Accident Analysis and Prevention 106 (2017) 109–114

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

Does gender moderate the association between intellectual ability and accidental injuries? Evidence from the 1953 Stockholm Birth Cohort study

Carl Bonander[a,b,*], Carolina Jernbro[a,c]

[a] Centre for Public Safety, Karlstad University, Sweden
[b] Department of Environmental and Life Sciences, Karlstad University, Sweden
[c] Department Health Sciences, Karlstad University, Sweden

ARTICLE INFO

Keywords:
Sweden
Gender
Health inequalities
Cognitive ability
Unintentional injury
Safety
Socioeconomic status
Accidents

ABSTRACT

In this paper, we test for gender differences in the effects of intellectual ability on accidental injury risks using longitudinal data from the 1953 Stockholm Birth Cohort study (n = 14,294). Intellectual ability was measured using IQ tests issued during a school survey at age ~13, and outcome and covariate data was collected via record linkage to population and health registers, following the cohort from childhood to 55 years of age. We used ICD codes to identify accidental injuries resulting in hospital admissions and deaths, and shared frailty models to quantify the effects of IQ, while allowing for within-individual dependencies and recurrent events. The models included tests for the moderating effects of gender, as well as childhood family variables (parental socioeconomic status), and cohort member mediators (highest achieved education, socioeconomic status and income at the time of the event). The results indicate an inverse association between childhood IQ and subsequent accidental injury events, where 1 SD decrease in IQ implies a 17.8% increase in injury risk. We also found evidence that gender moderates this relationship, where the effect size was twice as large for men than for women (21.8% vs 9.3% per 1 SD decrease). Adult socioeconomic status can explain roughly half of the observed association. Potential explanations for these results are discussed.

1. Introduction

Accidental injuries are a global public health problem, resulting in large societal and individual losses in terms of morbidity, disability and premature mortality each year (Murray et al., 2012). There are many individual, social and environmental risk factors for injury, which can affect injury risks in general (e.g. age, socioeconomic status and alcohol consumption (Carpenter and Dobkin, 2009; Laflamme and Diderichsen, 2000)), or increase the risk for specific external causes of injury (e.g. poor road quality, building standards, or occupational safety regulations). In this paper, we examine the relationship between cognitive ability and overall accidental injury risks in a Swedish birth cohort. We pay extra attention to the potential moderating effects of gender, and the impact of intermediary socioeconomic and educational mechanisms, on this relationship.

There is a plethora of evidence that cognitive ability is inversely associated with all-cause mortality (Batty et al., 2007a; Calvin et al., 2011) and other adverse health outcomes (see e.g. Der et al., 2009; Lundin et al., 2015). However, few studies have examined the association between childhood cognitive ability and subsequent accidental injuries, especially with respect to gender differences. In fact, most have used male only samples, which directly inhibit such comparisons. For instance, a study by Whitley et al. (2010) found evidence of an increased risk of dying in traffic accidents, fires and poisonings with lower scores on an intelligence test issued to Swedish male conscripts. Similarly, Osler et al. (2007) found an inverse relationship between intelligence and accidental injuries, specifically falls and poisoning, among Danish men. In a follow-up to the Swedish conscript study that linked the draft data to offspring data, Jelenkovicet al. (2014) found an association between lower paternal intelligence scores and increased risk of offspring mortality and injuries by external causes.

1.1. Gender differences in the effect of intelligence

The current literature on the effects of intelligence on all-cause mortality generally disfavors the gender-intelligence interaction hypothesis (Calvin et al., 2011). However, roughly 90 percent of the all-cause health burden is comprised of diseases rather than injuries (Haagsma et al., 2016), which could mask any differences specific to injury-related mortality and morbidity.

* Corresponding author at: Division of Risk and Environmental Studies, Department of Environmental and Life Sciences, Karlstad University, SE-651 88 Karlstad, Sweden.
E-mail address: carl.bonander@kau.se (C. Bonander).

http://dx.doi.org/10.1016/j.aap.2017.06.001
Received 5 March 2017; Received in revised form 16 May 2017; Accepted 1 June 2017

We argue that the etiology of injuries clearly distinguishes itself from that of diseases by being a result of an acute exposure to energy caused by some adverse event, which in itself is a consequence of an instantaneous and harmful interaction between an individual at risk and their surrounding physical and social environment (Haddon 1980). While the determinants of ill-health often overlap with those of accidents, injuries are more directly connected to activities that may put an individual at risk. They are also highly susceptible to human error in the absence of protective barriers that account for such errors (Reason, 2000). Thus, any variable that causes a systematic variation in the selection into, or the preference for, different activities with varying degrees of danger will likely affect the risk of injury. In addition, factors that (directly or indirectly) cause individual differences in the probability of human error will also play an important role. We argue that gender and intelligence independently serve as two of these variables, and that their interaction may modify the strength of their effects.

1.1.1. Gender differences

Independently, gender affects several factors that may cause individual differences in the exposure to injury risks. For instance, men are less likely to wear seatbelts, and more likely to drive under the influence of alcohol and to speed (Harré et al., 1996), which implies that they are less likely to comply with safety regulations. This is also consistent with research on gender differences in conformity and risk-taking (Byrnes et al., 1999; Charness and Gneezy, 2012; Cooper, 1979). Closely related to risky driving in the sense of being a correlate thereof (Oltedal and Rundmo, 2006), men also tend to score higher on tests of sensation-seeking personality traits (Cross et al., 2013), which implies that they are more likely to perform more risky behaviors and activities in general (Horvath and Zuckerman, 1993). Factors such as gender norms (Badgett and Folbre, 1999), differential preferences and attitudes towards risk and competition (Croson and Gneezy, 2009), and labor market discrimination (Azmat and Petrongolo, 2014) are also assumed to have contributed to a large occupational segregation of men and women (Kreimer, 2004), where most occupations with higher-than-average rates of work-related deaths are typically male-dominated (DeLeire and Levy, 2004). The explanations are likely multifaceted and far more complex than the snapshot of evidence provided here, but no matter what the exact causal factors and intermediate mechanisms of the relationship between gender and accidental injuries are, we can clearly observe a strong correlation between gender and the risk of all-cause injury. In fact, the relative risk is higher among men in almost all external cause categories (Haagsma et al., 2016).

1.1.2. Potential mechanisms behind the intelligence-injury association

While recurrent cognitive failures have been found to increase the risk of accidents, such failures have seldom been directly linked to measures of intelligence (Clarke, 2016). However, other traits that are directly related to intelligence, for instance speed of information-processing (Sheppard and Vernon, 2008), might have a negative effect on injury risks by affecting an individual's ability to successfully counteract the injury process before or during an accident. There is also some evidence that motor function is inversely related to intellectual ability, at least in pediatric samples (Smits-Engelsman and Hill, 2012). It is also likely that other environmental, social and behavioral factors can explain the observed relationship between intelligence and injury risks. Holding gender constant, intellectual ability affects a large set of variables that correlate with injury risks, e.g. personality, interests (Ackerman and Heggestad, 1997), labor market outcomes (Lindqvist and Vestman, 2011), educational achievement (Deary et al., 2007) and other socioeconomic variables (Strenze, 2007). These variables are likely to create inequalities in the exposure to hazardous environments, behaviors and safety information (Laflamme and Diderichsen, 2000; Pampel et al., 2010), and thereby affect injury risks as an indirect causal effect of intellectual ability. Thus, there is most likely a social gradient to the relationship between intelligence test scores and injury mortality and morbidity (and all-cause mortality), which is supported by empirical studies that find that socioeconomic status attenuates the association by approximately half (Batty et al., 2009).

1.1.3. An interactive model

If we consider these two components together, we have a male population that is more likely to perform more dangerous activities and less likely to use safety equipment and conform to safety regulations. Assuming that the effects of intellectual ability plays a more important role during these activities by either increasing the probability of an adverse event or the severity of its consequences, it is possible that men with lower cognitive ability will be more affected by injuries than women of equal cognitive ability. In fact, even if the gender differences are non-existent under similar conditions, we assume that, in a general population sample, men will be affected more greatly due to a larger exposure to hazardous environments. In this paper, we aim to test this interaction hypothesis using longitudinal data from a Swedish birth cohort that includes childhood intelligence test scores for both men and women, linked to future injury outcomes.

2. Methods and materials

2.1. Data

We used data from a Swedish birth cohort of 14,294 individuals born in Stockholm 1953, living in Stockholm in 1963 and still alive and residing in Sweden in 1980 and/or 1990 (which is the current definition of the cohort after the most recent follow-up data linkage). Mainly, we utilized data from intelligence tests collected during a school survey in 1966, when the cohort members were approximately 13 years of age. Due to changes in Swedish research ethics regulations during the course of the original cohort study, all individual records were anonymized in 1986, which prohibits direct identification of cohort members in administrative registers. Despite this caveat, 95% of the original cohort has been successfully supplemented with follow-up data by Stenberg et al. (2007), who used probability matching on 13 different variables to link the cohort to administrative registers (including the cohort member's year and month of birth, their parents' years of birth, and other variables describing occupational and housing conditions). This allows us to compare childhood intelligence data to follow-up injury data from the Swedish National Inpatient and Cause of the Death registers. For more information on the cohort itself, see Stenberg et al. (2007). The current study was approved by the Regional Ethics Committee in Uppsala (dnr 2016/125).

2.2. Variables

2.2.1. Outcome

We extracted information on external cause of hospital admissions and deaths from the Swedish hospital discharge and cause of death registers. Accidental injuries were classified according to the International Classification of Diseases (ICD)-8, ICD-9 and ICD-10 codes depending on the year of the event and the classification system used at that time (ICD-8: E800-E929 and E940-E949; ICD-9: E800-E869 and E880-E949; ICD-10: V00-X59 and Y85-Y86). Intentional injuries, injuries with undetermined intent and misadventures during hospital care were excluded (falls and traffic accidents, the two largest categories, account for roughly half of the recorded accidental injuries). Besides external cause codes, the observed injury data also contained information on year of death or hospital discharge. If multiple events were recorded within the same year, with the exact same injury diagnosis and external cause code, they were treated as double registrations and merged into one record (a double registration may e.g. occur if a patient is transferred from one hospital to another). We studied both hospital admissions and deaths as a single outcome variable, although it should be noted that non-fatal injuries heavily outweigh the number of