UvA Econometrics

Discussion Paper: 2013/02

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February 2013

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Summary There is ample evidence in the epidemiological literature that intelligence (like education and affluence) is related with reduced mortality rates and a longer life. This may be the direct result of safer and healthier behavior of more intelligent people. We have tried to test this hypothesis by a survey among students of the Amsterdam College of Applied Sciences (Hogeschool van Amsterdam) of whom intelligence had been recorded earlier. We find no convincing evidence in support of this hypothesis, in part because of the small sample size of 131 students.

Note The data that were collected and the data set that has been used in the analyses, together with explanatory notes (in Dutch), have been deposited with the *Data Archiving and Network Services (DANS)* of the Royal Dutch Academy of Arts and Sciences. They are freely available at http://www.persistent-identifier.nl?identifier=urn:nbn:nl:ui:13-tl6c-r4.

Acknowledgements We thank Peter Berkhout, Erik Plug and Kea Tijdens for advice about the survey, and the Fonds Kwantitatieve Economie for ready financial support.

Contents

1. Introduction

There is a substantial epidemiological literature to the effect that intelligence reduces mortality and thus contributes to a longer life (Calvin et al, 2011). An analysis of the Brabant data has shown that this also applies to the Netherlands, with intelligence assessed by Raven's *PMT* or *progressive matrices test* (Cramer, 2012). Various explanations of this relation have been put forward. First, intelligence is correlated with educational level and income, in short with a higher *socio-economic status (SES)*, and this in turn is known to lead to a longer life. One may of course then ask why this is so, and the standard answer is that a high SES is a concomitant of safer and healthier behavior. Further analyses, however, have shown that the effect of intelligence is not entirely accounted for by the intermediary of SES. Even if we allow for SES there remains a separate and independent effect of intelligence. The overall effect of intelligence must therefore at least in part be accounted for by a direct and specific effect, whereby more intelligent people show safer and healthier behavior than others. A rival and altogether different explanation is that some people have a stronger constitution than others, thereby a longer life and a more successful career - and a higher intelligence as well (Deary, 2008).

It is hard to distinguish between these various explanations. In the present modest survey we have tried to test one particular strand, namely the hypothesis that intelligence is directly related to safe and healthy behavior. We have done so by submitting a simple questionnaire to students of whom intelligence according to the *PMT* had been recorded earlier. In September 2009, 579 first year students who freshly enrolled in the Management and Economics department of the Amsterdam College of Applied Sciences (Hogeschool van Amsterdam) were subjected to a simplified version of the *Advanced PMT* (Hamel and Schmittman, 2006). This *advanced* version of the PMT was designed to ascertain differences in intelligence within a selected subpopulation, such as (in this case) students. We have combined the known test scores with the outcomes of a light internet survey of safe and healthy behavior in the spring of 2012. The intelligence score of the participants is already known, and we may also take it that they form a reasonably homogeneous group in respect of age, educational attainment and standard of living. Hence, these factors may be ignored without great harm.

2. The survey

In the spring of 2012 the target group of students received a request to participate in an online *Qualtrix* survey at their student e-mail address. The first question was whether they gave us permission to make use of information collected thirty months earlier for their participation in the *Young Enterprise* program (when their intelligence had been recorded). We point out that we cannot do so without the respondent's consent. Whoever disagrees should not complete the survey. Completion of the survey is rewarded by 10 euros.

From the middle of April to early July 2012 the students have been mailed four times. The first time we found that of the 579 students of September 2009, 154 no longer had a student e-mail address, presumably because they had abandoned their studies. This should leave 425 students still using their student mail address. In fact, there are (far) more who have abandoned their studies and no longer consult this e-mail address. According to the administration of the college, only 40% of the students who enrolled in September 2009 are

still active (232 students). We received 147 responses of which 131 were usable; the others were empty or incomplete, or submitted by people from outside the target group. The uncertainty about the number of students still consulting their student e-mail address prevents an estimate of the response rate. However, for a survey of this sort the number of 131 respondents means a small sample by any standards.

Properties of the sample

Of the 131 respondents 63 are men and 68 women, aged between 19 and 30 years, with a mean age of 22 years. 44% still lives with their parents, 90% completed the questionnaire in Dutch and only 10% in English.

The distribution of the intelligence score on the *PMT* - variable *iq* - among the 131 respondents is not much different from the initial population of 579 students, as shown in Figure 1. The 579 students have a mean score of 18,6 and a standard deviation of 4,6. The 131 respondents have the same mean score and a standard deviation of 5,1. One may wonder whether this is sufficient variation to show the effect of intelligence; there is of course a real danger that a selected group (like these students) is too homogeneous in respect of intelligence to bring out its effect. Unfortunately, we have no standards of comparison, precisely because we are employing the *advanced* version of the test that has been designed specifically for selected samples. All we can say is that the sample coefficient of variation is 0,28 and that the ratio of the mean values in the fourth and first quartile of the intelligence distribution is 2,15. These measures indicate a reasonable dispersion.

In a simple regression *iq* is barely related to background variables like gender, living with parents or language. There is a slight effect of age. Contrary to what one probably would expect *iq* somewhat declines with increasing age. But none of this is significant.

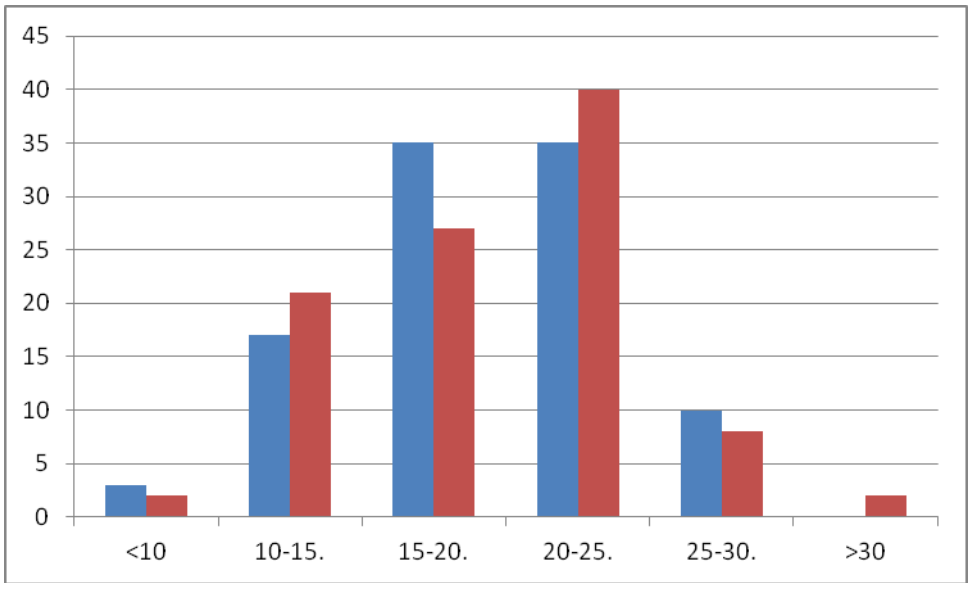

Figure 1. Frequency distribution of iq, in percent; left 579 students, right 131 respondents

3. Data and analysis

The questionnaire (Appendix 2) has 26 questions, some consisting of several parts (for example, question 2 asks for surname, Christian names, registration and date of birth). Two variables have been added from the 2009 database: intelligence (*iq*) and gender. The results have been transformed to a database with 29 variables (Appendix 1) that was used in the subsequent analysis. It consists of the survey replies, a new id number, variables from the 2009 database and derived variables like age and body mass index (BMI).

The variables of interest reflect eating habits, drinking, smoking, drug use, traffic behavior, medical care, fire risks and sex. The putative effect of intelligence, along with background variables, has been assessed by regression, probit and ordered probit analyses. In the first place we look for significance, i.e., relevant coefficients with a t-value exceeding 2. In view of the small sample size we also note *slight* effects with a t-value exceeding 1,5. All analyses have been carried out by *Stata 12.1*.

4. Results

The results for eating, drinking, smoking and drug use are reported in Table 1. This table shows that *iq* hardly affects behavior. Intelligent people eat more vegetables, but also drink more alcohol, at least beer and wine. The variable *harddrugs* is not informative since 90% of all respondents report that they never use them.

Table 1. Eating, drinking, smoking

variable	**informative**	**method**	**effect of *iq***	**other variables**
fruitveg		ordered probit	positive	gender positive
fastfood		ordered probit	none	gender negative, age slight positive
bmi		regression	none	gender negative
drinks		ordered probit	positive	gender negative
liquor		ordered probit	none	home positive
smoking		ordered probit	none	gender positive, home positive
softdrug		ordered probit	none	gender negative
harddrug	not informative			
sports		ordered probit	none	none

* gender 0=male, 1=female; home 1=with parents, 2=independent.

These results can be compared with two studies with much greater samples. Batty et al. (2008) studied the behavior of 4316 US Vietnam veterans; Jokela et al. (2009) a cohort of 10,000 British men and women born in 1958. Both studies report a modest negative correlation of *body mass index* with intelligence, which is not reproduced here. As for drinking, American veterans show a positive relation of intelligence with moderate alcohol consumption and a negative relation with excessive drinking. The first effect is reflected here in the positive relation with the consumption of beer and wine. Both studies show a clear negative effect of intelligence on smoking which we have not found.

The results for traffic participation are reported in Table 2. In several cases the survey results are hardly informative. For *helmet* there are only 19 respondents that ride a scooter; for *safety belt* only 24 who admit ever driving (the use of safety belts for backseat passengers is probably badly known). However, for *dandd* (or driving and drinking) there are 26 who admit having ever driven while under the influence of alcohol. In two out of four cases intelligence has the expected effect.

Table 2. Traffic participation

variable	**informative**	**method**	**effect of *iq***	**other variables**
helmet	hardly	ordered probit	positive	gender
safbelt	hardly	ordered probit	none	none
dandd	hardly	probit	negative	none
fines		regression	none	none

Table 3 reports the results for health behavior and fire prevention. Three variables are not informative since everybody has a doctor, is (compulsory) insured, and (almost) everybody takes the necessary vaccinations before setting out on a risky trip. In the remaining three cases intelligence has no effect on behavior.

Table 3. Health and fire prevention

variable	**informative**	**method**	**effect of *iq***	**other variables**
illness		ordered probit	none	none
doctor	not informative			
insurance	not informative			
vaccination	not informative			
smoke detector		probit	none	none
escape route		probit	none	gender negative

We have also questioned respondents about sex and these questions have been answered as well as other questions. There were only 2 refusals. Of the remaining 129 respondents 22 or 16% (9 men and 13 women) say that they never have sex. Among the others *iq* has a significant effect on *safesex,* along with age (the older the more cautious). A large proportion - almost 60% of those who have sex - reports a stable relation. In many cases condoms will be used as contraceptives rather than as a safety device guarding against venereal disease. Nevertheless, safe sex is positively related with intelligence.

Table 4. Safe sex

variable	**informative**	**method**	**effect of *iq***	**other variables**
safesex	hardly	ordered probit	positive	age positive

5. Conclusion

We have initially considered 20 variables that might show the effect of intelligence, but 4 are useless because they show too little variation. Among the 16 remaining variables there are 4 where intelligence does show the desired effect (eating vegetables, use of helmet, driving while under influence and safe sex), and one case where intelligence has a bad influence (drinking beer and wine). This last effect is a faint echo of other studies. The sample is small and various objections can be raised against the reliability of the data. However this may be, the results are unconvincing and give no firm support for the hypothesis that intelligence engenders safe and healthy behavior.

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List of variables (sample frequencies in brackets)

id — sample identification number, running from 1001 to 1132

name — surname, from questionnaire question 1

gender — 0 if male (63), 1 if female (68); from information obtained in September 2009

full — initially allotted by Qualtrix: 1 if respondent has finished survey to the end, 0 if respondent has stopped from a certain point onwards. This has later been revised by inspection of the data. The new codes are:

(2)	0	incomplete from certain question onwards
(118)	1	complete questionnaire
(11)	2	missing observations in one or two cases, mostly fines and bmi

language — set by Qualtrix: 1 if Dutch questionnaire (117), 2 if English (13)

age — age in years on May 15, 2012; obtained from questionnaire question 1 (date of birth): mean 22.07, standard deviation 1.99

iq — score on Raven's advanced progressive matrices test obtained by respondent in September 2009 on the 20-minute version (Hamel and Schmittman, 2006). A high score denotes a high intelligence: mean 18.63, standard deviation 5.15

smoking — question 2: do you smoke cigarettes?

(90)	1	never
(17)	2	now and then
(3)	3	every few days
(12)	4	every day, less than 10 cigarettes
(8)	5	every day, 10 cigarettes or more

fruitveg — question 3: do you eat fruit and/or vegetables?

(1)	1	(almost) never
(5)	2	less than once every week
(6)	3	about once every week
(41)	4	more than once every week
(78)	5	every day

fastfood — question 4: do you eat fastfood (French fries, Chinese takeout, pizza, etc.)?

(10)	1	(almost) never
(42)	2	less than once every week
(43)	3	about once every week
(34)	4	more than once every week
(2)	5	every day

drinks — question 5: do you drink beer and/or wine?

(28)	1	(almost) never
(24)	2	less than once every week
(37)	3	about once every week
(41)	4	more than once every week
(1)	5	every day

liquor question 6: do you drink hard liquor (vodka, liquor, gin, etc.)?

(45)	1	(almost) never
(53)	2	less than once every week
(27)	3	about once every week
(6)	4	more than once every week
(-)	5	every day

softdrug question 7: do you use soft drugs (cannabis, weed, magic mushrooms, etc.)?

(93)	1	never
(21)	2	less than once every month
(9)	3	about once every month
(7)	4	more than once every month
(-)	5	every day

harddrug question 8: do you use hard drugs (cocaine, XTC, speed, etc.)?

(118)	1	never
(8)	2	less than once every month
(2)	3	about once a month
(2)	4	more than once every month

safbelt question 9: do you use the safety belt in a car?

(-)	1	never
(13)	2	sometimes
(11)	3	always
(100)	4	not applicable (never travelling by car)

dandd question 10: have you ever driven a car after two or more alcoholic drinks?

(26)	1	yes
(64)	2	no
(39)	3	not applicable (no driver's licence)

helmet combination of question 11 and 12: do you ride a scooter and do you wear a helmet?

(110)	0	do not ride scooter and do not need helmet
(8)	1	ride scooter, wear helmet never
(3)	2	ride scooter, wear helmet: sometimes
(8)	3	ride scooter, wear helmet: always

fines question 13: how many fines for traffic violations did you have in the past year (if you don't know then fill out don't know)?; this last answer has been treated as a missing observation:

(97)	0
(13)	1
(5)	2
(4)	3
(1)	4
(2)	5

illness question 14: have you been ill during the past year?

(37)	1	never
(84)	2	at times
(9)	3	regularly

doctor question 15: do you have a family doctor?

(80)	1	yes, of my own
(41)	2	yes, family doctor of my parents
(3)	3	no

insur question 16: do you have a health care insurance?

(85)	1	yes, of my own
(42)	2	yes, through my parents
(-)	3	no insurance
(2)	4	don’t know

vaccin combination of question 17 and 18: have you ever travelled to Africa, Asia and/or South America, and did you take all necessary vaccinations in three categories?

(54)	1	I needed vaccinations and I took them
(10)	2	I needed vaccinations but I did not take them
(65)	3	for my destination I did not need vaccinations

bmi body mass index, calculated from questions 19 (height) and 20 (weight): mean 22.32, standard deviation 2.94

sports question 21: do you practise sports?

(21)	1	(almost) never
(19)	2	less than once every week
(32)	3	about once every week
(47)	4	more than once every week
(10)	5	every day

home question 22: do you live with your parents?

(57)	1	yes
(72)	2	no

smokedec question 23: do you have a smoke detector at home?

(87)	1	yes
(35)	2	no
(7)	3	don’t know

escape question 24: do you know the escape route in your house in case of fire?

(102)	1	yes
(27)	2	no

sex question 25: do you have sex?

(22)	1	never
(40)	2	(very) rarely
(5)	3	regularly, with different partners
(62)	4	regularly, in a steady relationship

safesex question 26: do you have safe sex?

(31)	1	never
(34)	2	sometimes
(43)	3	always
(21)	4	not applicable (no sex)

Default Question Block

This questionnaire is sent to students who participated in the course Young Enterprise in 2009-2010. In the analysis of the answers they will be linked with information collected for the 2009-2010 course. This can only be done with your consent. If you withhold it, do not complete the questionnaire.

I give permission to link my answers of the present questionnaire with information that I have provided in 2009-2010 for the course Young Enterprise.

- Yes
- No

1. What is your name, student number and date of birth?

First name _____

Surname

Student number _____

Date of birth (DD-MM-YYYY)

2. Do you smoke cigarettes?

- never
- now and then
- every few days
- every day, less than 10 cigarettes
- every day, 10 cigarettes or more

3. Do you eat fruit and/or vegetables?

- (almost) never
- less than once every week
- about once every week
- more than once every week
- every day

4. Do you eat fast food (french fries, Chinese takeout, pizza, etc.)?

- (almost) never
- less than once every week
- about once every week

- more than once every week
- every day

5. Do you drink beer and/or wine?

- (almost) never
- less than once every week
- about once every week
- more than once every week
- every day

6. Do you drink hard liquor (wodka, liquor, gin, etc.) ?

- (almost) never
- less than once every week
- about once every week
- more than once every week
- every day

7. Do you use soft drugs (cannabis, weed, magic mushrooms, etc.) ?

- never
- less than once every month
- about once every month
- more than once every month
- every day

8. Do you use hard drugs (cocaine, XTC, speed, etc.)?

- never
- less than once every month
- about once every month
- more than once every month
- every day

9. Do you use the safety belt in a car?

- never
- sometimes
- always
- not applicable (never travelling by car)

10. Have you ever driven a car after two or more alcoholic drinks?

- Yes
- No
- Not applicable (no driver's license)

11. Do you ride a scooter?

- Yes
- No

12. Do you wear a helmet?

- never
- sometimes
- always

13. How many fines for traffic violations did you have in the past year? (If you don't know, then fill out 'don't know'.)

14. Have you been ill during the past year?

- never
- at times
- regularly

15. Do you have a family doctor?

- yes, of my own
- yes, family doctor of my parents
- no family doctor

16. Do you have a health care insurance ?

- yes, of my own
- yes, through my parents
- no insurance
- don't know

17. Have you ever travelled to Africa, Asia and/or South America?

- Yes
- No

18. Did you take all necessary vaccinations?

- Yes
- No
- Not applicable (I did not need any)

19. What is your (approximate) length, in centimeters? (If you don't know, then fill out 'don't know'.)

20. What is your (approximate) weight, in kilograms? (If you don't know, then fill out 'don't know'.)

21. Do you practise sports?

- (almost) never
- less than once every week
- about once every week
- more than once every week
- every day

22. Do you live with your parents?

- Yes
- No

23. Do you have a smoke detector at home?

- Yes
- No
- Don't know

24. Do you know the escape route in your house in case of fire?

- Yes
- No

25. Do you have sex?

- never
- (very) rarely
- regularly, with different partners
- regularly, in a steady relationship

26. Do you have safe sex?

- never
- sometimes
- always
- not applicable (no sex)

If you have completed the questionnaire then report your bank account number so that we can transfer €10 to you as a reward. Please click the "next" button so all data will be saved and we can transfer the reward to you.

Thank you and good luck!