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No Brakes! Risk and the adolescent brain.

By Alan E. Kazdin and Carlo Rotella Posted Thursday, Feb. 4, 2010, at 10:02 AM ET



It's often said that adolescents are fearless and see themselves as invulnerable, that they're irrational in how they reason and process information, that they act with no logical basis for their decisions and don't really understand risk. This is all a little true, but only to the extent that it's true of everybody. People of all ages are bad at assessing risk and making rational decisions. People of all ages underestimate likely dangers and overestimate unlikely ones.

That's why Americans—who insist on their right to drive, use the phone, and eat at the same time—are more afraid of being killed by dastardly foreigners than by their neighbors or themselves. A series of recent studies has demonstrated that the level of irrationality among adolescents and adults is about the same, which means that we can no longer explain the risky behavior of teenagers by telling ourselves that adolescents suffer from some special inability to reason.

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These studies also encourage us to reconsider the notion that adolescents just make uniquely bad choices, and the corollary assumption that if we just tell them how to make better choices they will do so.

There are powerful forces—such as the brain's reaction to the presence of peers as a potent prompt and reward for sensation-seeking—that can move an adolescent to select risky behavior as the "right" choice. Urging kids to "Just Say No" to drugs, for instance, has been ineffective because it misses key factors leading to drug use. A given young person might say "No" when he or she is alone, but not when surrounded by peers. In fact, opting to say "Yes!" to drugs at a party—in a situation replete with the novel sensation and peer influence that light up the early adolescent brain like a Christmas tree—makes perfect sense because it maximizes rewards.

Interventions based on these erroneous assumptions are not likely to help much.

1. Reasoning with your child

We've written before about the relative ineffectiveness of reasoned argument as a way to change behavior. That's especially true in this case. When you sit down to explain to your early adolescent why it's unwise to climb the town water tower to have sex with predicate felons while doing nitrous, you're acting on two assumptions that we now know to be false: 1) teenagers do not understand risk and consequences (which leads to the mistaken notion that you can change your child's behavior by patiently explaining the dangers of the water tower escapade), and 2) the system in the early-adolescent brain that controls reason and abstract thinking can control the risky behavior encouraged by the system keyed to social and emotional stimulus. (More on these two systems later.)

Yes, it's always good to explain things to one's children, and doing so in a consistent, reasonable, gentle, and loving way can help build a strong relationship, which helps. And your explanation may well give them a tool for reasoning that they can reach for when they are ready to use what's in their mental toolbox. But your child may not be ready now. The potential positive long-term effects of explanation do not make it an effective short-term intervention that will stop your early-adolescent child from going out and doing something risky tomorrow.

2. Educational programs in the schools

This is a more expensive, elaborate, and systematic version of No. 1. Our schools make available all sorts of programs to explain to students what the problem is (drinking is bad), what it does (alters judgment), what can happen (car accident and death), and what one should do (don't drink). More than 90 percent of all U.S. high-school students have been exposed to sex, drug, and driver education in their schools, yet they still engage in high-risk behaviors. Current research now suggests that attempts to make adolescents less impulsive, less shortsighted, and more aware of consequences have very weak effects, if any, on behavior. That doesn't mean the programs are worthless. Some tiny number of students will be influenced by them in the short run, and in the long run they're likely to provide tools that a maturing young person can take up when the further development of the cognitive-control system has brought him to the point that he's ready to use them.

3. Pledges not to engage in risky behavior

One common intervention especially beloved by moral crusaders and supported by government funds asks teenagers to formally promise not to engage in behaviors that place them at risk. The focus has been on sexual activity. As far as we can tell, it doesn't work, and occasionally it makes things worse. A recent study by Janet Rosenbaum of Johns Hopkins University evaluated the effect of pledging abstinence (the "virginity pledge") versus not pledging among teenagers and then followed them for five years to evaluate the impact on sexual activity. Five years after the pledge, the results indicated that pledgers and nonpledgers did not differ in amount of premarital sex, sexually transmitted diseases, anal or oral sex, age of first sex, or number of sexual partners. Pledgers had used birth control and condoms less often than nonpledgers in the past year or at last sex. In short, the intervention was effective only in decreasing precautions taken during sex. As an ancillary but not irrelevant finding, five years after taking the virginity pledge 82 percent of the pledgers denied having ever pledged.

In our next piece we'll turn to what does seem to work best in containing adolescent risk, but first we need to take a closer look at the science. It's probably not a big surprise that those who take the most risks in adolescence tend to experience relatively poor long-term outcomes: higher rates of dropout, job loss, divorce, criminal behavior, dissatisfaction in relationships. But so do those who take no risks at all. Those in the middle of the sample, the vast majority who during adolescence take more risks than before but don't go completely wild, seem to do better over the long haul.

Whether that's because too little adolescent risk is as damaging to future development as too much or because the tendency to take too much or too little risk reflects personality characteristics already in place when puberty hits, the pattern of outcomes suggests that the human animal appears to be designed to function normally when its behavior grows somewhat riskier at the beginning of

adolescence. The top 10 in terms of danger—regular alcohol use, regular binge drinking, tobacco use, marijuana use, other illegal drug use, fighting, carrying a weapon, suicidal thoughts, suicide attempts, unprotected sexual behavior—qualify for that honor not only in their own right but because they are associated with other dangers, like car accidents, the leading cause of death among teenagers ages 15 to 19.

Speaking of car accidents, Larry Steinberg of Temple University, a leader in research on teenagers and risk, has described the early-adolescent brain as being like a car with a very responsive accelerator and weak brakes. Steinberg and others have put two brain systems under particular scrutiny in recent years.

The first, Steinberg's gas pedal, is the social-emotional system. About the time of the onset of puberty, changes in brain structure and function, hormones, and neurotransmitters work together to increase the desire to seek out rewarding experiences, especially the sensation afforded by novel and risky behavior. The effect of brain function is also conditioned by the social environment. Various lab experiments, including video driving games and gambling games, show that adolescents take more risks if peers are present or evaluating their performance.

Social information (Are people my age around?) connects with the brain's processing of rewards—in this case, neuroimaging shows that the presence of peers activates the same brain circuitry as does processing of rewarding experiences. Having peers around is a reward, and not having them around is felt as the opposite, which begins to explain your 14-year-old's sullen, moody, heedless demeanor around the house. As the social-emotional system undergoes robust development in early adolescence, the brain gets better at guiding behavior toward sensation and reward—flooring it, in other words. But Steinberg's brakes don't kick in until a little later.

The brakes take the form of the cognitive-control system, which constitutes an individual's capacity for self-regulation, including inhibition, planning, weighing consequences and risks and rewards, and abstract thinking. This system develops later than the social-emotional system, a process continuing well into late adolescence and early adulthood. The cognitive-control system connects—literally—with parts of the brain that control emotions.

As the cognitive-control system begins to develop in middle and late adolescence, thought and emotion are better coordinated, and emotions are held more in check. An adolescent's sheer ability to reason may already match an adult's, but the development of this system allows that ability to exercise greater practical control over risky impulses. Also, the influence of peers and the interest in novel experiences grow less salient and are more easily restrained. Now that the teenager sees the cost of risk as higher and risky behaviors as not quite as rewarding as they used to be, he becomes more able to stop himself from flooring the gas pedal.

The cognitive-control system's integration with the social-emotional system has been examined in studies that show how connections among areas of the brain proliferate to allow emotion and reason to "talk" to each other. One can see the effects of the second system's development not only in a reduction of risk behavior but also in adolescents' evaluations of reckless acts and increased caution.

The result is that risk-taking increases significantly with the onset of puberty, peaks somewhere in the middle of the decade between ages 10 and 20, and then declines and stabilizes in late adolescence and young adulthood. And, while in early adolescence antisocial and risky behavior is more likely to be done in groups, in late adolescence, such behaviors, to the extent they occur at all, are more likely to be performed by individuals acting alone.

It makes sense, then, that age 16 is the peak year for deaths by car accident: The age at which most novice drivers can first get their licenses coincides with the tail end of the peak of sensation-seeking and risky behavior.