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1 **Using a descriptive social norm to increase vegetable selection in workplace restaurant**

2 **settings**

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25 Running head: Descriptive norms and vegetable selection in workplace restaurants

26 **Abstract**

27 **Objective:** Recent work has shown that exposure to social norm messages may enhance the  
28 consumption of vegetables. However, the majority of this work has been conducted in  
29 laboratories, often with student populations. Little is known about whether this approach can be  
30 successfully used in other contexts. In this study, a poster featuring a message based on social  
31 norms was tested to examine whether it could increase and maintain the purchase of meals with  
32 vegetables in workplace restaurants.

33 **Methods:** A pretest-posttest design with three phases was used in three workplace restaurants in  
34 the United Kingdom. The first two weeks formed the pre-intervention phase, the second two  
35 weeks the intervention phase, and the last two weeks the post-intervention phase. During the  
36 intervention phase only, posters containing a social norm message relaying information about  
37 vegetable purchases of other diners were placed in each restaurant. The main outcome measure  
38 was the percentage of meals purchased with vegetables, which was analysed using Pearson's  
39 chi-squared test.

40 **Results:** Participants were judged to be: male (57%), not overweight (75%) and under the age of  
41 60 (98%). The intervention was positively associated with the percentage of meals purchased  
42 with vegetables: baseline vs. intervention (60% vs. 64% of meals purchased with vegetables;  $p <$   
43 0.01); intervention vs. post-intervention (64% vs. 67% of meals purchased with vegetables;  $p <$   
44 0.01); and baseline vs. post-intervention (60% vs. 67% of meals purchased with vegetables;  $p <$   
45 0.001).

46 **Conclusions:** Social norm messages may increase the purchase of vegetables in workplace  
47 settings.

48 **Trial ID:** NCT02603263.

49

50 **Keywords:** social norms, descriptive norm, healthy eating, vegetables, field study

51 **INTRODUCTION**

52 Individuals who report higher intakes of vegetables have a lower risk of a range of conditions  
53 such as coronary heart disease, stroke and cancer (He et al. 2006; Oyebode et al. 2014) and  
54 population dietary guidelines recommend an increase in consumption. In the United Kingdom  
55 (UK), the ‘5 A Day’ campaign has high levels of public recognition but the intake of fruits and  
56 vegetables remains below the recommended amount (Public Health England & Food Standards  
57 Agency, 2014). A review of international campaigns to increase consumption suggests that  
58 informational campaigns have had limited success (Rekhy and McConchie, 2014).

59  
60 Providing descriptive social norm information about the healthy behaviours of others has been  
61 shown to be effective in promoting health behaviours such as stair climbing and also in reducing  
62 unhealthy behaviours such as binge drinking, drunk-driving, smoking and unsafe sex (Burger et  
63 al. 2011; Chernoff et al. 2015; DeJong et al. 2009; Linkenbach et al. 2003; Perkins et al. 2002).  
64 For example, some research suggests that providing students with the information that other  
65 students drink less frequently than they might think has been reported to reduce levels of  
66 drinking on university campuses (for a review see Perkins et al. 2002). However, to date, few  
67 studies have investigated the potential of social norm messages to promote healthy eating in  
68 field settings.

69  
70 There is extensive evidence from laboratory-based studies of eating behaviour and from food  
71 diary studies with free-living participants, that the amount of food that people consume at an  
72 eating occasion is influenced by the eating behaviour of other people (de Castro et al. 1990; for  
73 reviews see Herman et al. 2003; Robinson et al. 2013a; Robinson et al. 2013b; Vartanian et al.  
74 2015). For example, people tend to eat more when they dine with familiar others (Herman,  
75 2015). There is also evidence that our perceptions of what other people eat predicts our own

76 self-reported eating (Haye et al. 2013), perhaps explaining why dietary patterns of socially  
77 connected individuals tend to be similar (Pachucki et al. 2011). These data suggest that people  
78 use the eating behaviour of others as a guide or norm and follow their lead when it comes to  
79 dietary decisions (Cruwys et al. 2015).

80

81 Indeed, providing information about the fruit and vegetable choices of others has been shown in  
82 experimental studies to affect eating behaviour. For instance, providing social normative  
83 information about fruit and vegetables has been shown to enhance the intention to eat these  
84 foods by men (Crocker et al. 2009). Presenting high school students with a descriptive social  
85 norm, suggesting that a majority of high school students try to eat a sufficient amount of fruit,  
86 significantly enhanced the self-reported consumption of fruit over a two-day follow-up period  
87 (Stok et al. 2014a). Similarly, social norms have been shown to enhance self-reported vegetable  
88 intake and intentions to consume vegetables (Stok et al. 2014b). However, a limitation of these  
89 studies is that they focus on self-reported eating behaviour and intentions to eat healthily, rather  
90 than measuring the consumption of these foods directly.

91

92 Exploring the use of social norms on actual fruit and vegetable intake in the laboratory,  
93 Robinson and colleagues conducted two studies (Robinson et al. 2014). In the first study,  
94 exposure to a descriptive norm message suggesting that most students ate more than 3 servings  
95 of vegetables a day significantly enhanced consumption of vegetables by participants by almost  
96 half a portion at a subsequent food buffet. The second study used a descriptive norm message  
97 suggesting that most students eat their five servings of fruit and vegetables a day, which also  
98 significantly enhanced the consumption of these foods by more than half a portion when later  
99 provided at a food buffet. Notably, in both experiments by Robinson and colleagues (2014),  
100 when split by habitual consumption, low but not high consumers of fruit and vegetables showed

101 increased consumption of these foods after they were presented with social norm information. It  
102 appears that low consuming individuals increase consumption to become more in line with the  
103 norm, while higher consumers do not change their consumption. This suggests that the overall  
104 effect of social norms messages to enhance fruit and vegetable intake is due to effects on low  
105 consumers.

106

107 Prior to conducting the present study, to the best of our knowledge only one published study has  
108 tested the effect of social norm messages on healthy eating in restaurant settings. Mollen and  
109 colleagues (2013) found that a poster displaying a healthy eating norm message increased self-  
110 reported consumption of salad in a university canteen, but this effect was observed only for  
111 those participants who recalled seeing the poster. As the work was conducted with students in a  
112 specific site (university canteen), it is unclear how effective these messages are in other settings  
113 and with other populations. Also, there is some data to suggest that behaviour change in  
114 response to a norm intervention might be sustained beyond the intervention period, but this  
115 possibility has yet to be assessed for an eating behaviour intervention (Lewis and Neighbors,  
116 2007; Neighbors et al. 2004).

117

118 In the present study, a social norms intervention was tested to examine whether it could enhance  
119 and then maintain the purchase of meals with vegetables in workplace restaurants, by adopting a  
120 method similar to that used by Burger and Shelton (2011); examining purchases pre-  
121 intervention, during intervention and post-intervention observation periods. It was hypothesised  
122 that introducing an accurate social norm message indicating that most diners in the restaurant  
123 consume vegetables with their lunch would be associated with an increase in the purchase of  
124 meals with vegetables. Based on the results of Burger and Shelton (2011), who found that the  
125 effects of a descriptive norm message on stair climbing was maintained a week after poster were

126 taken down from the site, we hypothesised that this effect might be maintained for at least a  
127 week after the posters were removed

128

## 129 **METHODS**

### 130 **Participants**

131 Participants comprised all individuals who purchased a meal within one of the three restaurants  
132 during the study period. Ethics approval was obtained from the University of Birmingham  
133 Science, Technology, Engineering and Mathematics Review Committee (Approval code:  
134 ERN\_13-0475AP8). The study was conducted in accordance with the British Psychological  
135 Society Guidelines on observational research and informed consent was not obtained.

136

### 137 **Design**

138 A pretest-posttest quasi-experimental design was used with three consecutive phases, each  
139 lasting 2 weeks: Pre-intervention Phase, Intervention Phase and Post-intervention Phase. During  
140 each phase cash register purchases made by participants dining at each of the three restaurants  
141 were recorded. During the intervention phase only, posters containing the social norm message  
142 were displayed in all restaurants. General posters on healthy eating which were normally  
143 displayed in the restaurants were present in all sites throughout the study.

144

### 145 **Sample Size**

146 Previous work using a social norm intervention in a pretest-posttest observational design yielded  
147 small effect sizes with phi values of 0.1 (Burger and Shelton, 2011). A power analysis was  
148 conducted (G-Power 3.1) revealing that at least 785 observations were required to detect a small  
149 effect (assuming an alpha of 0.05 and power of 80).

150

151 **Social Norm Message**

152 Posters were used to communicate the same descriptive social norm message in each restaurant.  
153 On average, five posters (210mm x 297mm) were placed in each restaurant, near to the  
154 entrances and on top of the food counters at the point of selection. In addition, approximately  
155 ten smaller (148mm x 210mm) posters were placed at each site in table-top holders, such that  
156 approximately half of the tables in each site featured one. The posters were printed in colour,  
157 featuring a brown wood effect background with text superimposed, varying in colour (grey,  
158 beige, orange, blue and white) and font type and size. Small leaf/floral motifs (white) were  
159 incorporated into the top and bottom of the poster design (above and below the text). The  
160 message stated “Most people here choose to eat vegetables with their lunch”.

161

162 The message was based on data acquired over a two week period prior to the start of the study at  
163 each site, using the same approach used for the study phases. The majority of participants (62%)  
164 purchased meals containing vegetables across all three sites. The poster message and design of  
165 the poster were selected on the basis of the responses of a focus group with 12 participants.

166

167 **Restaurants & Meals**

168 Three restaurants were recruited to this study. Two were based in the South of England and one  
169 in South Wales, UK. Data collection was carried out between February and August 2015; none  
170 of the six-week data collection periods included any public holidays. All three sites were  
171 workplace restaurants, with two serving meals seven days a week (from early morning to late  
172 night) and the other restaurant serving meals Monday to Friday only (from morning to mid-  
173 afternoon). All three catering sites were run by the same external catering company. Each site  
174 was a self-service restaurant serving hot and cold food and drink. Diners queued to select food at  
175 a food counter and then purchased their selection at the cash register before sitting to eat. All

176 sites offered a variety of main meals that included meals served with and without vegetables.  
177 These included hot meals (e.g. fish and fries) and cold meals (e.g. salads). Most meals cost  
178 between £3 and £4 (Great Britain Pound – GBP). All sites also offered side-portions of  
179 vegetables and it was possible for people to add vegetables to a meal that might otherwise not  
180 include them. They could also purchase other food items (e.g. cakes and chips) and drinks (e.g.  
181 water, soft drinks and hot drinks). Communal tables were provided for dining. The tables seated  
182 groups of around 2-6 people.

183

#### 184 **Procedure**

185 *Cash Registers:* All meal purchases were automatically recorded by cash registers at each of the  
186 restaurants, providing purchase data for all meals over the entire day. At one restaurant, cash  
187 register operators recorded lunchtime meal purchases by pressing the appropriate cash register  
188 button to indicate the specific meal that was purchased. Side orders of vegetables were also  
189 recorded by pressing a separate button. The chef at the restaurant was able to indicate to  
190 researchers which meals contained at least one serving of vegetables (at least 80g), thereby  
191 enabling the identification of these meals. At the two remaining restaurants, chefs directly  
192 indicated to the operators which meals contained at least 80g of vegetables. During each  
193 purchase, operators were then able to directly indicate whether lunchtime meals contained or did  
194 not contain an 80g portion of vegetables by pressing the corresponding button on the cash  
195 register operating system. They were also able to indicate side orders of vegetables by pressing a  
196 separate button. Researchers also trained the operators at these two restaurants to ensure  
197 consistent and correct identification of meals with and without vegetables. For the purposes of  
198 this study, vegetables included: leaf (e.g. spinach), pod (e.g. peas), legumes (e.g. lentils), root  
199 (e.g. carrots), bulb/stem (e.g. onion) and flower vegetables (e.g. broccoli). Potatoes (in any  
200 configuration) and vegetable-based garnishes (e.g. a single leaf of lettuce) were not counted.



201 Sales at each site were monitored against stock and none of the sites reported any significant  
202 discrepancies between these figures, which suggests that the till receipts were an accurate  
203 reflection of actual sales. The data from the tills was comprehensive in providing detailed  
204 information about all sales.

205  
206 *Observation of Participant Characteristics:* For one day during each phase at each restaurant a  
207 pair of researchers observed participants purchasing meals in the restaurants to estimate basic  
208 demographics (gender, age and weight status). Researchers were blinded to each other's ratings.  
209 Observations were conducted from 11am-2.00pm. Using previously established criteria (Eves et  
210 al. 2006; Kerr et al. 2001) participant gender was categorised on visual appraisal, weight status  
211 was categorised using body silhouettes (non-overweight vs. those who were overweight or  
212 greater) and age (under 60 versus over 60) was categorised based upon presence of grey hair and  
213 general appearance.

214

## 215 **Analysis**

216 *Participant characteristics:* To assess inter-rater reliability between observers, kappa max was  
217 used, reflecting the small differences in the total number of observations made by researchers.  
218 Data on participant characteristics were combined across all sites and analysed with Pearson's  
219 chi-squared test in International Business Machines Corporation Statistical Package for the  
220 Social Sciences (IBM SPSS - version 20), comparing: (1) pre-intervention to intervention; (2)  
221 intervention to post-intervention. This provided a check of whether the people visiting the  
222 restaurants changed between the phases.

223 *Meal data:* The number of meals purchased with and without vegetables during each two-week  
224 period were recorded at each site and combined across all sites. Pearson's chi-squared test was  
225 used to compare: (1) pre-intervention to intervention; (2) intervention to post-intervention; (3)

226 pre-intervention to post-intervention (to examine meal selections across the study). Odds ratio  
227 (OR) and confidence intervals (CI) were also estimated.

228 *Cold Drinks Data:* Purchases of water (as a percentage of the total number of cold drink  
229 purchases) were also examined as a comparator. This was to check whether purchases which  
230 were not expected to change across phases (because they were not the target of the social norms  
231 messages) changed, possibly because of a general change in purchasing patterns unrelated to the  
232 intervention. The data was extracted using the same approach used for the meal data.

233

## 234 **RESULTS**

### 235 **Participant Characteristics**

236 Observers showed very good inter-observer reliability (Landis and Koch, 1977), with a mean  
237 kappa max coefficient of 0.92 (range = 0.87 to 0.99). In total, 1585 participant observations  
238 were dual coded. Participant characteristics were averaged across sites; overall, 57% of those  
239 observed were men, 75% were judged not to be overweight or obese and 98% of participants  
240 were under 60 years of age. Examination of each characteristic across the different phases using  
241 Pearson's chi-squared test revealed that observed participant characteristics did not significantly  
242 differ across the test phases (all  $p > 0.05$ ; see Table 1 for a breakdown by study phase).

243

### 244 **Meal Purchases**

245 A total of 9445 meal purchases were recorded (further details are outlined in Table 1 below).  
246 The overall number of meals purchased remained stable over time, but the intervention and post-  
247 intervention phase were associated with increased purchase of meals with vegetables.

248

## 249 **INSERT TABLE 1**

250

251 Pearson's chi-squared test revealed that the introduction of the posters was associated with an  
252 increase in purchase of meals with vegetables from 60% during pre-intervention to 64% during  
253 the intervention phase;  $X^2 (1, N = 6357) = 11.32, p < 0.01, \Phi = 0.04$  (OR 1.2, 95% CI: 1.1-1.3).  
254 From the intervention phase to the post-intervention phase there was a further increase in  
255 purchase of meals with vegetables from 64% to 67%;  $X^2 (1, N = 6267) = 7.27, p < 0.01, \Phi =$   
256 0.03 (OR 1.2, 95% CI: 1.0-1.3). Overall, pre-intervention to post-intervention was associated  
257 with an increase in the purchase of meals with vegetables from 60% to 67%;  $X^2 (1, N = 6266) =$   
258 36.35,  $p < 0.001, \Phi = 0.08$  (OR 1.4, 95% CI: 1.2-1.5) (See Figure 1).

259

## 260 **INSERT FIGURE 1**

261

### 262 **Cold Drink Purchases**

263 A total of 15,415 cold drinks purchases were recorded (further details outlined in Table 1).  
264 Pearson's chi-squared test revealed that there was no significant association between test-phase  
265 and purchase of water from: pre-intervention to the intervention phase (15% versus 14%;  $X^2 (1,$   
266  $N = 11669) = 3.22, p > 0.05, \Phi = 0.02$  (OR 0.9, 95% CI: 0.8-1.0); intervention phase to the post-  
267 intervention phase (14% versus 14%;  $X^2 (1, N = 10520) = 0.95, p > 0.05, \Phi = 0.00$  (OR 1.0,  
268 95% CI: 0.9-1.1); or the pre-intervention phase to the post-intervention (15% versus 14%;  $X^2 (1,$   
269  $N = 10123) = 2.21, p > 0.05, \Phi = 0.02$  (OR 0.9, 95% CI: 0.8-1.0 – see Table 1).

270

## 271 **DISCUSSION**

272 The introduction of posters displaying social norm messages emphasising that most people eat  
273 vegetables with their meal in a workplace restaurant was associated with an increase in the  
274 proportion of meals purchased with vegetables, compared to the baseline period. The influence  
275 of the poster on the purchase of meals with vegetables persisted after the removal of the poster.

276 This study suggests that social norms might be used to promote the selection of vegetables in a  
277 real-world context.

278

279 It was hypothesised that the social norm message would be associated with an increase in the  
280 purchase of meals with vegetables because diners would use the information in the message as a  
281 guide to appropriate behaviour in that context (Herman et al. 2003). People tend to follow group  
282 norms because they provide a useful guide as to “correct” behaviour (everyone else is behaving  
283 this way for a reason so it is probably a good idea for me to behave similarly – see Robinson et  
284 al. 2013a for a review) but following a norm is also a positive experience because it enhances  
285 affiliation with the group and/or avoids negative sanctions associated with not conforming to the  
286 group norm (Higgs, 2015). The mechanism underlying behaviour change is unclear but one  
287 possibility is that the provision of the normative information led customers to compare  
288 themselves to the norm, which for some customers highlighted their deviation from the norm  
289 leading to a change in behaviour to bring them more in line with the perceived norm (Polivy &  
290 Pliner, 2015; Higgs & Thomas, 2016). The poster may have brought into focus the normative  
291 information and/or corrected a misperception about the norm. In support of this idea, correcting  
292 misperceptions of excess alcohol consumption has been shown to reduce subsequent drinking  
293 (Neighbors et al. 2004). The results of our study are consistent with our previous finding of  
294 increased selection and consumption of vegetables following exposure to a descriptive social  
295 norm message in a laboratory setting (Robinson et al. 2014).

296

297 Here, it was also possible to study vegetable sales after removal of the poster and observed a  
298 further increase in purchase of meals with vegetables. Given the pre-post design, an underlying  
299 time trend towards greater vegetable consumption, or a change in the type of customer towards  
300 those who are more inclined to choose vegetables cannot be ruled out. However the stability in

301 sales of water implies some consistency in purchasing behaviours over time and the  
302 observational data suggest that the characteristics of the customer base did not differ  
303 significantly across time in terms of age, gender and weight status (though these variables would  
304 benefit from being measured in more detail in future studies). The study was conducted across  
305 three separate workplace settings to reduce the overall variation in purchase patterns that might  
306 be introduced by examining a single site. There are several reasons why the increase in  
307 vegetable purchases was maintained after the posters were taken down. If a customer was  
308 prompted to purchase vegetables, and enjoyed eating those vegetables, then the behaviour might  
309 have been reinforced, leading to a change in habit and/or a positive change in self-perception  
310 about vegetable liking and consumption. The social norm information might also have drawn  
311 attention to other people in the restaurant who were consuming vegetables and there may have  
312 been some modelling of this behaviour that was maintained after the intervention period (see  
313 Vartanian, 2015 for a review of modelling of eating behaviour). Such an effect is predicted by  
314 the focus theory of normative conduct (Kallgren et al. 2000), which suggests that normative  
315 information is most effective in guiding behaviour when it made salient or accessible. It is  
316 possible that observing other people consuming vegetables in the restaurant served as cue to  
317 retrieve the normative information even after the posters were removed. A similar maintenance  
318 of the social norm effect was observed by Burger and Shelton (2011) who observed that people  
319 were more likely to use the stairs than the elevator for a week after intervention materials  
320 promoting stair use were taken down. However, to be sure that this latent effect is real the  
321 findings would need to be replicated using a randomised controlled design.

322  
323 Prior to conducting the present study, we were aware of only one other report of a significant  
324 effect of a social norm message in a field setting. Mollen and colleagues examined self-reported  
325 purchases, rather than sales, and an effect of the social norm message to increase vegetables

326 purchases was found only for customers who reported noticing the posters (Mollen et al. 2013).  
327 Here, a positive association of a social norm message with cash register recorded purchases is  
328 reported, that holds for the entire sample. It is possible that a larger association would have been  
329 observed for those participants who noticed the specific message on the posters. There was no  
330 assessment of whether the selection of meals translated into consumption, but this seems likely  
331 given evidence that the majority of people in similar settings clear their plates (Hinton et al.  
332 2013).

333  
334 Very recently, Thorndike and colleagues (2016) conducted a randomised control trial to  
335 examine whether social norm feedback (a letter mailed to participants) with or without a  
336 financial incentive could increase the purchase of healthy food items in a hospital cafeteria.  
337 They reported that social norm feedback with an incentive, but not social norm feedback in  
338 isolation, produced a significant increase in healthy food choices. A possible reconciliation of  
339 the null effect reported by Thorndike and the significant results reported here is that, in line with  
340 the focus theory of normative conduct (Kallgren et al. 2000), social norms may have a greater  
341 effect on behaviour when they are presented where the behaviour takes place (e.g. a poster by a  
342 food counter where food is selected), but fail to exert a significant influence when they are not  
343 presented at this point (e.g. a letter sent to a participant). An important point to consider in the  
344 further development of social norms interventions aimed at increasing the purchase of  
345 vegetables is the extent to which the results may be transferable to a range of food outlets.  
346 Workplace restaurants in which customers are familiar with the other diners may lend  
347 themselves to social norm interventions because impression management concerns may  
348 motivate conformity to the norm (Herman et al. 2003). Hence, different types of restaurant may  
349 not yield the same results and so further investigation is required to establish in which context  
350 social norm messages might be best targeted. One study placed placards on supermarket trolleys

351 displaying the average number of produce items purchased at that supermarket and found that  
352 this increased purchase of produce items (Payne et al. 2015). Both the present study and that  
353 conducted by Payne and colleagues (2015) used a norm message that emphasised the proximal  
354 context of the normative behaviour (the other people in that location). Other evidence suggests  
355 that individuals are more likely to be influenced by descriptive norms that are derived from the  
356 setting those individuals are currently occupying (e.g. most *here* choose to eat vegetables with  
357 their lunch) (see Goldstein et al. 2008). Establishing a connection between an individual and the  
358 norm referent based on their shared immediate surroundings might be sufficient to prompt  
359 following of the normative information.

360

361 The present results add to a growing body of data supporting the use of public health campaigns  
362 that have a basis in social norm theory (Marteau et al. 2001) and their advocacy (Davies et al.  
363 2014). Evidence suggests that norm messaging maybe effective in reducing risky behaviours  
364 such as excessive alcohol intake and behaviour harmful to the environment such as excessive  
365 energy consumption, although systematic reviews of the effectiveness of such campaigns have  
366 yielded inconsistent results and questions remain about when and for whom norm interventions  
367 may result in behaviour change (see Miller & Prentice, 2016 for a review). Fewer studies have  
368 evaluated the effects of norm messages designed to enhance a health promoting behaviour,  
369 although social norm interventions have been reported to enhance sunscreen use and increase  
370 levels of physical activity (e.g. Priebe & Spink, 2012; Reid & Aiken, 2013). An advantage of an  
371 intervention that emphasises the positive, healthy behaviours of others is that resistance to such  
372 messages is less likely than for messages that use controlling language (e.g., you should eat  
373 vegetables because it is good for your health) (Miller et al. 2007). Although the increased sale of  
374 meals with vegetables from the pre to post intervention phase may appear small at 7%, it is  
375 similar to that reported for health communication campaigns (Ammerman et al. 2002; Snyder,

376 2007; Pomerleau et al. 2005) and if this approach was adopted more widely across workplace  
377 restaurants, this could impact a substantial number of meals. It is premature to comment on the  
378 clinical significance of our findings, especially given that we did not measure actual  
379 consumption and the long term effects of the approach are unclear. However, evidence suggests  
380 that higher consumption of fruit and vegetables is associated with reduced risk of all-cause  
381 mortality, with an average reduction in risk of 5% for each additional vegetable serving a day  
382 (Wang et al. 2014). Overall, the results are promising because social norm interventions are  
383 likely to be cost effective to implement (requiring only the resources to produce and print a  
384 message) and have the potential to reach consumers who might most benefit from increasing  
385 their consumption of vegetables, such as those consuming low levels of vegetables.

386

387 Future research should first establish, using randomised controlled designs, how the effect of the  
388 social norm message compares with a control intervention. In addition, food wastage associated  
389 with this intervention should be evaluated to confirm that the vegetables purchased with meals  
390 are actually consumed. If the effectiveness of the social norm message is confirmed, subsequent  
391 work might investigate ways of optimising social norm interventions by testing the effects of  
392 different message types and possibly combining social norm interventions with other approaches  
393 to add value. Combining information about how others behave with information about whether  
394 that behaviour is valued or endorsed by the social group may be particularly effective in  
395 prompting behaviour change (Payne et al. 2015). Such an approach may also guard against the  
396 possibility that people who are already performing the behaviour at the normative level will  
397 react by reducing positive behaviour to fit in with the norm (Schultz et al. 2007). It would be  
398 useful to examine whether any increases in vegetable purchase represented additions to the  
399 standard meal or a substitute for other components of the meal (e.g. reducing the amount of  
400 more energy dense foods purchased) since this will be critical to the net health impact. Future



401 work should also distinguish between people who are habitual consumers of vegetables and  
402 those who are not habitual consumers of vegetables. At present we do not know if the norm  
403 message was associated with an increase in consumption of vegetables by those already  
404 consuming vegetables or by those who do not regularly consume vegetables. Previous data from  
405 laboratory-based studies suggests that low consumers might be more responsive to norm  
406 messages but this remains to be tested in the field. Only a small proportion of the sample were  
407 observed in the present study and so it would be better in future studies to be able to provide  
408 demographic characteristics for the whole sample. In addition, a limitation of study is that body  
409 weight was observed rather than measured, which may be subject to bias. Finally, it would also  
410 be desirable in future studies to examine a longer time-period for the intervention, to know if the  
411 effectiveness of the posters reduces over time due to customers habituating to their presence  
412 (although this might be offset by using different versions of the poster each week or changing  
413 their location). It would also be useful to assess a longer post-intervention phase to examine  
414 whether behaviour is maintained in the longer term.

415

## 416 **CONCLUSIONS**

417 The results of this study suggest that the social norm approach can be used to increase the  
418 purchase of vegetables and that further testing of its potential is warranted.

419

## 420 **List of Abbreviations**

421 Odds ratio (OR); confidence intervals (CI); United Kingdom (UK); International Business  
422 Machines Corporation Statistical Package for the Social Sciences (IBM SPSS); Charlton House  
423 & Company (CH&Co).

424

425

426 **Ethics Approval and Consent to Participate**

427 Ethics approval was obtained from the University of Birmingham Science, Technology,  
428 Engineering and Mathematics Review Committee (Approval code: ERN\_13-0475AP8). The  
429 study was conducted in accordance with the British Psychological Society Guidelines on  
430 observational research and informed consent was not obtained.

431

432 **Availability of Data**

433 The dataset supporting the conclusions of this article is included within the article.

434

435 **Competing interests**

436 All of the authors declare that they have no competing interests.

437

438 **Funding**

439 The study was funded by a grant from the Economic and Social Research Council (ESRC -  
440 ES/K002678/1), the University of Birmingham. The researchers designed the study and  
441 collected and analysed the results independently from the funders.

442

443 **Authors' Contributions**

444 All authors contributed to the design of the research. JT collected and analysed the data. JT and  
445 SH drafted the paper and all authors critically reviewed and improved it. Charlton House &  
446 Company (CH&Co) - the company managing the restaurants - was not involved in the study  
447 design process, analysis of results, or the write-up of the paper.

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450

451 **Acknowledgements**

452 The authors would like to acknowledge Caroline Fry and Judy Roberts for access to the  
453 restaurants and study materials, and Jinyu Liu and Julien Raguzzi who assisted with observing  
454 participants characteristics.

455

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Table 1: Participant characteristics and meal purchase measures split by study phase

Measure	Pre-intervention	Intervention	Post-intervention
<i>Participant Characteristics</i>			
Male participants	54%	58%	60%
Not overweight	71%	76%	77%
Participants under 60 years of age	97%	99%	99%
<i>Meal Purchases</i>			
Meals purchased with vegetables	1897	2028	2070
Meals purchased without vegetables	1281	1151	1018
Total meals purchased	3178	3179	3088
Percentage of meals purchased with vegetables	60%	64%	67%
<i>Cold Drink Purchases</i>			
Purchases of water	744	738	740
Purchases of other cold drinks	4895	5292	5228
Total cold drinks purchased	5639	6030	5968
Percentage of water purchased	13%	12%	12%

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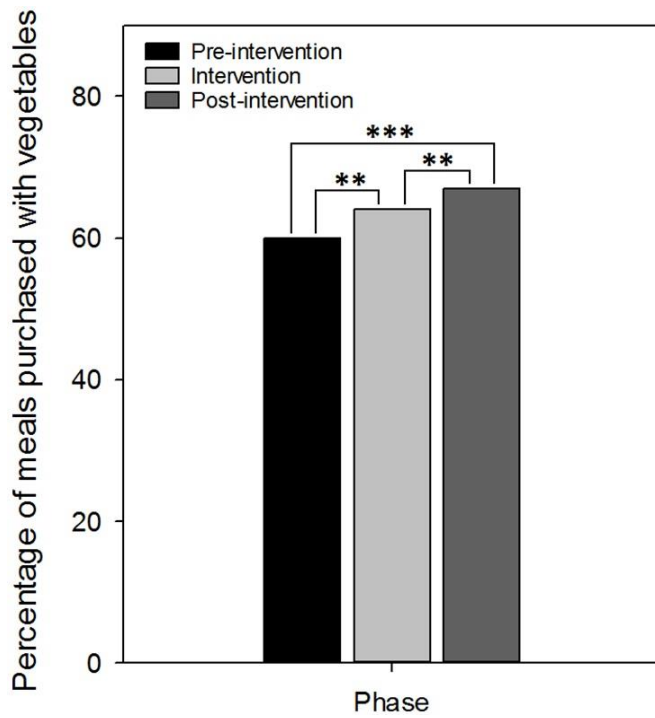
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662 **Figure 1** Percentage of meals purchased with vegetables, split by test phase. The introduction of the  
 663 poster was associated with a significant increase of meals purchased with vegetables from the pre-  
 664 intervention to intervention phase. Removal of the poster was associated with a further increase from the  
 665 intervention to post-intervention phase. Overall, baseline to post-intervention was associated with an  
 666 increase in the purchase of meals containing vegetables. \*\*  $p < 0.01$ ; \*\*\*  $p < 0.01$