

*models explain apparent contradictions in the literature, including different causes of risk taking for different individuals. Interventions to reduce risk taking must take into account the different causes of such behavior if they are to be effective. Longitudinal and experimental research are needed to disentangle opposing causal processes—particularly, those that produce positive versus negative relations between risk perceptions and behaviors.*

*Counterintuitive findings that must be accommodated by any adequate theory of risk taking include the following: (a) Despite conventional wisdom, adolescents do not perceive themselves to be invulnerable, and perceived vulnerability declines with increasing age; (b) although the object of many interventions is to enhance the accuracy of risk perceptions, adolescents typically overestimate important risks, such as HIV and lung cancer; (c) despite increasing competence in reasoning, some biases in judgment and decision making grow with age, producing more “irrational” violations of coherence among adults than among adolescents and younger children. The latter occurs because of a known developmental increase in gist processing with age. One implication of these findings is that traditional interventions stressing accurate risk perceptions are apt to be ineffective or backfire because young people already feel vulnerable and overestimate their risk. In addition, research shows that experience is not a good teacher for children and younger adolescents, because they tend to learn little from negative outcomes (favoring the use of effective deterrents, such as monitoring and supervision), although learning from experience improves considerably with age. Experience in the absence of negative consequences may increase feelings of invulnerability and thus explain the decrease in risk perceptions from early to late adolescence, as exploration increases. Finally, novel interventions that discourage deliberate weighing of risks and benefits by adolescents may ultimately prove more effective and enduring. Mature adults apparently resist taking risks not out of any conscious deliberation or choice, but because they intuitively grasp the gists of risky situations, retrieve appropriate risk-avoidant values, and never proceed down the slippery slope of actually contemplating tradeoffs between risks and benefits.*

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## INTRODUCTION

In this monograph, we review scientific evidence concerning the causes and remediation of unhealthy risk taking in adolescence. Adolescent risk taking has economic, psychological, and health implications (e.g., Maynard, 1997). Smoking, drug use, unprotected sex, and unsafe driving take demonstrable tolls in healthcare costs and property damage, as well as less readily

measured costs in human misery and lost potential. Habits begun at this age can last a lifetime. Table 1 shows one set of prevalence measures for adolescents. Opinions about proper solutions to the problem of unhealthy adolescent risk taking are plentiful, ranging from abstinence education to higher legal drinking ages. However, the public and policymakers rarely make use of the scientific literature on risky decision making in adolescence, and, as in many areas of human behavior, prevention and intervention programs are generally not based on such evidence.

Those seeking a comprehensive view of the evidence (and not just the bits supporting one’s own favored position) need to cast a wide net. One of the barriers to more comprehensive use of the scientific literature is the fragmentation of research. Relevant studies are scattered across disciplines (e.g., psychology, sociology, pediatrics, public health) and problem-specific professional communities (e.g., smoking, AIDS prevention, alcohol and substance abuse) whose members attend specialized conferences and read specialized journals, and who are sometimes isolated further by adherence to specific research paradigms or treatment modalities. To be sure, specialization is necessary if scholars are to apprehend the vast amount of research within particular problem domains. For example, the biochemistry of smoking and alcohol are each complex enough to justify separate expertise. The effects of alcohol on brain development and on psychomotor skills (e.g., driving) are themselves different enough to direct scholars and practitioners to separate conferences and publications.

However, fragmentation exacts a price. Relevant work is published that escapes notice in closely related domains (e.g., smoking versus alcohol use) and explanatory models found useful in one domain are not necessarily considered in other domains. There is also the problem of reinventing the wheel. For example, Dawes and Corrigan (1974; Dawes, 1979) found that many competing models of decision-making processes were inherently indistinguishable because of their shared statistical properties.<sup>1</sup> Additionally, the commonalities among laboratory and “real world” tasks argued to reflect risk taking need to be identified and limits of commonality or generalizability established. Risk taking in a laboratory task involving minor symbolic risks may have little to do with the risk taking of a carload of drunk adolescents on the interstate on a Friday night (Farley, 1996). Hence, a cross-cutting analysis is urgently needed to identify the findings and explanatory models that generalize across domains, as well as the domain-specific limits to generalization.

To address this need, we examine one topic that generalizes across domains: the optimality of adolescents’ decisions about

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<sup>1</sup> Attempts to reconcile the weights afforded to various factors in different studies were doomed to failure, because they reflected uninteresting measurement issues. In fact, Dawes’s conclusion was an inductive rediscovery of principles derived deductively by Wilks (1937), in an even more general look at the properties of linear models.

**TABLE 1**

*Percentages of Youth in 9th Through 12th Grades Engaging in Various Risk and Risk-Preventive Behaviors, From National Youth Risk Behavior Survey (1991–2003)*

Behavior	Data							Change: '91–'03	Change: '01–'03
	1991	1993	1995	1997	1999	2001	2003		
Seatbelts <sup>a</sup>	25.9	19.1	21.7	19.3	16.4	14.1	18.2	Decrease	None
Drinking driver <sup>b</sup>	39.9	35.3	38.8	36.6	33.1	30.7	30.2	Decrease	None
Carried weapon <sup>c</sup>	26.1	22.1	20.0	18.3	17.3	17.4	17.1	Decrease	None
Fighting <sup>d</sup>	42.5	41.8	38.7	36.6	35.7	33.2	33.0	Decrease	None
Suicide attempt <sup>e</sup>	7.3	8.6	8.7	7.7	8.3	8.8	8.5	None	None
Cigarette use <sup>f</sup>	27.5	30.5	34.8	36.4	34.8	28.5	21.9	Decrease	Decrease
Smokeless tobacco <sup>g</sup>	NA	NA	11.4	9.3	7.8	8.3	6.7	Decrease	None
Alcohol use <sup>h</sup>	50.8	48.0	51.6	50.8	50.0	47.1	44.9	Decrease	None
Marijuana use <sup>i</sup>	14.7	17.7	25.3	26.2	26.7	23.9	22.4	Increase	None
Cocaine use <sup>j</sup>	1.7	1.9	3.1	3.3	4.0	4.2	4.1	Increase	None
Sexual intercourse <sup>k</sup>	54.1	53.0	53.1	48.4	49.9	45.6	46.7	Decrease	None
Condom use <sup>l</sup>	46.2	52.8	54.4	56.8	58.0	57.9	63.0	Increase	Increase
Exercise <sup>m</sup>	NA	65.8	63.7	63.8	64.7	64.6	62.6	None	None
Physical education <sup>n</sup>	41.6	34.3	25.4	27.4	29.1	32.2	28.4	Decrease	None
Overweight <sup>o</sup>	NA	NA	NA	NA	10.8	10.5	12.1	None	None

**Note.** The data are from Centers for Disease Control and Prevention (2004).

<sup>a</sup>Rarely wore seatbelts while riding in a car driven by someone else

<sup>b</sup>Rode in a car with a driver who has been drinking alcohol during the past 30 days

<sup>c</sup>Carried a gun, knife, or club at least once during the past 30 days

<sup>d</sup>Was in a physical fight at least once during the past 12 months

<sup>e</sup>Attempted suicide at least once during the past 12 months

<sup>f</sup>Smoked cigarettes on at least 1 day during the past 30 days

<sup>g</sup>Used chewing tobacco, snuff, or dip on at least 1 day during the past 30 days

<sup>h</sup>Drank alcohol on at least 1 day during the past 30 days

<sup>i</sup>Used marijuana on at least 1 day during the past 30 days

<sup>j</sup>Used cocaine on at least 1 day during the past 30 days

<sup>k</sup>Has had sexual intercourse at least once

<sup>l</sup>Used condoms during sexual intercourse

<sup>m</sup>Participated in vigorous physical exercise for at least 20 minutes on at least 3 of the past 7 days

<sup>n</sup>Attends physical education class daily

<sup>o</sup>Is above the 95th percentile for the body mass index, by age and sex norms

risky behaviors. We consider both the processes involved and the performance levels that adolescents achieve—and could achieve, with possible interventions. Knowing those levels is critical to creating sound policies concerning such issues as drinking age and adolescents' culpability for crimes, informed consent for medical procedures, and responsiveness to AIDS-prevention curricula. We recognize that adolescents' choices reflect the interaction of general skills and specific situational demands, which together determine the bounds of rationality in adolescence. Thus, in this article, we discuss the mounting evidence about adolescent rationality and the implications of this evidence for problem behaviors.

Owing to the voluminous and fragmented nature of the literature, our review is not the conventional sort in which every article fitting some set of inclusion criteria is examined, effect sizes are calculated, and a single question (say, about effectiveness of pregnancy-prevention curricula) is asked and answered. Although we undertook such a conventional review before writing this paper, to ensure that our judgments are firmly grounded in current work, space does not permit us to discuss or even to

mention every scientific article on adolescent risk taking. Instead, our aim is to provide a solid, empirically grounded framework for understanding adolescent risk taking and determining what it would take to reduce or eliminate unhealthy behaviors.

Many unanswered questions concerning the nature of adaptive behavior, healthy risk taking, and rational decision making in adolescence remain. Notwithstanding the limitations of current knowledge, however, scientists have learned a great deal that can be useful today. Extant data identify successful practices (e.g., effective curricula for reducing risk taking) and promising practices that have yet to be studied systematically. Existing data also demonstrate that some common beliefs, such as the belief that adolescents feel uniquely invulnerable, are myths. Questions that are addressed by current data include the following, which provide an outline for the remainder of this review:

- Why is adolescent risky decision making important?
- What is rational, adaptive, or good decision making for adolescents?
- What are the main explanatory models of adolescent risk taking?

- 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