

The Kind of Student You Were in Elementary School Predicts Mortality

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Abstract

We examined the association of self-reported and teacher-rated student characteristics assessed at the end of primary school with all-cause mortality assessed through age 52. Data stem from a representative sample of students from Luxembourg assessed in 1968 ($N = 2,543$; $M = 11.9$ years, $SD = 0.6$; 49.9% female; $N = 166$ participants died). Results from logistic regression analyses showed that the self-reported responsible student scale ($OR = .81$; $CI = [.70; .95]$) and the teacher rating of studiousness ($OR = .80$; $CI = [.67; .96]$) were predictive for all-cause mortality even after controlling for IQ, parental SES, and sex. These findings indicate that both observer-rated and self-reported student behaviors are important life-course predictors for mortality and are perhaps more important than childhood IQ.

Understanding why certain people live longer than others is one of the most compelling personal and public health questions that can be addressed by science. Most people and most societies would like to know how to optimize the length of life. Mortality is also, without a doubt, considerably more objective than many other health outcomes, such as self-perceived physical health (see Friedman & Kern, 2014; O'Toole & Stankov, 1992). Given its importance, a broad line of research has focused on the identification of possible predictors of mortality. It is now well accepted that certain background and psychological factors contribute to longevity. For example, high socioeconomic status, or having a higher IQ, or possessing certain personality traits all show replicable associations with longevity (Calvin, Deary, Fenton, Roberts, Der, Leckenby et al., 2011; Hill, Turiano, Hurd, Mroczek, & Roberts, 2011; Jokela, Batty, Nyberg, Virtanen, Nabi, Singh-Manoux et al., 2013; Kern & Friedman, 2008; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). High socioeconomic status—either the one born into or the one achieved, confers an extended life (e.g., Bassuk, Berkman, & Amick, 2002). Childhood IQ has emerged as one important predictor of mortality (Batty, Deary, & Gottfredson, 2007; Calvin et al., 2011). Children with higher IQ tend to live longer and this relation was mainly independent of SES. Friedman and colleagues (1993; Friedman, Kern, & Reynolds, 2010) showed in a sample of gifted children that parent ratings of conscientiousness predicted longevity over more than 60 years, after controlling

for sex. More recently, teacher-rated dependability was shown to predict longevity along with IQ in the Scottish Mental Survey across a time span of 55 years (Deary, Batty, Pattie, & Gale, 2008).

One set of predictors that has not been considered in prior research is behaviors and ratings of school-based constructs that are narrower and more focused than constructs typically found in the domain of personality. While narrower than measures of IQ or typical Big Five scales in the domain of personality, these qualities are potentially more malleable as they could be the focus of educational interventions. But, can mortality really be predicted by, and potentially rely on, what kind of student you were in elementary school? Can scientists tell anything of importance about people's future life span from the way students either perceive themselves or are judged by their teachers when they are young? The current study set out to test whether

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Table 1 Scales of the MPS Along with Their Meaning and Example Items

Scale	Internal consistency		Description	Example item
	(n of items)			
1. Inattentiveness	.77 (8)		Lack of attention and to some extent unwillingness to take school seriously	Sometimes I do not pay attention in school.
2. School entitlement	.72 (12)		Students' demands toward their teachers or school in general	Students' wishes should always be fulfilled.
3. Responsible student scale	.52 (12)		Industrious and achievement-striving	I usually try hard to do my homework very accurately and carefully.
4. Sense of inferiority	.60 (7)		(Mainly upward) social comparisons in school contexts	If an exercise is very difficult I give up easier than my classmates.
5. Impatience	.51 (3)		Behaviors related to impatience	I quickly run out of patience.
6. Pessimism	.67 (9)		Negative and depressed view of the world	Usually, I am sad, I am happy only sometimes.
7. Defiance of parental authority	.67 (4)		Low level of rule orientation	I have back-talked to my mother.

Note. MPS = MAGRIP personality scales; n = number. The full questionnaire can be found in Spengler et al. (2015).

self-perceptions about school-related behaviors and attitudes along with simple ratings by their teachers predicted mortality in a 40-year prospective longitudinal study. To our knowledge, this is the first time school-based ratings as a more narrow measure of personality have been used to predict mortality from childhood to adulthood.

The second unique feature of the current study is that it addresses a methodological confound that permeates the research linking other individual differences to mortality. For example, research focused on childhood or adolescent personality uses observer ratings of conscientiousness (e.g., Friedman et al., 1993), whereas most, if not all of the research linking adult levels of conscientiousness to mortality have used self-reports (e.g., Hill et al., 2011). But what happens when we use the children as informants for their personality and personality-related traits in addition to observer ratings? In the current study, we take advantage of a 40-year longitudinal study that provides both observer-rated conscientiousness as assessed by teacher ratings and self-reports of school-based conscientiousness behaviors, such as being a responsible student. The same students completed an IQ test and provided information on their family background. Therefore, we have a unique opportunity to not only test the contribution of both observer-rated and self-reported conscientiousness-related dimensions for predicting mortality, but to do so in a long-term study with appropriate controls for potential confounding variables.

METHOD

Participants

The present study used the MAGRIP longitudinal study, which is a prospective epidemiological cohort design spanning 40 years (Brunner & Martin, 2011). In 1968, data on general cognitive ability, school and personality measures, and family background were collected from about half the Luxembourgish

student population at the end of primary school, when most children were in grade 6 ($N = 2,824$; $M = 11.9$ years; $SD = 0.6$ years; 49.9% female). The multistage sampling procedure is described in detail in Spengler, Brunner, Damian, Roberts, Lüdtke, & Martin (2015).

In 2008, data on the mortality rate for the initial sample was obtained from the database of the social security agency of Luxembourg (permission was granted by the Luxembourgish data protection committee "Commission Nationale Pour la Protection des Données"). Of the 2,824 initial participants, 2,377 (84%) were alive; 166 (6%) had died by the year 2008. The remaining 281 (10%) former participants could not be traced by their social security ID and had most probably left the country. Therefore, they were excluded from the analyses for the present study. Thus, the final sample consisted of 2,543 participants.

Analyses concerning attenuation showed that the sample with no valid information on mortality status did not differ from the sample under investigation. Relative to the final sample, participants that could not be traced showed no differences in mean childhood general cognitive ability (Cohen's $d = 0.04$) or childhood SES ($d = 0.04$). Also, relative to the final sample there were no significant differences for the seven scales of the MAGRIP personality scales (MPS, see below; $d = .00$ to $d = .05$).

Measures

Childhood Characteristics and Behaviors (Self-report)

Students completed the MAGRIP personality scales (MPS), which is a questionnaire that included a large set of items concerning the students' feelings, thoughts, and school and life habits. The questionnaire consisted of 108 items with a dichotomous format where the students had to decide whether the item was true for them or not. In previous work on the construct validity of the items (Spengler et al., 2015) we identified four school-related

Table 2 (Mean, Standard Deviations of and) Bivariate Correlations among Study Variables

	M	SD	2	3	4	5	6
1 Inattentiveness	.64	.28	.24 (.21; .28)	-.17 (-.21; -.13)	.30 (.26; .33)	.49 (.46; .52)	.16 (.12; .20)
2 School entitlement	.41	.23		-.20 (-.24; -.16)	.42 (.39; .45)	.30 (.26; .34)	.57 (.54; .60)
3 Responsible student scale	.83	.15			-.14 (-.18; -.10)	-.11 (-.15; -.07)	-.09 (-.13; -.05)
4 Sense of inferiority	.46	.25				.39 (.35; .42)	.50 (.47; .53)
5 Impatience	.52	.35					.30 (.27; .34)
6 Pessimism	.42	.24					
7 Defiance of parental authority	.55	.35					
8 Studiousness (Teacher rating)	3.4	1.07					
9 IQ	.01	.99					
10 Parental SES	39.27	13.46					
11 Premature mortality	—	—					

	7	8	9	10	11
1 Inattentiveness	.64 (.59; .67)	.02 (-.02; .06)	.07 (.03; .11)	.05 (.01; .09)	.08 (-.01; .17)
2 School entitlement	.10 (.07; .14)	-.28 (-.32; -.24)	-.24 (-.27; -.20)	-.14 (-.18; -.10)	.09 (.01; .16)
3 Responsible student scale	-.15 (-.19; -.11)	.17 (.13; .20)	.19 (.15; .23)	.06 (.02; .10)	-.15 (-.21; -.08)
4 Sense of inferiority	.20 (.17; .24)	-.34 (-.38; -.31)	-.31 (-.35; -.27)	-.18 (-.22; -.14)	.10 (.03; .18)
5 Impatience	.37 (.33; .42)	-.06 (-.10; -.02)	-.12 (-.17; -.09)	-.06 (-.10; -.02)	.06 (-.01; .14)
6 Pessimism	.07 (.03; .11)	-.35 (-.38; -.32)	-.35 (-.39; -.32)	-.19 (-.22; -.15)	.10 (.02; .17)
7 Defiance of parental authority		.07 (.02; .10)	.08 (.37; .44)	.07 (.03; .11)	.07 (.00; .15)
8 Studiousness (Teacher rating)			.40 (.37; .44)	.27 (.23; .31)	-.18 (-.25; -.10)
9 IQ				.26 (.22; .29)	-.10 (-.16; -.03)
10 Parental SES					-.11 (-.18; -.03)
11 Premature mortality					

Note. M = mean, SD = standard deviation, SES = socioeconomic status (at Time 1). 95% confidence intervals in parentheses. Correlations with premature mortality are based on point-biserial correlations.

and three non-school-related scales: inattentiveness, school entitlement, responsible student scale, sense of inferiority, impatience, pessimism, and defiance of parental authority. The validation of the scales and the items can be found in detail in Spengler et al., (2015). A description of the scales, internal consistencies, and an example item can be found in Table 1.

Teacher-Rated Studiousness

Teacher ratings of student Conscientiousness was assessed by a single item where teachers rated their pupils according to their studiousness. Responses were given on a 5-point rating scale (1 = very low, 2 = low, 3 = average, 4 = high, 5 =very high).

Childhood IQ

In 1968, IQ was assessed by 14 subtests of the “Leistungsprüfsystem” (L-P-S [Performance test system]; Horn, 1962, 1983). The L-P-S is a standardized German intelligence test battery that builds on Thurstone’s (1938) model of primary mental abilities. Its total score correlates .94 with the total score on the German version of the Wechsler Adult Intelligence Scale (Sturm & Büssing, 1982). Each subtest contained 40 items and had to be completed within strict time constraints that were specified in the test manual. The L-P-S subtests were averaged to create a single IQ score that was *z*-standardized ($\alpha = .86$).

Parental SES Based on Occupational Status in Childhood

We used parents’ occupations as an indicator for parental SES, which was assessed through children’s indications of their parents’ occupations. These occupations were mapped onto the categories of the International Standard Classification of Occupations (ISCO-88; Elias, 1997). For the present study, occupations were transformed using the International Socio-Economic Index of occupational status (ISEI; Ganzeboom, De Graaf, & Treiman, 1992). The ISEI’s theoretical range spans from 16 (farm-hands, laborers, helpers, and cleaners) to 90 (judges), with higher ISEI values indicating higher SES.¹ Interrater reliability of this ISEI coding was tested for two independent groups of raters, and was satisfactory (.72).

Mortality

The mortality rates for the MAGRIP sample were retrieved from the database of the social security agency of Luxembourg (see the Participants section).

Analyses

We conducted our analyses in two steps. First, we ran a series of bivariate logistic regression models.² In doing so, we assessed the extent to which each predictor was associated with mortality. Second, we ran a multiple logistic regression model in which we only included those predictors that were significant in the analyses of step 1. All metric predictors were entered as *z*-standardized variables ($M = 0$, $SD = 1$) in the logistic regression models. The risk of higher/lower mortality is displayed by means of odds ratios (OR). If they deviate from 1, they can be interpreted as increased/decreased odds of an event per additional unit of standard deviation in the predictor. For instance, if mortality was predicted by IQ an odds ratio of .60 means that individuals have 40% lower odds of dying per standard deviation increase in IQ. In terms of risk, they have a 12.5% lower risk of dying.

We used *Mplus* (Muthén & Muthén, 1998–2012) for all analyses. The percentage of missing data that were included in the

Table 3 Results from Bivariate Logistic Regressions with Single Predictors of Mortality

Predictor	Odds Ratio
	(95% Confidence intervals)
IQ	.81 (.69; .96)
Teacher-rated studiousness	.69 (.60; .80)
Inattentiveness	1.18 (1.01; 1.38)
School entitlement	1.20 (1.02; 1.40)
Responsible student scale	.74 (.64; .85)
Sense of inferiority	1.25 (1.07; 1.46)
Impatience	1.14 (.96; 1.35)
Pessimism	1.22 (1.04; 1.43)
Defiance of parental authority	1.16 (1.00; 1.36)
Parental SES	.79 (.66; .95)
Sex	.42 (.30; .59)

Note. SES = socioeconomic status, IQ = intelligence.

models was less than 5% for each variable, respectively. For the mortality variable, there were no missing data points as we only used data with valid information on whether a participant died or was still alive (see the Participants section). Hence, missing data for all other variables was unlikely to be a critical problem. We used multiple imputations to account for missing data (see Schafer & Graham, 2002). Therefore, 10 datasets were constructed in which missing values were estimated based on the available data. *Mplus* allows for the combination of the results from those multiple imputed datasets and obtains overall parameter estimates and standard errors that reflect uncertainty in the imputation as well as uncertainty due to random variation (Muthén & Muthén, 1998–2012).

RESULTS

First, we were interested in whether student characteristics and behaviors were related to mortality. Table 2 shows means, standard deviations, and correlations of the constructs under investigation. Mortality was related most strongly and negatively with teacher-rated studiousness ($r = -.18$, confidence interval [CI] = $-.18$ to $-.03$) and the responsible student scale ($r = -.15$, CI = $-.21$ to $-.08$). Moreover, we found negative relations with IQ ($r = -.10$, CI = $-.16$ to $-.03$) and parental SES ($r = -.11$, CI = $-.18$ to $-.03$). Inattentiveness, school entitlement, sense of inferiority, impatience, pessimism, and defiance of parental authority were related positively with mortality ($r = .06$ to $.20$; see Table 2).

Second, we tested the relation of teacher-rated studiousness and the student characteristics and behaviors scales, in separate bivariate logistic regressions to mortality. In other words we ran a single logistic regression for each of our predictors. Significant noncognitive predictors of mortality were teacher-rated studiousness, inattentiveness, school entitlement, responsible student scale, sense of inferiority, pessimism, and defiance of parental authority (see Table 3).

Table 4 Results from the Multiple Logistic Regression Model

Predictor	Odds Ratio
	(95% Confidence intervals)
IQ	.95 (.79; 1.14)
Teacher-rated studiousness	.80 (.67; .96)
Inattentiveness	1.07 (.87; 1.33)
School entitlement	.94 (.77; 1.15)
Responsible student scale	.81 (.70; .95)
Sense of inferiority	1.03 (.85; 1.26)
Impatience	1.05 (.86; 1.29)
Pessimism	1.06 (.85; 1.31)
Defiance of parental authority	1.10 (.89; 1.35)
Parental SES	.86 (.70; 1.05)
Sex	.48 (.33; .68)

Note. SES = socioeconomic status, IQ = intelligence.

To investigate the independent effect of childhood characteristics we included all predictors from the first set of logistic regressions in a single multiple logistic regression model (see Table 4). In an earlier study, the influence of childhood IQ on mortality was investigated in the MAGRIP sample (M. Wrulich, personal communication, October 18, 2013). These analyses revealed that intelligence, SES, and sex³ have an effect on mortality. Therefore, it was important to control for these variables in the present study (see also Table 2), which for the first time investigated the influence of the childhood school and personality characteristics and the teacher rating of studiousness on mortality.

We found a 20% reduced odds (6% reduced risk) of dying by the age of 52 per standard deviation increase in teacher-rated studiousness (OR = .80; CI = .67–.96). For the responsible student scale we found a 19% reduced odds of dying (5% reduced risk) by the age of 52 (OR = .81; CI = .70–.95). The only other significant predictor was the sex of the participants (OR = .48; CI = .33–.68). The odds of dying were reduced by 50% for women. This means that the risk of dying was 20% lower in women. Childhood IQ was not a significant predictor of mortality once sex and student personality characteristics were taken into account (OR = .95; CI = .79–1.14).⁴

DISCUSSION

Drawing on data from a longitudinal (nationally representative) sample spanning 40 years from childhood to middle adulthood the goal of the present study was to investigate the relation of student characteristics and behaviors in childhood to one of the most objective health outcomes—all-cause mortality. Most importantly, we demonstrated that children lived longer when they (1) were more responsible students, (2) were reported as more industrious by their teachers, and (3) were female. The effects were significant even after controlling for parental SES and IQ. Interestingly, childhood IQ was no longer a significant predictor when the school-based personality scales were included.

The responsible student and teacher-rated studiousness scales outperformed childhood IQ in predicting premature mortality up

to the age of 52. This might in part be due to the early period in life in which mortality was investigated. Prior research has focused on IQ as predictor of mortality in older samples (e.g., Whalley & Deary, 2001). Causes for mortality differ in older versus younger samples (Eurostat, 2009). For instance, IQ was shown to predict cardiovascular diseases and death (Hart et al., 2003). Our sample is younger and therefore has been less affected by mortality-related effects of chronic diseases. Until the age of 65, individuals (in Europe in general and Luxembourg in particular) most likely died because of suicide, accidents, and drug overdoses (Eurostat, 2009). This interpretation is consistent with the fact that unintentional injuries and transportation-related accidents, suicides, and alcohol-related deaths are among the most frequent causes of death in Luxembourg (Statec, 2009). Previous studies in adulthood demonstrated that conscientiousness-related traits were related to health behaviors relevant to mortality risk such as risky driving, risky sex, suicide, violence, and drug use (Bogg & Roberts, 2004). This might be the reason why our personality-related traits do a better job in predicting premature mortality during this earlier period of the life course than childhood IQ.

Moreover, the responsible student scale and teacher-rated studiousness reflect to some extent self-discipline and self-control, which are both aspects of conscientiousness. Being reliable and self-disciplined were identified, among others, as key facets of conscientiousness (see Bogg & Roberts, 2013). Therefore, it seems obvious that the effect of these student characteristics on all-cause mortality might be mediated by the same variables as conscientiousness, such as education, smoking, or lower body mass index (BMI; Turiano, Chapman, Gruenewald, & Mroczek, 2015; Turiano, Hill, Roberts, Spiro, & Mroczek, 2012). Taken together, conscientiousness was shown to be negatively associated with risky behaviors and positively related with behaviors beneficial to health (Bogg & Roberts, 2013). Yet, given the available data, we were not able to test these mediational pathways in the current study. Deary and colleagues (2008) demonstrated that education only accounted for 14% of the initial effect of dependability. Hence, it is important for future studies to empirically test theoretical models that include the relations between conscientiousness, health, and longevity via educational pathways and mechanisms that are not directly related to education (e.g., Friedman, Kern, Hampson, & Duckworth, 2014). Another limitation of our study lies in the fact that we do not have information about the exact time span between the childhood assessment of our constructs and the death of our participants. Therefore, we were unable to determine if time to death did play a significant role in how each predictor was related to mortality risk. As the predictors and mediation processes of life span health outcomes might differ across the life span (see Shanahan, Hill, Roberts, Eccles, & Friedman, 2014) it will be essential for future studies to investigate this important research question. Moreover, we did not have information on mortality status for about 10% of the initial population, which is another limitation of our study.

The student characteristics that we measured in childhood can be seen as more behavior-based than other typical self-reports of personality(-related) traits as we asked for their actual behavior and reaction in specific situations and as studiousness was judged by teachers who had manifold opportunities to observe students in the classroom. Therefore, there might be a higher chance of malleability for these kinds of traits. A specific training for improving those behaviors and habits might be useful, especially in the school context. This might flow into positive cumulative effects for important health outcomes and a longer life. Shanahan and colleagues (2014) describe this process as resource accumulation and positive amplification. For instance, an intervention to promote industriousness (and in turn longevity) in schools might be to exercise how to follow routines/roles and manage goal-oriented tasks, which are both aspects of being responsible and industrious. For instance, students could improve their health-related self-discipline by following a healthier diet. Those are activities that can be trained and implemented into everyday scholastic routines. Finally, this might promote a healthier and longer life. Early investments and interventions may provide multiple and important benefits across the life span, not only for the individual but also for society.

The current study identified personality-based constructs at a more narrow level as important predictors of mortality. This should encourage future studies to take the level of assessment of constructs into account. A first step has to be the replication of our results. Moreover, to identify the incremental validity of our or similar constructs future studies should include more traditional personality trait systems such as the Big Five as controls.

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Notes

1. In the present study, the highest ISEI value in a family (usually the father's ISEI value) was used. We used the ICSO-08 standards to transform parental jobs into the ISEI scores.
2. We did not run Cox regressions because we do not have the exact age of death or cause of death of the participants.

3. We also ran the logistic regressions separately for males and females. The results did not differ for males and females and were therefore not reported in the manuscript.

4. We also ran analyses with different interactions, teacher-rated studiousness and responsible student scale, responsible student scale and IQ, teacher-rated studiousness and IQ. None of these interactions added to the prediction of mortality (i.e., the odds ratios did not differ significantly from 1). Therefore, the results were not reported in the manuscript.

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