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## Childhood Conscientiousness and Longevity: Health Behaviors and Cause of Death

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Previous research showed that conscientiousness (social dependability) in childhood predicted longevity in an archival prospective cohort study of bright children first studied by Terman in the 1920s (H. S. Friedman et al., 1993). Possible behavioral mechanisms for this robust association are now examined by gathering cause of death information and by considering the possible mediating influences of drinking alcohol, smoking, and overeating. Survival analyses ( $N = 1,215$ ) suggest that the protective effect of conscientiousness is not primarily due to accident avoidance and cannot be mostly explained by abstinence from unhealthy substance intake. Conscientiousness may have more wide-ranging effects on health-relevant activities.

Observed associations between personality and health date back to the ancient Greek assertions of links between disease and the so-called bodily humors, but modern research has focused on such matters as chronic hostility or depression, repressive coping, and lifestyle health habits as possibly stable predictors of future health (see overviews by Friedman, 1991, 1992; Pennebaker, 1990; Temoshok, 1992). Is personality predictive across the life span, and, if so, what are the likely causal mechanisms? One of the best ways to address these questions would be to assess the personality of a group of children and follow them until their death. We can approximate just such a study by

building on the data first collected by Lewis Terman and his associates. Beginning in the 1921-1922 school year, Terman gathered detailed information on 1,528 bright boys and girls in California schools; they have been followed at 5- to 10-year intervals ever since. We have now gathered and coded the participants' death certificates.<sup>1</sup>

In previous research on these data (Friedman et al., 1993), it was found that childhood conscientiousness clearly predicts longevity, with low-conscientious children at increased risk of premature mortality throughout their adult lives. Conscientiousness at about age 11 was measured using ratings of the children by parents and teachers on prudence, conscientiousness, and social responsibility. This dimension also captures elements of what is sometimes now termed Agreeableness (such as freedom from vanity), as opposed to a focus on orderliness. The protective effect of conscientiousness that emerged is the first

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<sup>1</sup> This paper is one of a series developed from our large-scale, multi-year, multidisciplinary project on psychosocial predictors of health and longevity. The data are partly derived from the thousands of variables in the 70-year Lewis Terman life-cycle study archives, and partly collected by us as follow-ups to Terman's project. All relevant findings are included to the extent feasible in each paper, but multiple publication is necessitated by several factors: (a) the project proceeds systematically (over a period of years) in following up each set of major findings, and the follow-up analyses and results cannot of course be known in advance; (b) the complexity and scope of the analyses must be appropriate for the scope and space of the journal; (c) the complexity and diversity of the relevant literatures and time frames (ranging from breast-feeding, personality, and stress in childhood to friendships and hobbies in old age) preclude simple integration. Therefore, previous publications are cited where appropriate; care should be taken not to include overlapping findings in any meta-analyses or other reviews.

prospective, life-span evidence of the relation of childhood personality to longevity. In addition, the size of this effect was important—those at the 25th percentile of conscientiousness had a 30% greater mortality risk than those at the 75th percentile, which is comparable to the effects of systolic blood pressure or serum cholesterol on all-cause mortality. A 20-year-old in this sample near the top quartile (75th percentile) on conscientiousness could expect to live 2 years longer than someone near the bottom quartile. Given the size of this effect and its robustness in various associated statistical analyses, understanding its mechanisms—the causal pathway—holds high potential for illuminating the protective or harmful health effects of individual differences, across the life span. The present article examines certain likely behavioral mediators.

The relation of conscientiousness to longevity might emerge from a complex set of psychosocial forces, or it might be traceable to a fairly simple set of health-relevant behaviors. One approach to understanding the causal interrelations is to examine cause of death. It seems reasonable to expect, for example, that imprudent people, who are low on conscientiousness, are more likely to die of injury across the life span, although this has never been demonstrated. We therefore collected and coded the death certificates of those in Terman's original sample known to be dead as of 1986. (The conclusions also hold in analyses that continue through 1991.) Remarkably, less than 10% of the eligible sample could not be located.

The second important means of shedding light on the conscientiousness effect is to examine consumptive health habits known to be detrimental to health—namely, excessive alcohol consumption, smoking, and overeating. There is prospective evidence that low-ego-strength children are more likely to use drugs (Block, Block, & Keyes, 1988). One might also expect that prudent, responsible people are less likely to become heavy drinkers or extremely obese, although there is no clear longitudinal evidence on this point. Therefore, we constructed measures of these harmful health habits—drinking, smoking, and becoming obese—and examined their role in the conscientiousness-to-mortality relation.

What about the more complex causal connections? Conscientiousness could also be related to longevity through at least two other sorts of links. First, there could be underlying biological forces, such as genes or neonatal nervous system conditioning, that might be influencing both conscientiousness and longevity. Although such mechanisms have been postulated for extroversion and hyperreactive hostility, they have not been applied to conscientiousness. An effect of such an underlying third variable seems unlikely.

However, a whole host of psychophysiological and psychosocial factors might be related to both personality and health, in complex ways. For example, conscientiousness is related to certain positive feelings and motivations (Watson & Clark, 1992), which might affect recovery from illness. Or, there may be life-long impairment in the social relations of unconscientious, undependable people. If the relation between conscientiousness and longevity cannot be explained through injury proneness or through health behaviors such as alcohol abuse, then these other sorts of explanations become more likely and much more deserving of attention.

## Method

### *The Terman Sample*

The Terman Life-Cycle Study, begun in 1921–1922 when most of the 1,528 participants were in public school and continued until the present, is the longest prospective longitudinal study of a single cohort ever conducted. These data have been used primarily to describe the life course of gifted individuals (Sears, 1979; Terman et al., 1925; Terman & Oden, 1947). Terman's original aim was to secure a reasonably representative sample of bright California children (IQ of 135 or greater), and so almost every public school in the San Francisco and Los Angeles areas in the 1920s was searched for bright children. The average birth date was 1910, with a standard deviation of 4 years. Most of the children were preadolescent when first studied; those still living are now in their 80s. Most important is the fact that the data are collected prospectively, without any knowledge of eventual health or longevity, thus avoiding several common sources of bias. The data set is not as complete as we would design one to be today; detailed medical exams were done only in childhood, precluding a direct test of illness and physiological mediating mechanisms, so we focused on longevity. To protect against Type I statistical errors, in no cases were the relations of single items and mortality explored; predictors were selected before survival analyses were conducted. However, alpha levels were not adjusted.

In young adulthood, the participants were generally healthy and successful. In middle age, they were largely productive citizens—lawyers, businessmen, teachers, secretaries, housewives, and scientists—but with none clearly identifiable as a “genius.” The sample is relatively homogeneous on dimensions of intelligence, race (mostly White), and social class (little poverty). The sample thus tends to minimize the influences of demographically based determinants of poor health (such as no place to exercise, poor nutrition, no routine health care) and thus allows a clearer focus on the effects of psychosocial and behavioral variables. This sample is not representative of the U.S. population as a whole, and results are not directly generalizable to other groups, in other times, in other circumstances. On the other hand, there is little reason to suspect that the relationships being analyzed are strongly influenced by the characteristics of this sample. In other words, there is no reason to suspect that the relationship between conscientiousness and longevity is different for bright people than it is for people of average intelligence. (The sample is arguably more representative of the population than the various prospective studies that have followed samples of physicians or nurses.) The relatively homogeneous nature of the sample with respect to the above might excessively restrict the range on the predictor variables; however, our ongoing work shows that this is not the case; there is a more than adequate range of individual differences and behaviors.

To ensure comparability with previous work (Friedman et al., 1993), we restricted the present analyses to participants born between 1904 and 1915 inclusive ( $N = 1,373$ ). Because some of the information on consumptive behaviors was not collected until 1950, we restricted analyses to predict deaths occurring during 1950 or later. Seventy-eight participants died, and 34 were lost from the study before 1950, leaving a sample size of 1,261. Finally, we excluded 46 participants for whom we were missing most of the data on personality, leaving a final sample size of 1,215. We analyzed these participants over the period from 1950 until the date of their death or the most recent date they participated in the study. (Analyses are reported through 1986, to allow comparison with our previous study.) Of the 1,215 participants, 419 (34%) died between 1950 and 1986, and we know their date of death. Of the remaining 796, 666 (84%) participated in the 1982 or later waves of data collection.

### *Cause of Death*

We obtained death certificates for the deceased from state bureaus. This involved: guessing in which state the participant died (though most

were Californians), making positive identification (we did not have social security numbers), and satisfying various state requirements for release of death certificates. The certificates were then coded for underlying cause of death by our physician-supervised certified nosologist; we used the 9th revision of the International Classification of Diseases (ICD-9, U.S. Department of Health and Human Services, 1980). Cardiovascular disease (CVD) deaths were those coded 400–448. Cancer deaths were those coded 140–239. Deaths from injury (accidents and violence) were those coded 800–999. Deaths from other causes were categorized separately. For 81 of the 419 deceased participants, no death certificates were obtained. Physician review of information from next-of-kin allowed classification of 47 of these deaths into broad categories, including CVD and cancer. The total numbers of deaths from each cause are: 141 deaths from CVD (100 men, 41 women), 144 deaths from all cancers (88 men, 56 women), 31 deaths from accidents and violence (20 men, 11 women); 69 deaths from all other causes (39 men, 30 women); and 34 deaths from unknown causes.

### *Conscientiousness–Social Dependability*

We initially examined all items collected by Terman in 1922 that seemed relevant to personality. In 1922, one of the participant's parents (usually the mother, or both parents together) and the participant's teacher were asked to rate the participant on 25 trait dimensions chosen to measure intellectual, volitional, moral, emotional, aesthetic, physical, and social functioning. Each of these 25 traits was rated on a 13-point scale, according to the degree to which the child appeared to possess that trait. The scales used are remarkably modern in their appearance (see Friedman et al., 1993). Our measure of Conscientiousness–Social Dependability included the four items of prudence, conscientiousness, freedom from vanity/egotism, and truthfulness. This corresponds roughly to the Big Five dimension of Conscientiousness. However, some notions of conscientiousness include a “need for order,” a notion not captured in our dimension; rather, our conscientiousness scale may have also captured some elements (such as honesty) of what is sometimes termed Agreeableness (Costa, McCrae, & Dye, 1991); this definition of conscientiousness as including social dependability should be kept in mind in interpreting the results. The Cronbach's  $\alpha$  for this scale was .76, indicating good reliability.

### *Other Personality Measures*

We previously limited our survival analyses to six personality predictor dimensions (Friedman et al., 1993). These were chosen on the basis of three criteria: (a) theoretical considerations, such as theories of the Big Five dimensions of personality; (b) a detailed examination of the intercorrelations of all the personality items; and (c) a factor analysis of potentially relevant items. In addition to Conscientiousness, we created: a Sociability index; a High Self-Esteem–High Motivation dimension; a dimension of optimism–sense of humor named Cheerfulness; one of High Energy; and a measure of Permanence of Moods. None of these dimensions turned out to be as clearly related to longevity, and none of them are as obviously relevant to health behaviors such as accident avoidance or excessive drinking. The present article therefore focuses on conscientiousness, but we also examined the comparable models that included these other dimensions, especially Cheerfulness, since Cheerfulness was previously found to be inversely related to longevity. No significant changes emerged in current conclusions when these other dimensions were controlled. (Since Cheerfulness remains of special theoretical interest nonetheless, we are at present exploring other variables in the Terman data that may shed more light regarding Cheerfulness.) Also, a check for differential attrition showed that, among participants with personality information who were either lost to follow-up or dropped out of the study after 1922, there were no significant differences

on any of the personality scales between those lost from the study and those retained.

### *Perceived Stressful Family Environment*

Previous theory and research suggest that low-ego-strength individuals, particularly men, have had difficult relations with their parents and are more likely to believe they had a stressful family environment during their childhood. We therefore examined relations between childhood conscientiousness and retrospective, self-reported family stress. The latter refers to reports in young to mid-adulthood (two decades or so later) about childhood stress. In 1940 and 1950, the participants were asked to recall childhood conflict with parents, friction in the family, rebelliousness, and rejection by parents, on 5-point scales. (The  $\alpha$  reliability of our combined scale is .78). Because this information is retrospective, it may characterize dissatisfied adults as much as it indicates true childhood distress. Because it is difficult to be sure about what this variable represents, we did not use it as an explanatory variable in survival analyses, but its relation to conscientiousness is used to inform the discussion.

### *Alcohol Consumption*

Alcohol consumption was assessed in 1950 and 1960 through self-reports. At both decades, we classified participants into three categories: those who never took a drink or did so only on rare occasions, those who were moderate drinkers (never or seldom became intoxicated), and those who were heavier drinkers (drank fairly heavily or to excess). We used the rating, from either 1950 or 1960, that indicated the greater alcohol consumption as an indicator of alcohol intake for each participant. Given the conceptual clarity of the three categories and the intelligence and motivation of the respondents, this is likely a reliable measure, although it is possible that some self-deceiving heavy drinkers reported that they had seldom or never been intoxicated. The correlation between alcohol consumption reported in 1950 and 1960 was  $r(513) = .55$  for men, and  $r(423) = .63$  for women,  $p < .0001$ , indicating stability across a decade. Because some real change is to be expected (as people stop or start drinking), these high correlations are evidence for the reliability of the alcohol consumption measurement.

### *Smoking*

Smoking information was not well represented in the archival data, and we gathered further data during 1991–1992. If participants or their relatives were alive and could be located, we sent them a postcard asking whether they had ever smoked cigarettes, for how many total years they had smoked, and the average number of cigarettes per day they had smoked during the years that they smoked. Families of participants who died young were less likely to be reachable, and so smoking effects may be underestimated. We computed the number of cigarette-years for each participant by multiplying the total number of years he or she reportedly had smoked by the average number of cigarettes per day he or she had smoked during those years. The number of cigarette-years ranged from 0 (nonsmokers) to 3,600. This was converted into a four-category variable: 0 = nonsmoker; 1 = 1–320 cigarette-years; 2 = 321–880 cigarette-years; and 3 = 881–3600 cigarette-years.

### *Obesity (Body Mass Index)*

Direct evidence about eating habits was not available, but we inferred information about obesity from participants' body mass indexes. In 1940, participants reported their heights and their weights. Because Terman or his associates knew many of the participants, gross distortions in self-report are unlikely. However, the obesity measure was obtained before the participants reached middle age and so may not be relevant

to weight gain later in life. Body mass index was computed as weight/height<sup>2</sup>.

### Analysis

We used hazard regression analyses (survival analyses) to test the effects of the predictors on longevity. These are superior to logistic regressions in that they consider length of survival as well as survival status. Cox's widely used proportional-hazards model makes no assumption about the underlying hazard function but does assume that the effect of each explanatory variable is multiplicative and constant across age. The Gompertz (parametric) analysis is less flexible with respect to the hazard function but tests whether the effects vary as a function of age. We used both techniques, as appropriate. In this sample, the overlapping information they provided turned out to be nearly identical. Because it best meets the models' assumptions, we used the RATE program (Tuma, 1980).

## Results

### Cause of Death

Of participants in the lowest quartile on Conscientiousness, 106 died: 36 of CVD, 32 of cancer, 9 from injury, and the rest from other or unknown causes. Of those in the highest quartile on conscientiousness, only 93 died: 31 from CVD, 32 from cancer, 4 from injury, and the rest from other or unknown causes. (Note that these descriptive statistics do not take age of death or age at recruitment into account; the survival analyses reported later of course do.) Of participants whose cause of death is known, almost two-fifths of both the high- and low-conscientious quartiles died of CVD. Almost 40% of the high-conscientious participants died of cancer, compared with 33% of the low-conscientious participants (although the high-conscientious participants were less likely to die). Only 9% of the low-conscientious quartile, and only 5% of the high-conscientious quartile, died as a result of injury; those who died from injury were more likely to be in the low-conscientiousness quartile, but, overall, few people died as the result of injury. We next tested the statistical significance of these differences.

Conscientiousness was not significantly differentially related to cause of death. Table 1 shows the relative statistical fit of Gompertz models predicting mortality from Sex and childhood Conscientiousness. Model 1 predicts mortality from Sex only. Model 2 predicts mortality from Sex and Conscientiousness but statistically constrains Conscientiousness to predict equally to all causes of death. Model 3 predicts mortality from Sex and childhood Conscientiousness but allows Conscientiousness to predict differently to each cause of death. A comparison of Model 1 and Model 2 addresses the issue of whether adding Conscientiousness to the model statistically improves the fit of the model over simply considering Sex in the model. The difference in chi-squares between Model 1 and Model 2 is 14.17 ( $p < .001$ ; change in  $df = 1$ ), indicating that adding Conscientiousness to the model significantly improves the fit of the model. A model that constrains Conscientiousness to predict equally to all causes of death (Model 2) is more parsimonious than one in which Conscientiousness is not constrained to predict equally to all causes of death (Model 3). A comparison of Model 2 and Model 3 addresses the issue of whether Conscientiousness predicts equally or differentially to the various causes

of death. The difference in chi-squares between Model 2 and Model 3 is 4.82 (change in  $df = 4$ ), which is not statistically significant. Results thus indicate that highly conscientious people were less likely to die in any given year of injury, CVD, and cancer, as well as of all causes; that is, conscientiousness is not significantly differentially protective in minimizing the likelihood of death from injury. These results were confirmed by analyses that focused separately on each cause of death (not shown); most people died of CVD or cancer, and conscientiousness predicts longevity in these noninjury cases as well.

### Consumptive Behaviors

**Alcohol.** Consistent with other studies, proportional-hazards analyses with our 3-point scale (controlling for gender) revealed that heavy drinking was positively associated with premature mortality ( $N = 1,138$ , relative hazard [rh; the relative risk of dying] = 1.25,  $p < .01$ ), a result that held for men ( $N = 643$ ,  $rh = 1.25$ ,  $p < .05$ ) and marginally for women ( $N = 495$ ,  $rh = 1.23$ ,  $p < .15$ ).

Because there is some evidence that moderate alcohol consumption sometimes protects one from coronary heart disease, we also used dummy coding to compare abstainers with moderate drinkers and with heavy drinkers (i.e., looked for a U-shaped effect); however, no evidence of a U-shaped effect was found. No differences in risk were found between abstainers and moderate drinkers; only heavy drinking was harmful. Heavy drinkers had a higher mortality rate, compared with abstainers ( $rh = 1.51$ ,  $p < .01$ ), for men ( $rh = 1.45$ ,  $p < .10$ ) and women ( $rh = 1.50$ ,  $p < .15$ ). A comparison of moderate drinkers with heavy drinkers again showed that heavy drinkers had a higher mortality rate ( $rh = 1.32$ ,  $p < .05$ ; full sample  $Ns = 1,138$ ).

In correlational analyses, conscientious children were less likely to grow up to be heavy drinkers,  $r(1,138) = -.13$ ,  $p < .001$ , a small but meaningful relation in the expected direction. The relation held for men,  $r(643) = -.11$ ,  $p < .01$ , and women,  $r(495) = -.12$ ,  $p < .01$ . Of participants in the top quartile on childhood conscientiousness, 20% reported heavy drinking but 34% of those in the low-conscientiousness quartile did so.

**Smoking.** Information on smoking was the weakest variable in this study because we collected it recently through self-report or relative report questionnaires, with substantial missing data. Nevertheless, smoking was found to be a significant predictor of premature mortality ( $N = 689$ ,  $rh = 1.28$ ,  $p < .001$ ). This was true for both men ( $N = 357$ ,  $rh = 1.19$ ,  $p < .10$ ) and especially women ( $N = 332$ ,  $rh = 1.41$ ,  $p < .01$ ).

Conscientious children were less likely to grow up to be smokers. The correlation between childhood conscientiousness and smoking was  $r(689) = -.13$ ,  $p < .001$ . The relation held for men,  $r(357) = -.16$ ,  $p < .01$ , and marginally for women,  $r(332) = -.10$ ,  $p < .10$ .

**Obesity.** Body mass index was not a significant predictor of longevity, although we found some evidence that obesity is a cardiovascular risk for men. Furthermore, childhood conscientiousness was not significantly correlated with body mass index in adulthood  $r(1,044) = -.03$ ,  $ns$ .

Table 1  
*Goodness of Fit for Three Gompertz Models Predicting Cause-Specific Mortality From Sex and Childhood Conscientiousness*

Model	Statistical fit		
	$\chi^2$	<i>df</i>	<i>p</i>
Model 1, predicting mortality from sex	281.43	10	$p < .001$
Model 2, predicting mortality from sex and conscientiousness, constraining effect of conscientiousness to be equal across all causes of death	295.60	11	$p < .001$
Model 3, predicting mortality from sex and conscientiousness, not constraining effect of conscientiousness to be equal across all causes of death	300.42	15	$p < .001$
Model 2 versus Model 1	14.17	1	$p < .001$
Model 3 versus Model 1	18.99	5	$p < .01$
Model 3 versus Model 2	4.82	4	<i>ns</i>

*Note.*  $N = 1,215$ . Of participants in the lowest quartile of Conscientiousness whose cause of death is known, 37% died of cardiovascular disease (CVD) and 33 died of cancer; for participants in the highest quartile, 38% died of CVD and 40% died of cancer. Only 13 people died of injury in the highest and lowest quartiles combined.

### *Conscientiousness Effects, Controlling for Health Behaviors*

Focusing on participants who were still in the sample as of 1950 and for whom we also had information on childhood personality and alcohol consumption ( $N = 1,138$ ), we used a Cox proportional-hazards regression analysis to predict mortality from sex, conscientiousness, and alcohol consumption. As shown in Model 1 of Table 2, mortality was first predicted from Sex and Conscientiousness. (The interquartile relative hazard, comparing the predicted mortality risk at the 25th versus 75th percentiles, is presented for all personality variables in Tables 2 and 3.) As was demonstrated in our previous work using the less restricted sample (Friedman et al., 1993), childhood conscientiousness was a significant predictor of mortality risk in the sample.

As shown in Model 2 of Table 2, when alcohol consumption is added to the regression equation, it slightly diminishes the effect of Conscientiousness on mortality risk. Both low conscientiousness and high alcohol use increase the risk of mortality.<sup>2</sup>

Last, as shown in Model 3 of Table 2, when the remaining five personality scales (previously used in Friedman et al., 1993) were added to the equation, the relationship between Conscientiousness and mortality became slightly stronger. The significant inverse relation between Cheerfulness and longevity previously reported (Friedman et al., 1993) also remained marginally significant when alcohol use was entered into the equation in this smaller sample.

Focusing on participants who were still in the sample as of 1950 and for whom we also had information on childhood personality and smoking ( $N = 689$ ), we used a Cox proportional-hazards regression analysis to predict mortality from Sex, Conscientiousness, and smoking. As shown in Table 3, mortality was first predicted from Sex and Conscientiousness. Even with a markedly reduced sample size, Conscientiousness again was a significant predictor of mortality risk. As shown in Model 2 of

Table 3, when cigarette-years was added to the regression equation, it slightly, but not significantly, diminished the effect of Conscientiousness on mortality risk. Last, as shown in Model 3, when the remaining five personality scales were added to the equation, the relationship between Conscientiousness and mortality again remained significant.

Because the effect of Conscientiousness on longevity was known to be stronger for men than for women (Friedman et al., 1993), these Cox proportional-hazards regressions involving alcohol and smoking were repeated separately for men and women, as an added check (not shown). Although some of the Conscientiousness coefficients were now of borderline significance largely because of the decreased sample size, the same effect of Conscientiousness appeared, with comparable relative hazards. In additional analyses (not shown) we entered both alcohol and smoking (with gender and Conscientiousness) into the survival analyses (with an  $N = 664$ ), with and without the other personality measures. The effect of Conscientiousness on longevity remained statistically significant in both analyses.

### Discussion

A longstanding puzzle in psychology and medicine concerns the extent to which and the mechanisms whereby stable individual differences in responding might be associated with life-threatening diseases and premature mortality. Working from the longest continuous cohort study ever conducted (Terman & Oden, 1947), we arrived at the following question: Why is child-

<sup>2</sup> Survival analyses were also run predicting death from the year 1960 on ( $N = 1,078$ ), and after changing the alcohol index to refer only to usage in 1950 and predicting from 1950 on ( $N = 1,102$ ). The results were the same: In both these ancillary analyses, the same size decrease in the conscientiousness effect was observed when controlling for alcohol. The effect of alcohol itself on mortality was somewhat greater.

Table 2  
*Cox Proportional-Hazards Model Predicting Mortality From Sex, Alcohol Consumption, and Childhood Personality (1950)*

Variable	Model		
	1	2	3
Sex (F = 1)			
b	-.31***	-.26**	-.27**
rh	.73	.77	0.76
Conscientiousness			
b	-.25****	-.22***	-.28****
rh	.78	.80	0.75
Alcohol			
b		.19**	.17**
rh		1.21	1.19
High energy			
b			.07
rh			1.08
Cheerfulness			
b			.18*
rh			1.19
High motivation			
b			.14
rh			1.15
Sociability			
b			-.01
rh			0.99
Permanency of mood			
b			-.05
rh			0.95

Note.  $N = 1,138$ . Personality comparisons are 75th versus 25th percentiles. F = female; b = hazard regression coefficient; rh = relative hazard (relative risk of dying).

\*  $p < .10$ . \*\*  $p < .05$ . \*\*\*  $p < .01$ . \*\*\*\*  $p < .001$ .

hood conscientiousness so clearly related to longevity over the life span in the Terman sample?

Given that the unconscientious children were neither prudent nor socially responsible, it seemed more likely that they would tend to grow into adults who met accidental and violent deaths. However, conscientiousness predicted longevity but did not differentially predict cause of death. Although there was some indication that those who died from injury were more likely to be low on conscientiousness, this does not substantially explain the longevity differences, because so few people died from injury. (This is analogous to saying that conscientious people are less likely to die from bungee jumping, but bungee jumping is not a significant health risk in the population.) This finding is consistent with our previous finding (Friedman et al., 1993) that the effect of conscientiousness on mortality did not vary with age; if less conscientious people are dying violently, the effect of conscientiousness should be stronger at a younger age, when accidental deaths predominate. But it was not. In short, searching for differential cause of death rules out this most obvious and simple behavioral explanation for why conscientious people live longer.

It also seemed likely that conscientious children would grow up to have better health habits. Indeed, they were somewhat more likely to avoid heavy drinking and smoking, although the correlations were small. One third of the unconscientious children, but only one fifth of the conscientious children, grew up

to be heavy drinkers (around age 40). And, smoking and drinking were associated with increased mortality rates in this sample. Therefore, a part of the effect of conscientiousness on longevity seems to be accounted for by alcohol and cigarette usage. These effects may be underestimated due to unreliability of measurement, but note that the stability of the alcohol usage variable was high across a decade. Overall, the effects of substance use did not come close to fully explaining the sizable relationship of conscientiousness to longevity. When drinking and smoking were controlled for, conscientiousness remained a significant predictor of longevity. In addition, body mass was not related to conscientiousness and did not predict overall longevity in this sample. Conscientious people must be different in health-relevant ways other than their drinking, smoking, and degree of obesity.

The sample size and reliability of measurement were sufficient to detect effects of the size commonly encountered (note the associations that did emerge). Power analyses also showed good statistical power. Coupled with the data on death by injury, the present findings suggest that conscientious children do not live longer simply because they grow up to avoid injury-prone activities, or smoking and drinking. It is possible that other, unidentified unhealthy behaviors help place the unconscientious people at higher risk. Or, a more complex process may be involved.

Explicating the full process (through which conscientiousness is relevant) promises to provide significant insight into life-

Table 3  
*Cox Proportional-Hazards Model Predicting Mortality From Sex, Smoking, and Childhood Personality (1950)*

Variable	Model		
	1	2	3
Sex (F = 1)			
b	-.20	-.14	-.10
rh	.82	.87	.91
Conscientiousness			
b	-.30**	-.23*	-.37**
rh	.74	.79	.69
Smoking			
b		.22***	.22***
rh		1.25	1.25
High energy			
b			.00
rh			1.00
Cheerfulness			
b			-.11
rh			.89
High motivation			
b			.33**
rh			1.39
Sociability			
b			-.15
rh			.86
Permanency of mood			
b			.80
rh			1.09

Note.  $N = 689$ . F = female; b = hazard regression coefficient; rh = relative hazard (relative risk of dying).

\*  $p < .10$ . \*\*  $p < .05$ . \*\*\*  $p < .01$ .

long psychosocial influences on longevity. Because Terman and Oden's (1947) participants were of above-average intelligence and were well educated, access to basic health information is probably not a relevant factor. Similarly, because the participants were a mostly White, middle- and upper-middle-class group of children growing up in California in the 1920s, differential access to medical treatment is also not likely to be of relevance. (Also note that they had regular contact with Stanford University.) Socioeconomic status measured in childhood did not predict longevity in this sample, perhaps due to the underrepresentation of working-class families. It is still possible that unconscientious people may not have taken advantage of health care, but this too would likely be a function of personality rather than social constraints.

The present findings therefore increase the likelihood that either inherent psychobiological factors or life span psychosocial factors account for the links between conscientiousness and longevity. On the psychobiological side, any genetic, neonatal, or early socialization processes that affect both conscientiousness and health could account for the relation. The relation might be spurious (noncausal) if, for example, individual perceptual processes that make the person more conscientious also are characteristic of a more robust (long-lived) organism. Such simple biological explanations involving conscientiousness have not been offered and seem to us unlikely on theoretical grounds. In fact, conscientiousness is generally conceived to be much less likely to be related to health-relevant biological responding than are, for example, such traits as neuroticism or chronic hostility (Barefoot, 1992; Chesney & Rosenman, 1985; Eysenck, 1990; Smith & Christensen, 1992).

Much more likely is that conscientiousness has some of its effect on longevity through one or more psychosocial processes. These may work in concert with health behaviors. On the more psychological side, conscientious people may be better able to cope with stressful life events because they have prepared themselves psychologically (e.g., with proactive patterns of coping with stress) or pragmatically (e.g., buying insurance, backing up their files). On the more social side, conscientious, dependable people might be more likely to maintain stable marriages or other networks of social support, known to predict better health and longevity (House, Landis, & Umberson, 1988). Such relations—among conscientiousness, social relations, health behaviors, and health—should be the focus of future research, both prospective and cross-sectional.

Finally, it is known that conscientious people are more secure, constructive, productive people (Block & Block, 1980; Graziano & Ward, 1992; Ones, Viswesvaran, & Schmidt, 1993; Shedler & Block, 1990). They may have important elements of an emotionally self-healing personality (Friedman, 1991). For example, less conscientious adolescents (especially boys) are known to have adjustment problems at home and in school. This may lead to an unstable, stressful life involving a host of health risk factors, including a somewhat greater likelihood of substance abuse. Preliminary exploration in the Terman data has confirmed that unconscientious men in this sample were more likely to report having had stressful home environments during their childhoods. When we examined relations between childhood conscientiousness and retrospective, self-reported family stress, we found a correlation of  $r(531) = -.19, p < .0001$

for men and  $r(426) = -.08, ns$ , for women. This information is retrospective self-report about an emotional topic and so may characterize dissatisfied adults as much or more than it indicates true childhood distress. Nevertheless, the highly conscientious men reported a less negative early family environment than did the unconscientious men.

The conscientious children in this study seem to fit well into traditional theoretical conceptions of children with high ego strength: dependable, achieving, not impulsive. Thus it is not surprising that they would grow up to be somewhat less likely to smoke and drink, and perhaps be better adjusted. In Eysenck's (1990) terms, they seem lower on psychoticism, and in terms of the Big Five dimensions they seem high on Conscientiousness and probably on Agreeableness (John, 1990). Research on the basic dimensions of personality has indicated that people high on the Big Five dimensions of Conscientiousness and Agreeableness typically have positive feelings of well-being (McCrae & Costa, 1991; Watson & Clark, 1992). In particular, conscientious individuals tend to be high on measures of attentiveness and determination (see also Ones et al., 1993). It is unknown whether positive affect itself is warding off stress-related disease, perhaps through better-modulated sympathetic nervous system activity; this is unlikely given our previous findings regarding the inverse relation between cheerfulness and longevity in this sample. Or, perhaps these conscientiousness-based motivations are associated with various still-unidentified health-promoting behaviors. This last line of thinking points to the fascinating possibility that problems related to unconscientiousness may be a general risk factor for all-cause mortality. In other words, perhaps many adult psychosocial risk factors can be traced in part to early social undependability.

All of these factors—psychosocial coping with stress, substance abuse, and a self-healing psychological style—are the focus of a considerable amount of ongoing research. Many variables relevant to these constructs can probably be extracted from the Terman sample data, as well as from other archival data sets, and may prove a fruitful subject for targeted research on conscientiousness and longevity. A significant issue for future research is to uncover why unconscientiousness raises mortality risk; it does not seem to do so in any simple way.

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