Papers

Low intelligence test scores in 18 year old men and risk of suicide: cohort study

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Abstract

Objective To examine the association between intelligence test scores in men, measured at age 18, and subsequent suicide.

Design Record linkage study of the Swedish military service conscription register (1968-94) with the multi-generation register, cause of death register, and census data. Four tests were performed at conscription covering logic, language, spatial, and technical skills.

Setting Sweden.

Participants 987 308 Swedish men followed up for 5-26 years.

Main outcome measure Suicide.

Results 2811 suicides occurred during follow up. The risk of suicide was two to three times higher in those with lowest compared with the highest test scores. The strongest associations were seen with the logic test: for each unit increase in test score the risk of suicide decreased by 12% (95% confidence interval 10% to 14%). Associations were only slightly attenuated when we controlled for parents' socioeconomic position. Greatest risks were seen among poorly performing offspring of well educated parents.

Conclusions Performance in intelligence tests is strongly related to subsequent risk of suicide in men. This may be due to the importance of cognitive ability in either the aetiology of serious mental disorder or an individual's capacity to solve problems while going through an acute life crisis or suffering from mental illness.

Introduction

Impaired neurodevelopment is thought to increase the risk of several psychiatric disorders. In keeping with this, poor performance on tests of cognitive function is associated with an increased risk of depression[1] and psychosis.[2 3] Interpretation of these findings is hampered by the possibility that pre-existing mental illness may influence test performance (reverse causality). Furthermore, performance during psychiatric interviews may be influenced by an individual's intelligence.

Few studies have examined the associations of performance in intelligence tests with suicide, and results have conflicted. A study of conscripts in Israel suggested that people who committed suicide had above average intelligence ratings at conscription,[4] though the opposite was reported among Australian conscripts.[5 6] In a cohort of Swedish men conscripted in 1969-70, "intellectual capacity" was inversely associated with risk of suicide, although this association was attenuated after adjustment for measures of conduct and personality.[7] In a more recent follow up of Swedish conscripts, there was an inverse association between intelligence test performance and non-fatal self harm.[8]

We analysed the association between the results of four intelligence tests, recorded during medical examinations at conscription of Swedish men, and subsequent risk of suicide.

Methods

In the multi-generation register we used unique personal identification numbers to identify men born in 1950-76 in Sweden for whom we could also obtain information on their biological parents (n=1 421 326). Of these, 1 223 520 (86.1%) had a record in the military service conscription register between 1968 and 1994 and 1 084 644 (86.6%) had complete sets of data for intelligence test results. There are four basic tests: logic/general intelligence test; verbal test of synonym detection; test of visuospatial/geometric perception; and technical/mechanical skills with mathematical/physics problems.[2 8–10] Results from these tests are standardised against data from previous years to give scores from 1 (low) to 9 (high) for each of the four scales.[2]

We identified suicides using ICD-8-10 (international classification of diseases, 8th to 10th revision) from the Swedish cause of death register (up to 31 December 1999) and linked the dataset data from the Swedish census to obtain socioeconomic and educational data for the conscripts and their parents. We assessed the possible confounding effects of year of birth, conscription test centre (six centres), the highest socioeconomic index of either parent (blue collar worker, white collar worker, self employed, and other), and duration of each parent's and the conscripts' education.

We used Cox's proportional hazards regression to assess the association of intelligence measured at con-

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scription with subsequent suicide. Our analyses are based on the 987 308 (91%) conscripts with complete information on all the above confounding factors.

Results

We found strong linear associations with all four intelligence tests (table 1). Better performance on the tests was associated with a reduced risk of suicide. The strongest associations were with the logic test score, with a threefold difference in risk between high and low scorers (figure). The strength of the associations changed little in models that controlled for parents' socioeconomic index and education. Similar associations were seen in the subset of men with a record of their global test score (fully adjusted hazard ratio per unit increase 0.88 (95% confidence interval 0.86 to 0.90)).

Correlations between the four test scores ranged from $r=0.43$ to $r=0.69$. We fitted a model including terms for all four of the test scores to see if mutual adjustment attenuated the strength of any of the associations (see bmj.com). Associations with the synonym, technical, and spatial test scores were all greatly attenuated, but the strength of association with the logic test result was not greatly changed. Subsequent analyses were based on the logic test score alone.

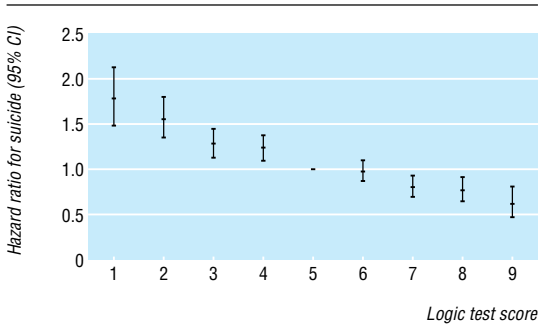
Influence of educational attainment on intelligence test-suicide associations

We examined the possible confounding effect of educational attainment in a restricted dataset of 542 283 men (n=1027 suicides) born 1950-65 and alive at the age of 25 years, who had therefore had the opportunity to complete their education. In a model adjusted for age and the other confounders, the hazard

Table 1 Associations of four intelligence test scores with suicide in age adjusted and fully adjusted models

			Hazard ratio (95% CI)	
	No of conscripts (n=987 308)	No of suicides (n=2811)	Age adjusted	Fully adjusted*
Logic test score:				
1	27 901	140	1.81 (1.51 to 2.18)	1.78 (1.48 to 2.14)
2	65 436	274	1.60 (1.38 to 1.84)	1.55 (1.34 to 1.79)
3	100 143	347	1.30 (1.14 to 1.48)	1.27 (1.11 to 1.45)
4	153 960	523	1.22 (1.09 to 1.38)	1.22 (1.08 to 1.37)
5	231 230	626	1.00	1.00
6	156 296	405	0.96 (0.84 to 1.08)	0.96 (0.85 to 1.09)
7	122 954	252	0.78 (0.67 to 0.90)	0.78 (0.68 to 0.91)
8	90 484	186	0.75 (0.63 to 0.88)	0.76 (0.64 to 0.90)
9	38 905	58	0.60 (0.46 to 0.78)	0.60 (0.46 to 0.79)
Per unit increase			0.88 (0.86 to 0.89)	0.88 (0.86 to 0.90)
Synonym (linguistic) test score:				
1	25 152	109	1.55 (1.27 to 1.90)	1.54 (1.25 to 1.89)
2	57 849	253	1.55 (1.34 to 1.79)	1.51 (1.31 to 1.76)
3	113 943	379	1.17 (1.03 to 1.33)	1.16 (1.02 to 1.32)
4	172 268	542	1.08 (0.96 to 1.22)	1.08 (0.96 to 1.21)
5	225 064	610	1	1
6	178 264	429	0.85 (0.75 to 0.96)	0.86 (0.76 to 0.98)
7	125 845	277	0.78 (0.68 to 0.90)	0.80 (0.70 to 0.93)
8	57 606	140	0.77 (0.64 to 0.93)	0.81 (0.68 to 0.98)
9	31 317	72	0.73 (0.58 to 0.94)	0.78 (0.61 to 1.00)
Per unit increase			0.90 (0.88 to 0.91)	0.90 (0.89 to 0.93)
Spatial test score:				
1	24 923	100	1.46 (1.18 to 1.80)	1.38 (1.12 to 1.71)
2	55 476	195	1.23 (1.05 to 1.45)	1.17 (1.00 to 1.38)
3	102 810	355	1.26 (1.11 to 1.44)	1.22 (1.06 to 1.39)
4	149 092	465	1.11 (0.98 to 1.25)	1.09 (0.96 to 1.23)
5	199 380	603	1	1
6	194 923	522	0.85 (0.76 to 0.96)	0.86 (0.77 to 0.98)
7	133 439	309	0.76 (0.66 to 0.87)	0.77 (0.67 to 0.88)
8	81 282	175	0.72 (0.61 to 0.85)	0.74 (0.63 to 0.88)
9	45 983	87	0.61 (0.49 to 0.76)	0.64 (0.51 to 0.81)
Per unit increase			0.90 (0.88 to 0.91)	0.91 (0.89 to 0.93)
Technical test score:				
1	29 539	140	1.63 (1.35 to 1.96)	1.64 (1.36 to 1.97)
2	66 382	246	1.27 (1.10 to 1.48)	1.26 (1.08 to 1.46)
3	125 751	463	1.24 (1.10 to 1.40)	1.24 (1.10 to 1.41)
4	170 311	563	1.20 (1.07 to 1.35)	1.20 (1.06 to 1.34)
5	199 944	542	1	1
6	178 009	407	0.87 (0.76 to 0.98)	0.87 (0.76 to 0.98)
7	127 904	272	0.80 (0.70 to 0.93)	0.81 (0.70 to 0.94)
8	53 986	104	0.70 (0.57 to 0.86)	0.72 (0.58 to 0.88)
9	35 482	74	0.80 (0.62 to 1.02)	0.81 (0.63 to 1.03)
Per unit increase			0.90 (0.88 to 0.92)	0.90 (0.88 to 0.92)

*Adjusted for age, year of birth, conscription test centre, parents' socioeconomic position, and education.



Fully adjusted suicide hazard ratios by categories of logic intelligence test score (category 5 is reference)

ratio per unit increase in the logic test score was 0.90 (0.86 to 0.93), further adjustment for educational level attenuated this association to 0.93 (0.90 to 0.97).

Influence of pre-existing psychiatric illness

Men with a psychiatric disorder recorded at conscription tended to perform poorly on the intelligence tests; 23.4% (6534/27 901) of those with scores of 1 on the logic intelligence test had a psychiatric diagnosis recorded at conscription compared with only 2.7% (1039/38 905) of those with scores of 9. Exclusion of all 59 613 men with psychiatric disorders recorded at baseline had little effect on the association between intelligence and suicide (fully adjusted hazard ratio per unit increase in logic test score 0.89, 0.87 to 0.91).

Interactions with own or parents' education

In the subset of men alive at the age of 25 years, the association of intelligence test scores with suicide differed depending on an individual's educational achievement ($P<0.005$ for interaction, table 2). The gradient of risk in relation to intelligence test score was strongest in those with high or medium levels of education and highest in those with high intelligence test scores. Among those with only primary level education, intelligence test performance did not seem to be associated with risk of suicide.

The greatest risk of suicide was seen among the men who had low intelligence test scores but had highly educated parents (see bmj.com). There was, however, no strong statistical evidence that the effects of test performance on risk of suicide differed with parents' education ($P=0.35$ for interaction). Associations of intelligence test scores with suicide persisted when we restricted analyses to suicides occurring 15 years or more after conscription (see bmj.com).

Discussion

We found a strong linear association between results of intelligence tests in early adulthood and subsequent suicide in men. The association seems to be mediated in part by educational attainment, which may perhaps influence subsequent job opportunities and income.

Though the large sample size gave us adequate power to investigate associations with suicide across the range of test results, the findings are restricted to men, and patterns of association in relation to intelligence testing may differ in women. Also, the lack of detailed information about the men who committed suicide, including possible confounding factors, such as drug and alcohol misuse, means we are unable to fully understand possible causal pathways. Exclusion of those with psychiatric disorder at baseline, however, did not greatly influence the strength of the association.

Possible explanations for association

The strength of the association and the large sample size suggest that our finding is unlikely to be due to chance. The association was little changed when we assessed confounding by mental illness by excluding those with psychiatric diagnoses at baseline. The association was most pronounced in the five years after conscription. If this difference is not simply a chance finding, it may reflect the effect of undetected mental illness at conscription on both test performance and subsequent risk of suicide over the initial years of follow up (reverse causality). Alternatively, it is possible that young adulthood (age 18-23 years) is the age of greatest vulnerability to any adverse effects of low mental ability, perhaps in relation to entering the job market or finding a partner.

The strongest associations of intelligence test scores with suicide were among people with highly educated parents. We have previously reported a similar finding with schizophrenia.[3] This association must be interpreted with caution as there is no evidence of statistical interaction ($P=0.35$). One interpretation could be that it indicates the adverse effect on mental health of a mismatch between parental aspirations and expectations and an individual's ability. Likewise, the observation that the associations between intelligence test score and suicide were weakest among the least well educated conscripts may be due to a lack of personal career aspirations, and therefore fewer disappointments, in this group. In the absence of such aspirations differences in intelligence may not influence risk of suicide.

There are several possible explanations for the observed association. Firstly, it is possible that influences on neurodevelopment during childhood (as indexed by intelligence test scores) also increase an individual's susceptibility to mental illness and hence suicide. In support of this possibility, poor intelligence test performance is associated with two of the main disorders contributing to suicide—depression[1] and

Table 2 Associations with each of four intelligence test scores in fully adjusted model including all four terms simultaneously (hazard ratio suicide per unit increase in test score)

Intelligence test	Hazard ratio (95% CI)		P value
	Age adjusted	Fully adjusted*	
Logic	0.88 (0.86 to 0.92)	0.92 (0.89 to 0.95)	<0.0001
Synonym	0.90 (0.88 to 0.91)	1.00 (0.97 to 1.03)	0.77
Spatial	0.90 (0.88 to 0.91)	0.97 (0.94 to 0.99)	<0.01
Technical	0.90 (0.88 to 0.92)	0.96 (0.94 to 0.99)	<0.005

*Mutual adjustment for other intelligence test score terms and age, year of birth, conscription test centre, parents' socioeconomic position, and education.

What is already known on this topic

The incidence of some psychiatric illnesses is higher among people who perform poorly on intelligence tests, though mechanisms for this association are unclear

The association of suicide with intelligence is unclear, with some studies reporting positive and others inverse associations

What this study adds

There is a strong inverse association between intelligence test scores and suicide with twofold to threefold higher rates in those with low scores than those with the highest scores

The association with suicide is seen across the whole range of intelligence scores

schizophrenia.[2 3] Exclusion of those men with pre-existing mental disorder at baseline did not, however, greatly influence the strength of the associations. Increased susceptibility to mental illness among those performing poorly on intelligence tests could result either from their reduced ability to compete for jobs, and therefore income and status, or from a direct impact of impaired neurodevelopment, as indexed by low intelligence test score, on particular regions of the brain which are important in the aetiology of mental illness. Secondly, it is possible that in times of crisis, individuals scoring poorly on intelligence tests are less able to identify solutions to their problems and in such situations suicide becomes an aberrant problem solving strategy. The observed lack of association among those with mental illness at baseline may be because this pathway is less important in such people who may have more severe levels of psychopathology. Lastly, the associations may be confounded by maladjustment and deviant behaviour in childhood. Psychosocial maladjustment in childhood may lead to poor school performance[11] and so poor performance on intelligence tests at conscription. In turn, childhood maladjustment is associated with an increased risk of suicide and this, rather than intelligence test performance, may underlie the observed associations.[7] More detailed studies are necessary to investigate possible pathways underlying the observed associations and their clinical implications.

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Assessing your learning needs

What does assessing your learning needs mean to you? Perhaps you are a junior doctor and feel that your main learning need is to pass exams and that you should stick to your curriculum. Or perhaps you feel you should have the freedom to learn what you want to learn, and not just what you need to learn. Both are valid views, but we should all think at least a little about our learning needs.

If you identify your own learning needs, rather than having learning imposed on you, then your learning will be more likely to change your practice.[1] Identifying your learning needs can be both interesting and challenging: you probably do it already, even if you don't think about it consciously. For example, if one of your patients asks you an important question that you can't answer, then you have identified a learning need. Similarly, if you audit your work and find that your patients with diabetes aren't doing as well as they should, then you need to learn about the care of diabetic patients. Thinking like this will make your learning more personal, and this will increase your motivation.[2]

These are informal ways of assessing your learning needs, but you can use more formal methods if you wish. For example, if you work in an interdisciplinary team you can do a formal "360 degree" appraisal: this involves asking your colleagues to give feedback on your strengths and weaknesses as a team member. You can also use critical incident reviews to inform your personal learning needs and those of your team.

Various methods are available to help you uncover the gaps in your knowledge, and different methods will suit different people. It's best to use more than one method, and a combination of subjective and objective methods often gives a better overall picture of your knowledge gaps. On bmjlearning.com, we have laid out some commonly used tools to help you assess your learning needs. You can access them on http://bmjlearning.com/planrecord/assessment/assessmentHome.jsp.

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