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The contribution of intellectual abilities to young adult's educational differences in health care use – A prospective cohort study

Maren Kraft[a,*,1], Koos Arts[b], Tanja Traag[b], Ferdy Otten[b], Hans Bosma[a]

[a] School for Public Health and Primary Care (CAPHRI), Department of Social Medicine, UM, CAPHRI, PO Box 616, Maastricht, MD 6200, The Netherlands
[b] Statistics Neteherlands, P.O. Box 4481, Heerlen, CZ 6401, The Netherlands

A B S T R A C T

Objectives: To examine the contribution of 12-year olds' intellectual abilities to educational differences in health care use in young adulthood. The focus on this life-course phase, including the socioeconomic circumstances in which the participants were brought up, allows an in-depth examination of the influence of important social mobility processes.

Methods: A large dataset of 10,400 participants was used to establish the relationship between intellectual abilities in early 2000 (when the participants were 12 years of age) and the educational differences in health care use in 2012 (when the participants were 24 years of age). Outcome variables, i.e. educational attainment and hospital admissions, GP costs, hospital costs, and medication use, were matched from national registers. Logistic regression analysis was used to determine educational differences in health care use, unadjusted and adjusted for the intellectual abilities.

Results: The educational differences in health care use varied by type of usage (e.g. low education — high hospital admission: OR = 2.89, CI = 2.27, 3.67; low education — high medication use: OR = 1.49, CI = 1.30, 1.71). Also, independent of parental socioeconomic status, intellectual abilities contributed substantially to the educational differences in health care use. The percentage reduction of the ORs after adjustment for intellectual abilities ranged between 1.84% and 38% and was on average almost 25%.

Conclusion: Educational differences in health care use in young adulthood appear partly based on prior differences in intellectual abilities. Further research is needed with longer follow-ups during people's life-courses. Additionally, we need more insight in how this evidence can effectively be used in the complex challenge of tackling socioeconomic differences in health.

1. Introduction

Intelligence has been referred to as the elusive fundamental cause of social class inequalities in health (Gottfredson, 2004). Several studies have shown that intelligence has an effect on diverse life-course outcomes, such as socioeconomic success, decisions we make in daily life (Gottfredson, 1997), longevity (Calvin et al., 2011; Deary, Weiss, & Batty, 2010; Deary, Whiteman, & Starr, 2004), and risks of morbidity (Der, Batty, & Deary, 2009). Individual differences, such as differences in intellectual abilities, might thus also contribute to the development of socioeconomic health differences (SEHD), i.e. the generally poor health outcomes for people in lower socioeconomic positions (Gottfredson, 2004). Much research addresses the influence of intelligence on SEHD. Whereas some studies found a marked reduction in SEHD after controlling for intelligence (Batty, Der, Macintyre, & Deary, 2006; Batty et al., 2009; Bosma, Traag, Berger-van Sijl, van Eijk, and Otten, 2007; Bosma, van Boxtel, Kempen, van Eijk, and Jolles, 2007), suggesting relevant confounding by intellectual abilities, others found no evidence for such a contribution (Singh-Manoux, Ferrie, Lynch, & Marmot, 2005; Bosma, Traag, et al., 2007; Bosma, van Boxtel, et al., 2007)

Mackenbach (2012) hypothesized that the increased opportunities for social mobility might be an important determinant of SEHD. Attaining a higher socioeconomic position compared to your parents (inter-generational) or compared to where a person started (intra-generational) is increasingly based on personal characteristics, such as intellectual abilities, rather than, as in previous times, on one's own socioeconomic family background. Individual differences, such as

* Corresponding author.
E-mail addresses: m.kraft@maastrichtuniversity.nl (M. Kraft), k.arts@cbs.nl (K. Arts), t.traag@cbs.nl (T. Traag), f.otten@cbs.nl (F. Otten), hans.bosma@maastrichtuniversity.nl (H. Bosma).
[1] Present address: Friedensplatz 8, 53111 Bonn, Germany.

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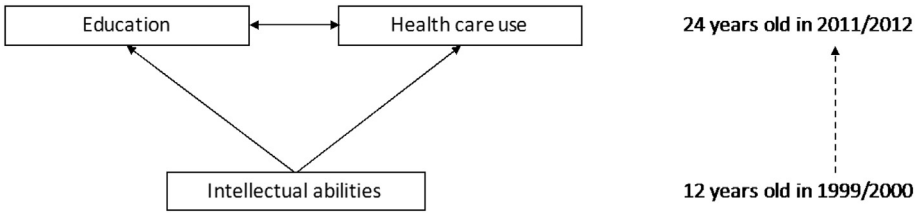

Fig. 1. Working model of the association between intellectual abilities in 2000 (at the age of 12) and educational differences in health care use in 2011/2012 (at the age of 24). The Netherlands, 1999–2012.

intellectual abilities, are formed in early life and might not only be of relevance for one's school and occupational career (socioeconomic attainment), but also for one's health-related career and life-course. As most of the prior research focused on adult population groups, there is thus a need to look at younger populations as well. During adolescence and young adulthood, important processes of social mobility take place during which intellectual abilities are allowed to have an important influence.

Using national registers and data from 19,391 Dutch youngsters, we set out to examine to what extent intellectual abilities at the age of 12 contribute to (or confound) the association between the attained educational level (as an indicator of socioeconomic position) and various indicators of health care use (both at the age of 24) and to examine the extent to which these associations are independent of the parental socioeconomic position. (See Fig. 1.)

2. Methods

2.1. Study population

The Secondary Education Pupil Cohort 1999 (VOCL'99), conducted by Statistics Netherlands (CBS) and the Groningen Institute for Education Research (GION), provides data of a random selection of Dutch secondary schools. In total 126 schools, out of 246, agreed to take part in the study (Kuyper, Lubbers, & Van der Werf, 2003). A sample of 19,391 participants from 825 school classes participated in filling in questionnaires at baseline in 1999/2000 (Traag, 2012). Information about the parental socioeconomic position, ethnicity, and marital status was collected through questionnaires for the parents at baseline. Any further information about the participants, available from national registers, has been linked to the VOCL'99 cohort. Linked data included information about the participants when they were approximately 24 years of age: hospital admissions, general practitioner (GP) costs, hospital costs, medication use, final attained educational level. Parental income (used as covariate) in 2003 has been linked to the VOCL'99 cohort as well. After the exclusion of missing cases due to death (N = 58), incomplete intelligence tests (N = 6545), and missing covariates (N = 5093), 10,400 participants (53.6%) remained for the analyses. More in-depth information can be found in Kraft, Traag, Arts, Otten, and Bosma (2016).

2.2. Measures

To link data to the VOCL'99 cohort, gender, date of birth and the postcode of participants were first used as key codes. Using these key codes, the participants were linked uniquely to the Dutch municipal population register (GBA). The GBA can link the matched codes with the health care use registers and socioeconomic registers. For every successful link from the national registers via the GBA to the VOCL'99 cohort, a unique record identification number (RIN) was created (Willenborg & Heerschap, 2012). The success rate of linking was 99.8% for the participants' data and 99.3% for the parental income measure.

2.3. Health care use

Four indicators for health care use were available. First, hospital admissions (no, yes) of participants were registered at the National Medical Registration (Landelijke Medische Registratie (LMR) in Dutch) in 2011 (2012 data were not sufficiently reliable and were therefore not used) (De Bruin et al., 2003). The LMR derives from Dutch Hospital Data (DHD) and includes all academic, general and categorical hospitals, except for centers for rehabilitation, asthma, and epilepsy. Deliveries without complications, part-time treatment for psychiatric illnesses, and daytime rehabilitation treatment were not registered. Only one of the two categorical cancer clinics in the Netherlands is represented in the LMR. In total, the LMR has sample coverage of about 84%. Second, although related to the previous hospital admission variable, hospital costs additionally indicate the severity of the diseases for which participants had been hospitalized. Third, registered costs related to the use of services of GPs were used. Both, hospital and GP costs were assessed in 2012. To the extent that these services are covered by the Dutch basic insurance, the costs are reimbursed by the health insurance companies [Zorgverzekeringswet (ZVW)] (Statistics Netherlands, 2015a). The two cost variables were summed and subsequently dichotomized into 80% of participants with the lowest costs and 20% of participants with the highest costs. Last, any reimbursed medication under the statutory basic medical insurance was used as fourth health outcome, assessed in 2012 (College voor Zorgverzekering, CvZ) (Statistics Netherlands, 2015b).

2.4. Attained educational level

The highest attained level of education at the end of the follow-up provides a measure for the socioeconomic position of the participants. The educational level, for which participants received a certificate, ranging from primary to university education (13 ordinal categories according to the 'Standaard Onderwijsindeling' (SOI) in Dutch) was determined in 2012 (Statistics Netherlands, 2015c). The variable was recoded into thirds (using tertiles). Although income data were also available, these were not used, because the income at age 24 cannot yet be considered as a valid indicator of socioeconomic position at that age (Galobardes, Shaw, Lawlor, Lynch, & Smith, 2006). In our data, education and income correlated only little (Pearson correlation: 0.06).

2.5. Intellectual ability

Intellectual ability was measured using the Dutch intelligence test for educational purposes (Nederlandse Intelligentietest voor Onderwijsdoeleinden, NIO), which total score gives an index of general intelligence, also known as 'g'. Intellectual abilities were assessed when participants were approximately 12 years old and entered the second class of secondary education, in 2000. NIO has been developed to support decisions on finding an adequate school level for pupils. It has been shown to be both valid and reliable (Van Dijk & Tellegen, 2004). The total intelligence quotient (IQ) score is generated from six subtests classified as verbal (synonyms, analogies and categories) and symbolic (numbers, math and spatial awareness). Fluid intelligence, the inherent ability to solve new problems, as well as crystallised intelligence, the ability to use learned knowledge, can be determined from this assessment tool. Furthermore, it has been shown that the total IQ is strongly related to the Wechsler Intelligence Scale for Children (WISC-R) with a correlation of 0.69 (Van Dijk & Tellegen, 2004). The total IQ score was