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National intelligence and suicide rate: an ecological study of 85 countries

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Abstract

According to de Catanzaro's (1981) evolutionary theory of human suicide, a threshold intelligence is necessary for suicidality. Intelligence and suicide mortality should thus be positively related. This prediction was tested and confirmed in an ecological study of 85 countries. National IQ was significantly positively related to the national male and female suicide rate. The relation was not attenuated when countries' per capita Gross Domestic Product and the type of national IQ estimation were controlled. The relation was still positive, though not statistically reliable, when three further indicators (rates of the divorced, aged, and unemployed), salient for suicide rates and available for a subset of 36 countries, were additionally partialed out. Further evidence for a positive relation of intelligence and suicide mortality is provided by the observation of excess suicide prevalence in the *Terman Genetic Study of Genius* sample, relative to the general population.

Keywords: Intelligence; Giftedness; Suicide; Theory of evolution; Individual differences; Cross-national differences; Sex; Ecological study; Terman study

1. Introduction

The question of a possible relationship between intelligence level and suicide has been largely neglected in the fields of individual psychological differences and suicidology. Intelligence is a term missing in the subject index of two authoritative, contemporary resources of suicidology, i.e., in the *Comprehensive Textbook of Suicidology* (Maris, Berman, & Silverman, 2000) and in the

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International Handbook of Suicide and Attempted Suicide (Hawton & van Heeringen, 2000). A subsection devoted to intelligence is found in a third major resource of suicidology, which is a book-length review of contemporary research findings (Lester, 2000, pp. 341–342, see references therein). However, all of the seven studies reviewed there were concerned with suicidal ideation or attempted suicide, rather than with completed suicide. The majority of the investigations addressed psychiatric conditions in clinical samples, rather than the general population. Also, not all of the studies adhered to rigorous standards of test-based intelligence measurement, but rather relied on parent ratings or clinicians' estimates. In other words, by design no study reviewed is suited for testing an association between intelligence and completed suicide.

However, higher intelligence in suicidal adolescents relative to control groups has been found by several other researchers, e.g., by Carls (1986) and Warnke, Friese, Trott, and Wewetzer (1996). Like the investigations reviewed by Lester (2000), clear limitations of these accounts are that they investigated attempted suicide rather than completed suicide, that they were based on clinical samples with psychiatric disorders as confounds, and that they employed retrospective designs. A further strand of indirect evidence is provided by the long recognised fact that suicide mortality is higher among college students than for same-age but less-educated young adults (Maris et al., 2000; Ross, 1969). Relatedly, at least one study reported above-average university grades for a sample of student suicides (Seiden, 1966). Study limitations such as population constraint, retrospective design, and psychiatric disorders as confounds also apply to these further lines of evidence.

The only theory-driven hypothesis of which I am aware that directly bears on the question of a relation of intelligence and suicide is found in the context of de Catanzaro's (1981) evolutionary theory of human suicide and self-damaging behaviour (see also de Catanzaro, 1984, 1986, 1991, 1992, 1995). The central argument of this theory is that "suicide will be most likely to occur when an individual has a dramatically reduced ability to contribute to his or her own inclusive fitness, defined as the welfare and reproduction of self and kin" (Buss, 1999, p. 94). Although this account represents a unified approach that is consistent with a wealth of epidemiological findings in suicide, it has received little attention outside the fields of evolutionary psychiatry (McGuire & Troisi, 1998, pp. 229–231) and evolutionary psychology (Buss, 1999, pp. 93–95; Gaulin & McBurney, 2001, pp. 302–304), with the account of Rubinstein (1986) being a notable exception to this neglect. A *Behavioral and Brain Sciences* target article introducing the theory faced criticism in open peer commentary (de Catanzaro, 1980), and the theory was not included in the compilation *Landmarks in 20th-Century Suicidology* (Shneidman, 2001). References to de Catanzaro's theory and his own empirical findings are only briefly mentioned in Maris et al. (2000, pp. 20, 27, 77, 82–83, 142, 157), and no reference thereof is found in Hawton and van Heeringen (2000).

The widespread neglect or rejection of this theory, as documented above, is unjustified. It is of note that the theory has been questioned on mere theoretical grounds (see de Catanzaro, 1980), whereas on the other hand empirical work has successfully tested predictions of this theory (e.g., Brown, Dahlen, Mills, Rick, & Biblarz, 1999; de Catanzaro, 1984, 1992, 1995).

One point in de Catanzaro's theory is salient for the present investigation: it is assumed that a threshold intelligence is necessary for suicidality (de Catanzaro, 1981, pp. 55, 65, 152, 154). This hypothesis is derived from the species generality of suicidal behaviour in humans and from cross-species differences in self-damaging behaviour. In other words, suicide is a human universal, but is

not found in nonhuman animals: "[...] it may take an intelligent animal to know when the situation is hopeless, to realize that purpose for life is removed in those circumstances, and that death can be self-induced" (de Catanzaro, 1981, p. 154).

A corollary of this hypothesis is that intelligence and suicide mortality should be positively related. This specific prediction is testable on an individual level as well as on an ecological level. I first discuss prevailing individual-level evidence for a positive relation of intelligence and suicide mortality, followed by a review of ecological-level evidence for this relation.

As concluded above, it appears that there is no sound individual-level study on the relation of intelligence and completed suicide. However, circumstantial evidence from the *Terman Genetic Study of Genius* (Holahan, Sears, & Cronbach, 1995; Oden, 1968), the longest follow-up study of the social sciences, yields an interesting insight. For this unique study 1528 gifted children (857 boys and 671 girls), who were on average eleven years old, were identified in Californian public schools during the years 1921/22 and were followed-up over the entire life cycle. The inclusion criterion was a Stanford-Binet IQ of 140 or higher, meaning that all study participants ranked within the 99th percentile of the population distribution of intelligence. The mean IQ of the group was 151. The sample contained such luminaries like the later eminent psychologist Lee J. Cronbach (Shavelson & Gleser, 2002).

As of 1960, 14 male and eight female suicides occurred in this group (Oden, 1968); as of 1970, 20 male and eight female suicides (Shneidman, 1971); and as of 1987, at a median participant age of almost 80 years, a total of 25 male and nine female suicides were known (Holahan et al., 1995, p. 220; Lester, 1991b). Suicide mortality within the Terman study sample has been repeatedly investigated (Lester, 1991a, 1991b; Oden, 1968; Shneidman, 1971; Tomlinson-Keasey, Warren, & Elliott, 1986; Warren & Tomlinson-Keasey, 1987). Intriguingly, any appreciation of the fact that suicide mortality was high in this cohort of highly intelligent individuals is absent in these accounts (see also Holahan et al., 1995, p. 21). This neglect is surprising because of the obviousness of the effect, as demonstrated in the following.

Assuming that over the 66-year observation period (1921/22 to 1987) a total of 100,828 person-years (1528 participants times 66 years) were observed during which 34 participants committed suicide yields a mean suicide density rate of 33 per 100,000 person-years over the observation period. This estimate is almost three times the contemporary suicide rate of the enrolment site for the Terman study, California (US Department of Health & Human Services, 1997). In turn, the contemporary Californian suicide rate is, due to widespread increases in suicide incidence over the 20th century, very likely an overestimate for the suicide rate of the 1910s birth cohort of the Californian general population. Further, since all other causes of mortality, as well as study attrition (Holahan et al., 1995, pp. 316–331), over the course of 66 years are not accounted for in the above calculation in which simply the maximum possible person-years figure was used, by necessity the above estimate is the lowest possible limit.

The lifetime suicide mortality for the gifted individuals of the Terman study was 2.25% which is roughly four times the suicide mortality for the general population. In their meta-analysis of the literature, Bostwick and Pankratz (2000) estimated the life-time suicide mortality for populations not suffering from affective disorders to be less than 0.5%. Similarly, Rossow and Amundsen (1995), in a 40-year follow-up study of 40,000 nineteen-year-old Norwegian military conscripts, reported a cumulative suicide mortality of 0.63% for those not diagnosed as alcohol abusers. Despite the fact that the latter prevalence figure is solely based on males who typically show a

suicide mortality several times higher than females, it is again roughly only one-quarter of the suicide mortality in the mixed-sex Terman study sample. The high suicide mortality in the Terman study is even more interesting in light of concurrent evidence of longevity (i.e., a lower total mortality, all causes combined) in this sample, relative to the corresponding general population birth cohort (Oden, 1968; Shneidman, 1971). As a consequence, by 1987 one in 11 male deaths and one in 19 female deaths in the Terman sample were from suicide (Lester, 1991a).

On the other hand, several points of objection to the observations from the Terman study may be raised with regards to the unusual amount of self-awareness, demand characteristics, desire to excel, and related sequelae that must have been experienced by the participants. They knew that they were selected for their likelihood of high achievement, and continued scientific investigation occurred precisely due to their exceptional intellectual abilities. The study context may well have influenced their behaviour and way of life, specifically, by exerting adverse effects due to concern about not living up to an assumed potential (cf. Warren & Tomlinson-Keasey, 1987, pp. 44–45): "The questionnaires Terman periodically sent the subjects repeatedly asked them to list their accomplishments, publications, honors, and awards. [...] Their letters to Terman often apologised for the fact that they had not done more with their lives."

There are two ecological-level studies on the relation of intelligence and suicide, the evidence from which is conflicting. Lester (1993) used data from Lynn (1980) to assess the association of regional differences in intelligence and suicide rate. Across 87 *Départments* (counties) of France, suicide rate was neither related to average intelligence ($r = -0.04$) nor to the population proportion of Institut de France members ($r = -0.05$). In a similar vein, Lester (1995) used data from Lynn (1979) for another ecological study bearing on the same question. Counter to the previous finding, across 12 regions of the United Kingdom and the Republic of Ireland regional intelligence was strongly positively associated with suicide rate ($r = 0.83$). Lester (1995) qualified this finding as most likely to be spurious, i.e., as a consequence of the concomitant variation of intelligence with socioeconomic indicators across regions. When urbanisation, infant mortality, and per capita income were accounted for in a multiple linear regression model, regional intelligence was not a salient predictor of regional suicide rate.

No ecological study has tested the de Catanzaro hypothesis on a cross-national level and accounted for sex. Internationally, suicide rate varies markedly, and sex differences in suicide rate are ubiquitous (Schmidtke et al., 1999). In order to test de Catanzaro's hypothesis cross-nationally, I used archival data sets providing national IQs as well as national male and female suicide rates for 85 countries around the world.

2. Method

National suicide rates by sex were obtained from Schmidtke et al. (1999), who reported contemporary figures for 82 countries. This compilation is comprised of three African countries (two East and one North African), 27 American countries (two North, six Central, and 12 South American, five Caribbean, and further two Oceanian), 18 Asian countries (seven West, seven South-Central, and four East Asian), and 34 European countries (10 North, eight South, seven West, and nine East European). Male and female suicide rates for three further countries, one American (Cuba), one Asian (Thailand), and one European (Slovakia), were retrievable

Table 1
National IQs and suicide rates of 85 countries

Country	National IQ	National suicide rate	
		Males	Females
Albania	90*	2.9	1.7
Argentina	96	9.7	3.7
Armenia	93*	3.9	1.7
Australia	98	21.5	5.0
Austria	102	34.2	1.7
Azerbaijan	87*	0.8	0.5
Bahamas	78*	2.4	0.0
Bahrain	83*	4.9	0.5
Barbados	78	8.9	2.2
Belarus	96*	55.7	9.4
Belgium	100	37.3	11.9
Belize	83*	1.1	1.0
Brazil	87	4.6	1.4
Bulgaria	93	25.3	9.7
Canada	97	21.5	5.4
Chile	93*	8.4	1.4
China	100	14.3	17.9
Colombia	89	4.9	1.3
Costa Rica	91*	7.1	1.2
Croatia	90	34.6	11.7
Cuba	85*	25.6	14.9
Czech Republic	97	28.1	9.5
Denmark	98	24.1	11.3
Ecuador	80	5.7	3.0
Egypt	83	0.1	0.0
El Salvador	84*	13.0	6.0
Estonia	97*	64.6	14.2
Finland	97	43.4	11.8
France	98	30.4	10.8
Georgia	93*	5.4	2.0
Germany	102	21.8	8.3
Greece	92	5.9	1.2
Hong Kong (SAR)	107	13.4	11.3
Hungary	99	55.5	16.8
Iceland	98*	15.8	3.0
Ireland	93	17.4	4.1
Israel	94	11.0	4.0
Italy	102	9.6	3.2
Jamaica	72	0.5	0.2
Japan	105	25.0	12.0
Kazakhstan	93*	39.7	9.0
Korea (South)	106	12.8	6.1
Kuwait	83*	2.1	1.5
Kyrgyzstan	87*	22.6	3.9
Latvia	97*	71.4	14.1
Lithuania	97*	81.9	13.4

(*continued on next page*)

Table 1 (*continued*)

Country	National IQ	National suicide rate	
		Males	Females
Luxembourg	101*	30.8	6.3
Malta	95*	6.6	1.6
Mauritius	81*	15.1	4.6
Mexico	87	4.5	0.7
Moldova	95*	29.5	7.6
Netherlands	102	16.2	8.0
New Zealand	100	20.5	5.4
Nicaragua	84*	4.3	1.8
Norway	98	17.7	6.9
Panama	85*	5.0	0.8
Paraguay	85*	3.3	2.1
Peru	90	0.7	0.3
Poland	99	24.7	4.5
Portugal	95	12.3	3.4
Puerto Rico (USA)	84	18.4	2.0
Romania	94	18.5	4.9
Russia	96	74.1	13.3
Singapore	103	14.0	9.6
Slovakia	96	23.4	4.6
Slovenia	95	45.1	12.6
Spain	97	11.0	3.4
Sri Lanka	81*	46.9	18.9
St. Lucia	75*	11.0	3.0
St. Vincent and the Grenadines	75*	0.0	0.0
Suriname	89	18.2	7.9
Sweden	101	20.0	8.5
Switzerland	101	29.5	11.1
Tajikistan	87*	5.4	3.4
Thailand	91	5.6	2.4
Trinidad and Tobago	80*	19.0	4.8
Turkey	90	3.8	2.4
Turkmenistan	87*	8.1	3.4
Ukraine	96*	38.2	9.2
United Kingdom	100	11.0	3.3
United States	98	19.8	4.4
Uruguay	96	16.6	4.2
Uzbekistan	87*	9.3	3.2
Venezuela	89*	7.8	1.8
Zimbabwe	66	10.5	5.2

Note. National IQs are from Lynn and Vanhanen (2002); table entries marked with an asterisk (*) are estimates, whereas the other IQ values are based on direct evidence. National suicide rates by sex are from Schmidtke et al. (1999), except for Cuba, Slovakia, and Thailand, which are from the *Human Development Reports 1990–1999*. See text for further details.

from the CD-ROM database release of the *Human Development Reports 1990–1999* (United Nations Development Programme, New York, 2000). Due to the dearth of statistics for African

and Oceanian countries, for subgroup analysis the 85 countries were aggregated into three world regions, comprised of 28 American/Oceanian, 22 Asian/African, and 35 European countries.

National divorce rates (percentage of marriages, as of 1996; available for 44 countries), proportions of population aged 65 and above (percentage of total population, as of 1997; 82 countries), and total unemployment rates (percentage, as of 1997; 42 countries) were also gleaned from the *Human Development Reports 1990–1999*. These indicators are of known salience for suicide rates, with which they reliably correlate positively because of the excess suicide mortality among the divorced, aged, and unemployed (Lester, 2000; Maris et al., 2000). Complete data were available for 36 countries. This subset is comprised of 29 out of the 35 European countries (except Croatia, Estonia, Ireland, Luxembourg, Malta, and the Republic of Moldova), of two North American countries (Canada and the United States), and of five Asian countries, four of the latter being Central Asian successor nations of the former Soviet Union (Azerbaijan, Kazakhstan, Tajikistan, and Uzbekistan), the fifth being Israel.

National IQs were obtained from Lynn and Vanhanen (2002, Table 6.5, pp. 73–80). The IQs for 50 of the 85 countries included in the present study are based on direct evidence, i.e., IQs averaged across intelligence test studies, whereas IQs for the remainder of 35 countries are estimated from neighboring or otherwise comparable countries' IQs. These authors' procedures for the calculation or estimation of national IQs are documented in detail in the data source. Figures of national Gross Domestic Product (GDP) per capita (as of 1998) were also gleaned from Lynn and Vanhanen (2002, Table 8.9, pp. 135–141). Since Western industralised nations have a higher suicide incidence than developing countries (Schmidtke et al., 1999), this measure of economic affluence was also predicted to be positively associated with suicide rate.

National IQs and suicide rates are given in Table 1. With these archival data, I assessed the ecological correlation (Lubinski & Humphreys, 1996) of national intelligence and national male and female suicide rate with Pearson correlation coefficients (r). Further, I tested the stableness of the obtained intelligence/suicide relation by controlling for the above social and economic indicators with higher-order partial correlation coefficients (r_p). Since the direction of all relations was predicted, one-tailed significance testing was employed throughout. The significance level was set at $p < 0.05$. Correlation coefficients per se are effect size indexes. Cohen (1988) has proposed now widely accepted conventional benchmarks for their interpretorial evaluation, such that absolute r values around 0.10 or lower are considered as small, around 0.30 as medium, and around 0.50 or higher as large effects. Magnitudinal evaluation of the intelligence/suicide relation was based on these benchmarks.

3. Results

Across 85 countries, national IQ was significantly positively related to national male ($r = 0.39$) and female (0.46) suicide rate (both ps < 0.001). Both relations remained stable when countries' per capita GDP and a dichotomous variable coding whether a country's IQ was calculated or estimated were jointly partialed out; $r_p = 0.43$ and 0.44 for the relation with male and female suicide rate, respectively (both ps < 0.001). GDP was weakly positively associated with the male ($r = 0.10$; $p = 0.19$) and female ($r = 0.17$; $p = 0.06$) suicide rate.

The relation between national IQ and suicide rate, controlled for GDP and type of IQ estimation, remained positive in the subgroup analysis. Across 28 American/Oceanian countries, national IQ was positively associated to male ($r_p = 0.24$; $p = 0.13$) and female ($r_p = 0.21$; $p = 0.16$) suicide rate; across 22 Asian/African countries, positively associated to male ($r_p = 0.15$; $p = 0.25$) and female ($r_p = 0.28$; $p = 0.10$) suicide rate; and across 35 European countries, positively associated to male ($r_p = 0.38$; $p = 0.02$) and female ($r_p = 0.36$; $p = 0.02$) suicide rate. Due to range restriction the relation was attenuated in the subgroup analysis, and, due to the reduced number of observations, the analyses are accompanied by a loss of statistical power. Consequently, the relation was statistically reliable only for the largest subgroup, comprised of the European countries.

National male and female suicide rates correlated strongly across the full set of 85 countries ($r = 0.80$), and likewise in the three subsets, with 0.73 for the Asian/African, 0.81 for the American/Oceanian, and 0.84 for the European countries (all ps < 0.001). National suicide rates were also positively associated with the social and economic indicators. Divorce rate correlated strongly with male ($r = 0.69$; $p < 0.001$) and female suicide rate ($r = 0.65$; $p < 0.001$); proportion of aged population correlated noticeably with male ($r = 0.50$; $p < 0.001$) and female suicide rate ($r = 0.47$; $p < 0.001$); and unemployment rate correlated moderately with male ($r = 0.28$; $p = 0.04$) and less with female suicide rate ($r = 0.18$; $p = 0.13$).

For the subset of countries with complete data on these indicators, the association between national IQ and suicide rate was still positive when all five variables (GDP, type of IQ estimation, and rates of the divorced, aged, and unemployed in the population) were jointly partialed out. This higher-order partial correlation of national IQ with male suicide rate was $r_p = 0.25$ ($p = 0.09$), and with female suicide rate $r_p = 0.22$ ($p = 0.12$). With 36 observations left for this analysis, these associations could not be established as statistically reliable.

4. Discussion

This study tested the hypothesis that intelligence and suicide mortality are positively related, as suggested by de Catanzaro's evolutionary theory of human suicide. The evidence from this ecological investigation of 85 countries is in favour of this hypothesis. Assumed population differences in intelligence may result in varying population proportions that rank beyond a threshold intelligence necessary for suicidal ideation, and this in turn could contribute to observed cross-national differences in suicide incidence. This explanation is possible because the statistical properties of the tails of overlapping distributions are such that even small mean group differences inevitably yield a marked imbalance in regards to the group membership of individuals found in the uppermost percentiles, i.e., the high-end tail, of the joint distribution (Hedges & Nowell, 1995). There are five points of interest in the results:

First, in terms of effect size, the positive relation of national IQ and national suicide rate across 85 countries equals a medium-to-large effect. It remained stable when a measure of countries' affluence (GDP) was statistically controlled. This finding disconfirms assumptions that cross-nationally suicide incidence is largely a reflection of industrialisation and affluence, that both national IQ and suicide rate are spuriously associated via affluence, and other related objections. However, due to the study's correlational design, the possibility that both intelligence and suicide incidence are confounded by other unknown factors cannot be ruled out.

Second, the intelligence/suicide relation was also found in subgroup analyses of three world regions. This result disconfirms possible objections concerning the generalisability of the finding. The relation found here could well be universal, and it is interesting that ethnic differences in suicide rates correspond to ethnic differences in intelligence, i.e., suicide rates averaged for East Asian countries are highest, are somewhat lower for European countries, whereas African and Caribbean countries have the lowest suicide rates (Rushton, 2000).

Third, the intelligence/suicide relation was still found, although attenuated, when population rates of the divorced, aged, and unemployed were additionally controlled. Generally, these indicators are of known salience for suicide incidence and thus were expected to be salient in this study's dataset. The stableness of the finding therefore lends support to the conjecture that there truly is a unique explanative contribution of intelligence to suicide incidence, independent of other social and economic factors. Since all variables used in the analyses are of imperfect reliability and measurement error attenuates effect size, the actual size of this effect must be larger than indicated in the analyses. Complete data for this analysis were available for most European countries, Canada, the United States, Israel, and several Central Asian countries. This country sample is pronouncedly diverse. Hence, it is difficult to assume nongeneralisability to other world regions. Still, it is unsatisfactory that, due to unavailable suicide statistics, African and Oceanian countries were not well represented in the sample.

Fourth, the different types of national IQ data (calculated versus estimated) used in this study had no discernible impact on results. This finding can be regarded as a validity cue for the procedures employed by Lynn and Vanhanen (2002).

Fifth, it is also of note that no consistent or relevant sex difference was found in regards to the intelligence/suicide relation, whereas recent reports point to a sex difference in general intelligence (cf. Allik, Must, & Lynn, 1999; Lynn, 1994, 1996, 1999, 2002; Lynn, Allik, & Must, 2000). This is further suggestive for the likely generality of the finding.

On an individual level, high intelligence may not by implication equal optimal adaptation. Conversely, as evidenced by the incidental observation of excess suicide mortality among the highly gifted participants of the Terman study and as hypothesised by de Catanzaro (1981), highly intelligent individuals may on average be less adapted to general living contexts and could be more prone to suicidality. Interestingly, this view is also found in lay theories of suicide, i.e., that intellectuals are more prone to suicidality in comparison to other population groups (Rook, 1959; Ross, 1969). Further, it is of note that it has been suggested (by double Nobel laureate Linus Pauling) that "exceptionally superior intelligence relative to the surrounding population" (Lehrke, 1997, p. 168) could be a molecular disease, i.e., a disorder resulting from chromosomal mutations.

Caution in the interpretation of ecological findings must be exercised when large land areas such as nations are used as the units of analysis (Voracek & Fisher, 2002; compare also within-country differentials in intelligence, as documented by Lynn, 1979, 1980). The present finding therefore needs further corroboration on an individual level (King, 1997).

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