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Short Communication

## Adolescents' intelligence is related to family income

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### ABSTRACT

In a recent article Lemos, Almeida & Colom (LAC, 2011) argued that adolescents' intelligence is related to parents' educational levels but not to family income. We examine their finding in two large, nationally representative American samples and find that in these samples (log) income had a strong positive relationship with intelligence.

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## 1. Introduction

The relationship between socio-economic background (i.e., parental socio-economic status) and success in intelligence tests is a hotly debated issue, and many studies in the literature examined this relationship (e.g., Blum, 1978; Bradley & Corwyn, 2002; Georgas, Weiss, van de Vijver, & Saklofske, 2003; Higgins & Sivers, 1958; Jensen, 1980; Neff, 1938; Neisser et al., 1996; Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003; Weiss, Saklofske, Prifitera, & Holdnack, 2006). It is therefore surprising that the relationships between the components of socioeconomic background and intelligence received very little attention. To the best of our knowledge, the only study that examined this relationship was conducted by Lemos, Almeida, and Colom (2011), who compared the relationship between family income and intelligence to the relationship between parents' education and intelligence. They used two samples of Portuguese adolescents ( $n = 1714$  and  $1519$ ), and for each sample regressed general intelligence ( $g$ ) on parents' education and income. The results were that parents' education had a highly significant effect on intelligence whereas family income did not have a significant effect.

This finding is quite surprising, since socio-economic background is treated in intelligence research as being associated both with both parents' education and with family income. For example, in Herrnstein and Murray (1994) classic study, and in the research that followed it (e.g., Fischer et al., 1996; Ganzach, 2011), parents' education and family income were assigned equal weights in estimating socio-economic background. If indeed family income is not important in intelligence models, perhaps it should not be taken into account in deriving a measure for socio-economic background.

Furthermore, it may be that the estimated effects of socio-economic background in regression models in this domain are severely downwardly estimated because of the inaccurate measurement of socio-economic background.

Thus, in the current study we again examine the role of family income and parents' education in two large nationally representative American samples.

## 2. Method

### 2.1. Samples

The data were taken from the 1979 and 1997 cohorts of the National Longitudinal Survey of Youth (the NLSY79 and NLSY97, respectively).

#### 2.1.1. The NLSY97

This is a probability sample of 8984 Americans born between 1980 and 1984. The participants were interviewed annually starting in 1997, when they were on the average 15 years. Our analyses draw on the interviews conducted in 1997 in which both parents and adolescents were interviewed.

#### 2.1.2. The NLSY79

This is a probability sample of 12,686 Americans born between 1957 and 1964. The participants were interviewed annually starting in 1979, when they were on the average 17.5 years old. Our analyses draw on the interviews conducted in 1979 in which both parents and adolescents were interviewed.

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## 2.2. Measures

The measures of intelligence, parents' education and income were similar in the NLSY79 and NLSY97.

### 2.2.1. Intelligence

The measure of intelligence in the NLSY is derived from participants' test scores in the Armed Forces Qualifying Test (AFQT), a highly *g*-loaded intelligence test<sup>1</sup>. This test was administered to groups of five to ten participants during June through October 1980. Respondents received compensation. The intelligence score in the NLSY is the sum of the standardized scores of four tests: arithmetic reasoning, paragraph comprehension, word knowledge and mathematics knowledge, and is expressed as a percentile score on the basis of the US army scoring scheme aimed at achieving nationally representative standard scores (see addendum to attachment 106 of the NLSY user guide<sup>2</sup>).

The reliability of the AFQT in our data is 0.92. The validity of the AFQT was demonstrated in numerous studies including the prediction of training success (e.g., *Ree & Earles, 1991*) job performance (e.g., *Scribner, Smith, Baldwin, & Phillips, 1986*), as well as other measures of socio-economic success (see an extended discussion of the validity of the AFQT in *Herrnstein & Murray, 1994*, "The Bell Curve").

### 2.2.2. Parents' education

The mother's and father's education were measured by the number of years of full-time education completed.

### 2.2.3. Family income

The logarithm of net family income, obtained from the adolescent's parents in a personal interview, was our measure of family income. Those adolescents who did not live with their parents (particularly in the somewhat older sample of the NLSY79) were omitted from the analysis, since no reliable information about family income was available for them. A log transformation of pay is commonly used in the literature (e.g., *Ganzach, Gotlibowski, Greenberg, & Pazy, 2013; Judge, Higgins, Thoresen, & Barrick, 1999*), among other reasons because the distribution of raw pay is skewed to the right, whereas the distribution of the logarithm of pay is approximately normal (see *Fig. 1*).

## 3. Results

*Table 1* presents means, standard deviations and inter-correlations of the study variables.

*Table 2* presents the results of two regressions in which intelligence is regressed on mother's education, father's education and family income. It is clear from the table that family income has a significant relationship with intelligence, both in the NLSY79 ( $\beta = 0.24, p < .0001$ ) and in the NLSY97 ( $\beta = 0.22, p < 0.0001$ ).

To examine the size of the effect of each of the variables we conducted a relative weight analysis (*Johnson, 2000; Tonidandel & LeBreton, 2011*). *Table 2* presents the relative weight values and the rescaled weights (scaled as a percentage of predictable variance) of the predictors. It is clear from these data that family income had an effect comparable to the effects of parents' education, although in the 1979 cohort this weight appeared to be somewhat lower than the weight of parents' education, whereas in the 1997 it seemed to be somewhat higher. Indeed, a comparison

of the correlations of family income and intelligence (see *Table 1*) suggests that this correlation is significantly stronger in 1997 than in 1979 ( $Z = 4.6, p < .0001$ ).

## 4. Discussion

The results of the current study stand in sharp contrast to those obtained by *LAC (2011)*. Whereas they found that family income was not related to intelligence, we find a strong relationship. This difference occurs despite some basic similarities between the two studies. Both studies used national representative samples of adolescents, and both relied on highly *g*-loaded standard intelligence tests.

In our view, there are two likely reasons for the difference between the results. The first is *LAC's (2011)* weak measure of family income. *LAC (2011)* used job classification to estimate income. Although job classes are related to income, they are obviously a noisy estimate of real income. Furthermore, *LAC (2011)* used a binary measure for income – distinguishing only between those whose job classification was above the average and those whose job classification was below. The loss of information associated with this categorization may also have severely hindered the validity of *LAC* measure of income. Finally, *LAC (2011)* obtained the job classification information on the basis of participants' descriptions of their parents' occupations<sup>3</sup>. These descriptions may be biased either by the young participants' lack of expertise in defining their parents' occupations, or by social desirability bias. In contrast, in the NLSY database, a continuous measure of actual income is obtained in personal interviews conducted by expert interviewers.

A second possible reason for the difference between the current results and *LAC's (2011)* results are socio-cultural differences between the context in which the *LAC* study was conducted (in Portugal) and the context in which the current study was conducted (in the US). That is, the differences between the two studies may stem from differences in the importance of the effect of family wealth on intellectual development between the Portuguese and American societies. Whether the effect of wealth on intellectual development is culturally and socially dependent is an interesting topic for future research.

There are also other differences in the methods of the two studies that could account for the different results. *LAC* samples were much smaller in size than the sample we used, and *LAC* used a cruder measure of education that was comprised of only seven levels, whereas we used a more refined measure of education (the number of years of education completed). *LAC (2011)* also used one variable – the achieved scholastic level of both parents – to represent parental education in their model, whereas we used two variables, the education of each of the parents. We think, however, that the difference in the method by which family income was estimated and the socio-cultural differences between the samples are substantially more important in accounting for the difference in the results of the two studies.

Finally, we also find that the relationship between family income and intelligence is stronger in the 1997 cohort than in the 1979 cohort. One explanation is that given the increase in income inequality in the American society over the last 50 years (e.g., *Hacker, 2006*), socio-economic background may have become more important in determining children's intelligence. Another explanation is that given the increased influence of intelligence on income (*Herrnstein & Murray, 1994*), and the strong genetic component of intelligence (e.g., *Bartels, Rietveld, Van Baal, &*

<sup>1</sup> For example, whereas the first factor (*g*) accounts for 53% of the variance of the Wechsler intelligence test, it accounts for over 70% of the variance in the AFQT (*Herrnstein & Murray, 1994, p. 606*).

<sup>2</sup> <http://www.nlsinfo.org/nlsy79/docs/79html/codesup/NLSY79%20Attachment%20106.%20Profiles%20of%20American%20Youth.pdf>.

<sup>3</sup> It is also not clear from *LAC's (2011)* description whether only the father's occupational classification was used to estimate income or whether the mother's occupation was used as well, and how the two were 'averaged' to obtain an estimate for family income.

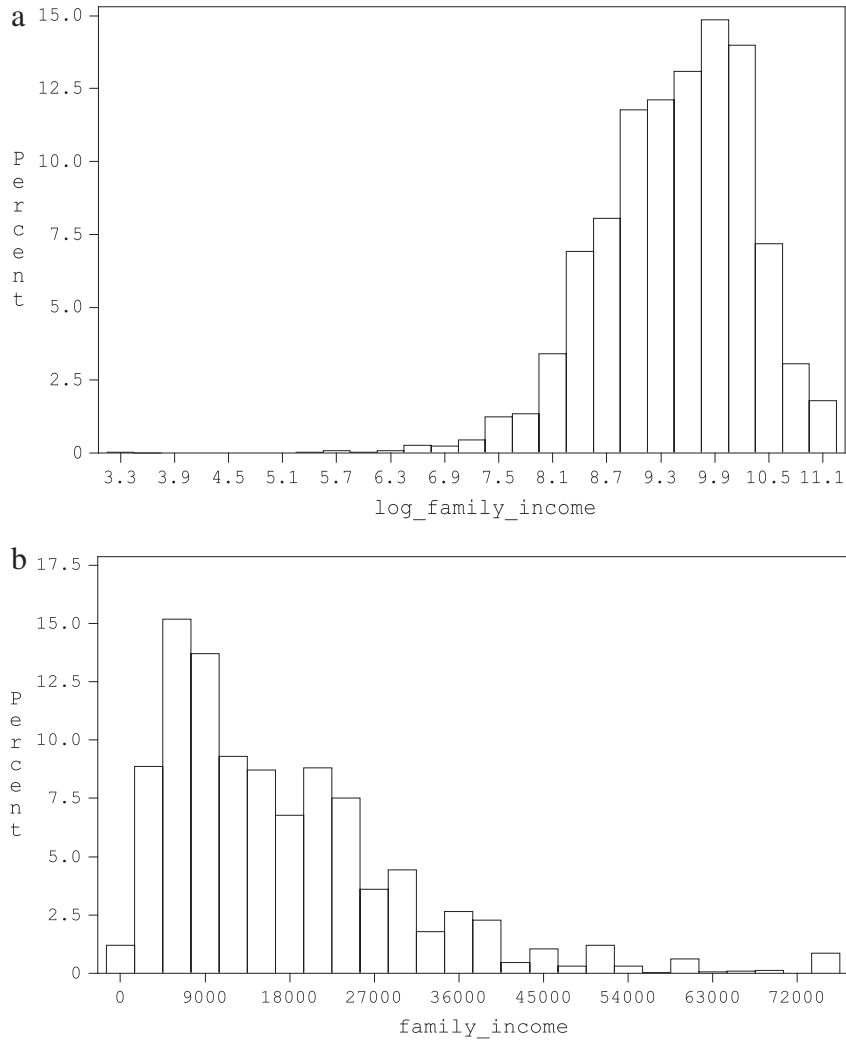


Fig. 1. Frequency distribution of family income and logarithm of family income in the NLSY79 (Fig. 1a) and raw family income (Fig. 1b).

Table 1  
Descriptive statistics.

	NLSY79 Mean	NLSY79 STD	NLSY97 Mean	NLSY97 STD	1	2	3	4
1 Intelligence	45.34	29.17	40.95	28.76	–	.42	.45	.44
2 Mother's education	12.44	2.91	10.87	3.17	.41	–	.64	.39
3 Father's education	12.56	3.21	10.95	3.93	.43	.63	–	.43
4 Family income	46360	42083	17247	13146	.37	.40	.43	–

Note: All correlations are significant on the .0001 level. Below the diagonal are the NLSY79 correlations, above are the NLSY97 correlations.

Table 2  
Standardized regression coefficients and relative weights predicting adolescents' intelligence.

	NLSY79				NLSY97			
	$\beta$	<i>t</i>	Relative weight	Relative weight%	$\beta$	<i>t</i>	Relative weight	Relative weight%
Mother's education	0.16**	10.8	0.083	33.3	0.19**	11.9	0.081	27.5
Father's education	0.26**	17.6	0.092	36.7	0.22**	13.4	0.098	33.3
Family income	0.24**	19.3	0.075	29.9	0.22**	15.3	0.115	39.2
R <sup>2</sup>	0.28				0.25			

\*\*  $p < .0001$ ;  $n = 6003$  for the NLSY79 and 4357 for the NLSY97.

Boomsma, 2002), differences in family income may be more strongly associated with parents' intelligence, and as a result with the intelligence of the children, in 1997 than in 1979. If the

relationship between intelligence and income (particularly among the adolescents' parents' income) is stronger in the Portuguese society than in the American society, this second explanation is

also consistent with the difference between LAC's (2011) finding about the relationship between family income and intelligence in Portugal and our finding about this relationship in the US.

## References

- Blum, J. M. (1978). *Pseudoscience and mental ability: The origins and fallacies of the IQ controversy*. New York: Monthly Review Press.
- Bartels, M., Rietveld, M. J. H., Van Baal, G. C. M., & Boomsma, D. I. (2002). Genetic and environmental influences on the development of intelligence. *Behavior Genetics*, 32(4), 237–249.
- Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology*, 53(1), 371–399.
- Fischer, C. S., Hout, M., Jankowski, M. S., Lucas, S. R., Swidler, A., & Voss, K. (1996). *Inequality by design: Cracking the bell curve myth*. Princeton, NJ: Princeton University Press.
- Ganzach, Y. (2011). A dynamic analysis of the effects of intelligence and socioeconomic background on job-market success. *Intelligence*, 39(2), 120–129.
- Ganzach, Y., Gotlibowski, C., Greenberg, D., & Pazy, A. (2013). General mental ability and pay: Nonlinear effects. *Intelligence*, 41(5), 631–637.
- Georgas, J., Weiss, L. G., van de Vijver, F. J., & Saklofske, D. H. (Eds.). (2003). *Culture and Children's Intelligence: Cross-cultural Analysis of the WISC-III*. Academic Press.
- Hacker, J. S. (2006). Inequality, American democracy, and American political science: The need for cumulative research. *Political Science & Politics*, 39(01), 47–49.
- Herrnstein, R. J., & Murray, C. (1994). *The Bell curve: Intelligence and class structure in American life*. Simon and Schuster.
- Higgins, C., & Sivers, C. H. (1958). A comparison of Stanford-Binet and Colored Raven Progressive Matrices IQs for children with low socioeconomic status. *Journal of Consulting Psychology*, 22(6), 465.
- Jensen, A. R. (1980). *Bias in mental testing*. New York: Free Press.
- Johnson, J. W. (2000). A heuristic method for estimating the relative weight of predictor variables in multiple regression. *Multivariate Behavioral Research*, 35(1), 1–19.
- Judge, T. A., Higgins, C. A., Thoresen, C. J., & Barrick, M. R. (1999). The big five personality traits, general mental ability, and career success across the life span. *Personnel Psychology*, 52(3), 621–652.
- Lemos, G. C., Almeida, L. S., & Colom, R. (2011). Intelligence of adolescents is related to their parents' educational level but not to family income. *Personality and Individual Differences*, 50(7), 1062–1067.
- Neff, W. S. (1938). Socioeconomic status and intelligence: A critical survey. *Psychological Bulletin*, 35(10), 727.
- Neisser, U., Boodoo, G., Bouchard, T. J., Jr., Boykin, A. W., Brody, N., Ceci, S. J., et al. (1996). Intelligence: Knowns and unknowns. *American Psychologist*, 51(2), 77.
- Ree, M. J., & Earles, J. A. (1991). Predicting training success: Not much more than g. *Personnel Psychology*, 44(2), 321–332.
- Scribner, B. L., Smith, D. A., Baldwin, R. H., & Phillips, R. L. (1986). Are smart tankers better? AFQT and military A productivity. *Armed Forces & Society*, 12(2), 193–206.
- Tonidandel, S., & LeBreton, J. M. (2011). Relative importance analysis: A useful supplement to regression analysis. *Journal of Business and Psychology*, 26(1), 1–9.
- Turkheimer, E., Haley, A., Waldron, M., D'Onofrio, B., & Gottesman, I. I. (2003). Socioeconomic status modifies heritability of IQ in young children. *Psychological Science*, 14(6), 623–628.
- Weiss, L. G., Saklofske, D. H., Prifitera, A., & Holdnack, J. A. (2006). *WISC-IV advanced clinical interpretation*. Elsevier.