Intelligence 40 (2012) 82–90

Contents lists available at SciVerse ScienceDirect

Intelligence

Associations between intelligence in adolescence and indicators of health and health behaviors in midlife in a cohort of Swedish women

Karin Modig [a,*], Lars R. Bergman [b]

[a] Institute of Environmental Medicine, Division of Epidemiology, Karolinska Institute, Box 210, 71 77 Stockholm, Sweden
[b] Stockholm University, Department of Psychology, Sweden

ARTICLE INFO

Article history:
Received 22 August 2011
Received in revised form 2 February 2012
Accepted 4 February 2012
Available online 22 February 2012

Keywords:
Cognitive epidemiology
Health behavior
Health
Women
Intelligence

ABSTRACT

The objective of this study was to investigate associations between intelligence and indicators of health status and health behaviors at age 43 in a cohort of Swedish women (n = 682). Intelligence was measured by standard IQ tests given at ages 10, 13, and 15. At the age of 43, 479 of the women were sampled for a medical examination in which 369 participated (77% participation rate). We performed correlations of IQ and the continuous health variables and we estimated logistic regression models with dichotomous health variables as the dependent variables. No significant correlations were found between IQ and any of the continuous health variables. In unadjusted logistic regression models where the cut-off points were set based on standard health risk levels, four out of sixteen indicators of unfavorable health status and health behaviors showed significant negative associations with intelligence, meaning higher risk with decreasing IQ-score. After adjusting for educational level, two remained statistically significant: being obese, OR 1.51 (95% CI 1.08, 2.12) and having a high systolic blood pressure OR 1.45 (95% CI 1.03, 2.03). For all other health variables, this study finds no support for a sizable association between IQ in adolescence and indicators of health and health behavior in midlife among Swedish women.

1. Introduction

The inverse association between early intelligence and later morbidity and mortality, sometimes referred to as cognitive epidemiology (Deary, 2005; Deary & Batty, 2007), is well established (Batty, Deary, & Gottfredson, 2007; Batty et al., 2009), at least among men. This relationship, together with its potential underlying mechanisms, has also been discussed in several papers (Batty, Deary, & Gottfredson, 2007; Batty, Kivimaki, & Deary, 2010; Deary, 2009; Lager, Bremberg, & Vagero, 2009, 2010). In these studies, intelligence was usually measured by global tests of mental ability where the scores on different subtests were added to give a combined score. Of course, such measures cannot automatically be assumed to be synonymous with intelligence in a more general sense since there exist different theories of the nature and structure of intelligence (Carrol, 1993; Gardner, 1993; Sternberg, 1985). However, within the dominant g-factor paradigm it is claimed that almost any high-quality test of mental ability that has a reasonably broad set of tasks will load heavily in the g-factor (Gottfredson, 2004; Jensen, 1998). Our definition of intelligence is based on this paradigm and, to avoid confusion with the broader intelligence concept, we henceforth mostly use the term "IQ" instead of intelligence.

Despite the established association between early IQ and later health outcomes the underlying mechanisms linking IQ to them are not clear. IQ may act through other variables, or perhaps not at all, if the associations are due to confounding from other factors. Further, as the association between IQ and mortality has been shown in some studies to be present for men only and not for women (Kuh, Richards, Hardy, Butterworth, & Wadsworth, 2004; Lager et al., 2009; Pearce, Deary, Young, & Parker, 2006) it raises questions about

* Corresponding author.
E-mail address: karin.modig@ki.se (K. Modig).

0160-2896/$ – see front matter © 2012 Elsevier Inc. All rights reserved.
doi:10.1016/j.intell.2012.02.002

whether the mechanisms linking IQ to health outcomes are different for men and women.

An often discussed mechanism is mediation by health behaviors, i.e. that IQ affects health behaviors which in turn affects health outcomes. The idea that highly intelligent individuals adopt healthier behaviors is perhaps the most advocated theory among people in general when discussing intelligence and health. It is not unlikely to think that a person with high intelligence would have a greater capacity to collect information about behaviors believed to affect health outcomes, compared to a person who is not so intelligent. Also, the disease and mortality outcomes that are associated with IQ appear to be outcomes related to lifestyle such as cardiovascular diseases (CVD), injuries, accidents, lung cancer, and skin cancer (Batty, Deary, & Gottfredson, 2007; Batty, Deary, Schoon, & Gale, 2007; Batty et al., 2007).

Potential mediation from health behaviors has been tested in some studies by adjusting the IQ–mortality association for health behaviors (Batty et al., 2008; Kuh et al., 2004) and by looking at the association of IQ with health behaviors alone (Anstey & Sachdev, 2009; Batty, Deary, & Macintyre, 2007; Chandola, Deary, Blane, & Batty, 2006). Either way, the results are not conclusive and in most cases they are based on men only or men and women were analyzed together.

Several studies have looked at early IQ and obesity later in life (Batty, Deary, & Macintyre, 2007; Batty, Deary, Schoon, & Gale, 2007; Chandola et al., 2006; Halkjaer, Holst, & Sorensen, 2003; Hart et al., 2004; Lawlor, Clark, Davey Smith, & Leon, 2006; Yu, Han, Cao, & Guo, 2010) and in most of these studies an association has been found in unadjusted models but after adjustment for adult socioeconomic position and/or education the associations are no longer statistically significant (Batty, Deary, Schoon, & Gale, 2007; Chandola et al., 2006; Halkjaer et al., 2003a; Lawlor et al., 2006). However, one study, based on men only, found a significant association also after adjustment for indicators of adult socioeconomic position (Batty, Deary, & Macintyre, 2007). In another study on men only, Batty et al. found an association of IQ with four of the five individual components comprising the metabolic syndrome: Hypertension, high body mass index, BMI, high triglycerides, and high blood glucose (Batty et al., 2008). Der, Batty, and Deary (2009) found several health outcomes, for example hypertension, to be associated with early IQ-level, however, they did not control the estimates for adult education or socioeconomic position.

Several studies have found an inverse association of IQ and smoking status (Anstey & Sachdev, 2009; Batty, Deary, Schoon, & Gale, 2007; Batty, Shipley, et al., 2008; Hemmingsson, Kriebel, Melin, Allebeck, & Lundberg, 2008; Kubicka, Matejcek, Dytrych, & Roth, 2001) but in many of these studies the association vanished or was heavily attenuated after adjustment for indicators of social class. We have also shown in a twin study that the association between IQ and smoking status seems to be confounded by common environmental factors (Wennerstad et al., 2010). Only a few of these studies included women, and those who did analyzed men and women in the same model adjusting for gender, which makes it difficult to see whether the associations were the same for men and women.

Another proposed mechanism behind the intelligence–health outcome relationship is what has been referred to as "system integrity" (Deary, Weiss, & Batty, 2010). It explains the relationship based on the idea that optimal brain development is strongly connected to optimal development of other somatic systems such as the cardiovascular system. This may be due to confounding from common genetic or biological factors. The theory receives some support from the established inverse association with CVD of both height and IQ (Pearce, Deary, Young, & Parker, 2005), or that low birth weight for gestational age and IQ both are related to CVD risk (Bergvall, Iliadou, Johansson, Tuvemo, & Cnattingius, 2006). It is feasible that malnutrition or other non-optimal conditions in fetal life or early postnatal life affects both the development of the brain and also the development of the cardio-vascular system, creating a spurious correlation between intelligence and risk of CVD.

Based on the divergent findings of the relationship between IQ and health behaviors and indicators of health, and the lack of studies based on female samples, our aim was to study these relationships for a cohort of Swedish women. In a longitudinal study they have been followed from the age of 10 to age 43 with IQ measured in early adolescence and health variables measured in midlife.

2. Methods

2.1. Sample

The present study is based on data on women from the Swedish longitudinal research program Individual Development and Adaptation, IDA (Magnusson, 1988). In IDA a whole school grade cohort of children from the town of Örebro, Sweden, has been followed from age 10 in 1965 to age 49 in 2004 and children who moved into Örebro after the age of 10 have been added to the cohort (n = 682 females). Örebro is a midsized Swedish town with a population of about 100,000 inhabitants. It is in many respects fairly representative of Swedish urban communities, excluding the big cities. However, for the 13 years old children in 1968 the average educational level of the parents and the children's intelligence tests results were slightly higher than the corresponding figures for the average urban community (Bergman, 1973).

IQ data from the school years were available for 657 girls, or 96% of the school grade cohort, and data from a medical examination at age 43 (in 1998) were available for 369 women, or 54% of the school grade cohort. However, from a representativeness point of view, the participation rate is higher (77%) since only a subsample of the whole school grade cohort was sampled for the medical examination (n = 479; Bergman, 2000).

To obtain some information about sample bias in the main investigation variable (IQ), we first compared the average IQ at age 10, 13, and 15 between those having taken part in the medical examination and the others in the school grade cohort and no significant differences were found. We then compared these two groups with regard to their final education obtained in another data collection at age 43 with a participation rate of 89% and again no significant differences were found (although there was a tendency for those who had taken part in the medical examination to have a *lower* final education than other cohort members). As expected, the IQ scores at age 10, 13 and 15 were highly correlated.