

- What are the key data—more particularly, the data that illuminate prediction, explanation, and intervention?
- What are some key implications of current findings for different approaches to risk reduction and avoidance?

BACKGROUND AND PERSPECTIVES

The intended audience for this monograph is anyone who wants to become acquainted with current scientific evidence concerning the causes and remediation of unhealthy risk taking in adolescence, including those for whom policy, practice, or prevention is the main motivation. A narrated list of findings, however, would be insufficient to address this topic. The first and most fundamental question is how to know what unhealthy risk taking is. The answer may seem obvious, but noted scholars have disagreed vehemently about this issue. So before we examine the issue in depth, we give the reader a sense of why the answer is not obvious and how the answer shapes thinking about unhealthy risk taking and its remedies. We then explain why evidence-based theories of risky decision making cannot be ignored if we wish to understand and apply the findings regarding adolescent risky decision making to improve lives. In short, if the goal is to change behavior in a positive direction, it is crucial to know more than a list of findings about risky adolescent decision making: It is crucial to know what the desired endpoint (“positive change”) is and how to measure it, and to know which explanations of behavior are likely to be true, based on the evidence. Thus, we review specific theories of behavior change and decision making because, in our view, these theories offer the best account of the evidence to date. “Theories,” in this usage of that term, are summaries and explanations of evidence, not speculations or philosophical arguments.

How can we know what unhealthy risk taking is? Although perspectives on how to tell if decision making is good or bad differ, each one captures important aspects of the data. Ultimately, we include both of the major schools of thought (coherence and correspondence) in our criteria for rational decision making, but others might justifiably side with one view rather than another (we present our arguments in depth later).

Traditional theories of rational decision making indicate that either risk taking or risk aversion can be rational, as long as the decision process is coherent (i.e., internally consistent). Traditional decision-making theorists do not make judgments about what people believe, and they would characterize many of the behaviors that society might wish to discourage among adolescents as “rational.” Although some might disagree with these conclusions about rationality, traditional theories point up factors that have been shown to influence risk-taking behavior in adolescence and, if the theories are true, they identify which policies and practices are likely to be effective in reducing risk taking (although new theories, discussed below, suggest that reducing unhealthy risk taking requires more than rational

reasoning skills). Traditional theories distinguish rational decision processes from good outcomes because outcomes are determined by many factors outside of the decision process. Someone cannot be described as engaging in unhealthy risk taking if there is no rational basis to predict that, for unforeseeable reasons, the outcome will turn out to be bad.

Critics of traditional theories disagree that outcomes are irrelevant to judging the quality of decision making and, on the contrary, disparage coherence of decision processes as a criterion of rationality. In this correspondence view, good outcomes signal good decision making. Correspondence refers to correspondence to reality, which outcomes reflect. Although this view has superficial appeal, there are numerous documented examples of decision makers who enjoyed good outcomes by accident (having made clear mistakes in judgment) and vice versa. The adolescent who has unprotected sex numerous times without getting pregnant could argue, in this view, that her behavior is perfectly rational because she has avoided an undesirable outcome. Clearly, the correspondence view has shortcomings that are not apparent at first blush.

Some evolutionary theorists have also criticized traditional coherence approaches to rationality, arguing that violations of logic or probability or other rules of coherence are apparent rather than real and that evolution gives human decision makers “simple heuristics that make us smart” (Gigerenzer, Todd, & the ABC Group, 1999). However, these simple gut-level decisions that are encouraged by evolution appear to make people stupid in the modern world under predictable circumstances, and they encourage unhealthy risk taking rather than discourage it. (Naturally, such behaviors may have been adaptive at an earlier point in evolutionary history.) The realm of adolescent decision making, therefore, provides a counterexample to the general claim made by some evolutionary theorists that the smart choices in one’s work or personal life are those selected for by evolution. It is useful for prevention and intervention efforts to acknowledge that adolescents may have to resist evolutionary pressures that promote consuming substances that offer immediate pleasure or having sex before they are prepared for its economic and psychological consequences.

We do not claim that evolutionary theories are irrelevant, and we cite several books for further reading in this area, such as those by Baumeister (2005); Geary (2005); and Gigerenzer, Todd, and the ABC Group (1999). Evolutionary theory, and the construct of adaptive behavior, is central to understanding rationality in the correspondence sense (i.e., which decision processes and behaviors promote positive long-term outcomes). However, evolutionary claims that are made on the basis of philosophical arguments, mathematical proofs not involving observables, and hypothetical computer simulations should be sharply distinguished from claims that have been tested empirically. If the policy recommendations of social scientists are to be taken seriously, it is necessary to retain scientific credibility by sticking to empirical evidence and to theories that

are grounded in empirical evidence. In order to be ready for consideration at the level of policy, promising evolutionary theories should be subjected to the same kinds of empirical tests as the core theories that we discuss below.

Whichever view of rationality one takes (traditional coherence, correspondence, or, at some future point when more data are gathered, evolutionary), it is essential to consider the developmental differences between adolescents and adults when judging their behavior. The traditional coherence view emphasizes the centrality of making choices that allow the decision maker to reach his or her own goals. As we discuss, evidence on developmental differences raises the specter that goals change with age, and the issue is then which goals (adolescents' current goals or their inferred future goals) to consider in judging rationality. If rationality also demands (as it must in traditional views) that decision processes be logical, then it also makes sense to ask whether adolescents are capable of thinking logically. We briefly review the data on that issue as well. Other developmental differences relevant to judging rationality, including impulsivity, are also reviewed.

Laboratory data on developmental differences in probability judgment and in decision making—for example, involving choosing between sure things and gambles—are also relevant to the kinds of psychological competence that underlie risk-taking behavior. The developmental questions are: What do children (and, subsequently, adolescents) know and when do they know it? On the one hand, laboratory studies have shown that young children trade off the probability of winning a prize and the number of prizes to be won (essentially multiplying the odds of winning by the amount to be won, and choosing accordingly; e.g., Reyna & Ellis, 1994). On the other hand, analogous studies of probability judgment and choice in adults have been the source of numerous illustrations of cognitive illusions—namely, adults ignoring objective information about probabilities and outcomes and instead basing their responses on illusory stereotypes or superficial wording of decision scenarios (e.g., Gilovich, Griffin, & Kahneman, 2002). However, this seeming contradiction between early analytic competence and late-persisting cognitive illusions can be explained by modern developmental theories (e.g., fuzzy-trace theory) that predict exactly these kinds of paradoxical patterns.

The theories that we review are older ones that have amassed the most definitive evidence about causal factors in risky decision making, and newer ones that enjoy the advantage of building on the discoveries of the pre-existing models, thus being able to improve on their predictions. We should add that all of the models we review, including the older models, should be considered currently relevant and that, although the data favor newer models, those data are far from extensive at this point. Traditional models are those that essentially adhere to the behavioral decision framework, which would include such rational deliberative approaches as health-belief models, the theory of reasoned action, the theory of planned behavior,

problem-solving approaches, and other similar theories including some with less evidence (that we, therefore, do not discuss). Concepts that figure in such models include perceived risks and benefits, social norms (beliefs about other people, such as whether one's parents approve of underage drinking or whether peers are engaging in sex), self-efficacy (beliefs about being competent in a specific domain or skill, such as being capable of standing up to pressure to have sex), perceived control, and behavioral intention. Newer models of adolescent risky decision making include the prototype/willingness model and fuzzy-trace theory. In these models, risk taking is determined by mental representations of risk takers (e.g., smokers) or risky situations (e.g., a couple alone in a hotel room on prom night), along with other factors such as willingness (as opposed to intention, in the prototype/willingness model) and situation-dependent retrieval of risk-avoidant values (in fuzzy-trace theory). These traditional and newer models aim to describe and explain real behavior. However, they also typically incorporate assumptions about what constitutes ideal behavior, and thus provide a goal for prescriptive interventions to improve decision making.

In each of these models, perception of risks plays an important role (although how people think about risk is construed very differently across models). There are different ways to assess risk perception that seem to yield different conclusions, but those conclusions are actually compatible. A concrete example may be helpful: Imagine an adolescent who has sex without a condom and who *overestimates* the risk of contracting a sexually transmitted disease but *overestimates* his own risk *less* than he does that of comparable others (e.g., other adolescents who have sex without condoms)—an optimistic bias. Furthermore, imagine that this adolescent rates his own risk of getting a sexually transmitted disease as higher than adolescents who use a condom rate their own risk and as higher than adults rate their own risk (regardless of whether they use a condom or not). (Conditional assessments, such as estimating the risk of acquiring sexually transmitted diseases if one has sex without a condom, do not change the result that adolescents rate themselves as more vulnerable than adults rate themselves.) As is apparent from this example, these comparisons suggest different messages about perceived vulnerability if taken in isolation from one another, but they are not mutually exclusive. This adolescent overestimates the level of objective risk, displays an optimistic bias relative to others, and yet acknowledges that he is at higher risk than adults and adolescents not engaging in specific risk-taking behaviors. Based on the literature, we can say that this adolescent is typical, as these results tend to be found consistently (except with respect to comparisons between lower-risk and higher-risk adolescents, which have produced variable results).

To preview our later discussion, the key descriptive findings regarding adolescents' perception of risks are these: Much like adults, most adolescents exhibit an optimistic bias, in which

they view their own risks as less than those of comparable peers. However, objectively higher-risk groups sometimes estimate their risk as higher, and sometimes as lower, than lower-risk groups rate themselves. For example, Johnson, McCaul, and Klein (2002) found that adolescents who were daily smokers and those engaged in unprotected sex estimated their risk of getting lung cancer or a sexually transmitted disease, respectively, as significantly higher than others not engaging in those behaviors did. Some studies confirm this pattern; other studies report no difference or lower perceived risks among those engaging in risk-taking behavior. As we discuss, measures matter; how the question about risk is asked makes a difference (Fishbein, 2003). The role of experienced outcomes may also explain these variable findings (experiencing negative outcomes may increase risk estimates and failing to experience negative outcomes may do the opposite), but preliminary evidence on this point is meager.

A consistent finding that emerges from this literature, and one that has been replicated in different laboratories, is that the optimistic bias is no more prevalent in adolescents than it is in adults, and, indeed, adolescents perceive themselves as more vulnerable than adults perceive themselves to be. In addition, when subjective and objective estimates of risk can be compared, adolescents tend to overestimate important risks (e.g., of HIV infection or lung cancer), although they may underestimate harmful consequences and long-term effects, such as addiction. They think that the risk is high, but the consequences are not that bad. (Not all risks are overestimated; unfamiliar risks that are not covered in health curricula, such as the risk of food poisoning, might well be underestimated.) Another consistent finding is that, when they are directly compared, benefits loom larger than risks. That is, perceived benefits predict risk-taking behavior and often carry more weight than perceived risks do. Thus, despite overestimation of risks, perceived benefits may drive adolescents' reactive behaviors and behavioral intentions, explaining why adolescents who perceive risks to be high would still take those risks. Nevertheless, constructs such as perceived risks and benefits do not explain all risk taking for all adolescents; there is variance in risk-taking behaviors that is not accounted for by traditional models.

The bottom line of the data concerning extant models is that the older models of deliberative decision making (resulting in behavioral intentions and planned behaviors) fail to account for a substantial amount of adolescent risk taking, which is spontaneous, reactive, and impulsive. This conclusion about gaps in older models holds even when higher methodological standards, such as conditional risk assessments (e.g., estimating the risk of acquiring sexually transmitted diseases if one has sex without a condom) and prospective designs that control for initial perceptions and behavior, are used in research (see Brewer, Weinstein, Cuite, & Herrington, 2004; Gerrard, Gibbons, Benthin, & Hessling, 1996; Weinstein & Nicolich, 1993; and Weinstein, Rothman, & Nicolich, 1998, for details concerning

design and methodology). To be sure, methodological improvements have resulted in improved support for traditional models, yielding, for example, stronger and more consistent relations between perceived risk and behavior (e.g., Brewer et al., in press; Fishbein, 2003). However, almost all of the patterns of findings we discuss that pertain to adolescents remain robust despite these methodological modifications.

We do not conclude that traditional models are worthless. On the contrary, there is ample evidence favoring such models and, simultaneously, evidence indicating that they have important gaps. We resolve this dilemma by acknowledging, based on the data, that adolescents apparently make decisions in different ways—namely, deliberately, reactively, and intuitively. Deliberate decision making is explained by traditional models; reactive decision making is explained by the prototype/willingness model; and fuzzy-trace theory explains intuitive decision making, contrasting gist-based intuition to avoid risk with deliberation that encourages risk taking. (A gist is a fuzzy mental representation of the general meaning of information or experience, and gist-based intuition is reasoning or decision making based on these fuzzy representations.) As we discuss in some detail, ideas about emotion (as temptation and as a healthy cue) and personal experience with risks are being increasingly incorporated into contemporary theories, including traditional behavioral decision-making approaches.

We have mentioned decisions that result from deliberation, reaction, and intuition, but one might also ask about decisions that come about through imitation, habit, social conventions, and social heuristics (see Nisbett & Ross, 1980, for an excellent discussion of some of these classic issues). These social factors are reflected in perceived social norms, images or prototypes, perceived benefits, and other constructs that we have reviewed, and, thus, they are indirectly represented to some extent in the theoretical approaches that we discuss. For example, adolescents might follow a social heuristic to “do what the majority does,” which would be reflected in perceived social norms (beliefs about what the majority does) and perceived benefits (the belief that doing what the majority does ensures being accepted by one's peer group, a social benefit). One might imagine that responding to these social factors could be reactive (going along with the majority without thinking) or deliberative (calculating that one would pay too high a price socially by opposing the majority). Habits are also, again indirectly, related to decision making in standard dual-process theories, as they reflect the operation of an evolutionarily older, associative system (Kahneman, 2003; Sloman, 2002). However, although much evidence supports the effects of imitation, habits, and social conventions on behavior, the connections between these effects and constructs in decision theories of adolescent risk taking have yet to be fully elaborated. Therefore, we do not discuss these factors further, except to acknowledge that habits (and addictions) established in adolescence can perpetuate behaviors that older decision makers would not have initiated. We do

discuss the role of social payoffs and other rationalizations for adolescent risk taking in the context of theories of rationality. As we explain later, merely asserting that risk taking has social benefits (e.g., peer acceptance) does not necessarily justify such behavior nor does it prove that the behavior is rational.

Thus, the sections that follow begin with a discussion of the importance of the topic—why adolescent risky decision making is important and what problems it causes for individuals and society. Then, we turn to the kinds of behavioral change we should hope to achieve to address such problems, by discussing what is rational, adaptive, or good decision making for adolescents. With this ideal of good decision making in mind, we then discuss the main explanatory models of actual adolescent risk taking and the data that bear on major constructs of these models, such as how adolescents perceive risk (e.g., the myth of invulnerability) and what changes in risky decision making occur with development, as adolescents mature and gain experience in the world. In our concluding section, we draw out some key implications of current findings for different approaches to risk reduction and avoidance.

SIGNIFICANCE OF THE PROBLEM

Why Is Adolescent Risky Decision Making Important?

The scientific literature confirms the commonsense belief that adolescence is a period of inordinate risk taking. For example, three million new cases of sexually transmitted infections are identified in adolescents every year in the United States, and more than half of all new cases of HIV infection occur in people younger than 25 (Centers for Disease Control and Prevention, 2004). Moreover, adolescents have one of the most rapidly increasing rates of HIV infection (e.g., 37% more young people were living with AIDS in 2003 than in 1999), with an average of two new young people in the United States infected with HIV every hour (Centers for Disease Control and Prevention, 2004; Rosenberg, Biggar, & Goedert, 1994). Substance use also typically begins in adolescence, as do its adverse health consequences, such as the risky sexual and driving behavior associated with alcohol use (Bachanas et al., 2002; Fergusson & Lynskey, 1996; Strunin & Hingson, 1992; Tapert, Aarons, Sedlar, & Brown, 2001). Motor-vehicle accidents are the leading cause of deaths among those aged 15 to 20 years; 31% of young drivers killed in motor-vehicle crashes in 2003 had been drinking (National Center for Statistics and Analysis, 2003; Turner & McClure, 2003). Although Table 1 indicates decreasing prevalence rates for risky behaviors through 2003, it also shows that progress has recently stalled, that rates remain unacceptably high, and that some behaviors continue to increase (Fig. 1).

Apart from the immediate consequences of risky behaviors, adolescents' risk behaviors also strongly predict health problems in adulthood (U.S. Department of Health and Human Services, 1994). Behaviors that were begun as voluntary choices

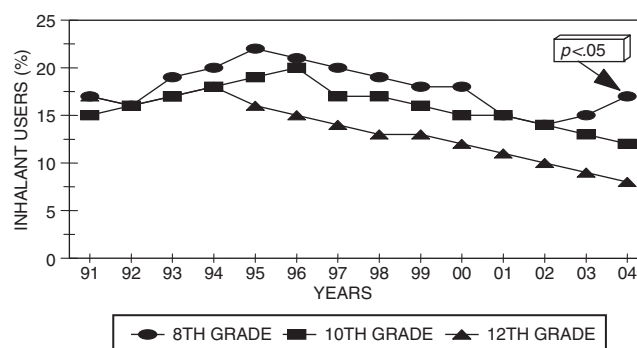


Fig. 1. Percentage of 8th, 10th, and 12th graders reporting lifetime use of inhalants from 1991 to 2004, showing significant increase among 8th graders (based on Johnston, O'Malley, Bachman, & Schulenberg, 2004).

to experiment can be perpetuated by addiction (Slovic, 2000, 2001). Although most drinkers do not progress to deep alcoholism, virtually all alcoholics started drinking in adolescence (Bonnie & O'Connell, 2004; Chambers, Taylor, & Potenza, 2003; Vaillant, 2003; Vaillant & Hiller-Sturmhöfel, 1996; see Table 2 for data pinpointing adolescence as a period of initial vulnerability to multiple risks). Prevention at the time when use is still a matter of deliberate choice is more successful and less costly and, thus, better for adolescents and for society, than dealing with an established addiction later. Delaying the onset of drinking and reducing the amount consumed decrease the risk of progressing to alcoholism.² Delay and reduction also allow the forebrain and other neurological structures that contribute to judgment and behavioral inhibition to mature, which should further reduce unhealthy risk taking (Crone & van der Molen, 2004; Dempster, 1992; Galvan et al., 2006; Hooper, Luciana, Conklin, & Yarger, 2004; Steinberg, 2005; Fig. 2). Similar arguments can be made for postponing sexual activity and certain other risky behaviors. Not only are immediate negative outcomes reduced, but older adolescents bring a more developed brain, as well as greater social and emotional maturity, to risky situations (e.g., Byrnes, 1998; Reyna, 1996).

²The problems we discuss in this article are not limited to the United States. For example, a recent report debunks the myth that European adolescents have fewer alcohol problems because their cultures teach them to handle alcohol responsibly from an early age; the report shows that a large majority of European countries had higher intoxication rates and binge drinking (five or more drinks in a row) rates among adolescents than the United States. Data collected from 15- and 16-year-olds in 35 European countries showed that European adolescents drink more often, drink more heavily, and get drunk more often than American adolescents do: In the United States, 22% binge drank in the past 30 days; in Denmark, that figure was 60%; in Germany, 57%; in Britain, 54%; in Italy, 34%; and in France, 28%. Intoxication rate in the last 30 days for U.S. adolescents was 18%, compared to 61% in Denmark, 53% in Ireland, 48% in Austria, and 46% in Britain. Only six European countries had lower intoxication rates than the United States. Data from Europe were collected as part of the European School Survey Project on Alcohol and Other Drugs, and the U.S. data were from the Monitoring the Future survey conducted annually among 8th, 10th, and 12th graders in the United States. These data have implications for hypotheses about the effects of accessibility of alcohol and for such public policies as raising drinking ages (see Grube, 2005).