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Brain Immaturity Could Explain Teen Crash Rate

Risky Behavior Diminishes At Age 25, NIH Study Finds

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By most physical measures, teenagers should be the world's best drivers. Their muscles are supple, their reflexes quick, their senses at a lifetime peak. Yet car crashes kill more of them than any other cause -- a problem, some researchers believe, that is rooted in the adolescent brain.

A National Institutes of Health study suggests that the region of the brain that inhibits risky behavior is not fully formed until age 25, a finding with implications for a host of policies, including the nation's driving laws.

"We'd thought the highest levels of physical and brain maturity were reached by age 18, maybe earlier -- so this threw us," said Jay Giedd, a pediatric psychiatrist leading the study, which released its first results in April. That makes adolescence "a dangerous time, when it should be the best."

Last month, Sen. William C. Mims (R-Loudoun) cited brain development research in proposing a Virginia bill that would ban cell phone use in vehicles by drivers younger than 18. It passed Friday.

In Maryland, Dels. Adrienne A. Mandel and William A. Bronrott said the research could bolster three bills the Montgomery County Democrats submitted to the legislature Friday. The bills would expand training and restrict passenger numbers and cell phone use for certain teenage drivers.

The measures also are supported by crash statistics and a soon-to-be-released study from Temple University, which used a driving-style test to show that young people consistently take greater risks when their friends are watching.

"This goes toward supporting evidence that the judgment of teens further deteriorates with distractions. These crashes are preventable," Mandel said. "I would welcome [researchers'] testimony at our bill hearings."

The research has implications beyond driving: Attorneys cited brain development studies as the U.S. Supreme Court considered whether juvenile offenders should be eligible for the death penalty. The court is expected to reach a decision by midyear.

Critics of brain-imaging research -- and Giedd himself -- emphasize that there is no proven correlation between brain changes and behavior. Giedd, however, said the duration and depth of the study mean "it's time to bring neuroscience to the table" in the teen driving debate.

"We can determine what is the relationship between brain development and driving ability and what we can do to make it better," Giedd said.

At Temple University in Philadelphia, psychology professor and researcher Laurence Steinberg plans a new study: scanning teenagers' brains while they perform a task that simulates driving decisions, in an effort to understand the biological underpinnings of risk-taking among young people.

Giedd intends to pursue similar studies with his subjects, focusing on ways to give young people, and those responsible for them, more tools for beating the odds.

Teenagers are four times as likely as older drivers to be involved in a crash and three times as likely to die in one, according to the Insurance Institute for Highway Safety.

"Right now our first subjects are reaching driving age," Giedd said. "What better application could there be than saving their lives?"

Environmental Impact

Lily and Zoe Ulrich, 15-year-old identical twins from Frederick, have been part of Giedd's study at NIH for two years. When they signed up, they answered questions about their diet, athletics, social habits, peer pressure, language skills and intellectual achievements.

The blond, 5-foot-4 sisters wear glasses, earn straight A's and often finish each other's sentences. They will receive their learner's permits this month. "I'm excited . . . it's really cool," Lily said. "I'm a little more nervous," said Zoe. "We think the same a lot of the time but not always."

Giedd would like to know why.

Sitting in his closet-size office in NIH's sprawling Building 10, he turns to his laptop, where the fruit of 13 years' work appears. It's an eight-second, time-lapse image of the brain, swept by a vivid blue wave symbolizing maturing gray matter. The color engulfs the frontal lobes and ends in "a direct hit," Giedd said, with the dorsal-lateral prefrontal cortex, just behind the brow.

About as thick and wide as a silver dollar, this region distinguishes humans from other animals. From it, scientists believe, come judgments and values, long-term goals, the weighing of risks and consequences -- what parents call wisdom or common sense and what science calls "executive functions."

While society and tradition have placed the point of intellectual maturity, the "age of reason," years earlier, the study -- an international effort led by NIH's Institute of Mental Health and UCLA's Laboratory of Neuro Imaging -- shows it comes at about age 25.

The process is generally completed a year or two earlier in women but varies greatly from person to person. Why that is, Giedd said, "we still don't know."

"We have to find out what matters. Diet? Education, video games? Medicine, parenting, music? Is the biggest factor whether you're a musician or a jock or the amount of sleep you get?"

As important, Giedd said, is the study's finding that the brain matures in a series of fits and starts. While it remains to be proved, he said, this "may be a key to when the brain is most receptive" to learning certain skills, such as driving.

The study, which is ongoing, involves scanning the brains of 2,000 people ages 4 through 26 using magnetic resonance imaging, a radiation-free tool that permits researchers to view the organs of healthy people in minute detail.

Every two years, study participants come to the Bethesda-based National Institute of Mental Health, where they are scanned and interviewed. Half the children are healthy, and half have brain-related disorders. In the next phase, researchers plan to focus almost solely on twins, hoping to expand beyond the 180 pairs participating now, to measure the impact of environmental factors on the maturing brain.

Giedd said he's been bashed by teenagers who said the study suggests they're brain-damaged. On the contrary, he said: "Teenagers' brains are not broken; they're just still under construction."

The pattern probably serves an evolutionary purpose, he said, perhaps preparing youths to leave their families and fend for themselves, without wasting energy worrying about it.

The findings imply that many life choices -- college and career, marriage and military service -- often are made before the brain's decision-making center comes fully online. But for young adults, "dying on a highway is the biggest risk out there," Giedd said. "What if we could predict earlier in life what could happen later?"

A 'Period of Recklessness'

Temple's Steinberg said the NIH/UCLA research supports his theory that teen recklessness is partly the result of a critical gap in time -- starting with the thrill-seeking that comes in puberty and ending when the brain learns to temper such behavior. Since children today reach puberty earlier than previously, about age 13, and the brain's reasoning center doesn't reach maturity until the mid-twenties, Steinberg said, "this period of recklessness has never been as long as it is now."

In a study to be published this year, Temple researcher Margo Gardner and Steinberg illustrated the impact of peer pressure on risk-taking. Volunteers in three age groups -- 13 to 16, 18 to 22 and 24 and older -- were told to bring two friends to the study, which involved an arcade-style driving game.

To "win," participants guided a car through a course as quickly as possible. Periodically, a yellow warning light flashed, and some time later a "wall" popped up. If players hit it, they lost all their "points."

Participants took the test alone and with their friends in the room. Researchers found that those in the two younger groups consistently took more chances with friends present. Those 24 and older behaved equally cautiously, regardless of whether friends were watching.

The results help show why teenagers are more likely to drink, take drugs or commit crimes in groups, he said. They're also reflected in auto crash statistics.

According to the Arlington-based Insurance Institute for Highway Safety, the chances of a crash by a 16- or 17-year-old driver are doubled with two peers in the vehicle and quadrupled with three or more. "Every passenger you add increases the risk," said Alan Williams, chief scientist at the institute. The brain and behavior studies, he said, "certainly tie in with what we know."

After a spate of teen driving deaths across the Washington region in the fall, Maryland is attempting to join Virginia and the District in limiting the number of unrelated passengers in cars with young drivers. In addition to cell phone restrictions that the Maryland and Virginia legislatures are considering, Maryland Gov. Robert L. Ehrlich Jr. (R) is backing a measure that would revoke the licenses of convicted drunk drivers under age 21, for as long as five years.

Steinberg said he agrees with such approaches. "We have to limit the harm adolescents [encounter], rather than to try and change them."

The best way to do that, he added, "is by passing laws."

Staff writer David Snyder contributed to this report.

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