Intelligence 40 (2012) 317–324

Contents lists available at SciVerse ScienceDirect

Intelligence

Cognitive ability and health-related behaviors during adolescence: A prospective study across five years

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ARTICLE INFO

Article history:
Received 6 May 2011
Received in revised form 6 February 2012
Accepted 17 March 2012
Available online xxxx

Keywords:
Intelligence
Adolescence
Health
Health behavior
Longitudinal research

ABSTRACT

Longitudinal research on the links between intelligence and health behaviors among adolescents is rare. We report longitudinal data in which we assessed the relationships between intelligence as assessed in Grade 7 and consequential health outcomes in Grade 11. The mean age of respondents (N = 420; 188 males, 232 females) was 12.30 years (SD = 0.49) in Grade 7and 16.17 years (SD = 0.45) in Grade 11. They completed standardized verbal and numerical ability tests and a measure of conscientiousness in Grade 7 and health related questions in Grade 11. Results indicated that higher intelligence was associated with a number of healthy behaviors including delay in onset of cigarette smoking. Intelligence significantly predicted less time spent watching TV, lower physical exercise, and lower consumption of stimulant drinks. Covariate analyses showed that general intelligence predicted health outcomes after controlling for conscientiousness, socio-economic status, and gender.

1. Introduction

Adolescence is a time of rapid development and change (Steinberg & Morris, 2001) including change related to health behavior. For example, the high school years are characterized by decreases in physical activity with declines becoming apparent in both males and females by age 13 years (Kahn et al., 2008). Teenagers also consume increasing amounts of unhealthy food (Johnson, Johnson, Wang, Smiciklas-Wright, & Guthrie, 1994). In Australia, as in some other industrialized nations, obesity is a growing problem among young people (Patton et al., 2011). It has also been estimated that 37% of 16–19 year olds in Australia drink at levels that put them at risk for short-term harm (Australian Institute of Health & Welfare, 2007).

Although many studies have been published in the adolescent literature reporting on the factors associated with health-related behaviors, relatively fewer focus on the role of intelligence. The aim of our study was to assess how early intelligence begins to predict health behaviors in the pre-adult years. As most previous studies are based on European and U.S. samples, we provide much needed longitudinal evidence from Australia pertaining to the role that intelligence plays in shaping the health-related behaviors of young people as they move through this important phase of the lifespan. Our study spans Grades 7–11, a critical time during which there is rapid physical growth, increasing demands by the peer group, and the development of new interpersonal relationships (e.g. Arnett, 1999; Smetana, Campione-Barr, & Metzger, 2006; Steinberg & Morris, 2001).

We were interested in those health behaviors of distinctive concern during the teenage years, namely, participation in physical exercise, the consumption of certain foodstuffs and stimulant drinks, drug usage, and time spent watching TV. These behaviors have long-term health implications into adulthood. For example, physical inactivity is associated with

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0160-2896/$ – see front matter
doi:10.1016/j.intell.2012.03.003

cardiovascular disease (Batty, Deary, Benzeval, & Der, 2010); poor diet has implications for diabetes, weight control and pulmonary function (e.g., Batty, Deary, & Gottfredson, 2007) and is associated with higher levels of television viewing (Miller, Taveras, Rifas-Shiman, & Gillman, 2008). Stimulant drinks contain unregulated substances with adverse side-effects (Seifert, Schaechter, Hershorin, & Lipshultz, 2011). It is therefore important to establish the links between these behaviors and cognitive ability during the formative adolescent years.

1.1. Intelligence and health

Gottfredson (1997a) claimed that IQ has important consequences for everyday life, a sentiment recently echoed by others (e.g., Anstey, Low, Christensen, & Sachdev, 2009; Deary, Batty, & Gale, 2008; Halpern, Joyner, Udry, & Suchindran, 2000; Reeve, 2009). Intelligence is also important in the health domain. Because intelligence involves the ability to reason and, because it "… reflects a broader and deeper capability for comprehending our surroundings — "catching on", "making sense" of things, or "figuring out what to do" (Gottfredson, 1997b, p. 13), it is reasonable to argue that one's level of cognitive ability will be related to health outcomes and ultimate survival (Gottfredson & Deary, 2004).

A number of longitudinal studies have linked childhood IQ to several different health outcomes in adulthood, including obesity and weight gain (Chandola, Deary, Blane, & Batty, 2006), the development of some cancers (Hart et al., 2003), and early mortality (Whalley & Deary, 2001). In a comparison of two British national birth cohorts (1958 and 1970), it was found that low IQ as assessed at age 10–11 years was associated with an increased likelihood of smoking during pregnancy (Gale, Johnson, Deary, Schoon, & Batty, 2009). These mothers were also more likely to be current smokers. However, the effect of childhood IQ on smoking in adulthood was mediated by the individual's level of educational attainment and her age at first pregnancy. In a large cohort of over 11,000 respondents it was found that IQ at age 7 years predicted mortality between ages 15–57 years, even after controlling for socio-economic factors, perinatal factors, and other factors such as height and weight (Leon, Lawlor, Clark, Batty, & Macintyre, 2009). Analyzing the data of the 1970 British Cohort Study (Batty, Deary, Schoon, et al., 2007), it was found that higher childhood intelligence was related to more frequent consumption of healthy foodstuffs 20 years later as well as an increased likelihood of participating in physical exercise. A number of these associations were attenuated after adjusting for socio-economic status and were stronger for verbal than non-verbal ability.

The landmark, large-scale, Scottish Mental Surveys which commenced in the 1930s provide further compelling evidence of the link between intelligence and mortality: individuals with lower intelligence in childhood were more likely to die of lung and stomach cancers which are often associated with smoking (Deary, Whiteman, Starr, Whalley, & Fox, 2004). Data from the Lothian Birth Cohort 1936 revealed that childhood IQ had a significant effect on health literacy almost 60 years later (Murray, Johnson, Wolf, & Deary, 2011). It has also been reported that child IQ is significantly related to cardiovascular disease in adulthood, as well as hypertension, and the likelihood of contact with psychiatric services (Deary, Batty, Gottfredson, & Sapolsky, 2005), as well as an increased likelihood of alcohol-related problems in adulthood (Pulkkinen & Pitkanen, 1994). The links between childhood intelligence and health outcomes at age 40 have been shown to extend to a broad range of health indicators, including chronic lung disease, musculoskeletal problems such as rheumatism and arthritis, asthma, and ulcers (Der, Batty, & Deary, 2009).

Cognitive ability has also been found to have important health implications during the critical adolescent years. A cross-sectional study of 300 U.S. teenagers found that brighter respondents were less likely to have engaged in sexual intercourse after controlling for age, pubertal development, and mother's level of education (Halpern et al., 2000). Brighter teenagers were also significantly less likely to have engaged in "early" behaviors (e.g., holding hands and kissing). Other cross-sectional studies of adolescents have found lower intelligence to be significantly linked to functional somatic symptoms (Kingma et al., 2011) and smoking behavior (Hemmingson, Kriebel, Melin, Allebeck, & Lundberg, 2008).

1.2. Personality as a possible confounding factor

There is compelling evidence that health behaviors are related to the personality variable conscientiousness (C). Individuals higher on C exercise higher levels of self-control (Costa & McCrae, 1992) and a number of reports have alluded to the important role that inhibition, low impulsivity, prudence, and constraint play in shaping behavior, including health-related behavior (see, for example, Bogg & Roberts, 2004). Thus, more inhibited individuals are less likely to seek immediate gratification and are therefore more likely to delay certain behaviors such as smoking, drug, or alcohol use. In their meta-analysis Bogg and Roberts (2004) concluded that some facets of C such as self-control, traditionalism, and responsibility were particularly important in predicting health-related behaviors.

Friedman and colleagues analyzed data from the Terman Longitudinal Study which commenced in 1921, concluding that C best predicted longevity (Friedman et al., 1993). They concluded that those higher on C are more likely to manifest better "health habits" (p. 183) and seek out "health-enhancing environments" (Hampson & Friedman, 2008, p. 777). The importance of C for health has been verified in a further longitudinal study spanning four decades (Hampson, Goldberg, Vogt, & Dubanoski, 2006). Teacher-rated childhood C was directly and significantly predictive of self-reported health outcomes almost 40 years later. Those adults who had since died and were not included in the follow-up scored more than a quarter of a standard deviation below their peers on C.

A study comprising a sample of frail elderly found that higher levels of C (and agreeableness) acted as protective factors against all-cause mortality (Weiss & Costa, 2005). A 10-year longitudinal study of over 1000 elderly respondents found that for every 1 SD increase in C there was a corresponding 18% lower rate in all-cause mortality for the whole group with these effects being significant for men (Taylor et al., 2009). Recently, Hagger-Johnson and Whiteman (2007) concluded that it is the self-discipline facet of C that drives health-promoting behaviors. Thus, we decided to assess C in Grade 7 and control for its effects in our analyses.

1.3. Aims and rationale of this study

Past research has tended to focus on the ability of early intelligence to predict outcomes in adulthood. The aim of this longitudinal study was to assess the ability of intelligence to predict important health outcomes during the adolescent years. This is of importance as health behaviors that are established during adolescence are likely to persist into adulthood. However, the adolescent years are also a time when powerful other forces may over-ride the influence of cognitive ability. For instance, social networks are rapidly expanding in adolescence. Peer groups play an important role in shaping adolescent behaviors and are deemed to be significant "sources of influence" in determining adolescents' trajectories of development (Smetana et al., 2006, p. 267). Adolescents are also subject to significant biological and personality change during this time (e.g. Roberts & DelVecchio, 2000) and it is not clear to what extent intelligence has an influence on important behaviors. Thus, it is imperative to establish whether intelligence predicts health outcomes during this volatile period of the lifespan.

In the present study we were interested in the extent to which cognitive ability assessed in Grade 7 predicted health behaviors in Grade 11. We assessed participation in physical exercise, the consumption of certain foodstuffs and stimulant drinks, drug usage, and time spent watching TV. In line with the reports discussed above, we formulated the following hypotheses:

1. We expected higher intelligence in Grade 7 to be significantly related to better health behaviors in Grade 11 (e.g., Gottfredson, 1997a, 1997b; Halpern et al., 2000; Hemmingson et al., 2008; Kingma et al., 2011).
2. We expected higher levels of C in Grade 7 to be significantly related to better health behaviors in Grade 11 (Bogg & Roberts, 2004; Hampson & Friedman, 2008).

2. Method

2.1. Participants

Data were drawn from the *Wollongong Youth Study* which commenced in 2003. The sample closely resembles the national Australian profile as judged by key demographic indicators such as the number of intact families in the study (Australian Bureau of Statistics, 2005) and language other than English spoken in the home (ABS, 2006). At Time 1 there was a close match between the socio-demographic characteristics of our sample and national trends (ABS, 2004a): for example, 20.4% of participants reported that their father was employed in the professional category (the figure nationally is 16.5%); 15.1% were associated professionals (12.7%); 11.2% were categorized as employed in intermediate production and transport (13.4%); 34.3% were tradespersons (21%); 4.8% were managers (9.7%); 3.3% were laborers (10.8%); 1.2% were categorized as advanced clerical (0.9%); 5.5% were intermediate clerical (8.8%); and 4.3% were employed as elementary clerical (6.1%).

Participants attended a number of schools in a Catholic Diocese of New South Wales, Australia (NSW). The Diocese is centered on the city of Wollongong (population approximately 250,000), but also reaches into south-western metropolitan Sydney thereby ensuring the socio-economic and cultural diversity of the sample. Attendance at non-government schools in Australia is growing rapidly; 33% of all students now attend independent (including Catholic) schools, a proportion that continues to grow (ABS, 2004b). Over the last decade, the number of students attending non-government schools has increased at a significantly faster rate than students in government schools (ABS, 2011).

Students were surveyed in the middle of their first year of high school, Grade 7, and then annually after that. At Time 1, 784 students (mean age = 12.30 years, SD = 0.49) completed the questionnaire (382 males and 394 females; 8 did not indicate their gender). The second time-point of interest to this report occurred four years later in the middle of Grade 11 (Time 2; mean age = 15.4 years; SD = 0.52) when students completed a measure of health behaviors. Time 2 measures were completed by 571 participants (269 males, 302 females) and we were able to directly match the Time 1 and 2 data of 420 respondents. The reduction in sample size in Grade 11 is attributable to the fact that the end of Grade 10 is an exit point for those students who do not wish to commit to senior high school, wish to enroll in technical college, or move to another school. Those who provided data at both time points scored significantly higher on verbal and numerical measures of cognitive ability than did those who provided data at Time 1 only (respectively t (711) = 5.91, p<.001, Cohen's d = .44; t (712) = 5.48, p<.001, Cohen's d = .41).

2.2. Materials

2.2.1. Time 1

Participants were provided with a test booklet containing various measures. Only those of direct relevance to this report are described here.

1. *Intelligence.* Upon entering high school all participants were required to complete state-based standardized assessments of numerical and verbal ability. This is required of all Grade 7 high school students in NSW. There were five numerical tests (number, measurement, space, data, numeracy problem solving) and three verbal tests (writing achievement, reading achievement, and language achievement). The subtests were combined to form a measure of general intelligence (g) with an alpha coefficient of .94. Although they cannot be strictly defined as intelligence tests, cognitive ability tests such as those described above have been shown to underpin a common g factor (see, for example, Deary, Strand, Smith, & Fernandes, 2007; Frey & Detterman, 2004). Our general measure of intelligence has been found to significantly predict school achievement 3 years later (Leeson, Ciarrochi, & Heaven, 2008).
2. *Conscientiousness* (Mak, Heaven, & Rummery, 2003). This measure was specifically designed for use with Australian high school students. It comprises 16 items derived from self-descriptors of this personality dimension originally suggested by John (1990) and Norman (1963). It has good validity, being highly correlated with school performance (Heaven & Ciarrochi, 2008) and strongly related to a brief measure of conscientiousness taken from the

International Personality Item Pool (see Heaven, Ciarrochi, & Vialle, 2007).

3. *Socio-economic status*. As an indicator of socio-economic status, each participant provided a written description of their father's employment (or their mother, if father was absent). These descriptions were coded into occupational categories that were used in Australia at the time (ABS, 2004a).

2.2.2. Time 2

The second time point of interest occurred 4 years later when students were in Grade 11. Students were asked to report on their health-related behaviors. These items were taken from research conducted into adolescent health in Europe on behalf of the World Health Organization (Currie, Hurrelmann, Settertobulte, Smith, & Todd, 2000). Questions covered substance use, eating habits, physical exercise, and time spent on the computer and watching television.

1. *Alcohol, cigarettes, and marijuana use.* Participants were asked the age at which they first consumed alcohol, got drunk, smoked a cigarette, and smoked marijuana. They were also asked whether they consume stimulant drinks such as "Red Bull" or "V" as mixers or on their own. We used principal axis factoring to explore the underlying structure of these items. On the basis of the eigenvalues and scree plot, we extracted two factors explaining a total of 63.45% of the variance. The two items dealing with stimulant drinks formed a separate scale with an alpha coefficient of .74 and loaded on the second factor. The first factor, which we labeled Drug use, contained the remaining items (alpha coefficient = .73).
2. *Consumption of foodstuffs.* Participants were asked to indicate how often they ate various foodstuffs (fruit, vegetables, brown bread, potato crisps, cakes/pastries, chips/fried potatoes, hamburgers/hotdogs/sausages). These items are also similar to those used in the 1970 British Cohort Study by Batty, Deary and Gottfredson (2007) and Batty, Deary, Schoon, et al., (2007). Principal axis factoring suggested two underlying factors explaining 61.57% of the variance. The first factor was labeled Healthy Food (fruit, vegetables) with an alpha coefficient of .80.The second factor was labeled Junk Food (potato crisps, cakes/pastries, chips/fried potatoes, hamburgers/hotdogs/sausages) and yielded an alpha coefficient of .71.
3. *Use of television.* We asked participants to provide the number of hours they watch television (including videos/DVDs) during the week as well as the weekend. These two items yielded an alpha coefficient of .82.
4. *Physical activity.* We asked participants to indicate the amount of physical exercise they had undertaken during the past 7 days. We were interested in exercise that led to an increase in one's heart rate for a total of 60 min per day. We also asked respondents to indicate their physical activity over a typical week. The alpha coefficient of this two-item scale was .92.

3. Results

Teenagers with higher levels of verbal ability were more likely to delay the onset of smoking cigarettes (r (122) = .18, $p<.05$). Table 1 shows the mean ages of commencement of substance use for males and females. Males were significantly younger than females when they first smoked cigarettes and marijuana. Gender explained 6.1% of the variance of age of cigarette smoking onset and 8.4% of the variance of age of onset of marijuana use. There were no significant gender differences with respect to onset of drinking alcohol or getting drunk.

Table 1
Mean age of onset of substance use behaviors.

Substance use	Males	Females	F	η^2
	M age	M age		
Drink alcohol	14.26	14.44	1.29	.003
Get drunk	14.77	14.99	1.93	.006
Smoke cigarette	13.79	14.85	10.75**	.061
Smoke marijuana	13.79	15.24	6.49*	.084

** $p<.001$.
* $p<.05$.

Males were significantly more likely to engage in regular physical exercise than females. During the past 7 days males reported exercising on 3.78 days whereas females exercised on 2.64 days, F (1, 563) = 43.27, $p<.001$, $\eta 2=.071$. In a typical week males exercised on 3.92 days, whereas females exercised on 2.87 days, F (1, 563) = 42.16, $p<.001$, $\eta 2=.07$. Participants reported watching TV on average 2 h per day during weekdays and 3 h per day during the weekend. There were no significant gender differences, F (1, 560) = 1.05, n.s.

A total of 15.4% of participants reported eating fruit once a week or less, while 8.7% ate vegetables once a week or less. Whereas females were significantly more likely to eat healthy food than males (F (1, 565) = 6.16, $p<.05$, $\eta^2=.011$), males were significantly more likely to eat junk food, F (1, 552) = 16.40, $p<.001$, $\eta^2=.029$. Finally, males ($M=4.13$) were significantly more likely than females ($M=3.52$) to consume stimulant drinks such as "Red Bull" and "V", F (1, 520) = 8.42, $p<.01$, $\eta^2=.016$. Descriptives for all other study variables are presented in the last two rows of Table 2

3.1. Correlations

The intercorrelations between the main variables are shown in Table 2. Those with higher levels of intelligence had higher levels of C. Intelligence was significantly positively related to lower levels of TV viewing and consumption of stimulant drinks with medium effect sizes (both $ps<.001$) as well as to lower participation in exercise ($p<.01$). These results lend partial support to the first hypothesis, with the only unpredicted result being that intelligence was associated with *less* physical exercise. As expected, C was significantly negatively related to drug use, and the intake of stimulant drinks, and significantly positively related to the intake of healthy foodstuffs and engagement in physical exercise. Thus, the second hypothesis was supported.

3.2. Predicting health behaviors from intelligence and conscientiousness

We ran a number of hierarchical regression analyses to ascertain the best predictors of time spent watching TV, engagement in physical exercise, and use of stimulant drinks. Given

Table 2
Intercorrelation matrix for intelligence (Grade 7) and health outcomes (Grade 11).

	1	2	3	4	5	6	7	8
1. Intelligence	–							
2 Conscientiousness	.16**	–						
3 Drug use	−.09	−.22***	–					
4 Healthy food	.06	.11*	−.07	–				
5 Junk food	−.03	−.07	.09*	−.19***	–			
6 TV viewing	−.19***	−.08	−.04	−.18***	.23***	–		
7 Physical exercise	−.16**	.13*	.01	.10*	.02	.01	–	
8 Stimulant drinks	−.19***	−.10*	.29***	−.02	.29***	.13**	.17***	–
M	87.7	65.24	1.76	10.18	12.46	8.73	6.53	3.80
SD	6.38	9.17	1.23	2.73	3.68	3.24	3.97	2.39

* $p<.05$
** $p<.01$
*** $p<001$.

the significant gender differences reported earlier, we controlled for this variable at step 1 of each analysis. We also controlled for the socio-economic status of participants as indexed by father's occupation. At step 2 we entered intelligence and C as a block. We also entered the variables in different orders (e.g., C first and then intelligence), but this made no difference to our interpretation of the results. We therefore report only the main hierarchical regression analyses.

These analyses are shown in Table 3. For physical exercise, sex of participant was a significant predictor at each stage of the analysis. The results show that males were more likely to engage in physical exercise than females. At step 2, R square change was .056; higher levels of intelligence predicted lower participation in physical exercise whereas C predicted higher levels of physical exercise. For television viewing as well as the consumption of stimulant drinks only general intelligence was a significant predictor at step 2.

4. Discussion

The aim of this research was to ascertain the extent to which intelligence as assessed in Grade 7 predicts a range of important health behaviors in Grade 11, after taking sex of participant, conscientiousness, and socio-economic status into account. Longitudinal studies in the health area that just focus on the teenage years are rare and our focus was on a range of behaviors known to have consequential health outcomes. Higher levels of intelligence predicted the delayed onset of smoking behavior in adolescence. This fits with the findings of Anstey et al. (2009) and the work of Taylor and colleagues who found that childhood IQ predicted smoking cessation in adulthood (Taylor et al., 2003). Higher levels of intelligence were negatively related to higher levels of TV viewing, positively associated with lower physical exercise, and negatively related to the consumption of stimulant drinks. There were no significant relationships between intelligence and the consumption of either healthy or junk food, or drug use. Regression analyses showed that higher intelligence was a significant predictor of lower levels of engaging in physical exercise as well as lower levels of TV viewing and the consumption of stimulant drinks after controlling for sex, level of conscientiousness, and socio-economic status.

As studies with adults have shown (e.g. Gottfredson, 2004; Gottfredson & Deary, 2004), we too found that general intellectual ability has long-term protective effects on the health behaviors of our teenagers, in particular, a delayed onset of smoking, reduced TV viewing, and reduced consumption of stimulant drinks. Greater levels of inactivity are likely to have detrimental effects on weight control and cardiovascular disease (see also Batty, Deary and Gottfredson, 2007; Batty, Deary, Schoon, et al., 2007; Batty et al., 2010; Miller et al., 2008). Stimulant drinks contain excessive levels of caffeine and other substances (e.g., taurine) that are not properly regulated or fully understood. These drinks have known adverse effects in young people (Seifert et al., 2011). Thus, as early as the high school years, intelligence is a powerful shaper of health-related behaviors and may play an important role in determining an individual's overall health trajectory for many years to come.

Gottfredson (1997b, 2004) has also shown the extent to which many individuals in industrialized countries simply misunderstand a clinician's directives or fail to understand a written prescription. Even though patients have access to adequate care, many seem to lack the capacity to follow simple medical instructions or guidelines (see also Baker, Parker, Williams, & Clark, 1998; Doak, Doak, & Root, 1996). Our results suggest that, while still at school, intelligence is beginning to shape the health-related behaviors of individuals.

However, contrary to findings with adults, brighter participants were less inclined to exercise regularly. This finding contradicts a number of other studies (e.g. Anstey et al., 2009; Taylor et al., 2003). Is it that brighter teenagers are more attracted to other activities, including studying, that precludes time for exercising? One possibility is that the culture of exercise for the young people in this study may be quite different than that for adults; it is possible that youth may exercise because they want to be seen as “cool” or popular. Exercise and physical activities are not often viewed as part of the “brains” crowd at school, whereas it is regarded as something that the “jocks” crowd or the “populars” will do (Barber, Eccles, & Stone, 2001). Although engaging in less physical activity, intelligent adolescents did engage in less TV watching, one form of sedentary behavior that may be a risk factor for poor health independent of exercise (Patel et al., 2010). As we continue tracking our respondents into adulthood, we will uncover the extent to which intelligence is associated with physical exercise.

4.1. Limitations and future directions

Although intelligence significantly predicted health outcomes, the effect sizes were not large. However, as Rutledge

Table 3
Results of regression analyses involving Grade 7 cognitive ability predicting Grade 11 health behaviors.

Dependent variable: Grade 11 physical exercise

Variable	B	SEB	β	df	t	R^2	ΔR^2
Step 1				2, 363		.054	.054***
(Constant)	9.06	.84			10.79***		
Socio-economic status	.04	.15	.01		.25		
Sex	−1.82	.40	−.23		−4.54***		
Step 2:				2, 361		.11	.056***
(Constant)	12.10	3.15			3.85***		
C	.09	.02	.21		4.14***		
Socio-economic status	.01	.14	−.00		−.05		
Sex	−2.00	.40	−.25		−5.04***		
Intelligence	−1.0	.03	−.15		−2.89**		

Dependent variable: Grade 11 TV viewing

Variable	B	SEB	β	df	t	R^2	ΔR^2
Step 1				2, 361		.007	.007
(Constant)	8.01	.72			11.07***		
Socio-economic status	.20	.13	.08		1.59		
Sex	−.01	.35	−.00		−.02		
Step 2:				2, 359		.038	.031**
(Constant)	17.15	2.77			6.20***		
C	−.02	.02	−.05		−1.0		
Socio-economic status	.17	.13	.07		1.37		
Sex	.11	.35	.02		.31		
Intelligence	−.09	.03	−.17		−3.15**		

Dependent variable: Stimulant drinks

Variable	B	SEB	β	df	t	R^2	ΔR^2
Step 1				2, 337		.02	.02
(Constant)	4.07	.52			7.90***		
Socio-economic status	.13	.09	.08		1.43		
Sex	−.52	.25	−.12		−2.13		
Step 2:				2, 335		.045	.024*
(Constant)	9.50	2.00			4.85***		
C	−.02	.01	−.07		−1.28		
Socio-economic status	.11	.09	.07		1.24		
Sex	−.43	.25	−.10		−1.75		
Intelligence	−.05	.02	−.13		−2.38*		

*** $p < .001$.
** $p < .01$.
* $p < .05$.

and Loh (2004) have argued, small effects can have large practical implications, especially in the health and medical area. They concluded that the predictors of "…disease incidence often appear small or even trivial by the guidelines we commonly use to assess our own effect sizes in the behavioral sciences" (p. 139), even though such effects can have very significant clinical outcomes. We would argue that, as our longitudinal study progresses, the effects of intelligence may be compounded over time with significant health effects.

A limitation of our study was the attrition rate after Grade 10. Attrition is a hallmark of research located within high schools, with brighter students tending to proceed to the final years of senior high school, while others seek to develop their opportunities in other ways (such as through technical training, apprenticeships, and other means). Notwithstanding the attrition rate, there was a very close match on key socio-demographic indicators between our sample and national data which, we believe, serves to minimize any possible biases in our data.

There can be no doubt that intellectual ability plays an important role in the health-related behaviors of youth and this study is one of a handful that has demonstrated the predictive power of intelligence on the later health behaviors of adolescents. As we continue to follow our participants, it will be important to assess how intelligence relates to their future health behaviors. In conclusion, it is clear that, even at a relatively early age, intelligence is implicated in the health behaviors of individuals and will no doubt continue to play an important role in shaping their future health status.

Acknowledgments

This research was supported by grants from the Australian Research Council (Grants LP0453853 and DP0878925). We also thank the Wollongong Catholic Diocese as well as the teachers and students for their support.

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