1 Associated socio-demographic and facility patterning of non-take-up, attendance and session count
2 within a Scottish exercise referral scheme.

3

4 **Abstract**

5 **Background:** Exercise referral schemes (ERS) aim to tackle non-communicable disease via increasing

6 levels of physical activity. Health benefits are reliant on uptake and attending sessions. Hence, it is

7 important to understand any variations in these parameters in order to target interventions to

8 improve uptake and attendance to those who need it most.

9 **Method:** Secondary analysis of one ERS database was conducted to 1) profile participants' non-

10 uptake of exercise referral; 2) describe any differences between non-attenders and attenders; and

11 3) report session count of attenders, exploring any relationship between attender demographics and

12 session count.

13 **Results:** The study shows, 1) sociodemographic profile of non-attenders is very similar to those who

14 attend; 2) there is a high, early withdrawal rate of attenders where 68% exit the scheme at five

15 exercise sessions or less and; 3) participant demographic characteristics do not influence session

16 count.

17 **Conclusions:** Knowledge of sub-populations non-uptake of their referral to ERS, and when people

18 stop attending sessions, provides critical information in understanding whom may be at risk of not

19 benefitting from exercise referral.

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21

22 **Introduction**

23 Exercise Referral Schemes (ERS) are a popular primary care-based physical activity (PA) intervention

24 aimed at tackling non-communicable disease (NCD) (1). However, ERSs are under scrutiny for overall

25 effectiveness (1, 2), due to a lack of evidence upon improvements in PA, or reduction in incidences

26 of NCD (3). Importantly, such outcomes are directly reliant upon individual uptake of ERS referral,

27 attending the designated number of prescribed sessions, and adhering to the prescribed exercises

28 within the programme (4).

29 Previous research has focused upon participants starting ERS (5, 6). Reviews by Gidlow et *al.* (7) and

30 Pavey et *al.* (4) cited uptake in primary studies ranging between 23-60% and 28-100% respectively.

31 However, very little focus has been placed upon explicitly detailing the subgroup who do not uptake

32 their referral. Failing to identify subgroups non-uptake of referral reflects a crucial gap of reporting

33 within ERS (8). Furthermore, it is widely established that dropout from ERS is an issue (9), with

34 attendance completion rates of between from 12% and 50% being reported (9, 10). Previous

35 research has demonstrated that increasing age and being male are positive predictors of completing

36 a programme (11, 12, 13). However, research examining ethnicity, deprivation index, referral reason,

37 or employment status is inconclusive (9, 11, 12, 13, 14, 15).

38 Common in the ERS literature, adherence is the term used to describe 'completing the scheme',

39 where it is defined as either completing a set percentage of sessions within the duration of the

40 scheme (e.g. 75%) (3) or attending an exit interview at the end of the scheme (11). However, such a

41 definition fails to provide equity in assessment across schemes of different durations. Furthermore,

42 it does not take into account what is performed in the exercise sessions, i.e. frequency, intensity,

43 type or time of the exercise prescription. Definitions aside, individuals' non-uptake of referral or

44 choosing to not complete the designated number of sessions, are likely to limit any associated health

45 benefits from ERS (8). Therefore, in order to understand if ERS is an effective non-pharmacological

46 therapy for NCD, there is a requirement to know of those referred, who does not choose to uptake

47 their treatment (i.e. prescribed exercise), and of those that are, how many sessions they complete.

48 This study aimed to examine routinely collected data from one ERS in Scotland. Specifically,

49 secondary analysis of an ERS database was used to 1) profile participants' non-uptake of ERS; 2)

50 describe any differences between non-attenders and attenders and; 3) report session count of

51 attenders, exploring relationships between attender demographics and session count.

52 **Methods**

53 **Study Design**

54 Anonymised historical data was retrieved on participants who were referred to an ERS in one region

55 in Scotland across 10 different leisure facilities between October 2016 and September 2017, and

56 January 2018 to June 2018. A retrospective cross-sectional analysis allowed exploration of

57 participant characteristics and scheme characteristics (i.e. quality of ERS site leisure facilities) and

58 their association with uptake and subsequent session count. The University of Stirling general

59 university ethics panel granted approval (GUEP 212).

60 **Participants**

61 The ERS accepted referrals for adults aged 18 years or above, who were judged by a heath care

62 professional (HCP) in either primary or secondary care, as not meeting PA guidelines and/or were

63 suffering from a medical condition that could potentially benefit from increased PA. Paper referrals

64 were sent from HCPs to the nearest leisure facility that was part of the ERS. Then, leisure facility staff

65 contacted participants by telephone. This telephone consultation allowed staff to take further

66 details from the participant brief participants about the ERS and answer any questions participants

67 had of the scheme. Participants were then invited to attend their local facility to register onto the

68 scheme.

69 **Exercise referral scheme**

70 Administration of ERS in this study is through a leisure trust, registered as a Scottish charity, on

71 behalf of the local council. The scheme investigated in the present study operated out of 10 different

72 leisure facilities and was free to attend for participants. Participants enrolled in a 10-week

73   programme; however, the ERS did not stipulate that the 10 weeks must run consecutively, or when

74   the programme must start. Referral sessions were run by an exercise referral instructor who held, as

75   a minimum, a qualification commonly referred to as 'GP referral' or 'exercise referral' qualification

76   (11). Participants were enrolled on to one of three different weekly sessions, internally named as

77   cardio-1, cardio-2, and strength and balance. There was no discernible difference between cardio-1

78   and cardio-2. Which session participants undertook was based upon their referral condition and

79   discussion with the exercise referral instructors. Participants were encouraged to attend two

80   sessions a week. Referral sessions were a mixture of aerobic and resistance style exercises, taken in

81   a group setting. Sessions lasted between 50 and 60 minutes; consisting of 15 minutes warm up and

82   cool down, positioned either side of a 20 or 30-minute exercise period. Intensity of the sessions was

83   recorded on a self-monitoring basis.

84   **Data recording**

85   An in-house routine service database captured data on participants. Data extraction from this

86   database was completed by one staff member (Health Development Officer) employed at the ERS.

87   The study used two different sets of data, captured at two different time points. First, data captured

88   between October 2016 and September2017 was related to participants registration for an ERS

89   membership and card (which granted access to the facility) and who presented at the leisure facility

90   and performed a minimum of one exercise referral session. For the purposes of this study, this group

91   of participants were classified as attenders. Second, between January 2018 and June 2018 data was

92   captured about participants who were referred to the ERS but chose not uptake referral; that is,

93   they did not present at the leisure facility. For the purposes of this study, this group are classified as

94   non-attenders. These were mutually exclusive categories (attenders/non-attenders). Historically

95   within the ERS, data on non-attenders were never retained. As part of this study, the ERS retained

96   these data to provide an insight into non-uptake of ERS.

97   Data made available included the following variables: gender, age, indices of deprivation, reason for

98   referral to ERS, date of obtaining ERS membership (this date was used to calculate time lag, defined

99   below), site location, and date of session. Gender (male and female) was extracted from referral

100 forms, which were pre-populated by the referring HCP. Age was recorded in years extracted from

101 referral forms. Participants were grouped into the following age bands: 16-44, 45-54, 55-64, 65-74

102 and 75+. Ages from 16 through to 44 were grouped due to small numbers and the data being heavily

103 skewed to older age ranges. Participants' home postcodes were converted into indices of

104 deprivation according to the Scottish Index of Multiple Deprivation (SIMD) official tool for identifying

105 areas of deprivation (16). Quintiles were measured between one (living in most deprived areas), to

106 five (living in least deprived areas). Referral reasons were grouped into six health conditions,

107 following James *et al*. (13): cancers, respiratory, neurological, frailty and mobility, musculoskeletal

108 (MSK) and cardiovascular. Time lag was defined as the sum of days between signing a membership

109 agreement and first swiping their membership card to enter the facility in order to undertake their

110 first exercise session. Additionally, time lag was used as a variable of analysis of high and low

111 attendance (defined below). Site location represented where a participant was referred too, and if

112 appropriate, where they undertook their attended ERS. James and colleagues grouped leisure sites

113 via their funding source, i.e., local authority-funded provider (14). Similarly, Hanson (11) grouped

114 schemes across two providers, however no indication is given on the distinction between them. All

115 leisure sites within this research study came from one funding source. Therefore, leisure facilities

116 were graded according to the VisitScotland Quality Assurance Grading Scheme for Visitor Attractions

117 , with grades of 5* Exceptional, 4* Excellent, 3* Very Good, 2* Good, 1* Acceptable (17). Since there

118 was no legal requirement for facilities to sign up for this Quality Assurance Grading Scheme, five

119 sites do not have a grading. Site locations were grouped into the following categories: VisitScotland

120 Quality Assurance star grade 5, 4, 3, 2, or 1 or no record of assessment. Date of sessions was used to

121 create exercise session count, recorded via membership swipe card entry into the facility. Session

122 count was used to represent attendance, which is defined as the number of sessions completed.

123 This study included two dependant outcome variables, which were (i) non-attendance vs attendance

124 and (ii) session count of attenders. Following Taylor and colleagues (18), a median split of session

125 count acted as a threshold for high or low session count. In addition, in an attempt to compare data

126 with previous research which has reported mean and median figures, the data was assessed for

127 distribution, where the median value was deemed an appropriate measure of centrality in

128 representing skewed data, which is a feature of this dataset. Therefore, those attending median

129 count of sessions or below were classified as low attenders; those completing above the median

130 threshold were classified as high attenders.

131 **Statistical Analysis**

132 Analyses were performed using Statistical Package for the Social Sciences version 23 (SPSS Inc.,

133 Chicago, IL, USA). Exploratory analyses were undertaken to establish descriptive measures of all

134 independent variables; age, gender, SIMD, referral reason, site location and time lag. Data are

135 presented as mean (range: minimum-maximum) or in pre-defined age bandings. Mean and median

136 (range: minimum-maximum) data is presented for the following results; session count and time lag

137 to provide appropriate clarity on measures of centrality for skewed data. Chi-squared ($\chi2$) analysis

138 was used to investigate differences between high and low attendance, and attenders and non-

139 attenders; statistical significance was set at $p \leq 0.05$. Where data was unreported (referral reason,

140 SIMD, and gender), individuals are excluded from analyses.

141 **Results**

142 **Attenders**

143 During a one-year period (October 2016 – September 2017), 405 participants were classified as

144 attenders. Attenders were predominately female (58% vs 42%, N= 384), referred with a

145 cardiovascular condition (32%) or frailty and mobility issues (24%), and over 65 years of age (70%).

146 Aside from those classified as residing in a SIMD 2 catchment area (27%), attenders were spread

6

147   evenly across SIMD catchment area. Referrals were spread evenly across referral sites (see Table 1).

148   Mean age of attenders was 70 (20-93) years, with males and females being on average 69 (20-91)

149   and 70 (32-93) years, respectively.

150   **Non-attenders**

151   During a six-month period (January 2018 – June 2018) 93 participants chose not to uptake the

152   exercise referral programme. Concurrent data on number of attenders were not available during this

153   period. Non-attenders were predominately female (55% vs 45%), referred for cardiovascular (36%)

154   or MSK conditions (34%) and above 65 years of age (70%). Those classified as residing in SIMD 2

155   (26%) and SIMD 3 (24%) catchment areas represented half of non-attenders. Referrals were spread

156   evenly across the 10 referral sites. Mean age of non-attenders was 68 (31-89) years, with males and

157   females being on average 68 (31-89) and 69 (42-85) years, respectively.

158   **Attenders vs non-attenders**

159   While acknowledging an inability to draw definitive conclusions from non-concurrent data, χ2

160   analysis revealed no statistically significant differences by age, sex, index of multiple deprivation,

161   and referral reason, between participants classified as non-attenders or attenders.

162   **Session count of attenders**

163   Mean (range) time lag between referral and obtaining ERS membership and presenting for their first

164   session was 46 (0-427) days; median time lag was 14 days (Figure 1). Eighteen percent (N = 73) of

165   participants obtained ERS membership and performed their first exercise referral session on the

166   same day. Thirty-seven percent (N = 149) of the participants presented at the leisure facility for their

167   first session within seven days. Mean and median session count was five and four (1-25),

168   respectively (Figure 2). Sixty-one percent (N = 248) of ERS participants completed five-exercise

169   sessions or less, however, one person attended 25 exercise referral sessions.

170   The median value of four exercise sessions completed was the threshold used to classify high or low

171   attendance. Similar percentages were observed across variables (referral reason, age, sex, index of

172   multiple deprivation and VisitScotland quality assurance-grading scheme) below or above median

173   session count (Figure 3). χ2 analysis revealed no statistical significance between those classified as

174   high and low attenders.

175   **Discussion**

176   The aim of this study was to; 1) profile participants who chose not to uptake (non-attenders) ERS; 2)

177   describe any differences between non-attenders and attenders and; 3) report session count of

178   attenders, exploring any relationship between attender demographic characteristics and session

179   count. Non-attenders were predominately female, aged 65 years of age and above, classified as

180   living in areas of greater deprivation and experiencing cardiovascular disease or MSK condition.

181   While concurrent comparison between non-attenders and attenders was not possible; demographic

182   characteristics of participants classified as attenders appear similar to non-attenders. Session count

183   of attenders was low, with a median and mean session count of four and five sessions, respectively.

184   There was no statistical evidence to suggest that participant demographics or ERS site quality

185   influenced session count.

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187   **Participant profiling of non-attenders vs attenders**

188   Previous research reporting participant demographic characteristics are generated directly from

189   those who start ERS (5, 6), with little focus on the subgroup that do not uptake referral. Data from

190   this study reports female, older adults, and those experiencing a cardiovascular of MSK condition, as

191   being the prominent demographic characteristics for non-attenders, which may reflect greater rates

192   of referral for these population sub-groups. This study therefore suggests that non-attenders from

193   this particular ERS are fairly representative of people referred to ERS i.e. predominantly female, aged

194 65 and suffering from cardiovascular conditions. Nonetheless, which demographic characteristics are

195 associated with uptake of ERS remains unclear.

196 Scottish primary care has seen a 20% increase in patients aged 65 years and over (19). Furthermore,

197 consultation rates increase with age, are more common in females and in lower quintiles of

198 deprivation (20). Mortality from cardiovascular disease in the UK is declining, however, prevalence

199 of cardiovascular disease appears to have increased in Scotland (21), with data suggesting the largest

200 increases were in those aged over 65 years (21). This may shed light on why a greater proportion of

201 non-attenders are older, female, and experiencing a cardiovascular condition. In this study data

202 capture of attenders and non-attenders did not overlap, and while it is not possible to draw strong

203 conclusions from non-concurrent groups, it is important that research does begin to draw

204 comparisons and highlight where possible differences and similarities between these mutually

205 exclusive groups. The present study has revealed no evidence of statistical differences between non-

206 attenders and attenders. As discussed, the similarity of groups may reflect primary care use and

207 subsequent HCP referral.

208 **Session count of attenders**

209 This study reports a low session count by attenders and is in keeping with previous studies reporting

210 high dropout (reported as adherence in their studies) (9, 11). However, only limited studies have

211 reported data directly upon session count (11, 18). This is an important omission because health

212 benefits are associated with completion of ERS (22). From a scheme which ran for 24-weeks, Hanson

213 and colleagues (11) report mean session attendance as four sessions for participants who stopped

214 attending before the 12-week midpoint (a comparable time duration to the ERS in the present

215 study). However, a higher mean session count of nine was reported in a 10-week RCT (18). The

216 heterogeneous nature of defining terms, measuring and reporting of ERS becomes problematic

217 when comparing across schemes (8). For example, previous reviews have defined attendance

218 (reported as adherence in the reviews) as percent participation of total number of available sessions

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219   (4, 23). This approach fails to consider that ERS often have different durations; meaning one referral

220   programme's 80% attendance threshold may not represent the same number of sessions as another

221   ERS. However, the reporting of session count is not standard practice within ERS (8). There needs to

222   be a drive for standardised definitions and measures across ERS. This study advocates the use of the

223   term attendance to representative of sessions count. Adherence, therefore, should be defined and

224   measured as a combination of session count (attendance) and performing the required exercise

225   prescription (frequency, intensity, type and time).

226   It is important to acknowledge the impact that dropping out of ERS may have on participants. Failure

227   to complete the duration may reduce any potential opportunity a participant has for achieving

228   positive benefits. Additionally, there is a lack of evidence upon what happens to those who choose

229   to exit ERS early. For example, do they go on and become independent exercisers; unfortunately, the

230   present study was unable to assess PA engagement external to the ERS. The current evidence does

231   suggest that schemes with a longer length (20+ weeks) have a positive impact on health and

232   improving PA levels (24). This raises the question on how many sessions should be performed in

233   order to promote long term behaviour change, be that at ERS or to become independently active.

234   Promotion of PA habits requires individuals to frequently practice the activity in stable contexts. One

235   previous review suggest that PA habits can develop over a period of weeks, however, there is

236   considerable inter-individual variability in how quickly habits can be formed (25). This suggests that

237   if participants were able to complete the allotted ERS programme, they place themselves in a better

238   position than those who do not complete, to promote positive behaviour change. More importantly,

239   and pertinent to this study, further research is needed, especially on factors and approaches that

240   may facilitate or impede attendance at ERS.

241   Acknowledging heterogeneity of ERS (e.g. scheme duration, definitions of terms), it is important to

242   start drawing comparisons, where possible, between schemes to determine what might be

243   influencing session count. However, the present study found no statistical evidence to suggest that

244   demographic characteristics influenced session count. Further, the present study found that site

245   location did not influence session count. However, VisitScotland quality assurance-grading scheme

246   does not account for provision of ERS, rather grading sites overall.. Only two other studies have

247   considered site location as a potential factor which found conflicting results. Hanson reported site

248   location significantly predicted uptake, 12-week attendance, and scheme completion, however, the

249   reasons for this are unclear (11). James reported that site variable did not improve the model fit,

250   therefore was not included in the final model analysis (14). Direct comparisons of these studies is

251   difficult, due to an inability to distinguish any objective differences between referral sites (11) and all

252   leisure sites within this research study came from one funding source.

253

254   **Strengths and Limitations**

255   This study benefits from strong ecological validity, which is important in determining and reporting

256   real life factors that may play a role within the success of ERS. Furthermore, the breadth of data

257   collected is consistent with previous research and commonly collected within ERS. Thus, providing a

258   comparable baseline across schemes. There are some key limitations to this study. First. it is

259   important to acknowledge that periods of data collection for attenders and non-attenders do not

260   directly overlap; hence, a true reflection of differences between non-attenders vs attenders cannot

261   be inferred. Subsequently, the authors acknowledge the potential for confounding effects of

262   seasonal variation, referrer habits or staff developments that are beyond our control. There may be

263   potential for misrepresentation of session count from using membership cards into the leisure site

264   as a proxy of session count, since exercise instructors could allow participants into the facility

265   without the need to swipe their membership card. However, with no registers taken within

266   sessions, this was the only means available to track number of sessions completed. Finally, although

267   the study examined participant's uptake and attendance with the scheme, it is unable to identify

268   barriers and facilitators of uptake or attendance. Furthermore, due to the study data being database

269   driven, it was not possible to assess if the ERS influenced PA engagement outside of the ERS

270   sessions.

271   **Conclusion**

272   Demographic characteristics or site characteristics do not appear to be associated with non-

273   attendance or with the number of sessions attended. Furthermore, attendance within this ERS was

274   low, with over half the participants exiting the scheme on or before their fifth session. Therefore,

275   there is a need to identify additional factors influencing participants choice to uptake their ERS

276   referral and to complete the duration of the scheme. Non-uptake and reduced attendance may limit

277   any associated health benefits that may be achieved from ERS.

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346   **Acknowledgments**

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375 **Tables.**

376 **Table 1.** Descriptive count and percent of total participant count of participant demographics, and
377 VisitScotland quality assurance grading scheme of referral site, for non-attenders and attenders.
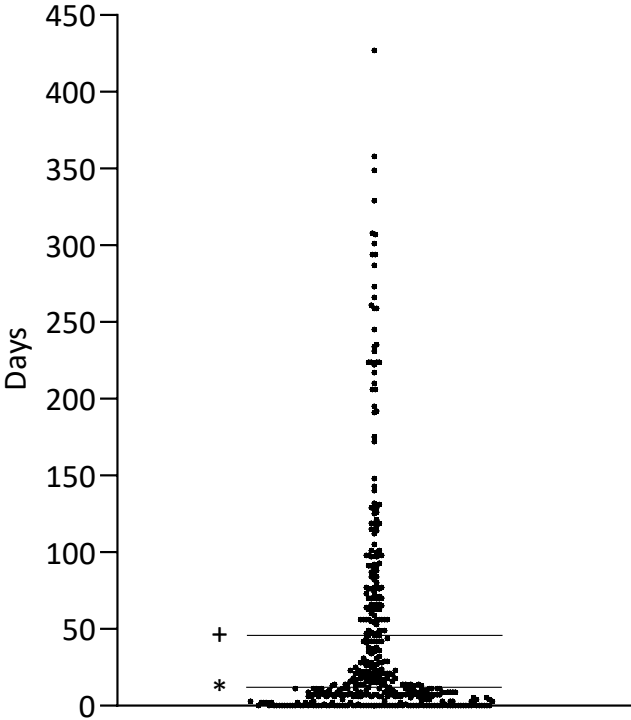
|	Non-attenders n=93 (Jan-June 2018 dataset)		Attenders n=405 (Oct 2016-Oct 2017 dataset)	
Referral reason	Frequency count (N)	Percent of total participant count (%)	Frequency count (N)	Percent of total participant count (%)
Cancers	1	1	8	2
Respiratory	4	5	15	4
Neurological	5	5	60	15
Frailty and mobility	18	19	99	24
Musculoskeletal	32	34	92	23
Cardiovascular	33	36	129	32
Missing	-	-	3	1
Total	93	100	405	100
SIMD quintiles				
SIMD 1	17	18	56	14
SIMD 2	24	26	109	27
SIMD 3	22	24	73	18
SIMD 4	17	18	75	19
SIMD 5	13	14	77	19
Missing	-	-	15	4
Total	93	100	405	100
Age Banding (yrs)				
16-44	5	6	10	2
45-54	5	5	30	7
55-64	18	19	84	21
65-74	32	34	136	34
75+	33	36	145	36
Total	93	100	405	100
VisitScotland quality assurance-grading scheme				
3 Star	32	35	120	30
4 Star	28	30	144	35
No Record or assessment	33	35	141	35
Total	93	100	405	100

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382 **Figures.**

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385 *Figure 1.* Time lag in days between signing contract and presenting at the leisure facility for first
386 exercise session with + and * representing mean and median time delay, respectively.
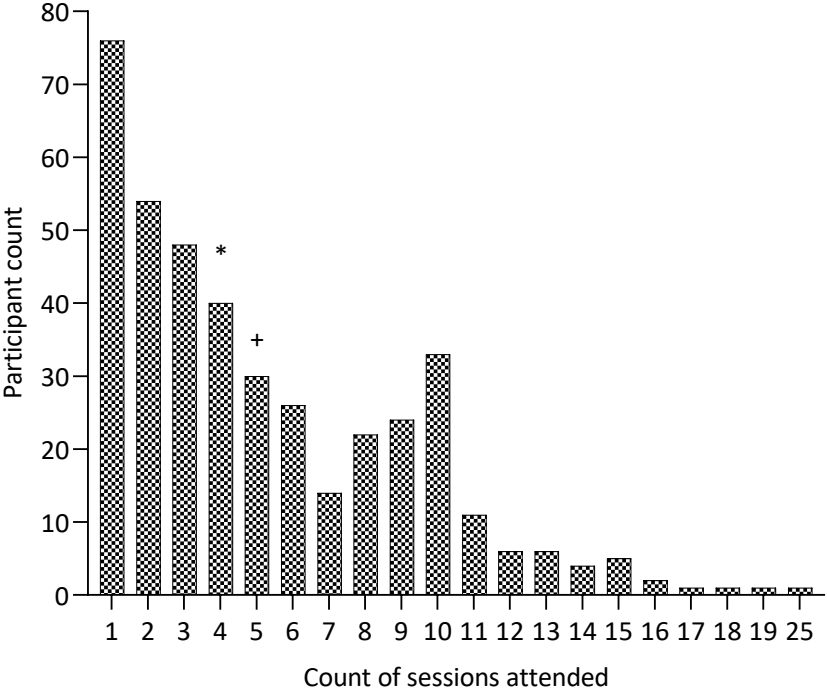
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388 *Figure 2.* Count of participants exiting scheme with + and * representing mean and median session
389 count across ERS, respectively. For illustrative purposes, 61% (N = 248) of participants exited on or
390 before their fifth sessions.
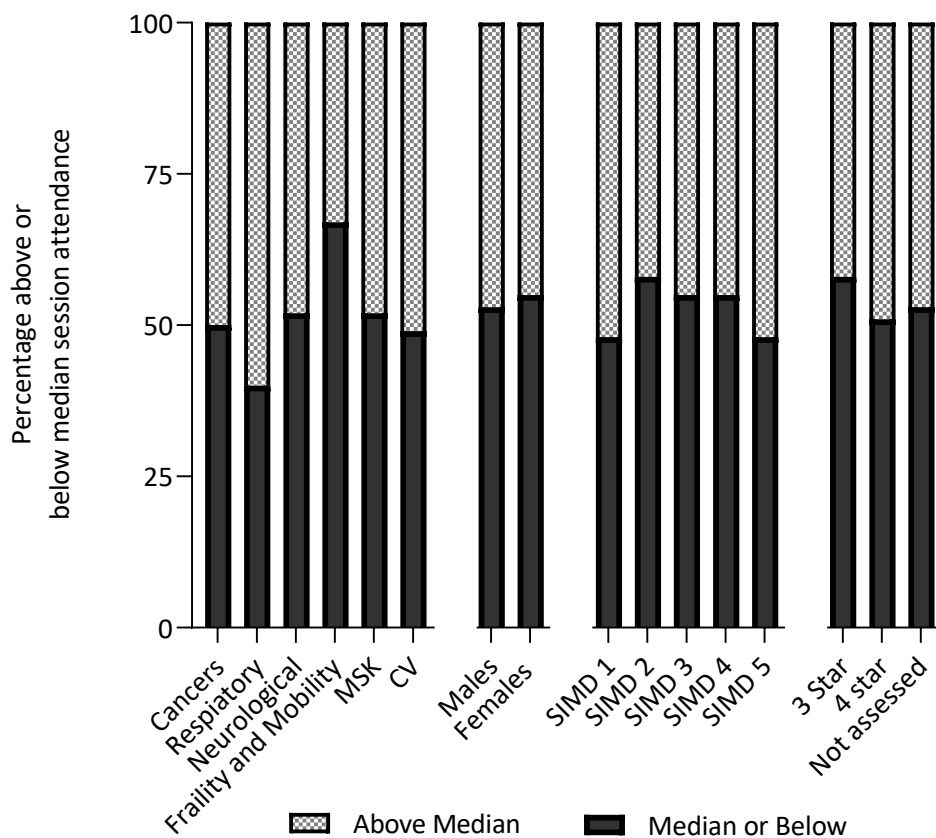
391

392 *Figure 3.* Participant demographics and ERS site quality percentage above or below median session
393 count.