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1 Title: Self-other Differences in Student Drinking Norms Research: The Role of Impression  
2 Management, Self-deception and Measurement Methodology

3

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26 ABSTRACT

27

28 **Background:** Data-driven student drinking norms interventions are based on reported normative  
29 overestimation of the extent and approval of an average student's drinking. Self-reported differences  
30 between personal and perceived normative drinking behaviors and attitudes are taken at face value as  
31 evidence of actual levels of overestimation. This study investigates whether commonly used data  
32 collection methods and socially desirable responding may inadvertently impede establishing 'objective'  
33 drinking norms.

34

35 **Methods:** UK students [N=421; 69% female; Mean age 20.22 years (SD = 2.5)] were randomly  
36 assigned to one of three versions of a drinking norms questionnaire: The standard multi-target  
37 questionnaire assessed respondents' drinking attitudes and behaviors (frequency of consumption, heavy  
38 drinking, units on a typical occasion) as well as drinking attitudes and behaviors for an 'average  
39 student'. Two deconstructed versions of this questionnaire assessed identical behaviors and attitudes  
40 for participants themselves *or* an 'average student'. The Balanced Inventory of Desirable Responding  
41 was also administered.

42

43 **Results:** Students who answered questions about themselves and peers reported more extreme  
44 perceived drinking attitudes for the average student compared with those reporting solely on the  
45 'average student'. Personal and perceived reports of drinking behaviors did not differ between multi-  
46 and single-target versions of the questionnaire. Among those who completed the multi-target  
47 questionnaire, after controlling for demographics and weekly drinking, socially desirable responding  
48 was related positively with the magnitude of difference between students' own reported  
49 behaviors/attitudes and those perceived for the average student.

50 **Conclusions:** Standard methodological practices and socially desirable responding may be sources of  
51 bias in peer norm overestimation research.

52

53

## INTRODUCTION

54

55 Drinking norms interventions are widely used in efforts to curb risky drinking practices among  
56 students (DeJong et al., 2006, DeJong et al., 2009, Haines et al., 2005, Moore et al., 2013, Moreira et  
57 al., 2009, Perkins, 2002, Perkins, 2003, Wechsler et al., 2003, Foxcroft et al., 2015). In these data-  
58 driven intervention approaches, self-report questionnaires gauging personal drinking behaviors and  
59 attitudes alongside matching perceptions for a normative target (e.g. the ‘average student’) feature  
60 heavily throughout assessment, intervention activities and evaluations. Self-other differences or  
61 differences between actual and perceived alcohol-related behaviors (i.e. *descriptive*) and  
62 attitudes/approval (i.e. *injunctive*) support intervention efforts designed to counter errors in perception  
63 by revealing 'actual' rather than attributed norms<sup>1</sup>. This is often achieved by feeding back and  
64 contrasting aggregate personal and peer norms to the target population in order to encourage revision  
65 of perceptions and behavior in line with (typically) lower actual drinking norms. Similar data  
66 collection exercises can be used to evaluate the impact of the intervention on behavior and perception  
67 and update future iterations in long running intervention programs.

68

69 Evidence that the standard data collection methodologies used in this field provide a reliable and  
70 accurate picture of young people’s actual and perceived drinking environments tends to be drawn from  
71 the broader alcohol epidemiologic field (e.g. Babor et al., 2000, Midanik, 1988, Del Boca and Darkes,  
72 2003). Investigations of data collection methodologies employed within the drinking norms field are

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<sup>1</sup> Descriptive and injunctive norms are appropriate social psychological terms widely used in the student drinking norms literature to distinguish normative behavior from normative approval of behavior. However, we refer to drinking behavior and drinking attitudes throughout much of the paper because our focus is often individual-reporting behavior rather than normative processes.

73 rare (Pape, 2012). Accumulating evidence, however, suggests there may be elements of drinking  
74 norms research methods that are potential sources of bias that may exaggerate peer norm  
75 overestimation. One selective review of the research concluded that peer norm overestimation may be  
76 an exaggerated phenomenon, with potential sources of exaggeration including sampling bias, a  
77 tendency to use forced choice response options and limited attention to potential underestimation of  
78 peer norms (Pape, 2012). The results of experimental studies have also questioned the ‘objectivity’ of  
79 data obtained in the context of drinking norms research. In these studies, students have been found to  
80 adjust their own reports downwards when exposed to information about their peer group’s standing  
81 (Cunningham and Wong, 2013, Klein and Kunda, 1993, Lombardi and Choplin, 2010).

82

83 Melson and colleagues (2011, 2012) investigated whether the common methodological practice in  
84 drinking norms research of questioning students conjointly about themselves and their peers impacted  
85 response patterns underpinning peer norm overestimation. Here, school pupils who completed a  
86 standard multi-target version of a drinking norms questionnaire, which included both personal and  
87 peer (the ‘typical pupil’) alcohol-related measures, reported more extreme perceived peer attitudes and  
88 were more likely to report that peers would consume alcoholic drinks compared to when the peer  
89 target was assessed in isolation. The impact of the manipulation was limited to shifts in perception  
90 responses rather than pupils’ own reported behavior and attitudes and key frequency of consumption  
91 and drunkenness responses were unaffected, suggesting limitations to the generalizability of this effect.  
92 As Melson et al. (2011) conducted their research with school pupils the extent to which these findings  
93 may be observed in university/college student populations has not yet been examined. This is  
94 important for a number of reasons. First, most drinking norms research and interventions have targeted  
95 university and college students. University and college students’ age, developmental phase and likely  
96 experience with alcohol means they may have more established drinking patterns and robust beliefs  
97 about their wider peer group (e.g. Monk and Heim, 2016). As a result they may be less sensitive to

98 features of the measurement tool. It is also important to establish that Melson et al.'s (2011) findings  
99 are not due to the demand characteristics of asking an adolescent population to complete sensitive  
100 measures in a classroom environment (McCambridge and Strang, 2006, Percy et al., 2005). Recent  
101 challenges reproducing evidence in psychological science suggest further caution against overreliance  
102 on effects obtained from single studies (Open Science Collaboration, 2015).

103  
104 Moreover, it is unclear whether the measurement effect reported by Melson and colleagues (2011)  
105 indicates a specific methodological artifact or a broader motive of presenting an overly positive  
106 version of oneself. Socially desirable responding (SDR) is the tendency to offer overly positive self-  
107 descriptions during self-report questionnaire assessments (Paulhus, 1984, Paulhus, 2002).  
108 Contemporary conceptualisations of SDR emphasize two dimensions: 'Impression management',  
109 reflecting conscious regulation of personal characteristics, attributes and behaviors, so as to cast  
110 oneself in a favorable light; and 'self-deception', an unconscious propensity to think about oneself in  
111 overly positive self-esteem maintaining ways when retrieving information during response (Paulhus,  
112 2002, Paulhus, 1984, Holtgraves, 2004). In this vein, North American College students scoring highly  
113 on a measure of impression management reported consuming 33% fewer drinks and lower AUDIT  
114 scores than those in the moderate or low range. Self-deception was unrelated to drinking behavior but  
115 was associated with reporting fewer alcohol-related problems (Davis et al., 2010, Lanyon and Carle,  
116 2007, Paulhus, 1991, Paulhus, 2002, Paulhus and Reynolds, 1995, Paulhus et al., 1995). These  
117 findings suggest that students may intentionally distort reports of their drinking behavior and related  
118 problems so as to cast themselves favorably to others. In limited circumstances they are also prone to  
119 the effects of self-deception.

120  
121 Recent research has highlighted SDR as a potential source of bias in self-reported student drinking  
122 responses (Davis et al., 2010). As a result SDR holds promise for understanding whether the self-other

123 differences observed in student drinking norms research reliably indicate drinking norm discrepancies  
124 or, to some extent, a socially motivated drive to present an overly positive version of oneself. Different  
125 dimensions of SDR may also be important for determining the nature of self-other difference  
126 measurement. Specifically, if self-other differences for peer group drinking behavior and attitudes are  
127 associated with impression management, then self-other differences may reflect intentional strategies  
128 to present an unrealistic and overly positive version of oneself. Associations with self-deception, on  
129 the other hand, may point towards a role for unconscious self-esteem maintaining biases in self-other  
130 difference reporting. Investigating the role of SDR in reported self-other differences will help elucidate  
131 the extent to which SDR poses a risk to reliable and valid measurement of self-other differences.  
132 Clarifying the likely motivational base of any SDR bias will also inform our understanding of the  
133 underlying processes involved and guide the development of effective strategies to minimize socially  
134 desirable response patterns.

135

136 Given their importance within student drinking norms research and interventions, remarkably few  
137 studies have investigated the reliability and validity of ‘self’ and ‘other’ drinking responses. The  
138 present study seeks to address this shortcoming in the literature by extending one of few  
139 methodological studies in this field (Melson et al., 2011). Consistent with earlier research, it was  
140 predicted that responses to a drinking norm questionnaire, which assesses personal and perceived  
141 drinking-related behaviors or attitudes conjointly, will differ from those that assess personal and  
142 perceived measures in isolation. Although observing the presence of specific measurement artifacts is  
143 important, understanding when and why they are likely to arise is crucial for advancing knowledge  
144 that may support effective strategies to limit threats to objective measurements of drinking norms.  
145 Therefore the central aim of this research was to investigate whether SDR plays a role in self-other  
146 differences reported by students, with the expectation that SDR would be positively associated with  
147 self-other differences.

148

149

**150 Participants and Procedures**

151 The research took place at two UK universities. Students (18-30 years) who had consumed alcohol in  
152 the past year were invited to participate in an online ‘Student Drinking Survey’ via a URL advertised  
153 on university social media, communication networks and research participation pools. Following self-  
154 selection, eligible participants provided informed consent prior to allocation to one of three different  
155 study conditions via a randomization function embedded in the online questionnaire. Ethics review  
156 committees approved the research at both institutions.

157

**158 Design**

159 Between-participants experimental design, with randomization to one of three different versions of a  
160 drinking norms questionnaire [(i) multi-target (MT) version or (ii) single-target ‘personal’ (ST<sup>PERS</sup>) or  
161 (iii) single-target ‘average student’ (ST<sup>AS</sup>) versions].

162

**163 Measures**

164 In overview, students provided demographic details (age, gender, ethnicity, year of study) and  
165 completed target-specific (‘personal’ and/or perceived ‘average student’) measures of drinking  
166 behavior and attitudes, as well as a measure of socially desirable responding.

167

168 Three different versions of a questionnaire were constructed. The first version was designed to closely  
169 resemble a standard type of questionnaire employed in this field (e.g., Haines et al., 2005) and  
170 included items to record students’ own alcohol-related behaviors and attitudes, in addition to their  
171 perceptions of each behavior and attitudes for the ‘average student your own age at your university’  
172 [i.e., a multi-target (MT) version]. Two single-target (ST) questionnaires included items corresponding



173 to a single target [i.e. single-target: ‘personal’ (ST<sup>PERS</sup>) or ‘average student’ (ST<sup>AS</sup>)]. Notwithstanding  
174 the omission of the other target, both ST versions of the questionnaire were identical to the full MT  
175 version.

176

### 177 *Drinking behavior*

178 Drinking behavior and perceptions of other students’ behavior were assessed using original and  
179 modified AUDIT-C items (Bush et al., 1998). Referring to the past 12 months, students reported how  
180 often a drink containing alcohol had been consumed, how many units of alcohol were drunk on a  
181 typical occasion and how frequently eight units of alcohol were consumed on one occasion. While the  
182 original versions of the AUDIT-C items were used to assess students’ own behavior, modified items  
183 assessed perceptions of identical behaviors for the ‘average student your own age at the university’.  
184 Original and modified versions of these items differed only in the specific target-referent of the item  
185 (e.g. ‘How often do *you* [the average student your own age at the university] have a drink containing  
186 alcohol?’). Responses were used to calculate mean monthly frequencies of consumption, heavy  
187 drinking and the usual quantity of units consumed on drinking occasions. Recent seven-day  
188 consumption was obtained by asking students to record the units of alcohol consumed on each of  
189 seven days for a ‘typical week in the past month’. Accompanying information provided guidance on  
190 the UK alcohol unit content of popular drinks and volumes.

191

### 192 *Drinking attitudes*

193 Attitudes and perceived attitudes to drinking were assessed using a scale described by Lewis et al.  
194 (2010) in a study with US college students. After removing four items of limited cultural relevance in  
195 a UK student population, the acceptability of 11 different alcohol-related behaviors were rated by  
196 students for themselves and/or the acceptability of each behavior perceived for the average student the  
197 respondent’s own age. Representative items include ‘Playing drinking games’ and ‘Drinking alcohol

198 daily'. Ratings were scored as unacceptable (1) through to acceptable (7) and summed to create  
199 separate personal and average student attitude indexes (Min=11, Max=77). Internal consistency of  
200 each index was good ( $\alpha=0.81-0.82$ ) (Paulhus et al., 1995).

201

### 202 *Socially desirable responding*

203 Socially desirable responding was assessed using the Balanced Inventory of Desirable Responding-  
204 Version 6 (BIDR: Paulhus, 1991), a 40-item measure of the propensity to provide overly positive self-  
205 descriptions. Twenty positive and negative items tap the self-deception dimension of SDR, reflecting  
206 unintended enhancement of personal abilities and qualities, or denial of undesirable ones. Twenty  
207 positive and negative items also measure impression management, reflecting purposeful inflation of  
208 socially desirable behaviors and qualities. Representative items are 'I never regret my decisions' (self-  
209 deception) and 'I never cover up my mistakes' (impression management), with all items recorded on  
210 7-point scales (*not true* to *very true*). The BIDR has received support as a valid measure of providing  
211 overly positive self-descriptions via convergent and discriminant associations with other measures of  
212 SDR and exaggerated virtue, adjustment, coping, self-esteem, 'lie' scales and under different role play  
213 instructions (Lanyon and Carle, 2007, Paulhus, 1991, Paulhus et al., 1995). Importantly, overly  
214 positive self-descriptions are only reflected in endorsement of extreme response categories 6-7 or 1-2  
215 (depending on positive or negative framing of items), indicating responses which are too good to be  
216 true. These are scored as '1' with all other response categories scored '0' (Paulhus, 1991). Impression  
217 management and self-deception item scores are summed separately (Min = 0, Max = 20 for both). In  
218 the present study internal consistency of both subscales was adequate ( $\alpha = .67-.76$ ) and within the  
219 normal range (e.g., Davis et al., 2010, Paulhus, 1991).

220

### 221 **Analysis**

222 Data from the two institutions were pooled to create a single dataset. We considered a nested approach  
223 to analyses to account for possible within-cluster similarity of responses at the two institutions.  
224 However, intraclass correlation coefficients for drinking behaviors, attitudes and SDR were very small  
225 and indicated that 1% or less of variability was accounted for at the institution-level. Given limited  
226 evidence that responses were clustered within institutions we analyzed the pooled dataset. Frequency  
227 of heavy drinking and seven-day consumption distributions were positively skewed and values were  
228 log transformed for main analyses, although descriptive statistics retain the untransformed values for  
229 ease of interpretation. To address the first hypothesis, personal and perceived versions of the AUDIT-  
230 C items and attitude indexes were compared between the MT and corresponding ST versions of the  
231 questionnaire using *t*-tests and Cohen's *d*. For the second hypothesis, analyses were necessarily  
232 restricted to students who completed the MT version of the questionnaire. Relationships between study  
233 variables were initially examined using zero-order correlations. Consistent with other studies, self-  
234 other difference values were calculated by subtracting personal from perceived response values for  
235 each AUDIT-C item and the drinking attitude indexes (Carey et al., 2006). Four hierarchical regression  
236 models were then constructed to examine whether SDR accounted for unique variance in self-other  
237 differences beyond demographics and recent seven-day consumption. Self-other differences were used  
238 as the key outcome variables in regression analyses based on their theoretical and practical  
239 significance in normative drinking research and interventions.

240

241

## RESULTS

242

243 A total of 421 participants across the two university institutions provided complete data, 322 (76%)  
244 from one institution and 99 (24%) from a second. As participants self-selected into the study,  
245 participation rates are not available. These samples were similar to the relevant student rolls on the  
246 proportion reporting White ethnicity, but female gender, younger, and undergraduate students were

247 overrepresented. The pooled dataset was over two thirds (69%) female, primarily undergraduate (94%)  
248 with an average age of 20.22 years (SD = 2.5). Half (50%) identified as ‘White British’ (or another  
249 White UK nationality), 38% White other and 12% Mixed, Black or Asian. Following randomization,  
250 142 students completed the MT version of the questionnaire, 158 completed the ST<sup>PERS</sup> version and  
251 121 completed the ST<sup>AS</sup> version [ $\chi^2_{(2, 421)} = 4.91, p > .05$ ]. Randomization of participants to complete  
252 the different version of the questionnaire was successful. Participants’ did not differ significantly  
253 across demographic variables: gender [ $\chi^2_{(2, 421)} = 0.622, p > .05$ ], age [ $F_{(2, 420)} = 0.22, p > .05$ ] year of  
254 study [ $\chi^2_{(2, 419)} = 0.1, p > .05$ ] or ethnicity [ $\chi^2_{(2, 411)} = 0.98, p > .05$ ].

255

### 256 **Questionnaire version**

257 Table 1 presents mean (SD) drinking behavior responses and attitude index scores obtained from the  
258 MT and corresponding ST versions of the questionnaire. Responses of students who completed the  
259 MT and ST<sup>PERS</sup> versions of the questionnaire did not differ for students’ own reported frequencies of  
260 consumption, heavy drinking, quantity of units on a typical occasion or the attitude index. There were  
261 also no differences between the MT and ST<sup>AS</sup> versions of the questionnaire in reported perceptions of  
262 the average student’s drinking behavior. However, students who completed the MT version of the  
263 questionnaire had higher perceived attitude index scores than those who completed the ST<sup>AS</sup> version.

264

265 TABLES 1 AND 2 AROUND HERE (APPENDED)

266

### 267 **Socially desirable responding**

268 Table 2 presents zero-order correlations for SDR subscales and key study variables. Inter-correlations  
269 for students’ personal and perceived drinking behaviors and demographics were broadly in line with  
270 the existing literature. Personal drinking behaviors and corresponding perceptions tended to be  
271 positively associated, although personal attitudes were unrelated to perceptions of the average

272 student's attitudes. Increasing age was associated with lighter drinking and more conservative attitudes,  
273 while male gender tended to be associated with heavier personal drinking and perceived drinking  
274 frequencies. Impression management was positively associated with female gender, perceptions of the  
275 average student's drinking frequency and negatively associated with students' own typical unit  
276 consumption and attitudes. Self-deception was positively associated with perceptions of the average  
277 student's heavy drinking. Two aspects of the relationship between SDR and AUDIT-C or attitudes  
278 measures are noteworthy. First, SDR was associated with all three AUDIT-C drinking behaviors and  
279 drinking attitudes, either via 'personal' or perceived 'average student' responses. Second, SDR was  
280 positively associated with reported perceptions of the average student's behaviors and negatively  
281 associated with students' own reported behaviors or attitudes.

282

283 TABLE 3 AROUND HERE (APPENDED)

284

285 Whether SDR accounted for unique variance in self-other differences was investigated by regressing  
286 the four self-other difference values separately on demographics (step 1), seven-day consumption (step  
287 2) and SDR subscales (step 3).

288

289 In each final model (Table 3), seven-day consumption and SDR subscales independently predicted  
290 self-other differences. Lower seven-day consumption strongly predicted larger self-other differences in  
291 each model ( $\beta$ 's = -0.32 to -0.60,  $ps < .001$ ). Higher impression management predicted larger self-  
292 other differences for frequency of consumption, typical units and attitudes ( $\beta$ 's = 0.19 to 0.22,  $ps$   
293  $< .05$ ) and higher self-deception predicted larger self-other differences for heavy drinking frequency ( $\beta$   
294 = 0.16,  $p < .05$ ). Increasing age and female gender initially predicted larger self-other differences for  
295 drinking frequency and attitudes, but were not independent of other factors in final models. Step 1 of  
296 the drinking frequency and attitude index models accounted for 5% and 8% of the variance in self-

297 other differences respectively. Seven-day consumption accounted for an additional 11-30% of variance  
298 across all four models, before SDR subscales accounted for a further 3-4% of the variance.

299

300 Possible moderation of the relationship between SDR subscales and self-other differences by gender  
301 was investigated by entering the product of SDR subscales and gender as interaction terms. These did  
302 not account for additional variance in self-other differences (data not reported). Figure 1 (a-d) depicts  
303 the increasing magnitude of self-other differences across low, medium and high impression  
304 management or self-deception scores (based on tertile splits) for AUDIT-C drinking behaviors and  
305 attitudes.

306 FIGURE 1(a-d) AROUND HERE (APPENDED)

307

## 308 DISCUSSION

309

310 This study investigated whether commonly used data collection methods and socially desirable  
311 responding (SDR) may contribute to frequently observed self-other differences within student drinking  
312 norms research. For the first time, we report that self-other differences appear to increase in relation to  
313 SDR, a reporting bias possibly reflecting a tendency to provide overly positive self-descriptions. A  
314 modest, but consistent, 3-4% of variance in self-other differences was accounted for by SDR across  
315 three dimensions of student drinking behavior and drinking attitudes, raising the possibility that SDR  
316 may be a common feature of observed self-other differences. Classifying participants as low, medium  
317 or high on SDR indicates that students who tend to respond on a socially desirable basis report  
318 markedly larger self-other differences than students less prone to SDR.

319

320 Whether SDR plays a causal role in determining the magnitude of self-other differences cannot be  
321 determined from the cross-sectional design of this part of the study. Available evidence and the results

322 of the present study, however, lend support to the contention that self-other differences may be  
323 exaggerated as a result of students' potentially casting themselves in too favorable a light. First, the  
324 measure of SDR used in this study has received support as a valid measure of providing overly  
325 positive self-descriptions, increasing confidence that desirable responding influences self-other  
326 difference measurement (Lanyon and Carle, 2007, Paulhus, 1991, Paulhus et al., 1995). Second, the  
327 question of whether observed self-other differences are objectively larger for high SDR scorers  
328 because they tend to be more moderate drinkers has partly been addressed in previous research carried  
329 out by Davis and colleagues (2010). Their research examined the extent to which differences in  
330 drinking reports across levels of impression management were independent of traits that would predict  
331 genuinely more moderate consumption. Consistent with an account based on biased reporting rather  
332 than true differences in behavior, statistically adjusting for impulsivity-constraint, a key predictor of  
333 drinking behavior (Hair and Hampson, 2006, Granö et al., 2004, Curcio and George, 2011) did not  
334 alter the significantly lower levels of alcohol use, hazardous drinking and problems reported by  
335 students scoring high on impression management. Furthermore, if the present findings were due to  
336 SDR and self-other differences sharing a common etiology, or associations, with unmeasured 'third'  
337 variables, we would expect SDR patterns to parallel known reporting patterns including the positive  
338 association between students' own drinking and peer perceptions (Carey et al., 2006). However, the  
339 present results indicate that SDR is both negatively correlated with students' own behavior and also  
340 positively correlated with perceptions of peer behavior. The current findings therefore suggest that  
341 socially desirable responding may exaggerate measured discrepancies between students' real and  
342 perceived drinking patterns.

343

344 As well as casting a degree of doubt on the size of self-other differences frequently obtained in  
345 drinking norms research, the current findings may have implications for intervention approaches.  
346 Importantly, these implications do not speak directly to the efficacy of normative intervention

347 approaches, but may be most relevant when considering the design and conduct of interventions. Data-  
348 driven norms interventions are unique in the field because self-other difference measurements are  
349 typically used during assessment, intervention and evaluation. In extreme cases of desirable  
350 responding, it is therefore conceivable that observed self-other differences may differ markedly from  
351 those which are true of the population, potentially influencing practitioner decision-making concerning  
352 where scarce resources are targeted. However, highlighting larger self-other differences as part of a  
353 normative intervention may also be preferred by practitioners due to the heightened salience and  
354 increased opportunity to alert students to perception-behavior discrepancies. In turn, students exposed  
355 to larger self-other differences may experience heightened dissonance that motivates a reduction in  
356 drinking; raising the possibility that SDR may actually increase the potency of an intervention.  
357 However, it seems prudent to suggest that careful consideration be given to the pros and cons of  
358 highlighting self-other differences that may, to a greater or lesser extent, reflect SDR. Although there  
359 may be some advantage to including larger self-other differences as part of an intervention, promoting  
360 accurate information is often considered a key element of normative intervention.

361

362 A further aim was to investigate whether commonly used data collection methods may contribute to  
363 self-other differences. Here, students questioned about their own drinking behaviors and attitudes, as  
364 well as those of the average student, reported more permissive attitudes among their peers than  
365 students asked solely about their perceptions of the average student. In contrast, students' own  
366 attitudes did not differ between questionnaires and reports of drinking behaviors (both personal and  
367 perceived) and appeared to be more robust to the questionnaire manipulation. Underscoring the need  
368 for research to improve measurement within drinking norms research (Monk and Heim, 2014, Pape,  
369 2012, Simons-Morton and Kuntsche, 2012), these findings extend those of Melson et al. (2011) to  
370 university settings which are frequently the target of drinking norms research and interventions. In  
371 doing so, we confirm that there appears to be a reproducible effect of the type of questionnaire used to



372 measure perceived drinking attitudes, which has the potential to increase the magnitude of self-other  
373 differences. Data in this study were collected remotely via an online survey, and used a different set of  
374 measures than in previous research. This suggests the measurement effect is not in itself an artifact of a  
375 specific set of attitude statements or of questioning a young sample in classroom environments  
376 (McCambridge and Strang, 2006, Percy et al., 2005, Open Science Collaboration, 2015). Importantly,  
377 this study also provides further evidence that student drinking behavior and perception responses  
378 appear to be robust to multi- or single-target presentation. This increases confidence that self-other  
379 differences/normative overestimation of drinking behavior may be unaffected by this aspect of  
380 standard methodology. The multi-target questionnaire used in this research assessed a single order of  
381 target presentation ('self-then-peer'), which does not control for possible ordering effects, but is  
382 consistent with available guidance and likely to reflect applied practice (Haines et al., 2005). The  
383 possible inflation of the true magnitude of discrepancy for personal and perceived drinking attitudes  
384 means researchers may prefer to consider alternatives to multi-target questionnaires when attempting  
385 to quantify accurately this type of discrepancy.

386

387 Our finding that SDR is related to self-other differences offers a useful starting point for investigating  
388 possible mechanisms responsible for the differences obtained in perceived peer attitudes using multi-  
389 and single-target questionnaires. However, SDR was unrelated to perceptions of the average student's  
390 drinking attitudes, suggesting that alternative accounts may be needed to explain this effect. One  
391 possibility is that multi-target questionnaires encourage a more context-specific form of SDR, distinct  
392 from the stable trait operationalization of SDR in this study. Research that can manipulate social  
393 desirability demands during assessments may help to identify whether self-other differences vary as a  
394 function of more contextually-dependent social desirability (e.g., Holtgraves, 2004).

395

396 A strength of the study was the use of a multi- rather than single- dimensional measure of SDR  
397 (Paulhus, 1991, Crowne and Marlowe, 1960), enabling tentative hypotheses about SDR processes that  
398 may influence drinking norms reports. Self-deception was positively associated with frequency of  
399 heavy drinking self-other differences, while impression management was positively related to self-  
400 other differences for drinking frequency and units on a typical occasion and attitudes. Biased estimates  
401 of heavy drinking self-other differences may therefore be obtained when students unintentionally  
402 retrieve overly positive self-esteem maintaining information during questionnaire assessments. In  
403 contrast, biased self-other differences for drinking frequency, quantity and attitudes may be obtained  
404 because students consciously distort reports in order to present a more favorable version of themselves.  
405 One possible explanation for the association of self-deception with frequency of heavy drinking self-  
406 other differences may lie in the self-esteem maintaining function of self-deception. Self-deceptive  
407 responding may become increasingly likely as questions deal with risky or health-compromising  
408 behaviors such as heavy drinking. Consistent with this account, Davis et al. (2010) also found that self-  
409 deception was unrelated to basic consumption reports but was negatively associated with reporting  
410 drinking problems. Strategies to limit the impact of SDR may also benefit from consideration of the  
411 different SDR processes. Thus, while confidentiality is often stressed during questionnaire assessments,  
412 a procedure that may help to reduce the impact of impression management, this is unlikely to address  
413 the hypothesised self-deception processes. Future research may therefore usefully develop and test  
414 targeted messages designed to minimize the impact of self-deception, for instance by encouraging  
415 more careful or balanced information retrieval.

416

417 The different SDR processes reported here also hold possible implications for applied drinking norms  
418 interventions. Credibility of normative feedback is a key moderator of intervention effectiveness (e.g.,  
419 Thombs et al., 2004, Polonec et al., 2006). Among students with strong impression management biases  
420 (i.e., reflecting conscious and intentional distortion of responses to present a more favorable version of

421 themselves), projecting this response bias onto peers could lead some to dismiss normative feedback  
422 components of interventions as poor reflections of real world norms. Additionally, among students  
423 who self-deceive, a drinking norms intervention might actually help to counter self-deceptive  
424 responding if, following exposure, respondents are encouraged to confront biased information retrieval.  
425 These possible implications are speculative and require further examination in carefully designed  
426 studies or by incorporating measures of SDR into evaluations of drinking norm interventions.

427

428 There are several possible limitations to this study. We used a self-selecting sample with an  
429 overrepresentation of females and younger undergraduate students. Notwithstanding these limitations,  
430 we note that the experimental findings reported closely resemble those obtained in previous research  
431 using a gender-balanced cohort of much younger of adolescent pupils (Melson et al., 2011), increasing  
432 confidence that our results are unlikely to be due to selection bias. The current research used distal  
433 (average student) targets because this is the dominant target within this field of research. However, it  
434 remains to be investigated whether perceptions of a more proximal target such as close friends would  
435 be less sensitive to measurement effects or unrelated to SDR. This area of research therefore warrants  
436 further exploration. Overall, while the experimental findings are consistent with earlier research, the  
437 role of socially desirable responding is novel and further investigation of its relationship to self-other  
438 differences and peer norm overestimation seems prudent.

439

440 In conclusion, self-reported differences between personal and perceived drinking behaviors and  
441 attitudes are frequently taken at face value as evidence of actual levels of normative overestimation  
442 within student populations. The present study indicates that reported self-other differences in drinking  
443 behaviors and attitudes may partly reflect socially desirable responding and be a possible by-product  
444 of standard methodological practices. Overestimation of peer drinking, as commonly reported, may not  
445 reflect 'objective' levels of overestimation in student populations.

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Table 1. Mean (SD) drinking and attitude index scores for multi- and single-target versions of the questionnaire

	Questionnaire version				Questionnaire version			
	MT	ST <sup>PERS</sup>	<i>t</i>	<i>d</i>	MT	ST <sup>AS</sup>	<i>t</i>	<i>d</i>
AUDIT Frequency of consumption	7.38 (4.99)	7.11 (4.93)	0.48 <sup>NS</sup>	0.05	10.9 (3.96)	11.17 (3.97)	0.54 <sup>NS</sup>	0.07
AUDIT Typical occasion units	6.1 (3.06)	5.80 (2.83)	0.88 <sup>NS</sup>	0.1	7.37 (2.61)	7.28 (2.61)	0.29 <sup>NS</sup>	0.04
AUDIT heavy drinking	2.43 (3.81)	2.31 (3.65)	0.3 <sup>NS</sup>	0.03	4.54 (5.66)	4.05 (3.71)	0.09 <sup>NS</sup>	0.02
Drinking attitudes	48.51 (9.99)	46.66 (11.43)	1.48 <sup>NS</sup>	0.17	60.49 (8.65)	56.28 (10.26)	3.61 <sup>***</sup>	0.44

\*\*\* $P < .001$ ; <sup>NS</sup>  $P > .05$ ; *d* = Cohen's *d*

MT: Multi-target version of the questionnaire; ST<sup>PERS</sup>: Single-target 'personal' version of the questionnaire; ST<sup>AS</sup>: Single-target 'average student' version of the questionnaire.

AUDIT frequency of heavy drinking values were log transformed





Table 3. Hierarchical regression analyses of socially desirable responding and self-other differences in frequency of consumption, typical occasion units, frequency of heavy drinking and attitudes

AUDIT frequency of consumption SOD						AUDIT typical occasion units SOD					
	Variable	$R^2$	$\Delta R^2$	beta	$t$		Variable	$R^2$	$\Delta R^2$	beta	$t$
Step 1	Age	.05	.05*	0.20	2.36*		Age	.03	.03 <sup>NS</sup>	0.11	1.28 <sup>NS</sup>
	Gender			0.10	1.2 <sup>NS</sup>		Gender			0.14	1.67 <sup>NS</sup>
Step 2	Age	.28	.23***	0.05	0.62 <sup>NS</sup>		Age	.13	.10***	0.01	0.00 <sup>NS</sup>
	Gender			-0.02	-0.21 <sup>NS</sup>		Gender			0.06	0.63 <sup>NS</sup>
	7-day consum			-0.52	-6.65***		7-day consum			-0.34	-4.00***
Step 3	Age	.32	.04*	0.04	0.58 <sup>NS</sup>		Age	.17	.04*	0.01	0.14 <sup>NS</sup>
	Gender			-0.05	-0.66 <sup>NS</sup>		Gender			0.03	0.42 <sup>NS</sup>
	7-day consum			-0.5	-6.55***		7-day consum			-0.32	-3.78***
	BIDR SD			0.00	0.06 <sup>NS</sup>		BIDR SD			-0.05	-0.65 <sup>NS</sup>
	BIDR IM			0.21	2.83**		BIDR IM			0.22	2.63*
AUDIT frequency of heavy drinking SOD						Drinking attitudes SOD					
Step 1	Age	.04	.04 <sup>NS</sup>	0.11	1.33 <sup>NS</sup>		Age	.08	.08**	0.15	1.79 <sup>NS</sup>
	Gender			0.17	2.00*		Gender			0.25	3.01*
Step 2	Age	.34	.30***	-0.06	-0.82 <sup>NS</sup>		Age	.17	.11***	0.04	0.52 <sup>NS</sup>
	Gender			0.04	0.5 <sup>NS</sup>		Gender			0.17	2.1*
	7-day consum			-0.59	-7.96***		7-day consum			-0.36	-4.38***
Step 3	Age	.37	.03*	-0.08	-1.12 <sup>NS</sup>		Age	.20	.04 <sup>†</sup>	0.04	0.49 <sup>NS</sup>
	Gender			0.02	0.29 <sup>NS</sup>		Gender			0.14	1.74 <sup>NS</sup>
	7-day consum			-0.60	-8.17***		7-day consum			-0.34	-4.22***
	BIDR SD			0.16	2.22*		BIDR SD			0.00	-0.04 <sup>NS</sup>
	BIDR IM			0.04	0.48 <sup>NS</sup>		BIDR IM			0.19	2.39*

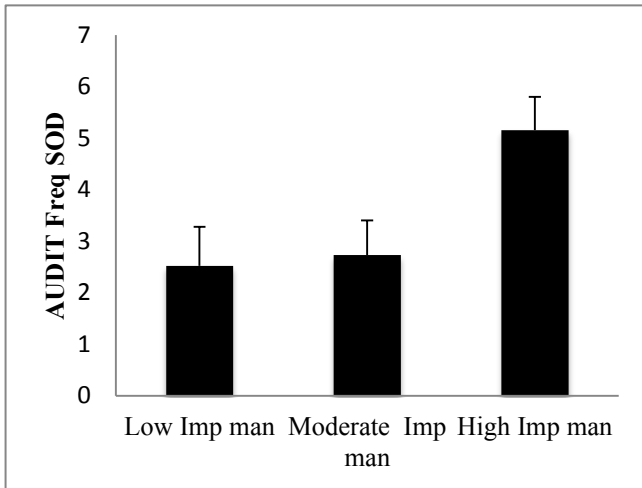


Figure 1a

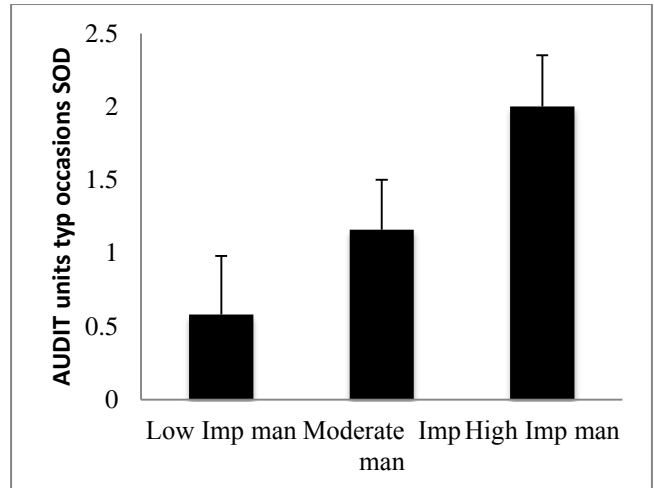


Figure 1b

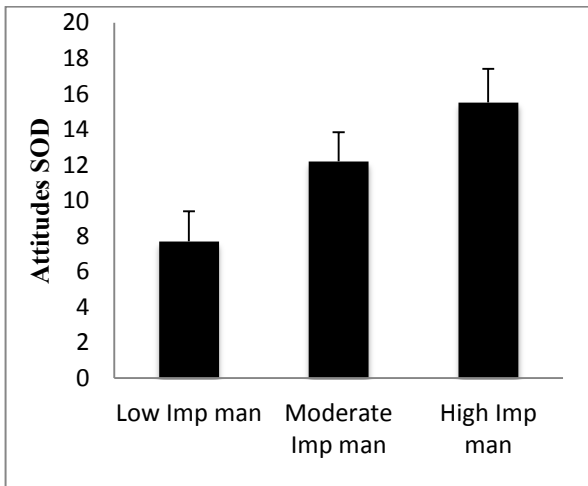


Figure 1c

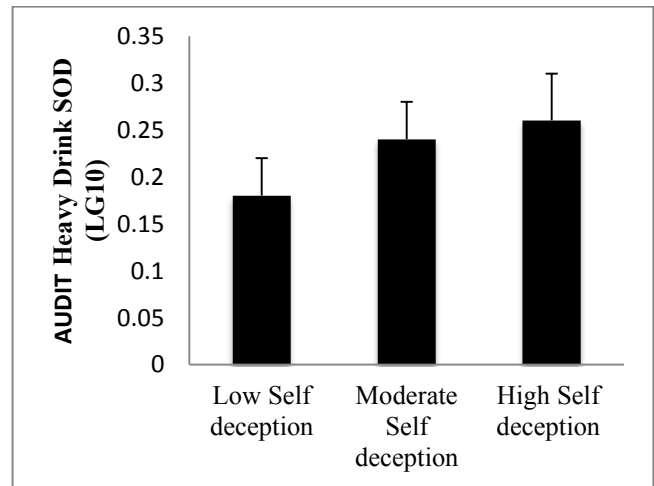


Figure 1d

546

547 Figure 1 (a-d): Mean self-other difference values at low, moderate and high (1a) impression  
 548 management for AUDIT frequency of consumption, (1b) impression management for AUDIT  
 549 quantity of units consumed on a typical occasion, (1c) impression management for drinking  
 550 attitudes index scores, and (1d) self-deception for AUDIT frequency of heavy drinking.

### Table (1-3) legends

#### Table 1:

\*\*\* $P < .001$ ; <sup>NS</sup>  $P > .05$ ;  $d$  = Cohen's  $d$

MT: Multi-target version of the questionnaire; ST<sup>PERS</sup>: Single-target 'personal' version of the questionnaire; ST<sup>AS</sup>: Single-target 'average student' version of the questionnaire.

AUDIT frequency of heavy drinking values were log transformed

#### Table 2:

MT respondents only  $N = 142$

\* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$

BIDR SD/IM = Balanced Inventory of Desirable Responding Self-deception/Impression management subscales

AUD Freq/Quan/Heavy = AUDIT Frequency of consumption/AUDIT Typical quantity of units consumed on a drinking occasion/AUDIT Frequency of heavy drinking

7-day consum = recent seven-day consumption.

Gender: Male = 0, female = 1

AUDIT frequency of heavy drinking and the seven-day consumption values were log transformed

#### Table 3:

MT respondents only  $N = 142$

<sup>†</sup>  $P = .051$ ; \* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$ ; <sup>NS</sup>  $P > .05$

SOD = self-other difference; BIDR SD/IM = Balanced Inventory of Desirable Responding Self-deception/Impression management subscales.

7-day consum = recent seven-day consumption.

AUDIT frequency of heavy drinking and seven-day consumption values were log transformed.

## Figure 1

551 Figure 1 (a-d):

552 Mean self-other difference values at low, moderate and high (1a) impression management for  
553 AUDIT frequency of consumption, (1b) impression management for AUDIT quantity of units  
554 consumed on a typical occasion, (1c) impression management for drinking attitudes index  
555 scores, and (1d) self-deception for AUDIT frequency of heavy drinking.