Annals of Epidemiology 22 (2012) 654–657

Contents lists available at SciVerse ScienceDirect

Annals of Epidemiology

journal homepage: www.annalsofepidemiology.org

Brief communication

Intelligence quotient in childhood and the risk of illegal drug use in middle-age: the 1958 National Child Development Survey

James W. White PhD [a,*], Catharine R. Gale PhD [b,c], G. David Batty PhD [c,d]

[a] Centre for the Development and Evaluation of Complex Interventions for Public Health Improvement, Cardiff University, Heath Park, Cardiff, UK
[b] Medical Research Council Lifecourse Epidemiology Unit, University of Southampton, Southampton General Hospital, Southampton, SO, UK
[c] Centre for Cognitive Ageing and Cognitive Epidemiology, Department of Psychology, University of Edinburgh, Edinburgh, UK
[d] Department of Epidemiology and Public Health, University College London, 1-19 Torrington Place, London, UK

ARTICLE INFO

Article history:
Received 30 January 2012
Accepted 4 June 2012
Available online 7 July 2012

Keywords:
Intelligence
Street drugs
Social class

ABSTRACT

Purpose: High childhood IQ test scores have been associated with increased alcohol dependency and use in adult life, but the relationship between childhood IQ and illegal drug use in later life is unclear.
Methods: Participants were 6713 members of the 1958 National Child Development Survey whose IQ was assessed at 11 years and had their lifetime illegal drug use measured at 42 years of age.
Results: In analyses adjusted for a range of covariates, a 1 SD (15-point) increase in IQ scores was associated with an increased risk of illegal drug use in women: ever using cannabis (odds ratio [OR], 1.30; 95% confidence interval [95% CI], 1.16–1.45), cocaine (OR, 1.66; 95% CI, 1.21–2.27), amphetamines (OR, 1.50; 95% CI, 1.22–1.83), amyl nitrate (OR, 1.79; 95% CI, 1.30–2.46) and “magic mushrooms” (OR, 1.52; 95% CI, 1.18–1.98). Associations were of lower magnitude in men.
Conclusions: In this cohort, high childhood IQ was related to illegal drug use in adulthood.

Introduction

Children who score higher on standard tests of intelligence have lower rates of mortality in mid-to late adulthood [1]. One potential explanation for these associations is mediation via adult health behaviors. Thus, greater childhood intelligence quotient (IQ) scores are related to lower rates of smoking [2], greater levels of physical activity, and an increased intake of fruits and vegetables [3]. Although high childhood IQ generally has been associated with favorable health-related behaviors, it has also been linked with alcohol dependency, more frequent alcohol consumption [4], and excess intake of alcohol per episode [5,6] in adulthood. There have, however, been few studies in which the authors investigated other behaviors that commonly accompany alcohol dependency, such as illegal drug use.

The few studies in which researchers investigated the link between childhood IQ and future illegal drug use have revealed highly discrepant findings with positive [7–9], inverse [7,8], and null associations [8,9] reported. These studies have also been small in scale and have not benefited from assessments on socioeconomic disadvantage in childhood [10,11] or adolescent mental health [8]. Given that intelligence quotient (IQ) is closely associated with socioeconomic disadvantage [12], illegal drug use [13], as well as mental health problems [14], these factors may be important confounds or mediators of the IQ–drug use relationship. Previous authors have also concentrated on hospital admissions for drug dependency, rather than recreational use, which is more common [7].

Accordingly, we used data from the 1958 National Child Development Study, a large birth cohort with assessments on childhood IQ, illegal drug use by middle age, and a range of additional risk factors to investigate potential confounders or mediators in the IQ–drug use link.

Methods

In the National Child Development Study data were collected on 17,416 individuals born in England, Wales, and Scotland during 1 week in March 1958, representing a 98.7% response [15]. In this on-going cohort study, data have been collected subsequently at 7, 11, 16, 23, 33, 42, 46, and 50 years of age. Data on birth weight was extracted from medical records in the initial survey. Ethical approval was obtained from South East Multi-Centre Research Ethics Committee in accordance with the Declaration of Helsinki [15].

Cognitive ability was assessed in schools at 11 years with the use of a general ability test consisting of 40 verbal and 40 nonverbal items, devised by the National Foundation for Educational Research

* Corresponding author. Centre for the Development and Evaluation of Complex Interventions for Public Health Improvement, Cardif University, 7th Floor Neuadd Meirionnydd, Heath Park, Cardiff CF14 4YS, UK.
E-mail address: whitej11@cf.ac.uk (J.W. White).

1047-2797
http://dx.doi.org/10.1016/j.annepidem.2012.06.001

in England and Wales [16]. Scores from this test correlate strongly with scores on a test of verbal ability used to select 11-year-old children for secondary school (r = 0.93), 16 suggesting a high degree of validity.

A study questionnaire at age 42 years inquired about drug use [17]. At 11 years, assessments included parental social class (father's most recent occupation, if no father then mother's) [18], housing tenure, household crowding, receipt of state benefits, and whether household amenities were shared, from which we constructed an index of material disadvantage [19]. Mothers completed the Rutter's Parental 'A' Scale of Behaviour Disorder [20], which we used to create measures of antisocial behavior and anxiety [19].

At the 42-year follow-up, information was collected on social class using occupation [18], levels of psychological distress (General Health Questionnaire) [21], age when full-time education was completed, and illegal drugs in the past 12 months, or ever. These drugs included cannabis, cocaine, amphetamines, ecstasy, lysergic acid diethylamide (LSD), amyl nitrate, magic mushrooms (ie, psilocybin mushrooms), temazepam, ketamine, crack, heroin, methadone, and a fictitious drug, semeron, to identify deceivers. Because the use of semeron was rare (N = 17; 0.15%) and removal of these participants had little effect on estimates, they were left in the analytical sample.

A total of 15,606 members of the 1958 cohort believed to be eligible (89.6% of those in the baseline survey) were traced, and 11,413 interviewed at 42 years. The present analyses are determined by 6713 (58.8% of those interviewed at 42 years) members who had complete data on intelligence at 11 years, drug use at 42 years, and the aforementioned covariates described. Cognitive ability scores were transformed into IQ equivalents to give a cohort mean of 100 and standard deviation of 15.

Preliminary analyses revealed that, at the 42-year follow-up, the use of drugs in the past 12 months was rare (only cannabis was used by >1% of the cohort), as was the lifetime use of crack (0.01%), heroin (0.06%), methadone (0.06%), and problem drug use (0.15%: defined as having seen as "specialist"/been to a hospital about drug use), such that estimates would not be precise. We therefore used assessments of the lifetime prevalence. The IQ score of those included in the analytical sample (mean 102.40; SD 13.99) was slightly greater than those not included (mean 97.83; SD 15.54; $P < .001$).

To summarize the relationship between childhood IQ and the covariates, we used Spearman and Pearson correlations. We used χ^2 tests to examine differences in the lifetime prevalence of reported drug use between men and women. We then used binary logistic regression to examine risk of using each drug per SD increase in IQ scores at 11 years. These analyses were adjusted for separately for potential confounds (birth weight, parental social class, material disadvantage) and mediating factors in childhood (anxiety, antisocial behavior) and adulthood (social class, age left education, psychological distress), followed by a full adjustment. In preliminary unadjusted analyses, associations between IQ and drug use were stronger in women than men for the lifetime use of cannabis (P for interaction = .04), amphetamines (P = .009), amyl nitrate (P = .003), magic mushrooms (P = .009), cocaine ($P < .001$), the use of any drug (P = .01), but not ecstasy, LSD, or temazepam. We therefore present results separately for men and women.

Results

Of the 3509 male and 3204 female study members, 38.7% and 24.0% had used cannabis by 42 years of age, respectively. The lifetime prevalence of drug use was greater in men than women for all drugs ($P < .03$). Table 1 shows that, on average, men and women with a greater IQ at age 11 came from a more advantaged socioeconomic background, experienced less material disadvantage, and showed less evidence of antisocial behavior as children. In women, but not men, there was an association between greater

Table 1
Childhood and adult characteristics of study participants and their relation with IQ at age 11 in 3509 men and 3204 women

	Men (n = 3509)		Women (n = 3204)	
	n (%) or mean (SD)	Correlation with IQ*	n (%) or mean (SD)	Correlation with IQ*
At 11 years of age				
Parental social class				
I	216 (6.2)	−0.29†,‡	168 (5.2)	−0.29†,‡
II	660 (18.8)		622 (19.4)	
III	404 (11.5)		368 (11.5)	
IV	1458 (41.6)		1326 (41.4)	
V	587 (16.7)		573 (17.9)	
VI	184 (5.2)		147 (4.6)	
Material disadvantage in childhood				
1 (least disadvantaged)	1082 (30.8)		953 (29.7)	
2	1080 (30.8)		953 (29.7)	
3	862 (24.6)		828 (25.8)	
4	424 (12.1)		408 (12.7)	
5 (most disadvantaged)	61 (1.7)	−0.31†,‡	62 (1.9)	−0.31†,‡
Birth weight, oz	131.15 (65.98)	0.01	124.94 (63.51)	0.02
Anxiety	3.18 (1.30)	−0.02	3.15 (1.20)	−0.04§
Antisocial behavior	7.60 (2.03)	−0.12†	7.11 (1.95)	−0.13†
At 42 years of age				
Social class				
I	248 (7.1)	−0.41†,‡	79 (2.5)	−0.30†,‡
II	1384 (39.4)		1107 (34.6)	
III	344 (9.8)		1106 (34.5)	
IV	1158 (33.0)		245 (7.6)	
V	294 (8.4)		538 (16.8)	
VI	81 (2.3)		129 (4.0)	
Psychological distress	1.42 (2.19)	0.02	1.86 (2.53)	−0.008
Age left education	17.30 (2.43)	0.40†	17.18 (2.06)	0.40†

* Pearson's correlations.
† $P < .001$.
‡ Spearman's rank correlations.
§ $P < .05$.

IQ and lower levels of anxiety in childhood. As anticipated, high IQ scores at 11 years were also linked to a higher achieved social class, and age at which study members left education.

In Table 2, we show the association between IQ and drug use before and after adjustment for a series of other potential risk factors. In men, after full adjustment for all risk factors, a 1 SD increase in IQ scores at 11 was associated with an increased risk of using cannabis (odds ratio [OR], 1.28; 95% confidence interval [95% CI], 1.17–1.39), LSD (OR, 1.28; 95% CI, 1.07–1.54), amyl nitrate (OR, 1.28; 95% CI, 1.07–1.54), magic mushrooms (OR, 1.26; 95% CI, 1.08–1.46), and any drug (OR, 1.28; 95% CI, 1.07–1.54) but not cocaine, amphetamines, ecstasy, or temazepam. These associations were replicated in women, with significant associations also found with cocaine (OR, 1.66; 95% CI, 1.21–2.27) and amphetamines (OR, 1.50; 95% CI, 1.22–; 1.83). Relative to the univariable model, the associations between IQ and most drugs were materially unchanged after these adjustments. Cocaine and amphetamine use in men, and LSD use in women, were however attenuated after adjustment for socioeconomic advantage in childhood or adulthood.

Discussion

In this longitudinal, population-based sample, children with a greater IQ were *more* likely to have used illegal drugs by middle age. These findings were little changed when we took into account a series of physical and psychosocial factors across the life course. These results add to the limited evidence which suggests that greater IQ in childhood might be linked with greater use of illegal drugs in adulthood [22–24]. Of particular relevance is our replication of stronger associations between IQ and drug use in women than men [22], a finding which has been found to also apply to the relationship between childhood IQ and excess alcohol consumption and alcohol dependency in adulthood [4,6].

This study has several strengths, including its large sample size and detailed data on the participants' early life that allowed us to adjust for a range of potentially mediating and confounding factors. There were also some limitations. First, those in the analytical sample represented 58.8% of participants who attended at age 42, and those who were excluded had slightly lower IQ scores. Second, as we used the lifetime prevalence of drug use, it is possible that drug use occurred before our IQ was assessed. However, most first experiences with drugs occur between 15 to 24 years of age [25,26], it is unlikely drug initiation preceded assessment of cognitive ability at age 11. Third, no information was recorded on the age when illegal drugs were first used. Nor was there information regarding length of time of drug use, or patterns of use throughout the life course. This information would have been useful in determining the timing and content of drug prevention interventions. However, the pattern of attenuation we observed may help to inform the content of drug prevention interventions. If social class is acting as a mediator of the IQ-drug use relation, this suggests that more resources should be devoted to increasing IQ in children. Conversely, if social class is acting as a confounder in the IQ–drug use relation, interventions should attempt to increase access to education, training, and employment.

In conclusion, in our large population-based cohort study, IQ at 11 years was associated with a greater likelihood of using selected illegal drugs 31 years later. These findings suggest that, in contrast to most studies on the association between childhood IQ and later health [27], a high childhood IQ may prompt the adoption of behaviors that are potentially harmful to health (ie, excess alcohol consumption and drug use) in adulthood [4,6]. Examination of childhood IQ with other risk factors for drug use may aid understanding the mechanisms underlying these associations, and inform interventions for reducing the impact of these behaviors.

Acknowledgments

David Batty is a Wellcome Trust Career Development Fellow. The Centre for Cognitive Ageing and Cognitive Epidemiology is supported by the Biotechnology and Biological Sciences Research Council, the Engineering and Physical Sciences Research Council, the Economic and Social Research Council, the Medical Research Council, and the University of Edinburgh. The work was undertaken

Table 2
ORs (95% CI) for the association of IQ at age 11 with lifetime illegal drug use in 3509 men and 3204 women

	Adjustments, OR (95% CI)*					
	No (%) of cases	Unadjusted	Birth weight, parental social class, material disadvantage in childhood†	Anxiety, antisocial behavior†	Current social class, age left education, psychological distress‡	All
Men						
Cannabis	1272 (36.2)	1.28 (1.19–1.38)	1.25 (1.16–1.35)	1.31 (1.21–1.41)	1.28 (1.18–1.40)	1.28 (1.17–1.39)
Cocaine	198 (5.6)	1.19 (1.02–1.38)	1.12 (0.95–1.32)	1.21 (1.04–1.41)	1.14 (0.95–1.35)	1.11 (0.93–1.32)
Amphetamines	340 (9.7)	1.13 (1.00–1.27)	1.09 (0.97–0.78)	1.15 (1.02–1.30)	1.13 (0.99–1.29)	1.12 (0.97–1.28)
Ecstasy	104 (3.0)	0.95 (0.77–1.16)	0.95 (0.76–1.18)	0.96 (0.78–1.17)	0.98 (0.77–1.24)	0.97 (0.76–1.23)
LSD	197 (5.6)	1.28 (1.09–1.49)	1.27 (1.08–1.49)	1.30 (1.11–1.52)	1.29 (1.08–1.53)	1.28 (1.07–1.54)
Amyl nitrate	254 (7.2)	1.23 (1.08–1.41)	1.16 (1.00–1.35)	1.25 (1.09–1.44)	1.23 (1.05–1.43)	1.19 (1.02–1.40)
Magic mushrooms	287 (8.2)	1.34 (1.17–1.52)	1.29 (1.12–1.48)	1.36 (1.19–1.55)	1.27 (1.10–1.48)	1.26 (1.08–1.46)
Temazepam	75 (2.1)	1.03 (0.81–1.31)	0.98 (0.76–1.27)	1.40 (0.81–1.32)	1.03 (0.77–1.37)	1.01 (0.76–1.35)
Any	1357 (38.7)	1.24 (1.15–1.33)	1.21 (1.12–1.30)	1.26 (1.17–1.36)	1.24 (1.14–1.35)	1.23 (1.13–1.34)
Women						
Cannabis	689 (21.5)	1.46 (1.32–1.61)	1.35 (1.22–1.51)	1.48 (1.34–1.63)	1.32 (1.19–1.48)	1.30 (1.16–1.45)
Cocaine	82 (2.6)	2.13 (1.61–2.82)	1.87 (1.39–2.59)	2.12 (1.60–2.81)	1.77 (1.30–2.40)	1.66 (1.21–2.27)
Amphetamines	182 (5.7)	1.50 (1.26–1.78)	1.40 (1.17–1.70)	1.52 (1.27–1.81)	1.54 (1.27–1.88)	1.50 (1.22–1.83)
Ecstasy	45 (1.4)	1.31 (0.94–1.84)	1.25 (0.87–1.80)	1.30 (0.92–1.82)	1.25 (0.86–1.83)	1.22 (0.83–1.80)
LSD	91 (2.8)	1.46 (1.14–1.86)	1.28 (0.99–1.67)	1.47 (1.16–1.88)	1.32 (1.01–1.72)	1.24 (0.94–1.64)
Amyl nitrate	76 (2.4)	1.98 (1.49–2.64)	1.87 (1.38–2.53)	2.02 (1.51–2.69)	1.80 (1.32–2.45)	1.79 (1.30–2.46)
Magic mushrooms	114 (3.6)	1.85 (1.47–2.33)	1.61 (1.26–2.06)	1.87 (1.48–2.35)	1.62 (1.26–2.08)	1.52 (1.18–1.98)
Temazepam	98 (3.1)	1.14 (0.91–1.42)	1.07 (0.84–1.36)	1.13 (0.89–1.41)	1.24 (0.96–1.59)	1.16 (0.89–1.51)
Any	770 (24.0)	1.44 (1.30–1.58)	1.35 (1.22–1.49)	1.46 (1.33–1.60)	1.32 (1.19–1.47)	1.30 (1.17–1.45)

CI = confidence interval; LSD = lysergic acid diethylamide; OR = odds ratio.
* Indicates per 1-SD increase in cognitive ability.
† Assessed at 11 years of age.
‡ Assessed at 42 years of age.

with the support of The Centre for the Development and Evaluation of Complex Interventions for Public Health Improvement (DECIPHer), a UKCRC Public Health Research: Centre of Excellence. Funding from the British Heart Foundation, Cancer Research UK, Economic and Social Research Council (RES-590-28-0005), Medical Research Council, the Welsh Government, and the Wellcome Trust (WT087640MA), under the auspices of the UK Clinical Research Collaboration, is gratefully acknowledged.

References

[1] Batty GD, Deary IJ, Macintyre S. Childhood IQ in relation to risk factors for premature mortality in middle-aged persons: the Aberdeen Children of the 1950s study. Br Med J 2007;61(3):241.

[2] Batty GD, Deary IJ, Macintyre S. Childhood IQ in relation to risk factors for premature mortality in middle-aged persons: the Aberdeen Children of the 1950s study. J Epidemiol Community Health 2007;61(3):241–7.

[3] Gale CR, Deary IJ, Schoon I, Batty GD. IQ in childhood and vegetarianism in adulthood: 1970 British cohort study. Br Med J 2007;334(7587):245.

[4] Batty GD, Deary IJ, Schoon I, Emslie C, Hunt K, Gale CR. Childhood mental ability and adult alcohol intake and alcohol problems: the 1970 British cohort study. Am J Public Health 2008;98(12):2237.

[5] Jefferis BJMH, Manor O, Power C. Cognitive development in childhood and drinking behaviour over two decades in adulthood. J Epidemiol Community Health 2008;62(6):506–12.

[6] Hatch SL, Jones PB, Kuh D, Hardy R, Wadsworth ME, Richards M. Childhood cognitive ability and adult mental health in the British 1946 birth cohort. Soc Sci Med 2007;64(11):2285–96.

[7] Osler M, Nordentoft M, Andersen AM. Childhood social environment and risk of drug and alcohol abuse in a cohort of Danish men born in 1953. Am J Epidemiol 2006;163(7):654.

[8] Ensminger ME, Juon HS, Fothergill KE. Childhood and adolescent antecedents of substance use in adulthood. Addiction 2002;97(7):833–44.

[9] Fergusson DM, Horwood LJ, Ridder EM. Show me the child at seven II: childhood intelligence and later outcomes in adolescence and young adulthood. J Child Psychol Psychiatry 2005;46(8):850–8.

[10] Fleming JP, Kellam SG, Brown CH. Early predictors of age at first use of alcohol, marijuana, and cigarettes. Drug Alcohol Depend 1982;9(4):285–303.

[11] Kellam SG, Ensminger ME, Simon MB. Mental health in first grade and teenage drug, alcohol, and cigarette use. Drug Alcohol Dependence 1980;5(4):273–304.

[12] Gottfredson LS. Intelligence: is it the epidemiologists' elusive‘ fundamental cause’ of social class inequalities in health? J Personality Soc Psychol 2004; 86(1):174–99.

[13] Buka SL. Disparities in health status and substance use: ethnicity and socioeconomic factors. Public Health Rep 2002;117(Suppl 1):S118.

[14] Martin LT, Fitzmaurice GM, Kindlon DJ, Buka SL. Cognitive performance in childhood and early adult illness: a prospective cohort study. J Epidemiol Community Health 2004;58(8):674.

[15] Power C, Elliott J. Cohort profile: 1958 British birth cohort (National child development study). Int J Epidemiol 2006;35(1):34–41.

[16] Douglas JWB. The home and the school: a study of ability and attainment in the primary school. London: MacGibbon and Kee; 1964.

[17] Centre for Longitudinal Studies. NCDS6 [cited 2011 Dec 13]: http://www.cls.ioe.ac.uk/page.aspx?&sitesectionid=771&sitesectiontitle=Data+Notes. Accessed 29.06.12.

[18] Office PC& S. Classification of Occupations 1980. London: Stationery Office Books; 1980.

[19] Gale CR, Hatch SL, Batty GD, Deary IJ. Intelligence in childhood and risk of psychological distress in adulthood: the 1958 National Child Development Survey and the 1970 British Cohort Study. Intelligence 2009; 37(6):592–9.

[20] Rutter M, Tizard J, Whitmore K. Education, health and behaviour. London: Longman Publishing Group; 1970.

[21] Goldberg D, Williams P. A user's guide to the General Health Questionnaire. Berkshire, UK: Nfer-Nelson Windsor; 1988.

[22] White J, Batty GD. Intelligence across childhood in relation to illegal drug use in adulthood: 1970 British Cohort Study [Internet]. J Epidemiol Community Health. 2011 Nov 14 [cited 2011 Dec 13], http://jech.bmj.com/content/early/2011/10/28/jech-2011-200252.abstract; 2011 [accessed 11.06.12].

[23] Osler M, Andersen A, Due P, Lund R, Damsgaard MT, Holstein B. Socioeconomic position in early life, birth weight, childhood cognitive function, and adult mortality. A longitudinal study of Danish men born in 1953. J Epidemiol Community Health 2003;57(9):681.

[24] Pudney S. Rarely pure and never simple: extracting the truth from self-reported data on substance use. [Internet]. The Institute of Fiscal Studies, http://www.cemmap.ac.uk/wps/cwp1107.pdf; 2006 [accessed 11.06.12].

[25] Vega WA, Aguilar-Gaxiola S, Andrade L, Bijl R, Borges G, Caraveo-Anduaga JJ, et al. Prevalence and age of onset for drug use in seven international sites: results from the international consortium of psychiatric epidemiology. Drug Alcohol Depend 2002;68(3):285–97.

[26] Degenhardt L, Chiu W-T, Sampson N, Kessler RC, Anthony JC, Angermeyer M, et al. Toward a global view of alcohol, tobacco, cannabis, and cocaine use: findings from the WHO World Mental Health Surveys. PLoS Med 2008;5(7):e141.

[27] Batty GD, Deary IJ, Schoon I, Gale CR. Childhood Mental Ability in Relation to Food Intake and Physical Activity in Adulthood: the 1970 British Cohort Study. Pediatrics 2007;119(1):e38–45.