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1 **Enablers and barriers in ultra-running: A comparison of male and female ultra-**  
2 **runners**

3 S. Valentin<sup>a\*</sup>, L. Pham<sup>b</sup>, and E. Macrae<sup>a</sup>

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5 *<sup>a</sup> Institute for Clinical Exercise and Health Science, School of Health and Life Sciences,*  
6 *University of the West of Scotland, Lanarkshire campus, Scotland, <sup>b</sup> Centre for Culture Sport*  
7 *and Events, School of Media Culture and Society, University of the West of Scotland, Paisley*  
8 *campus, Scotland \* stephanie.valentin@uws.ac.uk*

9

10 **Abstract**

11 Female participation rates in ultra-running is considerably lower than that of males,  
12 but the reasons for this are not fully understood. In this study, online questionnaire  
13 responses were collected from ultra-runners taking part in the Scottish Jedburgh 3  
14 Peaks ultra and Highland Fling race. One-to-one-semi-structured phone interviews  
15 were conducted with a subset of runners to further explore themes from questionnaire  
16 responses. Similar experiences among male and female ultra-runners were identified.  
17 Enablers were: wanting a challenge, nature/outdoors, and the friendliness of the ultra-  
18 community. The main barrier was training time. Qualitative responses suggested  
19 negotiation-efficacy was important for factoring in training around work and family  
20 commitments, and although a greater proportion of males had dependants compared  
21 to females, female participation was considerably lower than males. This may be due  
22 to the historical influences of traditional gender roles however this effect may be  
23 diminishing as female participation in Scottish ultra-races appears to be increasing.

24           Keywords: Gender; Barriers; Motivation; Ultra-running; Endurance; Negotiation-  
25           efficacy; Participation

## 26 **Introduction**

27 An ultra-marathon is any footrace event that is in excess of a standard marathon distance  
28 (26.2 miles; 42 km) (Mueller et al., 2019). Ultra-marathon events vary in terrain (e.g. sand,  
29 mountainous), technical aspects (e.g. navigation), format (e.g. set time or set distance), and  
30 environmental conditions (e.g. altitude, extreme heat or cold). Ultra-marathons are rapidly  
31 increasing in popularity, with the number of races and entrants growing continually (Hoffman  
32 et al., 2010). It is thought that the number ultra-marathon events has tripled since the 1980's  
33 (Krouse et al., 2011). However, female participation is considerably lower than that of males.  
34 For instance, the 'Badwater', a race in excess of 200km in extreme heat typically sees  
35 females make up around 19% of all runners (da Fonseca-Engelhardt et al., 2013). The low  
36 proportion of female participants is not unique to that race. Between 2003 and 2012, less than  
37 13% of runners were female in the 'Marathon des Sables', a 250km race over several days in  
38 the Sahara Desert (Knoth et al., 2012). Similarly, the Western States 100-mile Endurance  
39 Run also saw female participation of around 22% (Hoffman and Wegelin, 2009). Of note,  
40 this figure was only 10% for that race in the late 1980's (Hoffman and Wegelin, 2009), which  
41 although it suggests some improvement in female participation, it still remains dramatically  
42 below that of their male counterparts. Low female participation is not unique to ultra-  
43 marathon events, as it is also seen in other ultra-distance endurance sports. For example,  
44 ultra-triathlons may only see females make up less than 10% of starters (Knechtle et al.,  
45 2011).

46 Despite evidence that female participation in ultra-marathons has increased a little  
47 over the years in some races (Hoffman and Wegelin, 2009), there are no recent studies which  
48 have evaluated ultra-marathon participation by gender since the early 2010's, therefore it is  
49 not known whether female participation rates have continued to improve. If female  
50 participation remains below that of males, perhaps fundamental differences exist between

51 men and women in what brings them to endurance events beyond the marathon distance  
52 (Wegner et al., 2015). Although the sociodemographics of ultra-runners (Hoffman and  
53 Fogard, 2012), their general health (Hoffman and Krishnan, 2014), motivations (Hoffman  
54 and Krouse, 2018), psychological factors (Roebuck et al., 2018), and exercise behaviours  
55 (Hoffman and Krishnan, 2013) have previously been explored, studies evaluating gender  
56 differences in ultra-running tend to focus on differences in performance parameters and finish  
57 rates between males and females (e.g. Knoth et al., 2012). However, there is little known  
58 about the differences between male and female ultra-runners regarding motivations, barriers  
59 and/or constraints experienced in the sport. Krouse et al (2011) explored the motivation and  
60 goal orientation of female ultra-runners, which identified that the two strongest motivators for  
61 engagement in ultra-running in women were general health and psychological coping. This  
62 provides a valuable insight into the motivators of female ultra-runners, but without a similar  
63 male data set, it is difficult to make direct comparisons between motivations of male and  
64 female ultra-runners. Similarly, it is important to understand what barriers may be  
65 experienced in ultra-running and whether this differs between males and females.

66         The constraints model originally defined by Crawford et al (1991) encompasses three  
67 aspects of constraints in leisure; intrapersonal (an individuals' psychology, preferences and  
68 predisposition), interpersonal (an individuals' relationship with others), and structural (e.g.  
69 social factors). Building on this constraints model, it is proposed that activities associated  
70 with greater health and enjoyment motives, as perceived by an individual, will increase that  
71 individuals' efforts to negotiate constraints, thereby enabling participation (Hubbard and  
72 Mannell, 2001; Jackson et al., 1993). Thus, greater levels of motivation to participate in an  
73 activity encourages greater efforts to negotiate resources to overcome constraints (White,  
74 2008). How an individual believes they are able to negotiate constraints is termed negotiation  
75 efficacy (Ridinger et al., 2012). Distance running requires considerable amounts of time to

76 train, and this time requirement competes with time-need for other commitments such as  
77 family, friends, and work (Mueller et al., 2019). As such, constraints negotiation is  
78 particularly relevant in distance running, and this concept has previously been explored in  
79 half-marathon and marathon runners (Goodsell and Harris, 2011; Wegner et al., 2015).  
80 Greater levels of negotiation efficacy were similarly found in both male and female marathon  
81 runners compared to half-marathon runners (Wegner et al., 2015), suggesting that the greater  
82 event distance, rather than gender, reflects greater negotiation efficacy need. Whether high  
83 levels of negotiation efficacy are equally present in both male and female ultra-runners, is not  
84 yet known.

85         Despite the emerging knowledge of gender influences on half-and full-marathon event  
86 participation, barriers, enablers, and constraints negotiation have not been evaluated across  
87 male and female ultra-runners, therefore the reasons for lower female participation in ultra-  
88 running are still largely unknown. Furthermore, identifying what encourages runners to  
89 progress through taking part in more challenging ultras, and how this may differ between  
90 genders, has also not been explored. This is somewhat surprising, given that anecdotally the  
91 distinct under-representation of female participants in ultra-running seems to be more  
92 pronounced as the distance of the ultramarathon increases. By identifying the enablers and  
93 barriers experienced by those currently actively participating in the sport, it may provide  
94 insight into reasons for gender differences in ultra-running participation. Therefore, this study  
95 aims to explore the enablers and barriers experienced by male and female ultra-runners. As  
96 the literature on enablers and barriers in male and female ultra-running participation is sparse,  
97 this study takes an exploratory approach and will include two Scottish ultramarathons. To put  
98 participation rates from those two races into context (e.g. distance and format), this study will  
99 also identify the proportion of females that have taken part across a range of Scottish ultra  
100 events over recent years. This is particularly beneficial as most research in ultra-running has

101 focussed on a range of international events, but to our knowledge, not any in Scotland.

## 102 **Materials and Methods**

### 103 *Study Design*

104 This mixed methods study consisted of an online questionnaire with quantitative and  
105 qualitative questions, followed by telephone semi-structured interviews in a sub-set of the  
106 participants who completed the online questionnaire. It also included an analysis of female  
107 participation rates across ultra-running events in Scotland held between 2010 to 2018.

### 108 *The Races*

109 Two not-for profit Scottish ultra-marathons, the Jedburgh 3 Peaks (J3P) ultra, 38 miles  
110 (61.2km), and the Highland Fling Race (HFR), 53 miles (85.3km) were included in this  
111 study. The HFR runs along the first 53 miles (Milngavie to Tyndrum) of the long-distance  
112 route the West Highland Way. The race is held in April each year and race entry is via a  
113 ballot. A minimum level of running experience is required before a runner can be considered  
114 in the ballot, thus applications for the ballot are checked for eligibility by the race organisers.  
115 In total approximately 1000 places are allocated. The terrain is a mixture of mostly trails and  
116 paths, and some roads. It has a total ascent of 2300m. Until 2017, this race also included a  
117 relay option (team of four runners).

118 The J3P is held in October each year and takes place in the Scottish Borders, starting  
119 and ending in Jedburgh and includes the Eildon Hills. Total ascent is just over 850m and is  
120 predominantly on trails and paths. This race does have a relay option (team of four runners).  
121 No minimum level of experience is required, and entry is on a 'first come first served basis'  
122 for the individual race, although a ballot is used for the relay team entries. Given our focus on  
123 enablers and barriers to ultra-running, the HFR was selected due to it being a well-known  
124 race in the Scottish ultra-marathon calendar which attracts both experienced and those new to

125 ultra-running but with relevant experience. The J3P was selected as it perhaps sees more  
126 novice ultra-runners and it is organised by some of the same race directors as those involved  
127 in the HFR.

### 128 *Participants*

129 Runners were invited to take part in the online questionnaire on completion of their online  
130 race sign-up. The eligibility criteria were runners aged 18 years or over. Both races attract  
131 some runners from outside the United Kingdom and international runners were also eligible  
132 to take part in the study. Ethical approval was obtained from the university School of Health  
133 and Life Sciences ethics committee and online informed consent was obtained from runners  
134 prior to starting the questionnaire.

### 135 *Procedure*

136 An online questionnaire was created using the platform QuestionPro. Questions were  
137 designed to obtain demographic data, followed by open and closed questions which explored  
138 enablers and barriers to ultra-running. Prior to the questionnaire going live, it was piloted  
139 with a number of male and female runners with a range of ultra-running experience, and  
140 based on feedback from them and the race directors of the J3P and HFR, the questionnaire  
141 was further refined. As entries to the J3P and HFR are open at different times of the year, the  
142 final questionnaire was first made available from 26/4/18 to 23/9/18 to the 337 runners  
143 signed-up to the J3P, where 40.9% were female (n=138), 58.2% were male (n=196), 0.6%  
144 were non-binary (n=2), and one person changed their gender status after sign-up from non-  
145 binary to male.

146 On completion of the questionnaire, respondents were asked if they were willing to  
147 take part in a one-to-one semi-structured phone interview to further explore themes generated  
148 from the questionnaire responses. The interview schedule included questions which allowed



149 investigation of potential enablers and barriers for engagement, such as reasons for sustained  
150 involvement and personal pathways into ultra-running, circumstances that allowed for  
151 participation at that moment, and barriers to participation that had been faced in the past or  
152 were anticipated in the future.

153         From the J3P questionnaire responses and interviews, the questionnaire was further  
154 refined for the HFR by e.g. changing some open questions to closed questions to aid  
155 questionnaire brevity. The modified HFR questionnaire was made available from 21/10/18 to  
156 31/12/18 to the 1022 runners successful in the HFR ballot, where 28.7% were female (n=293)  
157 and 71.3% were male (n=729). HFR responders who indicated that they had completed the  
158 J3P questionnaire previously were not required to repeat common questions to avoid  
159 duplication. The same semi-structured interview questions as those used in the J3P were used  
160 in the phone interviews for the HFR. All interviews were audio recorded and were carried out  
161 by the same researcher.

162         As interviews served to supplement the qualitative data gained from the  
163 questionnaires, sufficient interviews were conducted until there was a state of ‘code’ and  
164 ‘meaning’ saturation from the combined questionnaire and interview thematic analysis,  
165 thereby allowing for meaningful findings to be reported (Hennink et al., 2017).

166         In addition, the proportion of female starts from Scottish ultras up to 100 miles in  
167 distance or not exceeding 24hrs in duration from 2010 to 2018 were collected. These data are  
168 freely available online.

### 169 ***Data analysis***

170 Quantitative data analysis on closed questions from the online questionnaires was performed  
171 using Microsoft Excel and SPSS v.25 (IBM). Descriptive statistics were obtained for  
172 continuous and categorical variables. The distribution of continuous data was assessed using

173 the Shapiro-Wilk test and by visual inspection of the frequency and residuals plots.  
174 Independent t-tests were performed to identify between-gender differences for continuous  
175 variables. A Chi-squared test for association was used to evaluate between-gender differences  
176 for categorical variables. For all tests,  $\alpha = 0.05$ . For closed questions where participants could  
177 tick more than one answer, the frequency of responses of each answer per gender was  
178 calculated and presented as a percentage of the total number of males or females that could  
179 answer that particular question.

180 For the qualitative data, a form of codebook thematic analysis was employed (Braun  
181 and Clarke, 2019). Initially, two of the researchers independently familiarized themselves  
182 with the qualitative J3P questionnaire data by reading through all the responses in the Excel  
183 output from QuestionPro. They then employed an inductive coding process to code the  
184 qualitative questionnaire data before working together to produce a codebook. Specifically,  
185 both coders took the same 10 cases initially and independently identified codes and sub-  
186 themes. From there, the coders compared and discussed their coding and sub-themes,  
187 allowing the coding to be refined and agreed, thereby forming the codebook (Roberts et al.,  
188 2019). Then the primary coder used the codebook to code the remainder of all the J3P  
189 questionnaire responses. The coders then discussed how the sub-themes related to each other,  
190 and pooled themes were created. This process also improved the robustness of the coding as  
191 discussions involved challenging codes and clarifying their meaning. This offered the  
192 primary coder the opportunity to reflect and justify the inclusion and meaning of codes in the  
193 codebook, and it ensured that coding drift had not taken place.

194 A similar process was used for qualitative analysis of the HFR questionnaire  
195 responses. Both coders familiarized themselves with the data by reading through all the  
196 qualitative responses. The initial codes used were those that emerged from the J3P responses,  
197 and both coders independently coded responses from the same 20 HFR responses. These

198 were discussed, such that new codes and sub-themes were created where required and  
199 existing ones refined, thereby further developing the codebook. The remainder of all the  
200 questionnaire responses were evenly split between the coders and evaluated. Once completed,  
201 all the coded text was reviewed by the primary coder who raised discrepancies with the  
202 secondary coder. This further round of challenge and clarification gave both coders the  
203 opportunity to reflect and justify their use of the codebook. From there, sub-themes and  
204 themes that were developed after the J3P analysis were expanded to include those developed  
205 from the HFR questionnaire.

206           Audio from the qualitative interviews was transcribed verbatim. Names were  
207 removed from transcripts to ensure anonymity, and participants given a unique identifier  
208 number. Transcribed data were imported into NVivo 12 (Qualitative Solutions Research  
209 International) and evaluated by two researchers using a hybrid approach of inductive and  
210 deductive codebook thematic analysis (Fereday and Muir-Cochrane, 2006); they employed a  
211 comparison of the interview data to codes in the existing codebook, while remaining open to  
212 the possibility of generating new codes from the interview data, which might result in  
213 revision of the codes and ultimately the overarching themes of the study. The researchers  
214 then agreed that through the analysis of all of the qualitative questionnaire data and the  
215 interview data, a state of ‘code and meaning saturation’ had been reached, or ‘the point when  
216 no additional issues are identified and the codebook begins to stabilise’ (Hennink et al., 2017,  
217 p.594) and where there was a rich understanding of the meaning of the data. This allowed for  
218 the researchers to then agree on the overarching findings and themes of the study with regard  
219 to the research questions.

220           Lastly, the proportion of female runners across all Scottish ultra events up to 100miles  
221 or up to 24hrs in duration was calculated from the total finishers of the respective race and

222 year, and these data were presented graphically using R. Events were categorised by distance  
223 or time depending on the format of the race.

## 224 **Results**

225 In total, 640 questionnaire responses were received across the two races, which  
226 provided a wealth of qualitative data. Questionnaire response rates for the J3P and HFR were  
227 38.0% (n=128) and 50.1% (n=512) respectively. Of those responders, 69 (53.9%) in the J3P  
228 and 151 (29.5%) in the HFR were female. A total of 13 interviews (7 female) were conducted  
229 to supplement and expand on the primary qualitative data that was collected through the  
230 questionnaires.

### 231 *Participant Characteristics*

232 Findings from the quantitative analysis on participant demographics are shown in  
233 Table 1.

234 Males were significantly older than females in both races but this only reached  
235 significance in the HRF (mean  $\pm$  standard deviation; male HFR:  $44.9 \pm 9.3$ , female HRF  $42.7$   
236  $\pm 8.3$ ,  $p=0.012$ ; male J3P:  $44.2 \pm 9.1$ , female J3P  $41.2 \pm 9.4$ ,  $p=0.158$ ). There was no  
237 significant difference in running experience or time since first ultra between males and  
238 females for the HFR, however there was evidence to suggest more females in the J3P had  
239 fewer years running experience compared to males ( $p=0.045$ ) and less time since their first  
240 ultra ( $p=0.003$ ). A significant difference for relationship status by gender was found for  
241 responders from the HFR ( $p=0.002$ ). Specifically, there were fewer single male responders  
242 than female responders (9.4% vs 19.5%). Although this was not statistically significant for  
243 the J3P, a similar trend existed. Both races found significant differences in dependents status  
244 by gender (HFR  $p=0.012$ , J3P  $p=0.011$ ); from the J3P responses, 60.3% of males had  
245 dependents, whereas this was almost half of that in females (37.7%). From the HFR, these

246 values were 62.3% and 50.3% respectively. There were no significant differences between  
247 males and females for either race in whether the race entered was their first ultra event or  
248 whether they would consider a harder ultra event in the future.

249 [Enter Table 1 about here]

250 Categorical responses from the questionnaires on the reasons for ultra-running  
251 participation split by males and females, are depicted for the J3P and HFR in Figures 1 and 2  
252 respectively. ‘Wanting a challenge’ was overall the most common reason for taking part in an  
253 ultra event, although females for whom the HFR event was their first ultra event most  
254 commonly reported taking part because ‘my friends are doing it’. Scenery, race atmosphere  
255 and friendliness were similarly reported for males and females across both races as reasons  
256 for signing up to those races specifically.

257 [Enter Figures 1 and 2 about here]

## 258 *Thematic analysis*

259 From the qualitative questionnaire responses and interviews, three themes and their  
260 associated sub-themes were identified, and these are described in more detail below. The  
261 themes and subthemes are also summarised in Figure 3 and example responses of male and  
262 female responses for each theme are given in Table 2.

263 [Enter Figure 3 and Table 2 about here]

### 264 1. Internal context

265 The sub-themes identified under ‘Internal Context’ were age, injury, and time management.  
266 Some responders considered taking part in more challenging ultras as a positive influence on  
267 age:

268 *‘attempt to stave off getting older’* (male, 59, HFR, questionnaire)

269 However, age was more often considered a limiting factor:

270 *'It's always a bit of a struggle; as I've got older, I'm aware it seems to take more work*  
271 *to stay at the same level'* (male, 50, HFR, questionnaire)

272 *'Not getting any younger. It's a pity this sort of sport wasn't available when I was*  
273 *younger. Only professional athletes did this sport when I was growing up. Now*  
274 *anyone is welcome and it's about personal best'* (female, 51, HFR, questionnaire)

275 *'worried about picking up injuries because of my age'* (male, 49, HFR, questionnaire)

276 Injury was frequently reported by both male and female questionnaire responders as a barrier  
277 to ultra-running, both to training and taking part in events. Qualitative responses around  
278 injury included those related to injury prevention and also strategies on how to deal with  
279 injuries when they occurred. Both males and females in this study reported that they used a  
280 similar range of pro-active approaches to reduce their risk of injury, which primarily included  
281 incorporating additional strength and conditioning as part of their training programme, yoga,  
282 and seeing a physiotherapist.

283 A lack of time to dedicate to training was very often reported both by male and female  
284 participants. This lack of time was primarily due to family and work commitments:

285 *'Balancing work, personal life, seeing family and my husband and training is*  
286 *challenging - it takes a lot of compromise'* (female, 35, HFR, questionnaire)

287 *'The single biggest challenge is time. Committing to running 50 training miles a week*  
288 *and yoga and weight training and a demanding job and a partner is a logistical,*  
289 *emotional nightmare'* (male, 40, HFR, questionnaire)

290 *'I would say that the time commitment is one of the most difficult things, because*  
291 *realistically, if, well I like to go to an event overprepared, so realistically you're out*  
292 *on the hills for hours at the weekend, both the Saturday and the Sunday. I'm also I'd*

293 *say middle of the pack pace, so, as a lot of my friends are quite a bit quicker, their*  
294 *runs will take maybe 4 hours, mine will take me six and a half. So it's just the actual*  
295 *logistics of fitting all that in and then kind of time for family and friends as well.'*

296 (female, 26, J3P, interview)

297 *'trying to fit a full time job and getting the training that you require, family*  
298 *commitments, particularly I've got an elderly parent who's in a nursing home so*  
299 *visiting her and getting any sort of running in the evening is pretty hard, so finding*  
300 *the time round about other commitments really.'* (male, 52, J3P, interview)

301 Negotiating time to train around other demands appeared key and this was evident from both  
302 male and female responses in this study:

303 *'I work shifts...I've got two kids age 8 and 5 and my wife is a nurse as well so it is*  
304 *really tricky actually to try and fit in the training...at the start of the month I'll just*  
305 *look at what I've got on, what shifts I'm doing, what kids commitments we've got you*  
306 *know for after school club...try and figure out when I'm going to fit in a long run,*  
307 *when I'm going to fit in a couple of short runs and really just try and accommodate*  
308 *everything'* (male, 38, HFR, interview)

309 *'Structured training programme overlaid onto work and personal commitments*  
310 *leading up to the race to anticipate when busy and less busy weeks will be.*  
311 *Compromise and support from friends and family'* (male, 31, HFR, questionnaire)

312 *'I guess it's harder to find time to train sometimes and you sort of have to work*  
313 *around kids and childminders sometimes, so either going earlier or later, or going*  
314 *when you drop them off at football training, go for a run, these sort of things'* (female,  
315 38, J3P, interview)

316           ‘Getting up early and using my lunch times wisely to get my training in’ (female, 35,  
317           HFR, questionnaire)

318   One other facet in relation to time negotiation that was identified in the present study was  
319   whole family involvement in running and training, thus essentially combining caring  
320   responsibilities and training:

321           ‘[the kids] quite often come to races and they know that’s what we do, or we go to  
322           parkrun together and do 5k together and then I go off and do my long run...’ (female,  
323           36, J3P, interview)

324           ‘Have easier weeks every now and then, buggy run, run with my wife alongside me on  
325           a bike’ (male, 30, HFR, questionnaire)

326   In families where both parents were long-distance runners, a tag-team approach was also  
327   occasionally reported as a way to factor in running time for both parents.

328           ‘we trade off on the weekends, sometimes he’ll go out for his long run and then I’ll go  
329           out the next day. So yeah we just kind of work it out between us’ (female, 36, J3P,  
330           interview)

331   Although lack of time was similarly reported as a frequent barrier to training by males and  
332   females, and effective time management, negotiation and compromise reported as ways to  
333   overcome that, differences between genders in the process of negotiation, or when it is  
334   deployed, was observed. For example, some females had reported delaying taking up running  
335   in order to prioritise family whilst their children were young, whereas this was not identified  
336   from any of the male responses:

337           ‘...when [the kids] were more independent and that meant I could have more time on  
338           my hands so I could go out on Sunday, for example, leave the house for a run. When  
339           they were younger I wouldn’t have done that...[my husband] does a lot more



340 *[running] than me, but yeah, he sort of has done consistently you know whereas I*  
341 *have fitted it in around what I thought the children needed'* (female, 51, J3P,  
342 interview)

343 2. External context

344 The sub-themes identified under the External Context theme were Nature, Environmental  
345 conditions, Ultra-running community and race environment, and Family/friends. Winter  
346 training in wet and cold conditions were reported as a challenge to training for an ultra-  
347 running event:

348 *'I don't anticipate any challenges [to training], other than rotten weather!'* (female,  
349 47, HFR, questionnaire)

350 *'having to train when I'm getting tired and the weather's cold/wet'* (female, no age  
351 provided, HFR, questionnaire)

352 *'Making sure I get the long miles in, particularly when we get winter weather.'* (male,  
353 50, HFR, questionnaire)

354 *'[my husband] is very understanding and as long as I plan [my training] in advance.*  
355 *This means going out in all weathers.'* (female, 49, HFR, questionnaire)

356 Overall however, nature, the landscape, and being outdoors were rated highly by both males  
357 and females, and contributed to a sense of enjoyment in ultra-running:

358 *'...you're going to be out there for a day out, a day out on the trails, a day out in the*  
359 *hills, and you know just, with the elements and the landscape...'* (male, 47, HFR,  
360 interview)

361 *'Glenogle up in Killin is one of my favourites purely for the scenery... So yeah, the*  
362 *scenery is quite a big draw.'* (female, 44, HFR, interview)

363 *'I love being in the mountains and experience nature while running.'* (female, 24,  
364 HFR, questionnaire)

365 Friends and the ultra-running community were frequent enablers to the sport and this was  
366 identified commonly in both male and female responders:

367 *'...as I've got into the ultra-running community and made more friends... nice*  
368 *chance to catch up with people as well before races and after races that maybe you*  
369 *only see a handful of times a year but in a weird way you can sometimes feel more*  
370 *close to than people you've known for 10-15 years, just because that experience that*  
371 *you have out there in an ultra, it's so indescribable to somebody who doesn't do*  
372 *something like that, it kind of brings you together when you can share that*  
373 *experience'* (female, 39, J3P, interview).

374 *'There is a wonderful feeling of camaraderie and friendship and people are very*  
375 *supportive if you ever have any problems, people aren't going to walk past you and*  
376 *leave you by the wayside, not that I've ever had any, I mean, you certainly wouldn't*  
377 *continue on if you saw someone in difficulty, you'd stop until they got help or*  
378 *whatever.'* (female, 69, J3P, interview)

379 *'There's a very supportive community, things like you know, if you're running a*  
380 *marathon people start and run and nobody speaks to you but if you're doing at an*  
381 *ultra, nobody would think worse of anyone for speaking to them and checking if*  
382 *they're alright, having a joke with them or something, it's much more of an inclusive*  
383 *supportive atmosphere round about it'* (male, 52, J3P, interview)

384 In other cases, families acted as enablers to start distance running, or husband /wives were  
385 also training partners:

386           ‘...started running in my late 30s...really because my kids were getting involved, my  
387           eldest son....he was 11 at the time and he wanted to join in with some of his pals who  
388           were going to the local running club.... my wife went along with him and it very  
389           quickly developed into a family activity so that’s where I got involved properly you  
390           know I suppose I’d tried on and off before but nothing too serious....then kind of got  
391           interested in longer distances than was happening through the running club... myself  
392           and my wife we run a lot together now and with friends you know she’s running ultras  
393           now too and we are signing up with the same events and training together so that’s  
394           good.’ (male, 47, HFR, interview).

395   There were no comments in the questionnaires that suggested any responders had personally  
396   experienced any gender bias in ultra-running. However, three female interviewees had  
397   initially perceived, or indeed experienced, ultra-running as a ‘masculine’ environment:

398           ‘This might more be an experience I had from a specific race that I went to, and the  
399           company that organised it, but it felt very male, maybe not male dominant, maybe  
400           masculine would be a better word to describe it. I’ve seen other ultras where there’s  
401           lots more women, it’s a lot more inclusive, however I think the one I managed to pick  
402           was just kind of yeah a bit more kind of masculine, and there seems to be people there  
403           who are doing it for a badge of honour not just to enjoy it....’ (female, 26, J3P,  
404           interview)

405           ‘In the ultra I would say that the average person who enters is probably going to be  
406           male and younger than me certainly a lot quicker than me so I don’t know how many  
407           51 year old mums would, I don’t expect to see them lining up on the ultra start line’  
408           (female, 51, J3P, interview)

409 *'there's all the gender roles you know generally women raise the kids have less time*  
410 *to train but for me it would be really great if there was something for the big ultras in*  
411 *particular or maybe more the famous ultrarunners could do to really encourage and*  
412 *bring more female runners in the sport in some ways.'* (female, 36, J3P, interview)

### 413 3. Internal dialogue and intrinsic motivation

414 Under the theme Internal Dialogue and Intrinsic Motivation, the following sub-themes were  
415 identified: Challenge, Know what I'm capable of, Self-belief, Enjoyment, Sense of adventure,  
416 and Sense of achievement. 'I want(ed) a challenge' was a very common response for reasons  
417 to take part in ultra events for both males and females. However, lack of confidence in their  
418 ability to complete the race they had signed up for was also reported by both males and  
419 females:

420 *'[being at the start line] will be quite daunting, I have to get round that. I find that*  
421 *mentally quite challenging, that's the impostor syndrome thing that comes out'*  
422 (female, 51, J3P, interview)

423 *'Ultra's are a bit beyond me. I don't know why I've entered this one!'* (male, 59, HFR,  
424 questionnaire)

425 There were no gendered reports in relation to confidence, however a female respondent did  
426 touch on how women may be less confident taking part in an ultra-running event:

427 *'Something that I notice a lot as an ultrarunner that is female, is that a lot of races*  
428 *are very male oriented. In fact it's not unusual to have sort of less than 30% of the*  
429 *field be women and I think the tougher the races are, the less women you see as well*  
430 *and I think part of that is it's a bit of a natural thing that I definitely felt myself which*  
431 *is that as women we are a little bit more cautious and I think we kind of think we*

432 *almost need to have done something before we are ready to do it, so I think a lot of us*  
433 *think I couldn't do this so I'm not willing to try.'* (female, 39, J3P, interview).

434 Enjoyment and a sense of achievement from taking part in ultras were very common amongst  
435 both males and females. The experience of enjoyment and sense of adventure was frequently  
436 linked to the outdoor environment, and sense of achievement appeared closely related to the  
437 concept of challenge.

#### 438 ***2010-2018 Scottish Ultra Events***

439 Female participation rates in the 193 Scottish ultra-running events from 2010-2018  
440 are presented by time in Figure 4 and by race distance in Figure 5.

441 [Enter Figure 4 and 5 about here]

#### 442 **Discussion**

443 This study explored barriers and enablers to ultra-running experienced by males and  
444 females from two Scottish ultra-running events (the HFR and J3P), and evaluated female  
445 participation rates across a range of Scottish ultra-running events since 2000. We found  
446 female participation made up around one third of the HFR entrants although this was higher  
447 for the J3P at approximately 50% female. This is in-keeping with what is anecdotally  
448 reported, as the HFR is the longer and arguably more challenging race of the two events (53  
449 vs 38 miles). This percentage of female participation however is higher than those reported in  
450 previous studies in ultra-runners (e.g. da Fonseca-Engelhardt et al., 2013; Hoffman et al.,  
451 2010), although those studies were on races of greater distances which are anecdotally  
452 thought to have lower female participation rates. This is in agreement with the trend of  
453 female participation rates in the 193 Scottish ultra-running events from 2010-2018 presented  
454 here, where although the proportion of female runners showed an increasing trend with time,  
455 female participation was generally lower in races of greater distances. Of those 193 Scottish

456 ultra events, the proportion of female participants was greater than male participants in only 4  
457 events (2%), and interestingly all of those 4 events were 12-hour events (The Glenmore 12 in  
458 2011, 2014 and 2018, and the 12 hrs Edinburgh 2018). It is not clear why the only category  
459 with greater female participation was the 12-hr race format. This is also in contrast to Sehovic  
460 et al (2013) which in an analysis of 12-hr ultra-marathons across the world showed that  
461 female participation was fairly constant at 16-22% for each decade from 1981 to 2010.  
462 Perhaps these differences are due to geographical location (Scotland-specific rather than  
463 world-wide), and the difference in years included (pre- 2010 or post-2010). The reasons for  
464 the stark contrast in female participation rates in the 12-hr format compared to the distance  
465 format would warrant further evaluation.

466         Mean age across the HFR and J3P races for both genders spanned 41.8 to 44.9 years,  
467 which is similar to other studies on ultra-runners (Hoffman and Fogard, 2012; Hoffman and  
468 Krishnan, 2014, 2013; Hoffman and Krouse, 2018; Hoffman and Wegelin, 2009).  
469 Furthermore, males were older than females in both races and although this was only  
470 statistically significant for the HFR, this trend is similar to findings from other research on  
471 ultra-runner demographics (Hoffman and Wegelin, 2009). From the questionnaire responses,  
472 increasing age could function as either an enabler or a barrier to taking part in ultra-running  
473 and this did not appear to be influenced by gender. Some responses related to engaging in  
474 ultra-running to avoid changes associated with ageing, whereas others became more cautious  
475 in training due to their age, in particular in relation to picking up injuries. Running injuries  
476 are extremely common across runners training for any distance, with lower limb injury rates  
477 ranging from 19.4% to 79.3% (van Gent et al., 2007), yet the vast majority of runners  
478 continue to run despite their injury (Linton and Valentin, 2018). Therefore, it was not  
479 surprising that both males and females frequently reported injury as a barrier to training and  
480 taking part in ultra-running events. Moreover, there did not appear to be a difference between

481 genders in how they dealt with injury as a barrier to ultra-running, with both genders  
482 reporting a pro-active approach to managing and preventing injury including strength and  
483 conditioning, yoga, and seeing a physiotherapist.

484 Hoffman and Krouse (2018) previously reported on ultra-runner characteristics such  
485 as marital status and number of children, however these data were not separated by gender  
486 and the study was conducted with ultra-runners in North America. In the present Scotland-  
487 based study, the proportion of males with dependents was similar for the two races (around  
488 60%), whereas for females this was lower at 50% for the HFR and even lower for the J3P  
489 race at 38%. A similar trend has also been found in half-marathon and marathon runners  
490 taking part in an event in the Southeastern United States in 2012, with 48.4% of males living  
491 with a partner and children, whereas this figure was lower at 35.5% for females (Wegner et  
492 al., 2015). In that study, the majority of women were single without children (38.0%),  
493 whereas that category was lower for males at 26.4%. This suggests that similar trends exist in  
494 the difference in proportion of males and females with dependents across endurance events of  
495 a range of distances (half-marathon, marathon and ultra), although this is based on a small  
496 sample of races thus this would warrant further assessment across a greater range of events.

497 Previous work has observed that conflicts between family time and time to train is  
498 common in long-distance runners (Goodsell and Harris, 2011). In the present study, effective  
499 time management seemed imperative to plan training sessions in and around work and family  
500 commitments, suggesting evidence of negotiation-efficacy. Higher levels of motivation to  
501 engage in an activity has positive effects on negotiation and finding strategies to overcome  
502 barriers, whilst reducing the perception of constraints experienced (White, 2008). However,  
503 an inherent reduced sense of entitlement to leisure is thought to exist in females with caring  
504 responsibilities due to traditional family roles, thereby leading to constraints in leisure time  
505 (Maume, 2008). This may be an insight into why previously fewer females took part in ultra-

506 running, particularly at the greater distances as these events take even greater amounts of  
507 time to train. Roles and responsibilities of males and females in the family have seen  
508 considerable changes in the last several decades, with men and women increasingly  
509 contributing equally to caring for children as more women are in employment (Goldscheider  
510 et al., 2015). Hamilton and White (2010) have argued that when domestic duties are shared  
511 between partners, overall physical activity participation is increased and enhanced,  
512 particularly for women; yet women still struggle to negotiate leisure and sport access in an  
513 environment where discourses of ‘good motherhood’ continue to denote women as the  
514 primary caregivers. This became apparent in the present study, where even though both males  
515 and females expressed negotiation efficacy to find time to train, some females still reported  
516 having delayed training due to caring responsibilities for young children. Although this was  
517 not directly expressed, social expectations are often internalized and it may be that females  
518 are less confident to negotiate time that is required for training. This lack of confidence  
519 presents as a complex mix of internal interpersonal, intrapersonal and structural constraints,  
520 and this warrants further in-depth investigation within a constraints model.

521         Although a study on half-marathon runners rather than ultra-marathon runners, Nilson  
522 and colleagues (2019) showed females made up 52% of runners in the 21-30 age bracket of  
523 the Gothenburg half-marathon in 2017, but that this percentage steadily decreased across the  
524 age categories, with only 25% of runners in the 51-60 age category being female. It may be  
525 that lower female participation with increasing age is a ‘hangover’ from more traditional  
526 family roles seen previously. With the rise of egalitarianism in family roles amongst males  
527 and females (Knight and Brinton, 2017), the gender imbalance in participation in endurance  
528 events may well self-regulate with time.

529         This study also identified several instances where negotiation efficacy in ultra-running  
530 training was framed as a family focussed event, e.g. something done with the family or with a



531 partner, which is a key finding here and deserves further exploration in future work. At  
532 present the majority of studies have focussed more on how mothers negotiate their own  
533 ‘athlete identities’ and access to their sport, rather than how family units negotiate this  
534 collectively (McGannon et al., 2018). This is similar to Goodell and Harris (2011), who  
535 found that cooperation strategies were often used where one or both partners were marathon  
536 runners. In the present study, no data was collected on whether respondents had a partner  
537 who was also a long-distance runner, therefore how negotiation-efficacy and cooperation  
538 perhaps differed when both parents were ultra-runners would warrant further evaluation.

539           Although respondents often doubted their own abilities or whether this ‘extreme’ race  
540 environment was *‘for them’*, they nevertheless found it to be a welcoming, supportive space.  
541 There were many similarities in what brought people to and kept them in ultra-running; the  
542 friendliness and comradery of the sport was overwhelmingly voiced by both males and  
543 females. This was similar to a study by Kazimierczak and colleagues (2019), who identified  
544 social interactions with other runners and the friendships that develop as a strong motive to  
545 take part in ultra-running. Furthermore, that study highlighted how those social interactions  
546 created a sense of belonging, which was thought important for the process of developing and  
547 maintaining a social identity as an ultra-runner. A stronger sense of social identify is thought  
548 to be linked with increased motivation to engage in sport (Stevens et al., 2017). Whether  
549 social identity of ultra-runners differed between males and females was not evaluated by  
550 Kazimierczak and colleagues (2019). Although a marathon event, a reduced sense of ‘runner  
551 identity’ was observed in females compared to male entrants to a marathon in South-East  
552 China where females made up 30% of runners to that race (Qiu et al., 2020). Thus, further  
553 work should explore ultra-runner identity and whether this differs between males and  
554 females.

555           This study identified and compared the enablers and barriers to ultra-running in males  
556 and females which has been relatively unexplored. Therefore, this study provides new  
557 insights into participation by gender in ultra-running. However, the following study  
558 limitations should be considered. This study was exploratory and only included qualitative  
559 data from runners entered in two ultra-running events in Scotland, therefore future work  
560 should identify whether similar findings exist in other countries and cultures. In this study,  
561 the number of interviews made up a relatively small proportion of those which engaged with  
562 the questionnaires; although the authors are satisfied saturation was reached and the  
563 interviews served to supplement the richness of information that was gained from the  
564 questionnaires, future studies exploring a diverse range of events (e.g. levels of navigation or  
565 challenging terrain and environmental conditions, or perhaps corporate events rather than run  
566 club or not-for-profit events) might benefit from incorporating a wider range of responses  
567 using an interview or focus group format. Lastly, in this study, long-distance runners who had  
568 already taken part in an ultra-running event or who had signed up for their first ultra-running  
569 event were included, therefore barriers and motivations discussed here are from those already  
570 engaged with the sport. Further research could identify whether endurance runners currently  
571 not engaged in the ultra-running sport express the same barriers and motivations for ultra-  
572 running, and how this may be experienced differently between males and females.

573           Nuanced differences in negotiation-efficacy is likely a key reason for divergent  
574 participation rates between males and females in the ultra-running sport. Future work should  
575 explore this in greater depth by evaluating negotiation-efficiency within a constraints model  
576 in both male and female ultra-runners across a larger number of races and geographical  
577 locations. In particular, the role of the family/partners as an enabler into the sport should be  
578 evaluated going forwards. Furthermore, due to the decrease in female participation in ultra-

579 running with increasing event distance, future work should also identify how negotiation-  
580 efficacy is influenced across the types of ultra-running events.

## 581 ***Conclusion***

582         The findings from this study suggest that barriers and enablers to ultra-running are  
583 largely similar for males and females. The ultra-running community appears to be inclusive  
584 and no overt male-bias was identified; only a very small number of female participants  
585 mentioned they perceived the environment to be somewhat masculine and that they would  
586 like to see more women in the sport. However, finding the time to train was the most  
587 common barrier experienced by both males and females and the strategies participants  
588 employed to deal with this were varied, but were not strictly demarcated by gender. Both  
589 male and female participants noted that negotiating time for running with family and work  
590 commitments required considerable planning and prioritising, and that sometimes this  
591 process of negotiation efficacy was a family or team effort. Yet, from the participants in this  
592 study, more males had dependents compared to the female participants yet female  
593 participation was lower, suggesting more nuanced differences in negotiation-efficacy may be  
594 present. Despite gradual shifts towards egalitarian family roles in society, more restrictive  
595 traditional gender roles persist, and these may still influence the negotiating-efficacy of  
596 female ultra-runners more than males, thereby potentially reducing availability of female  
597 training time. However, as female participation in Scottish ultra-races appears to be  
598 increasing with time, the historical influence of traditional gender roles which could have  
599 limited female participation previously, may be diminishing.

600

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606 None of the authors have any conflicts of interest to declare.

607

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725 **Table 1:** Participant demographics of the Jedburgh 3 Peaks and Highland Fling race, split by gender

Variable	Jedburgh 3 Peaks			Highland Fling		
	Males	Females	p-value	Males	Females	p-value
Age (years), mean (SD)	44.19 (9.14)	41.82 (9.42)	0.158	44.90 (9.30)	42.67 (8.27)	<b>0.012</b>
Years running experience, n (%)			<b>0.045</b>			0.415
<5 years	14 (24.1)	18 (26.9)		78 (22.7)	27 (17.4)	
5-9 years	15 (25.9)	25 (37.3)		98 (28.5)	48 (31.0)	
10-14 years	9 (15.5)	15 (22.4)		68 (19.8)	27 (17.4)	
15+ years	20 (34.5)	9 (13.4)		100 (29.1)	53 (34.2)	
Years since first ultra, n (%)			<b>0.003</b>			0.130
<3 years	17 (39.5)	39 (69.6)		77 (28.8)	40 (35.1)	
3-5 years	15 (34.9)	14 (25.0)		102 (38.2)	48 (42.1)	
5+ years	11 (25.6)	3 (5.4)		88 (33.0)	26 (22.8)	
Relationship status, n (%)			0.342			<b>0.002</b>
Single	6 (10.5)	11 (16.4)		32 (9.4)	30 (19.5)	
Relationship	51 (89.5)	56 (83.6)		309 (90.6)	124 (80.5)	
Dependents status, n (%)			<b>0.011</b>			<b>0.012</b>
None	23 (39.7)	43 (62.3)		131 (37.8)	78 (49.7)	
Yes	35 (60.3)	26 (37.7)		216 (62.3)	79 (50.3)	
This race first ultra, n (%)			0.834			0.766
Yes	8 (14.5)	9 (13.2)		26 (7.8)	10 (7.0)	
No	47 (85.5)	59 (86.8)		306 (92.2)	132 (93.0)	
Consider harder ultra, n (%)			0.707			0.238
Yes	39 (72.3)	47 (71.2)		208 (68.9)	81 (60.9)	
No	5 (9.3)	9 (13.6)		36 (11.9)	22 (16.5)	
Don't know	10 (18.5)	10 (15.2)		58 (19.2)	30 (22.6)	

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728 **Table 2:** Themes, sub-themes, and example quotations from the questionnaires / interviews split by males and females. Example quotations include those  
 729 from the Jedburgh 3 Peaks and Highland Fling race.

Theme	Sub-themes	Female example quotations	Male example quotations
Internal context	Injury	'remaining injury free'	'getting stronger/faster while staying injury free'
	Time management	'Trying to find the time to train for them when I run my own business and have a small child to take care of as a single parent'	'Fitting enough training miles in around four children and a busy job'
	Age	'I still did it - even at my age!'	'I am not getting any younger so want to try it before age potentially makes it more difficult'
External context	Nature	'it's a day outside in beautiful scenery'	'a day out on the trails, a day out in the hills,...just enjoying being outside, yeah, away from everything else'
	Environmental conditions	'having to train when I'm getting tired and the weather's cold/wet'	'Running in the dark late at night and in all weathers.'
	Ultra-running community and race environment	'It's very sociable and everybody chats ... I did like that, the contact you get from people round about you [during a race]'	'very supportive community, ...nobody would think worse of anyone for speaking to them [during a race]... having a joke with them or something, it's much more of an inclusive supportive atmosphere round about it'
	Family and friends	'having supportive husband and family'	'A very patient and supportive wife'
Internal dialogue and Intrinsic motivations	Challenge	'I quite like the challenge of seeing how close I can get to a course record'	'it's all about the challenge'
	Know what I'm capable of	'Now I want to see how far I can go'	'to find out what I'm capable of both mentally and physically'
	Self-belief	'I still have that fear but I suppose I have done more races where I have managed to do what I thought I couldn't do so my confidence has improved a bit.'	'Ultra's are a bit beyond me. I don't know why I've entered this one!'
	Enjoyment	'I get a lot of enjoyment out of them'	'Sheer enjoyment'

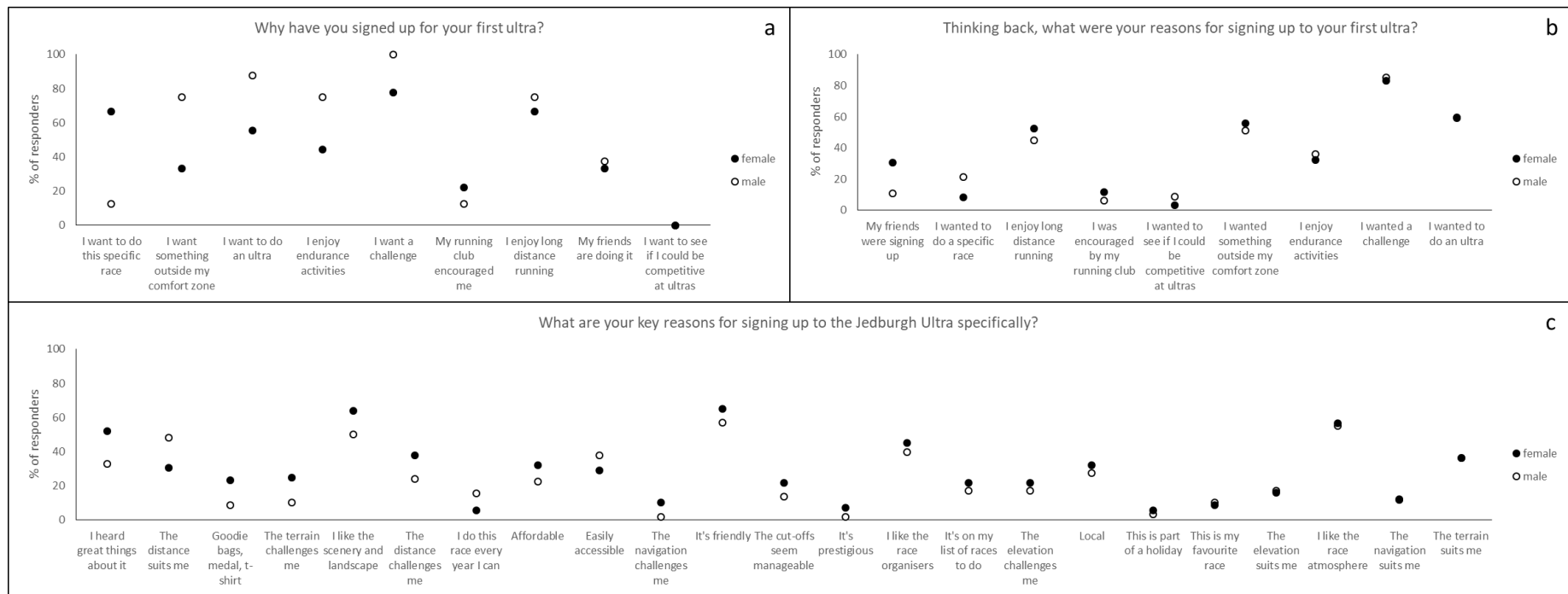
	Sense of adventure	'I get to see parts of the countryside I wouldn't normally see which gives me a great sense of adventure.'	'...the adventure in running. New routes every day. Never the same route twice'
	Sense of achievement	'the sense of achievement is huge!'	'the feeling of achievement after completing a race'

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733 Figure 1. Percentage of male and female responders per answer option from the Jedburgh 3 Peaks 2018 questionnaire for (a) reasons for signing  
 734 up to their first ultra – this race is their first ultra (female n=9, male=8), (b) reasons for previously signing up to an ultra – any ultrarace  
 735 excluding Jedburgh Ultra 2018 (female n=59, male n=47), (c) reasons for signing up to the Jedburgh Ultra race specifically (female n=69, male  
 736 n=58)

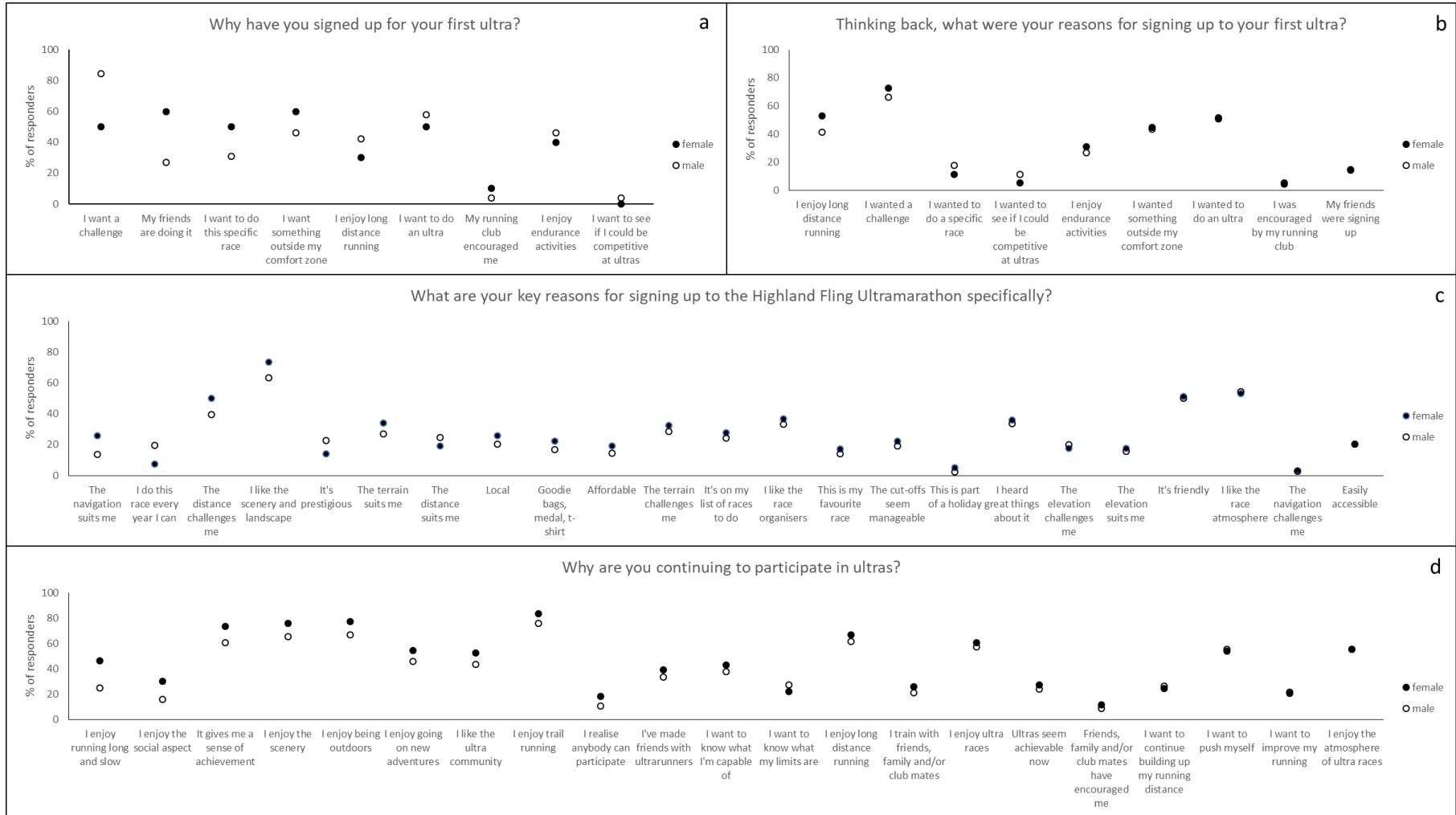


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740 Figure 2. Percentage of male and female responders per answer option from the Highland Fling 2019 questionnaire for (a) reasons for signing up  
741 to their first ultra – this race is their first ultra (female n=10, male=26), (b) reasons for previously signing up to an ultra – any ultrarace excluding  
742 Highland Fling 2019 (female n=136, male n=306), (c) reasons for signing up to the Highland Fling race specifically (female n=158, male  
743 n=342), and (d) reasons for continuing to participate in ultras (female n=136, male n=306). Note, responders could tick multiple answer options  
744 per question



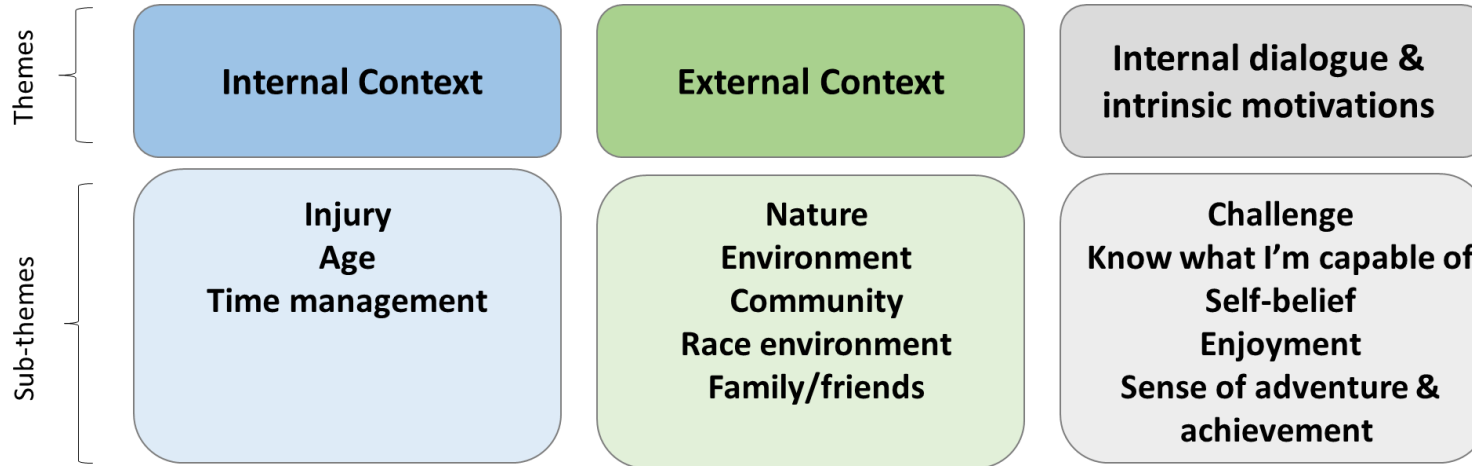
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749 Figure 3. Themes and sub-themes



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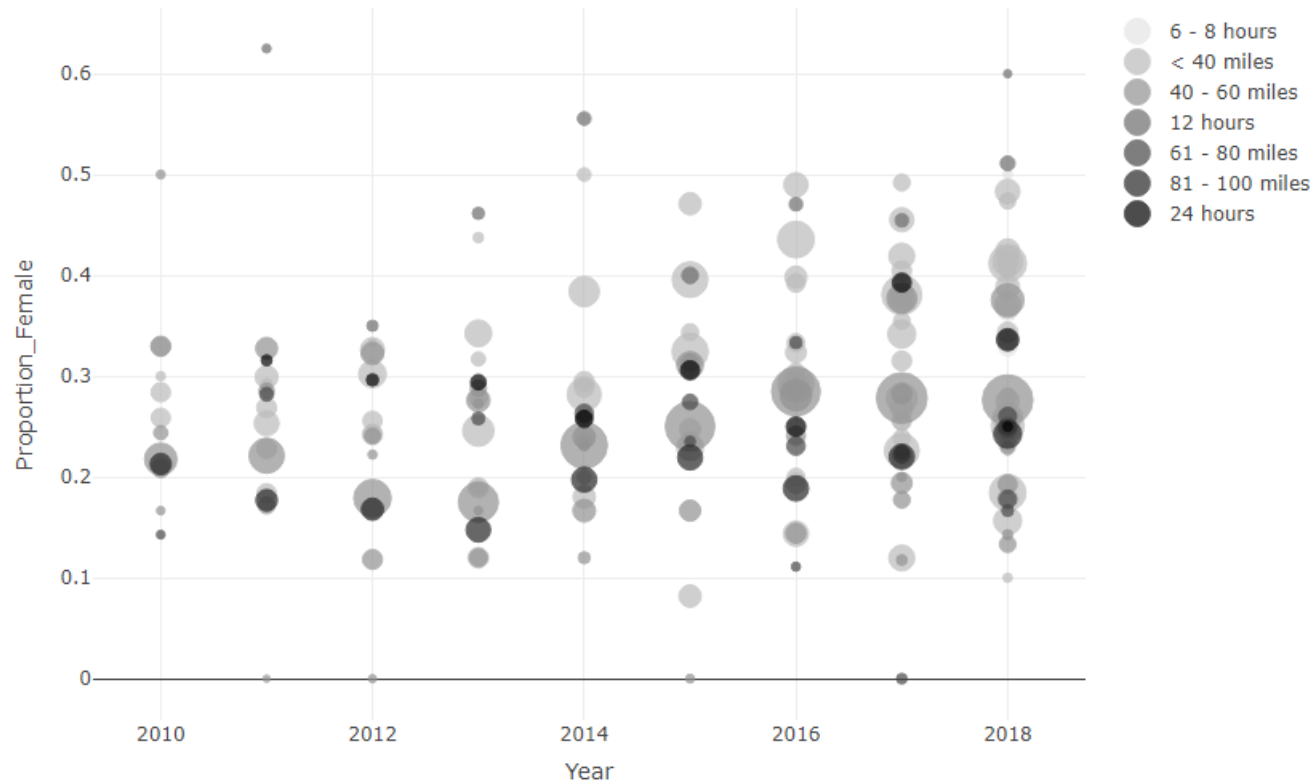
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761 Figure 4. Proportion of female runners from finishers of 45 Scottish ultras of different distances from 2010 – 2018 (n=193 events). The greater  
762 the number of runners in a race, the greater the size of the bubble.



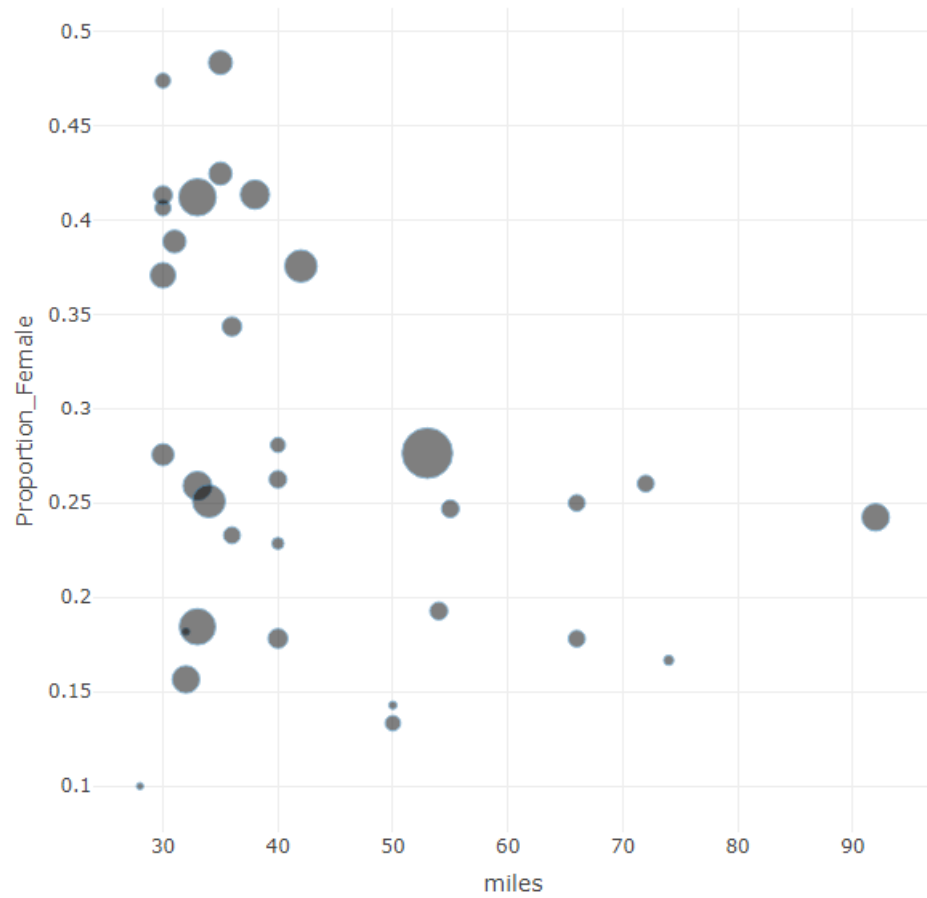
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766 Figure 5. Proportion of female runners from finishers of 40 ultra-running events in Scotland in 2018 by distance (time-format events not  
767 included). The greater the number of runners in a race, the greater the size of the bubble.



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