inhibit uptake of FMT in patients (Palmer *et al.* 2016; Park *et al.* 2017). It is therefore necessary to explore how FMT is represented and discussed internationally in key channels of societal information.

FMT in the scientific literature

The most common clinical applications of FMT are for the treatment of recurrent *Clostridium difficile* infections (CDI) in the gut, which can cause severe and sometimes fatal diarrhea. There has been a marked increase in the incidence of such infections in the twenty-first century (DePestel and Aronoff 2013), alongside an increase in antibiotic or antimicrobial resistance (Collins, Jaspal, and Nerlich 2017).

One of the first scientific articles on FMT appeared in 2003 (Aas, Gessert, and Bakken 2003). As the analytics derived from the SCOPUS database shows (Figure 1), FMT research began to increase in around 2010 and accelerated after the first randomized controlled clinical trial of FMT for recurrent CDIs was reported in 2013 (Rao and Safdar 2016). In the US, the Food and Drug Administration (FDA) has regulated human feces as an experimental drug since 2013 (Mole 2013).

The 2013 research that increased attention to FMT in science and the media was reported in *Scientific American* under the title "The S••t hits the fan!!", one of many puns used in reporting on progress in FMT research (Stone 2013). Furthermore, in 2013 the *American Microbiome Institute* published a blog post on "The Great Fecal Microbiota Transplant Debate", which indicated the transition of FMT into public debate. The focus was on the regulation of FMT (American Microbiome Institute 2014).

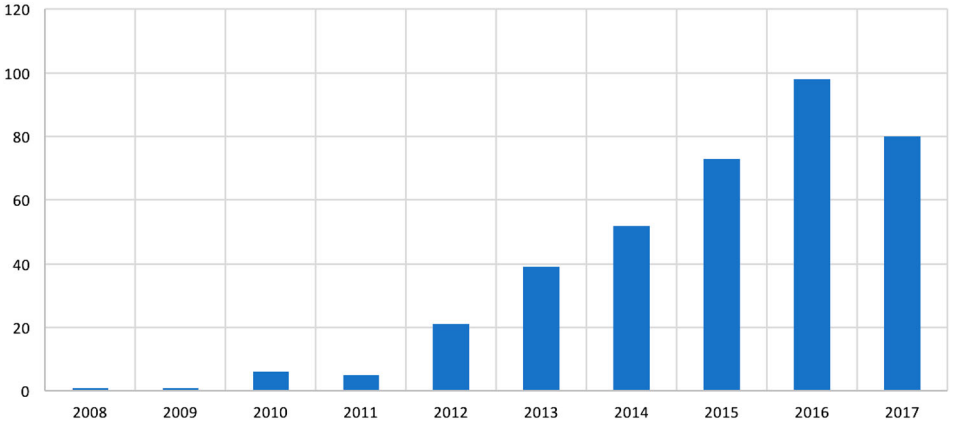

Figure 1. Scientific articles on FMT, 2008–2017 (derived from SCOPUS).

The first example of FMT via enema for treatment of pseudomembranous colitis was described in 1958 (Eiseman *et al.* 1958). FMT was first used in 1983 to treat CDI in a patient who presented immediate resolution and remained asymptomatic at the 9-month follow-up (Schwan *et al.* 1984). With reported success rates of ~90% for CDI, FMT has recently surged in popularity both within the scientific literature and public debate (e.g. Sha *et al.* 2014).

There has been some consideration of the ethical issues associated with FMT (Ma *et al.* 2017). These relate to patient understanding and informed consent; ascertaining a "healthy" donor; risk and safety; and public health implications. Moreover, there has been some research into public and, especially, patient understanding of FMT in response to the widespread perception that patients with CDI would be unwilling to consider FMT due to its association with other people's feces. In a US survey (Zipursky *et al.* 2012), most respondents recognized the unappealing nature of FMT but, when presented with a scenario of recurrent CDI, 85% of respondents were willing to receive this treatment. In a qualitative focus group study, patients with the same condition generally expressed willingness to undergo FMT despite initial distaste, as there was a perception that the advantages outweigh the "yuck factor" and that this medical intervention is "natural" (Kahn, Gorawara-Bhat, and Rubin 2012).

FMT in the print media

The print media constitute an important source of societal information regarding health and medicine (e.g. Jaspal and Nerlich 2016) and can set the tone for sociopolitical debate by influencing and reflecting new health and policy agendas (Reese, Gandy and Grant 2001).

As Matthew Nisbet has pointed out: "Even in today's dramatically altered media landscape, coverage in print and online, at both traditional and new media outlets, still drives discussion of complex issues" (Nisbet 2018). These channels are especially important because, as Davis (2017) stresses, "[m]edia agencies do not simply report on what is happening as they circulate information from the frontline to media devices across the globe; they also frame, edit, transform and intensify knowledge […] and shape how it is acted upon, experienced, recalled and entered into history."

The only study to explore media framings of FMT is Chuong, O'Doherty, and Secko's (2015) analysis of reporting of FMT in Canadian national and local newspapers and in three major Canadian television networks between 2007 and 2013, that is, it stops just when FMT reporting accelerates. This study found that the distasteful character of FMT was emphasized in media reporting and that this in turn was used to construct messages regarding the legitimacy and social acceptability of FMT. The authors note that this emphasis shifts the debate away from concerns surrounding social, scientific and regulatory challenges.

Our article looks at a longer time-frame and focuses on emerging social representations of FMT in the English-language print media globally, exploring what conceptions, expectations and assumptions are being formed, what risks and benefits are discussed, and what language is employed.

Methods

Social representations theory

When faced with novel scientific issues, the media tend to rely on metaphors and commonplace images in order to conceptualize and communicate about them. In this study, we use Social Representations Theory (SRT) (Moscovici 1988) which describes the social, cultural and linguistic mechanisms whereby knowledge is elaborated collectively and how meanings come to be attached to novel phenomena. A social representation consists of a framework of words, images, values and practices in relation to a given phenomenon, in the present case, FMT. Social representations enable individuals to understand and communicate about the novel and unknown through two principal social psychological processes – *anchoring* and *objectification*.

Anchoring refers to the process of making something unfamiliar become understandable by linking it to something familiar. Objectification is the process whereby unfamiliar and abstract objects are transformed into concrete and "objective" common-sense realities – most notably through the use of metaphor. Metaphors allow individuals to map aspects of more familiar knowledge (the so-called source domain) onto more unfamiliar knowledge (the so-called target domain) (Lakoff and Johnson 1980).

Social representations can be used as part of individual and collective symbolic coping with new technologies (Wagner, Kronberger, and Seifert 2002). This type of coping can be aided by humor, as has been observed in the case of cancer (Demjén 2016). As we shall see, humor played an important role in familiarizing people with an unfamiliar and at first sight seemingly disgusting technology.

This study stands in a long tradition of work focusing on health and illness, new genetics and genomics from a social representations and media perspective (e.g. Jaspal and Nerlich 2016). It ties in with anthropological work on purity, danger and disgust (e.g. Douglas 2000; Miller 1997), but for reasons of space this aspect of FMT cannot be studied in detail here.

Data collection

In order to generate a corpus of news articles on FMT, we searched for "fa(e)cal microbial", "microbiota transplant" and "stool transplant" on the Nexis® UK news database (high similarity setting, All English Language). "Fa(e)cal transplant" generated a corpus suitable for qualitative analysis, namely $n = 1609$ articles – 1547 with duplicates removed [24 December 2017 search]. All searches indicated that the first article on FMT was published in 2003.

The following graph (Figure 2), representing All English Language News echoes the scientific publication history of FMT accurately (see Figure 1), with a recent peak of interest between 2013 and 2015 and a dip after 2016:

We restricted our analysis to the period between 2003 and 2017 and focused on "newspapers only" within All English Language News, thus excluding trade publications, websites, magazines etc. This left n = 612 articles and after duplicates were removed, the remaining overall corpus consisted of n = 504 articles.

The main newspapers reporting on FMT were the *Mail Online*, *The New York Times* and *The Hamilton Spectato*r (Canada), followed by *The Globe and Mail* (Canada), *The Times* and *The Guardian*. Canadian science was often in the spotlight, especially focusing on issues around regulation. The corpus contains a small number of items (n = 20) distributed to local newspapers in the US through "University Wire". We left these in our corpus, as press releases can set the tone and framing for debates about emerging technologies (e.g. Brechman, Lee, and Cappella 2009).

The selected 504 articles published in English Language Newspapers were scrutinized, focusing initially on the headlines to gain an overall impression of the themes and tone of the news reporting. The right margin was used to note emerging theme titles which captured the essential qualities of the discussion. This procedure was repeated with every article. These initial codes included, amongst others, particular forms of language (e.g. puns, wordplay, metaphor, etc.), salient topics and events, key actors, and emerging patterns within the data, which clustered especially around the three aspects of FMT: feces (F), bacteria/microbes (M) and transplants/donation (T).

Subsequently, the right margin was used to collate these initial codes into potential themes, which captured the initial codes from the first stage of the analysis. The themes were intended to address the original research questions. As outlined by

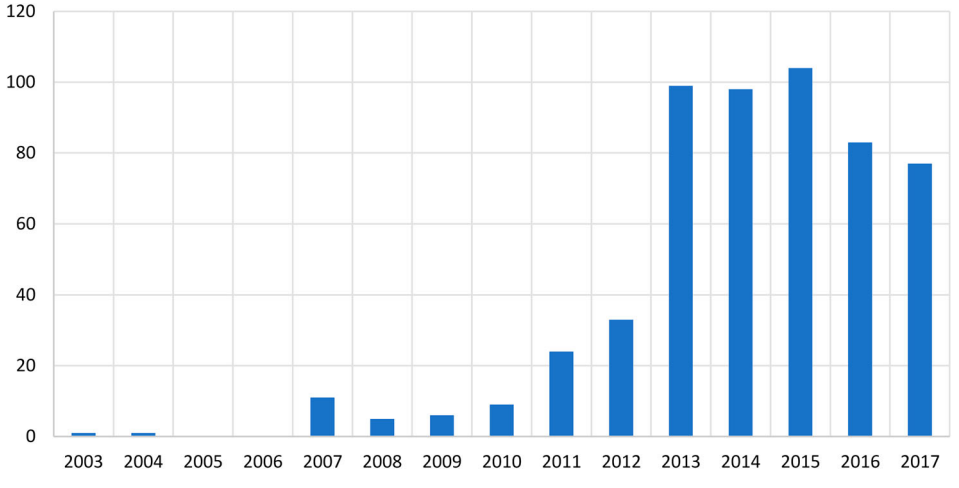

Figure 2. All English language news coverage of FMT, 2003–2017.

Braun and Clarke (2006, 82), "a theme captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set." All of the authors reviewed the themes against the corpus of data in order to ensure their compatibility and listed numerous extracts from the articles against each corresponding theme. For reasons of space, we only refer to the by-line when relevant for the argument. We provide the news source and date – in European format – in brackets after quotes.

Results

After several rounds of collaborative coding, three overarching themes (related to a number of different rhetorical strategies, from punning, to metaphors to the argumentative use of "but", to the telling of scientific and personal stories) emerged that shape social representations of FMT:

- efforts to challenge existing social representations of feces and to familiarize readers with the use of feces as a new medical technology presented socially acceptable;
- attempts to objectify microbiota/microbes/bacteria through the use of metaphors that also anchor their emerging social representations to older ones of beneficial bacteria and probiotics;
- endeavors to also anchor emerging social representations of transplants/transplantation and donation to older social representations of mundane as well as highly medicalized technologies.

A brief history of FMT in English language newspapers

FMT first appeared as a topic in English language newspapers in a 2003 investigative article for the Australian Financial Review under the title "Cure caught between two stools; Men's health". The article frames FMT in terms of "transplantation medicine" and "treatment of last resort for those infected with a bug known as clostridium difficile". The hero of the story is the well-known Sydney gastroenterologist, Thomas Borody who "called this fecal bacteria cure 'flora power'". The article ends with some reflections on the yuck factor, pointing out that "for many it [FMT] is just plainly distasteful." However, "Borody notes there was similar distaste when we first heard about blood transfusions. […] Just as we overcame our 'hemophobia' so he believes we could eventually overcome our 'fecophobia'." As we shall see, this gradually happened with FMT both through rhetoric and technology.

After the initial interest in FMT in 2003, there was a lull in reporting in English language newspapers until around 2012/2013, when various issues appeared more regularly in the headlines. In 2012 we find a first mention of DIY FMT alongside a gradual acceptance of FMT and an overcoming of the so-called yuck factor. A year later there are first mentions of fake/artificial or "synthetic" poo or poop, even a

"poop pill". 2013 saw the publication of a widely reported "landmark" paper and FMT is linked to the microbiome.

2013 saw headlines about stool or poo "banking" and seems to have been the year that, according to one headline, FMT has gone from "Extreme to mainstream" (The Globe and Mail, Canada 26/04/2014). A 2015 article says "The microbiome is so hot right now" and that "the faecal matter industry is booming". In 2015 the acronym FMT appears for the first time in a headline. Controversy around FMT and obesity emerged. A headline proclaimed "Bowel hope turns to crap" (Sydney MX, Australia, 06/02/2015). In 2017 autism (re)appears as one of the many hyped-up diseases that FMT is supposed to "cure". Mo Costandi, a renowned neuroscientist, wrote an article in the Guardian entitled "Are gut microbes really a panacea, or just overhyped?" (2017). An article in The Globe and Mail entitled "Poo and woo woo" in a "post-truth" world.

After this short historical overview, we shall now discuss emerging social representations thematically.

Social representations of feces: challenging taboos

In press reports on FMT, the novelty of the procedure is acknowledged, as well as the possibility that this use of feces might provoke disgust in readers. In the articles, there is an attempt to mitigate the "yuck", "ick" or even "yeuch" factor. As one newspaper put it, "Before you pooh-pooh the idea, read on." (Toronto Star, Canada, 04/04/2011).

Feces are at their core "dirt out of place", as discussed in Mary Douglas' (1966) analysis of dirt and impurity. Inside the body, feces are considered to be "in their place" while outside they are seen as impure and unhygienic. Following Douglas, medical anthropologist Sjaak Van der Geest (2007, 384) argues that "[s]hit is an intimate product. We part with it in private and there it should remain. By talking and writing about it, it becomes a matter out of place; it disturbs the order of proper behavior." Work from anthropologists McGlotten and Webel (2016) uses several case studies to illustrate how instances involving excrement connect to "affective eddies of purity and pollution". Frequently associated with "dirtiness" and disgust, the authors also note that fecel matter has become a "biopolitical object" closely tied to human health. A further article by Veripps (2017) explores the increase in depictions of excrement in paintings and artistic performances since the mid twentieth century, arguing that this is associated with broader biopolitical and economic forces.

In the context of "dirt out of place", the "gut reaction" to the FMT process of feces outside of the body being inserted into another body is likely to be one of disgust, one of saying "yuck". Throughout our corpus, this gut reaction is highlighted but also counteracted through various rhetorical strategies, namely punning, strategic use of numbers/science, contrastive storytelling, and the use of "but". As we shall see, this positive framing of feces in the context of FMT interacts with a more positive framing of microbes more generally, as bacteria are seen as "good", rather than only "bad".

Rhetorical strategies

Punning is a key rhetorical strategy within the corpus we analyzed. Interestingly, Van der Geest (UCL Medical Anthropology series 2017) highlights how disgust and humor are closely connected in the context of defecation, suggesting that "without disgust, shit would not be able to provoke laughter or to produce rhetorical power."

Many headlines use the word "gut" creatively and humorously to overcome gut reactions and proclaim: "Have you the guts for faecal transplants?" (The Irish Times, 24/07/2012); "Trust your gut" (The Toronto Star, 05/01/203; also Belfast Telegraph, 19/01/2016); "Rebiotix investors go with their gut" (Star Tribune, Minneapolis, MN, 11/08/2014); or even: "Mosley delivers digestive tract" (The Dominion Post, Wellington, New Zealand, 01/10/2013) or "Gut hack" (The New York Times, 11/04/2017). Others focus more on feces themselves, as in: "The Scoop on Poop" (New York Observer, 16/10/2008); "Don't pooh-pooh it" (The Globe and Mail, Canada, 21/01/2015), "Too good to be poo" (National Post, f/k/a The Financial Post, Canada, 07/11/2015) etc. This strategy is similar to the as yet understudied use of gut puns in the popularization of microbiomics.

In addition to the use of punning in headlines, several articles quoted scientists' use of puns. One proponent in particular, Borody, is reported as writing scientific papers that include "such titles as Flora Power and Toying with Human Motions. But he is also deadly serious" (Yukon News, 21/01/2011). This contrast between fun and seriousness is important in the articles.

Borody also uses quantitative science, alongside wordplay, to destigmatize the use of feces as a treatment. As the article says: "One of his published studies reported that in patients with recurrent C.difficile infection, 60 out of 67–90 per cent – of those who received faecal transplants were cured." (Yukon News, 21/01/2011). In the same article, another scientist is quoted (using playful reference to the smell of feces):

> Alex Khoruts, a gastroenterologist at the University of Minnesota Medical School in the United States, agrees that the science is not to be sniffed at. 'The data are very strong,' he said in a telephone interview. 'There is no question that it works.'

The pun of "sniffing at" the science of FMT highlights that, looking beyond the fact that FMT uses feces, there is clinical evidence that it is highly effective.

Alongside the use of playful words, numbers and quasi-marketing, the rhetorical strategy of recounting stories serves to challenge the taboo around feces. These stories focus on a very sick patient being cured through help from a close relative who donates their feces altruistically, as the following excerpt illustrates:

> She was so sick that her children rushed her back to the hospital. Her doctor suggested a fecal transplant. That sounded disgusting, but it worked. Her daughter, my niece, was the donor. My sister went back to work this week! We are all delighted it was so effective I was a little nervous about sharing my story due to it being such a personal experience and because of the yuck factor, but I know that if it helps even just one person it will be worth it. (Illawarra Mercury, 09/07/2017)

This story of overcoming disgust, the gifting of feces and the miracle end-result was common throughout our corpus. It serves to personalize FMT, an otherwise abstract phenomenon, whose disgust factor often trumps and obscures its high degree of effectiveness in patients who undergo it. Sometimes anchoring (to other forms of organ donation/transplantation) was used to destigmatize feces and to attenuate the yuck factor:

> Organ transplants are well-known, life-saving medical procedures but a Rossford woman said it was the transfer of fecal matter into her colon, donated by her son, that saved her life and ended nearly a year and a half of misery and pain. (The Blade, Toledo, Ohio, 24/02/2014)

The association with family is important here. Donation and transplantation happen within family groups, which familiarizes the process and evokes the social representation of organ donation, such as in the context of kidney donation. This helps render the procedure of FMT more palatable and more "familiar". In a film review of "One Mississippi", the reviewer talks about

> the episode's gut-wrenching punchline: a fecal transplant. The joke seems juvenile and uncomfortable, which is perhaps what makes laughing irresistible. But despite the slew of poop jokes that Tig doesn't hesitate to share, Bill offers to be the fecal donor without hesitation. Maybe that's what family is all about? (Michigan Daily: University of Michigan-Ann Arbor, 11/09/2016)

This familial and familiar context enables people to overcome disgust as an obstacle to FMT. In "Perspective on Disgust" (relating to food), Rozin and Fallon define disgusting things as those that have "the capacity to contaminate […], with feces being a universal disgust object among adults" (Rozin and Fallon 1987, 24–25). As we have seen, humor (principally through the use of puns) helps to overcome this obstacle. Moreover, the embedding of feces within a loving family context serves to increase the acceptability of FMT primarily by anchoring it to organ donation, which sometimes occurs within families. Here feces become, as Rozin and Fallon (1987, 32) suggest, items of "positive contamination" between people who love each other.

Rhetorical strategies to pre-empt negative social representations

This strategy of using a personal (family) miracle story to overcome the yuck reaction is often combined with the "but" strategy – frequently in unison. "But" as a discourse marker has been studied by linguists for a long time (Lakoff 1971). Most instances of "but" in our corpus seem to perform a "correction function", where the clause introduced by "but" provides a correct replacement for the assumption given in the first clause, although in many instances it is used to deny certain expectations about feces.

Often "but" is preceded by the phrase "as strange/weird/grim/awful/appaling as it might sound", which constitutes a form of disclaimer. It essentially prepares the reader for an assertion, which could be construed as "strange" by

acknowledging but challenging this assumption and implicitly requesting the reader's attention. "It may sound a little bit grim but fecal transplants administered through the colon are helping fight the C Diff infection" (The Sun, 09/12/2014).

> Weird though it sounds, some vulnerable people have received faecal transplants to repopulate the intestine with normal bacteria, of which there may be 30,000 different species having been denuded by antibiotics. We know of no better way to replace them at the moment. Disgusting as they may sound, faecal transplants can cure cases that are otherwise intractable. (Daily Mirror, 03/09/2012)

In other cases, "but" is used more straightforwardly (albeit combined with a pun) as in: "Faecal transplants are the butt of many jokes amongst the medical profession, but doctors say that should not distract from the success rate." (Asian News International (ANI), 14/07/2011).

The tone becomes more serious when FMT is represented as a means of averting death. In some articles, it is argued that, while FMT might be disgusting, *but* if one has to choose between life and death, one chooses FMT:

> For most of us, the mental image invoked by the term 'fecal transplant' is grimace-inducing. There's a serious yuck-factor involved with that combination of words. But for people suffering from the serious bacterial infection clostridium difficile – C-diff – fecal transplants can be the difference between life and death. (Times-News, Burlington, North Carolina, 05/01/2015)

The social representation of FMT as life-saving serves to override the anchoring of FMT to feces, which may initially induce the affective response of disgust. In this process of turning the disgusting into the desirable, bacteria are co-opted and they, too, are reframed, from being "bad" to being "good".

Social representations of microbes: objectifying through metaphors

Since the advent of the germ theory of disease, "germs", including bacteria, have been regarded as bad, as our enemies. This social representation of bacteria is well established. However, this changed when the "war" against germs and/or bacteria was sometimes interrupted by periods of peace and reconciliation, as it became clear that there are also friendly bacteria that enhance human wellbeing. Moreover, there has also been a shift from only glorifying antibiotics as saviors, to celebrating probiotics and enlisting them in fighting disease (Nerlich and Koteyko 2008).

Anchoring FMT in probiotic discourse

Articles on FMT make use of these existing positive representations of probiotics, to engage readers with this novel medical treatment.

> Faecal transplants are the butt of many jokes amongst the medical profession, but doctors say that should not distract from the success rate. 'It is the ultimate pro-

> biotic treatment,' said Thomas Riley, a professor of microbiology and immunology at the University of WA.' (Asian News International (ANI), 14/07/2011)

Some, echoing probiotic marketing language (see Nerlich and Koteyko 2008), invoke "vitalism", such as this headline: "Vital signs: Fecal pills help balance body bacteria" (The Ticker: Baruch College 23/02/2015). Others even invoke a supernatural power, calling FMT "God's probiotic" (thespec.com, 17/07/2010). Thus, FMT is anchored to the socially acceptable and, in many cases, lauded use of probiotics in medicine, generalizing the positive characteristics of probiotics to FMT which continues to carry a stigma due to its association with feces.

Recently, research into the microbiome has begun to change social representations of good and bad bacteria yet again (see Hodgetts *et al.* 2018). Probiotics and now FMT are especially enlisted in the fight against hospital-acquired infections such as C. Diff. As one article stated: "Probiotics contain good bacteria that are considered beneficial and safe" (MailOnline, 21/10/2016). Unlike feces, where puns and wordplay helped to familiarize readers with FMT and to overcome the "poo-taboo", microbes are frequently objectified.

Representing bacteria as friends

Bacteria were represented as friends, heroes and angels, as highlighted in the following examples:

> So why and how does the poop – yuck! – of a healthy human being cure one sickly of C. difficile … or any of these other gut problems? Imagine a field of devils (bacteria with potential to harm) and angels (the good bacteria) that have nowhere to live except a boat in the gut. (Daily Nation, Kenya, 28/02/2017)
>
> "Bugs are our friends; Instead of worrying about a bit of dirt, we should learn to love the thousands of tiny creatures that colonise our bodies" (The Sunday Times, 07/08/2016). Here, instead of a purification of poo, we see a purification of bacteria. "'Bacteria don't have to be enemies,' he [Maharshak] concluded. 'They can be our friends.'" (Jerusalem Post, 10/04/2016)

These "friends" help people fight against "Bad bacteria that live in the gut plotting various diseases and discomfort for you" (Sunday Independent, 20/03/2016). In some articles, bacteria are framed not only as heroes and friends, but as "miracle workers" (Indiana Daily Student, 04/02/2016) (this reporting is linked to Indiana University's fecal microbiota transplant research program).

Unlike feces, bacteria are portrayed as having agency. One headline talks about "Parasites as health helpers" (The Denver Post, 22/10/2013) and another about: "Microbial miracle workers" (Indiana Daily Student: Indiana University, 04/02/2016). The personification of bacteria as friends or foes serves to differentiate those that harm from those that benefit us. It is within this context of personification and objectification (in terms of angels, friends etc.) that the debate around FMT unfolds.

Representing bacteria as balanced ecosystems

Bacteria as heroes are not "lone rangers". They work as communities, as whole ecosystems – rainforests and their creatures. As the article that uses the metaphor of miracle workers continues to point out:

> The microbiome is like an entire ecosystem, albeit a bit smaller. The microbial community in the mouth, for example, can be as complex as an entire rainforest, with just as many creatures eating what they can and fighting for survival. Unlike rainforest animals, these critters in your mouth are incredibly small and single-celled. (Indiana Daily Student: Indiana University, 04/02/2016)

These ecosystems and communities can only work if they are not disturbed or thrown out of balance. The balance metaphor, also conspicuous in discourses around probiotics, is prominent here (Nerlich and Koteyko 2008). "Antibiotics so upset the balance of her internal microbial ecosystem that she eventually was treated with a fecal transplant" (The Calgary Herald (Alberta) 13/11/2013). Representations of microbes as communities or ecosystems then lead some to call FMT something "like an ecosystem transplant" (Michigan Daily: University of Michigan-Ann Arbor, 16/05/2016). In contrast to such natural ecosystems, *Clostridium difficile* bacteria are portrayed as engaged in land-grabbing and colonization of the gut. Such actions are portrayed as destroying the natural balance, which is important to the health of our microbiome and ourselves (Sunday Mail (South Australia), 27/10/2013), a balance that can be restored through FMT (Stoke The Sentinel, 24/07/2015).

The bad bacteria are objectified in terms of "evil invaders" and "a donor's good bacteria push out the baddies." (The Dominion Post, Wellington, New Zealand, 27/09/2014). Similarly, another article stated that:

> The drugs [antibiotics] save people's lives, but they also kill off beneficial bugs that usually would keep C. difficile in check. Think about what happens to a population of deer when they have no predators, Tebas said. A fecal transplant restores C. difficile predators. (The Philadelphia Inquirer 06/04/2014)

A new metaphor in the context of the ecological framing of the microbiome is that of the "garden", favored, for example, by Carl Zimmer, a renowned science writer. One of his articles is headlined: "Tending the body's microbial garden" (The New York Times, 19/06/2012). In another entitled "Some of my best friends are bacteria", he writes:

> When I asked Gordon about do-it-yourself microbiome management, he said he looked forward to a day 'when people can cultivate this wonderful garden that is so influential in our health and well-being' – but that day awaits a lot more science. So he declined to offer any gardening tips or dietary advice. 'We have to manage expectations,' he said. (The New York Times, 19/05/2013)

Fighting FOR, not against, bacteria

Metaphors of microbes and bacteria as agents, communities and ecosystems contribute to objectifying them and shape social representations that enable FMT to

be regarded as a socially acceptable, even desirable treatment. These emerging social representations of FMT also counter a discourse previously dominated by war and battle against bacteria, a discursive turn that microbiologists have long advocated (Lederberg 2000). Instead of waging war against bacteria, headlines talk about "The battle for bacteria" (Mirror Publications, 26/05/2016). Social representations implicitly specify the desirable patterns of action in response to the "represented" – in this case, bacteria are no longer to be fought against but rather to be *fought alongside*, to be tended, befriended and nurtured.

The positioning of bacteria as friends influences how newspapers discuss transplantation and donation, as in this quote: "An entire bacterial neighborhood is transplanted, almost like an organ transplant minus the anti-rejection drugs, says Dr. Alexander Khoruts of the University of Minnesota." (Buffalo News, New York, 21/12/2010). This social representation makes FMT appear more natural – like gardening rather than traditional medical interventions.

Social representations of transplantation and donation: anchoring the novel to the old

Headlines rarely focused on the T in FMT, i.e. on transplantation and donation (excluding the use of the phrase "fecal transplants"). This aligns with the currently limited studies of fecal donation (see McSweeney *et al.* 2019). There was consistent anchoring of FMT in older forms of transplantation and donation, with a gradual shift from altruistic donation to more commercial transactions.

There appear to be two social representations of the FMT process – one that constructs it as mundane and another that depicts it as scientific, medical and technological. The mundane one is attached to altruistic donation, while the technological one relates to commercial and monetized transactions.

Representing transplantation/donation as mundane

Social representations of actions involving what one may call "the gift of shit" (rather than the selling of it) are embedded in long-standing social representations of gift-giving (Titmuss 1970) and in particular the altruistic donation of blood, semen, tissue, organs or, more recently, stem cells and umbilical cord blood (Busby 2006). Furthermore, by emphasizing family connections, the "dirty" business of FMT is rendered more familiar and less "foreign" (Douglas 1966): "Thanks to her dad's donation, Rachel's gut flora was 'retrained'" (Herald Sun (Australia), 23/10/2016).

The mundane process of fecal transplantation involves everyday familiar objects, such as a blender and a turkey baster. Indeed, one article states that: "In the brave new world of DIY faecal transplants, you can now liquidize your partner's poo in a blender and insert it into your body at home." (MX (Australia), 28/05/2014) And not just any blender, one article explicitly talks about a "smoothie blender" (South China Morning Post, 19/07/2016). "I even told you about a nurse who

underwent a fecal transplant for persistent diarrhea – not at a medical facility, but at home, using her husband's feces, a blender and a turkey baster." (Wisconsin State Journal, Madison, Wisconsin, 09/06/2013)

This DIY procedure has been partially commercialized and also mediatized (there are YouTube videos that provide how-to-do advice).

> The treatment for digestive diseases championed by Sydney doctor Thomas Borody has been trialled in hospitals, and now the US has a take-home version. They are being sold by Catherine Duff's Faecal Transplant Foundation, with Duff saying that when no doctor would give her the treatment, her hubby mixed his in a blender with saline. (MX, Australia, 28/05/2014)

To put it bluntly: "That's right. A healthy stool, from someone else, injected where the sun does not shine via reverse enema. Doctors are doing the procedure right now: They call it a s --- swap." (The New York Post, 18/05/2014)

> The procedure is, of course, messy and odoriferous, but it's also simplicity itself. Gene's marching orders were to procure a dedicated blender and sieve, enema tubing and syringe, and lots and lots of newspaper. F.M.T. basically consists of blending stool with saline, straining it, and reintroducing it into the colon via enema. (The New York Times, 07/08/2013)

Some newspapers used the metaphor of an "oil change" (Times-News (Burlington, North Carolina) 05/01/2015). It is a combination of the mundane and technological social representations of the FMT process that construct FMT as a simple, effective and acceptable process for the treatment of CDI.

Representing transplantation/donation as medical

FMT is increasingly regulated and "medicalized", as DIY FMT carries risks and dangers. In the future, FMT could involve "synthetic stools" made up of bioengineered organisms and the healthy microbiota could be delivered in the form of a pill rather than a fecal transplant (OpenBiome 2015). In the media coverage, pills are presented as better than pure poo: "Dr. Thomas Louie used to whip up fecal transplants in blenders. He now has a more palatable approach: pills you pop in the mouth and swallow." (The Calgary Herald, Alberta, 04/10/2013) This more technological and medical approach has been taken on by some start-ups such as OpenBiome. "More than 500 centres in the US now offer faecal transplantation, with most using frozen donations from the not-for-profit stool bank organisation, OpenBiome, in Boston. The UK regulator (MRHA) has temporarily classed faecal transplants as a medicinal product." (Pakistan Today, 29/10/2015)

> The feces donated under clinical oversight are stringently tested and screened for diseases and infections before being used. As one article claims: "Fecal donors undergo more stringent tests than those who give blood." (Jerusalem Post, 10/04/2016)

Here, there is a social representation of FMT principally as a medical process, which overshadows the yuck factor, on the one hand, and concerns around the

de-regularized and hence risky use of FMT as a treatment. The anchoring of FMT to blood donation serves to generalize the socially acceptable characteristics of blood donation to the relatively novel and poorly understood process of FMT.

Anchoring FMT to biobanks

FMT is anchored to older social representations of blood donation, but also to newer ones of biobanks, for example. In the case of FMT, newspapers reported the uses of "brown banks", "stool banks", or "poo banks" or, more prosaically, FMT banks. People can donate feces to such banks to be used by others, or they can make money by selling their feces to such banks. Using the emerging metaphor of a "gut garden", *The Times* reported: "Open Biome is a 'stool bank' that will supply you with faecal transplants from healthy people to enrich your gut garden. It will also pay good money for faecal donations from healthy people. Now there's a tip you did not expect to read in The Times." (The Times, 10/04/2017).

This process turns "waste" into "gold" (e.g. thespec.com, 12/08/2016; thetimes.co.uk, 04/06/2015). People concerned about contracting C. Diff in the future (or any other disease for which FMT is recommended) can also engage in "self-banking", i.e. they can "deposit" healthy feces in a bank to be used in case of future illness (see National Post (f/k/a The Financial Post) Canada, 05/11/2013) – they can use it as a type of health insurance. Stool banking has not yet achieved the status of other blood, organ and tissue banking activities which have been studied extensively by social scientists (Martin, Brown, and Turner 2008). However, the anchoring of FMT to other types of biobanking opens up pathways for greater social awareness, understanding and indeed acceptability of feces as a biological substance analogous to others that can, and indeed should, be "banked".

Conclusions

> Bacteria may not build cities or have interesting social lives, but they will be here when the Sun explodes. This is their planet, and we are on it only because they allow us to be. (Bryson 2003, 369)

Living with bacteria in world struggling with antimicrobial resistance is difficult. However, there has recently been a "revolution" in scientific knowledge about the microbiome (Blaser 2014), which has changed, and continues to change, the ways in which we understand human-microbial relations.

Just as human relations with bacteria have changed over time, so too have their collective social representations. Such social representations started to emerge as soon as microbes began to appear under the microscope and when bacteria and, more importantly, germs became objects of science, medicine and social policy. Over time, they have evoked emotions that range from fascination to fear and disgust.

Social representations of FMT, rather than bacteria alone, are complicated by the fact that FMT does not only concern bacteria and microbes, good or bad, but is

associated with a more entrenched and longstanding object of disgust, namely feces (Chuong, O'Doherty, and Secko 2015). For positive social representations of FMT to emerge, the taboo and stigma attached to such "dirt out of place" has to be overcome. An inherently negative social representation has to be turned into a positive one. Many articles in our corpus therefore focused on dispelling the so-called "yuck factor" through the use of wordplay and puns, the telling of miracle healing stories, the framing of bacteria as miracle workers and the contrastive use of "but" within patient stories and journalistic accounts of FMT. New social representations of feces started to be crafted and feces were turned into new types of social "objects" through a new type of objectification.

Alongside this dispelling of the yuck factor, many articles also reframed bacteria from being bad to being good, from enemies to friends, from others to neighbors, from weeds to gardens. Such reframing anchored itself in older stories of probiotics and their vital potential for enhancing human health as well as in newer stories about the microbiome. Emerging social representations of bacteria and microbes as good, rather than bad, began to be reinforced.

FMT was also anchored in older and newer types of social representations of social actions and interactions and of social gifts and exchanges. DIY FMT was anchored in mundane actions of using blenders and turkey basters and the altruistic giving of gifts; medical applications of FMT were enhanced through the promise of technology and sterility and linked to more commercial and monetized transactions between people. In short, the very new donation and transplantation of feces was situated in older types of medical donations and their social representations, such as blood donation, semen donation, organ and tissue donation, even stem cell or umbilical cord donation, thus giving FMT a place in the modern bioeconomy and biopolitics and a place in our collective social representations of health and illness, medicines and treatments (see Chuong *et al.* 2017).

There is now significant evidence of the effectiveness of FMT as a medical procedure. Yet, much of the research into public and patient understanding of FMT suggests that disgust at the procedure constitutes a key barrier to acceptability and uptake. The emerging media representations discussed in this article have the potential to shape more positive social representations of FMT in the general population, paving the way for FMT to become a more socially acceptable and effective medical procedure. Future research can build on this baseline in order to study how social representations circulate in the wider media and public sphere, online as well as offline, and how they may change over time and differ between countries, as research into FMT progresses.

Note

1. We have used the American English spelling "feces" or "fecal", except for instances when citing articles or organizations that use British English, in which case, the spelling is "faeces" or "faecal".

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