Judgment and decision making in adolescents

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Introduction

Adolescence is a stage in which individuals transition from childhood to adulthood, typically defined as spanning the teenage years. Adolescents face many important decisions, often for the first time in their lives. These decisions may involve drinking alcohol, smoking cigarettes, using other substances, and having sex (Eaton et al., 2006; Faden, 2006; Klein, 2006), as well as engaging in aggressive and violent behaviors (Loeber and Hay, 1997). As newly licensed drivers, adolescents need to make decisions about driving that influence their risk of experiencing motor-vehicle accidents (Lourens, Vissers, and Jessurun; 1999; Turner and McClure, 2003). Adolescents may legally decide to seek part-time employment, with potential consequences for their performance in school (Steinberg, Fegley, and Dornbusch, 1993).

Policy makers, parents, teachers, and other adults responsible for the welfare of adolescents need to decide whether adolescents have the competence to make decisions on their own. If adolescent decision making competence is overestimated, then adolescents may feel overwhelmed with decisions that are too difficult for them. If it is underestimated, however, then adolescents may needlessly be kept from the autonomy they seem to desire, and may be ill-prepared for making their own decisions later in life.

The question of whether adolescents have sufficient decision-making competence also has legal implications. If adolescents have the decision-making competence of adults, one could argue that they should legally be treated as adults. That is, competent adolescents should not need parental consent to seek care for their sexual health, substance use problems, or mental health. However, it could also be argued that competent adolescents should be tried as adults when they are accused as a crime (see Halpern-Felsher and Cauffman, 2001).

Behavioral decision research offers a framework for evaluating, and, if needed, improving adolescent decision making competence, and includes the following three lines of
research (Fischhoff, 2008). First, research on decision making involves *normative* analyses that identify the principles to be followed in order to make decisions that are most likely to meet the decision-makers' goals. Second, *descriptive* analyses examine how adolescents make decisions, with judgments about the quality of their decision-making processes being made on the basis of these normative principles. Third, *prescriptive* analyses identify ways to improve adolescents' decision-making processes, focusing on fixing the gaps between the normative and the descriptive results. The following sections discuss each of these three lines of research, as it has focused on adolescent decision-making competence. The studies discussed in each section are drawn from research in judgment and decision making as well as developmental psychology and public health.

**Normative Analysis: How Should Adolescents Make Decisions?**

Studies of how people make decisions typically include normative judgments about the quality of these decisions, in terms of how these decisions should have been made. In general, these normative theories posit that a good decision-making process should involve (a) assessing beliefs about the likelihood that different possible outcomes will occur, for each of the available options (b) assessing the value of each possible outcome related to each available option, in terms of how well it helps the decision maker to achieve his or her goals, and (c) combining probabilistic beliefs and values to choose the option that is most likely to lead to the best possible outcome for the decision maker. The sections below provide more detail about how normative theories propose to judge the quality of these three decision-making processes.

**Assessing beliefs**

A decision-maker’s assessed probability beliefs may be evaluated for *correspondence*, in terms of comparison to an external objective criterion, and *coherence*, in terms of being
consistent with other beliefs expressed by the decision maker. For example, judged probabilities about specific events (e.g., getting a high school diploma by age 20) should be an accurate reflection of statistical population estimates (e.g., the percent of 20-year olds who have a high school diploma). Because such statistical estimates are often not available for every event, probability judgments may also be evaluated by their coherence. That is, multiple probability judgments made by one individual should be consistent with each other, adhering to the rules of probability theory (Fischhoff, 2008; Hammond, 1990). For example, the judged probability of two events happening in conjunction (e.g., being in school next year and getting a high school diploma by age 20) should be smaller than or equal to the judged probability of each individual event happening on its own. Similarly, the judged probabilities of mutually exclusive events (e.g., getting a high-school diploma by age 20 versus not) should add up to 100%. Such coherence is a necessary, but not a sufficient, condition for accuracy.

Assessing values

A decision-maker’s values may also be evaluated in terms of correspondence, in terms of adherence to normative standards, and coherence, in terms of showing internal consistency. Correspondence norms that apply to assessed values include the sunk cost rule, which posits that good decisions should be made on the basis of expected future outcomes, without considering unrecoverable past expenditures. The latter are also referred to as “sunk costs.” Thus, it is normatively incorrect to continue investments in a course of action that is no longer profitable. For example, a good decision maker should be willing to stop watching a movie that he or she no longer enjoys, even if he or she paid to watch it (see Arkes and Blumer, 1985).

Judging assessed values by their coherence involves comparing an individual’s choices for internal consistency, or the extent to which they reflect stable preferences. While
values may vary across different decision makers, an individual’s values should be unaffected by normatively irrelevant variations in the way information is presented. For example, judgments of condom quality should be independent of whether a type of condom is described as 95% effective or 5% ineffective (Linville, Fisher, and Fischhoff, 1993), and evaluations of a medical treatment should be independent of whether it is described as having a 75% survival rate or as having a 25% mortality rate (Levin, Schnittjer, and Thee, 1988).

**Combining beliefs and values to make choices**

Normative theories pose that decision makers should choose the course of action that is most likely to lead to an outcome that will best meet their goals, given their values and their beliefs. Making decisions typically involves making trade-offs, comparing all of the available options in terms of their expected risks and benefits. Good decision makers may defensibly choose to take risks to increase the likelihood of gaining the benefits they desire (Goldberg and Fischhoff, 2000; Goldberg, Halpern-Felsher, and Millstein, 2002). For example, adolescents may choose to have sex to foster closeness in their romantic relationships, thus accepting the risk of unwanted pregnancy and sexually transmitted infections (Brady and Halpern-Felsher, 2008; Furman and Shaffer, 2003). Adolescents may also choose to experiment with smoking cigarettes and drinking alcohol to look more “cool” and feel more relaxed, thus accepting the potential damaging health effects (Brady, Song, and Halpern-Felsher, 2008). Decisions to engage in some potentially risky behaviors, such as having sex and drinking alcohol, may actually be considered part of a normal adolescence (Baumrind, 1987), and, ultimately, a normal adulthood.

Furthermore, individuals may need to make different decisions in order to optimize their goals, as a result of having different beliefs and values. A specific option may be likely to meet one individual’s goals, but not another’s. If adolescents and adults show systematic differences in their beliefs and values, then there may be instances in which they should not
be making the same decisions. Moreover, their differences in beliefs and values may make it
difficult for them to judge the quality of one another’s decisions (Keren and Bruine de Bruin,
2003).

Potential shortcomings

Because decision-making outcomes are easier to observe than decision-making
processes, it may be tempting to evaluate the quality of adolescents’ decisions by the
outcomes they experience (Baron and Hershey, 1988). People who do so may fail to
recognize that decisions tend to be made under uncertainty, with chance playing a role in
determining the obtained outcomes. As a result of chance, good decision-making processes
may sometimes result in a poor outcome, and bad decision-making processes may sometimes
result in a good outcome. Normative theories therefore posit that decisions should be
evaluated on the basis of their processes, rather than their outcomes (e.g., Edwards, Kiss,
Majone, and Toda, 1984; Keren and Bruine de Bruin, 2003; Raiffa, 1968; von Winterfeldt
and Edwards, 1986). In the long run, however, better decision-making processes should result
in better decision-making outcomes – in terms of fulfilling the goals of the decision maker
(Frisch and Clemen, 1994; Frisch and Jones, 1993; Hershey and Baron, 1992, 1995).

If adolescents are judged by the outcomes they experience, they may appear to be
poor decision makers. Indeed, adolescents may be more likely than adults to experience
specific negative life outcomes. For example, adolescents are more likely than adults to be
involved in motor vehicle accidents, including those related to drinking and driving (Lourens
et al., 1999; National Highway Traffic Safety Administration, 2003; Turner and McClure,
2003). Sexually active adolescents are more likely than sexually active adults to experience
condom failures (Crosby, Sanders, Yarber, and Graham, 2003; Macaluso et al., 1999), and to
acquire sexually transmitted infections such as HIV (Centers for Disease Control and
Prevention, 2004). Compared to adult women, adolescent females are more likely to
experience sexual assault (Humphrey and White, 2000; Smith, White, and Holland, 2003), and have higher abortion rates (Jones, Darroch, and Henshaw, 2002). Although the experience of negative life outcomes may be affected by uncontrollable factors such as disadvantaged socio-economic status (Brady and Mathews, 2002) and exposure to violence (Brady, Tschann, Pasch, Flores, and Ozer, 2008), the choices individuals make presumably also affect the outcomes they experience in their lives.

Yet, some have argued that it is appropriate for adults to judge the quality of adolescents’ decisions, because they may have insights into how adolescents will feel about their decisions in their adult future (Reyna and Farley, 2006). That argument may be especially relevant for adolescent decisions that may have consequences persisting into adulthood. Studies in a variety of domains suggest that adolescents’ risky choices are indeed related to experiencing negative outcomes later in life. For example, initiating cigarette smoking at a younger age is related to smoking more and developing nicotine dependence in subsequent years (Gervais, O’Loughlin, Meshefedjian, Bancej, and Tremblay, 2006) and having a higher risk of getting lung cancer as an adult (Hegmann et al., 1993). Starting to drink at a younger age is related to developing alcohol dependence in adulthood, as well as to academic difficulties, employment problems, substance use, and violent behaviors – all of which may affect life outcomes experienced in adulthood (Ellickson, Tucker, and Klein, 2003; Grant and Dawson, 1997; Gruber, DiClemente, Anderson, and Lodico, 1996). Adolescent obesity, presumably reflecting unhealthy choices in diet and exercise, is likely to persist into adulthood, and is related to increased risk of heart disease, other health problems, and premature death (Must, 1996). Adolescent females are physiologically more susceptible than adult women to acquiring sexually transmitted infections (Critchlow et al., 1995), whose long-term consequences may include infertility, and cervical cancer (Dillner et al., 1997; Grodstein, Goldman, and Cramer, 1993; Wallin et al., 2002). Because the reported results
tend to be correlational, it is unclear whether, for these specific topics, decisions made as an adolescent did indeed affect the outcomes experienced as an adult. However, logically, it makes sense that some of adolescents’ decisions will have long-term consequences, potentially causing decisional regret in adulthood.

Using adults’ feelings of regret as a standard for judging the quality of life decisions may also mean questioning decisions made in adulthood. When asked to report their life regrets, adults include decisions that are likely made in adulthood, such as not working harder in one’s career, or not getting a divorce (Gilovich and Medvec, 1995; Lecci, Ocun, and Karoly, 1994; Wrosch and Heckhausen, 2002).

Nevertheless, regret may be used as a standard for evaluating decisions. Researchers in judgment and decision making have developed regret theory, defining regret as the difference between the experienced outcome and the best outcome that would have been experienced if another course of action had been chosen (Loomes and Sugden, 1982). Taken as a normative theory of decision making, regret theory posits that good decisions are ones that minimize regret, given the decision maker’s beliefs and values. Doing so would entail the avoidance of choosing options that have any chance of leading to a catastrophic outcome – even if, overall, it has the best chance of fulfilling the decision-maker’s goals. In that sense, regret theory deviates from traditional normative theories of decision making.

The next section presents descriptive studies of how adolescents actually make judgments and decisions, as compared to normative standards. It examines whether adolescents have the ability to adhere to the various normative principles of decision making, and are able to apply these skills to decisions when faced with the pressures of real-world decisions. It provides possible explanations for why adolescents may be more likely than adults to take seemingly unwise risks, in some real-world contexts.
Descriptive Analysis: How Do Adolescents Make Decisions?

Descriptive behavioural research examines how people actually make judgments and decisions, typically comparing elements of their decision-making performance to specific normative standards. For example, research participants may be given questions that ask them to assess the probability of various events happening to them, to examine whether their assessed beliefs are internally consistent. Similarly, research participants may be given vignettes describing decision-making scenarios in which costs have been sunk, to examine whether their values follow the sunk-cost rule. Most of these studies hone in on specific elements of the decision-making process, systematically varying elements of hypothetical decision scenarios. Such experiments have contributed to researchers’ understanding of when and why people’s decisions violate principles of coherence and correspondence (Dawes and Hastie, 2001; Kahneman, Slovic, and Tversky, 1982; Yates, 1990).

Assuming that the conditions under which decision-making errors occur generalize to the broader population, judgment and decision making researchers have typically recruited undergraduate college students for participation in their studies. Participants under the age of 18 are more difficult to recruit, requiring approval from officials at the schools or other organizations through which they are contacted, as well as written parental consent (Esbensen, Melde, Taylor, and Peterson, 2008). Perhaps as a result, the descriptive studies that have been conducted in the field of judgment and decision making have largely ignored individual differences in decision-making competence, as well as the developmental progression of decision-making competence across the lifespan. However, there is a small but growing body of research on individual differences as well as adolescent decision making (see Bruine de Bruin, Parker and Fischhoff, 2007a; Jacobs and Klaczynski, 2002; Lopes, 1987; Parker and Fischhoff, 2005; Stanovich and West, 1998, 2000, 2008).
Traditionally, developmental research of cognitive development has assumed a linear progression toward greater logic and efficiency in adulthood (Piaget and Inhelder, 1978). By contrast, descriptive research in judgment and decision making seems to suggest that adults may not always follow normative principles when making decisions (Dawes and Hastie, 2001; Kahneman, Slovic, and Tversky, 1982; Yates, 1990). Therefore, the quality of adolescents’ decisions should not just be evaluated in terms of normative standards, but also in comparison to adult decision making. Whether or not they follow normative principles, adults are considered competent in the eyes of the law. It could therefore be argued that adolescents should earn the same rights as adults when their decision-making skills become similar to those of adults (Halpern-Felsher and Cauffman, 2001).

The following section discusses descriptive research on adolescent decision making, as compared to normative standards, as well as adult decision making. It is based on recent reviews of the literature that describe how adolescents perform on the judgment and decision making tasks that have traditionally been studied using adults (Fischhoff, 2008; Jacobs and Klaczynski, 2001; Reyna and Farley, 2006). Like the previous section on normative decision making, the present section is divided in the ability (a) to assess beliefs, (b) to assess values, and (c) to combine beliefs and values to choose between options.

Assessing beliefs

Studies on adolescents’ ability to assess probability beliefs have used standards of correspondence as well as standards of coherence. Few studies have evaluated adolescents’ probability judgments by the standards of coherence. Those that have seem to suggest that children and adolescents may be better able than adults to judge probabilities that are internally consistent. For example, as children transition into adolescence and young adulthood, they become more, rather than less, likely to commit the conjunction fallacy -- by judging higher probabilities for the combination of two events happening than each
individual event happening (Davidson, 1995; Klaczynksi, 2001). However, they are also more likely to judge probabilities on the basis of base rates rather than stereotypes, thus being able to avoid the *representativeness heuristic* (Jacobs and Potenza, 1991).

Studies that use standards of correspondence suggest that adolescents’ judged probabilities of different events happening in their lives are related to their actual life experiences. In the 1997 wave of the National Longitudinal Study of Youth, a nationally representative sample of U.S. adolescents was asked to judge their probability of experiencing various significant life events, including getting a high school diploma by age 20. Their mean judged probability for this event was significantly related to self-reports of whether or not these adolescent respondents were in school, as given on the survey (Fischhoff et al., 2000). The National Longitudinal Study of Youth has been able to follow these adolescent respondents through early adulthood, asking them every subsequent year whether or not various events have happened in their lives. Longitudinal analyses showed that the probability judgments of having a high school diploma by age 20, as given by participating adolescents in 1997 were relatively accurate, with participants’ mean probability judgment reflecting the proportion of these participants who reported having a high school diploma by the time they were surveyed at age 20, and valid, as seen in significant correlations between individuals’ probability judgments and self-reports of whether or not they had a high school diploma at age 20 (Bruine de Bruin, Parker, and Fischhoff, 2007b).

Additional research suggested that adolescents’ judged probabilities may even have predictive validity in contexts that are emotionally charged. Female adolescents’ judged probabilities of whether they may be infected with Chlamydia have been shown to predict whether or not they subsequently test positive on a clinical Chlamydia test, even after controlling for demographic variables and sexual history (Bruine de Bruin, Downs, Murray, and Fischhoff, in press). Thus, these probability judgments may be simpler, less obtrusive,
and contain more information than self-reports of demographic background and sexual activity that typically inform physicians’ decisions about whether or not to give patients a clinical Chlamydia test.

However, standards of correspondence prescribe that it is not sufficient for decision makers to judge probabilities that have external validity, in terms of being related to their actual life experiences. To inform effective decisions, probability judgments should also be accurate, in terms of reflecting the objective percent chance that the predicted event will happen. Significant correlations between judged probabilities and outcomes may be observed even when decision makers misjudge the absolute magnitude of probabilities. Indeed, adolescents’ judged probabilities of dying in the next year and by age 20 are significantly correlated to the threats they perceive in their lives – yet, their absolute probability judgments show that they largely overestimate their actual probability of dying (Fischhoff, Bruine de Bruin, Parker, Millstein, and Halpern-Felsher, in press). By comparison, adults seem better capable than adolescents, at judging their probability of dying by a certain age (Hurd and McGarry, 1995, 2002).

Compared to adults, adolescents also overestimate their likelihood of experiencing a variety of health-related risks, such as becoming addicted to alcohol, cigarettes or other various substances, getting a sexually transmitted disease, and having an unwanted pregnancy (Cohn, Macfarlane, Yanez, and Imai, 1995; Millstein and Halpern-Felsher, 2002; Quadrel, Fischhoff, and Davis, 1993). As adolescents age and gain experience with the related risky behaviors (e.g., drinking alcohol smoking cigarettes, using substances, having sex), they may learn that negative outcomes are not actually as likely as they perceived them to be. For example, sexually active adolescents tend to have lower and more realistic judgments of the risks of getting pregnant or contracting HIV (Gerrard, Gibbons, Benthin, and Hessling, 1996; Halpern-Felsher et al., 2001).
Adolescents’ tendency to overestimate these probabilities can only partially be explained by their confusion about how to accurately use probabilities. Adolescents are more likely than adults to use “50%” when they do not know what number to use in response to a probability question, leading to overestimations of small risks (Bruine de Bruin, Fischhoff, Millstein, and Halpern-Felsher, 2000). However, even when 50% responses are removed from the analyses, adolescents’ judged probabilities may still be higher than adults’ judged probabilities.

Assessing values

Few descriptive studies have examined adolescents’ ability to assess values. Those that have used the standards of coherence and correspondence, and show mixed results. Some studies suggest support for traditional theories of linear developmental progression. That evidence comes from studies about correspondence to normative rules. Compared to early-adolescents, mid-adolescents are less likely to commit a variety of reasoning errors (Klaczynski, 2001), including the sunk-cost fallacy (Klaczynski and Cottrell, 2004). However, despite the possible age-related improvement, adults still honor sunk costs when normative rules hold that they should not (Arkes and Blumer, 1985).

Other evidence questions the traditional theories of linear developmental progression. Compared to older decision makers, young children aged 4-5 are less likely to make framing errors, such that their preferences are less likely to be affected by normatively irrelevant variations in the description of decision options (Reyna and Ellis, 1994). Thus, adolescents’ values may show less coherence than that of children, in the sense of showing consistency across different frames. Adults’ preferences are also inconsistent, in terms of showing this framing effect (Tversky and Kahneman, 1981).
Combining beliefs and values

Few studies have examined how adolescents combine beliefs and values, when making their decisions. Those that have been conducted suggest that adolescents are outperformed by adults. Compared to adults, adolescents generate fewer risks and benefits of decision options (Beyth-Marom, Austin, Fischhoff, Palmgren, and Jacobs-Quadrel, 1993; Halpern-Felsher and Cauffman, 2001) and are less likely to report seeking advice to support their decisions (Halpern-Felsher and Cauffman, 2001). This finding may be due to adolescents being less likely than adults to recognize the limitations of their decision-relevant knowledge. Indeed, some studies suggest that such overconfidence in decision-relevant knowledge decreases with age (Crawford and Stankov, 1996; Klaczynski, 2001).

Potential shortcomings

It should be noted that the developmental studies that have been described in this section used a cross-sectional design comparing different groups of adults and adolescents, rather than a longitudinal design following adolescents as they grow older over time. One potential draw-back of cross-sectional designs is that differences between adolescents and adults may reflect variations in the experiences of the individuals in these cohorts rather than developmental differences. For example, adolescents’ exposure to exaggerated warnings about the risks of having sex may lead them to judge higher risks of getting pregnant or sexually transmitted infections compared to adults who were not subject to such education (Cohn et al., 1995; Millstein and Halpern-Felsher, 2002; Quadrel et al., 1993). Such cohort effects may vary as the nature of sexuality education changes over time.

To date, descriptive studies examining how adolescents perform on various traditional judgment and decision-making tasks have suggested a mixed pattern of results. Adolescents’ assessments of probabilities may be coherent, in terms of showing internal consistency, without necessarily showing correspondence to external standards. Possibly, coherence
reflects a cognitive skill that adolescents have mastered, while correspondence improves with experience that adolescents still lack. The latter is supported by the finding that adolescents’ probability judgments become more accurate as they gain experience with risky behaviours and related outcomes (Gerrard et al., 1996; Halpern-Felsher et al., 2001).

Fewer studies have examined adolescents’ ability to assess values, or to combine beliefs and values to make decisions. However, here, too, a mixed pattern of results emerged, across studies using different measures, in terms of the development of these abilities with age. Some studies showed more and others showed less normatively appropriate behaviour with age. When adults are shown to deviate from normative rules in their judgments and decisions, their presumed errors seem to show a systematic rather than a random pattern. These results suggest that adults are not confused about how to answer, but, rather, have learned to systematically violate specific normative rules as they age. Possibly, they are relying on simplifying heuristics, or rules of thumb, to make their judgments and decisions. It has been argued that using these heuristics may be adaptive, because they reduce the cognitive capacity needed to make effective judgments and decisions (Gigerenzer, Todd, and the ABC Group, 1999). Moreover, these heuristics may even be appropriate, if real-world judgments and decisions are structured in a way that is different from those used in these judgment and decision making studies. For example, it has been argued that recipients should be sensitive to whether real-world messages are framed in positive or negative terms, because it presents relevant information held by the speaker (McKenzie, 2004; Sher and McKenzie, 2005; McKenzie and Nelson, 2003).

Recent theories of adolescent decision making have adopted a dual-process approach to explain the mixed pattern of results described above. Although dual-process approaches are still in need of development (for critiques, see Keren and Schul, in press), they generally distinguish between analytical and intuitive abilities (e.g., Evans and Over, 1996; Sloman,
Analytical abilities may be needed to figure out how to adhere to normative rules of judgment and decision making, while intuitive ability may additionally be needed to make decisions in the real world. Developmental dual-process theories suggest that these two sets of abilities may mature at different rates, such that adolescents may have the analytical ability needed to follow complex normative principles, but lack the intuitive ability to make real-world decisions. For example, it has been suggested that, compared to adults, adolescents are still lacking the emotional/intuitive ability needed to recognize when heuristics may benefit decisions (Jacobs and Klaczynski, 2001; Klaczynski and Cottrell, 2004); quickly comprehend the intuitive gist of a risky decision (Reyna, 2004; Reyna and Farley, 2006); resist “hot” impulses swaying them from the decisions they had planned to make in a “cold” state (Gerrard, Gibbons, Houlihan, Stock, and Pomery, 2008); have sufficient self-regulation to inhibit their drive to seek rewards (Steinberg, 2008); and to resist taking risks in the presence of their peers that they would not have taken if they were on their own (Gardner and Steinberg, 2005).

If adolescents’ ability to make hypothetical decisions in the psychological laboratory does not translate to the decisions they make in the real world, then traditional judgment and decision making studies may have limited external validity (Dhami, Hertwig, and Hoffrage, 2004; Gigerenzer et al., 1999; Klein, 1999). Fortunately, two recent studies have suggested that performance on traditionally studied hypothetical judgment and decision-making tasks is significantly correlated to real-world decision outcomes, thus suggesting some level of external validity (Bruine de Bruin et al., 2007a; Parker and Fischhoff, 2005). Both studies used a comprehensive measure of Decision-Making Competence, one developed for adolescents (Youth-DMC; Parker and Fischhoff, 2005) and one developed for adults (Adult-DMC; Bruine de Bruin et al., 2007a), covering hypothetical decision-making tasks that have traditionally been used to examine adherence to normative rules relevant to belief assessment.
(e.g. consistency in risk perception), value assessment (e.g., resistance to framing, resistance to sunk costs), and the combination of beliefs and values when making decisions (e.g., applying decision rules). Adolescents who are more likely to follow these norms are less likely to engage in risky and delinquent behaviours (Parker and Fischhoff, 2005). Adults who are better able to follow these norms obtain better outcomes in their lives, as self-reported in the Decision Outcome Inventory (Bruine de Bruin et al. 2007a). Both of these results hold after controlling for performance on existing measures of general cognitive ability, suggesting that decision-making competence measures are more proximal to real-world decision outcomes.

These validation studies, however, do not show whether there is a causal link between decision-making competence and life outcomes. Randomized controlled studies would be needed to examine whether people who are taught to follow normative rules of judgment and decision making will improve their life outcomes, compared to a control group. Participants in such studies would be randomly assigned to receiving education in decision-making or a control group, and followed over time to examine the effect on their performance on paper-and-pencil measures of decision-making competence as well as their experienced life decision outcomes. In the next section, we discuss prescriptive analyses aiming to improve adolescents’ decision-making competence and outcomes.

**Prescriptive Analysis: How Can We Improve Adolescents’ Decisions?**

Prescriptive studies examine the effectiveness of strategies for improving adolescent decision making. Below, we discuss programs that have targeted adolescents’ health decisions and programs that have targeted adolescents’ decision making.
Programs targeting adolescent health behaviors

Adolescents have been targeted by many interventions designed to inform their decisions in a wide variety of domains, including, for example, sexual behavior, eating disorders, obesity, physical activity, smoking, and drug use (for reviews, see Kirby, 2002a, 2002b; Stice, Shaw, and Marti, 2006; Skara and Sussman, 2003; Wiehe, Garrison, Christakis, Ebel, and Rivara, 2005). Many of these programs have little to no effect on adolescents’ real-world decisions, possibly because they are not based on normative analyses of how adolescents should make decisions, or descriptive analyses of how adolescents are making these decisions. Reviews of sexuality education have suggested that programs that are grounded in normative and descriptive approaches may be more likely to affect adolescents’ behavior and outcomes (e.g., DiCenso, Guyatt, Willan, and Griffith, 2002; Kim, Stanton, Li, Dickerson, and Galbraith, 1997; McKay, 2000; Michie and Abraham, 2004).

If programs have a normative basis, they tend to rely on the health belief model (Becker and Rosenstock, 1987), the theory of planned behavior (Ajzen, 1991), or protection-motivation theory (Rogers, 1983). These theories propose linear statistical models to predict intended health behavior from variables such as perceived vulnerability to risk, perceived social norms, perceived barriers to implementing risk reducing behaviors, and perceived self-efficacy to overcome those barriers. Indeed, these general concepts are loosely based on the normative approach to decision making that is described above. However, these linear models have been criticized for, among other things, being statistically indistinguishable, generating few testable hypotheses, and failing to provide specific suggestions on what adolescents need to know to improve their decisions (Brewer and Rimer, 2008; Dawes and Corrigan, 1974; Ogden, 2003; Reyna and Farley, 2006). Moreover, the intentions they aim to predict may not be related to actual behaviors, especially among adolescents, who may be less able than adults to behave as they intended, when faced with real-world pressures on
decision making (Gardner and Steinberg, 2005; Gerrard et al., 2008; Reyna and Farley, 2006).

Although these models of health behavior have been adapted from normative theories of decision making, they differ in important respects. While health theories of behavior change evaluate a decision by whether a risk reduction behavior is chosen, normative theories of decision making evaluate a decision by the quality of decision making processes. As a result, one main difference between the two approaches pertains to their treatment of judged risks. Health theories of behavior change predict that better decisions (as shown in choosing risk reduction behaviors) will be made by decision makers who perceive themselves to be at higher risk, and even overestimate their risk. Normative theories of decision making predict that better decisions (as shown in better processes) will be made by decision makers who can accurately judge absolute and relative risks of different behaviors.

Thus, models of health behavior may inspire communications that aim to increase perceived risk without considering accuracy. Perhaps as a result of such warning messages, adolescents are more likely than adults to overestimate the risks of negative health outcomes related to risky behaviors, such as having sex and using various substances (Millstein and Halpern-Felsher, 2002). However, when adolescents start engaging in those risky behaviors, they may find out that these negative outcomes are not actually that likely. For example, sexually active adolescents judge the risks of getting pregnant or contracting HIV as lower than do abstainers, and adolescents who had been passengers in a car with a drunk driver judged the risk of getting into a drunk-driving accident as lower than those who did not have that experience (Gerrard et al., 1996; Halpern-Felsher et al., 2001). Perhaps as a result, adolescents may become frustrated with educators’ use of scare tactics (DiCenzo, Borthwick, Busca, Creatura, Holmes, Kalagian, and Partington, 2001).
These results counter the folk wisdom that adolescents perceive themselves as invulnerable, and have implications beyond the psychological laboratory. Adolescents may experience serious consequences from overestimating risks. Female adolescents who do not get pregnant after an episode of unprotected sex may conclude that they are infertile, and continue to engage in more unprotected sex (Downs, Bruine de Bruin, Murray, and Fischhoff, 2004). That conclusion is likely to be unwarranted, and can have serious consequences: those who believe that they are infertile are more likely to have unprotected sex, which puts them at risk for pregnancy (Downs, Bruine de Bruin, et al., 2004). Thus, programs may be more effective in the long run if they teach people to have realistic expectations (Rothman, 2000).

Programs targeting adolescent decision-making

Few decision-making researchers have been involved with the development and evaluation of programs targeting adolescent decision-making competence (for exceptions, see Baron and Brown, 1991). One notable exception is the GOFER program, which aims to teach adolescents general decision-making skills, in the hope of ultimately improving adolescents’ real-world decisions and outcomes (Mann, Harmoni, Power, Beswick, and Ormond, 1988). The program teaches adolescents the normative approach to making decisions described above, emphasizing the relevance of assessing valid and consistent beliefs and values, and combining beliefs and values to choose the option that is most likely to achieve the decision-maker’s goals. In addition, it also borrows from descriptive research, teaching adolescents how to cope with the social, motivational, and emotional pressures that may sway their decisions (Janis and Mann, 1977). The program has been shown to improve adolescents’ self-reports of their decision habits, as well as their knowledge of decision-making processes, compared to a no-treatment control group. However, it has not been evaluated in terms of effects on real-world decisions and outcomes.
Another intervention developed by decision-making researchers specifically targets female adolescents’ sexual decisions (Downs, Murray, et al., 2004; see also Bruine de Bruin, Downs, and Fischhoff, 2007). An interactive DVD addressed deliberative skills and emotional/experiential skills that adolescents seemed to need to make better decisions, as suggested in descriptive research discussed above. For example, the program explicitly addressed female adolescents’ tendency to overestimate sex-related risks, showing how they vary for different behaviors and accumulate with repeated exposures. It also addressed female adolescents’ perceptions of having little control over their interactions with their partners, teaching them the skills needed to negotiate safer sexual behaviors with their sexual partners. Specifically, the DVD showed adolescent females interacting with adolescent males, allowing viewers to choose how the female character would respond to pressure from the male character. Viewers were asked to perform cognitive rehearsal, imagining what they would say or do in such a situation (Bandura, 2000; Maibach and Flora, 1993), that increases the perceived feasibility of implementing decisions which may otherwise seem difficult or daunting (Driskell, Copper, and Moran, 1994). A longitudinal trial following 300 sexually active female adolescents over the course of six months showed that, compared to controls, those viewing the DVD were significantly more likely to become abstinent, less likely to experience condom failures if they did choose to have sex, and less likely to be diagnosed with a sexually transmitted infection (Downs, Murray, et al., 2004).

**Potential shortcomings**

Unfortunately, policy makers and educators do not always use evidence provided by existing prescriptive research to select programs for adolescents. For example, many U.S. schools present adolescents with abstinence-only education that leaves out information about condom use, because it is feared that presenting such information will encourage adolescents to become sexually active – even though there is no evidence for that claim (Kirby, 2002a).
Similar arguments have been made to prevent adolescents from accessing free condoms or over-the-counter emergency contraception (also referred to as the morning after pill), without there being any evidence that these risk reduction strategies increase sexual activity (Gold, Wolford, Smith, and Parker, 2004; Kirby, 2002b). Needle exchange programs have also been opposed, even though they have been shown to reduce needle sharing and related HIV-risk, without increasing drug use in the community (Drucker, Lurie, Wodak, and Alcabes, 1998).

Presenting adolescents with ineffective programs creates opportunity costs, in the sense of using time that could have been spent on effective programs. It may also potentially harm adolescents, if they are taught strategies that make them worse off. For example, sexuality education promoting “abstinence-only” may be less effective than those that promote both abstinence and condom use (McKay, 2000; Kirby, 2002). Adolescents who choose to be abstinent may be less likely to use contraception when they eventually decide to have sex (Bearman and Brueckner, 2001). Even adolescents who believe that they are “abstinent” may be putting themselves at risk for acquiring sexually transmitted infections, because they may interpret it as including oral sex (Remez, 2000) and even anal sex (Schuster, Bell, and Kanouse, 1996).

Even when educators present adolescents with programs that have been shown to be effective, they may make changes that threaten that effectiveness – either inadvertently or on the basis on their own intuitions. Teachers have also been shown to leave out taboo topics that are relevant to adolescents’ decisions (Halperin, 1999). Doing so may threaten the quality of the program, and reduce its previously reported effect on adolescent decision making. Indeed, programs that effectively reduced adolescents’ risk taking in randomized controlled trials have not had a good record in community settings, due to reduced fidelity to content (Maher, Peterman, Osewe, Odusanya, and Scerba, 2003; Robinson et al., 2002; Valdiserri, Ogden, and McCray, 2003). In the context of obesity prevention, trained
interventionists were better than regular classroom teachers in effectively conveying program content (Stice, Shaw, and Marti, 2006). Moreover, video-based programs about condom use are more effective than facilitator-led programs in terms of reducing adolescents’ probability of acquiring sexually transmitted infections (O’Donnell, O’Donnell, San Doval, Duran, & Labes, 1995; O’Donnell, San Doval, Duran, & O’Donnell, 1998). These results suggest the importance of consistently presenting effective program content teaching adolescents how to improve their real-world decisions and their experienced outcomes.

Summary and Conclusions

Behavioral decision making offers three interrelated lines of research studying adolescent decision making. Normative approaches state how adolescents should be making decisions, and posit that beliefs and values should show correspondence to external objective criteria as well as coherence or internal consistency. Because chance plays a role in determining outcomes, even the best possible decision may lead to an undesired outcome. Therefore, normative approaches hold that decisions should be evaluated by their processes and not by their outcomes. Across multiple decisions, however, good processes should be more likely than bad processes to lead to good outcomes. With risk taking and related negative life outcomes seeming more common for adolescents than for adults, it has been argued that adolescents are relatively poor decision makers – especially if they come to regret their decisions later in life. However, if later experiences of regret are used as a standard for evaluating decisions, then adults may also be judged as bad decision makers. Many life regrets reported by adults include decisions that are likely made in adulthood, such as not working harder in one’s career, or not getting a divorce (Gilovich and Medvec, 1995; Lecci, et al., 1994; Wrosch and Heckhausen, 2002). Yet, good decisions may be ones that minimize
expected regret, by avoiding options that may produce a catastrophic outcome (Loomes and Sugden, 1982).

*Descriptive* approaches examine how adolescents actually make decisions, comparing the processes they use to those prescribed by normative standards. Adolescents may generally be similar to adults in terms of their deliberative ability to adhere to various normative principles, as measured with hypothetical decision-making problems. However, they may lack intuitive skills, making them less likely than adults to recognize when heuristics may benefit decisions (Jacobs and Klaczynski, 2001; Klaczynski and Cottrell, 2004), quickly comprehend the intuitive gist of a risky decision (Reyna, 2004; Reyna and Farley, 2006), resist impulses towards unplanned risk taking (Gerrard et al., 2008), have sufficient self-regulation to inhibit their drive to seek rewards (Steinberg, 2008), or counteract the influences of their peers (Gardner & Steinberg, 2005). As a result, adolescents may be more likely than adults to sway from their intended decisions when faced with real-world pressures on decision making. However, more research is needed to understand the specific intuitive skills adolescents would need to make better real-world decisions even when faced with peers and impulsivity, how these skills develop as they grow into adults, and whether their effective implementation can be taught before adulthood.

*Prescriptive* approaches aim to improve adolescents’ decisions. Most programs targeting adolescent decision making have been developed by researchers in public health, and focus on health decisions about sexual behavior, eating disorders, obesity, and other topics relevant to adolescents. Many of these public health programs show mixed results at best, possibly because decisions about what to teach adolescents are often not based on evidence of what works (Michie and Abraham, 2004; Reyna and Farley, 2006). Effective programs tend to be grounded in normative and descriptive analyses, teaching adolescents how to overcome any difficulties that they may have in applying normative principles of
decision making, as identified in descriptive studies (DiCenso et al., 2002; Kim et al., 1997; Kirby, 2002a, 2002b; McKay, 2000; Michie and Abraham, 2004). If programs have a normative basis, they tend to rely on traditional models of health behavior change. Some of these models suggest that increasing perceptions of risk will make it more likely that recipients will avoid risky behaviors. However, as adolescents mature, they may gain experience with risky behaviors, and may learn that negative outcomes may not be as likely as they had thought (Gerrard et al., 1996; Halpern-Felsher et al., 2001). Therefore, long-term maintenance of healthy behaviors may be more likely with programs that foster realistic expectations (Rothman, 2000).

Researchers in judgment and decision making tend to be at home in normative and descriptive approaches. Yet, to date, they have conducted relatively few prescriptive studies to develop and evaluate programs teaching decision-making skills to adolescents (Baron and Brown, 1991). One exception is the GOFER program, which showed improvements in self-reports of decision making, but was not evaluated in terms of effects on actual real-world decisions (Mann et al., 1988). Another exception is a DVD-intervention that successfully taught female adolescents to avoid sexually transmitted infections, as measured in self-reports and on a clinical test (Downs, Murray et al., 2004). These results suggest that adolescents may be taught how to make better real-world decisions, even ones that may be made in “hot” emotional states rather than “cold” emotional states, and under the pressures of real-world decisions.

Traditionally, researchers in judgment and decision making have aimed to understand general psychological processes that underlie decision making, by studying hypothetical decisions made in the lab. The development of effective prescriptive programs requires a better understanding of how adolescents make real-world decisions, as well as the deliberative and intuitive decision-making skills they need to improve those decisions –
especially when they may be swayed by peers or their own impulsivity. It also requires validated measures of these skills, to follow their developmental progression, identify needs for improvement, and to evaluate prescriptive programs that aim to establish that improvement. Recently validated measures of decision-making competence (Parker and Fischhoff, 2005; Bruine de Bruin et al., 2007a) may help to inform such descriptive and prescriptive lines of research on adolescent decision making. Thus, behavioral decision research may provide the theoretical approach and the methodological tools needed to understand how adolescents should make their decisions, how they actually make their decisions, and how they can improve their decisions, if they are provided with programs.

References


Bruine de Bruin, W., Downs, J. S., Murray, P. M., & Fischhoff, B. (in press). Can female adolescents tell whether they have a Chlamydia infection? *Medical Decision Making*.


cervicitis – age, oral contraception, specific cervical infection, smoking, and douching.


