IQ in early adulthood and later risk of death by homicide: cohort study of 1 million men

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Background

Risk factors for homicide are emerging; however, the predictive value of IQ, for which there is a strong *prima facie* case, has yet to be examined.

Aims

To examine the association between IQ and risk of death by homicide.

Method

A cohort of 968 846 men, aged 18–19 years, were administered an IQ test battery at military conscription and then followed for mortality experience over two decades.

Results

There were 191 deaths due to homicide during follow-up. In age-adjusted analyses, a high total IQ test score was associated with a reduced rate of homicide (hazard ratio (HR) per standard deviation increase in IQ score=0.49, 95% CI 0.42–0.57). A step-wise gradient was apparent across the three IQ groups (P-value for trend <0.001). After adjustment for indicators of socio-economic position and illness at conscription, this gradient was marginally attenuated (HR=0.57, 95% CI 0.49–0.67).

Conclusions

High IQ test scores in early adulthood were associated with a reduced risk of death by homicide.

Declaration of interest

None. Funding detailed in Acknowledgements.

In the developing field of violence epidemiology,[1] a series of studies have shown that social factors are associated with the risk of being a victim of homicide. Thus, persons with higher educational credentials, individuals in the professional social classes, and people with higher income experience lower homicide rates.[2–4] A further individual characteristic, intelligence (IQ), a correlate of these indices of socio-economic circumstances, has recently been shown to be related to the risk of having experienced violent assault in children who were followed until age 17 years.[5] That is, after adjustment for covariates, individuals in the highest IQ scoring group reported a marked reduction in the prevalence of assault in comparison with the lowest IQ scorers. A corollary of these different strands of evidence is that persons with high IQ will have a decreased risk of death due to homicide. We are unaware of any previous studies to have tested this hypothesis.

Method

Participants and record-linkage of registers

The present cohort comprised all non-adopted men born in Sweden from 1952 to 1976 for whom both biological parents could be identified in the Multi-Generation Register (MGR). Using unique personal identification numbers we were able to link the MGR to military, education and census registries resulting in 1 346 545 successful matches. Approval was obtained from the regional ethics committee, Stockholm.

Conscription examination

The Swedish military service conscription examination involves a medical assessment in which physical health, mental status and cognitive function (denoted here as IQ) are ascertained. The present data-set covers examinations from 1 January 1970 to 31 September 1994. During this period, this examination was required by law; only men of foreign citizenship or those with a severe medical condition or disability were excused. IQ was measured by four sub-tests representing logical, spatial, verbal and technical abilities.[6]

Owing to military secrecy, a detailed description of the IQ tests is not available to persons outside the Swedish conscription board; however, the sub-tests have been described in general terms.[7] In brief, the logical test measures the capacity to understand written instructions and apply them to solving a problem. Items from the spatial test depicted a plan drawing of an object in its pre-assembled, two-dimensional state. Respondents were required to identify, from a series of drawings of fully assembled, three-dimensional objects, which it represented. The verbal test measures vocabulary. The participant was required to determine which out of four alternatives is the synonym of a given word. The technical test measures understanding of chemistry and physics, and implies a component of general knowledge. Tests were presented in succession to participants in the form of written questionnaires. All test scores – including a global IQ score derived from a summation of the four sub-tests results – were standardised to give a Gaussian distributed score between 1 and 9 (a 'standard nine' or 'stanine' score), with higher values indicating greater intellectual capacity.

The IQ tests used in this study reveal established associations with other variables in our analyses (see Results). Thus, IQ scores were strongly related to measures of socio-economic position such as education, occupational social class and height. Further, the content of the tests is varied and, in line with Spearman's original findings, and in common with other data-sets examined in this area,[8] the first unrotated principal component from the tests is a strong g (general intelligence) factor. Additionally, the results from the four IQ sub-tests are closely correlated ($r > 0.70$, $P < 0.001$). These observations suggest that the IQ tests have a high degree of both concurrent and predictive validity.

Height, measured using a standard protocol, was used as a correlate of early-life socio-economic position,[9] such that shorter persons generally originate from more impoverished backgrounds.[10] The highest socio-economic index of either parent was based on census assessments in the 1960s and 1970s (five categories: non-manual (high/intermediate), non-manual (low), manual skilled, manual unskilled and other). The study

participants' attained education level, extracted from Population and Housing Census of 1990 and originally coded into five categories, was collapsed into four (<9 years of primary school, 9–10 years of primary school, full secondary school, higher education). To ascertain comorbidity by the time of conscription we used two sources of data: the conscription examination itself (for data on psychoses (ICD–8/ICD–9: 290–299),[11,12] neuroses (ICD–8/ICD–9: 300–316), mental disability (ICD–8/ICD–9: 317–319) and cardiovascular disease (ICD–8/ICD–9: 390–459)) and the cancer register (for any mention of cancer). Using these data, composite variables for somatic and psychiatric illness were created.

Statistical methods

Our analyses are based on 968 846 conscripts with complete information on IQ, covariates and mortality experience. Pearson correlation coefficients among the four IQ sub-tests were generally high (range 0.48–0.70). Given, also, that preliminary analyses revealed that patterns of association between each of the IQ sub-test scores and homicide were similar, we report only the association between mortality due to homicide and global IQ scores (denoted hereafter as IQ).

We examined the proportional hazards assumption graphically for IQ in relation to homicide mortality and found no evidence for violation. We therefore used a series of Cox's proportional hazard models[13] to assess the association, if any, of IQ with homicide risk. In these analyses we adjust for a range of confounding and mediating variables. Given their time of measurement relative to that of IQ, we conceptualised somatic and psychiatric illness, height and parental occupational social class as confounding variables and the individual's own education and occupational social class as mediating variables. In view of the well-documented increases in IQ over time,[14] and the wide range of birth years (24 years) in the present analyses, we controlled for the latter. Given that it is plausible that the IQ testing protocol could have varied somewhat by conscript testing centre, we also included this as a potential confounder. Hazard ratios (HRs) with accompanying 95% confidence intervals (CIs) were initially adjusted for age (in using age as the time axis, we controlled for it), and then, separately, for the covariates described above. In order to preserve statistical power in the context of relatively low numbers of homicides, the stanine IQ scores were collapsed into three groups (1–2, 3–4 and 5–9) for the purposes of these survival analyses. In addition to these computations of effect estimates across the IQ categories, we also calculated a hazard ratio per standard deviation (1.93 IQ units) increase in the nine-point version of the IQ scale ($HR_{s.d. IQ increase}$). The follow-up period began at the date of conscription. Men were censored at the time of death, emigration, or 31 December 2001, whichever came first. All analyses were computed using STATA (version 8.1) for Windows.

Results

We examined the relationships between IQ and each of the study covariates (Table 1). In comparison with their lower IQ-scoring counterparts, higher IQ-scoring men were taller and less likely to have a parent in an unskilled occupation. Men with higher IQ scores were also markedly less likely to be diagnosed with a psychiatric illness at conscription; the prevalence of somatic disease was also slightly reduced in this group. These gradients were generally incremental across the IQ range.

In univariate analyses we related selected covariates to the risk of homicide (results not tabulated). A mean of 19.4 years of follow-up (range 0.01–32.29) gave rise to 191 such deaths in the 968 846 men. For all three markers of socio-economic position, disadvantaged groups experienced an increased risk of mortality due to homicide. Thus, higher rates of mortality due to homicide were associated with low parental social class (unskilled v. non-manual: HR=3.33, 95% CI 1.49–7.46), and study participant's basic educational qualifications (≤10 years v. higher education: HR=2.98, 95% CI 2.08–4.25) and reduced height (lowest tertile v. highest: HR=1.62, 95% CI 1.11–2.34).

In Table 2 we report the relation between IQ and subsequent mortality due to homicide. In age-adjusted analyses there was an inverse relation between IQ and homicide mortality such that a one standard deviation advantage in IQ conferred a 51% reduction in risk ($HR_{s.d. IQ increase}$=0.49, 95% CI 0.42–0.57). In the highest IQ-scoring group, there was an 82% lower rate of homicide (HR=0.18, 95% CI 0.13–0.26) relative to the lowest. A step-wise effect was seen across the three IQ groups (P-value for trend <0.001). When we adjusted separately for indicators of early-life socio-economic position (height and parental occupational social class), these gradients were essentially unchanged. Although controlling for somatic illness at conscription had no impact on the effects estimates, there was a 12% attenuation in the IQ–homicide association when psychiatric disease was added to the multivariable model (HR=0.55, 95% CI 0.47–0.63). Multiple covariate control had little impact on the strength of the IQ–homicide gradient (HR=0.57, 95% CI 0.49–0.67).

We conducted two sets of subgroup analyses. In the first, educational attainment was available for a subgroup of study participants (960 148; 127 homicide deaths). In the present analytical sample (r=0.49; P<0.001) and other studies,[15] education and IQ are strongly positively correlated. Thus, in the lowest IQ group, the proportion of persons with low educational attainment (<10 years) was over 4.5 times greater (36.2%) than in the highest IQ group (7.7%). Given this problem of collinearity between IQ and education, we elected not to control for education in the main analyses. In our subgroup analyses, the age-adjusted IQ–homicide relation (HR=0.49, 95% CI 0.41–0.59) was attenuated

Table 1 IQ score and study covariates in Swedish men (n=968 846)

Variable	Stanine IQ score range		
	1–2	3–4	5–9
Participants, n	93 231	247 351	628 264
Psychiatric illness at conscription, %	16.67	7.35	3.97
Somatic illness at conscription, %	2.89	2.77	2.74
Parent in unskilled occupation 1960–70, %	33.88	27.08	17.37
Age at testing, years: mean (s.d.)	18.24 (0.58)	18.22 (0.54)	18.27 (0.53)
Height, cm: mean (s.d.)	177.39 (6.68)	178.45 (6.45)	179.81 (6.40)

Table 2 Relationship between IQ and mortality by homicide in Swedish men (*n*=968 846)

Variable	Stanine IQ score range, HR (95% CI)			P	HR s.d. IQ increase (95% CI)
	1–2	3–4	5–9		
Deaths, *n* (%)	59 (0.063)	60 (0.024)	72 (0.011)	–	–
Participants, *n*	93 231	247 351	628 264	–	–
Age-adjusted, HR (95% CI)	1.0 (ref)	0.38 (0.27–0.55)	0.18 (0.13–0.26)	<0.001	0.49 (0.42–0.57)
Height-adjusted, HR (95% CI)	1.0	0.39 (0.27–0.56)	0.19 (0.13–0.27)	<0.001	0.50 (0.43–0.58)
Parental social class-adjusted, HR (95% CI)	1.0	0.40 (0.27–0.56)	0.21 (0.15–0.30)	<0.001	0.51 (0.44–0.60)
Psychiatric illness at conscription, HR (95% CI)	1.0	0.46 (0.32–0.66)	0.24 (0.16–0.34)	<0.001	0.55 (0.47–0.63)
Somatic illness at conscription, HR (95% CI)	1.0	0.38 (0.27–0.55)	0.18 (0.13–0.26)	<0.001	0.49 (0.42–0.57)
Multiply-adjusted,[a] HR (95% CI)	1.0	0.48 (0.33–0.69)	0.27 (0.19–0.39)	<0.001	0.57 (0.49–0.67)

HR s.d. IQ increase, hazard ratio per standard deviation (1.93 IQ units) increase in the nine-point version of the IQ scale.
a. Multiple adjustment is adjustment for all covariates in the table plus year of birth and conscription office.

by only 22% after control for education (HR s.d. IQ increase=0.60, 95% CI 0.49–0.74).

In a second, separate subgroup analysis, we focused on men who were 40 years of age or older by 2001 (i.e. born after 1960) who had information on their own occupational social class (*n*=355 014; 55 homicide deaths). These data were coded into the same categories as parental social class shown previously. As with education, IQ was incrementally associated with social class such that men in the lowest IQ group (38.4%) were around 2.5 times more likely to belong to the manual unskilled group in comparison with those in the highest IQ-scoring group (14.5%). When the participant's own socio-economic group was added to the statistical model (HR s.d. IQ increase=0.51, 95% CI 0.39–0.67) there was a very small (10%) attenuation in the IQ–homicide relation compared with the age-adjusted relation in this subgroup (HR=0.54, 95% CI 0.41–0.71).

For over a quarter (27.8%; *n*=374 286) of the original study sample, information was missing for IQ or one or more covariate, so raising concerns regarding selection bias. In comparison with the analytical sample, the characteristics of the excluded groups differed somewhat. Owing to the large sample size, these differences invariably attained statistical significance although absolute values were not always large (data not shown). There was a higher proportion of persons in the lower IQ-scoring group in the analytical sample, although this was not reflected in a difference in educational level. For selection bias to be a major problem in the present study, however, the IQ–homicide mortality gradient we have reported would have to be in opposing directions (and of a very large effect size) in persons omitted from the analyses. We tested this issue in persons in the excluded group with data on vital status, IQ and age (24 homicides; 166 751 men). In age-adjusted analyses, the IQ–homicide mortality relation (HR=0.53, 95% CI 0.36–0.78) was very similar to that apparent in the analytical sample (HR=0.49, 95% CI 0.42–0.57). Therefore, selection bias does not appear to be present for the association being studied here.

Discussion

Our study finds evidence for a strong, inverse relation between IQ and death by homicide; persons with higher IQ scores were less likely to be murdered. The novel findings are based on data from almost 1 million men who were well characterised for IQ, comorbidity, socio-economic position and mortality. This relation appeared to be independent of other risk factors for homicide. To our knowledge, this is the first study to examine the relation between IQ and homicide.

As indicated, to date, markers of socio-economic position are the most commonly examined individual-level predictors of death due to homicide. In the few studies conducted, the lowest rates of homicide mortality are seen in persons with higher occupational attainment and educational credentials (the latter observation, in part, led to our examining the IQ–homicide link reported herein).[2–4] In our study, the same observations were made for parental occupational social class and the participants' own educational attainment by early adulthood in relation to homicide risk. The observation of a protective effect for increased height may be as much attributable to the favourable social circumstances it indexes as to the possible deterrent to violence that increased stature could confer.

Given the aforementioned relation between IQ and socio-economic position, and the observation that the latter predicts homicide risk, socio-economic position is a potentially key confounding variable in the IQ–homicide association. In the present analyses we adjusted for the two markers of childhood socio-economic circumstances (parental social class and height) and the IQ–homicide effects estimates were essentially unaltered. In subgroup analyses, there was only a modest attenuation of the IQ–homicide association when either the individual's education or social class was added to the multivariable model; both may be regarded as mediating variables in these analyses. Given that education may be a proxy for IQ, its use as a covariate in this manner is debatable.[16] This methodological caveat notwithstanding, education had only a small effect on the IQ–homicide association, reducing the hazard ratio by 22%. That this cohort is well characterised for these social factors suggests that the apparent relation of IQ with homicide is unlikely to be explained substantially by residual confounding by such covariates, but we cannot rule it out as a possible important, alternative explanation.

In addition to the issue of confounding as an alternative explanation for the apparent IQ–homicide link, selection bias would occur in the present study if the IQ–mortality gradients differed markedly between persons included in the analyses and

those excluded. There were differences in IQ and some study covariates between those persons included in the analyses and those excluded, so raising such concerns. However, importantly, the point estimate for the IQ–homicide association was very similar in each of these groups, indicating that selection bias is probably not responsible for the associations reported here.

Possible mechanisms

There are some possible, but as yet untested, explanations for the apparent protective effect of high IQ scores against later homicide risk. First, verbal skills are highly loaded on general intelligence.[8] All other factors being equal (e.g. personality traits, context, past experiences), as discussed, it might be that people with higher intelligence are more able to verbally conduct and nullify a dispute, without having to resort to physical means, because they can call on a larger range of strategies for resolution. However, when we examined the association of the verbal intelligence component of our IQ score with homicide, there was no suggestion that this relation was stronger than that apparent for the other components of IQ, that is logical, spatial or technical abilities.

Second, it is well established that persons with higher IQ have larger income and employment of higher social status than persons with lower test scores.[17] It may be that individuals with higher IQ can better afford to live apart from neighbourhoods with high crime rates and low social cohesion. Although, as discussed, we controlled for a series of indices of social circumstances at the level of the individual, we did not have data on neighbourhood social cohesion/capital or similar with which to explore this matter.

Third, it is possible that low IQ scores are a proxy for reduced risk perception, a mechanism that has been advanced to explain the inverse relation between IQ and motor vehicle accidents.[18,19] Thus, it may be that persons with low cognitive ability are more likely to place themselves in circumstances of higher personal jeopardy so leading to elevated homicide risk.

Fourth, the IQ–homicide association could be explained by unmeasured confounding. In Sweden, 75% of homicide victims are intoxicated with alcohol;[20] use of illicit drugs is also common. We have previously shown higher IQ-scoring people to be less likely to report alcohol-induced hangovers than their lower IQ-scoring peers.[21] Although alcohol consumption data were available for a subgroup of study participants, there were too few homicide deaths among these men to facilitate analyses. There were no data on other drug misuse.

Finally, there is growing evidence that the characteristics of perpetrator and victim correlate. Importantly, there is evidence that perpetrators have IQ scores lower than that of the general population, even after those with intellectual disabilities are excluded from analyses.[22,23] That is, there appears to be an association between the IQ of the perpetrator and risk of committing homicide. As evidenced by assortative mating, in general, people tend to seek the company of like-IQ individuals (among other characteristics). Since in cases of homicide, perpetrator and victim are often known to one another,[24] it is likely that we are, at least in part, observing an association between low IQ of the perpetrator and raised risk of committing homicide. We did not, however, have any information on the IQ of the perpetrator, or any other such data, with which to test this or any of the other above possibilities. The absence of data pertaining to the perpetrator, in addition to those regarding social cohesion/capital in the neighbourhood of the victim, are clear limitations of our study.

Public health implications

Although a large proportion of the variance in IQ is heritable, it is also influenced by environmental factors that may be amenable to intervention. These include early-life circumstances such as living conditions and nutrition.[25,26] We believe that current public health policy which aims to reduce health inequalities should continue to be based on a broad front, including educational opportunities and interventions directed at childhood (e.g. Sure Start (www.surestart.gov.uk/) in the UK). Interventions need to be based on the best possible evidence about the factors generating and maintaining social and health inequalities, and there is therefore a need to take forward the currently modest literature on IQ and health (including homicide and suicide), and to empirically investigate why IQ might predict health outcomes and how the links between low socio-economic status, low IQ and poor health might be broken.

In conclusion, we found that high IQ test scores in early adulthood were associated with protection against later mortality as a victim of homicide. As this is the first study to report on this relation, replications are required in different settings, especially using data-sets that have potential confounding and mediating variables for both the perpetrator and victim which the present data-set did not hold.

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Hysteria

Harold Merskey

Ancient Egyptians and Greeks knew the pregnant womb enlarged and later might prolapse. Mediaeval physicians fancifully supposed it moved freely. Post-Renaissance doctors called many organic and affective symptoms hysterical or hypochondriacal. In the 19th century Littré wrote of hysteria, Russell Reynolds recognised motives for symptoms, Janet created 'dissociation' – and Freud 'repression'. Shell-shock made hysteria a reality. Multiple personality and false memories destroyed dissociation and wounded repression, which dies on close inspection. Physiological responses are now often mislabelled as 'somatoform', implying motivated. Hysterical symptoms still occur, often briefly, with neurological conditions, mass complaints and subjective awareness of their physical improbability.