Sociodemographic and Psychosocial Factors in Childhood as Predictors of Adult Mortality

ABSTRACT

Objectives. Childhood sociodemographic, psychosocial, and environmental factors are often assumed to affect adult health and longevity. These relationships were prospectively tested by using the 7-decade Terman Life Cycle Study of Children With High Ability (n = 1285).

Methods. Parental socioeconomic status, childhood health, objective childhood stressors (e.g., death or divorce of parents), and childhood personality were considered as potential predictors in hazard regression analyses of longevity through 1991.

Results. Parental divorce during childhood predicted decreased longevity, with sex controlled. Other potential social predictors failed to show significant associations with longevity. Three dimensions of childhood personality—conscientiousness, lack of cheerfulness, and permanency of mood (males only)—predicted increased longevity. The effects of parental divorce and childhood personality were largely independent and did not account for any of the gender difference in mortality.

Conclusions. A small number of childhood factors significantly predicted mortality across the life span in this sample. Further research should focus on how these psychosocial factors influence longevity. (*Am J Public Health.* 1995;85:1237–1245)

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Introduction

The inverse association of socioeconomic status with current morbidity and mortality has been clearly demonstrated.[1–3] It is also well established that childhood sociodemographic and psychosocial factors (e.g., socioeconomic status) and family stability are predictive of later intellectual and emotional health.[4–8] In contrast, the effects of childhood psychosocial factors on long-term physical health and longevity are mostly unstudied,[9,10] despite the existence of several commonly accepted theories of healthy development that implicitly predict a relationship between early social environment and adult health. One hypothesizes that those with higher socioeconomic status have greater access to material resources and services that help to promote or maintain health.[11] A second hypothesizes that early stress leads to unhealthy behaviors such as substance abuse, failure to take prophylactic measures, and risk taking, each contributing to a shortened life expectancy.[12] Yet another theory suggests that problems with self-esteem, chronic hostility, depression, and related psychophysiological imbalances lead to health problems in adulthood, probably via the neuroendocrine and/or immune systems.[13–18] For example, type A and related maladaptive behavior patterns are thought to have their roots in childhood, possibly contributing to lifelong patterns of physiological hyperreactivity.[19] A fourth theory postulates that children who grow up with family friction or divorce are more likely to experience the kinds of social problems or social isolation that have been found to be inversely associated with longevity.[20,21] Alternatively, some family stress may be temperamentally based, with this biological predisposition also leading to poor health; if so, the relationship of family stress to adult health and longevity could be spurious rather than causal, depending on the precise nature of the underlying processes. Possible examples include predispositions to depression or alcoholism that run in families. As a precursor to examining specific hypothesized mechanisms, we sought to ascertain whether and the extent to which childhood traits and environment predict one's life expectancy.

In an earlier article addressing the possible relationships of longevity (through 1986) to childhood personality (measured in 1921–1922), we reported a substantial positive association with conscientiousness, a moderate inverse association with cheerfulness (good sense of humor), and a weak association with permanency of mood.[22] Is it possible that these relationships are spurious and are due to the impact of other childhood factors (e.g., socioeconomic status, family environment, childhood health) on both childhood personality and longevity? In this

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article, we try to locate any impact of childhood personality on longevity within a broader array of childhood factors.

If the father is absent from the home, either psychologically or physically, children may grow up more hostile or unsociable. A number of studies have shown that young adolescents, especially boys, who have experienced the divorce of their parents are later found to be undercontrolled (i.e., not conscientious), aggressive, and excitable.[23–27] Related longitudinal work suggests that boys whose parents subsequently get divorced can be similarly characterized.[28] Do social dimensions such as divorce and personality dimensions such as lack of conscientiousness have independent predictive effects on longevity? If the demographic and psychosocial variables that predict longevity are substantially correlated with the personality variables that predict longevity, then it is important to consider alternative causal mechanisms that might link the three domains.

A variety of studies suggest that childhood health predicts adult mortality, but a recent review[29] concluded that only studies of childhood respiratory tuberculosis have documented support for a specific (biomedical) mechanism linking childhood illness to adult mortality. However, these authors also concluded that studies showing a relationship between height in late adolescence or early adulthood and adult mortality suggest that other mechanisms, perhaps involving childhood nutrition or illnesses, also operate to link childhood conditions to longevity. Given that severe childhood illnesses can affect psychological development, it is conceivable that childhood health accounts for some of the previously reported association between childhood personality and longevity.

Sex differences in psychosocial factors are especially interesting, because sex is a strong predictor of longevity. There are numerous hypotheses concerning why women outlive men (e.g., stronger constitution, less exposure to stress, and greater social constraints against unhealthy behaviors such as smoking and excess drinking), and a number of biological and behavioral differences have been examined.[30,31] Yet researchers have been unable to demonstrate that such factors account for even half of the sex difference in life expectancy. Could sex differences in childhood psychosocial variables contribute to the sex difference in life expectancy?

We examine these issues using data gathered by the Terman Life Cycle Study of Children with High Ability. Starting in 1921, Lewis Terman and his associates recruited 1528 bright male and female children, mostly between the ages of 6 and 17 years. A range of sociodemographic and psychosocial data was collected from both parents and teachers. Participants were restudied at 5- to 10-year intervals over the subsequent 70 years. Through 1991, we know who was still alive and the year of death of those who had died. Because the sample contains roughly equal numbers of males and females, it is well suited for investigations of sex differences. We know of no other data set containing concurrently collected childhood psychosocial data and seven decades of follow-up data for a sample this large.

Methods

Subjects

The original sample consisted of 856 male and 672 female participants in the Terman Life Cycle Study. Terman's aim in selecting participants was to gather a sample of children in California with a Stanford-Binet IQ of at least 135. The sample is, therefore, quite homogeneous on intelligence. It is also homogeneous with respect to race (99% White) and, to a lesser extent, social class (mostly middle class).[32] There is, however, the normal range of variation in psychosocial characteristics and lifestyles. Although many of the children became businessmen, physicians, homemakers, lawyers, teachers, scientists, and writers, the sample contains few, if any, true geniuses. The average year of birth was 1910. When the subjects were first studied, the mean age was 11.8 years for boys and 11.1 years for girls.

As in Friedman et al.,[22] the present analyses were restricted to those subjects who were of school age in 1921 and 1922 (i.e., born between 1904 and 1915; n = 1373), but we now include follow-up through 1991 (previously, follow-up was through 1986). Because the initial recruitment of subjects was conducted over several years and because we wanted to ensure a modest time gap between the initial assessment and death, analyses were restricted to predict deaths occurring after 1930. This restriction excludes 16 participants who died and 25 who were lost to follow-up before 1930. The latter differed from the overall sample in that their parents had about 2.5 years less education, and their fathers had somewhat less prestigious jobs. We excluded 47 subjects who were missing data on all six personality measures, but the 63 participants who were missing data on isolated personality measures were assigned the mean. Although this is a suboptimal strategy for imputing missing data, it had very little impact on the analysis, as fewer than 5% of the subjects were affected. All analyses were replicated after excluding those with partial personality data, and the results were substantively unchanged. The excluded subjects were a little younger at recruitment (0.9 year) than the overall sample.

These exclusions resulted in a final sample size of 1285, or 94% of those born between 1904 and 1915. These subjects were analyzed over the period from 1930 until the date of their death or the most recent date they participated in the study. Of the 1285, 560 (44%) had died by 1991 and we know their date of death. Of the remaining 725, 542 (75%) participated in the 1986 and/or 1991 waves of data collection. Only 110 dropped out of the study before the 1977 wave of data collection. The dropouts did not differ significantly on any of the predictor variables (listed in Table 1) from those who remained in the study. Therefore, they are retained in the analysis and treated as censored observations as of the date they last participated.

Predictor Variable Selection

In this article, we examine the effects on longevity of four childhood variable domains: demographic factors, childhood health, family stability, and childhood personality. A description of the specific measures follows.

Demographic factors. Sex is one of the strongest predictors of mortality and is included in all analyses. Year of birth (cohort) is an important predictor when looking at cross-sectional data, but it is less significant when the sample is restricted to those born between 1904 and 1915. Family socioeconomic status is a third possible predictor. We used three indicators of childhood socioeconomic status: father's occupational status (a 7-point scale ranging from 1 = professional to 7 = unskilled blue collar) and both father's and mother's education (highest grade completed, up to a maximum of 22 or 6+ years of postgraduate education). A composite measure derived from these three indicators of socioeconomic status was also analyzed. Because it did not outperform the individual indicators, these analyses are not presented. Unfortunately, the power to assess the effects of childhood socioeconomic status

in this data set is substantially constrained by the severe underrepresentation of participants from lower socioeconomic status families. With respect to occupation, no father had an unskilled job, 11% had semiskilled jobs, 7% were farmers, and fully 57% had professional or semiprofessional/managerial jobs. Similarly, in a generation where the norm was an eighth-grade education, more than half the mothers and fathers finished high school and 31% of the fathers had a college degree. If poverty is the aspect of socioeconomic status that most closely relates to mortality, very few individuals in this sample would have been at increased risk. Thus, this data set can provide only a limited test of the possible association between childhood socioeconomic status and adult mortality. Given this limitation, our primary rationale for including measures of childhood socioeconomic status in the analysis is to assess whether other associations, especially those between childhood personality and mortality risk, might be accounted for by socioeconomic status.

Childhood health. We selected five variables as indicators of physical health in childhood. These were birthweight; child's health during the first year of life (a 4-point Likert scale ranging from "poor or very poor" to "very good"); rating of child's health at recruitment into the study (a 5-point Likert scale ranging from "below average" to "very superior"); and prior history of serious accidents or surgeries (both coded 0 = none, 1 = one, 2 = two or more). Birthweight was treated both as a continuous variable and as two dichotomous variables identifying those who were underweight (less than 5.5 lb.) or overweight (more than 10.0 lb).

Family stability. Breakup of the nuclear family is a major source of psychosocial stress. To assess its possible effects on life expectancy, we used four measures: death of father or mother (two variables) before child turned 21, parents divorced (or separated for an extended period) before child turned 21, and a summary item indicating whether any of these three types of family breakup occurred. All four items are measured dichotomously (0 = no, 1 = yes).

Childhood personality. In previous work, we used parent and teacher ratings on 25 traits to construct personality measures (e.g., optimism, high self-esteem[33,34]) that current theory predicts should be related to health and that basic theory and research have shown are reliable and meaningful components of the so-called big five factors of personality.[35,36]

TABLE 1—Summary Statistics for Distributions of Predictors of Adult Mortality, Terman Life Cycle Study Sample (n = 1285)

	n[a]	Mean	SD	Range Minimum	Range Maximum
Sex, % female	1285	43.9%			
Year of birth	1285	1910	2.90	1904	1915
Childhood health					
Birthweight (lb)	1177	8.16	1.49	3	15
Low birthweight (<5.5 lb)	1177	3.3%			
High birthweight (>10 lb)	1177	13.6%			
Health during first year[b]	1189	3.28	0.83	1	4
Health at time of recruitment[c]	1217	2.16	1.35	0	4
Childhood accidents[d]	1149	0.34	0.59	0	2
Childhood surgery[d]	1151	0.72	0.59	0	2
Socioeconomic status					
Father's occupation[e]	1151	2.43	1.30	1	6
Father's education, y	1103	12.17	3.85	2	22
Mother's education, y	1144	11.62	2.93	2	18
Family stability					
Death of father before age 21	1285	16.7%			
Death of mother before age 21	1285	7.6%			
Parental divorce before age 21	1285	13.1%			
Any family breakup	1285	33.3%			
Personality measures[f]					
High energy	1244	0.00	0.80	−3.67	3.67
Cheerfulness	1283	−0.02	0.65	−2.25	1.75
Conscientiousness	1270	0.00	0.71	−2.43	1.86
Motivation	1263	−0.01	0.67	−2.50	1.88
Sociability	1233	−0.01	0.71	−2.67	2.00
Permanency of mood	1279	0.00	0.76	−2.50	2.00

[a]Differences in sample sizes are due to missing data.
[b]Mean is based on a 4-point Likert scale (1 = poor or very poor; 4 = very good).
[c]Mean is based on a 5-point Likert scale (1 = below average; 5 = very superior).
[d]0 = none; 1 = one; 2 = two or more.
[e]Mean is based on a 7-point scale (1 = professional; 7 = unskilled blue collar).
[f]Measures were scaled to have a mean of 0 in full sample and an interquartile range equal to 1.

Four main personality dimensions and two supplementary predictors were constructed. The sociability index, which includes items like "fondness for large groups," corresponds to the extraversion dimension common to most personality theories. The self-esteem/motivation scale includes items such as "self-confidence" and "will power" and roughly corresponds to the bipolar dimension of emotional stability vs. neuroticism. Third, a measure of conscientiousness/social dependability includes "prudence," "conscientiousness," and "truthfulness." This scale corresponds to the big-five dimension of conscientiousness (low impulsivity). The fourth scale measures cheerfulness/optimism/sense of humor, which has been hypothesized to promote mental and physical health. The fifth predictor is termed high energy, indicating an active, energetic child (cf., the activity temperament dimension of Buss and Plomin[37]). The final personality predictor is a measure of permanency of mood, used to assess the dimension of emotional stability in a manner distinct from the self-esteem measure. With the exception of high energy ($\alpha = .43$), the internal consistency of the childhood personality measures was moderate to good. Additional details on their construction and psychometric properties are given elsewhere.[22] That study found that three of these scales (conscientiousness, lack of cheerfulness, and permanency of mood) predicted longevity. All personality measures were scaled to have a mean of zero in the full sample and an interquartile range equal to 1 (see below).

The demographic and childhood health measures are based on parental reports at the time of recruitment into the study. The personality measures are derived from parent and teacher ratings, also obtained at recruitment. The family

TABLE 2—Bivariate Hazard Regression Analyses Predicting Total Mortality from Sociodemographic and Psychosocial Predictors, with Sex Controlled (n = 1285)

	Value	Cox Model	Gompertz Model
Family stability measures			
Parental divorce before age 21	b	.37***	.36***
	SE	.12	.12
	rh[a]	1.44	1.43
Any family breakup	b	.20**	.20**
	SE	.09	.09
	rh	1.22	1.22
Personality measures			
Cheerfulness	b	.11*	.11*
	SE	.06	.06
	rh	1.11	1.12
Conscientiousness	b	−.23†	−.22****
	SE	.06	.06
	rh	.79	.80
Permanency of mood	b	−.12**	−.11**
	SE	.06	.06
	rh	.89	.90
Control variable			
Sex (female = 1)	b	−.42†	−.42†
	SE	.09	.09
	rh	.66	.65

Note. The bivariate effects on mortality of the following predictors were *not* statistically significant at the $P < .20$ two-tailed level:

- Childhood health measures
  - Birthweight (lb)
    - Low birthweight (<5.5 lb)
    - High birthweight (>10 lb)
  - Health during first year
  - Health at time of recruitment
  - Childhood accidents
  - Childhood surgery
- Socioeconomic status measures
  - Father's occupation
  - Father's education
  - Mother's education
- Family stability measures
  - Death of father before age 21
  - Death of mother before age 21
- Personality measures
  - High energy
  - Motivation
  - Sociability
- Year of birth

[a]*rh* = relative hazard [equals exp(b)].
*$P < .10$; **$P < .05$; ***$P < .01$; ****$P < .001$; †$P < .0001$.

stability measures are based on data collected from the proband at multiple points, as well as from the parent at baseline. The distributions of the predictors are summarized in Table 1.

Analytic Procedure

Hazard regression analysis was used (1) to test the bivariate relationship of each predictor variable with longevity, controlling for sex; and (2) to construct a final equation estimating the independent effects of the significant predictors. Within the general class of hazard regression models, we estimated two specific types. Cox's widely used (semiparametric) proportional hazards model makes no assumptions about the underlying hazard function, but assumes that the effect of each explanatory variable is multiplicative and constant across all ages. The Gompertz (parametric) model assumes that the underlying hazard function, $h(\text{age})$, describing the risk of death at any age can be summarized by the following exponential equation:

$$\ln[h(\text{age})] = A + B\ \text{age},$$

where A and/or B can be linear functions of the predictor variables.* Empirically, we have found that the Gompertz model fits the survival function for both men and women in this sample exceptionally well, in part because the focus on mortality after age 20 years excludes the high-risk period of infancy and early childhood.

An important strength of hazard regression models is their ability to properly treat right-censored data. Almost 30% of the Terman sample was known to be alive in 1991, at ages ranging from 76 through 87 years. We do not know how long these individuals will live, but we used the information that they lived until at least 1991. For others who are not known to be dead, we know the last year they participated in the study, and we treated their data as censored after this date. Depending on the software, hazard regression models can also handle left-truncated data, where the time or age at which one begins observing subjects varies across subjects. RATE,[38] which accepts left-truncated data, was used to estimate all hazard regression equations. All analyses are restricted to the period after 1930, after all subjects were at least 15 years old. (We could have analyzed survival beyond some fixed age, say age 25, instead of 1930, but this would have required ignoring a relatively large number of person-years of data. However, because relatively few deaths occurred between 1930 and 1940, the results of the two analyses would be expected to be very similar.)

We used a stepwise procedure for identifying significant predictor variables after controlling for sex. However, because RATE does not contain an option for stepwise analyses, we manually implemented a forward stepwise analysis. Our rationale for adopting a stepwise approach was that there are a variety of theoretical perspectives suggesting very different causal orderings of these domains (see "Introduction"). We did not feel comfortable assuming a particular ordering a priori, and we were unable to empirically determine an appropriate ordering because most of the predictors were assessed cross-sectionally at the time of recruitment into the study.

As in ordinary regression analysis, the relationship between a significant predictor and the risk of death may not be linear. For example, it could be that low self-esteem is a risk factor, but the difference in mortality between those with moderate vs. high levels is modest or even nonexistent. Therefore, for each interval-

*It should be noted that for both the Gompertz and Cox hazard regression analyses, the underlying time dimension is age. Thus, the B coefficient for age in the Gompertz model estimates how mortality risk increases as one ages from approximately 20 years old in 1930 to 81 years old in 1991. Had we measured time as "years since 1930," as is often done in epidemiological analyses, it would have been necessary to include year of birth or age in 1930 as a predictor, in order to adjust for the fact that those born earlier tend to die first.

scaled variable that was significantly related to longevity, we tested whether the relationship was curvilinear with a quadratic term. Sex is one of the strongest predictors of longevity, and we were concerned that the effects of other variables might be different for men and women. Therefore, for each significant predictor we also tested for an interaction effect of it with sex.

Because the personality scales lack a natural metric, it is desirable to present their coefficients in a form that facilitates interpretation and comparison across variables. Due to the well-known problems with standardized coefficients,[39,40] we rescaled each measure so that one point equals the interquartile range of that scale. (The mean of each personality scale was already adjusted to zero in the full Terman sample and is approximately zero in the present sample, as seen in Table 1. It should be noted that quadratic terms [e.g., conscientiousness squared] and interaction terms [e.g., sex by permanency of mood] were scaled according to the metrics of their corresponding main effects, not according to the interquartile range of the product terms.) This scaling caused each coefficient to estimate the predicted difference in the log hazard rate between individuals at the 75th and 25th percentiles of the personality scale, holding constant any other variables in the hazard regression equation. The coefficients of dichotomous variables, such as sex and parental divorce, were left unstandardized to facilitate intergroup comparisons.

TABLE 3—Gompertz and Cox Hazard Regression Models of Total Mortality (n = 1285)

	Value	Cox Model	Gompertz Model
Sex (female = 1)	b	−.38****	−.39****
	SE	.09	.09
	rh[a]	.68	.68
Conscientiousness	b	−.15**	−.15**
	SE	.07	.07
	rh	.86	.86
Conscientiousness squared	b	.10*	.10*
	SE	.06	.06
	rh	1.11	1.11
Parental divorce	b	.30**	.29**
	SE	.12	.12
	rh	1.35	1.34
Permanency of mood	b	−.23***	−.22***
	SE	.08	.08
	rh	.79	.80
Permanency of mood × sex	b	.36***	.35***
	SE	.11	.11
	rh	1.44	1.42
Cheerfulness	b	.18***	.18***
	SE	.07	.07
	rh	1.20	1.20
Age	b	. . .	.065****
	SE		.003
	rh		1.067
Intercept/constant	a	. . .	−8.256
Global test for all variables in model			
Likelihood ratio χ^2			615.89****
df			8
P			<.0001
Global test for psychosocial variables			
Likelihood ratio χ^2		41.26****	39.36****
df		6	6
P		<.0001	<.0001

[a]*rh* = relative hazard [equals exp(b)].
*$P < .10$; **$P < .05$; ***$P < .01$; ****$P < .0001$.

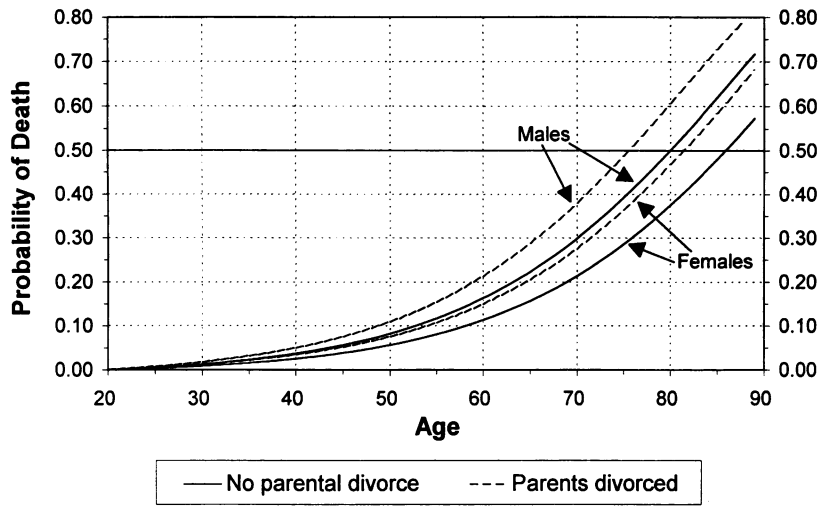
Results

The well-known effect of sex on life expectancy is clearly evident in this sample. As of 1991, 50% of the males were known to have died, 26% were known to be alive, and the remaining 23% were censored before 1991. Among women, only 35% were known to be dead and 32% were known to be alive in 1991. In a bivariate hazard regression analysis, the hazard rate for women is 66% (i.e., 34% less than that for men; $P = .0001$). According to the Gompertz model, this effect is constant across the age range.

Table 2 shows which of the childhood demographic and psychosocial predictors were significantly or marginally significantly associated with mortality after controlling for sex. Parental divorce before age 21 was associated with a 44% increase in mortality risk ($P < .01$), and any family breakup during childhood ($P < .05$) had a bivariate effect about half this size. Conscientiousness ($P < .001$) and permanency of mood ($P < .05$) were associated with lower mortality, whereas cheerfulness ($P < .10$) predicted marginally increased mortality. As stated above, the personality measures were scaled so that the interquartile range equals one point; therefore, for example, the predicted log hazard rate for someone at the upper quartile of conscientiousness was .22 *less* than that for someone at the lower quartile, holding sex constant. This corresponds to a relative hazard of 0.80, or a 20% differential in mortality risk in any given year. Although these associations of family stability and personality measures are consistent with expectations, except for the direction of the cheerfulness-mortality correlation, Table 2 also reveals a large number of hypothesized childhood predictors that are *not* associated with adult mortality.

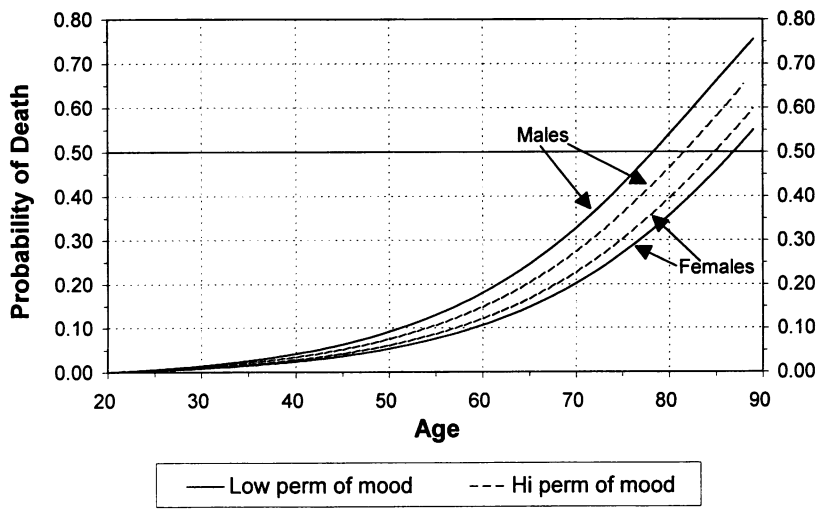
When we controlled for sex and conscientiousness* (the strongest predictors) and reexamined all the other predictors, the association with parental divorce declined ($P < .02$), whereas the inverse association with cheerfulness became somewhat stronger ($P < .03$). Motivation, which was previously insignificant, became significant ($P < .03$), but none of

*We knew from both past[22] and present analyses that conscientiousness is curvilinearly related to mortality risk; a quadratic model of the relationship indicates that differences at the lower end of the distribution are more strongly associated with mortality than differences in the upper half of the distribution. Therefore, both linear and quadratic conscientiousness terms were included in all subsequent analyses.



Note. Fitted curves are based on Gompertz hazard function estimates.

FIGURE 1—The probability of a 20-year-old dying by a given age, by sex and parents' divorce status.



Note. Fitted curves are based on Gompertz hazard function estimates.

FIGURE 2—The probability of a 20-year-old dying by a given age, by childhood permanency of mood.

the other variables was significant at the .05 level. Interestingly, although there was no main effect, there was fairly strong evidence suggesting that permanency of mood was related to mortality, but in opposite directions (see below) for men and women ($\chi^2 = 8.47$ with 2 df, $P = .02$). In succeeding steps of the analysis, we added parental divorce, permanency of mood (and its interaction with sex), and cheerfulness to the equation. At this stage, none of the remaining variables in either part of Table 2 was statistically significant, nor were the other quadratic terms and interactions of sex with the significant predictors. The bivariate association between any family break-up and longevity is entirely attributable to the effect of parental divorce, one of the three items used to construct it. The absence in the Gompertz equation of any significant interactions of age with the other predictors supports the proportional hazards assumption of the Cox model. In one final analysis, we forced each of the three socioeconomic status measures into the equation and found that controlling for socioeconomic status did not alter the results. The estimates and standard errors for the final Gompertz and Cox hazard equations, shown in Table 3, are remarkably consistent, suggesting that an exponential hazard function (assumed for the Gompertz model) is reasonable for predicting survival beyond early adulthood.

Although the coefficients of conscientiousness appear to be only marginally significant, this is due to the inclusion of the quadratic term in the model. A global test of the hypothesis that the coefficients of both conscientiousness and conscientiousness squared equal zero (i.e., that conscientiousness has no effect) is strongly rejected (for the Cox model, $\chi^2 = 10.79$ with 2 df, $P < .005$). Similarly, after controlling for all other effects in Table 3, a global test of both the main effect of permanency of mood and its interaction with sex (i.e., the null hypothesis that permanency of mood has no effect on longevity) is also strongly rejected (for the Cox model, $\chi^2 = 12.21$ with 2 df, $P < .002$). Both significance tests are comparable for the Gompertz model. It is important to note that the coefficients indicate that although permanency of mood had a significant positive effect on longevity for men (sex = 0), it had a negative, albeit not statistically significant, effect for women. (Negative coefficients indicate a reduction in the hazard rate and, consequently, increased longevity.)

The only two nonpersonality variables that significantly predicted longevity were sex and parental divorce. The 13% of subjects whose parents divorced (or were separated for an extended period) before the subject's 21st birthday had a 34% higher mortality rate than those whose parents had stable marriages. It is worth noting that the inclusion of parental divorce in the model did not substantially alter the effects of the personality measures and vice versa. The coefficient for sex indicated that gender differences in personality and/or the risk of parental divorce cannot explain the gender difference in life expectancy; the relative hazard for women's mortality is, on average, still only about two thirds that of men (varying to some extent with permanency of mood).

Using the Gompertz equation estimates, we computed the predicted mortality curves for persons with various child-

hood characteristics. Figure 1 shows these mortality curves for men and women who were 20 years old in 1930 and at the mean of the three personality measures. These curves indicate that among males who were born in 1910, those whose parents divorced or separated before the subjects reached age 21 had a predicted median age of death of 75½ years, whereas those whose parents remained married had a predicted median age of death of 80 years. The corresponding predicted median ages of death for women were 81½ and 86 years. Thus, for subjects at the mean of the three personality factors, the predicted differential in life expectancy was 6 years for females vs. males and 4½ years for those with undivorced vs. divorced parents. Comparable estimates of the median ages of death for persons at the upper and lower quartiles of the personality scales indicated a 2-year within-sex differential for both conscientiousness and (lack of) cheerfulness. For permanency of mood, which interacts with sex, the median ages of death were 78 and 82 years for males at the lower and upper quartiles and 87 and 85 years for females. The sex difference is estimated to be substantially larger for those rated low on permanency of mood (see Figure 2).

Discussion

By examining a broad array of childhood sociodemographic, social, and psychological factors as prospective predictors of longevity, we intended to begin constructing a comprehensive model of the relationship of childhood attributes and circumstances to longevity across the life span. The present study also sought to build on our previous results documenting an association between childhood personality and longevity. We anticipated that several of the demographic and social variables would be moderately strong predictors of longevity, at least as strong as the personality measures, and that their inclusion in the model might reduce the predictive power of childhood personality.

One of the most important findings is that parental divorce was associated with decreased longevity. Many fewer marriages ended in divorce during the early part of this century, but subjects who experienced parental divorce or separation before age 21 tended to have a shorter life span, by more than 4 years, than children who did not experience parental divorce. Although previous studies found associations between parental divorce and a variety of negative psychosocial outcomes, we believe this is the first study to demonstrate an association between parental divorce and longevity. A Swedish study of 4216 individuals aged 30 through 75 years reported a nonsignificant positive association between growing up in a broken family (parental death or divorce before age 16) and mortality.[9] Despite the larger sample, this study had considerably less power due to the availability of only 4 years' worth of mortality data.

It is important to note that the effect of parental divorce is largely independent of the effects of childhood personality. Controlling for parental divorce has a negligible effect on the coefficients of the childhood personality measures. This is largely due to the lack of a substantial correlation between the personality measures and parental divorce (maximum correlation is −.14 with conscientiousness).

The other positive finding concerns the resilience of the previously reported relationships between childhood personality (conscientiousness in particular) and longevity. Psychosocially stable and socially responsible people may be those who practice patterns of self-care that tend to ward off illness. They might have better health habits, cooperate more with medical treatment, and/or avoid dangerous situations. On the other hand, unstable undercontrolled individuals may be more likely to abuse drugs,[41] ignore health recommendations, and generally behave in an imprudent manner with regard to their health (and other matters). These latter personality traits might also contribute to mortality through assorted stress and coping mechanisms. Such people may be less prepared for the challenges of daily life, or they may be less likely to attain higher-status positions and the associated financial resources, informational (including medical) resources, and social resources.

Consistent with both the behavioral and the stress and coping types of explanations are data reported by Terman in the 1940s on the early career success of men in this sample. A comparison between clearly successful and clearly unsuccessful men (of equal intelligence) revealed that success was predicted by such traits as prudence, perseverance, common sense, and to some extent, social adjustment.[42] Whether or how this career success is associated with longevity is not yet known. Even though the socioeconomic status of one's family of origin fails to predict longevity in this sample, one's own socioeconomic attainment may prove to be a crucial mediating factor between childhood personality and longevity. This possibility will be the focus of a subsequent paper.

Childhood permanency of mood is associated with increased longevity for males only. Although this is the direction we anticipated for this relationship, its specificity to only one sex was not anticipated. Perhaps this scale taps a slightly different concept for boys and girls, despite the fact that its mean is virtually identical for the two sexes. For boys, permanency of mood may indicate a lack of volatility, aggressiveness, and/or hyperactivity. For girls, it may indicate a lack of moodiness. Stated differently, low scores on this scale may be indicative of excessive externalizing behavior for boys and excessive internalizing for girls. If so, our results suggest that excessive externalizing is the better predictor of reduced longevity.

The popular literature strongly suggests that optimism and cheerfulness are beneficial for survival, perhaps especially for recovering from life-threatening illnesses such as cancer. Although the scientific evidence supporting this claim is quite controversial,[43] the present findings clearly do not support the broad interpretation of this hypothesis. Those members of the Terman sample who were rated as optimistic and cheerful as children died at a younger age than others, with an estimated 2-year differential in life expectancy between those at the 25th and 75th percentiles. Although this result might be due to a Type I error, given the number of variables used in the analysis, there is some evidence that cheerfulness and/or optimism, especially unrealistic optimism, may be positively associated with the onset of particular diseases,[44,45] while also helping one to survive these or other diseases.[46] Subsidiary analyses of the Terman data (to be reported elsewhere) suggest that the effect of cheerfulness is not specific to cardiovascular deaths, cancer deaths, or death by injury. These analyses also indicate that whereas childhood cheerfulness and optimism are weakly associated with some negative health behaviors (e.g., smoking and heavy alcohol consumption, but not obesity) in adulthood, these associations can at best only account for a trivial portion of the estimated effect of cheerfulness on mortality. Assuming the association between cheerfulness and mortality were independently replicated, additional analyses of these and other data would be needed (e.g., examining the association between

childhood personality and adulthood personality and how these are related to health behaviors and occupational career choices) if we are to learn the mechanisms underlying this unexpected association.

Before controlling for parental divorce, conscientiousness, cheerfulness, and permanency of mood, the mortality hazard rate for women was 66% as great as the rate for men. Although some prior research suggests that the sex difference in hazard rates is greatest during early adulthood, when men are most at risk for accidents, this pattern is not observed in the Terman sample, perhaps because of the subjects' above-average intelligence. The introduction raised the possibility that childhood demographic, psychosocial, and/or personality factors might help to explain the large sex difference in life expectancy. Our results indicate that this is not the case. After controlling for these other predictors, the relative hazard rate was, on average, still 68%; the difference had hardly declined at all. Thus, parental divorce and childhood personality are independent predictors of longevity, but do not help to explain why women live longer.

Importantly, results from the present study fail to support several plausible explanations for the previously reported relationship between childhood personality and longevity.[22] One such explanation for the relationship is that a third variable, such as childhood health, is related to both childhood personality and longevity. However, childhood health does not account for the relationship between childhood personality and longevity in this sample because none of the five childhood health variables significantly predicts longevity beyond 1930. Perhaps other health measures, not available in this study, would predict adult mortality. Other explanations for the childhood personality–longevity association implicate family background variables. Children with stressful family backgrounds may be less conscientious or less emotionally stable. If a stressful childhood family environment was also associated with longevity, then the relationship between childhood personality and longevity might be spurious. However, this explanation is also not supported in this sample; death of either parent and childhood socioeconomic status do not predict longevity. (Although the lack of a significant effect for death of one's mother might be due to a lack of statistical power, because the proportion of affected subjects was only 7.6%, the proportion experiencing paternal death was greater than the proportion experiencing parental divorce or separation [see Table 1].) Controlling for parental divorce does not substantially alter the association between childhood personality and longevity. We also analyzed whether retrospective reports of one's childhood family environment, assessed in 1940 and 1950, predicted longevity. Although no relationship was found, we prefer not to draw firm conclusions given concerns about the validity of such data.[47]

Numerous other studies[1–3] found associations of adult socioeconomic status with health status and mortality in adults. A study of the 8-year mortality rate of 6298 men and 6397 women aged 16 through 74 years in 1980 found a significant nonmonotonic association between childhood socioeconomic status (retrospectively reported) and mortality for men, but not for women.[10] For both sexes, children of unskilled workers had the highest adult mortality rates. In the Terman sample, childhood socioeconomic status fails to predict longevity. Much of the explanation probably lies in the unique character of the sample. As described earlier, although the sample was not screened for social class, it was selected on the basis of measured IQ and severely underrepresents children from lower socioeconomic status families, defined in terms of father's occupation, father's education, and mother's education; in particular, there are no children of unskilled workers. Although this fact substantially reduces the power to detect relationships between socioeconomic factors and longevity, it importantly also reduces the risk that relationships observed in this data set are attributable to socioeconomic status. Consistent with this reduced risk, our analyses revealed no evidence that the observed differences in childhood socioeconomic status that exist in this sample either predict adult mortality or weaken the associations of childhood personality and parental divorce with adult mortality.

What are the precise causal mechanisms responsible for the associations between childhood personality, parental divorce, and longevity? This question is difficult to answer. The causal pathways probably involve the interaction of a number of factors, including health-related behaviors, stress and coping mechanisms, social support, and other lifestyle factors. Some of this information was collected longitudinally for the Terman sample, and other pertinent information (such as smoking pattern and cause of death) has just recently been collected. Future research will investigate available psychosocial factors in early and middle adulthood that might mediate or moderate the effects of childhood personality and parental divorce on longevity in this sample. Research on other data will be required to investigate whether the above results generalize beyond a highly intelligent, predominantly middle-class White cohort born in the first two decades of this century. □

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