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Effect of partners' disgust responses on cancer patients' psychological wellbeing

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Short title: Partners' disgust and psychological wellbeing in cancer patients

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42 **Abstract**

43 The aim of this study was to explore quantitatively the relationship between disgust responses
44 in cancer patients and their partners, and in turn their relationship to patients' psychological
45 wellbeing. We recruited 50 participants with heterogeneous cancer diagnoses and their
46 partners from cancer-related groups (e.g. charities). Patients completed questionnaires to
47 determine levels of disgust propensity, disgust sensitivity, self-disgust, and symptoms of
48 anxiety and depression. Disgust propensity and sensitivity were also assessed in their partners.
49 Partners' disgust sensitivity was significantly positively correlated with cancer patients' self-
50 disgust, disgust propensity and depression. Path analyses suggested that patients' self-disgust
51 plays a role in mediating the effect of partners' disgust sensitivity on patients' psychological
52 wellbeing. This study provides the first quantitative evidence that psychological wellbeing in
53 cancer patients is contingent on their partners' sensitivity to disgust, and that patients' self-
54 disgust plays a mediating role. Focusing therapeutically on disgust responses could well be
55 beneficial to people with cancer.

56

57 **Keywords:** Disgust propensity, disgust sensitivity, depression, anxiety, self-disgust

58

59 **Introduction**

60 Cancer is increasingly recognized and conceptualized as a disease that affects the entire
61 family unit, especially the patient’s significant other (Hodges, Humphris, & Macfarlane, 2005;
62 Baik & Adams, 2011; referred to here as their “partner” for brevity). Research indicates that
63 the relationship with their partner plays a critical role in cancer patients' adaptation to the
64 illness (e.g., Wimberly, Carver, Laurenceau, Harris, & Antoni, 2005). When attachment with
65 the partner is less secure, the relationship can lead to the creation, transmission, and
66 maintenance of poor psychological wellbeing (e.g., Rodin et al., 2007).

67 One potential means by which partners may influence patients’ wellbeing is through
68 negative emotions such as disgust, i.e., feelings of revulsion triggered by something offensive
69 or unpleasant, linked to behavioral avoidance and rejection (Rozin, Haidt, & McCauley,
70 2008). Patients with cancer often experience strong disgust reactions in response to a range of
71 cancer-related stimuli (Powell, Azlan, Simpson, & Overton, 2016). With cancer, the disgust
72 emotion is not exclusively experienced by patients, but partners may also experience disgust
73 towards their significant others as a result of symptoms and treatment side effects (e.g., stoma
74 usage; Smith et al., 2002). As well as disgust arising from physical aspects of the disease and
75 cancer care, disgust in the partners of cancer patients may also originate from anxiety
76 concerning infection from (even a non-contagious) disease (e.g., Wortman & Dunkel-
77 Schetter, 1979). People naturally avoid individuals who appear to have an infectious disease
78 (Kouznetsova, Stevenson, Oaten, & Case, 2012), and also those with non-infectious
79 conditions that mimic disease cues, such as obesity (Park, Schaller, & Crandall, 2007).

80 Partners of cancer patients, as with all other individuals, will exhibit differences in
81 disgust responding. Van Overveld and colleagues (van Overveld, de Jong, Peters, Cavanagh,
82 & Davey, 2006) make a distinction between “disgust propensity” (an individual’s tendency to
83 experience disgust, i.e., the likelihood that an individual will be disgusted), and “disgust

84 sensitivity” (the degree to which the response is unpleasant or distressing to an individual, i.e.
85 the extent to which the disgust experience is negatively appraised), a distinction validated via
86 the Disgust Propensity and Sensitivity Scale (van Overveld et al., 2006). This instrument
87 measures propensity and sensitivity broadly and has been shown to have a two factor solution
88 with items separately loading ($>.3$) on the two subscales. Hypervigilance to avoid impurity
89 may be particularly prominent in individuals who have higher disgust propensity, where they
90 may have enhanced sensory sensitivity (e.g., Schäfer, Leutgeb, Reishofer, Ebner, & Schienle,
91 2009), accompanied by a tendency to overestimate threats and the potential risk of infection
92 (e.g., Deacon & Olatunji, 2007; Schaller & Park, 2011). A similar overstated reaction may
93 also occur in individuals with higher disgust sensitivity, where they may experience
94 difficulties in successfully controlling specific affective experiences (e.g., Cisler, Olatunji, &
95 Lohr, 2009), and have a tendency to develop more intense disgust-related evaluations of
96 disgust-relevant stimuli (e.g., Olatunji, Lohr, Smits, Sawchuk, & Patten, 2009).

97 The frequency (disgust propensity) and intensity (disgust sensitivity) of disgust
98 reactions in cancer partners may be influential in affecting how patients feel about *themselves*.
99 It has been suggested that individuals may internalize the revulsion of others directed towards
100 them in the form of “self-disgust” (Powell, Overton, & Simpson, 2014). Self-disgust has been
101 proposed as an emotion schema consisting of two components, disgust towards the “self” and
102 disgust towards one’s behavior (“disgusting ways”; Powell, Simpson, & Overton, 2015a).
103 Self-directed disgust has been conceptualized as part of the emotional pantheon centered on
104 bodily characteristics (Fox, 2009; Neziroglu, Hickey, & McKay, 2010; Moncrieff-Boyd,
105 Byrne, & Nunn, 2014). Considerable theoretical interest has been directed towards self-
106 disgust as a pan-diagnostic concept relevant to the development and maintenance of a range
107 of mental health problems including depression (Overton, Markland, Taggart, Bagshaw, &
108 Simpson, 2008) and anxiety (Azlan, Overton, Simpson, & Powell, 2016). Taken together, the

109 evidence above suggests that disgust propensity and disgust sensitivity in the partners of
110 cancer patients, and the ensuing responses to the patient's symptoms and side effects of
111 treatments, may influence how disgusted patients feel about themselves and hence their
112 subsequent psychological wellbeing.

113 In spite of the potential connection between disgust in cancer patients and partners,
114 work conducted so far on the topic has been largely qualitative and has focused on issues of
115 sexuality (e.g., Hawkins, Ussher, Gilbert, Perz, Sandoval, & Sundquist, 2009), post-treatment
116 care of colorectal surgery (e.g., Persson, Severinsson, & Hellström, 2004) and side effects
117 following therapy (e.g., Navon & Morag, 2003). Little is known about the contribution of
118 partners' disgust responses to patients' psychological wellbeing, and no research has yet
119 investigated the relationship quantitatively. In the present study we conducted an initial
120 exploration of the effects of disgust traits in partners on self-disgust and anxious and
121 depressive symptoms in cancer patients. Based on the considerations above, we hypothesised
122 that self-disgust levels (and anxiety/depression) would be heightened in cancer patients and
123 that this would be positively associated with trait disgust propensity and disgust sensitivity in
124 partners.

125

126

127 **Methods**

128 *Participants and Procedure*

129 Ethical approval was granted by the host research institution prior to data collection. We
130 recruited 50 participants with heterogeneous cancer diagnoses and their partners that had
131 never been diagnosed with cancer. Patients were required to have an active cancer diagnosis
132 (either recently diagnosed, undergoing treatment, or experiencing some degree of persistent

133 or recurrent disease) rather than being in remission. Additionally, participation was only
134 available to those who had a partner.

135 The cancer sample was recruited from cancer charities, cancer and health forums,
136 cancer care organizations and mental health organizations for people with cancer, based in
137 English speaking countries. Overall, 1,008 organizations were initially approached, and of
138 those, 107 agreed to share our advertisement with their members. The eventual sample came
139 from organizations based in the United Kingdom, United States of America, and Canada.

140 We conducted recruitment in two phases. In phase 1, the participants were recruited
141 without remuneration ($n = 18$), and in phase 2 ($n = 32$), the participants were rewarded with
142 remuneration to boost recruitment (10 US dollars per patient, and 10 US dollars per partner).
143 One British pound was donated to Worldwide Cancer Research for every dyad that took part.
144 Overall, 171 individuals with cancer accessed the study website, but only 131 individuals
145 filled in the measures, another 40 individuals deciding not to go forward. From the 131
146 individuals who filled the measures, 78 of their partners initially responded, but only 50
147 partners finished the measures, the other 28 partners deciding not to go forward.

148 The data were gathered as part of a larger survey into psychological responses to
149 cancer, examining disgust propensity, sensitivity and self-disgust in people diagnosed with a
150 broad range of cancers (versus cancer-free controls), and their association with psychological
151 wellbeing. In a previous publication based on that survey (Azlan et al., 2016), we published
152 data from 107 individuals with cancer (reduced from the full cohort of 131 by the constraints
153 of matching to a control group). Those included in the present study were the reduced cohort
154 of respondents for whom we had both patient and partner data.

155 The cancer-related organisations were identified through internet searches. Some of
156 the organizations were contacted through their websites and some were contacted by emailing
157 their staff or coordinators. The contact communication first explained the context of our work

158 (“our group has recently been working on quality of life and mental health in people with
159 cancer and we’d like to extend this work to cancer-care context.”), our current interest (“we
160 would like to evaluate how.... feeling states and mental well-being in people with cancer are
161 influenced by their partners' psychological traits, with a view to ultimately help them to have
162 an improved quality of life’.) and what we needed from them (“[we] were wondering if it
163 might be possible to contact people who have cancer through your organisation, and, if so,
164 what steps would be necessary to make that happen.”) If the organisation replied and was
165 willing to help, we then forwarded them an advertisement which they could circulate to their
166 members. After introducing the team, the advertisement stated that we were investigating
167 (“how partners’ psychological traits and self-conscious emotional factors might impact on
168 how people with cancer feel about themselves.”) The study “needs you and your
169 spouse/partner to participate as a pair.” Participants were told that they would receive a full
170 debrief following participation.

171 On the study website to which potential participants were directed, patients were
172 reminded that the study aimed to explore what impact “your partners’ psychological traits
173 and self-conscious emotional factors have on your emotional responses”, and that the study
174 “needs you and your spouse/partner to participate as a pair, but for the study to be valid and
175 produce meaningful results you must complete the survey separately.” In the informed
176 consent, patients were told “If you agree to participate in this survey, please leave your and
177 your partners’ email address in the space provided.” Furthermore, in the informed consent,
178 patients declared “I agree to complete the survey separately to my partner, in confidence, and
179 we will not actively try to influence each other’s responses.” Participants completed the
180 measures listed below in a counterbalanced order and were then fully debriefed. In the
181 debrief participants were told that the study was “concerned with how partners’ psychological
182 traits influence emotional responses and psychological well-being (i.e., depression and

183 anxiety) in cancer patients.” Furthermore, “it was hypothesised that those who have partners
184 with the lower level of such emotions would report lower levels of negative self-directed
185 emotions (and hence better well-being on average) than those who have partners with higher
186 levels of negative, externally directed emotions.”

187 The partners of cancer patients were contacted using the email addresses the patients
188 had provided. In the distribution email for the partners, the partners were informed that the
189 cancer patient has participated in a survey. The partner was told that the patient “has
190 participated in a survey that needs you to participate as a pair, but for the study to be valid
191 and produce meaningful results you must complete the survey separately” and that the
192 research is “looking at the relationship between your psychological traits and your partner’s
193 [i.e. the patient’s] emotional responses.” In the informed consent, the partner was told that:
194 “If you decide to take part you will be asked to fill-out a series of questionnaires about
195 yourself, your background and your psychological traits.... you are asked to participate
196 regardless of the nature (e.g., negative, neutral or positive) of your cancer care experience.”
197 We also emphasised that “it is very important that you and your partner do not actively try to
198 influence each other’s responses.”, furthermore “your partner will not see your responses.”
199 Partners were then directed to a separate link that presented a modified online survey. The
200 measures they completed are listed below. They were debriefed after completing the survey.

201 Patients had a mean age of 49.16 years ($SD = 14.20$) and partners a mean age of 49.70
202 years ($SD = 12.80$). Nine of the couples were same-sex, and of the remaining 41, the patient
203 was male in 15 couples and female in 26. Ethnicity was assessed by question(s) that asked
204 “How would you describe your ethnicity?”, with a range of response options (White British,
205 Asian British, Asian Other, Black Other, White Irish, Indian, Black British, Chinese, White
206 European, Pakistani, Black Caribbean, Other ethnic group, White Other, Bangladeshi and

207 Black African; “white” here is used to mean people of native British, Irish and European
208 origin). The majority of couples, 38 of 50, had the same ethnicity. Regarding patient
209 ethnicity, 36 of 50 were non-White British (most frequently ‘White Other’, n = 17, or ‘White
210 European’, n = 10). Of the partners, 34 of 50 partners were non-white British (most
211 frequently ‘White European’, n = 14, or ‘White Other’, n = 13), the remainder of each group
212 being White British.

213 Survey questions in the cancer patients’ survey requested information about medical
214 history and status. The survey asked “what type of primary cancer have you been diagnosed
215 with? What stage is your cancer at now? Have you received treatment for your cancer?
216 Which form of treatment have you received?” Responses indicated that participants had
217 various types of primary cancer, the most common being gastrointestinal stromal tumour
218 (14%), gynaecological (10%), breast (8%), colon (8%), and Hodgkin lymphoma (8%). One
219 participant reported more than one type of primary cancer. Of those who chose to declare, the
220 modal Stage (12/40) was II in terms of progression. The majority of participants had received
221 multiple treatments for their cancer, with chemotherapy (60%), surgery (44%), and
222 radiotherapy (42%) being the most common. Only two participants had not had treatment for
223 their cancer.

224

225 ***Measures***

226 Patients provided demographic information and completed measures of trait self-disgust,
227 disgust propensity, disgust sensitivity, and anxiety and depression, whereas their partners
228 only completed demographics and measures of disgust propensity and disgust sensitivity.

229 *Self-disgust.* Participants’ trait self-disgust was measured using the Self-Disgust Scale
230 (Overton et al., 2008). For each of 18 items, participants rate how much they agree it is
231 descriptive of them on a 7-point Likert scale (1=*strongly agree*, 7=*strongly disagree*). The

232 scale contains a number of filler items and two 5-item subscales, one measuring physical self-
233 disgust (an example item from the physical self-disgust subscale is “I find myself repulsive”)
234 and the other behavioral self-disgust (an example item from the behavioral subscale is “I
235 often do things I find revolting”). Hence the lowest score for the full scale (used here) was 10
236 and the highest – indicating the highest level of self-disgust – was 70. In the cancer patient
237 sample, the Cronbach’s alpha for self-disgust was .93.

238 *Disgust propensity and sensitivity.* Participants’ disgust propensity and disgust
239 sensitivity were measured using a version of the 12-item Disgust Propensity and Sensitivity
240 Scale-Revised (DPSS-R; Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007). Participants
241 read 12 statements and chose the answer which is most appropriate to them, on a 5-point
242 scale (1=*never*, 5=*always*). Examples of disgust propensity items are “I experience disgust”
243 and “I feel repulsed”, and examples disgust sensitivity items are “It scares me when I feel
244 nauseous” and “I think disgusting items could cause me illness/infection.” Based on
245 psychometric evaluations of the DPSS-R (Goetz, Coughle, & Lee, 2013), a recommended 10
246 item solution (six items for disgust propensity and four for disgust sensitivity) was used for
247 analyses, with potential scores ranging from 6-30 on the propensity subscale and 4-20 on the
248 sensitivity subscale, with higher scores indicating higher levels of disgust propensity and
249 sensitivity (respectively). The 10 item solution proposed by Goetz et al. (2013) involves
250 removing items that loaded onto a third factor in their study (i.e. neither propensity nor
251 sensitivity), that factor concerning negative appraisals of oneself in response to feeling
252 disgusted – “It embarrasses me when I feel disgusted,” “I think feeling disgusted is bad for
253 me.” For the 10 item solution in the cancer sample, the Cronbach’s alpha for disgust
254 propensity was .79 and .69 for disgust sensitivity. In the partner sample, alphas were .83 for
255 disgust propensity and .77 for disgust sensitivity.

256 *Anxiety and depression.* Levels of anxiety and depression in participants were
257 measured using the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith,
258 1983). The scale was developed for use amongst hospital inpatients and has been previously
259 validated in patients with cancer (e.g., Smith et al., 2002). The HADS also has been used in
260 control samples (e.g., Azlan et al, 2016). The scale consists of 14 items with seven items
261 measuring anxiety and another seven items measuring depressive symptoms. Each item is
262 rated on a 4-point scale (0–3 *with varying labels*) according to the severity of difficulties
263 experienced, hence scores range from 0-21 on each subscale, with higher scores indicating
264 higher levels of anxiety and/or depression. Example items from the anxiety subscale are “I
265 get sudden feelings of panic” and “I feel tense and wound up,” and example items from the
266 depression subscale are “I feel as if I am slowed down” and “I have lost interest in my
267 appearance.” In our cancer sample, the alpha coefficients for HADS were .82 (anxiety)
268 and .81 (depression).

269

270 ***Data analysis plan***

271 Following descriptive and correlational analyses on SPSS v. 22 (IBM Corp., Armonk, NY,
272 US), a path model was developed using in AMOS version 22 (IBM Corp.) to examine the
273 relationship between partners’ disgust traits and patients’ psychological wellbeing. Path
274 analysis has several advantages over standard multiple regression, including the estimation of
275 direct and indirect effects (through mediating variables) simultaneously; the ability to model
276 multiple endogenous (i.e., dependent) variables at the same time, allowing one to account for
277 their interdependence caused by extraneous variables (by correlating their error terms); and
278 the calculation of multiple measures of fit to the data (see e.g. Powell et al., 2016).

279 As recommended by Hayes (e.g., Hayes, 2009), bias-corrected bootstrapping was
280 used to produce robust confidence intervals and standard errors (and hence probability values)

281 for all estimates, including direct and indirect effects, removing any restrictions on the nature
282 of the underlying sampling distribution. Ten thousand resamples were used for the
283 bootstrapped estimates (Mallinckrodt, Abraham, Wei, & Russell, 2006). The bootstrap
284 adjusted p-value was interpreted to assess model fit based on the Chi-square statistic (χ^2),
285 along with the Comparative Fit Index (CFI) and the Root Mean Square Error of
286 Approximation (RMSEA).

287 One note of caution needs to be mentioned here, namely that the statistical analyses
288 include 5 predictor variables and a number of control variables (see below), hence with 100
289 participants, the subject/predictor ratio falls below the criteria suggested for regression-based
290 models (for example Green, 1991, suggests $n > 50 + 8m$, where n is the number of
291 participants and m is the number of predictors), with a consequent increase in the likelihood
292 of Type 2 errors.

293

294 ***Procedure***

295 ~~Ethical approval was granted by the host research institution prior to data collection. As part~~
296 ~~of a larger survey into psychological responses to cancer, we approached cancer charities and~~
297 ~~support groups with a link to an online survey. Participation was only available to those who~~
298 ~~had a partner. Before proceeding, patients were told that they and their partner would need to~~
299 ~~participate as a pair, and would be required to leave their and their partners' email addresses.~~
300 ~~Patients also were told that they would need to complete and submit their questionnaires~~
301 ~~separately from their partners. For the partners, they were approached with a separate link to~~
302 ~~an online survey by the email addresses left by the patients. Participants completed the~~
303 ~~measures listed above in a counterbalanced order and were fully debriefed.~~

304

305

306 **Results**

307 *Bivariate associations and other comparisons*

308 Disgust sensitivity was higher in cancer patients ($M = 9.60, SD = 3.23$) than in their partners
309 ($M = 9.16, SD = 3.27$), while disgust propensity was lower in cancer patients ($M = 14.44, SD$
310 $= 3.83$) than their partners ($M = 15.80, SD = 3.86$; as in Azlan et al., 2016), although in
311 neither case were these differences significant, although in the case of disgust propensity,
312 there was trend ($t(49) = -1.83, p < .01, d = .38$).

313 Bivariate correlational analyses between partner and patient variables ~~were carried out~~
314 ~~using SPSS version 22 (IBM Corp., Armonk, NY, US)~~ and are presented in Table 1. There
315 were significant positive correlations between partners' disgust sensitivity and two of three
316 disgust traits in the cancer patients: self-disgust, and disgust propensity, but not disgust
317 sensitivity. There was also a significant positive correlation between partners' disgust
318 sensitivity and patients' depression. However, there were no significant correlations between
319 disgust propensity in partners and any of the cancer patients' disgust traits or measures of
320 their psychological wellbeing.

321

322 *Mediation analyses*

323 ~~A path model was developed using in AMOS version 22 (IBM Corp., Armonk, NY, US) to~~
324 ~~examine the relationship between partners' disgust traits and patients' psychological~~
325 ~~wellbeing. As recommended by Hayes (e.g., Hayes, 2009), bias corrected bootstrapping was~~
326 ~~used to produce robust confidence intervals and standard errors (and hence probability values)~~
327 ~~for all estimates, including direct and indirect effects, removing any restrictions on the nature~~
328 ~~of the underlying sampling distribution. Ten thousand resamples were used for the~~
329 ~~bootstrapped estimates (Mallinckrodt, Abraham, Wei, & Russell, 2006). The bootstrap~~
330 ~~adjusted p value was interpreted to assess model fit based on the Chi-square statistic (χ^2),~~

331 ~~along with the Comparative Fit Index (CFI) and the Root Mean Square Error of~~
332 ~~Approximation (RMSEA).~~

333 In our path analyses we controlled for the patient's gender, age of patients and
334 partners, ethnicity (1 = White British, 0 = non-White British), the ethnic match within the
335 couples (1 = same ethnicity, 0 = different ethnicity), and sexuality of the couples (1 =
336 heterosexual, 0 = homosexual). Gender (e.g., Rohrmann, Hopp, & Quirin, 2008), age (Curtis,
337 Aunger, & Rabie, 2004), and cultural background (Moretz et al., 2009) have all been shown
338 to influence disgust responding. Furthermore, given that attitudes to same-sex and
339 heterosexual couples differ (Inbar, Pizarro, Knobe, & Bloom, 2009), insofar as self-disgust is
340 constructed in part from the attitudes of others towards us (Powell et al., 2015a), this may in
341 turn influence self-disgust levels in these two groups.

342 The results of the path analyses are presented in Table 2. The first analysis, without
343 patients' disgust propensity and disgust sensitivity (Model 1; Figure 1; a reasonable fit to the
344 data: $\chi^2(6) = 15.45, p = .02$; CFI = 0.94, RMSEA = 0.18, 90% CI [.07, .29], $p = .03$),
345 revealed a positive relationship between partners' disgust sensitivity and patients' self-disgust,
346 which in turn had a positive relationship with patients' anxiety and depression. Patients' self-
347 disgust fully mediated the association between partners' disgust sensitivity and levels of
348 anxiety and depression, controlling for patients' gender, sexuality, and the age of both
349 partners and patients. Partners' disgust propensity also exerted a significant indirect effect on
350 patients' anxiety and depression via patients' self-disgust, but the effect was in the opposite
351 direction to that of disgust sensitivity (i.e., partners' disgust propensity was related to anxious
352 and depressive symptoms via reduced self-disgust in patients).

353 When patients' disgust propensity and disgust sensitivity were also included in the
354 model (Model 2; Figure 2; necessarily a perfect fit to the data, $\chi^2 = .00$), the indirect effects
355 of partners' disgust sensitivity on patients' anxiety, $\beta = .15$, 95% CI [.01, .48], $p = .07$, and

356 depression, $\beta = .17$, 95% CI [.01, .50], $p = .07$, via patients' self-disgust, were still borderline
357 significant. However, the indirect effects of partners' disgust propensity on patients' anxiety,
358 $\beta = -.10$, 95% CI [-.36, .01], $p = .13$, and depression, $\beta = -.11$, 95%, CI [-.39, .01], $p = .13$,
359 via the patients' self-disgust, were no longer significant. The results suggest that the effect of
360 partners' disgust traits on patients' anxiety and depression is partly driven by the shared
361 variance they have with the patients' disgust traits.

362

363 **Discussion**

364 The main purpose of this study was to explore how partners' disgust traits affect
365 psychological wellbeing in cancer patients. The strongest finding from the study – in line
366 with our original hypothesis - was a positive relationship between partners' disgust sensitivity
367 and patients' self-disgust, and between patients' self-disgust and patients' anxiety and
368 depression; that is, the more intense the disgust sensitivity in partners, the poorer the
369 psychological wellbeing in patients, a relationship in which patient's self-disgust plays a
370 mediating role. Existing studies acknowledge that partners experience disgust towards cancer
371 patients (e.g., Hawkins et al., 2009; Persson et al., 2004; Wortman & Dunkel-Schetter, 1979),
372 and aversion towards cancer patients generally stems from changes in the appearance of the
373 patient and fears that the disease is contagious, which has been documented as a major cause
374 of rejection of the patient (Crowther, 2010). Patients are explicitly aware of the rejection,
375 some of them saying that their partners refuse to have any physical contact with them, due to
376 the disgust evoked by the sight of their bodies (Navon & Morag, 2003).

377 The features of the facial disgust reaction are essentially defensive, with the
378 narrowing of the nostrils and movements of the mouth region suggestive of expulsion and the
379 prevention of penetration (Angyal, 1941). Disgust-related avoidance in cancer can take many
380 forms (Reynolds, Bissett, Porter, & Consedine, 2016), and partners' heightened disgust

381 sensitivity may serve as an instinctive response to protect them from infection and
382 contamination (e.g., Curtis et al., 2004), possibly arising from a failure of emotion regulation
383 and impulse control (e.g., Cisler et al., 2009). This is consistent with evidence elsewhere that
384 disgust levels increase when the threat of infection (Fessler, Eng, & Navarrete, 2005), or even
385 the perceived threat of infection is high (Prokop & Fančovičová, 2013).

386 Behaviors engendered by the heightened disgust sensitivity in partners might be
387 perceived as indicating rejection or disapproval by patients. For example, partners may
388 engage in “neutralizing” behaviors such as wiping their hands, or showering immediately
389 after contact with the patients, which might be interpreted by patients as evidence for them
390 being appraised as repulsive, leading to heightened self-disgust (e.g., de Jong & Borg, 2015).
391 Consequently, if partners experience a greater intensity of disgust and are not effective in
392 hiding their disgust, it might intensify self-disgust in patients via internalization of the
393 partners’ expression of disgust (Powell et al., 2014; de Jong & Borg, 2015), which in turn
394 may result in patients’ mental health problems (e.g., Azlan et al., 2016; Powell et al., 2016).

395 Although there was a relationship between partners’ disgust sensitivity and patients’
396 self-disgust, contrary to our original hypothesis, the same was not true for partners’ disgust
397 propensity and patients’ self-disgust. While it might be anticipated that partners’ disgust
398 propensity - their tendency to experience disgust, or how readily they respond with disgust -
399 would influence patients’ self-disgust in the same way as partners’ disgust sensitivity, disgust
400 propensity appears to be relatively malleable, being influenced (for example) by context
401 (Viar-Paxton & Olatunji, 2012), emotion regulation (Cisler et al., 2009), and habituation
402 (Azlan et al., 2016). That may make disgust propensity (versus disgust sensitivity) a
403 fluctuating, “noisy” source of information about the partners’ emotional state, adding little to
404 the information provided by disgust sensitivity, which appears to be more stable over time
405 (cf. test-retest reliability; van Overveld et al., 2006; Olatunji et al., 2007).

406 In the context of cancer, therapy for couples has tended to focus almost exclusively on
407 protecting and rebuilding their sexual relationship (e.g., Grayer 2016). However, findings
408 from the present research suggest that focusing on disgust responses, particularly self-disgust,
409 could well be beneficial therapeutically to people with cancer. The development of
410 depression and anxiety might be diminished by attention to the degree of self-disgust
411 experienced by cancer patients, and interventions intended to reduce levels of these
412 maladaptive responses (Azlan et al., 2016). Recent experimental work has shown that the
413 self-affirmation of valued character traits may be a promising tool for reducing in-the-
414 moment feelings of self-directed disgust (Powell, Simpson, & Overton, 2015b).

415 There may also be scope to develop therapeutic interventions for couples based on
416 other aspects of disgust. Although, as we mentioned above, disgust sensitivity remains
417 relatively stable across time, disgust propensity appears to be more malleable (Azlan et al.,
418 2016). Indeed, disgust propensity shows evidence of habituation in a domain-specific manner
419 via exposure to relevant disgust elicitors (Rozin, 2008). It is possible that (for example) prior
420 exposure to examples of disgust-eliciting stimuli ahead of treatment could lessen disgust
421 propensity in partners, or at least inoculate them to the effect of upcoming elicitors. However,
422 it must be remembered that in the present study partner's disgust propensity played a less
423 important role than their disgust sensitivity in patient's anxiety and depression.

424 In more general terms, the present study's focus on emotional factors in the genesis of
425 anxiety and depression in people with cancer suggests that therapeutic approaches using
426 "second wave" cognitive behavior therapy (CBT) based on challenging dysfunctional
427 thoughts may be less appropriate in this group. Recently, Acceptance and Commitment
428 Therapy (ACT) has been proposed as a useful approach for psychological distress in cancer
429 patients (Angiola & Bowen, 2013). Our findings here which stress the importance of
430 emotional factors in psychological wellbeing in cancer patients adds further weight to this

431 suggestion, given ACT's focus on emotional acceptance. Early indications are that ACT is
432 indeed more effective than CBT at lowering levels of depression and anxiety in people with
433 breast cancer (Paez, Luciano, & Gutierrez, 2007).

434 Limitations: The primary limitation in this study is the moderate sample size, which
435 reflects the challenge of conducting a dyadic study involving people with cancer, with only
436 around ten percent of the organizations we approached being willing to share our advert with
437 their members. This recruitment difficulty is the likely cause of an aspect of our participant
438 sample that adds a challenge to how representative they were, namely nine of the couples
439 (18%) in our study were same sex, a figure that is much higher than the proportion of same
440 sex couples in any of the countries in which the recruiting organizations were based. In the
441 UK for example, the most recent survey suggests that around 1% of couples are same sex
442 (Office of National Statistics, 2015). As a consequence, our sample may not be representative
443 with respect to this dimension. In terms of the influence that this may have on relevant
444 measures, as we mentioned above, self-disgust levels may be different in same sex and
445 heterosexual couples given differences in attitudes towards these groups (Inbar, Pizarro,
446 Knobe, & Bloom, 2009) and the role of the attitudes of others in constructing self-disgust
447 schema (Powell et al., 2015a).

448 A further limitation of the present research is that it relies entirely on self-report
449 measures. However, self-report measures have been extensively used in research on disgust
450 as they are inexpensive, easy to administer (in comparison to physiological and neurological
451 measures), and are particularly useful in studies (such as this) that are concerned with the
452 simultaneous assessment of multiple emotional states (Simpson, Carter, Anthony, & Overton,
453 2006).

454 Finally, this study was also limited by its cross-sectional design, although longitudinal
455 studies are very difficult to conduct and interpret in people with cancer, who have a chronic

456 progressive illness, the nature of which and the treatments associated with which change over
457 time. Furthermore, we have found the attrition rate (particularly with negatively-valenced
458 studies like our own) to be high in this group.

459

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464

465 **Compliance with Ethical Standards**

466

467 **Conflict of Interest.** See statement on title page

468

469 **Human Rights and Informed Consent.** All procedures followed were in accordance with
470 the ethical standards of the responsible committee on human experimentation, Institutional
471 and/or National, and with the 1964 Helsinki declaration and its later amendments or
472 comparable ethical standards. All individuals included in the study provided informed
473 consent.

474

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495 [space.library.yorku.ca/xmlui/handle/10315/28261](https://utmb-ir.tdl.org/utmb-ir/bitstream/handle/2152.3/123/Crocker_Crowther_Final_6_18_10.pdf?sequence=1&isAllowed=yhttp://yorkspace.library.yorku.ca/xmlui/handle/10315/28261)

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634

635 **Figures**

636

637 Figure 1.

638 Mediation model 1 - Effect of partners' disgust sensitivity and disgust propensity on anxiety
639 and depression in people with cancer through patients' self-disgust. Control variables and
640 error terms are omitted for clarity. Error terms for the two outcome variables (anxiety and
641 depression) were correlated. All estimates are standardised betas (β). Significance levels
642 were determined based on bootstrapped CIs (10,000 resamples). Paths in bold represent
643 significant path estimates. Asterisked coefficients are significant at $*p < .05$, and $**p < .01$.

644

645 Figure 2.

646 Mediation model 2 - Effect of partners' disgust sensitivity and disgust propensity on anxiety
647 and depression in people with cancer through patients' self-disgust, controlling for patients'
648 disgust traits. Control variables and error terms are omitted for clarity. Error terms for the
649 two outcome variables (anxiety and depression) were correlated. All estimates are
650 standardised betas (β). Significance levels were determined based on bootstrapped CIs
651 (10,000 resamples). Paths in bold represent significant path estimates. Asterisked
652 coefficients are significant at $*p < .05$

653

654 *Table 1.* Bivariate correlation coefficients (Pearson's *r*) among study variables in cancer
 655 patients and their partners

Variable	1	2	3	4	5	6	7
1. Disgust propensity (partner)	—						
2. Disgust sensitivity (partner)	.76**	—					
3. Disgust propensity(patient)	.07	.35*	—				
4. Disgust sensitivity(patient)	.07	.20	.65**	—			
5. Self-disgust (patient)	.11	.36**	.51**	.38**	—		
6. Anxiety (patient)	.11	.19	.49**	.39**	.48**	—	
7. Depression (patient)	.17	.36*	.52**	.40**	.55**	.59**	—
Range	10-28	4-20	6-24	4-16	14-67	1-18	0-19
<i>M</i>	15.80	9.16	14.44	9.60	37.00	8.46	7.02
<i>SD</i>	3.86	3.27	3.83	3.23	16.18	3.86	4.04

656 *Note.* *N* = 50 patient-partner dyads. Asterisked coefficients are significant at **p* < .05 and ***p* < .01.

Table 2. Direct and indirect effects and 95% confidence intervals for mediation models.

Model pathways	Model 1				Model 2			
	Estimates	SE B	95% CI		Estimates	SE B	95% CI	
			LL	UL			LL	UL
<i>Direct effects</i>								
Partners' DP → Patients' SD	-.40	.22	-.71	.01	-.26	.25	-.61	.20
Partners' DS → Patients' SD	.63*	.22	.24	.95	.41	.26	-.03	.82
Partners' DP → Patients' anxiety	.17	.22	-.17	.53	.27	.22	-.07	.62
Partners' DP → Patients' depression	.01	.24	-.36	.42	.09	.24	-.26	.50
Partners' DS → Patients' anxiety	-.19	.25	-.57	.19	-.32	.26	-.73	.08
Partners' DS → Patients' depression	.21	.22	-.16	.54	.09	.23	-.32	.43
Patients' SD → Patients' anxiety	.53**	.14	.28	.74	.37*	.18	.10	.67
Patients' SD → Patients' depression	.50**	.14	.31	.77	.40*	.19	.11	.71
Patients' DP → Patients' SD	—	—	—	—	.30	.21	-.04	.64
Patients' DS → Patients' SD	—	—	—	—	.08	.17	-.26	.30
Patients' DP → Patients' anxiety	—	—	—	—	.30	.26	-.18	.67
Patients' DP → Patients' depression	—	—	—	—	.27	.22	-.10	.61
Patients' DS → Patients' anxiety	—	—	—	—	.06	.24	-.27	.48
Patients' DS → Patients' depression	—	—	—	—	.09	.16	-.16	.36
<i>Indirect effects</i>								
Partners' DP → Patients' SD → Anxiety	-.20*	.13	-.47	-.04	-.10	.11	-.36	.01
Partners' DP → Patients' SD → Depression	-.22*	.13	-.48	-.04	-.11	.11	-.39	.01
Partners' DS → Patients' SD → Anxiety	.32**	.14	.14	.63	.15	.13	.01	.48
Partners' DS → Patients' SD → Depression	.33**	.14	.16	.64	.17	.13	.01	.50

Note. $N = 50$ patient-partner dyads. SD = Self-disgust; DS = Disgust Sensitivity; DP = Disgust Propensity; BCa 95% CI = Bias-corrected and accelerated bootstrapped 95% confidence interval; LL = lower limit; UL = upper limit; SE B = bootstrapped standard error. Asterisked coefficients are significant at $*p < .05$ and $**p < .01$.



