Original article

Adolescents' Perceived Risk of Dying

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Abstract

Purpose: Although adolescents' expectations are accurate or moderately optimistic for many significant life events, they greatly overestimate their chances of dying soon. We examine here whether adolescents' mortality judgments are correlated with their perceptions of direct threats to their survival. Such sensitivity would indicate the importance of ensuring that adolescents have accurate information about those threats, as well as the psychological support needed to deal with them.

Methods: Data from two separate studies were used: a national sample of 3,436 14–18-year-old adolescents and a regional sample of 124 seventh graders and 132 ninth graders, 12–16 years old. Participants were asked about their chance of dying in the next year and before age 20, and about the extent of various threats to their physical well-being.

Results: Adolescents in both samples greatly overestimated their chance of dying. Those mortality estimates were higher for adolescents who reported direct threats (e.g., an unsafe neighborhood). Thus, adolescents were sensitive to the relative size of threats to their survival, but not to the implications for absolute risk levels.

Conclusions: Contrary to the folk wisdom that adolescents have a unique sense of invulnerability, the individuals studied here reported an exaggerated sense of mortality, which was highest among those reporting greater threats in their lives. Such fears could affect adolescents' short-term well-being and future planning. © 2009 Society for Adolescent Medicine. All rights reserved.

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Adolescents' willingness to prepare for the future depends, in part, on their confidence in living long enough to get a return on that investment. If life seems fragile, then why study hard, create stable relationships, or delay the pleasures of potentially risky behaviors such as sex or driving? Despite common wisdom, studies have found that adolescents are, if anything, less likely than adults to see themselves as relatively invulnerable, compared with their peers [1,2]. In the 1997 National Longitudinal Study of Youth (NLSY97) [3], a large representative sample of US 14-to-16-year-olds dramatically overestimated "the percent chance that you will die from any cause (crime, illness, accident, and so on) in the next year." Their

mean response, 18.6%, was two orders of magnitude higher than the statistical mortality rate, 0.08% [4]. This pessimism about dying existed despite respondents' generally accurate, and sometimes optimistic, judgments for the probabilities of other events associated with investing in their future (e.g., staying in school, having paid employment, getting a diploma) [5,6]. In contrast, adults' mortality judgments tend to be relatively accurate [7,8].

These results are worrisome for those concerned with adolescents' well-being. Young people who doubt their future bear an unwarranted burden in the present and may fail to plan effectively for the future. They may, for example, doubt the value of actions that protect their future health, if they do not expect to enjoy it [3].

Although the NLSY97 report [3] documented adolescents' exaggerated mortality judgments, it did not attempt to explain them. By the mid-teen years, higher-order cognitive processes

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have matured to the point that adolescents' cognitive capacity to think about uncertain events resembles that of adults [9–13]. *What* adults and adolescents believe about such events depends, however, on their exposure to personal experiences and summary information, which may be accurate or subject to various biases [9–13]. Fortuitously, NLSY97 included questions eliciting adolescents' beliefs regarding several direct threats to their survival, including exposure to gangs, weapons, or actual violence. Here we examine whether those judgments are related to mortality judgments. We also look at a second study with similar questions, asking whether it reveals similar patterns of exaggerated mortality judgments and correlations with judgments of other threats.

If adolescents' mortality judgments are correlated with their threat judgments, then adolescents may be attending to potentially valid cues regarding threats in their lives but exaggerating the absolute level of risk that is implied. In that case, adolescents might benefit from communications helping them to place those risks in perspective. On the other hand, if mortality judgments are unrelated to perceived threats, then they may be driven by noncognitive factors, such as adolescents' fears about their lives and futures [14–16]. In that case, adolescents may need help in dealing with these existential threats and the decisions that depend on them.

We consider correlations with two aspects of the mortality judgments. The first is adolescents' actual judgments of the percent chance of dying. The second is whether adolescents say "50%." Studies have found that people sometimes say "50," in the sense of "50–50," rather than as a numeric probability [17,18]. Such 50s appear to capture the *epistemic uncertainty* of people who are unable or unwilling to express their beliefs in a quantitative form [17–19]. As a result, these responses reflect uncertainty about an event rather than certainty about it having a 50% chance of occurring. The prevalence of such 50s is more common with threatening events, open-ended response scales, and adolescent respondents. As such, 50s might provide a window into how adolescents think about such a deeply uncertain event as their own mortality [17,18].

NLSY97 provided the first reported documentation of adolescents' exaggerated mortality judgment [5]. After briefly reprising that result, we examine correlations with other judgments of direct threats. We then examine whether the mortality judgments and their correlations with other judgments are replicated in a second study, with a smaller, less representative sample. When several questions address a topic, they are combined into an index; a measure of internal consistency is also reported. Both studies received institutional review board approvals from their academic institutions.

Study 1: NLSY97

Participants

The cohort represents US adolescents aged 12–16 years as of December 31, 1996, oversampling African-American and Hispanic individuals. Screening of 94% of the occupied households selected through a stratified multistage probability sample identified 9,943 eligible respondents based on age and usual place of residence (for details, see [20]). Of those, 8,984 (92%) participated. The mortality question was asked of an older, representative subsample of respondents (n = 3,436), ages 14–18 (mean = 15.8; SD = .70). Most interviews were conducted in 1997, when respondents were 14–17 years of age, with 2.3% in 1998, when some were 18. Of those, 49.4% were female, 95.0% in school, and 98.9% living with a parent or guardian; 58.3% were white, 27.0% African-American, 12.2% Asian, 2.5% of another racial background, and 20.6% of Hispanic ethnicity.

Mortality question

Participants answered, "What is the percent chance that you will die of any cause some time in the next year—crime, illness, accident, and so on?" Two paragraphs of introductory instructions described probabilities in both subjective probability and relative frequency terms [1]. Participants were also asked for the probability of dying before age 20. Because the two mortality judgments were highly correlated (r = .97), we analyzed only those for dying in the next year. Most adolescents (62.6%) gave the same probability for both time periods, a further suggestion of the difficulty of evaluating their prospects for survival.

Threat questions

(1) *Violent events*: Participants reported whether (a) there were gangs in their neighborhood or school; (b) any of their brothers, sisters, cousins, or friends belonged to a gang; (c) they had ever belonged to a gang; (d) they had ever carried a handgun; (e) they had ever attacked someone with the idea of seriously hurting them or had a situation end up in a serious fight or assault; and (f) they had ever seen someone get shot or shot at with a gun. Response options were yes and no (coded as 1 and 0). Internal consistency, as measured by Kuder-Richardson 20 (KR-20, akin to Cronbach's alpha, but for dichotomous data), was .60. The mean across items was .20 (SD = .22).

(2) *Perceived threat*: Participants reported whether they felt safe in school, on a scale anchored at 1 = strongly agree and 4 = strongly disagree, with a mean of 1.88 (SD = .72).

(3) *Crime expectations*: Using a 0–100% scale, participants reported probabilities of (a) being the victim of a violent crime at least once in the next range year, (b) being arrested, rightly or wrongly, at least once in the next year, and (c) serving time in jail or prison before turning 20. Internal consistency, as measured by Cronbach's alpha, was .68, for a mean of 8.81% (SD = 12.82).

(4) *Health threat*: Participants gave self-ratings of general health (1 = excellent; 5 = poor), with a mean of 1.93 (SD = .02).

Study 2: UCSF

Participants

A total of 124 public school seventh graders and 132 ninth graders participated in a longitudinal study of risk judgments and behaviors [21]. They were 12–16 years of age (mean = 13.8, SD = 1.13), about 2 years younger than the NLSY97 sample. All lived with a parent or guardian in the San Francisco Bay Area. Of the participants, 77% were white and 58% female.

Mortality question

Participants answered the same mortality question as in NLSY97, without the full instructions.

Threat questions

(1) *Violent events*: Participants reported whether they had been (a) a victim of a violent crime and (b) held up at gunpoint. Response options were yes (1) and no (0). KR-20 was .32, a low value. The mean across items was .04 (SD = .15).

(2) *Perceived threat*: Participants gave self-ratings of feeling safe (a) in my neighborhood and (b) at school (1 = strongly disagree to 5 = strongly agree.) Responses were reverse coded in the data analyses. Cronbach's alpha was .70, and the mean was 1.86 (SD = .77).

(3) *Crime expectations*: On the 0–100% scale, participants reported the probability of being victim of a violent crime at least once in the next year, with a mean of 18.64% (SD = 20.34).

(4) *Health threat*: Participants reported whether they had ever (a) been seriously ill, (b) had a serious illness lasting more than 1 year, and (c) had a life-threatening illness. Response options were yes (1) and no (0). KR-20 was .68, and the mean was .15 (SD = .24).

Results

Mortality expectations

Study 1: NLSY97. Figure 1 shows mortality judgments. The mean and median (MDN) are 18.6% and 10%, respectively. Of all responses, 20.1% were 50s. To estimate the number of 50s that would have been expected were all responses produced by the same underlying process, we fit a beta distribution to the overall response distribution, according to a method reported elsewhere [19]. We found that only 3.9% of all responses would have been 50s, suggesting that
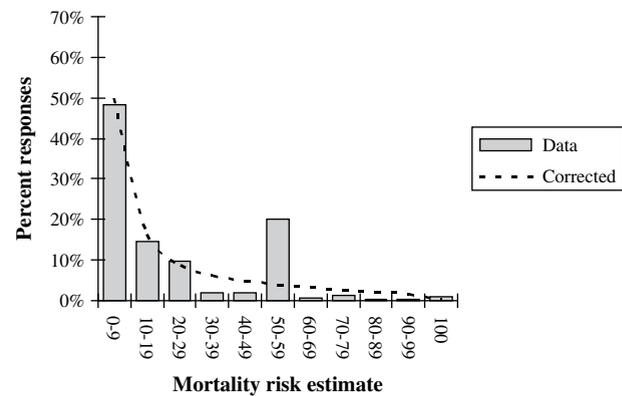

Figure 1. Response distribution for dying in the next year and its beta correction (dotted line); NLSY sample (Study 1).

the rest of the reported 50s reflected epistemic uncertainty. Discarding all 50s reduced the mean and median to 10.9% and 5%, respectively. Thus, overestimating mortality reflects more than just anomalous 50s.

Study 2: UCSF. There are no significant differences between seventh and ninth graders' mortality judgments, in terms of central tendency (mean = 17.2, MDN = 5; mean = 16.3, MDN = 5; Mann-Whitney $z = .25$, $p = .80$), response distribution (Kolmogorov-Smirnov $z = .51$, $p = .96$), or rate of 50s (22.0% vs. 16.0%, $\chi(1) = 1.45$, $p = .23$). As a result, their responses are combined (Figure 2). Overall, mortality judgments (mean = 16.7, MDN = 5) are lower than with NLSY97 (mean = 18.6, MDN = 10), but still much higher than the statistical estimate (0.08%) [4]. In all, 19.3% of the judgments were 50s, compared with 3.2% predicted by the beta function procedure. Discarding all 50s reduced the mean and median to 10.8% and 5.0%, respectively, still very high.

Correlations between mortality judgments and threat reports

Nonparametric correlations were used because of the nonnormal distributions, choosing Goodman-Kruskal gamma, which ignores the many ties necessarily found with these response modes. The first column of Table 1 reports correlations between the perceived threat measures and the actual mortality judgments. The second column reports correlations with whether participants said 50. Superscripts reflect the significance of partial correlations, examining whether participants' use of 50 adds to the predictions based on their actual mortality judgments. They reflect partial Kendall's Tau-b correlations [23] because significance levels cannot be calculated for partial gammas [24]. Strube's test for pooling dependent hypothesis tests [25] was used to assess overall predictive power across the reported correlations.

NLSY97. All four measures of reported threat correlated significantly with both the actual mortality judgments and whether participants gave 50 as their chance of dying.
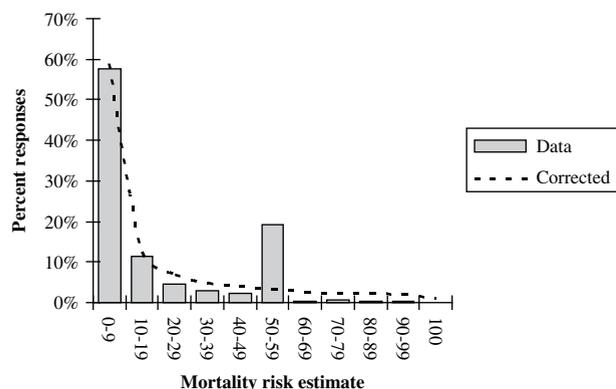
Figure 2. Response distributions for the probability of dying in the next year and its beta correction (dotted line); UCSF sample (Study 2).

Significant correlations with saying 50 remained for perceived threat and crime expectations, after partialing out actual judgments (Table 1). The Strube test found highly significant correlations between mortality judgments and the set of reports of direct threats.

UCSF. Perceived threat and crime expectations correlated significantly with both actual mortality judgments and whether participants said 50, correlations that remained after partialing out actual judgments (Table 1). Mortality judgments were not significantly correlated with reports of health threat or violent events (a composite measure with low internal consistency). The Strube test shows highly significant correlations between mortality judgments and the reports of direct threats.

Discussion

Adolescents overestimate their chances of dying in the next year, using a response mode that produced generally

Table 1
Gamma correlations

Predictor	All responses (0–100%)	50% responses (vs. other)
Study 1: NLSY97		
Violent events	.11**	.12**
Perceived threat	.07**	.12*[a]
Crime expectations	.45**	.37**
Health threat	.14**	.14**[a]
Combined Strube test	$z = 10.67, p < .001$	$z = 7.76, p < .001$
Study 2: UCSF		
Violent events[a]	.16	−.04
Perceived threat	.21**	.31*[a]
Crime expectations	.53**	.61**[a]
Health threat	.04	−.03
Combined Strube test	$z = 5.54, p < .001$	$z = 4.48, p < .001$

All measures were coded such that higher scores refer to more negative experiences.

* $p < .01$.

** $p < .001$.

[a] Partial Kendall's Tau-b correlation was significant at $p < .05$ after controlling for mortality judgments on the full scale.

accurate (and, where appropriate, small) probabilities for other significant life events. That result, originally observed in NLSY97, a large, nationally representative sample of adolescents, was replicated in a regional convenience sample. Although the statistical death rate is 0.08%, adolescents' median estimates were 5% and 10%. The means were even higher, 17% and 19%. In part, that reflects the roughly 20% of adolescents who said that they have a "50%" chance of dying. A curve-fitting procedure suggested that most of these 50s were not numeric probabilities but expressions of epistemic uncertainty, as though those adolescents did not know what to think or say about their chances of dying.

In addition to replicating the exaggerated mortality judgments, the current study revealed that mortality estimates were correlated with adolescents' judgments of several direct threats to their survival. For example, adolescents who gave higher probabilities of dying also tended to report feeling less safe, having been the victim of violent crime, expecting to be a victim, and seeing more gang activity in their neighborhoods, among other threats. These judgments of direct threats were also correlated with whether respondents gave 50% as their probability of dying, correlations that typically remained after partialing out the actual probability judgment.

The strongest correlations were with the crime expectations measure, which used the same probability scale as the mortality question, suggesting a contribution of method variance. In the UCSF study, *perceived* threats and crime expectations correlated strongly with mortality judgments, whereas reports of *actual* violent events and health threats did not. Violent events were rare, reducing that test's statistical power. However, many adolescents reported serious health threats, making correlations with that measure possible. Perhaps adolescents' actual health experiences are less related to their perceived mortality than are the fears expressed in their summary judgments.

Like any correlational analyses, ours allow different causal interpretations. For example, the correlation between mortality judgments and crime expectations could mean that adolescents believe that crime threatens their lives or that they engage in crime because they do not expect to live long anyway. Living in unsafe neighborhoods could increase both mortality judgments and crime expectations. The social dysfunction that is a root cause of many threats might also induce fear for the future. The epistemic uncertainty captured in 50 responses is thought to reflect some combination of affective and inchoate cognitive responses to events that individuals find it hard to analyze or contemplate.

These correlations support the construct validity of these probability judgments, which are predictably related to adolescents' experiences and perceptions, as were the other NLSY97 probability judgments. Thus the mortality judgments appear to capture adolescents' *relative* feelings of vulnerability. Accounting for the exaggerated *absolute* mortality judgments requires an additional inference. Namely, adolescents are not just differentially sensitive to

these threats but also unduly sensitive to them. Thus, for example, adolescents who see greater neighborhood violence not only perceive higher mortality judgments but also perceive a high sense of mortality. That seems plausible, given the cognitive and emotional power of such intense, salient events [22,26]. However, it requires an inferential step, beyond our analyses.

Other than the mortality and crime expectation questions, the measures used in our analyses were developed by other researchers, specialists in those topics and blind to our hypotheses. This arrangement should reduce spurious correlations because of shared method variance or biased wording, at the possible price of making them imperfect measures of our focal concerns.

Despite their imperfections, the present results seem sufficiently robust and sufficiently troubling to bear attention. If adolescents really have the sense of foreboding seen here, then its sources and remedies should be important to adults concerned with adolescents' well-being. Adolescents need faith in their future so as to invest in their own human capital, by studying, working, and avoiding risky behaviors [27]. That faith may require both the belief that specific threats are low and the feeling that their world will protect them from unnamed threats.

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