One of the hallmarks of adolescence—not only in the United States, but around the world—is that risky and reckless behavior is commonplace. Rates of risk taking are higher during the late teen years than during any other period of development. And the list of risky behaviors that are more common during adolescence than before or after is remarkably diverse.

Compared to people of other ages, adolescents are more likely to commit crimes, experiment with alcohol and other drugs, deliberately hurt themselves, and have unprotected sex. Adolescents are even more likely than children or adults to accidentally drown, which must be due to bad decision-making, since teenagers have considerable strength and stamina compared to people of other ages.

The heightened propensity of adolescents to engage in risky behavior has been a longstanding concern to parents, schools, and society, and for good reason. Although this stage of life is relatively free from disease and illness, rates of morbidity and mortality more than double between childhood and adolescence. The major contributors to health problems during adolescence are not disease or illness—they are behavioral, and frequently the result of risky decision making.

“The major contributors to health problems during adolescence are not disease or illness.”

For decades, psychologists have struggled to explain why adolescents behave more recklessly than adults. The familiar explanations have not held up to scientific scrutiny, however. Teenagers are not especially irrational, ignorant, or likely to suffer from delusions of invincibility—or at least no more so than adults are. When it comes to thinking about risk, teenagers are surprisingly perceptive, informed, and rational.

Indeed, by the time they are 16, adolescents' cognitive skills, reasoning abilities, and understanding of risk are indistinguishable from those of adults. Despite these capabilities, though, adolescents are more likely than adults to take chances—a finding that has been borne out in laboratory experiments as well as in the real world.

This fact helps to explain why school-based health education has had such mixed results. Health education is based on the premise that adolescents engage in risky behavior because they are insufficiently knowledgeable about the dangers inherent in different risky activities, and our schools have done a commendable job when it comes to educating adolescents about the potential harms of various worrisome behaviors.

But scientific evaluations of health education programs generally have shown that these efforts are far more effective in changing what teenagers know and believe than changing how they actually
behave. Nearly all adolescents are well aware of the dangers of smoking, but many try cigarettes because they believe that they won’t become addicted. Similarly, virtually all adolescents are knowledgeable about the risks of unprotected sex, but a large proportion of sexually active teens do not use condoms regularly. Driver education helps teenagers pass written licensing exams, but has no discernable impact on rates of teen motor vehicle accidents.

**Brain systems mature at different rates**

For the past 20 years, my colleagues and I have been trying to understand why teenagers, despite being as intellectually capable as adults, and as knowledgeable about the potential consequences of risky behavior, are more likely to make risky decisions. Our attempt to solve this puzzle—most simply put, if teenagers are so smart, why do they do such stupid things?—has led us to look inside the adolescent brain for insight.

All risk-taking involves weighing the potential rewards of a risky decision (e.g., impressing my friends with how fast I can drive) against the potential costs (e.g., being ticketed for speeding). When we perceive the possible rewards as large enough, relative to the potential costs, we are more likely to make the risky choice. The key to understanding why adolescents take more risks than adults is that when faced with a risky choice, adolescents are more likely than adults to focus on the potential rewards of different courses of action, including ones that are potentially dangerous. This creates a different decision-making calculus for teenagers that increases their inclination to take the risk.

In order to understand the neurobiological underpinnings of this process, it is helpful to first distinguish between two different brain systems that mature during adolescence. The “cognitive control” system is localized mainly in the lateral prefrontal cortex (the areas directly inside one’s temples) and in pathways that link these parts of the brain to other regions. This system is responsible for the development of higher-order cognitive abilities (often called “executive functions”) such as planning ahead and thinking about the future consequences of one’s decisions, as well as self-regulation—the ability to willfully exercise control over thoughts, feelings, and behaviors.

The other brain system, referred to as the “socioemotional incentive-processing system,” comprises the limbic system (a deep-seated, lower region of the brain) and its connections to other brain structures. This second system is responsible for processing emotions, social information, and the experiences of reward and punishment.

We now know that the two brain systems develop along different timetables during adolescence, and understanding their asynchrony helps explain why teenagers are especially prone to take risks. The cognitive control system matures gradually over the course of adolescence and is still developing well into the mid-20s. The parts of this system that regulate basic cognitive abilities and logical thinking are mature by age 16, which explains why adolescents perform as well as adults on tests that measure things like memory and logical reasoning, especially when these abilities are assessed under optimal circumstances. (Because it is newly developed, adolescents’ higher-order thinking is more easily disrupted by emotional arousal, stress, and fatigue.) But the parts of this system that are especially important for self-regulation are still maturing well into the early 20s.

**Teenagers have more difficulty controlling their impulses**

This is nicely illustrated in a study from our lab that employed a task on which being able to put the brakes on impulsive behavior is essential for successful performance. The computerized task, called the Tower of London, displays a stack of three balls—one red, one yellow, and one blue—next to three different-sized pegs onto which the balls can be moved using the computer’s mouse or touchscreen. One peg can hold one ball, one holds up to two, and the third holds up to
three. The balls are stacked in what is labeled the “start position.” Below the pegs are a second set of identical balls that are stacked in a different order from the first one, labeled as the “goal position.”

The player is instructed to use the pegs as placeholders while moving the balls in the first stack back and forth until the pattern resembles the one shown in the goal position, and to do this using as few moves as possible. Some problems are easy, and can be solved in as few as three moves, but others are very hard, and take up to seven moves to finish. Making the wrong first move (i.e., moving the top ball on the starting stack onto the longest peg, when it should have been moved onto the shortest one, so that a second ball can be placed at the bottom of the longest peg) makes it impossible to solve the problem in the fewest number of moves. Solving the difficult problems in the minimum number of moves necessitates developing a strategy before acting, which takes a bit of time.

Adolescents take about 6 seconds before making their first move, regardless of the difficulty of the problem. Adults wait this long when the problems are easy, but they take twice as long when the problems are hard. Adolescents have more difficulty controlling their initial impulses, which results in poorer performance when the problems are hard. In our studies, which we’ve now conducted around the world, there is a steady increase during the teens and twenties in how long people wait before making their first move. This reflects the maturation of the brain’s cognitive control system, which is a universal feature of brain development in adolescence and young adulthood.

“The adolescent brain’s reward center is exquisitely sensitive to opportunities for pleasure.”

Unlike the development of the cognitive control system, which is gradual and protracted, changes in the socioemotional incentive processing system occur very early in adolescence, primarily because of the impact of puberty on the brain. Pubertal hormones make the brain more sensitive to reward, and, as a consequence, this system is much more easily aroused by the anticipation and receipt of rewards among teenagers than adults. When presented with a rewarding stimulus while their brains are being scanned—a pile of coins, for example, or pictures of smiling faces—adolescents exhibit stronger activation in the brain’s reward centers than either children or adults. The adolescent brain’s reward center is exquisitely sensitive to opportunities for pleasure.

The different timetables followed by the two brain systems creates an imbalance during which people are very easily aroused by rewards but not yet able to resist their temptation when it is prudent to do so—it’s like starting a car’s engine before a good braking system is in place. Understanding the nature of this imbalance helps explain why adolescents are more inclined than adults to take risks, even when they know better. The combination of an easily activated reward center and a still maturing capacity for self-control makes it hard to resist the pull of potentially pleasurable experiences.

As a consequence, there is a sharp increase in what psychologists call “sensation seeking” (the pursuit of novel, exciting, and sometimes risky experiences) during the first half of adolescence, and a decline as people mature into adulthood. Most of us, as adults, no longer find many of the experiences we enjoyed as teenagers (like driving over the speed limit or being drunk) as pleasurable as we once did, and those of us who still do are better able to resist these temptations when we know we ought to.

Adolescent risk taking is a natural product of neurobiological immaturity

Brain science has changed the way we think about adolescent risk taking. We no longer view it as
the result of some sort of cognitive or emotional deficiency that needs to be remediated. Instead, risk taking appears to be a natural, hardwired, and evolutionarily understandable feature of this stage of development, one that is seen not only in humans, but in other mammals as well. We evolved to take more risks during adolescence so that we would venture out into the wild and find mates at a time when fertility is at its peak. It may no longer be especially suitable for the world we live in now, but it’s in our genes, and there isn’t much we can do to change that.

Yes, teenagers vary in the extent to which they engage in risk taking, and among those who do, in the extent to which their risky behavior is worrisome (not all risk taking is bad), but as a group, adolescents are significantly more likely to engage in risky behavior than adults, both in the real world and on laboratory-based tasks.

One thing we’ve discovered in our lab is that teenagers’ inclinations to take risks are amplified when they are in groups, mainly because when adolescents are with their friends, their easily aroused reward centers are even more likely to be activated. We think this is because peers are so inherently rewarding during adolescence that they prime the brain’s reward centers to be more sensitive to other types of rewards, which further tips the decision making calculus toward choices that are rewarding but risky.

Most parents and teachers agree that adolescents do a lot of dangerous things when they are with their peers that they would never do on their own. Some of this is no doubt the result of explicit peer pressure, but we’ve shown in our studies that the mere presence of friends—even if they are not allowed to communicate—makes teenagers behave more recklessly.

“Instead of trying to change teenagers into something they aren't, we should try to reduce the risks they’re exposed to.”

If adolescent risk-taking is best understood as a natural product of neurobiological immaturity, the ineffectiveness of programs designed to educate adolescents about the dangers of different types of risky activity is predictable. Classroom-based health education is an uphill battle against evolution and endocrinology, and it is not a fight we are likely to win.

Instead of trying to change teenagers into something they aren't, we should try to reduce the risks they’re exposed to, by having more widely available after-school programs that provide more structure and supervision during hours when parents are working, stricter laws regulating the sale of alcohol and tobacco to minors, and better enforcement of graduated licensing regulations.

Doing so would improve—and even save—many adolescents’ lives. Information alone is simply not enough to deter risky behavior when individuals are at a point in development where it is easy to become aroused and hard to control the impulses that this arousal generates.


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