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

Running title: Social capital and suicide

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Abstract

Background 'Social capital' refers to the existence of voluntary community networks and relationships based on trust, and the use of these networks and relationship to enable positive social action. Social capital is positively associated with selected indices of mental health.

Methods We performed an ecological investigation of the relationship between social trust (as one component of social capital) and national suicide rates in eleven European countries (n=22,227).

Results There was an inverse relationship between social trust and national suicide rates (i.e. the higher the social trust, the lower the suicide rate), after controlling for gender, age, marriage rates, standardised income and reported sadness.

Conclusions Social capital may have a protective effect against suicide at national level. Multi-level analysis, taking account of both group-level and individual-level variables, would help clarify this relationship further and guide appropriate interventions at both group and individual levels.

Key words

Suicide

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.

Methods

The European Social Survey (ESS) is an academically-driven social survey designed to study attitudes, beliefs and behaviour patterns in European countries [9]. Full ESS data are available on an open-access basis (www.europeansocialsurvey.org). We used ESS data relating to eleven European countries: Switzerland, Germany, Spain, Finland, France, United Kingdom, Norway, Poland, Portugal, Sweden and Slovakia. These ESS data were collected between 2003 and 2004. We stratified data by country and gender, and extracted mean age, proportion married, mean income and reported sadness. Income was categorised into twelve categories (category 1 was less than Sterling £1,312 per year; category 12 was greater than £87,432). Income was standardised using purchasing power parity (for actual individual consumption) conversion rates (US$, 2003) from the Organisation for Economic Cooperation and Development (http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE4). Sadness was measured by asking each participant how often they felt sad in the previous week (a score of 1 meant 'none or almost none of the time'; 4 meant 'all or almost all of the time').

We used three questions from the ESS to assess perceptions of social trust as a measure of social capital, as previously described by Von dem Knesebeck *et al* [10]. The three questions were:

- "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people? Please tell me on a score of 0 to 10, where 0 means you can't be too careful and 10 means that most people can be trusted."

- "Do you think that most people would try to take advantage of you if they got the chance, or would they try to be fair?"
- "Would you say that most of the time people try to be helpful or that they are mostly looking out for themselves?"

The three questions used bipolar eleven point scales; an overall score for social trust was calculated by summing the three items (i.e. the higher the score, the higher the social trust).

We obtained national suicide rates from the World Health Organization (WHO) (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html). The WHO suicide data (2002-2004) were selected to coincide as closely as possible with the ESS data (2003-2004).

We analysed data using the Statistical Package for the Social Sciences [11]. We analysed correlations using Pearson's test (r). We performed linear regression analysis with national suicide rate (per 100,000 population per year) as the dependent variable; independent variables were age, proportion married, standardised income, sadness and social trust.

Results

This analysis included 22,227 participants (10,443 male, 10,784 female) from eleven European countries (Table 1). Mean age ranged from 42.57 years (males, Poland) to 52.10 years (females, Portugal). Proportion married ranged from 57% (males, Sweden) to 80% (females, Portugal).

Mean standardised income ranged from US$327.29 (females, Portugal) to US$848.39 (males, United Kingdom). Mean scores for sadness ranged from 1.25 (males, Finland) to 1.94 (females, Slovakia). Social trust ranged from 12.18 (males, Poland) to 20.60 (females, Norway). National suicide rates ranged from 3.3 suicides per 100,000 population per year (females, United Kingdom) to 31.7 (males, Finland). None of these differences between groups were statistically significant ($p>0.05$).

Insert Table1, Table 2 and Figure 1 around here

Proportion married was positively correlated with age (Pearson's $r=0.528$, $p<0.05$) and sadness ($r=0.654$, $p<0.01$), and negatively correlated with standardised income ($r=-0.477$, $p<0.05$) and suicide rate ($r=-0.512$, $P<0.05$) (Table 2). Social trust was positively correlated with standardised income ($r=0.755$, $p<0.01$) and negatively correlated with sadness ($r=-0.713$, $p<0.01$). There was no statistically significant bi-variable correlation between social trust and suicide rate ($r=-0.004$, $p>0.05$) (Figure 1). On multi-variable analysis (adjusted $r^2=47.9\%$), suicide rate was inversely associated with sadness ($p=0.004$) and social capital ($p=0.013$) (Table 3).

Insert Table 3 around here

Discussion

This ecological analysis showed an inverse relationship between social trust (as a component of social capital) and national suicide rate; i.e. the higher the social capital, the lower the suicide rate. This relationship was not apparent on bi-variable testing but was apparent on multi-variable testing. This suggests that at least one of the factors additionally controlled for in the multi-variable analysis (age, proportion married, standardised income, sadness) acts as either a negative confounder or an effect-modifier in the relationship between social trust and suicide rate, at national level.

In order to be a confounder, the relevant factor would have to be independently related to both variables of interest (social trust, suicide rate) and must not lie on a causal pathway between them. In our analysis, sadness is the only factor that is independently related to both social trust and suicide rate, but sadness does not fulfil the other criterion for being a negative confounder because it is conceivable that sadness lies on a causal pathway between social trust and suicide rate; i.e. social trust at national level could affect levels of sadness at national level which, in turn, could affect suicide rate at national level. On this basis, it is not possible to conclude that sadness is a simple negative confounder of the relationship between social trust and suicide, although it still appears to be an effect-modifier, the precise significance of which requires further study. It is also noteworthy that while sadness has a negative correlation with social trust, it also has a negative correlation with suicide rate; i.e. the lower the sadness level, the higher the suicide rate. The latter, counter-intuitive correlation merits closer examination both at national level (to seek to explain it) and at individual level (to see if it holds true at individual level).

Our study has several strengths: we report data relating to eleven European countries; we controlled for multiple variables through stratification (gender) and multi-variable linear regression analysis (age, proportion married, standardised income, sadness); and our final model accounted for 47.9% of variance in national suicide rates. Our study also has several limitations: while we took account of certain independent variables (e.g. social trust, standardised income), we did not take account of others (e.g. inequality); and while we controlled for 'sadness' in the week prior to ESS interview, we did not control for formal mental illness (e.g. rates of depressive disorder). Our study just looked at one component of social capital (social trust); further studies are needed to examine other dimensions of social capital (e.g. voluntary work). In addition, social capital is a property of communities rather than individuals and is, therefore, an essentially 'ecological' concept; as a result, all studies of social capital will be subject to the inherent strengths and limitations of ecological study design.

We used ecological data from two different sources (ESS and WHO) which may have limited comparability; i.e. whereas ESS data are based on samples from each country, WHO suicide rates relate to each entire country. It is noteworthy, however, that ESS samples were generally large (in this analysis, n= 22,227). Nonetheless, the validity of our findings is still dependent on the validity of the ESS methodology, and while there have been several studies of the general validity of the ESS (e.g. pre-testing of the questionnaire using interaction analysis) [12], it remains possible that the validity of at least some of the questions varies between countries; the ongoing assessments of validity and continuous quality-improvement strategies within the ESS methodology are likely to minimize but not entirely eliminate this concern.

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

setting of high regulation, close interaction and, arguably, high social capital; i.e. within in a close-knit community with considerable inter-dependence, shared goals and common activities.

When these, and other similar factors identified by Kushner and Sterk [7], are taken into account, Durkheim's data do not provide strong support for a simple negative correlation between social cohesion and suicide rate. At a conceptual level, it is useful to note that our analysis, consistent with Kushner and Sterk's re-analysis of Durkheim's data [7], did not identify a simple, significant bi-variable correlation between social trust and suicide rate: we only identified the relationship between social trust and suicide rate on multi-variable analysis, which also provided evidence that this relationship is modified by "sadness", at national level. It is important to note, however, that Durkheim's data were collected, analysed and interpreted at various different levels (individual, community and national), while our data were analysed at national level: direct comparison of results from these differing levels of analysis run the risk of the ecological fallacy.

The ecological fallacy occurs when conclusions obtained through the analysis of data at the level of groups (e.g. the conclusions in this study) are applied directly at the level of the individual. In order to avoid this error, conclusions drawn from ecological studies should be (a) applied at the level at which analysis occurred (in this study, at national level) and/or (b) used, mindfully, to suggest directions for future research at individual level. Our findings, for example, suggest a relationship between social trust and lower suicide rates at national level, but, because of the ecological nature of our analysis, our findings do not indicate whether or not the individuals who experience low social trust are the same as those who die by suicide.

Our findings do suggest, however, that it may be useful to conduct studies at the individual level to see if this is the case. It may, for example, prove to be the case that low social trust has a contextual effect; i.e. that it is not the individuals who experience low social trust who necessarily die by suicide themselves, but that the presence of such individuals in a community is associated with an *overall* increase in risk of suicide amongst *all* members of the community. If this were the case, one might expect significant variation in rates of suicide and/or attempted suicide between communities, such as those reported in 73 south London electoral wards [8]; this merits closer study. In addition, the effect of social trust may, in turn, vary between communities; Fitzpatrick *et al* [15], for example, provide that the psychological benefits of social capital may not apply equally to all groups within a given community (e.g. homeless individuals).

It is, again, important to bear in mind the ecological fallacy in the interpretation of these findings. A range of individual-level risk factors have already been identified in relation to both suicide and attempted suicide, and it is possible that social capital is related to some of these; the elucidation of these inter-relationships would require a multi-level analytic approach which would take appropriate, simultaneous account of both group-level and individual-level risk factors. Our study suggests a relationship between social capital and sadness at national level, but multi-level study is required to elucidate the inter-relationships between this kind of group-level factor and various relevant individual-level factors, such as age, gender, mental illness, substance misuse and physical illness [16,17,18].

Conclusions

Our analysis suggests there is an inverse relationship between social trust (as one component of social capital) and suicide rate at national level in Europe; i.e. the higher the level of social trust in a country, the lower the suicide rate. This is an ecological finding that is applicable at national level, but which also suggests a useful direction for further research at the individual level. Both quantitative and qualitative research methodologies would be helpful in determining the extent and nature of the relationship between social capital and suicide rates, and the precise role of sadness in modifying the relationship at national level. Multi-level analysis, which would take simultaneous account of group-level and individual-level variables, would be especially useful in determining the appropriate mix of public health and individual-level interventions likely to assist in better understanding and addressing problems related to suicide at both national and individual levels.

Table 1. Gender, age, marital status, income, sadness, social trust and suicide rates for males and females in eleven European countries[a]

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

Notes

[a] Data on gender, age, marital status, income, sadness and social trust (as one component of social capital) are derived from the European Social Survey (ESS) [9]; data on national suicide rates are derived from the World Health Organisation (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html).

[b] Income was categorised into twelve categories (category 1 was less than Sterling £1,312 per year; category 12 was greater than £87,432)

[c] Income was standardised using purchasing power parity (for actual individual consumption) conversion rates (US$, 2003) from the Organisation for Economic Cooperation and Development (http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE4)

[d] Sadness was measured by asking each participant how often they had felt sad in the previous week (a score of 1 meant 'none or almost none of the time'; 4 meant 'all or almost all of the time') [9]

[e] We used three questions from the ESS to assess perceptions of social trust as one component of social capital, as previously described by Von dem Knesebeck *et al* [10] (see *Methods*).

Table 2: Correlation matrix (Pearson's coefficients) for age, proportion married, standardised income, sadness, social trust and suicide rates in eleven European countries [a]

	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 [d]	0.276	-0.380	0.755 **	-0.779 **	-	-
Suicide rate per 100,000 population	-0.315	-0.512 *	0.118	-0.475 *	-0.004	-

Notes

[a] Data on age, marital status, income, sadness and social trust (as one component of social capital) are derived from the European Social Survey (ESS) [9]; data on national suicide rates are derived from the World Health Organisation (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html); Pearson's coefficients (r) are shown.

[b] Income was standardised using purchasing power parity (for actual individual consumption) conversion rates (US$, 2003) from the Organisation for Economic Cooperation and Development (http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE4)

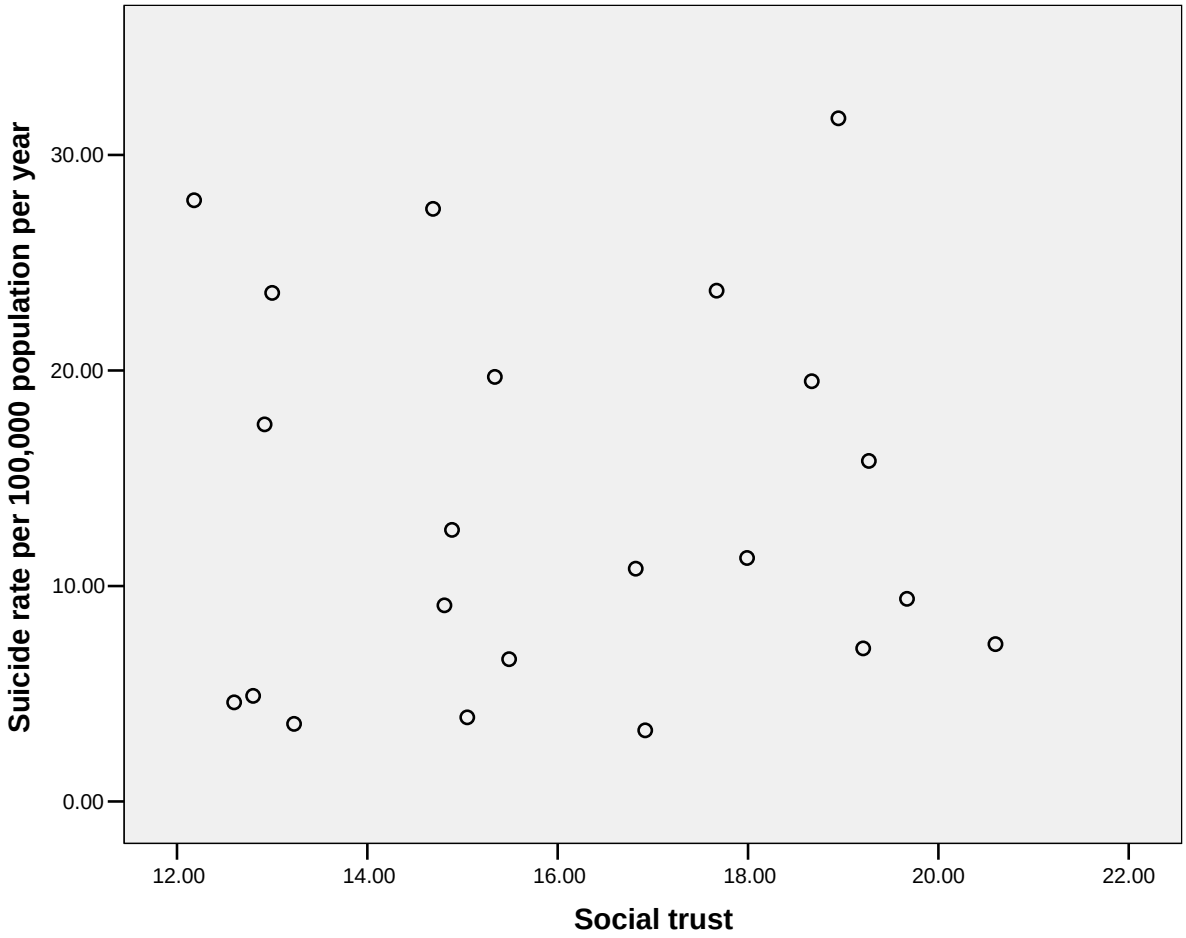
[c] Sadness was measured by asking each participant how often they had felt sad in the previous week (a score of 1 meant 'none or almost none of the time'; 4 meant 'all or almost all of the time') [9]

[d] We used three questions from the ESS to assess perceptions of social trust as one component of social capital, as previously described by Von dem Knesebeck *et al* [10] (see *Methods*).

* Statistically significant with $p<0.05$ (two-tailed)

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

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



Notes

This scatter plot charts suicide rate per 100,000 population per year (Y-axis) against social trust (as one component of social capital) (X-axis). We used three questions from the ESS [9] to assess perceptions of social trust as one component of social capital, as previously described by Von dem Knesebeck *et al* [10] (see *Methods*). Data on national suicide rates are derived from the World Health Organisation (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html). On bi-

variable analysis, there was no statistically significant correlation between social trust and suicide rate ($r=-0.004$, $p>0.05$) (Table 2) but on multi-variable, linear regression analysis (after controlling for gender, age, proportion married, standardised income and sadness) there was a statistically significant inverse relationship between social trust and suicide rate ($p=0.013$) (i.e. the higher the social trust, the lower the suicide rate) (Table 3).

Table 3: Multi-variable, linear regression analysis of age, age, proportion married, standardised income, sadness and social trust in relation to suicide rates in eleven European countries [a]

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

Notes

[a] Data on age, marital status, income, sadness and social trust (as one component of social capital) are derived from the European Social Survey (ESS) [9]; data on national suicide rates are derived from the World Health Organisation (http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html); suicide rate per 100,000 population per year is the dependent variable in this analysis; there were 22 groups in this analysis (one male group and one female group for each country); adjusted r^2 for the model is 47.9%.

[b] Income was standardised using purchasing power parity (for actual individual consumption) conversion rates (US$, 2003) from the Organisation for Economic Cooperation and Development (http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE4)

[c] Sadness was measured by asking each participant how often they had felt sad in the previous week (a score of 1 meant 'none or almost none of the time'; 4 meant 'all or almost all of the time') [9]

[d] We used three questions from the ESS to assess perceptions of social trust as one component of social capital, as previously described by Von dem Knesebeck *et al* [10] (see *Methods*).

Declaration of Interest

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