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How much is '5-a-day'? A qualitative investigation into consumer understanding of fruit and vegetable intake guidelines

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1 **How much is ‘5-a-day’?: A qualitative investigation into consumer understanding of**
2 **fruit and vegetable intake guidelines**

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13 **Authorship**

14 CR contributed towards the design of the PS questionnaire, conducted qualitative data
15 collection, carried out all analyses and drafted the manuscript. JVW designed the study and
16 was Principal Investigator on the grant. ISY, MCMcK and KMA were co-investigators on the
17 grant application, and MCMcK assisted with the analysis and interpretation of the qualitative
18 data. KMA developed the first draft of the PS questionnaire and provided advice on its
19 analysis. CRD, LLH and AJMcG were responsible for participant recruitment and completion
20 of the study protocol. CRD and AJMcG also assisted with the FG discussions. All authors
21 critically reviewed and approved the manuscript.

22

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30

31 **ABSTRACT**

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Background: Despite the known health benefits of fruit and vegetables (FV), population intakes remain low. One potential contributing factor may be a lack of understanding surrounding recommended intakes. This study aimed to explore understanding of FV intake guidelines among a sample of low FV consumers.

Methods: Six semi-structured focus groups were held with low FV consumers (n=28, age range 19-55 years). Focus groups were digitally recorded, transcribed verbatim, and analysed thematically using NVivo to manage the coded data. Participants also completed a short questionnaire assessing knowledge on FV intake guidelines. Descriptive statistics were used to analyse responses.

Results: Discussions highlighted that although participants were aware of FV intake guidelines, they lacked clarity with regards to the meaning of the ‘5-a-day’ message, including what foods are included in the guideline, as well as what constitutes a portion of FV. There was also a sense of confusion surrounding the concept of achieving variety with regards to FV intake. The sample highlighted a lack of previous education on FV portion sizes, and put forward suggestions for improving knowledge, including increased information on food packaging, in supermarkets and through health campaigns. Questionnaire findings were generally congruent with the qualitative findings, showing high awareness of the ‘5-a-day’ message, but a lack of knowledge surrounding FV portion sizes.

Conclusions: Future public health campaigns should consider how best to address the gaps in knowledge identified in this study, and incorporate evaluations that will allow the impact of future initiatives on knowledge, and ultimately behaviour, to be investigated.

65 **INTRODUCTION**

66 The World Health Organisation (WHO) set a minimum daily target of 400 g FV which has
67 since been translated into the ‘5-a-day’ public health message within the UK ^(1,2). Despite
68 these guidelines, current population intakes remain suboptimal ⁽³⁾.

69 Knowledge is potentially an important predictor of FV intake ⁽⁴⁻⁷⁾. Few studies have
70 investigated consumer understanding of the meaning of the ‘5-a-day’ message, including
71 which foods are included in the guidelines and what counts as a portion of FV. Greater
72 awareness of the amounts and types of FV needed to achieve the recommended guidelines
73 might promote better adherence and increased intake. For example, improved comprehension
74 of what constitutes a portion of FV, may enhance consumers’ capability and motivation to
75 achieve the recommendations ⁽⁸⁾. It might also help individuals to accurately assess their
76 current FV intake and consequently plan dietary changes. Discordant findings between
77 people’s perception of their FV intake and their actual intake have been observed. For
78 instance, one study ⁽⁹⁾ found that amongst 426 elderly participants, 83% were aware of FV
79 intake guidelines, and 35% felt they were eating enough FV. However, a closer examination
80 (using a dietary recall of typical FV intake) of the latter group showed that some individuals
81 were consuming as little as two portions of FV per day. One explanation for this discrepancy
82 might be that the individuals felt they were eating enough FV for their health personally, and
83 so did not need to meet the intake guidelines ⁽¹⁰⁾. However, another possibility is that
84 participants did not understand how to quantify a portion of FV.

85 The few studies which have been conducted to date on consumer understanding of FV intake
86 guidelines have primarily investigated knowledge amongst American ^(7, 11-14), Australian ^{(8, 15-}
87 ¹⁷⁾, and New Zealand consumers ⁽¹⁸⁾. Only two studies ^(19,20) have investigated knowledge
88 within the UK, and these studies used samples of University students and socially-deprived
89 individuals. Given that FV-based public health campaigns, intake recommendations and
90 portion size (PS) guidance vary greatly between countries (see Supporting Information Table
91 S1), the majority of evidence to date cannot necessarily be generalised to a UK context.
92 Hence, the objective of the current paper was to explore awareness and understanding of FV
93 intake guidelines, with a particular emphasis on sources of FV and FV portion sizes (PSs),
94 within a sample of low FV consumers.

95

96

97 **MATERIALS AND METHODS**

98 **Study Sample and Recruitment**

99 The current sample comprised participants taking part in a pilot randomised controlled
100 feeding study, entitled the Biomarkers of Fruit and Vegetable (BIOFAV) study. Full details
101 of the pilot trial have been published elsewhere ⁽²¹⁾. In brief, it was designed to investigate
102 novel biomarkers of FV consumption amongst 32 healthy, low FV (≤ 2 portions) consumers.
103 Participants were recruited through an intranet advertisement published within [University
104 name removed for blinding purposes], and through word-of-mouth. The study was approved
105 by the [removed for blinding purposes] research ethics committee of [removed for blinding
106 purposes], and participants provided written informed consent.

107 *Focus Group Discussions*

108 Six focus groups (FGs) were conducted between August 2011 and May 2012, during the first
109 week of the four week BIOFAV study. The FGs ranged in size between four and six
110 participants. They lasted 45 to 60 minutes and were digitally recorded.

111 The FGs were moderated by CR, with assistance from another researcher (CRD/AJMcG).
112 Moderators received formal training in conducting FGs. To ensure consistency, a semi-
113 structured topic guide was developed based on a prior literature search. The guide was piloted
114 on a group of four research students (aged between 20-30 years); sample questions are
115 illustrated in Supporting Information Table S2. The co-moderator ensured all topic areas
116 were covered within each session and volunteers were encouraged to fully express their
117 views, provided the conversation was relevant to the aims of the research. At the end of each
118 session, participants were asked if they had any other issues they would like to raise.

119 *Questionnaire*

120 Prior to the FGs, demographic information was collected on the sample. A questionnaire
121 about the '5-a-day' FV guideline was also administered. The purpose of the questionnaire
122 was to provide some context on the sample, and to aid with the interpretation of participant
123 responses during the qualitative discussions.

124 The questionnaire covered four areas; awareness of the '5-a-day' message, knowledge on
125 foods that are classified as a fruit or vegetable according to the '5-a-day' message, PSs of
126 commonly consumed FV and knowledge on portions provided by combinations of FV (to
127 reflect normal dietary consumption patterns). Participants were firstly asked 'Are you aware

128 of the '5-a-day' message about FV consumption?', to which they could answer 'yes', 'no' or
129 'not sure'. Secondly, participants were given a categorisation task which required them to
130 identify foods which counted as a fruit or vegetable according to the '5-a-day' message from
131 a list of 39 commonly consumed foods. A third question showed a list of 27 FV with specific
132 quantities (e.g. four spears of broccoli) and asked participants to record how many portions of
133 fruit or vegetables each would contribute towards the '5-a-day' message (e.g. ½ portion).
134 Finally, the questionnaire presented seven combinations of FV (e.g. one medium apple, one
135 medium pear and two medium glasses of fruit juice) and asked participants to specify how
136 many portions each set would equate to if eaten within the course of one day.

137 *Statistical Analysis*

138 FGs were transcribed verbatim by CR. Another study team member listened to the audio
139 recordings and checked this against the transcripts. Data were analysed using Braun and
140 Clarkes' inductive thematic analysis framework ⁽²²⁾. This involved six steps i) familiarisation
141 with data, ii) initial descriptive coding of data, iii) search for themes, iv) review of themes, v)
142 naming and defining of themes and vi) writing up of results. CR carried out this process, and
143 the transcripts were then read by MCMcK and the codes were checked and compared. Few
144 between-researcher discrepancies were found and consensus was reached through discussion.
145 QSR NVivo 8 was used to facilitate data coding and management.

146 Questionnaire responses were analysed using PASW (SPSS Inc, Chicago, IL). Descriptive
147 statistics were used to describe the demographic profile of participants. Categorical data are
148 presented as frequencies and percentages, while continuous data are shown as the median and
149 interquartile range (IQR) (due to the small sample size). For questionnaire analysis, correct
150 responses were given a score of one, whilst incorrect and 'don't know' responses were given
151 a score of zero, making a maximum possible score of 74. Percentage of correct responses was
152 calculated for each participant for the questionnaire as a whole and for each of the four
153 questionnaire domains. Descriptive statistics were used to report the frequency of correct and
154 incorrect responses, and percentage knowledge scores for the sample are presented as the
155 median and interquartile range (IQR). The small sample size did not permit statistical testing
156 of responses by demographic variables.

157 **RESULTS**

158 Twenty-eight participants took part in the FGs (sample characteristics are shown in Table 1).
159 The main themes which emerged from the analysis of the transcripts were: (i) knowledge; (ii)

160 education; and (iii) suggestions for improving FV PS knowledge (see Supporting Information
161 Table S3 for a full list of themes, subthemes and quotations).

162 ***Knowledge***

163 Whilst the majority of participants claimed to be aware of the ‘5-a-day’ campaign, a lack of
164 knowledge was evident regarding the specifics of the message (Quote 1, Table 2). For
165 example, most participants were confused as to which foods counted as a fruit or vegetable
166 according to the ‘5-a-day’ message. Additionally, when prompted by the moderator, some
167 expressed their surprise at foods such as tomato-based sauces, which they would not have
168 previously classified as a fruit or vegetable (Quote 2, Table 2). Some participants also said
169 they were unaware that potatoes were not classified as a vegetable according to the
170 guidelines. Most ambiguity existed with regards to composite foods (e.g. spaghetti bolognese
171 and stew), with many participants stating they did not normally count these foods towards
172 their FV intake (Quote 3, Table 2). One participant also indicated that they were uncertain
173 about what conditions a food needed to satisfy to be classified as a fruit or vegetable (Quote
174 4, Table 2).

175

176 Most participants also expressed a lack of awareness surrounding PSs for FV, and this was
177 the prevailing topic of conversation during the FG discussions about the ‘5-a-day’ message.
178 Respondents mentioned varieties they deemed particularly difficult, including lettuce, and the
179 heterogeneity in PSs for different FV was highlighted as a factor which made it more difficult
180 to identify a portion of FV (Quote 5, Table 2). When additional FV guideline rules were
181 discussed, for example that fruit juices can only count as a maximum of one portion per day,
182 some participants questioned the reasoning behind this rule (Quote 6, Table 2). Generally, it
183 was suggested by participants that PSs for fruit were easier to establish than vegetables, with
184 some mentioning fruit as “*more discrete*” (FG1, M, 19yrs) and the fact that you could “*use*
185 *the whole thing*” (FG2, M, 20yrs). Most participants claimed that composite food dishes
186 including FV (e.g. sandwiches, stew and soup) were particularly difficult to quantify in terms
187 of the number of portions that were provided in one serving (Quote 7, Table 2).

188

189 Variety was a key concept discussed in multiple FGs. Firstly, some participants claimed that
190 they had misinterpreted the ‘5-a-day’ message as meaning five portions of fruit, plus five
191 portions of vegetables a day (Quote 8, Table 2). Many participants also alluded to the fact
192 that they were not previously aware that FV intake should ideally be comprised of a variety

193 of FV, and some thought eating five of the same type of fruit or vegetable would be sufficient
194 to meet recommendations (Quote 9, Table 2).

195

196 Finally, in relation to their lack of knowledge of FV PS, some participants expressed that they
197 had difficulty estimating their current intake of FV (Quote 10, Table 2; Quote 11, Table 2).

198

199 ***Education***

200 Overall, findings from the FGs suggested that participants had received little or no
201 information on what constituted a portion of FV according to intake guidelines. However,
202 some sources of education mentioned included front-of-pack labelling, school and magazine
203 articles (Quote 12 & 13, Table 2). There were mixed opinions with regards to the preferred
204 unit of measurement for FV PSs. Some believed grams were superior as this is a universal
205 measurement, and is used on packaging (Quote 14, Table 2). Others expressed concern that
206 they were not familiar with grams as a form of measurement, it would be a hassle to weigh
207 FV before eating, and there was no need to be so precise (Quote 15, Table 2). Tablespoons
208 and handfuls were both generally perceived as more useful measures for FV PS (Quote 16,
209 Table 2). However, some participants believed that handfuls could be confusing as the size of
210 an individual's hands differ (Quote 17, Table 2). In two FGs, participants stated that they
211 preferred to guess FV PSs based on the size of well-known FV such as an apple (Quote 18,
212 Table 2).

213

214 On the whole, participants agreed that having more information on what constitutes a portion
215 of FV would impact positively on their current FV consumption (Quote 19 & 20, Table 2).
216 With increased information some said they would feel 'more informed' and 'more aware',
217 and that the guidelines would seem 'more achievable'. However, others said they did not
218 think about FV PS, instead preferring to eat depending on their appetite. Some participants
219 also suggested that increased FV PS information would not overcome other barriers towards
220 FV consumption, including routine and preparation (Quote 21 & 22, Table 2).

221

222 ***Suggestions for Improving Portion Size Knowledge***

223 Suggestions for improved future communication of FV PS included increased information on
224 packaging and displays in the FV produce section of supermarkets. Some participants said
225 they would like personal assistance whilst shopping for FV (i.e. somebody to inform you of

226 how much you need to make up a portion of FV) (Quote 23, Table 2), although this idea was
227 refuted by younger participants (Quote 24, Table 2).

228

229 Other proposals included increased FV PS information in eateries which could be used when
230 ordering food, governmental campaigns and more promotional material, including leaflets or
231 posters (Quote 25 & 26, Table 2). Assistance with meal planning and FV PS information in
232 recipe books were also suggested as possible motivators for increasing FV intake (Quote 27
233 & 28, Table 2).

234

235 **Questionnaire Results**

236 A summary of the scores from each domain of the FV guidelines questionnaire are illustrated
237 in Supporting Information Table S4. All participants were aware of the '5-a-day' FV
238 guidelines and the majority were able to correctly identify foods which counted as a fruit or
239 vegetable (median knowledge score 91%). Only 39.3% and 42.9% of participants correctly
240 stated that jacket potatoes and potatoes respectively were not included in the FV count
241 (Supporting Information Table S5).

242 The median knowledge score for identifying the portions provided by different amounts of
243 individual types of FV was 37% (Supporting Information Table S6). For most foods (59%),
244 less than half of the sample correctly answered the portions provided by the stated quantities
245 of FV. More than 50% of participants correctly identified the portions provided by ten foods
246 only. These were mostly in the form of one 'piece' of fruit or vegetable (e.g. one apple, one
247 banana).

248 Apart from one combination of FV (1 apple, 1 banana, 1 glass of fruit juice), the majority of
249 participants ($\geq 50\%$) incorrectly assessed the number of portions provided by different
250 selections of FV (Supporting Information Table S7). The median knowledge score for this
251 task was 21.4%.

252

253 **DISCUSSION**

254 Despite awareness of the UK government's '5-a-day' recommendation for FV, this study
255 demonstrated a lack of knowledge with regards to the specifics of the message. Some mis-
256 understandings of '5-a-day' exist, notably the belief that it recommends five fruit *and* five

257 vegetables per day, and not appreciating the importance of variety. There were also
258 knowledge gaps regarding what is included in the FV recommendation, and a lack of
259 knowledge about what constitutes a portion of FV, or how to actually achieve the
260 recommended intake target.

261 **Identification of FV within the Context of the ‘5-a-day’ Guidelines**

262 The FG discussions highlighted a lack of clarity with regards to which foods count as a fruit
263 or vegetable according to the ‘5-a-day’ message. Specifically, individuals illustrated a deficit
264 of knowledge on whether certain composite foods counted towards FV guidelines. This is in
265 line with findings from another study ⁽¹⁴⁾ which suggested that FV consumed in composite
266 dishes were the most difficult to classify for American consumers. The exclusion of
267 composite foods whilst assessing FV intake can have important implications in terms of the
268 conclusions that are reached regarding current consumption. For example, a study ⁽²³⁾ showed
269 that excluding composite foods from FV estimates can misclassify participants as low/non-
270 consumers of FV. Indeed, a possible explanation for the increase in FV consumption
271 observed in UK adults in the National Diet and Nutrition Survey between 2002 ⁽²⁴⁾ and 2012
272 ⁽⁴⁾ (2.8 portions FV/day versus 4.1 portions FV/day respectively) is that the most recent
273 survey used disaggregated data for a wider range of composite dishes. Composite foods
274 account for as much as 20-30% of vegetable intake and 10% of fruit intake, thus illustrating
275 the need for consumers to be better informed of the value of FV-rich meals in relation to
276 achieving FV guidelines ⁽²⁵⁾. Additionally, the public should be made aware of how to easily
277 incorporate portions into commonly consumed meals. Such information could have a positive
278 impact in terms of making the ‘5-a-day’ target seem more achievable; a point which was
279 strongly advocated in the FGs within this study.

280 Although the sample scored well in the questionnaire when asked to identify foods which are
281 classified as a fruit or vegetable, as voiced in the FGs, there was some uncertainty in relation
282 to potatoes, chickpeas and lentils. The international variation in the classification of potatoes,
283 with some countries, such as the USA, including potatoes as a vegetable, and others, such as
284 the UK, excluding potatoes from their FV guidelines (as per recommendations set by the
285 WHO/FAO) may be confusing for individuals as indicated by the data gathered here.
286 Regardless of the reason, this is an important finding as it highlights that some consumers
287 may count potatoes towards their daily intake of FV, and thus they may be over-estimating

288 their consumption. Future education resources should endeavour to clarify this for the general
289 public.

290 **Understanding of FV Portion Sizes within the Context of the ‘5-a-day’ Guidelines**

291 Another key finding from the focus groups was that the majority of participants had trouble
292 conceptualising a portion of different types of FV, which is a key skill required in
293 understanding the ‘5-a-day’ message. This finding is consistent with previous studies
294 conducted in the area ^(8,12,14,15,18-20). Participants generally found it more challenging to
295 decipher the portions provided by FV which were not in the form of one whole food/piece,
296 with some stating that this was the main reason why vegetables were often more difficult to
297 determine in terms of portions in comparison to fruit. The questionnaire responses reinforced
298 this finding, and also revealed that, when faced with a list of FV, most respondents were
299 unable to tell how many portions the combination would provide. When translated into a
300 normal day-to-day dietary context, this suggests that these consumers are unlikely to be able
301 to accurately assess their own daily intake of FV, and this was acknowledged within the FGs.
302 Hence, it is possible that this sample are making dietary choices regarding FV consumption
303 based on ill-informed perceptions about their current intake. Another key finding was that
304 some participants believed that the ‘5-a-day’ guideline required consumption of five portions
305 of fruit *in addition to* five portions of vegetables per day. This notion has been observed
306 elsewhere ⁽²⁶⁾, and could, potentially, be demotivating and thus might suggest a need for the
307 refinement of ‘5-a-day’ in order to facilitate better consumer understanding. There may be
308 some merit, for example, in providing separate intake recommendations for FV, as is the case
309 in Australia (Go for 2&5 campaign).

310 From a nutrition research perspective, the lack of PS knowledge presented within this study
311 emphasises the complexities of measuring FV intake using self-report measures. Some
312 measures of dietary intake, including FFQs, require respondents to report their frequency of
313 consumption of FV based on an ‘average portion’. As highlighted here, people are not
314 necessarily aware of what a standard portion of FV equates to, and hence the validity of such
315 data might be compromised. In terms of implications for the assessment of FV intake in the
316 future, researchers should provide assistance to respondents when quantifying FV intake (e.g.
317 through the use of a food PS atlas).

318 One of the key messages advocated by the ‘5-a-day’ campaign is the importance of
319 consuming a variety of FV, however, this work indicates that this message is not well
320 understood. For example, during the FGs, a number of individuals indicated that they
321 thought eating five of the same FV would suffice in terms of achieving the ‘5-a-day’
322 guidelines. Similarly, Carter *et al.* ⁽¹⁶⁾ also found that a sample of Australian participants were
323 unclear as to whether FV intake guidelines stipulated that five different FV needed to be
324 consumed each day. These are again important findings in terms of the probability that
325 people are misjudging the adequacy of their FV intake. Participants in the current study also
326 conveyed the notion that eating five of the same FV was unappealing and an unrealistic target
327 in relation to their satiety. Hence, education on consuming a variety of FV, particularly
328 within meals, could make the guidelines more achievable.

329 In terms of why consumers lack understanding on FV intake guidelines including PSs, there
330 are a number of proposed explanations. The first, and perhaps most obvious reason, could
331 simply be a result of a lack of education. Within the current study, for example, the majority
332 of participants claimed to have been exposed to limited information about FV PSs, except
333 occasionally from packaged FV sources. A second potential reason, which was raised by
334 participants, is the confusion generated by the substantial variation in the amounts of FV
335 needed to achieve one portion.

336 In terms of the future, and how knowledge on achieving a portion of FV could be increased,
337 the results from the FGs suggested a collaborative effort is required from the food industry
338 (e.g. packaging), retailers (e.g. supermarket displays and eateries) and health promotion
339 bodies (e.g. campaigns and promotional material) to address key misconceptions or deficits in
340 knowledge. With regards to PS information on packaged FV, it is worth noting that, at
341 present, no regulations exist within the UK in relation to making claims on the portions
342 provided by FV products. Manufacturers are not obliged to display such details, and thus
343 there is great inconsistency with regards to the level of information currently provided.
344 Furthermore, there is variability in the methods used to communicate PS information to
345 consumers (e.g. various logos have been employed).

346 What was ambiguous from the current study was how PS information would best be
347 communicated in terms of grams/household measures. Future studies should seek to clarify
348 this issue. Furthermore, public health campaigns should investigate not only whether
349 increasing PS information can reduce confusion and increase understanding (knowledge), but

350 also whether it has the potential to facilitate long-term increases in FV consumption
351 (behaviour), and overcome other barriers towards FV intake such as those mentioned in this
352 study (appetite, routine, preparation).

353 **Strengths and Limitations**

354 This study provides some of the first evidence about consumer understanding of FV
355 guidelines within the UK, including the novel topic area of FV PSs. However, the findings
356 should be interpreted in light of some limitations. Firstly, the sample is comprised of a small
357 number of mostly of well-educated young adults, with normal BMIs, thus the findings may
358 not be generalisable to other groups in the population. However, this sample of low FV
359 consumers represented an ideal opportunity to investigate understanding of intake guidelines.
360 Secondly, whilst the FGs were held as close as possible to the start of the four week
361 intervention, participants may have sought information on FV from the research team during
362 prior feeding sessions which could have influenced their attitudes. Similarly, although the
363 quantitative questionnaire was distributed at the beginning of the study, it is possible that
364 participants may have acquired some information on FV at the screening visits. However, this
365 was unavoidable as the questionnaire could not have been distributed before individuals were
366 deemed eligible, and consented onto the study. Furthermore, the question assessing
367 knowledge of the '5-a-day' message may have facilitated guessing which could have
368 potentially inflated the accuracy score. Finally, the questionnaire was not validated nor
369 formally piloted prior to use. Whilst one existing validated questionnaire contains questions
370 on FV PS knowledge ⁽²⁰⁾, it assessed knowledge on a limited number of foods and did not
371 examine understanding of sources of FV, which was a key aspect of the current paper. In
372 comparison to most previous studies assessing knowledge of FV intake guidelines, including
373 FV sources and FV PS, the questionnaire used in the current study measured knowledge
374 based on a greater number of items, making it one of the most comprehensive measures to
375 date.

376 In conclusion, this study showed some mis-understanding surrounding the UK '5-a-day'
377 message, including what foods are included within the guideline. It also emphasised a lack of
378 knowledge with regards to FV PS. Future public health campaigns should attempt to address
379 these mis-conceptions and gaps in knowledge, and incorporate evaluations that will allow the
380 impact of future initiatives on knowledge, and ultimately behaviour, to be investigated.

381

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389

390 **TRANSPARENCY DECLARATION**

391

392 The lead author affirms that this manuscript is an honest, accurate, and transparent account of
393 the study being reported, that no important aspects of the study have been omitted and that
394 any discrepancies from the study as planned (and registered with) have been explained. The
395 reporting of this work is compliant with STROBE guidelines.

396

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