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Article

Social connections and suicidal behaviour in young Australian adults: Evidence from a case–control study of persons aged 18–34 years in NSW, Australia



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ABSTRACT

Purpose: There is evidence that social isolation is a risk factor for suicide, and that social connections are protective. Only a limited number of studies have attempted to correlate the number of social connections a person has in their life and suicidal behaviour.

Method: Two population-based case–control studies of young adults (18–34 years) were conducted in New South Wales, Australia. Cases included both suicides ($n=84$) and attempts ($n=101$). Living controls selected from the general population were matched to cases by age-group and sex. Social connections was the main exposure variable (representing the number of connections a person had in their life). Suicide and attempts as outcomes were modelled separately and in combination using conditional logistic regression modelling. The analysis was adjusted for marital status, socio-economic status, and diagnosis of an affective or anxiety disorder.

Results: Following adjustment for other variables, those who had 3–4 social connections had 74% lower odds of suicide deaths or attempts (OR=0.26, 95% CI 0.08, 0.84, $p=0.025$), and those with 5–6 connections had 89% lower odds of suicide deaths or attempts (OR=0.11 95% CI 0.03, 0.35, $p<0.001$), compared to those with 0–2 social connections. With the number of social connection types specified as a continuous variable, the odds ratio was 0.39 per connection (95% CI 0.27, 0.56, $p<0.001$).

Conclusions: A greater number of social connections was significantly associated with reduced odds of suicide or attempt. This suggests that suicide prevention initiatives that promote increased social connections at an individual, familial, and wider social levels might be effective.

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Introduction

Suicide is the leading cause of death among young people in Australia, accounting for 25% of all deaths in the age groups 15–30 years (ABS, 2012). Non-fatal suicidal behaviours are also particularly prevalent among young people (Martin, Swannell, Hazell, Harrison, & Taylor, 2010). A number of important risk factors for suicide among young people have been identified, including a psychiatric diagnosis, family history of suicide, stressful life events, and access to means

(Gould, Greenberg, Velting, & Shaffer, 2003). However, there is relatively limited research on protective factors for suicide.

Social connections (a person's subjective sense of having close and positively experienced relationships with others) (Seppala, Rossomando, & Doty, 2013, p. 412) are potential protective factors for suicide. At an individual level, family (closeness and caring from family) and school connections (a feeling of connection to the school environment) have been found to be associated with lower risk of suicide attempt in a cross-sectional survey of young people in the United States (Hall-Lande, Eisenberg, Christenson, & Neumark-Sztainer, 2007). Lower levels of social connections were associated with an increased risk of suicide attempt in a hospital-

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based case control study of adults (Compton, Thompson, & Kaslow, 2005). A longitudinal cohort of male health professionals by Kawachi et al. (1996), found that socially isolated men (not married, fewer than six friends or relatives, no membership in church or community groups) were at increased risk of death from accidents and suicides compared to men with the highest level of social networks. This suggests that people with a greater number of social connections may have lower risk of suicide than those with fewer social connections.

Social connections at the wider neighbourhood and societal level may also be protective factors for suicide, although there may be some differences across different cultural contexts. An ecological study, set in Japan, found that areas with higher feelings of social trust had lower suicide rates than areas those with lower social trust (Okamoto, Kawakami, Kido, & Sakurai, 2013), while a Dutch study found that higher levels of neighbourhood attachment, degree of interaction with neighbours, and responsibility for the environment were associated with lower suicide rates at an area level (Kunst, van Hooijdonk, Droomers, & Mackenbach, 2013).

Social support is a multifactorial “metaconstruct” comprised of several different theoretical constructs (Vaux, 1988). Four of the main constructs studied in social support research include emotional (demonstrations of love and caring, esteem and value, encouragement, and sympathy), informational (provision of facts or advice), instructional (offering or supplying behavioural or material assistance with practical tasks or problems), and appraisal support (the communication of information that which is relevant to self-evaluation). These different types of support may operate separately or together (Thoits, 2011). For example it is likely that social support provides an avenue for persons to feel as though they matter to others, leading to greater self-esteem. Advice from others about problems may also lead to behavioural changes and reduce perceived life problems and stressors.

Other perspectives relevant to the social support literature (particularly measurement of social support) is whether the support is received or perceived. Measures of received social support refer to the specific supportive behaviours provided to recipients by their support networks (Haber, Cohen, Lucas, & Baltes, 2007). Perceived social support measures refer to a recipients’ perception of the general availability of support and/or global satisfaction with support provided (Haber et al., 2007). There is considerable evidence that perceived social connections have a greater influence on health outcomes than received social support (Thoits, 2011; Turner & Marino, 1994).

Researchers have further posited that social support may have either (or both) a main or buffering effect on mental health (Cohen & Wills, 1985). The buffering effect suggests that social support protects (i.e., buffers) people from the adverse effects of stress by influencing appraisal and coping (Lakey & Orehek, 2011). The main effects suggests that social support promotes mental health by providing persons with regular positive experiences and a set of stable, socially rewarded roles. Cohen and Wills (1985 p. 311) argue that this provides positive affect, a sense of predictability and stability and self-worth. Evidence from meta-analytic studies suggests that the main effects of social support on mental health is stronger than buffering effects (Lakey & Cronin, 2008; Lakey & Orehek, 2011).

There have been no studies on the number of social connections in a person’s life and suicidal behaviour in Australia, and none focusing on young adults. Such information would be important to informing suicide prevention efforts for young people. Accordingly, the aim of the present study is to examine the number of social connections in those persons who have attempted or died by suicide compared to living controls using two population-based case–control studies of young adults (18–34 years) set in Australia. We use the term case to refer to those who died by or attempted suicide in the context of the case–control study design employed. In using these terms, we do not

wish to underrepresent the experience or complexity of experience among these people but are using these terms for the sake of brevity.

Methods

Study design

Two population-based case–control studies (matched for age and gender) covering metropolitan and rural population catchments of New South Wales (NSW) (Australia)—one of suicide and one of attempted suicide—were combined to investigate associations between social connections and suicidal behaviour in young adults aged between 18 and 34 years.

Case selection

The inclusion criteria for deaths were that they were coronial-determined cases of intentional self-harm, which is the official terminology for suicide deaths in the National Coronial Information System (NCIS) database and in coronial records. Cases had to have resided in the sample areas. The inclusion criteria for attempts were that the person had been admitted to a hospital ED for intentional self-harm and been treated by a doctor. Further details on the process for including cases are below.

Suicides

Information on coronial-determined suicides was obtained from the NCIS for the Coronial Court jurisdictions of Sydney, Westmead, Wollongong, Newcastle, Maitland, East Maitland, Bathurst, Orange and Dubbo, NSW, for the period 2003–2008. The authors conducted coronial file audits to identify and enumerate contact details for the next-of-kin (NOK) or significant others. Staff at the Department of Forensic Medicine then assessed the list of NOK to exclude those who had previously requested no further contact with the Department. Project information and an invitation to participate in the study were sent on behalf of the Chief Forensic Pathologist, NSW. Eligible proxies for the interview had to have a close relationship with the person who had died or attempted suicide, and thus be knowledgeable about the past and recent circumstances of a persons’ life.

After potential participants were selected according to the inclusion criteria above, social workers employed by the NSW Department of Forensic Medicine who were in contact with NOK provided advice on who should not be contacted, based on their understanding of NOK emotional and life circumstances and their amenability to participate in the project.

Of the 219 potential suicides in the coronial data extracted by the authors, 120 cases were contacted to participate in the study. The reasons for exclusion ($n=99$ cases) was based on advice from social workers concerning specific clinical circumstances of next-of-kin and their likely amenability to participate, an inability to locate respondents because of change in address, and all cases of murder-suicide. The participation rate from the 120 cases contacted was 70%. Consenting next-of-kin of suicide cases ($n=84$) participated in face-to-face interviews to collect information on socio-demographic factors, life events and other antecedent circumstances of the suicide case.

Suicide attempts

343 Potential participants (young adults admitted to hospital following a suicide attempt) were approached by hospital staff and invited to participate in the study. Of these, 38% could not be

contacted or were unable to complete an interview due to their mental state, and two young people were verified to have died subsequently. Contacts to confirm interviews were made with 214 young adults, and interviews were conducted with 101 (47%).

Control selection

The sampling frame for population-based controls was provided by the Australian Bureau of Statistics (ABS) and derived from the Census of Population and Housing and the Monthly Population Survey (MPS) design framework. Census Collection Districts (CDs) were selected systematically according to the Socio-Economic Index of Economic Resources (SEIFA) (ABS, 2013) and corresponded to the Local Government Area (LGA) characteristics covered by the coronial and hospital jurisdictions described above. CDs were selected such that there was an 80% probability that the residences contained young adults for strata matching to the sex and age group (within 2–3 years) of the cases.

Suicide controls

Controls aged 18–34 years were recruited from the general population in urban and regional areas of NSW. Consenting young adults (matched by age-group and sex to cases) were asked to nominate an informant (next of kin or relative) for interview to compare with the third-person respondent interview relating to suicide cases.

Suicide attempter controls

Consenting young adults aged 18–34 years (matched by age and sex to attempted suicide cases) were recruited from the population catchments of the hospitals where the attempted suicide cases were recruited. They were invited to participate in a first-person interview to complete a survey about their lives and circumstances to compare with the same information collected from first-person interviews of attempted suicide cases.

Survey and interview format

The questionnaire was derived from standard psychiatric and psychological instruments, in the National Survey of Mental Health and Well-Being (NSMHWB) and standard population surveys (particularly the Australian Health Survey) and the Australian Census. The World Health Organization Composite (WHO) International Diagnostic Interview (CIDI) was used to collect information on self-reported mental health symptoms, which were used to score ICD-10 mental disorder diagnosis (Andrews & Peters, 1998; Peters & Andrews, 1995; Wittchen, 1994).

The interview questions focused on the following domains: (1) socio-demographic factors, including income, education, occupation, employment status, and marital status. We also collected information on religion, country of birth, living arrangement (e.g., who the person was living with), income and whether the person had any children, and: (2) high prevalence psychiatric disorders, affective disorders (F30–F34), and anxiety disorders (F40–F43), ascertained through the CIDI interview. The questionnaire was developed for electronic collection of responses via a laptop computer during the interview. Trained clinical interviewers with health, medical, social work or psychology qualifications interviewed cases and controls.

Outcome variables

The primary outcome variable was suicide or attempted suicide, which were combined in order to achieve greater statistical power for the analysis. The secondary outcome variables were suicide and suicide attempt assessed separately.

Social connectedness variables

Social connection is defined by Seppala et al. (2013) as “a person’s subjective sense of having close and positively experienced relationships with others in the social world.” We focus on the perceived social support, which we conceptualise as having a main effect on suicide risk. The items we used to measure social support were based on the provision of emotional and instrumental support.

However, the data used to assess social connection represented individual, community and societal connections. Therefore, from the perspective of measurement, the following definition, from Lee and Robbins (1995), relates more closely to our study: “The term social connectedness represents one’s subjective sense of connection not only to close others but to the whole social world, which includes close others, strangers, and the community at large” (Lee & Robbins, 1995, pp. 232–241, cited in Seppala et al., 2013, p. 415).

These variables were coded with binary responses (‘Yes’, ‘No’) to the following:

- Individual level connections: Do you have good friends living near you? Do you have family living near you that you get on with? If you have work- [or school-] related problems do you have someone you can talk to, if you want to? Is there someone on whom you can rely-for help or to talk to? Is there one person with whom you have a close confiding relationship? Is there anyone who is dependent on you for care? Is there anyone who is dependent on you financially? Is there anyone who is dependent on you emotionally? If you needed \$500 for an emergency would you have it yourself or could you easily borrow it?
- Community level connections: Do you belong to any clubs, societies, groups, and did you attend more than 1 of their activities in the last year? Do you have neighbours you get on with, and you do things for each other? Does your local community feel like a home? Does your area have a reputation for being unsafe?
- Societal level connections: Do you take an interest in the news (radio, TV, or paper) on a regular basis? After testing the associations between these variables and the combined suicidal behaviour outcome (e.g., deaths and attempts) in multivariate logistic regression, we also developed an index that quantified the number of social connections per person, as described below.

Confounders

The selection of covariates was guided by the development of a directed acyclic graph (Fleischer & Diez Roux, 2008) and informed by relevant literature. Variables that were plausible common causes (confounders) of both social connectedness and suicide and attempted suicide were included in analyses (Fleischer & Diez Roux, 2008). Possible confounding variables included employment status (unemployed, student, not in the labour force (NILF), employed), and marital status (married/de facto, never married, or separated/divorced). Common mental disorders such as anxiety and/or affective disorder experienced in the previous twelve months before the interview were also included as predictors in the analyses. We matched cases and controls by age and sex.

Socio-economic status (SES) was also considered as a potential confounder and measured through a combined education–income

measure, and has been described previously (Milner et al., 2013; Page et al., 2014; Taylor, Page, Morrell, Carter, & Harrison, 2004). Education was coded as an ordinal variable: high school education or less, post-school training such as certificate or diploma, and university qualification. Income (AUD) was coded as annual household income: \$29,999 or less, \$30,000–\$69,999, and \$70,000 and over. The income–education measure combined the three levels of household income and education to result in an index with five levels. Bivariate analyses of the SES index with suicide and attempts (separately by sex) indicated that the index could be reduced to three levels (low, medium and high education–income) with a reasonably linear gradient of odds ratios (ORs) for the outcome variables, by grouping the lower two categories and upper two categories together. This produced a composite socio-economic (SES) measure of ‘low’, ‘middle’, and ‘high’ SES groups.

Statistical analysis

Conditional logistic regression models (matching for five-year age group and sex) were used to assess the effects of the study variables on the likelihood of suicide and/or suicide attempt (together and separately).

Initial univariate analyses were used to estimate unadjusted ORs for suicidal behaviour in relation to each of the individual, community and societal social connection variables specified above. The relationship between social connections and suicidal behaviour was then assessed after controlling for the other possible confounders.

An index of social connections representing the number of connections a person had at the time of interview (either from first-person interviews for suicide attempts or with the next of kin for suicide deaths) was developed. This was based on the six social

connectedness variables (described above) found to be significant (at $p < 0.05$) in the multivariate conditional logistic regression models. The social connections index therefore included between 0 and 6 connections per person. We further categorised this index of social connections into three levels based on the observed distribution of the continuous social connections measure (0–2, 3–4, or 5–6 social connections).

We analysed the relationship between the social connection index as a categorical variable (0–2, 3–4, or 5–6 social connections), and suicide death and attempts (combined outcome). We also assessed whether there was a linear relationship between the number of social connections and suicide deaths and attempts by modelling the social connection variable as a continuous measure (for the combined suicide or attempted suicide outcomes). Following this, we examined suicide deaths and attempts as separate outcomes using the same predictor variables and confounders in two multivariate models. All analyses were conducted using Stata version 12.1 (StataCorp, 2012).

Results

For the suicide case–control analysis, there were 71 male and 13 female ($n=84$) suicides matched by age group and sex with 223 community controls. For the attempted suicide case–control analysis, 32 males and 69 females cases were matched with 239 community controls. Most suicide deaths occurred among those aged 30–34 years (41.7%) and 25–29 years (33.3%), with 20% from those aged 20–24 years, and 5% from those aged 18–19 years. Among the attempted suicides, the highest proportions comprised those aged 20–24 years and 30–34 years (37.5% in each age group), with 15.6% from those

Table 1
Association between social connection variables and suicidal behaviour in young adults aged 18–34 years, NSW, Australia.

		Case	Cont.	Unadjusted			Adjusted		
				OR	95% CI	p Value	OR	95% CI	p Value
Club membership and attendance	Yes	67	277	0.42	0.30, 0.60	< 0.001	0.57	0.38, 0.87	0.009
	No	118	212	1.00			1.00		
Good friends live close by	Yes	139	431	0.42	0.27, 0.65	< 0.001	0.63	0.37, 1.09	0.099
	No	46	58	1.00			1.00		
Family members live close by	Yes	141	394	0.76	0.50, 1.15	0.192	0.87	0.53, 1.43	0.577
	No	44	95	1.00			1.00		
Talk about school/work problems	Yes	153	456	0.33	0.19, 0.57	< 0.001	0.52	0.27, 1.01	0.050
	No	32	31	1.00			1.00		
Is there someone on whom you can rely-for help or to talk to?	Yes	169	479	0.24	0.10, 0.54	0.001	0.68	0.25, 1.87	0.455
	No	16	10	1.00			1.00		
Have close confiding relationship	Yes	155	466	0.28	0.16, 0.52	< 0.001	0.45	0.22, 0.93	0.033
	No	28	22	1.00			1.00		
Help neighbours	Yes	90	302	0.53	0.37, 0.76	0.001	0.63	0.41, 0.95	0.029
	No	94	181	1.00			1.00		
Have emotional dependents	Yes	106	320	0.65	0.45, 0.94	0.022	0.79	0.51, 1.22	0.286
	No	78	162	1.00			1.00		
Others dependent on you for care	Yes	49	168	0.68	0.44, 1.02	0.063	0.85	0.50, 1.36	0.452
	No	136	321	1.00			1.00		
Financial dependents	Yes	42	153	0.51	0.33, 0.79	0.002	0.73	0.42, 1.25	0.253
	No	143	335	1.00			1.00		
Community feels like home	Yes	119	401	0.43	0.29, 0.64	< 0.001	0.71	0.42, 1.16	0.178
	No	59	80	1.00			1.00		
Live in an unsafe area	Yes	35	98	0.94	0.61, 1.45	0.777	0.81	0.48, 1.37	0.441
	No	98	388	1.00			1.00		
Could borrow \$500 from another person	Yes	165	481	0.11	0.05, 0.27	< 0.001	0.28	0.10, 0.77	0.014
	No	20	8	1.00			1.00		
Interested in the news	Yes	112	395	0.33	0.22, 0.4	< 0.001	0.46	0.28, 0.73	0.001
	No	71	91	1.00			1.00		

Notes: Unadjusted and adjusted odds ratios (95% CIs) of suicide deaths and attempts from conditional logistic regression. Cases matched by 5-year age strata and sex. Adjusted analysis includes mental disorder (affective disorders, and anxiety disorders), socio-economic status based on composite measure of household income and educational achievement (low, medium, high), employment status (unemployed, student, not in the labour force (NILF), employed) and relationship status (separated/divorced, single, married).

aged 25–29 years, with 9.4% aged 18–19 years. A greater portion of those who attempted suicide had a mental disorder (79.4%) than those who died by suicide (48.8%).

The majority of those who attempted suicide did so by overdosing on medications and other drugs, while a number also engaged in self-harming behaviours such as cutting. The main method of suicide was by hanging (51%), with other methods including drug toxicity, carbon monoxide poisoning, jumping, gunshot, self-immolation and vehicular crash.

Club membership and attendance (OR=0.57, 95% CI 0.38, 0.87, $p=0.009$); being interested in news (OR=0.46, 95% CI 0.28, 0.73, $p=0.001$); helping neighbours (OR=0.63, 95% CI 0.41, 0.95 $p=0.029$); having at least one close confiding relationship (OR=0.45, 95% CI 0.22, 0.93, $p=0.033$); having someone that would be willing to lend \$500 (OR=0.28, 95% CI 0.10, 0.77, $p=0.014$); and having someone to talk to about school or work problems (OR=0.52, 95% CI 0.27, 1.01, $p=0.05$) significantly reduced the odds of suicide or suicide attempt compared to controls in adjusted analyses (Table 1). These variables were included in the social connection index.

Using the social connection index as a categorical measure, cases (combined suicide attempts and deaths) had significantly lower odds of having multiple social connections than controls (Table 2). Those who had 3–4 social connections had 74% lower odds of suicide (OR=0.26, 95% CI 0.08, 0.84, $p=0.025$), and those

with 5–6 connections had 89% lower odds of suicide (OR=0.11 95% CI 0.03, 0.35, $p < 0.001$), compared to those who with 0–2 social connections. With the number of social connection types specified as a continuous variable, the reduction in odds ratio was 39% for each additional social connection (OR=0.39 95% CI 0.27, 0.56, $p < 0.001$) (Table 3).

Analysing suicide deaths and attempts separately show similar effect sizes and patterns as to those above, but were statistically significant only with respect to suicide attempts. Results suggest that the social connections index was associated with significantly lower odds of deaths when measured as a continuous variable but not when measured as a categorical variable (Table 4).

Discussion

The present study shows that young adults who had a higher number of social connections had a reduced risk of suicide death or suicide attempt after controlling for other known risk factors. There was a clear dose–response relationship between the number of different social connections a person had in their life and their risk of suicide or attempted suicide.

When support variables were measured individually, attendance and membership in a club, having someone to talk about school and work problems with, helping neighbours, and being interested in the news (a proxy for being interested the world at large) and having a

Table 2
Number of social connections (measured as a categorical variable) and suicidal behaviour in young adults aged 18–34 years, NSW, Australia.

	Case	Control	Unadjusted			Adjusted		
			OR	95% CI	p Value	OR	95% CI	p Value
Number of connections								
5–6	72	336	0.07	0.03, 0.16	< 0.001	0.11	0.03, 0.35	< 0.001
3–4	92	148	0.22	0.09, 0.52	0.001	0.26	0.08, 0.84	0.025
0–2	22	10	1.00			1.00		
Mental disorder								
Yes	121	91	8.49	5.74, 12.56	< 0.001	7.20	4.63, 11.18	< 0.001
No	64	394	1.00			1.00		
Socio-economic status+								
Low	107	184	3.98	2.44, 6.48	< 0.001	2.69	1.49, 4.86	0.001
Med	47	146	1.83	1.08, 3.09	0.024	1.85	1.01, 3.41	0.047
High	31	155	1.00			1.00		
Employment status								
Unemployed	22	47	1.89	1.06, 3.37	0.030	1.17	0.58, 2.37	0.654
Student	3	9	1.15	0.30, 4.49	0.838	0.49	0.09, 2.80	0.422
NILF	54	96	2.24	1.47, 3.41	< 0.001	1.84	1.08, 3.15	0.026
Employed	106	335	1.00			1.00		
Relationship status								
Separated	27	18	8.60	4.16, 17.78	< 0.001	3.64	1.50, 8.85	0.004
Single	129	266	5.03	3.02, 8.37	< 0.001	3.63	2.03, 6.49	< 0.001
Married	29	201	1.00			1.00		

Notes: Number of social connections (measured as a categorical variable). Unadjusted and adjusted odds ratios (95% CIs) of suicide deaths and attempts from conditional logistic regression. Cases matched by 5-year age strata and sex. Adjusted analysis includes mental disorder (affective disorders, and anxiety disorders), socio-economic status based on composite measure of household income and educational achievement (low, medium, high), employment status (unemployed, student, not in the labour force (NILF), employed) and relationship status (separated/divorced, single, married).

Table 3
Number of social connections (measured as a continuous variable) and suicidal behaviour in young adults aged 18–34 years, NSW, Australia.

	Case	Control	Unadjusted			Adjusted		
			OR	95% CI	p Value	OR	95% CI	p Value
Number of social connections (continuous)								
			0.29	0.21, 0.40	< 0.001	0.39	0.27, 0.56	< 0.001
Mental disorder								
Yes	121	91	8.49	5.74, 12.56	< 0.001	7.19	4.63, 11.17	< 0.001
No	64	394	1.00			1.00		
Socio-economic status+								
Low	107	184	3.98	2.44, 6.48	< 0.001	2.65	1.47, 4.79	0.001
Med	47	146	1.83	1.08, 3.09	0.024	1.82	0.99, 3.34	0.053
High	31	155	1.00			1.00		
Employment status								
Unemployed	22	47	1.89	1.06, 3.37	0.030	1.18	0.59, 2.39	0.636
Student	3	9	1.15	0.30, 4.49	0.838	0.47	0.08, 2.66	0.390
NILF	54	96	2.24	1.47, 3.41	< 0.001	1.85	1.08, 3.17	0.024
Employed	106	335	1.00			1.00		
Relationship status								
Separated	27	18	8.6	4.16, 17.78	< 0.001	3.73	1.54, 9.04	0.004
Single	129	266	5.03	3.02, 8.37	< 0.001	3.70	2.07, 6.62	< 0.001
Married	29	201	1.00			1.00		

Notes: Number of social connections (measured as a continuous variable). Unadjusted and adjusted odds ratios (95% CIs) of suicide deaths and attempts from conditional logistic regression. Cases matched by 5-year age strata and sex. Adjusted analysis includes mental disorder (affective disorders, and anxiety disorders), socio-economic status based on composite measure of household income and educational achievement (low, medium, high), employment status (unemployed, student, not in the labour force (NILF), employed) and relationship status (separated/divorce, single, married).

Table 4
Number of social connections (measured as a categorical and continuous variable) and suicidal behaviour in young adults aged 18–34 years, NSW, Australia.

	Case	Control	Unadjusted			Adjusted		
			OR	95% CIs	p Value	OR	95% CIs	p Value
Suicide attempt								
<i>Number of social connections (categorical)</i>								
5–6	33	165	0.19	0.06, 0.53	0.002	0.06	0.01, 0.28	< 0.001
3–4	50	71	0.05	0.02, 0.15	< 0.001	0.22	0.05, 0.97	0.046
0–2	19	7	1.00			1.00		
<i>Number of social connections (continuous)</i>								
	102	243	0.26	0.15, 0.46	< 0.001	0.25	0.16, 0.38	< 0.001
			1.00			1.00		
Suicide death								
<i>Number of social connections (categorical)</i>								
5–6	39	171	0.17	0.03, 1.06	0.058	0.11	0.01, 1.04	0.054
3–4	42	77	0.49	0.08, 3.05	0.446	0.26	0.03, 2.36	0.23
0–2	3	3	1.00			1.00		
<i>Number of social connections (continuous)</i>								
	84	251	0.41	0.22, 0.76	0.005	0.36	0.21, 0.62	< 0.001
			1.00			1.00		

Notes: Unadjusted and adjusted odds ratios (95% CIs) of suicide from conditional logistic regression. Cases matched by 5-year age strata and sex. Adjusted analysis includes mental disorder (affective disorders, and anxiety disorders), socio-economic status based on composite measure of household income and educational achievement (low, medium, high), employment status (unemployed, student, not in the labour force (NILF), employed) and relationship status (separated/divorced, single, married).

close confiding relationship were significantly associated with lower odds of suicidal behaviour after adjustment for confounders. It is notable that individually significant social connections were associated with similarly lower odds ratios of suicidal behaviour (OR between 0.45 and 0.57). The exception was being able to borrow \$500 if the respondent needed it (OR=0.28). This finding suggests that a financial safety or security net is a relatively important protective factor for suicide or attempted suicide.

The results of this study are broadly consistent with previous research on social connections and suicide and attempted suicide (Compton et al., 2005; Hall-Lande et al., 2007). For example, in a sample of young adults attending Miami-Dade public school system, Joiner et al. (2009) documented the contribution of low family social support and the feeling “that one does not matter” to suicidal ideation. The authors interpreted these findings in terms of the Interpersonal-Psychological Theory of Suicide (Joiner et al., 2009), which argues that two interpersonal constructs, perceived burdensomeness and thwarted belongingness “instill the desire for death” as a necessary condition for suicidal behaviour. Although suicide ideation is not attempted suicide or suicide itself, it is likely to be relatively prevalent in young people; thus, this study lends support to the idea that a greater number of social connections are protective factors for suicide.

In addition to connections with immediate family and friends, the present study has shown significant relationships between social connections at the neighbourhood and societal level and suicidal behaviour. Variables such as club membership and attendance, and interest in the news have also been used in studies on “social capital”, defined in terms of high levels of interpersonal trust, norms of mutual aid and reciprocity in a community (Coleman, 1990; Lochner, Kawachi, Brennan, & Buka, 2003; Putnam, 1993). Social capital has been argued to be the “glue” that holds communities together (Putnam, 2000), and has been found to be associated with a wide range of health outcomes in a recent systematic review (Uphoff, Pickett, Cabieses, Small, & Wright, 2013), including being associated with lower rates of suicide (Helliwell, 2007; Kunst et al., 2013; Okamoto et al., 2013). However, the present study did not aim to assess social capital or measure this underlying construct. We focused instead on quantifying the number

of social connections cases and controls had in the lives of a sample of young people. Despite this, several variables in this study do overlap with variables considered to be important components of social capital. For example, club membership and attendances and helping neighbours could be considered an aspect of bonding social capital, emanating from relationships with those with similar socio-demographic and socioeconomic characteristics (Kim, Subramanian, & Kawachi, 2006).

Several limitations in our study need to be considered when interpreting its results. As mentioned above, we did not examine social capital as a construct, which is comprised of a wider range of factors than the items that were included in our study. We also are unable to assert that fewer social connections cause a greater risk of future suicide, since the present study is a cross-sectional observational study, despite their significant association with suicide and attempted suicide. Common to most case-control studies relying on self-report, recall bias associated with differences in responses between cases and controls may be contributing to the associations between social connectedness and suicide found here (Pouliot & De Leo, 2006). These issues may be compounded by interviewers who ask questions differently depending on whether the proxy or first person was a case or a control, thus introducing interviewer bias into the results. Nonetheless, there are numerous advantages of conducting interviews with proxies, as researchers are able to tailor questions to match the information provided for cases, and increase the number of factors for investigation.

We have used a combined endpoint of suicidal behaviour, which included suicide death and suicide attempt. There may be differential associations for each of these endpoints when considered separately, which would modify the estimate of association for the combined endpoint. However, we tested this and found results to be broadly similar. A strength of the study (compared to previous research) (e.g., Beautrais, Joyce, & Mulder, 1997; Brent et al., 1993; Charlton, 1995; Lesage et al., 1994) is that it used population-based cases and controls, which reduces the likelihood of biased exposure information and sample selection bias. Other strengths include its relatively large sample size compared to other case-control studies of suicide among adolescents and young adults (Beautrais et al., 1997; Brent et al., 1993; Charlton, 1995; Lesage et al., 1994); and the capacity to provide detailed information on risk and protective factors for suicidal behaviour. Past studies also have not had been able to examine both suicide attempt and deaths at the same time.

To conclude, our results suggest that it is not only personal and family relationships that are protective for suicidal behaviour, but also social connections and interests in wider society. The results also suggest a dose-response association between the number of social connections a person has and their odds of suicide. From a clinical and prevention perspective, this suggests that interventions that provide or encourage an interest in social connections at the individual, family and wider social level might be beneficial. In particular, we would highlight the importance of considering memberships in sporting and other clubs as potential protective factors, as well as forming bonds with peers at school and neighbours. Our results also underpin the importance of strong friend and family networks.

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