BEHAVIORAL RESEARCH

A New Discipline Probes Suicide's Multiple Causes

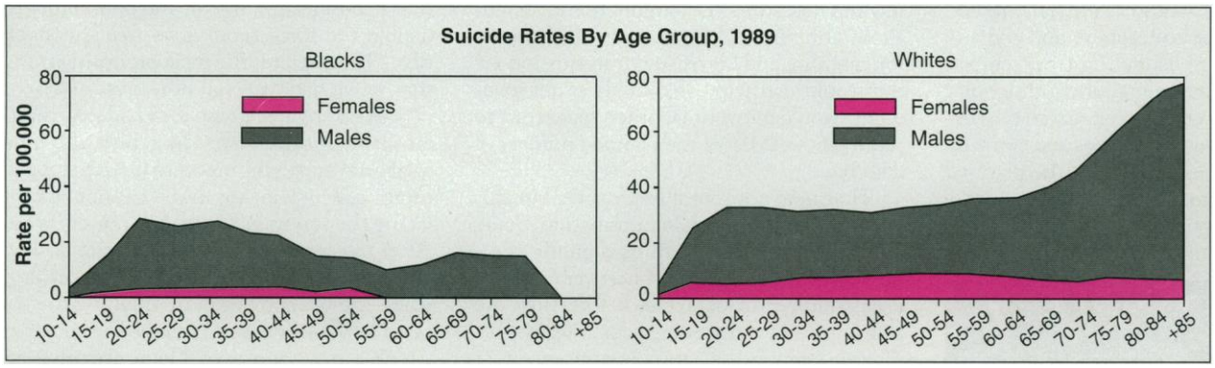
Open just about any magazine or newspaper these days, and you're likely to find an article on suicide—whether about alleged suicide attempts by Britain's Princess Diana or the high rates of suicide among teenagers. As University of Pittsburgh psychiatrist and depression researcher David Kupfer points out, "We are dealing with a major disorder." Officially, there are 32,000 suicides a year in the United States, but the real number is a lot higher, he says. And for every completed suicide there are 100 attempts. Particularly worrisome are the high suicide rates among young people, which have persisted since the mid-1970s.

Researchers are therefore hard at work trying to nail down the factors that induce some people to commit the ultimate act of self-destruction. But in the opinion of speakers at the International Conference on Suicidal Behavior, held last week at the University of Pittsburgh, suicidology is only in its infancy, and the goal is still distant. What's needed, they say, is an integrated effort that incorporates everything from cultural studies to biochemistry in studying the problem—much like the approach pioneered by the meeting sponsor, Pittsburgh's Western Psychiatric Institute and Clinic (WPIC), which recently became the locus of the first federally funded clinical research center devoted to the study of suicide.

Presentations at the meeting indicated, however, that a trend toward a multidisciplinary approach is already beginning to take hold. The participants reported studies of a variety of social, psychological, and biochemical factors—including emotional loss and social isolation—that are associated with risk for suicide. And, although it is still unclear how all the variables interact, one conclusion has gained new reinforcement: Suicide is rarely an aberrant act by an otherwise normal individual. Rather, what most suicidal people have in common is a serious psychiatric disorder—most often, depression.

Take, for example, a study of 67 teen suicides by WPIC psychiatrist David Brent. The results revealed, Brent says, that 40% of the victims suffered from major depression, and one-third were addicted to alcohol or other drugs. Furthermore, says the center's director, psychiatrist John Mann, antisocial and borderline personalities (the latter being people whose relationships are chaotic and who react to breakups with extreme distress and depression) are frequent among adolescents and young adults who kill themselves.

Families not the key. Previous work has shown that unstable and abusive families produce more than their share of pathology, including suicide attempts. But the majority of subjects in Brent's study came from reasonably stable families. Findings such as his are suggesting that suicide itself—as opposed to attempts—is more closely linked with individual psychological factors than with family environment.



Brent now says that "the most important issue" in studying suicide is "whether suicidal behavior is simply a manifestation of a psychiatric disorder" or whether there are independent and as yet unidentified factors that interact with psychopathology to produce a fatal result. In other words, since most people with psychiatric disorders don't try to kill themselves, researchers suspect that the suicide-prone have some kind of excess vulnerability, which may be rooted in biology or personality. At least two findings support that belief: One is that a history of previous suicide attempts ranks as the number one predictor of suicide, above any type of psychopathology. Another is that suicide has a moderate tendency to run in families. Brent says that, according to a study currently under way, a person from the family of someone who attempts suicide has a higher risk of suicidality than someone from a family with no suicide attempters—even if family psychiatric histories are otherwise comparable.

Epidemiological studies described at the meeting also pointed up the many mysteries still surrounding suicide proneness, such as why some ethnic groups have higher rates than others—disparities that can't be explained by group differences in age or psychopathology. Within the United States, for example, one of the most intriguing differences is the low suicide rate among blacks—only about 60% of the average for whites, according to epidemiologist Eve Moscicki of the National Institute of Mental Health. Even more striking is the fact that black suicides do not increase in old age, whereas white suicides do. In fact, said Moscicki, for black women, suicide is "practically nonexistent" by late middle age. Conferees could only speculate on the reasons. Sociologist Ronald W. Maris, director of the University of South Carolina's Center for the Study of Life-Threatening Behavior, pointed out that many suicidal males may get killed early in shoot-outs—what the experts call "victim-precipitated homicide." He added that some cultural factors, such as the support offered by extended families and the powerful role of religion, may exert a protective effect for blacks, especially women.

But since social studies can't provide all the answers, many researchers believe that biological investigations are imperative for gaining a more complete understanding of what drives people to kill themselves. "We have gone about as far as we can go with the psychosocial variables," asserts psychiatrist Emil Coccaro of the Eastern Pennsylvania Psychiatric Institute. Researchers have long wanted to find a biological "marker" for suicide, and over the past dozen years or so the prime candidate that has emerged is a deficiency of the neurotransmitter serotonin, which has been linked not only with depression but also with high levels of aggressiveness, irritability, and impulsivity—and with violent suicides.

At the conference, psychiatrist Alec Roy of the Albert Einstein College of Medicine reported that among a group of violent male offenders, those who had attempted suicide had lower levels of a serotonin breakdown product in their cerebrospinal fluid, as well as higher lifetime histories of violent, aggressive acts, than nonattempters. Coccaro also finds that Veterans Administration patients

who have attempted suicide have reduced responses to a drug that increases brain serotonin—regardless of whether they have a mood or personality disorder. Coccaro believes that serotonin acts as a "brake" for violent impulses.

Other research suggests that people who actually commit suicide—rather than just attempt it—may have serotonin deficiencies even in the absence of violent histories. That work was reported by Pittsburgh neuroanatomist and receptor pharmacologist Victoria Arango, whose team has been comparing the brains of 20 suicide victims with those of 20 sex- and age-matched controls. Arango has produced autoradiography images showing that certain brain areas associated with mood (in the prefrontal cortex and hippocampus) show an increase, in the suicide victims, in serotonin binding sites—which, researchers believe, means that extra receptors have been created to compensate for a serotonin deficiency. Arango says this finding is consistent with the data on attempters.

Researchers warn that no single set of factors—much less a single neurotransmitter system—is adequate to explain suicide. Hence the need to plant themselves "at the intersection of psychiatry, biology, personality, sociology, and culture," as Maris put it. Otherwise, he said, "we are going to continue to have a very rudimentary science of suicidology."

–Constance Holden

SPACE SCIENCE

Galileo Gets a Boost; UARS Goes Bust

A homeowner knows the feeling. As soon as you fix the furnace, the air conditioner goes on the fritz. You repair the leaky roof, and termites show up in the basement. Spacecraft seem to work the same way. At a press conference on 11 June, engineers and scientists at the Jet Propulsion Laboratory (JPL) announced that they had figured out how to bypass the disabled main antenna of the Jupiter-bound Galileo spacecraft by funneling critical information through a far less powerful secondary antenna. Most of the mission will be saved.

But the next day officials at NASA's Goddard Space Flight Center had to announce that the Upper Atmosphere Research Satellite (UARS), whose 10 instruments had been studying the atmosphere and the sun since the satellite's launch last September, had been crippled by a malfunctioning solar array. Whether engineers can match the success of their Galileo colleagues and come up with a fix to salvage the rest of the planned 3-year mission remains to be seen.

Just getting around Galileo's simple problem, its snared main antenna, will take some ingenious dodges. Unless the antenna can be unjammed and fully opened (*Science*, 23 August 1991, p. 847), Galileo's transmissions from Jupiter through its secondary antenna will be 10,000 times weaker than planned. A weaker signal would ordinarily mean that data transmission, to be intelligible, would have to be that much slower, rendering Galileo nearly mute. But at the press conference, Leslie Deutsch, who manages technology development for NASA's Deep Space Network of receiving antennas, explained how Galileo's rate of data transmission could be increased by a factor of 10. Part of the improvement would come from combining the signals received by several ground antennas and upgrading the amplifiers attached to those antennas. More powerful techniques for catching and correcting transmission errors would also help. All told, these improvements would allow the Galileo spacecraft to return about 0.1% of the planned number of data bits.

JPL

Worse than a leaky roof. Engineers at JPL are fiddling with a stuck Galileo-type antenna in hopes of freeing the one in space.

That may not sound impressive, but this data trickle will be rich in information: Some types of observations will be digitally compressed into one-tenth to one-twentieth the usual number of data bits before they are transmitted. Even sending back images—ordinarily among the most data-intensive of observations—"will not be as hard as I thought it would be," says project scientist Torrence Johnson of JPL. Engineers have found that Galileo has enough spare computing power for the job in the spacecraft's attitude control computer. In quieter moments it will have time to "redraw" the images mathematically using only 5% to 10% of the original number of data bits. Added to the improvements in reception, data compression will enable Galileo to accomplish 70% of the mission objectives, Johnson said.

Within that average, not all Galileo science will fare equally well. Researchers interested in the behavior of Jupiter's magnetosphere can look forward to about 75% of the data the mission had originally promised. But meteorologists expecting to sort out why the Jovian winds blow the way they do by studying pictures of its clouds will get only a few hundred of the tens of thousands of images they were counting on.

On the whole, though, the mood among Galileo scientists is definitely upbeat again, even though what had seemed the engineers' best hope of freeing the main antenna has not panned out. After six of a planned seven cycles of warming and cooling of the central tower, where three ribs of the umbrella-like antenna are stuck, project manager William O'Neil of JPL concedes that "if it was going to work, it would have worked by now." O'Neil still holds out some hope for one more temperature manipulation—simply letting the antenna warm as Galileo sweeps closer to the sun at the end of the year. If that doesn't do the trick, engineers will take the brute force approach—rapidly cycling the motors that open the antenna on and off in order to double the force tending to free the stuck ribs. "That by far is the most promising thing that we've had," O'Neil now says.

UARS engineers wish they had some similar plans of their own. On 1 June the lone solar array supplying power to UARS stopped rotating, which means that it cannot be kept facing the sun to maintain full power levels. After the spacecraft switched to the backup drive unit, all went well until the next day, when the backup began misaligning the array. That's just the sort of mundane but catastrophic mechanical problem, crippling an entire array of instruments in one stroke, that last fall prompted a review panel to recommend that NASA scale back its plans for Earth Observing System (EOS) satellites. The EOS satellites, successors to UARS, would have put 50% more instruments on a single platform, where they would be vulnerable to a single glitch (*Science*, 27 September 1991, p. 1481).

While NASA ponders the lessons of the UARS failure, the array has been fixed in one position that supplies enough power for only two of the 10 instruments, and troubleshooting continues. One thing seems clear: A fancy electronic fix à la Galileo will probably not help. UARS deputy project manager John Donley of Goddard suspects the team may have a clutch problem on its hands. And you car-owners know what that's like.

–Richard A. Kerr