

1 Friendships, loneliness and psychological well-being in older adults: A limit to the benefit
2 of the number of friends

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Abstract

11

12 *Objectives:* To examine the relationship between number of friends and loneliness,
13 depression, anxiety and stress in older adults. *Methods:* Data were obtained from 335 older
14 adults via completion of an online survey. Measures included loneliness (UCLA Version 3),
15 depression, stress and anxiety (DASS-21). Participants also reported their number of close
16 friends. *Results:* Regression analysis revealed an inverse curvilinear relationship between
17 number of friends and each of the measures tested. Breakpoint analysis demonstrated a
18 threshold for the effect of number of friends on each of the measures (loneliness = 4,
19 depression = 2, anxiety = 3, stress = 2). *Discussion:* The results suggest that there is a
20 limit to the benefit of increasing the number of friends in older adults for each of these
21 measures. Elucidating these thresholds can enable loneliness and psychological well-being
22 interventions to be more targeted.

23

Keywords: Loneliness; Friendships; Older Adults; Psychological Well-being

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25 of the number of friends

26 **Introduction**

27 Loneliness has been defined as an unpleasant or distressing experience resulting from
28 a perceived qualitative or quantitative deficiency in one's social relationships (Peplau and
29 Perlman 1982; Russell, Peplau and Cutrona 1980). As such loneliness can be emotional or
30 social. Emotional loneliness is derived from a perception of inadequate intimacy in
31 relationships, whereas social loneliness is due to deficits in the quantity of social
32 relationships (Hawkley and Cacioppo 2010).

33 Transient experiences of loneliness are believed to be adaptive in that they provide
34 motivation to form and maintain social connections in order to promote the survival of
35 genes (Cacioppo and Hawkley 2009; Cacioppo *et al.* 2006; Hawkley and Cacioppo 2010).
36 However, sustained loneliness has been repeatedly linked to many negative psychological
37 and physiological health outcomes across age groups. These outcomes include anxiety and
38 depression (Age Uk South Lakeland 2018; Barg *et al.* 2006; Cacioppo, Hawkley and
39 Thisted 2010; Lee *et al.* 2021), suicidality (Stravynski and Boyer 2001; Van Orden *et al.*
40 2010), maladaptive stress responses (Adam *et al.* 2006; Steptoe *et al.* 2004), cognitive
41 decline and Alzheimer's Disease (Boss, Kang and Branson 2015; Donovan *et al.* 2017;
42 Wilson *et al.* 2007) cardiovascular disease (Momtaz *et al.* 2012; Valtorta *et al.* 2018;
43 Valtorta *et al.* 2016), malnutrition (Ramic *et al.* 2011), sleep quality (Yu *et al.* 2018),
44 functional decline (Perissinotto, Stijacic Cenzer and Covinsky 2012) as well as increased
45 risk of mortality (Holt-Lunstad *et al.* 2015; Holt-Lunstad, Smith and Layton 2010).

46 These negative impacts have associated economic costs. The cost of loneliness to UK
47 employers has been estimated as being £2.5 billion due to increased staff turnover, reduced
48 productivity, the impact of caring responsibilities and sickness absence related to ill health
49 (New Economics Foundation and Co-op 2017). The monetised impact of severe loneliness

50 has been estimated as £9,900 per person due to its impact on well-being, health and
51 productivity (Peytrignet, Garforth-bles and Way 2020).

52 Further, loneliness is becoming increasingly prevalent in later life with in excess of 1
53 million UK residents over the age of 50 reporting that they are chronically lonely
54 (Abrahams 2018). This figure is expected to increase to 2 million by 2025 (Abrahams
55 2018). Importantly, as the worldwide population is ageing (UN DESA's Population
56 Division 2019), the negative health correlates of loneliness are linked to increased strain on
57 the National Health Service usage in the UK. For example, loneliness in older adults was
58 consistently and positively associated with the number of General Practitioner visits in
59 both cross-sectional and longitudinal analysis as well as with Emergency Department visits
60 for women (Burns *et al.* 2020).

61 Due to the multiple negative impacts demonstrated above, the UK government has
62 implemented, or is planning to implement a number of initiatives with the goal of reducing
63 loneliness in this age group. This includes strengthening their "Tackling Loneliness" charity
64 network, the awarding of £31.3 million of funding to charities supporting people who
65 experience loneliness and the announcement of an additional £7.5 million to tackle
66 loneliness during winter (Sport 2021)

67 Clearly loneliness has a negative impact on both individuals and a society as a whole.
68 Therefore, it is important to fully understand contributors to this experience in order to
69 reduce its deleterious impact.

70 **Friendships in later life**

71 At its core, loneliness relates to a perceived lack of meaningful social connections and
72 interactions (Cacioppo and Patrick 2008; Reichmann 1959; Townsend 1968). Friendships
73 are a type of social connection which appear to be particularly important to older adults
74 with evidence indicating that this age group are more satisfied with their friendships than

75 their younger counterparts (Nicolaisen and Thorsen 2017). Additionally, research has
76 shown that a preference for emotionally close social partners increases with age
77 (Carstensen 1992).

78 Socioemotional selectivity theory (Carstensen, Isaacowitz and Charles 1999) provides
79 a framework for this observation. This theory posits that the perception of time causes
80 individuals to prioritise particular social goals which are in competition with one another.
81 Younger individuals who perceive time to be expansive focus on the pursuit of future
82 oriented knowledge based goals. In contrast, those that perceive time as limited, such as
83 older adults, become more focussed on present oriented goals. These present focussed goals
84 include the aim of emotional satisfaction. As such, selectivity of social partners in this age
85 group is increased with a preference for high quality relationships emerging. Older adults
86 are thought to construct their social world to match these social goals. This leads to a
87 reduction in social network size beginning in early adulthood and results in a network
88 which excludes novel social partners and maintains those that are already emotionally close
89 (English and Carstensen 2014). Thus, highlighting the notion that existing close
90 friendships become more important with age.

91 **Friendships and loneliness in older adults**

92 Studies have repeatedly shown that in older adults, friendships are a greater
93 determinant of loneliness than relationships with family members (e.g., Shiovitz-Ezra and
94 Leitsch 2010). For example, it has been shown that interactions with friends reduce
95 loneliness to a greater extent than interactions with close relatives including children,
96 grandchildren and neighbours (Lee and Ishii-Kuntz 1987; Mullins, Johnson and Andersson
97 1987; Pinqart and Sörensen 2001; Steed *et al.* 2007). Having close friends who reside in
98 close proximity is more important than having relatives that do (Eshbaugh 2009) and those
99 with networks composed mainly of kin appear to be more vulnerable to loneliness and
100 negative psychological well-being (Silverstein, Chen and Heller 1996). Additionally, 50% of

101 those who report having no friends also report feeling lonely (Holmén *et al.* 1992)
102 suggesting that social connections which are not friendships, such as kinship, may be less
103 important in terms of loneliness in some cases.

104 As pointed out by Pinqart and Sörensen (2001), an explanation for a stronger
105 association between friendships and loneliness in comparison to familial relationships and
106 loneliness may lie in the quality of those relationships. Friendships tend to be of higher
107 quality than familial relationships, as the latter are more likely based on obligation and
108 may also involve caregiving responsibilities (Bengtson *et al.* 1985). Given the importance of
109 shared experiences, interests, attitudes and lifestyle for friendships, these relationships may
110 offer more insight into understanding loneliness than family relationships (Rawlins 1995).

111 Further evidence for the importance of friendships in relation to loneliness has been
112 demonstrated. For example, Eshbaugh and colleagues (2009) found that in older women
113 living alone, having close friends who reside within 50 miles was a significant negative
114 predictor of loneliness. A similar finding was evident in work by Mullins and associates
115 (1990) in older adults living in independent living facilities. Further, a lack of friends was
116 reported as a reason for feeling lonely in Finnish older adults (Savikko *et al.* 2005).
117 Additionally, frequency of contact with friends has been evidenced as having a negative
118 relationship with loneliness in older adults across marital statuses (Pinqart 2003).

119 **Quantity of friends and loneliness**

120 As outlined above, friendships are clearly important in terms of reducing loneliness.
121 In this context it is important to note that research has consistently demonstrated that the
122 quantity of friends has a negative association with loneliness. This has been found in
123 adolescents (Lodder *et al.* 2017), children (Nangle *et al.* 2003), sophomore high school
124 students (Russell *et al.* 2012) and older adults (Shiovitz-Ezra and Leitsch 2010). The
125 association between this objective parameter and subjective loneliness has repeatedly been

126 found despite the consensus being that loneliness is a subjective experience. Despite this
127 association, there has been limited investigation of the ways in which the number of friends
128 contributes to this. One notable exception is research exploring the discrepancy between an
129 individual's ideal and actual number of friends (Russell *et al.* 2012) which finds a
130 curvilinear relationship between this discrepancy and loneliness in college students. Here,
131 loneliness decreases as the number of actual friendships rises towards the number of ideal
132 friendships. Once the ideal number of friendships is passed, loneliness begins to increase
133 again. The authors explain this non-linear relationship in relation to the
134 cognitive-discrepancy model of loneliness (Thibaut and Kelley 2017). Here a loss or gain of
135 a friend when the number of friendships is close to an individual's ideal number may be
136 especially important for determining loneliness. However, a loss or gain may be less
137 important when the number is far above or below this ideal number.

138 Studies, apart from that of Russell and colleagues (2012), have overlooked the
139 possibility that the relationship between the quantity of friends and loneliness may be
140 curvilinear. The presence of a non-linear relationship may be indicative of a limit to the
141 effect of increasing friends on loneliness. Work by Brummet and colleagues (2001) suggests
142 that the link between the number of social contacts and risk of mortality in coronary
143 patients is non-linear. Here, the mortality rate was highest in those with three or fewer
144 social contacts. When four social contacts were present, the risk was reduced by more than
145 half and remained at a similar level with further additions of social contacts. It is possible
146 that a similar relationship may be present between the number of friends and loneliness,
147 given the previously established links between loneliness and coronary heart disease
148 (Valtorta *et al.* 2016). The presence of a limit makes theoretical sense as it has previously
149 been established that there is a constraint on the number of emotionally close relationships
150 an individual can maintain within their social network with an increase in emotional
151 closeness linked to a reduction in network size (Roberts *et al.* 2009). Additionally, studies
152 have shown that intimacy in friendships differentiates between those who are lonely and

153 those who are not (Drageset, Kirkevold and Espehaug 2011; Hamid 1989; Williams and
154 Solano 1983) although not in all cases (Mullins and Mushel 1992). It is therefore plausible
155 that, as more friends are added to a person's network, the emotional closeness within the
156 network is decreased, which in turn impacts on how lonely the individual feels. Thus,
157 creating a natural limit. It is also possible that individuals experiencing loneliness may
158 surround themselves with acquaintances as a coping strategy which could suggest a curved
159 association between number of friends and loneliness.

160 As mentioned above, there are a variety of negative psychological outcomes
161 associated with loneliness. Similarly to loneliness, previous research has shown that
162 friendships have been linked to improved mental health. Quantity of friends is related to
163 reduced levels of depression in older adults (Potts 1997). Friendship support has been
164 linked to better affect balance in the same age group (Montpetit, Nelson and Tiberio
165 2017). Subjective isolation from friends is linked to a greater increase in both depression
166 and psychological distress than subjective isolation from family (Taylor *et al.* 2018). An
167 increase in the number of friends is linked to a reduction in stress (Horst and Coffé 2012).
168 Older adult friendships are linked to better psychological well-being in comparison to
169 family relationships (Nussbaum 1994). Similarly, friendship networks have been shown to
170 have a stronger relationship with psychological well-being than kin based networks (Cable
171 *et al.* 2013). Finally, a lower number of social relationships has been linked to the
172 maintenance of low negative affect and high negative affect (Huxhold *et al.* 2020).

173 Of note, friendship closeness has also been associated with reduced levels of
174 depression in both older adults (Bishop 2008) and adults (Taylor *et al.* 2015). As outlined
175 previously, increasing a person's number of friendships may reduce levels of this closeness
176 within their social network. This reduction in closeness to network contacts may in turn
177 lessen the impact of the number of friends on depression creating a natural limit. However,
178 as with loneliness, there has been little exploration of whether the number of friends relates
179 to psychological health outcomes and there has been no exploration of what an optimal

180 number of friends may be in terms of these outcomes in this age group.

181 **Quantity vs Quality**

182 It is important to note here that quality of friendships has often been indicated as
183 being important in terms of loneliness. Higher quality friendships are related to lower levels
184 of loneliness. This association has been found in the oldest old (Long and Martin 2000),
185 during adolescence (Lodder *et al.* 2017) and in children (Parker and Asher 1993). This
186 relationship has also been found for social relationships more generally in older adults; with
187 higher quality social relationships predicting lower levels of loneliness (Pinquart and
188 Sörensen 2001).

189 Quality within friendships is therefore clearly important with regards to loneliness.
190 As it is known that relationship closeness is correlated with relationship quality (e.g.,
191 Crespo *et al.* 2008), we argue that it is more appropriate to focus on the ways in which
192 close, and therefore high quality, friendships impact loneliness rather than more peripheral,
193 low quality, friendships. This allows the exploration of the impact of these arguably more
194 important friendships in relation to loneliness in older adults. Further, this encompasses
195 both the theoretical quantitative social and qualitative emotional aspects of loneliness as
196 highlighted above.

197 **The present study**

198 As illustrated, a closer inspection of the relationship between number of close friends
199 and loneliness and its psychological health correlates is warranted. To this end, the present
200 study aimed to extend previous findings in the following key ways. First, the study aimed
201 to determine the relationship between the number of close friends and loneliness along with
202 three of its associated psychological health outcomes: depression, anxiety and stress.
203 Crucially, the existence of a non-linear relationship was explored. A further aim was to

204 determine the optimal number of close friends for each of these parameters. As outlined
205 above, a negative relationship between number of close friends and loneliness and each of
206 the associated psychological well-being measures has previously been established. Here, we
207 expected to replicate those findings. However, no hypothesis was made in relation to a
208 potential curvilinear relationship. Instead we posed the research question, Is there a
209 curvilinear relationship between number of close friends and loneliness in older adults. As
210 the second aim was exploratory no hypothesis was made in this regard either. Again, a
211 research question was posed of what is the optimal number of close friends in terms of
212 loneliness in this age group?

213

Method

214 Design

215 The present study was an exploratory, cross-sectional and correlational investigation
216 into the relationship between number of close friends and loneliness, depression, anxiety
217 and stress in older adults.

218 Participants

219 A target sample size of 400 was pre-registered, this was primarily determined by cost.
220 Due to time constraints this number fell somewhat short of the target. However, this
221 number is still sufficient to perform the analysis (1 predictor per 25 cases, Harrell 2015;
222 Austin and Steyerberg 2015; Roscoe 1975; Schmidt 1971; Tabachnik and Fidell 2009). A
223 total of 350 residents of the United Kingdom aged 65 or over responded to an online
224 questionnaire. This was advertised via the recruitment platform Prolific (Palan and
225 Schitter 2018), Facebook adverts and via word of mouth. The Facebook and Prolific
226 adverts were targeted specifically to UK residents aged 65 plus. Those that completed the
227 questionnaire via Prolific were paid £2 upon completion. To be eligible to take part in the

228 study participants were required to not have had a current clinical diagnosis of depression
229 or anxiety. The initial sample consisted of 350 respondents (138 male, 211 female and one
230 participant did not specify).

231 Measures

232 **Key Dependent Variables.** *Loneliness.* There were four dependent variables
233 examined in this study. The first was loneliness as measured by the University of
234 California, Los Angeles, Loneliness Scale-Version 3 (UCLA-3) (Russell 1996). The UCLA-3
235 is a 20-item self-report scale designed to measure an individual's subjective feelings of
236 loneliness. Participants are asked how often each statement is descriptive of them (e.g.,
237 How often do you feel that you lack companionship?). Items are on a scale ranging from 1
238 (Never) to 4 (Often) and nine items are reverse scored. All items are summed to give one
239 loneliness score; a higher score represents greater levels of loneliness. Version 3 of this scale
240 has demonstrated good internal reliability (Cronbach's $\alpha = .96$) (e.g., Russell 1996), with
241 the reliability for the present study being .94, and has demonstrated a unidimensional
242 factor structure (Russell 1996).

243 *Psychological Well-being.* The three psychological well-being measures were all
244 assessed via the short version of the Depression Anxiety and Stress Scale (DASS-21)
245 (Lovibond and Lovibond 1995). The DASS-21 consists of 21 items and consists of three
246 7-item subscales measuring depression, anxiety and stress separately. Participants are
247 asked how much each statement has applied to them over the past week (e.g. I found it
248 hard to wind down). Items are on a scale ranging from 0 (Never) to 3 (Almost Always).
249 Items are summed for each scale separately and multiplied by two to allow comparison to
250 the original 42-item DASS scale. No items are reverse scored. A higher score in a subscale
251 represents a greater level of that particular psychological state. The separate depression,
252 anxiety and stress scales have all repeatedly demonstrated good internal reliability (all
253 Cronbach's $\alpha > .80$) (e.g., Osman *et al.* 2012). Reliability for the present study is as

254 follows: Anxiety (Cronbach's $\alpha = .80$), Stress (Cronbach's $\alpha = .88$) and Depression
255 (Cronbach's $\alpha = .90$). The DASS-21 scale has repeatedly demonstrated a three factor
256 structure representing the three separate scales (e.g., Norton 2007; Crawford and Henry
257 2003; Scholten *et al.* 2017; Sinclair *et al.* 2012). Table 1 contains the descriptive statistics
258 for each of the dependent variables.

259 **Key Independent variable.** The main independent variable of interest was the
260 number of friends participants reported having. This variable was elicited by asking
261 participants to "Please indicate how many close friends you currently have". The question
262 eliciting the number of close friends was modelled after Russell and colleagues (2012).
263 However, instead of asking participants to indicate this number on a 7-point likert scale
264 ranging from "none" to "11+", we asked participants to provide the actual number, as the
265 number of friends is better operationalised as a count variable than a 7-point likert scale.
266 The definition of a close friend was left to the interpretation of the participant based on
267 previous findings that friendships are not easily defined in older adults (Adams, Blieszner
268 and DeVries 2000).

269 **Covariates.** Four demographic covariates were included in this study as they have
270 previously been linked to one or more of the dependent variables. Age was included as a
271 continuous variable. Gender was included as a categorical variable with female being the
272 reference category. Marital status was included as a categorical variable with response
273 options being "In a relationship", "Married/Registered civil partnership", "Separated but
274 still married or in a registered civil partnership", "Divorced" and "Widowed". The reference
275 category for this variable was "Single, never married or in a civil partnership". Highest
276 attained level of education was also included as a categorical variable with response options
277 being "Some secondary school", "GCSE or equivalent", "A level or equivalent",
278 "Undergraduate degree". The reference category for this variable was "Primary School".

279 Other measures were collected as part of a separate study, (the ideal number of
280 friends, the Satisfaction with Life Scale (Diener, Emmons and Larsen 1985), as well as

281 three other measures of loneliness - the short De Jong Gierveld Scale (Jong-Gierveld and
282 Tilburg 1999), the short Social and Emotional Loneliness Scale for Adults (DiTommaso,
283 Brannen and Best 2004) and a direct measure of loneliness) but are not reported on here.
284 Please see the following link for a study containing this information
285 https://osf.io/5f2ph/?view_only=6617265f58804de9b0145806375bb6a6.

286 Procedure

287 Ethical approval was granted by the local ethics committee. Data were collected
288 between May and July 2019. Once informed consent was obtained, participants completed
289 all measures via an online questionnaire hosted by Qualtrics (Anon 2020) available at
290 <https://www.qualtrics.com>. The demographic measures were completed first followed by
291 each of the scales. The order these were presented in were randomised. The questions
292 relating to the number of ideal and actual friends were completed last. The whole
293 questionnaire took no longer than 20 minutes to complete.

294 Analytical Approach

295 All analyses were performed using R version 3.6.1 (R Core Team 2017). Observations
296 which contained missing data for the independent variable and dependent variables were
297 removed (13 cases) as were two outliers where the number of friends was listed as 105 (30
298 *SD* away from mean) and age as 66,123 years. Finally, due to the presence of extreme
299 values and asymmetry (skewness = -1.37), the data were winsorized to 3 standard
300 deviations for the number of friends (12 friends) variable (12 cases). This resulted in a final
301 sample of 335 participants; 290 of which were recruited via Prolific and 45 via social media.

302 The data met the assumptions of non-multicollinearity, homoscedasticity and
303 non-autocorrelation. The loneliness data met the assumption of normally distributed
304 residuals. The three DASS variables all exhibited some skew in the distribution of

305 residuals. However, this is to be expected given that the majority of respondents were not
306 currently experiencing high levels of depression, anxiety or stress. However, regression is
307 relatively robust, therefore we used this technique (Berry 1993) and we further assessed the
308 robustness of these models with other techniques (e.g., segmented regression).

309 Prior to performing regression analyses, some demographic factor levels were grouped
310 to result in a more equal n per cell. For marital status, single and undisclosed were
311 combined into one level. As were separated and divorced. For education, primary and
312 secondary school were combined. Based on a visual inspection of the data and a plot of
313 residuals, the fit of polynomial regression models were assessed for all dependent variables.
314 It was found that a quadratic model had the best fit to the data in each case. This was
315 based on the model with a statistically significant reduction in residual sum of squares as
316 indicated by a Chi-Squared difference test. A Davies test was then employed to test for a
317 non-constant regression parameter in the predictor. This was followed by segmented
318 regression via the segmented package (Muggeo 2008) and multivariate adaptive regression
319 spline analysis (“mars”) via the earth package (Milborrow, Hastie and Tibshirani 2011) to
320 determine and confirm a breakpoint in the data. The segmented package utilises an
321 algorithm which determines the breakpoint iteratively. Similarly, the earth package uses an
322 algorithmic approach to examine breakpoints in the data. We also performed additional
323 analyses including robustness checks - these can be found at
324 https://osf.io/5f2ph/?view_only=6617265f58804de9b0145806375bb6a6 .

325

Results

326 Sample Characteristics

327 Sample characteristics and descriptive statistics are presented in Table 1. In the final
328 sample 60% of participants were female and 40% were male. The mean age of participants
329 was 69 years ($SD = 4.29$). Most participants reported being married or in a civil

330 partnership (62%) and having completed an undergraduate degree (35%).The average
331 number of close friends reported was four. All were residents of the United Kingdom.

332 **Main Analysis**

333 **Correlations.**

334 The bivariate correlations are presented in Table 2. Number of friends was
335 significantly negatively associated with each of the dependent variables. Loneliness was
336 significantly positively associated with each of the psychological well-being variables.

Table 1

Sample Characteristics (n = 335)

Characteristic	Statistic (Mean (SD) or n (%))
Age	69.36 (4.29)
Gender	
Female	201 (60)
Male	134 (40)
Marital Status	
Single	19 (6)
In a relationship	26 (8)
Married/ Civil Partnership	207 (62)
Separated	4 (1)
Divorced	50 (15)
Widowed	28 (8)
Undisclosed	1 (0)
Education	
Primary school	2 (1)
Some secondary school	28 (8)
GCSE's or equivalent	66 (20)
A level or equivalent	67 (20)
Undergraduate degree	116 (35)
Postgraduate degree	56 (17)
Number of Friends	4.26 (4.11)
Loneliness	40.22 (11.64)
Depression	6.99 (8.01)
Anxiety	3.68 (5.42)
Stress	8.23 (8.12)

Table 2

Zero-order correlations for study variables (n=335)

	No. of Friends	UCLA_Total	DASS_Depression	DASS_Anxiety
No. of Friends				
UCLA_Total	-0.50***			
DASS_Depression	-0.25***	0.59***		
DASS_Anxiety	-0.16**	0.37***	0.56***	
DASS_Stress	-0.13*	0.44***	0.72***	0.62***

337 **Regressions.**

338 Hierarchical OLS regression analysis with the inclusion of a quadratic term was
339 performed for each of the outcome measures to test for a curvilinear relationship.

340 ***Loneliness*** After adjusting for all demographic information the final model was
341 significant ($F(12,322) = 15.09, p < .001$). In this model both the linear term for number of
342 close friends ($B = -4.78, p < .001$) and the quadratic term ($B = .27, p < .001$) remained
343 significant. As quadratic relationships are difficult to interpret from coefficients alone,
344 please see Figure 1.

345 Of the demographic covariates, only being married or in a civil partnership, in
346 comparison to being single, was a significant predictor of loneliness ($B = -6.29, p = .006$).
347 Those with this particular marital status reported less loneliness than those who were
348 single. This final model explained 34% of the variance in loneliness scores (Table 3).

349 As suggested by the plot, there appears to be a point at which the effect of the
350 number of close friends on loneliness is greatly reduced. A Davies Test indicated that there
351 was a significant difference between the slopes when segmenting the regression line at 3.90
352 friends ($p < .001$). Breakpoint analysis via the “segmented” package further supported
353 that a breakpoint could be elicited at this point ($\psi = 3.86, 95\%CI [2.77, 4.94]$).
354 Multivariate adaptive regression spline analysis further suggested a knot at 4 close friends.
355 This analysis suggests that the effect of additional close friends on loneliness is diminished
356 once around four close friends are reached.

Table 3

	Loneliness				
	Model 1	Model 2	Model 3	Model 4	Model 5
Number of friends	-4.591*** (0.499)	-4.725*** (0.496)	-4.757*** (0.498)	-4.705*** (0.501)	-4.783*** (0.500)
Number of friends ²	0.253*** (0.044)	0.268*** (0.044)	0.272*** (0.044)	0.266*** (0.045)	0.274*** (0.045)
Marital Status: In a Relationship		-6.151* (2.858)	-6.235* (2.862)	-6.401* (2.867)	-5.243 [†] (2.899)
Marital Status: Married/ Registered Civil Partnership		-6.946** (2.243)	-6.896** (2.245)	-7.139** (2.259)	-6.290** (2.285)
Marital Status: Separated or Divorced		-3.958 (2.505)	-3.882 (2.508)	-3.738 (2.513)	-3.198 (2.520)
Marital Status: Widowed		-4.347 (2.814)	-3.953 (2.863)	-3.861 (2.865)	-3.022 (2.871)
Age			-0.096 (0.127)	-0.115 (0.128)	-0.090 (0.131)
Gender (Female→Male)				1.123 (1.138)	0.622 (1.158)
Education: GCSE or Equivalent					-1.938 (2.133)
Education: A Level or Equivalent					1.734 (2.151)
Education: Undergraduate Degree					1.849 (2.026)
Education: Postgraduate Degree					0.636 (2.228)
Constant	52.212*** (1.156)	58.144*** (2.467)	64.784*** (9.088)	65.734*** (9.139)	62.786*** (9.917)
<i>N</i>	335	335	335	335	335
R ²	0.316	0.342	0.343	0.345	0.360
Adjusted R ²	0.312	0.330	0.329	0.329	0.336
Residual Std. Error	9.656 (df = 332)	9.528 (df = 328)	9.534 (df = 327)	9.535 (df = 326)	9.486 (df = 322)
F Statistic	76.766*** (df = 2; 332)	28.443*** (df = 6; 328)	24.430*** (df = 7; 327)	21.497*** (df = 8; 326)	15.091*** (df = 12; 322)

† p<0.1; * p<0.05; ** p<0.01; *** p<0.001: Reference categories: marital status = single or undisclosed, gender = female, education = primary or some secondary school

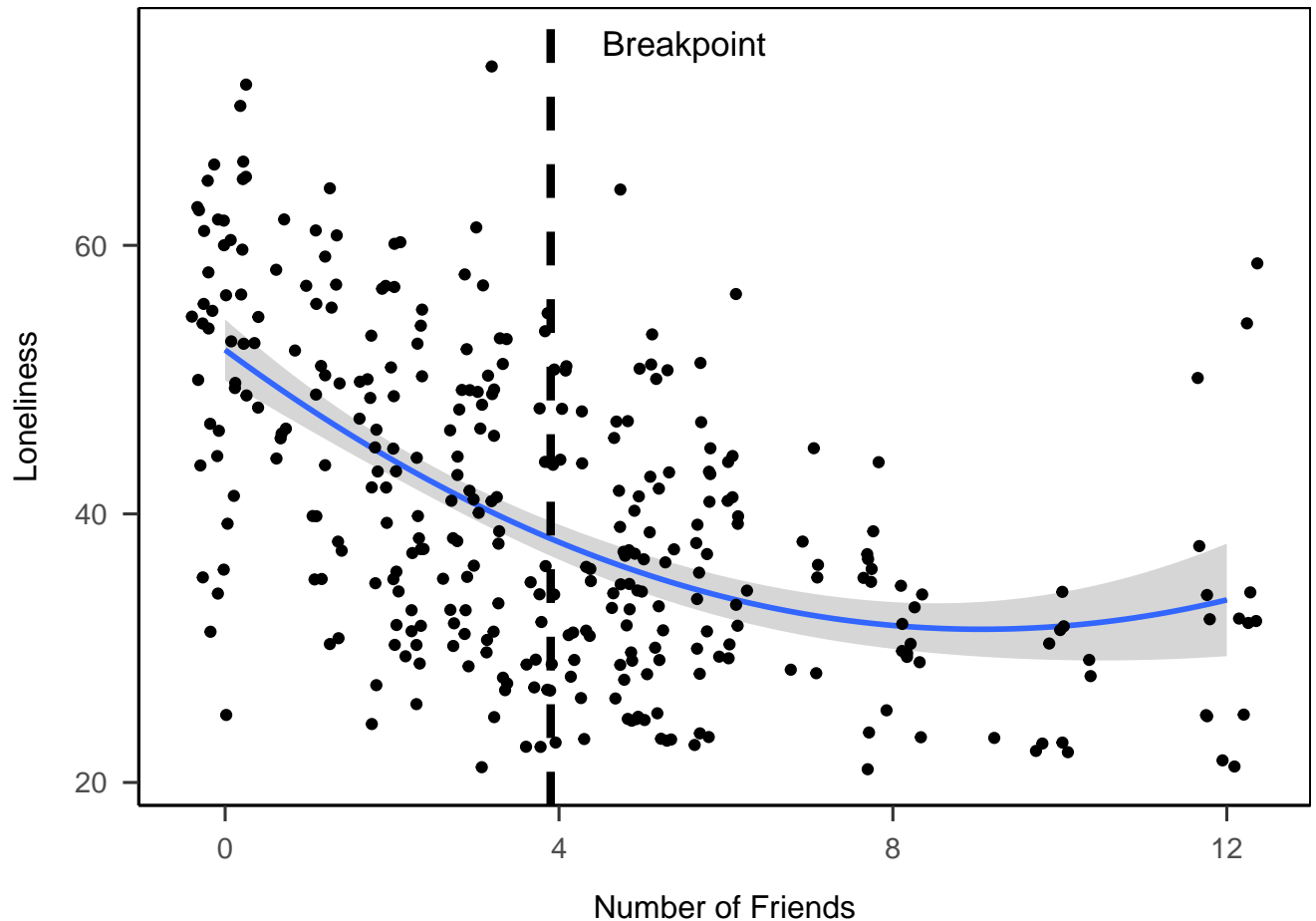


Figure 1. Loneliness as a function of the number of friendships (curvilinear fit with 95%CI).

Breakpoint is determined by segmented regression

357 **Depression** After adjusting for all demographic information the final model was
 358 significant, ($F(12,322) = 4.43, p < .001$). In this model both the linear term for number of
 359 close friends ($B = -2.16, p < .001$) and the quadratic term ($B = .15, p < .001$) remained
 360 significant. The plot in Figure 2 demonstrates this relationship.

361 Table 4 summarises all models on depression. Of the demographic covariates, gender
 362 was a significant predictor of depression ($B = -2.72, p < .01$), with men reporting less
 363 depression than women. Educational attainment was also a significant predictor of
 364 depression (Table 4: all dummy variables $p < .01$). Those who reported that they had
 365 received an education past primary school level reported less depression than those that

366 had not. This model explained 11% of the variance in depression scores.

367 Similar to the effect for loneliness, there appeared to be a point at which the effect of
368 number of close friends on depression is greatly reduced. A Davies Test indicated that
369 there was a significant difference between the slopes when segmenting the regression line at
370 2.16 friends ($p < .001$). Breakpoint analysis via the “segmented” package in R confirmed
371 that a breakpoint could be elicited at this point ($\psi = 2.17$, SE = .491, 95%CI [1.19, 3.12]).
372 Multivariate adaptive regression spline analysis further suggested a knot at 2 close friends.
373 This analysis suggests that the effect of additional close friends on depression is diminished
374 once a cut-off of around two close friends is reached.

Table 4

Hierarchical OLS regression analysis to predict depression (+/- SE).

	Depression				
	Model 1	Model 2	Model 3	Model 4	Model 5
Number of friends	-2.096*** (0.393)	-2.066*** (0.397)	-2.016*** (0.397)	-2.136*** (0.395)	-2.162*** (0.399)
Number of friends ²	0.135*** (0.035)	0.135*** (0.035)	0.130*** (0.035)	0.143*** (0.035)	0.146*** (0.035)
Marital Status: In a Relationship		1.973 (2.287)	2.105 (2.284)	2.490 (2.262)	2.809 (2.309)
Marital Status: Married/ Registered Civil Partnership		0.132 (1.794)	0.053 (1.792)	0.617 (1.782)	0.822 (1.820)
Marital Status: Separated or Divorced		-0.195 (2.004)	-0.314 (2.002)	-0.649 (1.983)	-0.501 (2.008)
Marital Status: Widowed		1.164 (2.252)	0.543 (2.285)	0.328 (2.261)	0.600 (2.287)
Age			0.152 (0.101)	0.196 ⁺ (0.101)	0.196 ⁺ (0.104)
Gender (Female→Male)				-2.606** (0.898)	-2.721** (0.922)
Education: GCSE or Equivalent					-1.142 (1.699)
Education: A Level or Equivalent					-0.059 (1.713)
Education: Undergraduate Degree					0.088 (1.614)
Education: Postgraduate Degree					-0.357 (1.775)
Constant	11.982*** (0.910)	11.564*** (1.974)	1.083 (7.252)	-1.120 (7.211)	-0.940 (7.900)
<i>N</i>	335	335	335	335	335
R ²	0.105	0.110	0.116	0.139	0.142
Adjusted R ²	0.100	0.094	0.097	0.117	0.110
Residual Std. Error	7.599 (df = 332)	7.623 (df = 328)	7.609 (df = 327)	7.524 (df = 326)	7.556 (df = 322)
F Statistic	19.488*** (df = 2; 332)	6.776*** (df = 6; 328)	6.153*** (df = 7; 327)	6.559*** (df = 8; 326)	4.434*** (df = 12; 322)

† p<0.1; * p<0.05; ** p<0.01; *** p<0.001: Reference categories: marital status = single or undisclosed, gender = female, education = primary or some secondary school

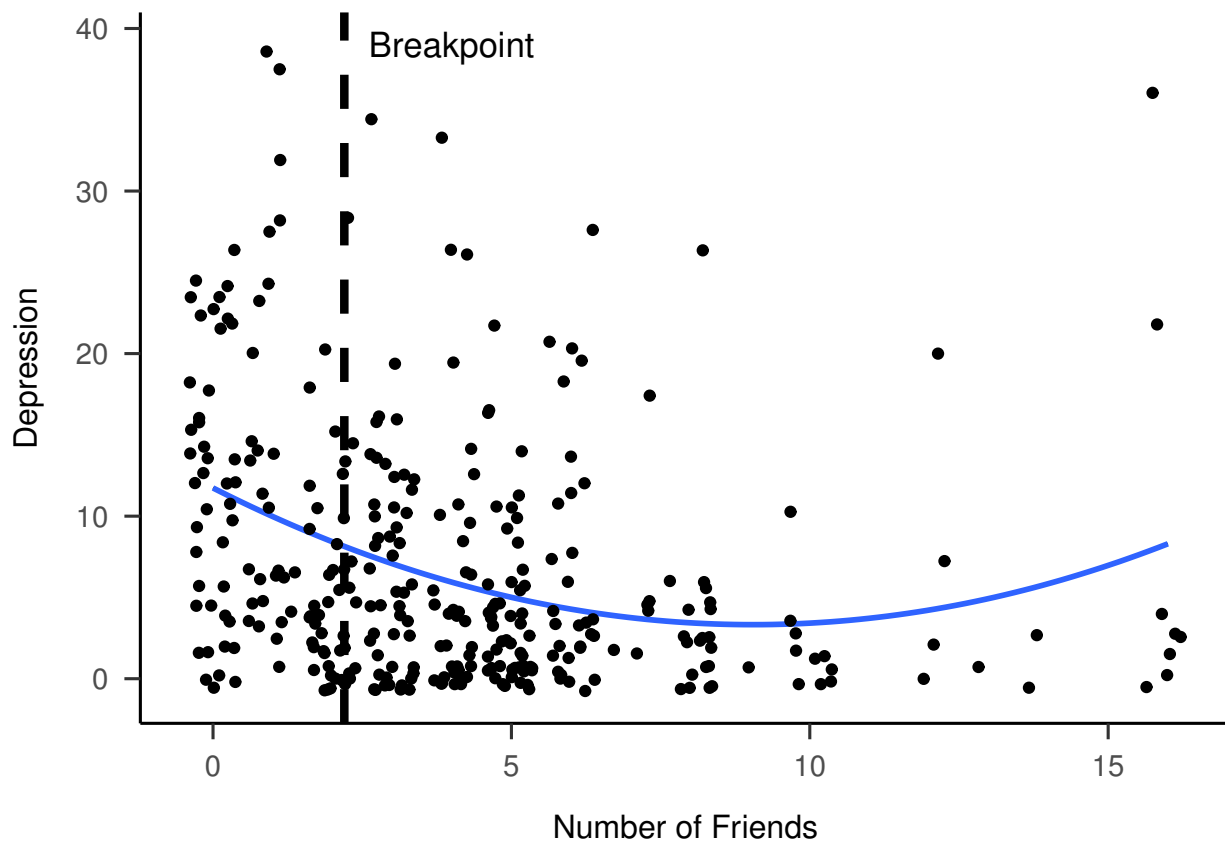


Figure 2. Depression as a function of the number of friendships (curvilinear fit with 95%CI). Breakpoint is determined by segmented regression.

375 **Anxiety** After adjusting for all demographic information the final model was
 376 significant, ($F(15,319) = 1.74, p = .043$). In the final model, both the linear term for
 377 number of close friends ($B = -.74, p = .001$) and the quadratic term ($B = .04, p = .014$)
 378 remained significant. This quadratic relationship is illustrated in Figure 3. None of the
 379 demographic covariates were significant predictors of anxiety. This model explained 3.2%
 380 of the variance in anxiety scores. See Table 5 for all coefficients.

381 Figure 3 suggests a breakpoint after which there is no additional reduction from
 382 adding close friends. A Davies Test indicated that there was a significant difference
 383 between the slopes when segmenting the regression line at 2.51 friends ($p < .01$).
 384 Breakpoint analysis confirmed that a breakpoint could be elicited at this point ($\psi = 2.51$,

385 95%CI [1.02, 4.0]). Multivariate adaptive regression spline analysis further suggested a
386 knot at 3 close friends. This analysis suggests that the effect of additional close friends on
387 anxiety is diminished once a threshold of approximately three close friends is reached.

Table 5

Hierarchical OLS regression analysis to predict anxiety (+/- SE).

	Anxiety				
	Model 1	Model 2	Model 3	Model 4	Model 5
Number of friends ²	-0.980*** (0.275)	-0.944*** (0.276)	-0.941*** (0.278)	-0.976*** (0.279)	-0.970*** (0.280)
Number of friends	0.066** (0.024)	0.064** (0.024)	0.064** (0.025)	0.068** (0.025)	0.067** (0.025)
Marital Status: In a Relationship		3.207* (1.591)	3.213* (1.595)	3.322* (1.597)	2.905+ (1.620)
Marital Status: Married/ Registered Civil Partnership		1.400 (1.249)	1.397 (1.251)	1.558 (1.258)	1.185 (1.277)
Marital Status: Separated or Divorced		0.988 (1.394)	0.983 (1.398)	0.887 (1.399)	0.720 (1.408)
Marital Status: Widowed		0.749 (1.567)	0.723 (1.596)	0.662 (1.596)	0.444 (1.604)
Age			0.006 (0.071)	0.019 (0.071)	-0.015 (0.073)
Gender (Female→Male)				-0.745 (0.634)	-0.469 (0.647)
Education: GCSE or Equivalent					-1.230 (1.192)
Education: A Level or Equivalent					-2.142+ (1.201)
Education: Undergraduate Degree					-2.305* (1.132)
Education: Postgraduate Degree					-1.397 (1.245)
Constant	5.943*** (0.636)	4.508** (1.373)	4.069 (5.064)	3.440 (5.089)	7.716 (5.540)
<i>N</i>	335	335	335	335	335
R ²	0.046	0.061	0.061	0.065	0.080
Adjusted R ²	0.040	0.043	0.041	0.042	0.045
Residual Std. Error	5.313 (df = 332)	5.305 (df = 328)	5.313 (df = 327)	5.310 (df = 326)	5.299 (df = 322)
F Statistic	8.026*** (df = 2; 332)	3.529** (df = 6; 328)	3.017** (df = 7; 327)	2.815** (df = 8; 326)	2.327** (df = 12; 322)

† p<0.1; * p<0.05; ** p<0.01; *** p<0.001: Reference categories: marital status = single or undisclosed, gender = female, education = primary or some secondary school

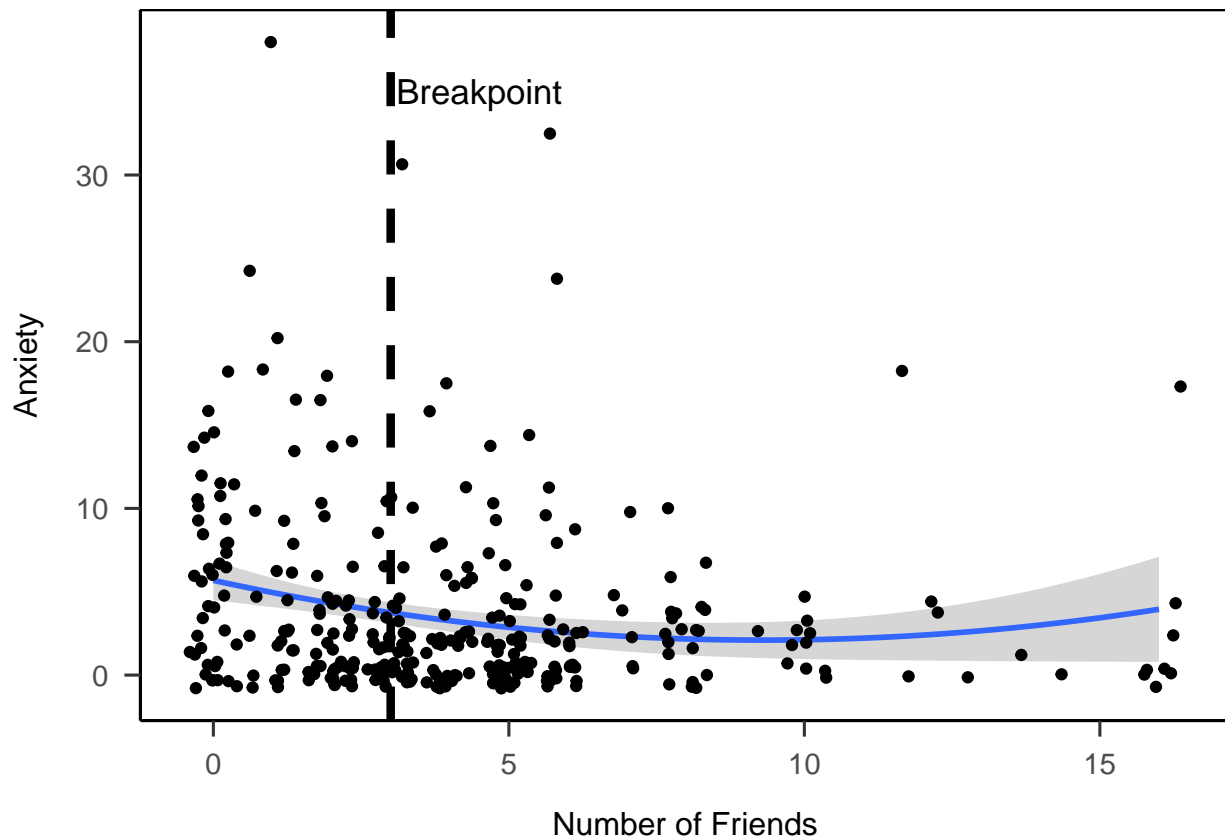


Figure 3. Anxiety as a function of the number of friendships (curvilinear fit with 95%CI). Breakpoint is determined by segmented regression.

388 **Stress** After adjusting for all demographic information, the final model was
 389 significant, ($F(12,322) = 2.448, p < .001$). In this model both the linear term for number
 390 of close friends ($B = -1.51, p < .01$) and the quadratic term ($B = .11, p < .05$) remained
 391 significant. This relationship is illustrated in Figure 4.

392 Of the demographic covariates, being in a relationship was a significant predictor of
 393 stress ($B = 6.15, p < .05$). Those who were in a relationship reported more stress than
 394 those who were single. This model explained 4.9% of the variance in stress scores. See
 395 Table 6 for all coefficients.

396 Figure 4 suggests the presence of a threshold above which there is no further
 397 reduction in stress with a further increase of reported close friends. A Davies Test

398 indicated that there was a significant difference between the slopes when segmenting the
399 regression line at 2.05 friends ($p < .05$). Breakpoint analysis confirmed that a breakpoint
400 could be elicited at this point ($\psi = 2.05$, $SE = .64$, 95%CI [0 .80, 3.30]). Multivariate
401 adaptive regression spline analysis further suggested a knot at 2 friends. This analysis
402 suggests that the effect of additional close friends on stress is diminished once around two
403 friends are reached.

Table 6

Hierarchical OLS regression analysis to predict stress (+/- SE).

	Stress				
	Model 1	Model 2	Model 3	Model 4	Model 5
Number of friends	-1.462*** (0.412)	-1.396*** (0.413)	-1.374** (0.415)	-1.454*** (0.416)	-1.511*** (0.418)
Number of friends ²	0.104** (0.037)	0.103** (0.037)	0.100** (0.037)	0.109** (0.037)	0.112** (0.037)
Marital Status: In a Relationship		5.440* (2.380)	5.499* (2.384)	5.754* (2.380)	6.148* (2.421)
Marital Status: Married/ Registered Civil Partnership		1.607 (1.868)	1.571 (1.871)	1.946 (1.875)	2.249 (1.908)
Marital Status: Separated or Divorced		0.726 (2.086)	0.672 (2.089)	0.450 (2.086)	0.741 (2.104)
Marital Status: Widowed		1.760 (2.344)	1.482 (2.385)	1.339 (2.378)	1.563 (2.397)
Age			0.068 (0.105)	0.097 (0.106)	0.089 (0.109)
Gender (Female→Male)				-1.732 [†] (0.945)	-1.797 [†] (0.967)
Education: GCSE or Equivalent					-1.582 (1.781)
Education: A Level or Equivalent					-0.132 (1.796)
Education: Undergraduate Degree					-0.909 (1.691)
Education: Postgraduate Degree					0.935 (1.860)
Constant	11.449*** (0.955)	9.555*** (2.055)	4.858 (7.571)	3.394 (7.586)	4.349 (8.280)
<i>N</i>	335	335	335	335	335
R ²	0.042	0.063	0.064	0.074	0.084
Adjusted R ²	0.036	0.046	0.044	0.051	0.049
Residual Std. Error	7.976 (df = 332)	7.936 (df = 328)	7.943 (df = 327)	7.914 (df = 326)	7.920 (df = 322)
F Statistic	7.194*** (df = 2; 332)	3.661** (df = 6; 328)	3.192** (df = 7; 327)	3.233** (df = 8; 326)	2.448** (df = 12; 322)

[†] p<0.1; * p<0.05; ** p<0.01; *** p<0.001: Reference categories: marital status = single or undisclosed, gender = female, education = primary or some secondary school

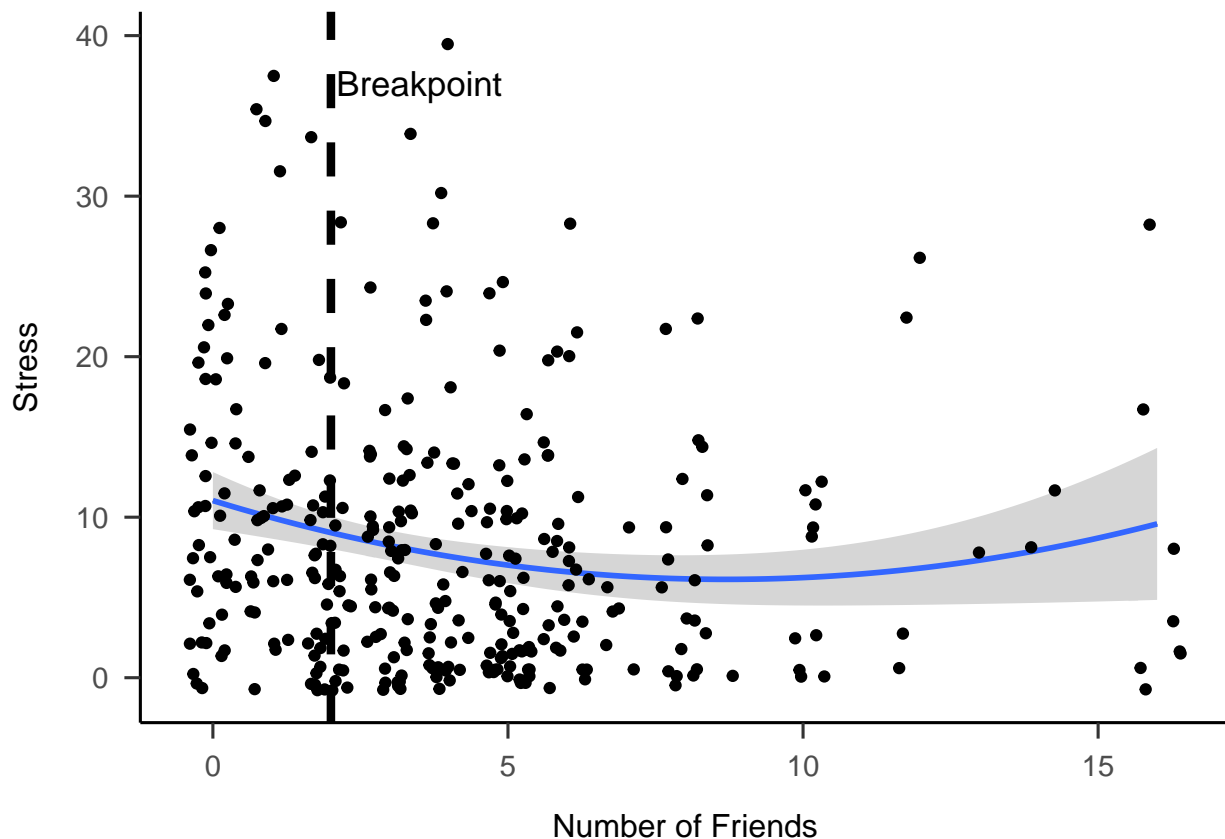


Figure 4. Stress as a function of the number of friendships (curvilinear fit with 95%CI). Breakpoint is determined by segmented regression.

404

Discussion

405 The purpose of this study was to explore the relationship between the reported
406 number of close friends and loneliness, depression, anxiety, and stress in older adults. Our
407 findings demonstrated significant inverse curvilinear relationships between the number of
408 close friends and each of these parameters. These findings support those of previous studies
409 which demonstrated a negative relationship between the quantity of friends and loneliness
410 (Lodder *et al.* 2017; Mullins and Dugan 1990; Nangle *et al.* 2003; Russell *et al.* 2012;
411 Shiovitz-Ezra and Leitsch 2010). The present findings are also in line with previous work
412 demonstrating that having a greater quantity of friends is associated with better

413 self-reported mental health (Bishop 2008; Cable *et al.* 2013; Horst and Coffé 2012; Huxhold
414 *et al.* 2020; Montpetit, Nelson and Tiberio 2017; Nussbaum 1994; Potts 1997; Taylor *et al.*
415 2018). Russell and colleagues (2012) have previously demonstrated that there is an inverse
416 curvilinear relationship between the discrepancy between the number of actual and ideal
417 friendships and loneliness in college students. However, we believe a curvilinear relationship
418 for the effect of close friends on each outcome measure has gone previously untested.

419 Inspection of the plots for each of the outcome measures shows that there are
420 relatively few individuals who report having many friends whilst simultaneously
421 experiencing high levels of loneliness, depression, anxiety or stress. We have discussed the
422 notion that having a large social network may reduce emotional closeness across the
423 relationships within it (Roberts *et al.* 2009) and in turn this lack of emotional closeness
424 may increase feelings of loneliness (Drageset, Kirkevold and Espehaug 2011; Hamid 1989;
425 Williams and Solano 1983). It may be that whilst these individuals report having many
426 close friends, these relationships are not actually providing the closeness, connection, and
427 understanding needed to stave off loneliness and its maladaptive correlates due to the size
428 of their networks. However, further work, ideally of a longitudinal nature, is needed to
429 corroborate this.

430 It is therefore possible that a small cluster of observations could be driving the
431 quadratic fit. However, we believe that this is unlikely to be the case. Bootstrapping,
432 which reduces the weight of extreme cases, further supported the curvilinear relationship
433 (see supplementary materials). Further, we conducted segmented regression using both the
434 “segmented” and “earth” packages to determine break-points in the data. These
435 approaches reduce the effect of outliers and consistently detected break-points in the data
436 (please see https://osf.io/5f2ph/?view_only=6617265f58804de9b0145806375bb6a6).

437 Thus, each of our mental health related variables demonstrated that there was a
438 point past which the addition of more close friends no longer has a substantial beneficial

439 effect. An increase of close friends was associated with a decrease in loneliness until four
440 close friends were reached, for depression this number was found to be two close friends, for
441 anxiety three close friends and for stress the threshold was two close friends. A slightly
442 larger threshold value for loneliness in comparison to the other mental health variables is to
443 be expected, as loneliness is more directly related to social connections and interactions
444 than the other psychological well-being outcomes. The presence of a friendship threshold in
445 terms of loneliness could be due to a reduction in emotional closeness to network members
446 as network size is increased (Roberts *et al.* 2009).

447 It is encouraging that the threshold for the number of close friends in each instance
448 appears to be relatively low. Making and maintaining meaningful social connections takes
449 time and effort (Lang *et al.* 2013). However, given that on average a person's closest group
450 of contacts, known as their support group, has been found to include around five members
451 (Dunbar and Spoons 1995), it is possible that many older adults will already have met this
452 number, or be close to it. The elucidation of these thresholds for close friendships is
453 important as they can allow those involved in loneliness and mental health interventions to
454 focus their limited resources on increasing social interaction opportunities for those with
455 few or no close friends. This would be with the ultimate aim of reducing the negative
456 physical and psychological impacts of loneliness as well as reducing the economic cost and
457 strain on health services associated with loneliness. As research has previously shown that
458 perceived quality of relationships has a protective effect against loneliness (Hawkley *et al.*
459 2008; Pinquart 2003), those with more friendships than a threshold could be encouraged to
460 improve the quality and closeness of their friendships, rather than increase the number of
461 friends they have.

462 A successful intervention to reduce loneliness could include elements of the previously
463 successful "Friendship Program" (Hamid 1989). This program encourages reflection on
464 one's own aspirations for friendships as well as reflection on current friendships. It also
465 incorporates education around attitudes and experiences in the process of building

466 friendship. This includes actively utilising those already established but lesser used
467 connections for support and by encouraging a proactive approach to maintaining and
468 deepening friendships. The program has been found to both improve the quality of current
469 friendships as well to increase the number of friendships. Further benefits of improving the
470 quality of these relationships include this having increased resilience to adversity (Graber,
471 Turner and Madill 2016) and a more adaptive stress response (Calhoun *et al.* 2014).

472 Alternatively, these individuals could be included in interventions with the aim of
473 improving the other contributing factors to loneliness and psychological well-being such as
474 health status and mobility (Theeke 2009). These could include cognitive based
475 interventions to improve mobility (Marusic, Verghese and Mahoney 2018) and physical
476 activity interventions to improve mobility (Yeom, Keller and Fleury 2009) and health
477 status (Hwang and Braun 2015). As well as directly targeting psychological well-being with
478 the aim of reducing loneliness in tandem. In this regard, a variety of interventions have
479 been shown to be successful including psychotherapy and behavioural interventions
480 (Pinquart, Duberstein and Lyness 2007). In particular, reminiscence therapy has
481 repeatedly demonstrated a positive outcome in relation to depressive symptoms and
482 subjective wellbeing (for a review see Yen and Lin 2018). This type of therapy involves
483 recalling events from the past and sharing them with an observer or group who listen
484 without making comment.

485 The present study has a number of strengths. To our knowledge, it is the first to
486 explore the possibility of a curvilinear relationship between the quantity of close friends
487 and loneliness, as well as its associated psychological well-being outcomes in an older adult
488 population. It is also the first to assess the presence of break-points within this
489 relationship. As mentioned previously, for both of these analyses robust techniques were
490 employed to increase confidence in our findings.

491 We also explicitly focussed on close friendships and did not include any peripheral

492 friendships. This is because emotional closeness has repeatedly been shown to be more
493 important than network size and frequency and contact with friends in terms of loneliness
494 (Drageset, Kirkevold and Espehaug 2011; Hamid 1989; Williams and Solano 1983). Close
495 friends also appear to be more important than less close friends in regards to subjective
496 well-being (Horst and Coffé 2012). We asked participants specifically to include only
497 friends that they thought of as close, although the interpretation of a close friend was left
498 to the participant, this reduced any confusion about who to include in this number. This
499 clarity has not always been present in previous studies (e.g., Pinquart 2003; Savikko *et al.*
500 2005; Steed *et al.* 2007).

501 However, the current study is not without its limitations. Firstly, the present research
502 was an online study only available to those with access to the internet. Many older adults
503 do not have this access (Yu *et al.* 2016) and/or autonomy with internet use (Hargittai,
504 Piper and Morris 2019) and so the current findings are not representative of the UK
505 population. Second, the definition of a close friend was left to each participant's own
506 interpretation. Respondents were able to decide what a close friend meant to them, and to
507 allocate their personal contacts accordingly. Although in previous studies, similar to ours,
508 no definition for friendships has been given (e.g., Mullins and Dugan 1990; Russell *et al.*
509 2012), individual interpretations may differ between participants and providing an explicit
510 definition, such as in Williams and Solano's study (Williams and Solano 1983), may have
511 resulted in different findings. However, we believe that leaving this concept open to
512 interpretation allows for more accurate inclusion of those whom respondents feel close to,
513 rather than forcing them to exclude contacts based on a definition which may be
514 incompatible with respondents' own views. This is something that has been cautioned
515 against previously by Adams and colleagues (2000) who outline that it is not suitable to
516 assign a definition of friendship to individuals as many do not share the same criteria for
517 this type of relationship. Therefore, future research may benefit from repeating the study
518 to include face-to-face data collection for those without access to the internet and

519 potentially the incorporation of an established definition of a close friend and comparing if
520 this differs from a respondent's definition.

521 As mentioned previously we focussed on only close friendships. Doing so allowed the
522 determination of the number of high quality and rewarding friendships that individuals
523 should focus on to reduce loneliness and improve psychological well-being. This is
524 important as these emotionally close friendships require bilateral effort, time and other
525 resources to initiate and maintain and as such are more costly in comparison to less
526 emotionally close relationships (Roberts and Dunbar 2011). However, despite the
527 importance of these close relationships in terms of loneliness, more peripheral friendships
528 could still be having an impact on our outcome measures. It may be beneficial for future
529 work to take into account these friendships also.

530 Further, the present study did not explicitly take into account the impact of the
531 quality of friendships on loneliness and mental health. Although we have mentioned the
532 minority of participants who may have been experiencing low levels of closeness in the
533 friendships they reported, as participants were asked *specifically* about close friends, it is
534 likely that many of these contacts represent high quality relationships. Regardless, as the
535 quality of friendships has been linked to loneliness and mental health (e.g., Mullins and
536 Dugan 1990; Wheeler, Reis and Nezlek 1983), future studies would benefit from also
537 including the quality or emotional closeness of these friendships explicitly as a covariate to
538 determine whether the effect of the number of friends remains after adjusting for this.

539 Similarly, the present study did not account for the types of support that can be
540 exchanged within friendships. Both emotional and instrumental support within social
541 networks have been shown to predict levels of loneliness (e.g., Sanchez, Gierveld and
542 Delgado 2012). Including the type support both given and received within close friendships
543 in future analyses could assist in unpicking the aspects of these friendships which are most
544 optimal in preventing loneliness in this age group.

545 It is important to note that the number of close friendships is not the only aspect of
546 an individual's social network with implications for loneliness within this age group.
547 Structural and compositional aspects of this network can also explain loneliness and its
548 associated negative outcomes. For example, it has been demonstrated that social network
549 size as well as brokerage and embeddedness can predict loneliness in older adults (Kim *et*
550 *al.* 2021). Compositionally, the presence of a romantic partner is protective against
551 loneliness (Martina 2021). This could potentially be due to the increased opportunity for
552 accruing additional friends within a social network. The inclusion of such parameters in
553 the above analyses would provide a deeper understanding of the effect of the number of
554 close friendships on loneliness in older adults after controlling for these aspects.

555 In terms of additional future directions, as well as a replication, and taking into
556 account the aforementioned issues, future research should establish who these close friends
557 are. We know that these are emotionally close relationships but is there a difference in the
558 impact on loneliness and psychological well-being in terms of the length of the relationship
559 and whether these contacts belong to a dense network? Is it preferable to have contact with
560 these friends in a certain way for a certain length of time or at a particular frequency? Or
561 is the content of the interactions more important? Previous research suggests that network
562 density is important in terms of happiness and subjective well-being (Huang *et al.* 2019)
563 and that frequency of contact has a differential effect on subjective well-being dependent on
564 the mode utilised (Horst and Coffé 2012). Therefore these nuances are possible and should
565 be explored in order to further inform interventions. Importantly, the current investigation
566 was cross-sectional in nature. It may well be possible that there is a limit to the benefit of
567 increasing the number of friendships over time. It also may be possible that having a larger
568 number of friends leads to improved well-being. However, we cannot rule out the possibility
569 of reverse causation. A longitudinal design would be necessary to determine this in future.

570 For now we conclude that there is a nonlinear relationship between the reported
571 number of friends and loneliness, depression, anxiety and stress in older adults. We further

572 conclude that based on the present data there appears to be a limit to the beneficial effect
573 of increasing the number of friends in this population. The findings are in need of
574 corroboration incorporating a more representative sample of this population and future
575 work is necessary to further qualify the nature of these friendships. However, these findings
576 have important implications in the development and provision of loneliness and
577 psychological well-being interventions.

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NA

Declaration of Conflicting Interests

The Authors declare that there is no conflict of interest

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