

Does a brief state mindfulness induction moderate disgust-driven social avoidance and decision-making? An experimental investigation

Lisa M. Reynolds · Yee Sing Lin ·
Eric Zhou · Nathan S. Consedine

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Abstract In this experimental study, we evaluated whether manipulated disgust and mindfulness predicted social avoidance in bowel health contexts. Community participants ($n = 101$) were randomised to conditions in which disgust and/or state mindfulness were experimentally induced. Tasks assessing social avoidance and perceptions of available social networks in the context of bowel/health problems were conducted. Manipulation checks confirmed the elicitation of disgust and state mindfulness in the applicable conditions. As expected, persons in the disgust condition were more likely to exhibit immediate social avoidance (rejecting a glass of water). State disgust predicted greater socially avoidant decision-making, less decisional conflict, and smaller social network maps. State mindfulness predicted fewer names on inner network circles and amplified the effect of disgust on creating smaller social network maps. This report furthers understanding of disgust and avoidance in bowel health contexts, and suggests the need for caution in mindfulness interventions that raise awareness of emotion without also providing skills in emotional regulation.

Keywords Disgust · Avoidance · Emotion · Decision-making · Mindfulness · Bowel health

Introduction

Bowel health problems can take a social toll. Exposure to feces, unpleasant odors, and aspects of anal anatomy and

function, are awkward areas of social interaction and conversation and have the potential to negatively impact on relationships. Paradoxically, however, these very social relationships are central to a patient's ability to withstand the demands associated with physical health challenges—social support improves the morbidity and perhaps even mortality effects of disease (Holt-Lunstad et al., 2010). Withdrawal from friends, family, and colleagues during bowel health issues is common, and can include restriction of activities, problems with intimacy, and avoidance of communication (Drossman et al., 2009; Porter et al., 2005), with the latter associated with poorer relationship functioning, greater psychological distress (Porter et al., 2005), and the exacerbation of bowel symptoms (Bevan, 2009). Despite the established detriment of social avoidance in the context of bowel problems, there has been scant research on why avoidance occurs and how it might be minimised. The current report describes an experimental investigation into a possible cause (disgust) of social avoidance in the context of bowel problems where exposure to feces is likely, and explores whether state mindfulness might have a role in moderating the relationship between disgust and social avoidance.

Disgust as the emotional substrate of social avoidance

The reasons underlying social avoidance in physical health contexts are many and varied – from withdrawal associated with depression (Peveler et al., 2002), misconceptions and stigma (Flanagan & Holmes, 2000), fear of causing pain or discomfort (Cagle & Bolte, 2009), and worry that affection may lead to unwanted sexual activity (Henson, 2002), to simply not knowing what to say (Chapple et al., 2004). Emotions are heavily implicated in social avoidance. Several emotions, notably fear, embarrassment, and disgust

L. M. Reynolds (✉) · Y. S. Lin · E. Zhou ·
N. S. Consedine
Department of Psychological Medicine, University of Auckland,
Victoria Street West, Private Bag 92019, Auckland 1142,
New Zealand
e-mail: n.consedine@auckland.ac.nz

evolved, in large part, because they motivate avoidance (and anticipated avoidance) of stimuli that potentially operate as an emotional trigger (Consedine & Moscovitz, 2007). Given its avoidance-promoting function in health contexts, *disgust* may be of particular importance (Reynolds, Consedine, Pizarro, et al., 2013). In theory, the core function of disgust is to promote the avoidance of actual and potential contaminants—that is, people or stimuli that may carry a pathogen transmission risk (Rozin et al., 2005). Such elicitors include “risky” people (Curtis et al., 2004), bodily products (Deacon & Olatunji, 2007), violations of the body envelope (Borg et al., 2010), and reminders of death (Berle & Phillips, 2006). Functionally, disgust is characterized by a rejection and avoidance dynamic that manifests in action tendencies, experiential and cognitive states, and expressive changes (Angyal, 1941), all of which operate to promote withdrawal from potentially health-deleterious stimuli or people.

Importantly, disgust appears to have health-promoting functions in motivating the avoidance of potential contaminants yet to be contacted. Thus, disgust *anticipatorily* motivates decisions that reduce the odds of exposures. Anticipated disgust may motivate the avoidance of cancer screens (Reynolds et al., 2013), greater anticipated delay in seeking help for bowel symptoms (Reynolds et al., 2014) or sexual concerns (McCambridge & Consedine, 2014), and experimentally induced disgust predicts greater future intention to use condoms (Tybur et al., 2011).

Whereas evidence suggests disgust may cause both immediate and anticipated avoidance of disgusting stimuli, it is unclear whether disgust is a cause or correlate of *social* avoidance. In theory, we might expect a causal link through disgust’s tendency to promote risk-minimisation via the “behavioral immune system” (Schaller & Park, 2011). Because new health threats can be difficult to detect, disgust operates conservatively, cross-sectionally predicting lower social interaction and extraversion in geographic areas where disease risks have historically been high (Neuberg et al., 2011). The emotion may thus influence the size and shape of social networks (Schaller et al., 2011) or social behaviors during the diagnosis and treatment of conditions involving exposure to disgust’s elicitors.

Avoidance of disgust’s elicitors appears exaggerated among certain people. Disgust sensitivity peaks in the first trimester of pregnancy (Fessler et al., 2005), when conception risk is high (Fessler & Navarrete, 2003), and is high during demanding medical regimens (Kollei et al., 2012); disgust’s avoidance-promoting effects are stronger among persons in poorer health (McCambridge et al., 2014). Although avoidance may be functional, disgust can promote avoidance when threats are absent (Oaten et al., 2011), perhaps particularly during times of health vulnerability or where partners exhibit disease cues. This report

tests how disgust impacts socially avoidant behavior and decision-making in bowel health problems—an area with scant research to date.

State mindfulness—a role in moderating disgust-generated social avoidance?

Given evidence (albeit not in the social domain) that disgust promotes avoidance in health, a key next step is to consider how to ameliorate this effect; this report experimentally evaluates whether state mindfulness may be relevant. Theory distinguishes *state* mindfulness (i.e., being mindful in the current moment) from *trait* mindfulness (i.e., the stable tendency to be mindful), both of which appear to impact social interactions. More trait mindful persons show less interpersonal aggression (Heppner et al., 2008), may have superior social skills (Dekeyser et al., 2008) and maintain relationships (Barnes et al., 2007), and mindful physicians are more empathic and engage in greater rapport building (Beach et al., 2013). Experimental data indicate that inducing state mindfulness produces similar social effects, promoting better communication (Barnes et al., 2007) and less aggressive behavior following social rejection (Heppner et al., 2008). Our report extends this research by testing the possibility that induced state mindfulness reduces social avoidance in situations where avoidance is likely.

Numerous studies suggest that state mindfulness can be taught (Kabat-Zinn, 1990), with training focusing on building awareness as well as the ability to tolerate and accept unpleasant emotions, weaken automatic reactions, and develop a non-judging, non-reactive attitude (Baer et al., 2009). Attenuating emotion-behavior links has proven effective in managing cravings (Ostafin & Marlatt, 2008) and physical pain (Kabat-Zinn, 1990), leads to less avoidance among spider phobics (Hooper et al., 2011), and to longer perseveration on challenging tasks (Hesser et al., 2013). Thus, the ability to ‘stay with’ unpleasant emotions (such as disgust) may lead to less avoidant decisions and behavior.

Despite this apparent logic, however, one recent study indicates that trait mindfulness may not necessarily predict lower *avoidance* when emotional. In this study, more mindful persons were *more* avoidant when disgusted, requiring a prompt and taking longer to touch a stoma bag, and being less likely to choose a drug with disgusting side effects (Reynolds, Consedine, & McCambridge, 2013). Although this report did not assess *social* avoidance and only evaluated trait mindfulness, it may be that “staying present” with emotions like disgust allows them to exert more influence, making avoidance *more* likely, at least when there are few costs to avoidance. Thus, although greater engagement with emotions leads to less avoidance

in some contexts (Evans et al., 2009), such engagement may lead to *more* avoidance if this is the more contextually appropriate strategy.

Overall then, early indications regarding the nature and strength of the relationship between trait and state mindfulness and social avoidance are ambiguous. State mindfulness may promote less avoidant decision-making in general, but perhaps not when avoidance-promoting emotions are active. This report investigates whether a brief state mindfulness induction predicted less avoidance and less conflicted decision-making in bowel health contexts, and assessed whether state mindfulness moderates disgust-generated social avoidance.

The current report

Bowel health problems characterised by actual or anticipated exposure to fecal symptoms are robust elicitors of disgust, with avoidant behavior and decision-making likely consequences (Reynolds et al., 2013). However, few studies have tested whether disgust might influence *social* avoidance or whether its effects might be moderated by state mindfulness. This work investigated whether manipulated disgust predicted greater social avoidance in bowel problems and evaluated whether a brief state mindfulness induction altered the link between disgust and avoidance. Specific hypotheses were:

1. Greater experienced disgust would predict greater social avoidance and restricted networks;
2. Higher disgust and/or state mindfulness would predict less conflicted decision-making;
3. State mindfulness would be associated with social avoidance and restricted networks, and would moderate the relationship between disgust, social avoidance and restricted networks.

Method

Participants and recruitment

People fluent in English between 18 and 30 years were invited to a study on “Stress, Emotions, and Health” through campus posters, flyers and emails. Entry to win a \$200 shopping voucher prize was offered. Due to a late and unexpected influx of participants exceeding available personnel resources, of the 232 who completed the initial questionnaire online, only 139 were invited to the follow-up session. Of these, eight declined taking part in the follow-up session, nine could not make available session times, and 18 did not show up to their scheduled appointment. Informed consent was obtained from all people included in the study. Of the 104 who completed both baseline and laboratory

components, debriefing identified three who reported believing that the study was investigating how they responded to the smell; these participants were excluded. This left a sample of 101 participants. Demographics did not vary between conditions (see Table 1). Participants were generally healthy with a small percentage reporting previous diagnoses: heart condition (3.0 %); bowel condition (7.9 %); compromised immune function (5.0 %); and a previous (unspecified) cancer diagnosis (1.0 %).

Procedure

In this report, state mindfulness and disgust were independently manipulated to test the separate and combined effects of these factors on social avoidance in scenarios of various bowel problems. Ethics approval was obtained and data collected between January and August 2013. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

Participation began by completing an online consent form and baseline questionnaire assessing demographics, health variables, and dispositional measures; followed by attending a 30-min laboratory session. To control for possible gender differences in trait disgust (Haidt et al., 1994), participants were gender block randomized to one of four conditions: control (condition 1); state mindfulness induction (conditions 2 and 4); disgust manipulation (conditions 3 and 4). Twenty-six participants were randomized to the mindfulness/non-disgust condition, and 25 in each of the other three conditions.

On arrival at the laboratory, participants were informed that the researcher would be timing different phases of the study and taking notes. Participants were given 5 min to settle into the environment and complete a written consent form. Participants then listened to a 10-min audio of either the mindfulness (Conditions 2 and 4) or non-mindfulness (Conditions 1 and 3) recordings. To induce mindfulness, an audio recording was adapted from a validated induction (Erismann & Roemer, 2010). The recording consisted of mindfulness information, a breathing exercise, information about emotion management, and a mindfulness exercise. In the non-mindfulness conditions, participants listened to a recording about the public service from a national radio program. A state mindfulness measure was then administered. Next, participants were taken to a second room where disgust was either manipulated (or not) using a feces-like odor previously shown to elicit disgust (Schnall et al., 2008). Five sprays of the “objectionable” but non-hazardous odor (Liquid Assets Novelties LLC 2005) were covertly sprayed into a rubbish bin liner. The researcher was not blind to this manipulation. Upon entering this room, participants were asked to take a seat (two were available) and seat choice was

Table 1 Study measures and demographic characteristics for participants per condition

Measure	All participants (<i>n</i> = 101)	Condition 1 control (<i>n</i> = 25)	Condition 2 mindfulness/non-disgust (<i>n</i> = 26)	Condition 3 non-mindfulness/disgust (<i>n</i> = 25)	Condition 4 mindfulness/Disgust (<i>n</i> = 25)	Statistical results
<i>Age</i>						
Mean (<i>SD</i>)	20.98 (2.86)	21.72 (3.51)	20.50 (2.44)	20.84 (2.61)	20.88 (2.82)	<i>F</i> = 0.83
<i>Gender</i>						
Male	36 (35.6 %)	10 (27.8 %)	9 (25.0 %)	8 (22.2 %)	9 (25.0 %)	$\chi^2 = 0.37$
Female	65 (64.4 %)	15 (23.1 %)	17 (26.2 %)	17 (26.2 %)	16 (24.6 %)	
<i>Marital status</i>						
Single	76 (75.2 %)	16 (21.1 %)	22 (28.9 %)	18 (23.7 %)	20 (26.3 %)	$\chi^2 = 6.33$
Married	3 (3.0 %)	2 (66.7 %)	0 (0.00 %)	0 (0.00 %)	1 (33.3 %)	
Living as a couple	22 (21.8 %)	7 (31.8 %)	4 (18.2 %)	7 (31.8 %)	4 (18.2 %)	
<i>Ethnicity</i>						
NZ European	49 (48.5 %)	12 (24.5 %)	14 (28.6 %)	13 (26.5 %)	10 (20.4 %)	$\chi^2 = 8.88$
NZ Maori/Pacific	2 (2.0 %)	1 (50.0 %)	0 (0.00 %)	1 (20.0 %)	0 (0.00 %)	
Asian	30 (29.7 %)	8 (26.7 %)	7 (23.3 %)	5 (16.7 %)	10 (33.3 %)	
Other	20 (19.8 %)	4 (20.0 %)	5 (25.0 %)	6 (30.0 %)	5 (25.0 %)	

recorded. A measure of state emotion was administered and the researcher then offered a glass of water, noting whether the water was accepted. Next, several tasks designed to assess socially avoidant decisions and behaviors were completed. Procedures in all conditions were standardised so that factors such as the greeting by the researcher, description of tasks, response options to questions and room set-up including chair placement were identical. To minimize possible sample contamination, participants were asked to keep their experience of the study confidential and not to share details with others.

Measures

State mindfulness

To assess state mindfulness, participants completed the Toronto Mindfulness Scale (TMS; Lau et al., 2006) in which participants rate 13 items on a scale of 1 (not at all) to 5 (very much) on how well statements describe current experience. The TMS can be divided into two subscales; *decentering* (awareness with some distance) and *curiosity* (awareness of experience with curiosity). Mean scores for all items provides a total score, and mean scores for the subscales are calculated, with higher scores indicating greater state mindfulness. Internal reliabilities were adequate; decentering $\alpha = .69$, curiosity $\alpha = .81$. Because of our focus on avoidance, this report focused on the decentering component, capturing the tendency to process

emotions without reaction or judgement. To investigate an alternative possibility that the mindfulness manipulation might simply be increasing positive affect, the DES joy subscale ($\alpha = .83$) was used to assess this likelihood.

State disgust

To assess state disgust, participants completed the state Differential Emotions Scale (DES; Izard et al., 1993); a 30-item scale with three items for each of 10 emotions. Using a 1–5 scale, participants rate the extent to which they are experiencing each emotion. Items are aggregated to provide composite scores, with higher scores indexing greater state emotion. Because both disgust and fear promote avoidance and are likely in health contexts, only these scores were used; however, all items were included to maximize blindness. The DES does not assess embarrassment, hence three items were added from the Susceptibility to Embarrassment Scale (SES) using the same scale and scoring. DES subscales were reliable (disgust $\alpha = .63$, fear $\alpha = .87$) as were the three embarrassment items ($\alpha = .90$).

Assessment of social avoidance

Immediate behavioral avoidance

Immediate avoidance of social interaction was assessed in two ways; seat choice and acceptance of water offered by the researcher:

1. *Seat choice*: in the second room, the researcher gestured to the participant to sit in one of two seats in standardised positions, stating “please take a seat where you feel most comfortable”. One seat was close to the researcher (as indicated by pen and paper on the table) and the other seat was more distant. Seat choice was recorded and coded as 0 for the close seat and 1 for the further (socially avoidant) seat.
2. *Acceptance of water*: after completion of the state emotion measure in the second room, the researcher asked whether the participant would like a glass of water. If the participant accepted, the researcher poured the water to a standardised line on a disposable water cup. Acceptance of water was coded 0 and the more avoidant, non-acceptance response coded 1.

Socially avoidant decision-making

Anticipated social avoidance was assessed with three decision-making scenarios related to bowel problems in social contexts. Scenarios were developed based on common situations as assessed by a colorectal surgeon and a health psychologist, both experienced in work with patients with bowel health issues. Participants were asked to imagine themselves in each situation and to choose between more and less socially avoidant response options.

1. *Delay meeting a friend* with constipation who will “share all the intimate details of their bowel troubles”. Participants were asked to choose between the options; “see your friend tonight” or “let them know you would rather wait a few days”.
2. *Agree to sex tonight* with a partner who has fecal incontinence and sometimes has “fecal leakage that can be unpleasant”. Participants were asked to choose between the options; “yes to sex tonight” or “no you don’t feel like sex tonight”.
3. *Postpone a weekend away* with a new partner rather than disclose that you have a stoma that “drains feces into a bag stuck to the outside of your body”; Participants were asked to check one of three boxes that gave the options; “tell them today so they have a few days to think about it before you go away”, “tell them at the beginning of the weekend” or “postpone the weekend away, and tell them later when you are more certain about this person”.

For each situation, answers were coded 0 for non-avoidance and 1 for socially avoidant options. In Scenario 3, only 6 people answered with the second option and, given the qualitative difference between disclosure and non-disclosure, a decision was made to combine the first and middle options as ‘non-avoidant’ which were coded 0,

with postponing coded as 1. An aggregate of all three decisions was calculated, with scores ranging from 0 to 3 with higher scores indicating greater social avoidance.

Following each scenario, participants were asked to mark on a 100 mm visual analogue scale (VAS) how easy or difficult it had been making their decision. In Scenario 1, the end points of the line read “very easily chose to see friend tonight” and “very easily chose to wait a few days” and in Scenario 2, end points were “very easily chose yes” and “very easily chose no”. The centre point on both lines were marked “almost couldn’t choose”. Length from the mid-point was measured in mm so that scores ranged from 0 to 50 mm. In Scenario 3, the 100 mm line was marked with “making this decision was very easy” at one end, and “making this decision was extremely difficult” at the other. Length was measured so that scores ranged from 0 to 100 mm. This number was halved to put scores for Scenario 3 on the same metric as those for Scenarios 1 and 2. Conflict scores for the 3 scenarios were then summed to give an aggregate total conflict score ranging from 0 to 150, with higher scores indicating greater decisional conflict.

Perceptions of social networks

Drawing on theory that persons become less prone to social engagement when they are exposed to contamination threats (Schaller & Murray, 2008), we investigated whether network size might be influenced by induced disgust and/or mindfulness. Participants were asked to imagine that they had been diagnosed with a serious health condition that made them think about the people who are important to them. Participants were provided with a “map” adapted from work originally conducted by Fiori, Antonucci and Cortina (2006) and recently validated in a physical health setting (Vassilev et al., 2013). This method asks participants to place themselves in the middle of three concentric circles, listing persons who “are so close it is hard to imagine life without them” (inner), “not quite that close, but still important” (middle) and “any other people” (outer). For analysis, the number of names within each circle was counted and an overall total score obtained by summing all names.

Analytic strategy

Investigation began by assessing whether state disgust and state mindfulness were induced using ANOVA analyses. Next, the relationship between state disgust and state mindfulness on immediate behavioral avoidance (i.e., seat choice and acceptance of water) was assessed using logistic regression. Second, using hierarchical multiple regression,

the links between disgust, state mindfulness and socially avoidant decision-making and decisional conflict were investigated. Finally, the relationships between disgust, mindfulness and social networks were assessed using hierarchical multiple regression.

Results

Experimental manipulations

Analyses began by assessing whether state mindfulness had been successfully induced. Given that the induction may have also influenced positive affect, both TMS decentering and DES joy scores were assessed using a 2 (disgust vs. non-disgust condition) \times 2 (mindfulness vs. non-mindfulness condition) MANOVA. As expected, there was a multivariate effect for mindfulness, Wilks' $\Lambda = .90$, $F(2,96) = 5.42$, $p = .006$, $\eta^2 = .10$. Follow up tests indicated that persons in the mindfulness conditions reported higher decentering than those in the control conditions, $F(1,97) = 9.44$, $p = .003$, $\eta^2 = .09$; the induction was specific to mindfulness with no difference in positive affect (DES joy) across conditions $F(1,97) = 2.23$, $p = .139$, $\eta^2 = .02$. As importantly, there was also no difference in state mindfulness between disgust and non-disgust conditions, Wilks' $\Lambda = .95$, $F(2,96) = 2.54$, $p = .084$, $\eta^2 = .05$, nor was there any interaction Wilks' $\Lambda = .99$, $F(2,96) = .37$, $p = .690$, $\eta^2 = .01$.

Next, a MANOVA was conducted to determine whether disgust was successfully manipulated and to check for any changes in other avoidance producing emotions. As expected, there was a multivariate effect for disgust condition, Wilks' $\Lambda = .88$, $F(3,95) = 4.48$, $p = .005$, $\eta^2 = .12$. Follow up univariate tests indicated state disgust was higher in the disgust conditions, $F(1,97) = 13.55$, $p = .000$, $\eta^2 = .12$, and, importantly in terms of eliminating other affective bases for avoidance, the disgust induction was specific to disgust; fear, $F(1,97) = 2.53$, $p = .115$, $\eta^2 = .03$ and embarrassment, $F(1,97) = .51$, $p = .478$, $\eta^2 = .01$, did not vary as a function of condition. There was no difference in state emotion across the mindfulness conditions, Wilks' $\Lambda = .98$, $F(3,95) = .53$, $p = .534$, $\eta^2 = .02$, or an interaction, Wilks' $\Lambda = .99$, $F(3,95) = .26$, $p = .857$, $\eta^2 = .01$.

Disgust, state mindfulness, and immediate behavioral avoidance

It was expected that disgust would predict social avoidance and that state mindfulness might moderate this effect. To investigate this hypothesis, participant seat choice and water acceptance were assessed. To analyse seat choice, a logistic regression with disgust condition entered at the first

step, mindfulness in a second, and the interaction between these variables entered in a final step. The model was not significant at Step 1, $\chi^2(1, N = 101) = 1.21$, $p = .270$, nor Step two $\chi^2(2, N = 101) = 1.23$, $p = .540$, or step 3, $\chi^2(3, N = 101) = 2.17$, $p = .538$, thus, evidence for the influence of these variables on seat choice and condition was not found.

Next, acceptance of water using a parallel logistic regression was investigated. The Step 1 model was significant $\chi^2(1, N = 101) = 5.53$, $p = .019$, with participants in the disgust condition more likely to decline the offered water (see Table 2). Step 2 showed a marginal effect, $\chi^2(2, N = 101) = 5.62$, $p = .060$, and at Step 3 the resulting model was not significant $\chi^2(3, N = 101) = 6.11$, $p = .107$, and the main effect from the disgust condition was no longer evident.

Disgust, state mindfulness, and socially avoidant decision-making

Next, the relationship between disgust, state mindfulness and decisions where bowel problems might create social avoidance was investigated. Given the likely nuance of these issues, greater power was required to detect possible relationships and moderating effects. Thus, subsequent analyses utilised the more sensitive continuous measures of state disgust (scores on DES disgust) and state mindfulness (scores on TMS decentering).

To investigate our hypothesis regarding the effects of state disgust and state mindfulness on decision-making in bowel health contexts, we tested the ability of these variables to predict the overall social avoidance score from the scenarios. A hierarchical multiple regression was conducted with disgust and decentering entered at the first step, and the interaction between these variables entered in the next step. The final model predicted avoidance, $R^2 = .08$, $F(3,97) = 2.88$, $p = .040$, with greater disgust predicting more avoidance, $\beta = .10$, $t(100) = 2.37$, $p = .020$. State mindfulness was not a predictor in this model, $\beta = -.18$, $t(100) = -1.27$, $p = .209$, nor was the interaction, $\beta = .03$, $t(100) = .24$, $p = .810$. Thus, the hypothesis that higher state disgust would predict greater social avoidance was supported, but neither a main nor moderating effect for state mindfulness was found.¹

¹ Given that participants with bowel conditions may have responded differently to these decision-making tasks, we ran alternative analyses excluding these people ($N = 8$), and other than some significant findings now being marginalized (likely due to reduced power), no substantive differences in the overall pattern of findings emerged. Likewise, to test the possibility that relationship status influenced these decisions, we ran alternative regression models with relationship status as a possible covariate at Step 1, and as above, apart from a loss in power, no substantive differences emerged.

Table 2 Logistic regression: Multivariate predictors of water acceptance

Variable	B	Wald	Odds ratio	95 % CI for odds ratio	
				Lower	Higher
<i>Step 1</i>					
Disgust condition	−0.97	5.36	0.38*	0.17	0.86
Constant	0.12	0.18	1.13		
<i>Step 2</i>					
Disgust condition	−0.97	5.35	0.38*	0.17	0.86
Mindfulness condition	0.13	0.09	1.14	0.50	2.56
Constant	0.05	0.02	1.06		
<i>Step 3</i>					
Disgust condition	−0.67	1.32	0.25	0.16	1.61
Mindfulness condition	0.39	0.48	1.48	0.49	4.46
Disgust x mindfulness	−0.58	0.48	0.56	0.11	2.88
Constant	−0.08	0.40	0.92		

* $p < .05$

Next, decisional conflict in making these decisions was assessed. To identify the predictors of the aggregate conflict score, a hierarchical multiple regression was conducted, with disgust and decentering scores entered in Step 1 and their interaction at Step 2. At Step 1, the model predicted decisional conflict, $R^2 = .07$, $F(2,98) = 3.76$, $p = .027$, but entering the interaction term marginalized the model, $R^2 = .07$, $F(3,97) = 2.49$, $p = .065$. In the final model, higher state disgust predicted less conflict, $\beta = -3.45$, $t(100) = -2.59$, $p = .011$, but state mindfulness was not a predictor, $\beta = -2.69$, $t(100) = -.65$, $p = .519$, and nor was the interaction term significant, $\beta = .54$, $t(100) = .17$, $p = .864$. Again then, the expectation that disgust would predict less decisional conflict was supported, but neither a main nor moderating effect for state mindfulness was found.

Disgust, state mindfulness and social networks

Finally, the expectation that disgusted people would be more socially restrictive but that state mindfulness would moderate this effect were investigated. To test these ideas, four key multiple regressions predicting (a) total network size and (b) the number of persons listed in inner, middle, and outer circles were conducted. Disgust and mindfulness were entered in Step 1 and the interaction entered at Step 2 (see Table 3). As predicted, overall network size was lower among more disgusted persons, $\beta = -1.74$, $t(97) = -2.70$, $p = .008$. This effect was *intensified* among those higher in state mindfulness, $\beta = -3.37$, $t(97) = -2.27$, $p = .025$, with greater state mindfulness increasing the effect of disgust on inner circle numbers. No main effect for state mindfulness on the overall network size was evident, $\beta = -2.06$, $t(97) = -1.03$, $p = .304$.

Further regressions tested the numbers within each circle to assess the prediction that peripheral network members would be differentially pruned from networks when people were disgusted. In line with predictions, disgust had no main effect on numbers in the inner circle, $\beta = -.17$, $t(97) = -.06$, $p = .547$, whereas it did predict fewer persons in both middle, $\beta = -.83$, $t(97) = -2.40$, $p = .018$, and outer circles $\beta = -.79$, $t(97) = -2.35$, $p = .021$. For its part, mindfulness was associated with putting fewer people in the inner network $\beta = -1.35$, $t(97) = -2.27$, $p = .026$. Interactions were also evident; the effect of mindfulness on a smaller inner circle was greater among more disgusted persons, $\beta = -1.34$, $t(97) = -3.02$, $p = .003$, and state mindfulness exaggerated the effect of disgust in promoting a smaller middle circle, $\beta = -1.95$, $t(97) = -2.43$, $p = .017$, although not outer circle, $\beta = -.09$, $t(97) = -.11$, $p = .912$.

Discussion

Consistent with predictions and theory, disgust predicted less conflict in decision-making, more socially-avoidant decision-making and behavior, and smaller social network ratings. Although state mindfulness alone was not linked to the behavioral or decision-making variables, it did predict putting fewer people in the inner network, and also increased the socially restricting effect of disgust on some outcomes. Below, these findings are discussed in the context of prior work on disgust, social avoidance, and mindfulness in health contexts, and we assess the clinical implications of the results, and outline study limitations and future directions.

Table 3 Multiple regression: multivariate predictors of numbers in social network circles

Variable	Model 1			Model 2		
	β	SE B	B	β	SE B	B
<i>Total # in social network:</i>						
DES disgust	−1.37*	0.64	−0.22	−1.74**	0.64	−0.28
TMS decentering	−1.82	2.03	−0.09	−2.06	1.99	−0.10
DES disgust x TMS decentering				−3.37*	1.48	−0.23
R^2		0.05			0.10	
F for change in R^2		2.46			5.17*	
<i># inner circle:</i>						
DES disgust	0.03	0.19	0.02	−0.17	0.19	−0.06
TMS decentering	−1.25*	0.62	−0.21	−1.35*	0.60	−0.22
DES disgust x TMS decentering				−1.34**	0.44	−0.30
R^2		0.04			0.13	
F for change in R^2		2.18			9.10**	
<i># middle circle:</i>						
DES disgust	−0.62	0.35	−0.19	−0.83*	0.35	−0.25
TMS decentering	0.09	1.10	0.01	−0.05	1.07	−0.01
DES disgust x TMS decentering				−1.95*	0.80	−0.25
R^2		0.04			0.09	
F for change in R^2		1.71			5.91*	
<i># outer circle:</i>						
DES disgust	−0.78*	0.32	−0.24			
TMS decentering	−0.65	1.03	−0.06			
DES disgust x TMS decentering (not taken into model)						
R^2		0.06				
F for change in R^2		2.94				

* $p < .05$; ** $p < .01$

Disgust and social avoidance in bowel health contexts

Consistent with a few experimental studies testing disgust’s avoidance-promoting role in health (McCambridge et al., 2014; Reynolds et al., 2014; Tybur et al., 2011), one contribution of this research lies in highlighting disgust’s causal role in promoting *social* avoidance. Disgusted participants behaved more avoidantly (rejecting water), made more socially avoidant (and less conflicted) *decisions* in bowel health scenarios (putting off meeting a friend, delaying a weekend away, and saying no to sex), and created a more restricted social network, mostly by recording fewer middle and peripheral members. This pattern is consistent with data indicating that induced inflammation increases feelings of social disconnection (Eisenberger et al., 2010) and that groups living in regions with historically high rates of infectious disease report lower extraversion and openness (Schaller et al., 2008). In theory, a “behavioral immune system” kicks in when we are disgusted—protecting us from the pathogens that others

might carry by limiting social interactions (Curtis et al., 2011; Neuberg et al., 2011).

This interpretation is strengthened by our result that peripheral persons were differentially pruned from networks when people were disgusted. Although recording fewer network members might reflect an *immediate* desire to leave the laboratory (see below), it may also indicate that disgust is particularly sensitive to health threats from strangers. Prior work indicates that strangers evoke stronger avoidance of disgusting material (Peng et al., 2013) and bodily fluids are perceived more disgusting (Curtis et al., 2004). In theory, the response is stronger vis-à-vis less familiar persons because familiar conspecifics carry common germs that are more readily defended (Peng et al., 2013).

Although disgust did not impact all the social avoidance metrics employed here (seat choice was unaffected), the overall pattern points to disgust being causally involved in social avoidance in bowel health. Thus, the first contribution of this work lies in showing that, at least when com-

pleting hypothetical bowel related vignettes in the laboratory, disgust is causally implicated in health-related social avoidance behaviors, decisions, and perceptions.

State mindfulness and social avoidance in bowel problem contexts

Second, this report tested whether state mindfulness might have a primary or moderating effect on social avoidance in bowel health contexts. Prior research suggested that dispositionally more mindful persons are more socially competent (Dekeyser et al., 2008), more empathic (Barbosa et al., 2013), and have better relationships (Barnes et al., 2007); thus induced mindfulness might predict *more* social engagement. However, minimal evidence that state mindfulness predicted less socially avoidant behavior or decision-making was found. Indeed, other than placing fewer persons in the inner circle during the network rating task, there were no main effects associated with state mindfulness at all. It may be that the nature or magnitude of the induction was insufficient to impact outcomes here, that the scenarios are too abstract, that state and trait mindfulness operate differently, or that more mindful persons are somehow more “realistic” in their ratings of anticipated social behavior.

Finally, this report evaluated whether induced mindfulness might moderate the social-avoidance producing effect of disgust. Although evidence suggests lower *experiential* avoidance among more mindful persons (Boulanger et al., 2010), it was unclear whether lower avoidance would be evidenced in social, bowel-health scenarios. On the one hand, because mindfulness training may weaken the tendency to behave automatically in response to feelings (Baer et al., 2009), the disgust-avoidance link might be weakened. On the other, one study has shown that *trait* mindfulness predicted greater avoidance when disgusted (Reynolds et al., 2013). Consistent with the latter, trait-based study, this report found that a brief induction increased disgust’s effects on creating smaller networks overall as well as magnifying the effects of disgust in specifically creating smaller middle networks; likewise, the effect of state mindfulness on creating a smaller inner network was exaggerated by disgust.

In the absence of prior work testing whether emotions promote avoidance comparably across persons varying in state mindfulness, interpretations of this pattern are necessarily preliminary. One possibility (Reynolds et al., 2013) is that current emotion may be more strongly incorporated within the decisional processes of more mindful persons and/or that our induction increased the awareness of emotionality during the decisional tasks. Dispositional mindfulness is known to enhance the tendency to integrate diverse sources of information (Langer,

1989), and this tendency may extend to include felt emotions; disgust might be more experientially salient during the decisional tasks. Paradoxically then, it might be that the lower experiential avoidance of more mindful individuals may sometimes lead to avoidance-promoting emotions exerting a greater influence on behavior. So whereas greater engagement with emotions leads to perseverance and less avoidance in some contexts (Evans et al., 2009), at other times such engagement may lead to *more* avoidance, at least where there are no immediate costs.

Alternately, it may be that felt emotions are differentially used to guide estimates of future feelings among more mindful persons (an “I feel disgusted and socially avoidant now and thus I might in the future” type effect). Within the current design, whether such estimations are more accurate cannot be determined, although work in affective forecasting suggests that more mindful people do make better estimations (Emanuel et al., 2010). Conversely, the comparative *lack* of disgust-driven avoidance in the non-mindful conditions may reflect a failure among these persons to incorporate felt emotion within their decisional processes. If disgust evolved to facilitate avoidance of disgust’s elicitors, then a failure to avoid when disgusted may imply ignoring or over-riding this mechanism.

Less clear is why more mindful people listed fewer persons in the inner circle when making social network ratings, and why this effect was stronger when they were disgusted (keeping in mind that more mindful people were not more disgusted overall). One possibility is that a methodological artifact was present in which disgust promoted a desire to complete tasks quickly so that exposure to the olfactant was terminated. If the mindfulness induction increased awareness of felt disgust, those disgusted may have listed fewer persons to hasten completion of the tasks. To test this possibility, times taken to complete individual laboratory tasks (and the aggregates) were contrasted across conditions; no systematic differences emerged. Hence, though they may be dispositionally less experientially avoidant, greater state mindfulness may not lead to reduced social avoidance in the presence of strong, avoidance-promoting emotions.

Clinical implications

Bowel symptoms such as chronic fecal incontinence and constipation necessarily involve exposure to disgust elicitors such as feces, unpleasant odors, and gastrointestinal investigations (Reynolds et al., 2013); disgust evolved to promote the avoidance of such stimuli. In this light, although social avoidance might be understandable, it may also be detrimental. Maintaining relationships, contact with others, and meetings with health professionals are impor-

tant in illness management and recovery (Holt-Lunstad et al., 2010). Social withdrawal predicts poorer psychological and physiological outcomes (Milbury & Badr, 2013), hence despite the motivational logic of disgust-driven social avoidance, the costs can be high. The current report provides a clear demonstration that disgust is a primary affective substrate for social avoidance in contexts where exposure to feces is likely, and is thus a factor that should be considered in research and clinical work in the area.

However, it is important to remember that avoidance is not always detrimental and the costs and benefits of social engagement may be complex. Indeed, inclusive fitness benefits may be gained from (temporarily) withdrawing from family whilst contagious (Hamilton, 1964) or from relationships more broadly. Social exchanges are not always supportive, nor are “supportive” behaviors always experienced as such (Martin et al., 1994). Thus, the ability to discern who to connect with and who to stay away from at times of physical or psychological vulnerability can be important (Dakof & Taylor, 1990). Confronting others’ “disgusting” symptoms may be awkward or damage relationships. Qualitative work implies some benefits to social avoidance among patients who may use wigs or scarves to hide the visible (disgusting) effects of cancer treatment (Rosman, 2004). Temporary avoidance of this kind may circumvent awkwardness or uncomfortable discussions that strain relationships, enabling patients to sustain relationships longer term. Thus, as is common in bowel contexts where symptoms fluctuate or resolve, temporary avoidance may be adaptive.

Given the complexity of deciding who to connect with and who to avoid when managing bowel problems; a discerning, reflective perspective may be useful. Mindfulness-based interventions appear suitable and have shown benefit in numerous clinical contexts, equipping people with regulatory skills and the ability to engage with experience without judgment or reaction (Gayner et al., 2011). However, our data suggest caution may be warranted when applying brief state mindfulness inductions in contexts where problematic avoidance is likely (as with exposure to feces). Mindfulness training, particularly in its early phases, may run the risk of increasing problematic avoidance behaviors (at least temporarily) if the awareness of “unpleasant” emotion is raised without concomitant training on how to *cope* with feelings that promote avoidance (e.g., teaching non-judging and/or non-reacting skills).

Limitations and concluding remarks

Although these findings represent a useful addition to the understanding of how disgust and state mindfulness may

impact social avoidance in bowel health contexts where extended exposure to feces occurs (such as patients/caregivers dealing with fecal incontinence, chronic constipation or constructed stomas), there are limitations. Firstly, links between disgust and avoidance were relatively small and the moderating influence of state mindfulness only seen in the social network maps, implying other factors are involved and suggesting the need for a larger sample size. Equally, mindfulness training or meditation history was not measured and it seems possible that a brief induction could qualitatively differ from the characteristics associated with formal training or traits. Similarly, the sample was comprised of young, essentially healthy volunteers—not necessarily representative of how individuals facing real bowel health issues might respond. Our sample contained 8 % who reported a bowel problem, and no substantive differences emerged when data were analyzed excluding these people. Likewise, relationship status could also impact responses to questions regarding intimacy; again, however, alternative models covarying relational status failed to substantively change results. However, given prior findings that greater trait mindfulness was associated with more avoidant decision-making in bowel health (Reynolds et al., 2013), it seems likely that the current report is uncovering a worthy area of interest. These data suggest that when mindfulness is induced, people may differentially incorporate current emotional states into their thinking and responses to social relationships. Designs that assess the impact of state disgust and mindfulness on social avoidance where people have health conditions that require heightened exposure to feces could provide important clinical insights in an area where avoidance is common and normatively detrimental. Finally, research in other contexts suggests habituation to disgust elicitors may occur (Rozin, 2008), although no work has investigated exposure effects in bowel health contexts. Future research could provide important clinical guidance into those most vulnerable to disgust-generated avoidance and how best to provide supportive intervention.

Conflict of interest Lisa Reynolds, Yee Sing Lin, Eric Zhou and Nathan Consedine declare they have no conflict of interest.

Animal and Human Rights and Informed Consent All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

References

- Angyal, A. (1941). Disgust and related aversions. *Journal of Abnormal and Social Psychology*, 36, 393–412.

- Baer, R. A., Walsh, E., & Lykins, E. L. B. (2009). Assessment of mindfulness. In F. Didonna (Ed.), *Clinical handbook of mindfulness* (pp. 153–168). New York: Springer.
- Barbosa, P., Raymond, G., Zlotnick, C., Wilk, J., Toomey Iii, R., & Mitchell Iii, J. (2013). Mindfulness-based stress reduction training is associated with greater empathy and reduced anxiety for graduate healthcare students. *Education for Health: Change in Learning and Practice*, 26, 9–14.
- Barnes, S., Brown, K., Krusemark, E., Campbell, W. K., & Rogge, R. D. (2007). The role of mindfulness in romantic relationship satisfaction and responses to relationship stress. *Journal of Marital and Family Therapy*, 33, 482–500. doi:10.1111/j.1752-0606.2007.00033.x
- Beach, M. C., Roter, D., Korthuis, P. T., Epstein, R. M., Sharp, V., Ratanawongsa, N., et al. (2013). A multicenter study of physician mindfulness and health care quality. *The Annals of Family Medicine*, 11, 421–428. doi:10.1370/afm.1507
- Berle, D., & Phillips, E. S. (2006). Disgust and obsessive-compulsive disorder: An update. *Psychiatry - Interpersonal and Biological Processes*, 69, 228–238.
- Bevan, J. L. (2009). Interpersonal communication apprehension, topic avoidance, and the experience of irritable bowel syndrome. *Personal Relationships*, 16, 147–165. doi:10.1111/j.1475-6811.2009.01216.x
- Borg, C., de Jong, P. J., & Schultz, W. W. (2010). Vaginismus and dyspareunia: Automatic versus deliberate disgust responsivity. *Journal of Sexual Medicine*, 7, 2149–2157. doi:10.1111/j.1743-6109.2010.01800.x
- Boulanger, J. L., Hayes, S. C., & Pistorello, J. (2010). Experiential avoidance as a functional contextual concept. In A. M. Kring & D. M. Sloan (Eds.), *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment*. New York: Guilford Press.
- Cagle, J. G., & Bolte, S. (2009). Sexuality and life-threatening illness: Implications for social work and palliative care. *Health and Social Work*, 34, 223–233. doi:10.1093/hsw/34.3.223
- Chapple, A., Ziebland, S., & McPherson, A. (2004). Stigma, shame, and blame experienced by patients with lung cancer: Qualitative study. *BMJ*, 328, 1470.
- Consedine, N. S., & Moscovitz, J. T. (2007). The role of discrete emotions in health outcomes: a critical review. *Applied and Preventive Psychology*, 12, 59–75. doi:10.1016/j.appsy.2007.09.001
- Curtis, V., Aunger, R., & Rabie, T. (2004). Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society Biological Sciences: Series B*, 271, S131–S133.
- Curtis, V., de Barra, M., & Aunger, R. (2011). Disgust as an adaptive system for disease avoidance behaviour. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366, 389. doi:10.1098/rstb.2010.0117
- Dakof, G. A., & Taylor, S. E. (1990). Victims' perceptions of social support: What is helpful from whom? *Journal of Personality and Social Psychology*, 58, 80.
- Deacon, B., & Olatunji, B. O. (2007). Specificity of disgust sensitivity in the prediction of behavioral avoidance in contamination fear. *Behaviour Research and Therapy*, 45, 2110–2120. doi:10.1016/j.brat.2007.03.008
- Dekeyser, M., Raes, F., Leijssen, M., Leysen, S., & Dewulf, D. (2008). Mindfulness skills and interpersonal behaviour. *Personality and Individual Differences*, 44, 1235–1245.
- Drossman, D. A., Chang, L., Schneck, S., Blackman, C., Norton, W. F., & Norton, N. J. (2009). A focus group assessment of patient perspectives on Irritable Bowel Syndrome and illness severity. *Digestive Diseases and Sciences*, 54, 1532–1541. doi:10.1007/s10620-009-0792-6
- Eisenberger, N. I., Inagaki, T. K., Mashal, N. M., & Irwin, M. R. (2010). Inflammation and social experience: An inflammatory challenge induces feelings of social disconnection in addition to depressed mood. *Brain, Behavior, and Immunity*, 24, 558–563. doi:10.1016/j.bbi.2009.12.009
- Emanuel, A. S., Updegraff, J. A., Kalmbach, D. A., & Ciesla, J. A. (2010). The role of mindfulness facets in affective forecasting. *Personality and Individual Differences*, 49, 815–818. doi:10.1016/j.paid.2010.06.012
- Erismann, S. M., & Roemer, L. (2010). A preliminary investigation of the effects of experimentally induced mindfulness on emotional responding to film clips. *Emotion*, 10, 72–82. doi:10.1037/a0017162
- Evans, D. R., Baer, R. A., & Segerstrom, S. C. (2009). The effects of mindfulness and self-consciousness on persistence. *Personality and Individual Differences*, 47, 379–382. doi:10.1016/j.paid.2009.03.026
- Fessler, D. M. T., Eng, S. J., & Navarrete, C. D. (2005). Elevated disgust sensitivity in the first trimester of pregnancy - Evidence supporting prophylaxis the compensatory hypothesis. *Evolution and Human Behavior*, 26, 344–351.
- Fessler, D. M. T., & Navarrete, C. D. (2003). Domain-specific variation in disgust sensitivity across the menstrual cycle. *Evolution and Human Behavior*, 24, 406–417.
- Fiori, K. L., Antonucci, T. C., & Cortina, K. S. (2006). Social network typologies and mental health among older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 61, 25–32.
- Flanagan, J., & Holmes, S. (2000). Social perceptions of cancer and their impacts: Implications for nursing practice arising from the literature. *Journal of Advanced Nursing*, 32, 740–749. doi:10.1046/j.1365-2648.2000.01535.x
- Gayner, B., Esplen, M. J., DeRoche, P., Wong, J., Bishop, S., Kavanagh, L., & Butler, K. (2011). A randomized controlled trial of mindfulness-based stress reduction to manage affective symptoms and improve quality of life in gay men living with HIV. *Journal of Behavioral Medicine*, 35, 272–285. doi:10.1007/s10865-011-9350-8
- Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences*, 16, 701–713.
- Hamilton, W. D. (1964). The genetical evolution of social behaviour. *I. Journal of theoretical biology*, 7, 1–16.
- Henson, H. K. (2002). Breast cancer and sexuality. *Sexuality and Disability*, 20, 261–275. doi:10.1023/a:1021657413409
- Heppner, W. L., Kernis, M. H., Lakey, C. E., Campbell, W. K., Goldman, B. M., Davis, P. J., et al. (2008). Mindfulness as a means of reducing aggressive behavior: Dispositional and situational evidence. *Aggressive Behavior*, 34, 486–496.
- Hesser, H., Molander, P., Jungermann, M., & Andersson, G. (2013). Costs of suppressing emotional sound and countereffects of a mindfulness induction: An experimental analog of tinnitus impact. *PLoS ONE*, 8, 5. doi:10.1371/journal.pone.0064540
- Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, 7, 7.
- Hooper, N., Davies, N., Davies, L., & McHugh, L. (2011). Comparing thought suppression and mindfulness as coping techniques for spider fear. *Consciousness and Cognition*, 20, 1824–1830. doi:10.1016/j.concog.2011.05.013
- Izard, C. E., Libero, D. Z., Putnam, P., & Haynes, O. M. (1993). Stability of emotion experiences and their relations to traits of personality. *Journal of Personality and Social Psychology*, 64, 847–860.

- Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York: Delta.
- Kollei, I., Brunhoeber, S., Rauh, E., de Zwaan, M., & Martin, A. (2012). Body image, emotions and thought control strategies in body dysmorphic disorder compared to eating disorders and healthy controls. *Journal of Psychosomatic Research*, *72*, 321–327.
- Langer, E. J. (1989). *Mindfulness*. Cambridge, MA: Da Capo Press.
- Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., et al. (2006). The Toronto mindfulness scale: Development and validation. *Journal of Clinical Psychology*, *62*, 1445–1467.
- Liquid Asssets Novelties LLC. (2005). *Liquid Ass [Material Safety Data Sheet]*. Retrieved from <http://www.liquidass.com/MSDS.html>
- Martin, R., Davis, G. M., Baron, R. S., Suls, J., & Blanchard, E. B. (1994). Specificity in social support: Perceptions of helpful and unhelpful provider behaviors among irritable bowel syndrome, headache, and cancer patients. *Health Psychology*, *13*, 5.
- McCambridge, S. A., & Consedine, N. S. (2014). For whom the bell tolls: Experimentally-manipulated disgust and embarrassment cause sexual health avoidance among some people. *Emotion*, *14*, 407–415. doi:10.1037/a0035209
- Milbury, K., & Badr, H. (2013). Sexual problems, communication patterns, and depressive symptoms in couples coping with metastatic breast cancer. *Psycho-Oncology*, *22*, 814–822. doi:10.1002/pon.3079
- Neuberg, S. L., Kenrick, D. T., & Schaller, M. (2011). Human threat management systems: self-protection and disease avoidance. *Neuroscience and Biobehavioral Reviews*, *35*, 1042–1051. doi:10.1016/j.neubiorev.2010.08.011
- Oaten, M., Stevenson, R. J., & Case, T. I. (2011). Disease avoidance as a functional basis for stigmatization. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*, 3433–3452. doi:10.1098/rstb.2011.0095
- Ostafin, B. D., & Marlatt, G. A. (2008). Surfing the urge: Experiential acceptance moderates the relation between automatic alcohol motivation and hazardous drinking. *Journal of Social and Clinical Psychology*, *27*, 404–418.
- Peng, M., Chang, L., & Zhou, R. (2013). Physiological and behavioral responses to strangers compared to friends as a source of disgust. *Evolution and Human Behavior*, *34*, 94–98. doi:10.1016/j.evolhumbehav.2012.10.002
- Peveler, R., Carson, A., & Rodin, G. (2002). ABC of psychological medicine: Depression in medical patients. *BMJ. British Medical Journal*, *325*, 149–152.
- Porter, L. S., Keefe, F. J., Hurwitz, H., & Faber, M. (2005). Disclosure between patients with gastrointestinal cancer and their spouses. *Psycho-Oncology*, *14*, 1030–1042. doi:10.1002/pon.915
- Reynolds, L. M., Consedine, N. S., & McCambridge, S. A. (2013). Mindfulness and disgust in colorectal cancer scenarios: Non-judging and non-reacting components predict avoidance when it makes sense. *Mindfulness*. doi:10.1007/s12671-013-0200-3
- Reynolds, L. M., Consedine, N. S., Pizarro, D. A., & Bissett, I. P. (2013b). Disgust and behavioral avoidance in colorectal cancer screening and treatment: A systematic review and research agenda. *Cancer Nursing*, *36*, 122–130. doi:10.1097/NCC.0b013e31826a4b1b
- Reynolds, L. M., McCambridge, S. A., Bissett, I. P., & Consedine, N. S. (2014). Trait and state disgust: An experimental investigation of disgust and avoidance in colorectal cancer decision scenarios. *Health Psychology, Advance online publication*.,. doi:10.1037/hea0000023
- Rosman, S. (2004). Cancer and stigma: Experience of patients with chemotherapy-induced alopecia. *Patient Education and Counseling*, *52*, 333–339.
- Rozin, P. (2008). Hedonic “adaptation”: Specific habituation to disgust/death elicitors as a result of dissecting a cadaver. *Judgement and Decision Making*, *3*, 191–194.
- Rozin, P., Haidt, J., & McCauley, C. R. (2005). Disgust: The body and soul emotion. In T. Dalgleish & M. J. Power (Eds.), *Handbook of cognition and emotion*. John Wiley & Sons Ltd: Chichester, UK.
- Schaller, M., & Murray, D. R. (2008). Pathogens, personality, and culture: Disease prevalence predicts worldwide variability in sociosexuality, extraversion, and openness to experience. *Journal of Personality and Social Psychology*, *95*, 212–221. doi:10.1037/0022-3514.95.1.212
- Schaller, M., & Park, J. H. (2011). The behavioral immune system (and why it matters). *Current Directions in Psychological Science*, *20*, 99–103.
- Schnall, S., Haidt, J., Clore, G. L., & Jordan, A. H. (2008). Disgust as embodied moral judgment. *Personality and Social Psychology Bulletin*, *34*, 1096.
- Tybur, J. M., Bryan, A. D., Mangan, R. E., & Hooper, A. E. C. (2011). Smells like safe sex: Olfactory pathogen primes increase intentions to use condoms. *Psychological Science*, *22*, 478–480. doi:10.1177/0956797611400096
- Vassilev, I., Rogers, A., Blickem, C., Brooks, H., Kapadia, D., Kennedy, A., et al. (2013). Social networks, the ‘work’, and work force of chronic illness self-management: A survey analysis of personal communities. *PLoS ONE*, *8*, e59723. doi:10.1371/journal.pone.0059723