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1   **Social Capital and Suicide in Eleven European Countries: An Ecological Analysis**

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4   *Running title: Social capital and suicide*

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35

36 **Abstract**

37

38 *Background* 'Social capital' refers to the existence of voluntary community networks and

39 relationships based on trust, and the use of these networks and relationship to enable positive

40 social action. Social capital is positively associated with selected indices of mental health.

41

42 *Methods* We performed an ecological investigation of the relationship between social trust (as

43 one component of social capital) and national suicide rates in eleven European countries

44 (n=22,227).

45

46 *Results* There was an inverse relationship between social trust and national suicide rates (i.e. the

47 higher the social trust, the lower the suicide rate), after controlling for gender, age, marriage

48 rates, standardised income and reported sadness.

49

50 *Conclusions* Social capital may have a protective effect against suicide at national level. Multi-

51 level analysis, taking account of both group-level and individual-level variables, would help

52 clarify this relationship further and guide appropriate interventions at both group and individual

53 levels.

54

55

59   Social medicine

60   Community networks

61   Social capital

Background

The term 'social capital' [1] refers to the existence of voluntary community networks and relationships based on trust, and the use of these networks and relationships to enable positive social action. Examples of activities associated with high social capital in a society include volunteering for charities, engaging in 'community alert' schemes, organising local football leagues and voting in local elections. There is growing evidence of a positive relationship between social capital [1] and good mental health [2-6]. There is, however, a paucity of research about social capital and suicide.

Kushner and Sterk [7] re-analyzed Emil Durkheim's original data on suicide and social cohesion, and concluded that rates of suicide are often greatest among communities with *high* levels of social cohesion. Neeleman *et al* [8] studied rates of deliberate self harm in 73 south London electoral wards and found that rates of deliberate self harm in minority ethnic groups relative to the white group were low in some areas and high in others. This suggests that the relationship between ethnicity and deliberate self harm is both significant and complex, and may be affected by additional factors such as ethnic density, status integration, and the extent to which membership of a given ethnic group offers psychological and social support to the individual, or increased levels of social capital to the community.

In this ecological study, we used data from the European Social Survey (ESS) to investigate the relationship between suicide rates and social trust (as a component of social capital) in eleven European countries.

85

Methods

87

88   The European Social Survey (ESS) is an academically-driven social survey designed to study

89   attitudes, beliefs and behaviour patterns in European countries [9]. Full ESS data are available

90   on an open-access basis (www.europeansocialsurvey.org). We used ESS data relating to eleven

91   European countries: Switzerland, Germany, Spain, Finland, France, United Kingdom, Norway,

92   Poland, Portugal, Sweden and Slovakia. These ESS data were collected between 2003 and 2004.

93   We stratified data by country and gender, and extracted mean age, proportion married, mean

94   income and reported sadness. Income was categorised into twelve categories (category 1 was

95   less than Sterling £1,312 per year; category 12 was greater than £87,432). Income was

96   standardised using purchasing power parity (for actual individual consumption) conversion rates

97   (US$, 2003) from the Organisation for Economic Cooperation and Development

98   (http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE4). Sadness was measured by

99   asking each participant how often they felt sad in the previous week (a score of 1 meant 'none or

100   almost none of the time'; 4 meant 'all or almost all of the time').

101

102 We used three questions from the ESS to assess perceptions of social trust as a measure of social

103 capital, as previously described by Von dem Knesebeck *et al* [10]. The three questions were:

104

105   • "Generally speaking, would you say that most people can be trusted, or that you can't be

106   too careful in dealing with people? Please tell me on a score of 0 to 10, where 0 means

107   you can't be too careful and 10 means that most people can be trusted."

108   • "Do you think that most people would try to take advantage of you if they got the chance,

109   or would they try to be fair?"

110   • "Would you say that most of the time people try to be helpful or that they are mostly

111   looking out for themselves?"

112

113   The three questions used bipolar eleven point scales; an overall score for social trust was

114   calculated by summing the three items (i.e. the higher the score, the higher the social trust).

115

116   We obtained national suicide rates from the World Health Organization (WHO)

117   (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html). The

118   WHO suicide data (2002-2004) were selected to coincide as closely as possible with the ESS

119   data (2003-2004).

120

121   We analysed data using the Statistical Package for the Social Sciences [11]. We analysed

122   correlations using Pearson's test (r). We performed linear regression analysis with national

123   suicide rate (per 100,000 population per year) as the dependent variable; independent variables

124   were age, proportion married, standardised income, sadness and social trust.

125

126   **Results**

127

128   This analysis included 22,227 participants (10,443 male, 10,784 female) from eleven European

129   countries (Table 1). Mean age ranged from 42.57 years (males, Poland) to 52.10 years (females,

130   Portugal). Proportion married ranged from 57% (males, Sweden) to 80% (females, Portugal).

131   Mean standardised income ranged from US$327.29 (females, Portugal) to US$848.39 (males,

132   United Kingdom). Mean scores for sadness ranged from 1.25 (males, Finland) to 1.94 (females,

133   Slovakia). Social trust ranged from 12.18 (males, Poland) to 20.60 (females, Norway). National

134   suicide rates ranged from 3.3 suicides per 100,000 population per year (females, United

135   Kingdom) to 31.7 (males, Finland). None of these differences between groups were statistically

136   significant (p>0.05).

137

138   *Insert Table1, Table 2 and Figure 1 around here*

139

140   Proportion married was positively correlated with age (Pearson's r=0.528, p<0.05) and sadness

141   (r=0.654, p<0.01), and negatively correlated with standardised income (r=-0.477, p<0.05) and

142   suicide rate (r=-0.512, P<0.05) (Table 2). Social trust was positively correlated with

143   standardised income (r=0.755, p<0.01) and negatively correlated with sadness (r=-0.713,

144   p<0.01). There was no statistically significant bi-variable correlation between social trust and

145   suicide rate (r=-0.004, p>0.05) (Figure 1). On multi-variable analysis (adjusted r^2=47.9%),

146   suicide rate was inversely associated with sadness (p=0.004) and social capital (p=0.013) (Table

147   3).

148

149   *Insert Table 3 around here*

150

151   **Discussion**

152

8

153 This ecological analysis showed an inverse relationship between social trust (as a component of

154 social capital) and national suicide rate; i.e. the higher the social capital, the lower the suicide

155 rate. This relationship was not apparent on bi-variable testing but was apparent on multi-variable

156 testing. This suggests that at least one of the factors additionally controlled for in the multi-

157 variable analysis (age, proportion married, standardised income, sadness) acts as either a

158 negative confounder or an effect-modifier in the relationship between social trust and suicide

159 rate, at national level.

160

161 In order to be a confounder, the relevant factor would have to be independently related to both

162 variables of interest (social trust, suicide rate) and must not lie on a causal pathway between

163 them. In our analysis, sadness is the only factor that is independently related to both social trust

164 and suicide rate, but sadness does not fulfil the other criterion for being a negative confounder

165 because it is conceivable that sadness lies on a causal pathway between social trust and suicide

166 rate; i.e. social trust at national level could affect levels of sadness at national level which, in

167 turn, could affect suicide rate at national level. On this basis, it is not possible to conclude that

168 sadness is a simple negative confounder of the relationship between social trust and suicide,

169 although it still appears to be an effect-modifier, the precise significance of which requires

170 further study. It is also noteworthy that while sadness has a negative correlation with social trust,

171 it also has a negative correlation with suicide rate; i.e. the lower the sadness level, the higher the

172 suicide rate. The latter, counter-intuitive correlation merits closer examination both at national

173 level (to seek to explain it) and at individual level (to see if it holds true at individual level).

174

175 Our study has several strengths: we report data relating to eleven European countries; we

176 controlled for multiple variables through stratification (gender) and multi-variable linear

177 regression analysis (age, proportion married, standardised income, sadness); and our final model

178 accounted for 47.9% of variance in national suicide rates. Our study also has several limitations:

179 while we took account of certain independent variables (e.g. social trust, standardised income),

180 we did not take account of others (e.g. inequality); and while we controlled for 'sadness' in the

181 week prior to ESS interview, we did not control for formal mental illness (e.g. rates of depressive

182 disorder). Our study just looked at one component of social capital (social trust); further studies

183 are needed to examine other dimensions of social capital (e.g. voluntary work). In addition,

184 social capital is a property of communities rather than individuals and is, therefore, an essentially

185 'ecological' concept; as a result, all studies of social capital will be subject to the inherent

186 strengths and limitations of ecological study design.

187

188 We used ecological data from two different sources (ESS and WHO) which may have limited

189 comparability; i.e. whereas ESS data are based on samples from each country, WHO suicide

190 rates relate to each entire country. It is noteworthy, however, that ESS samples were generally

191 large (in this analysis, n= 22,227). Nonetheless, the validity of our findings is still dependent on

192 the validity of the ESS methodology, and while there have been several studies of the general

193 validity of the ESS (e.g. pre-testing of the questionnaire using interaction analysis) [12], it

194 remains possible that the validity of at least some of the questions varies between countries; the

195 ongoing assessments of validity and continuous quality-improvement strategies within the ESS

196 methodology are likely to minimize but not entirely eliminate this concern.

197

198 Notwithstanding these considerations, our data suggest that social trust (as one component of

199 social capital) is negatively correlated with suicide rate, at national level. This is consistent with

200 some but not all of the existing literature in relation to social capital and mental health.

201 Weitzman and Kawachi [2], for example, found that students on campuses with higher-than-

202 average levels of social capital had a 26% lower individual risk for binge drinking than their

203 peers at other colleges. Boydell *et al* [6] found an inverse association between perceived social

204 cohesion and the incidence of psychosis in South London, while Rosenheck *et al* [4] reported

205 that areas with high social capital offered better housing to the homeless mentally ill. McCulloch

206 [3] found that people in the lowest categories of social capital had increased psychiatric

207 morbidity and Murray *et al* [13] reported that social participation was positively associated with

208 various indices of mental health, including positive affect and satisfaction with life.

209

210 The relationship between social capital and mental health is, however, likely to be complex:

211 Mitchell and LaGory [14] found that high levels of 'bonding' social capital were associated with

212 *increased* levels of mental distress. McKenzie *et al* [5] noted that people with psychoses in areas

213 of high perceived community safety had shown *higher* hospital readmission rates than those in

214 areas of low perceived safety. Kushner and Sterk [7] re-analyzed Durkheim's original data on

215 suicide and social cohesion, and concluded that rates of suicide are often greatest among

216 communities with *high* levels of social cohesion. Kusher and Sterk [7] draw particular attention

217 to Durkheim's classification of military suicide as "altruistic" (e.g. sacrificing oneself for one's

218 colleagues in battle) rather than "fatalistic", thus effectively eliminating this group of suicides

219 from further consideration in his work. Rather than resembling Durkheim's "altruistic" suicide,

220 however, military suicide more closely resembles Durkheim's "fatalistic" suicide, occurring in a

221 setting of high regulation, close interaction and, arguably, high social capital; i.e. within in a

222 close-knit community with considerable inter-dependence, shared goals and common activities.

223

224 When these, and other similar factors identified by Kushner and Sterk [7], are taken into account,

225 Durkheim's data do not provide strong support for a simple negative correlation between social

226 cohesion and suicide rate. At a conceptual level, it is useful to note that our analysis, consistent

227 with Kushner and Sterk's re-analysis of Durkheim's data [7], did not identify a simple,

228 significant bi-variable correlation between social trust and suicide rate: we only identified the

229 relationship between social trust and suicide rate on multi-variable analysis, which also provided

230 evidence that this relationship is modified by "sadness", at national level. It is important to note,

231 however, that Durkheim's data were collected, analysed and interpreted at various different

232 levels (individual, community and national), while our data were analysed at national level:

233 direct comparison of results from these differing levels of analysis run the risk of the ecological

234 fallacy.

235

236 The ecological fallacy occurs when conclusions obtained through the analysis of data at the level

237 of groups (e.g. the conclusions in this study) are applied directly at the level of the individual. In

238 order to avoid this error, conclusions drawn from ecological studies should be (a) applied at the

239 level at which analysis occurred (in this study, at national level) and/or (b) used, mindfully, to

240 suggest directions for future research at individual level. Our findings, for example, suggest a

241 relationship between social trust and lower suicide rates at national level, but, because of the

242 ecological nature of our analysis, our findings do not indicate whether or not the individuals who

243 experience low social trust are the same as those who die by suicide.

244

245   Our findings do suggest, however, that it may be useful to conduct studies at the individual level

246   to see if this is the case. It may, for example, prove to be the case that low social trust has a

247   contextual effect; i.e. that it is not the individuals who experience low social trust who

248   necessarily die by suicide themselves, but that the presence of such individuals in a community is

249   associated with an *overall* increase in risk of suicide amongst *all* members of the community. If

250   this were the case, one might expect significant variation in rates of suicide and/or attempted

251   suicide between communities, such as those reported in 73 south London electoral wards [8]; this

252   merits closer study. In addition, the effect of social trust may, in turn, vary between

253   communities; Fitzpatrick *et al* [15], for example, provide that the psychological benefits of social

254   capital may not apply equally to all groups within a given community (e.g. homeless

255   individuals).

256

257   It is, again, important to bear in mind the ecological fallacy in the interpretation of these

258   findings. A range of individual-level risk factors have already been identified in relation to both

259   suicide and attempted suicide, and it is possible that social capital is related to some of these; the

260   elucidation of these inter-relationships would require a multi-level analytic approach which

261   would take appropriate, simultaneous account of both group-level and individual-level risk

262   factors. Our study suggests a relationship between social capital and sadness at national level,

263   but multi-level study is required to elucidate the inter-relationships between this kind of group-

264   level factor and various relevant individual-level factors, such as age, gender, mental illness,

265   substance misuse and physical illness [16,17,18].

266

267   **Conclusions**

268

269   Our analysis suggests there is an inverse relationship between social trust (as one component of

270   social capital) and suicide rate at national level in Europe; i.e. the higher the level of social trust

271   in a country, the lower the suicide rate. This is an ecological finding that is applicable at national

272   level, but which also suggests a useful direction for further research at the individual level. Both

273   quantitative and qualitative research methodologies would be helpful in determining the extent

274   and nature of the relationship between social capital and suicide rates, and the precise role of

275   sadness in modifying the relationship at national level. Multi-level analysis, which would take

276   simultaneous account of group-level and individual-level variables, would be especially useful in

277   determining the appropriate mix of public health and individual-level interventions likely to

278   assist in better understanding and addressing problems related to suicide at both national and

279   individual levels.

280 **Table 1. Gender, age, marital status, income, sadness, social trust and suicide rates for**

281 **males and females in eleven European countries[a]**

282

Country	Gender	n	Mean age (years)	Proportion married	Mean income category[b]	Standardised mean income (US$)[c]	Sadness in the past week[d]	Social trust[e]	Suicide rate per 100,000 population per year
Switzerland	Male	815	49.39	0.71	8.79	817.90	1.41	17.67	23.7
	Female	988	50.59	0.77	8.48	776.08	1.55	17.99	11.3
Germany	Male	1437	47.37	0.65	6.81	711.80	1.38	15.34	19.7
	Female	1479	48.15	0.73	6.37	633.35	1.59	15.49	6.6
Spain	Male	902	44.82	0.61	6.23	754.06	1.51	14.89	12.6
	Female	974	47.26	0.71	5.89	676.70	1.74	15.05	3.9
Finland	Male	919	47.45	0.64	7.28	688.98	1.25	18.95	31.7
	Female	977	49.95	0.70	6.75	604.88	1.33	19.67	9.4
France	Male	930	47.50	0.67	6.93	733.20	1.45	14.69	27.5
	Female	1056	48.79	0.70	6.41	640.48	1.71	14.81	9.1
United Kingdom	Male	1079	48.82	0.67	7.55	848.39	1.49	16.82	10.8
	Female	1315	50.52	0.74	6.99	740.16	1.61	16.92	3.3
Norway	Male	891	45.30	0.62	8.83	847.65	1.27	19.27	15.8
	Female	859	46.50	0.67	8.48	799.04	1.39	20.60	7.3
Poland	Male	815	42.57	0.67	3.58	360.94	1.57	12.18	27.9
	Female	906	45.52	0.75	3.42	331.79	1.80	12.60	4.6
Portugal	Male	863	49.49	0.73	4.95	451.07	1.67	12.92	17.5
	Female	1359	52.10	0.80	4.39	327.29	1.90	12.80	4.9
Sweden	Male	951	46.21	0.57	7.64	758.67	1.27	18.67	19.5
	Female	975	48.19	0.65	7.13	672.18	1.50	19.21	7.1
Slovakia	Male	841	42.70	0.65	4.06	497.10	1.83	13.00	23.6
	Female	896	44.07	0.74	3.74	420.14	1.94	13.23	3.6

283

284 *Notes*

285 ^a Data on gender, age, marital status, income, sadness and social trust (as one component of

286 social capital) are derived from the European Social Survey (ESS) [9]; data on national suicide

287 rates are derived from the World Health Organisation

288 (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html).

289 ^b Income was categorised into twelve categories (category 1 was less than Sterling £1,312 per

290 year; category 12 was greater than £87,432)

291 ^c Income was standardised using purchasing power parity (for actual individual consumption)

292 conversion rates (US$, 2003) from the Organisation for Economic Cooperation and

293 Development (http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE4)

294 ^d Sadness was measured by asking each participant how often they had felt sad in the previous

295 week (a score of 1 meant 'none or almost none of the time'; 4 meant 'all or almost all of the

296 time') [9]

297 ^e We used three questions from the ESS to assess perceptions of social trust as one component of

298 social capital, as previously described by Von dem Knesebeck *et al* [10] (see *Methods*).

299

300

301 **Table 2: Correlation matrix (Pearson's coefficients) for age, proportion married,**

302 **standardised income, sadness, social trust and suicide rates in eleven European countries** [a]

303

	Mean age	*Proportion married*	*Standardised income* [b]	*Sadness* [c]	*Social trust* [d]	*Suicide rate per 100,000 population per year*
Mean age	-	-	-	-	-	-
Proportion married	0.528 *	-	-	-	-	-
Standardised income [b]	0.199	-0.477 *	-	-	-	-
Sadness [c]	-0.063	0.654 **	-0.713 **	-	-	-
Social trust [a]	0.276	-0.380	0.755 **	-0.779 **	-	-
Suicide rate per 100,000 population	-0.315	-0.512 *	0.118	-0.475 *	-0.004	-

304

305 *Notes*

306 [a] Data on age, marital status, income, sadness and social trust (as one component of social

307 capital) are derived from the European Social Survey (ESS) [9]; data on national suicide rates are

308 derived from the World Health Organisation

309 (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html); Pearson's

310 coefficients (r) are shown.

311 [b] Income was standardised using purchasing power parity (for actual individual consumption)

312 conversion rates (US$, 2003) from the Organisation for Economic Cooperation and

313 Development (http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE4)

314   [c] Sadness was measured by asking each participant how often they had felt sad in the previous

315   week (a score of 1 meant 'none or almost none of the time'; 4 meant 'all or almost all of the

316   time') [9]

317   [d] We used three questions from the ESS to assess perceptions of social trust as one component of

318   social capital, as previously described by Von dem Knesebeck *et al* [10] (see *Methods*).
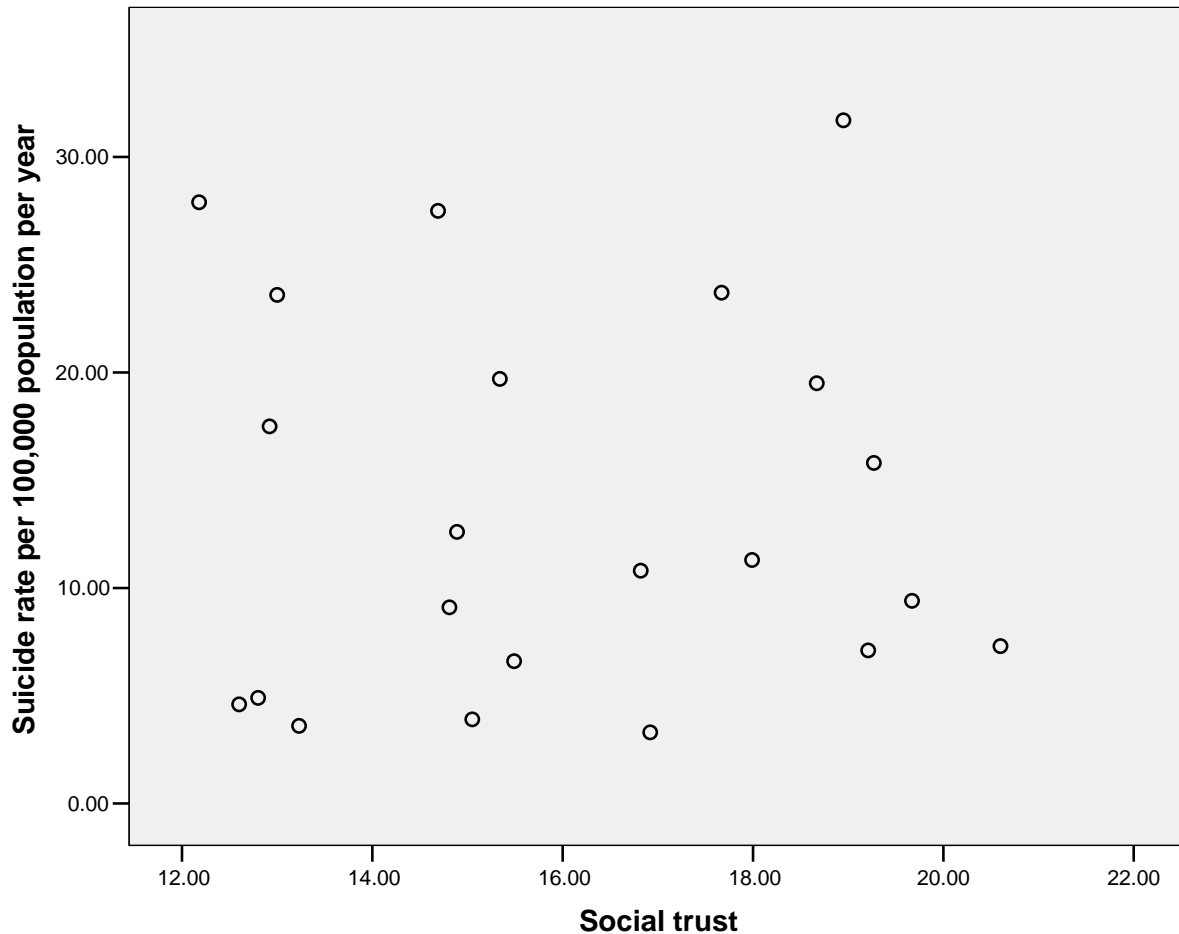
319   * Statistically significant with p<0.05 (two-tailed)

320   ** Statistically significant with p<0.01 (two-tailed)

321

322

323   **Figure 1: Scatter-plot of social trust and suicide rates in eleven European countries**

324

325

326   *Notes*

327   This scatter plot charts suicide rate per 100,000 population per year (Y-axis) against social trust

328   (as one component of social capital) (X-axis). We used three questions from the ESS [9] to

329   assess perceptions of social trust as one component of social capital, as previously described by

330   Von dem Knesebeck *et al* [10] (see *Methods*). Data on national suicide rates are derived from

331   the World Health Organisation

332   (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html).   On bi-

333   variable analysis, there was no statistically significant correlation between social trust and

334   suicide rate (r=-0.004, p>0.05) (Table 2) but on multi-variable, linear regression analysis (after

335   controlling for gender, age, proportion married, standardised income and sadness) there was a

336   statistically significant inverse relationship between social trust and suicide rate (p=0.013) (i.e.

337   the higher the social trust, the lower the suicide rate) (Table 3).

338

339

340

341 **Table 3: Multi-variable, linear regression analysis of age, age, proportion married,**

342 **standardised income, sadness and social trust in relation to suicide rates in eleven**

343 **European countries** [a]

344

Variable	ß	Standard error	95% confidence intervals		t	p
Constant	163.217	35.722	87.490	238.944	4.569	0.000
Mean age	-0.415	0.904	-2.332	1.501	-0.460	0.652
Proportion married	-7.436	53.024	-119.841	104.969	-0.140	0.890
Standardised income [b]	-0.004	0.014	-0.034	0.026	-0.289	0.777
Sadness [c]	-49.958	14.731	-81.187	-18.729	-3.391	0.004
Social trust [c]	-2.777	0.999	-4.895	-0.658	-2.779	0.013

345

346 *Notes*

347 [a] Data on age, marital status, income, sadness and social trust (as one component of social

348 capital) are derived from the European Social Survey (ESS) [9]; data on national suicide rates are

349 derived from the World Health Organisation

350 (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html); suicide

351 rate per 100,000 population per year is the dependent variable in this analysis; there were 22

352 groups in this analysis (one male group and one female group for each country); adjusted r^2 for

353 the model is 47.9%.

354 [b] Income was standardised using purchasing power parity (for actual individual consumption)

355 conversion rates (US$, 2003) from the Organisation for Economic Cooperation and

356 Development (http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE4)

357 *c* Sadness was measured by asking each participant how often they had felt sad in the previous

358 week (a score of 1 meant 'none or almost none of the time'; 4 meant 'all or almost all of the

359 time') [9]

360 *d* We used three questions from the ESS to assess perceptions of social trust as one component of

361 social capital, as previously described by Von dem Knesebeck *et al* [10] (see *Methods*).

362   *Declaration of Interest*

363

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