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Explaining the Rise in Youth Suicide

David M. Cutler, Edward L. Glaeser,
and Karen E. Norberg

Emile Durkheim's *Suicide* documented a monotonically increasing relation between age and suicide. Such a relation has been observed repeatedly since the beginning of the nineteenth century, making it one of the most robust facts about suicide. The differences in suicide rates by age are very large. In the United States in 1950, for example, suicide rates were four times higher for adults (ages twenty-five to sixty-four) than for youths (ages fifteen to twenty-four) and eight times higher for the elderly (sixty-five and older) than for youths.[1] Economic theory explained this relation naturally, with the young having the most life to lose and also having the least information about what their life will be like (Hamermesh and Soss 1974).

In recent decades, however, the monotonic relation between age and suicide has disappeared. Figure 5.1 shows suicide rates by age in 1950 and 1990. Between 1950 and 1990, youth-suicide rates tripled (particularly among young men), while suicide rates for adults fell by 7 percent, and suicide rates for the elderly fell by 30 percent. In 1990, suicide rates for young adults (ages twenty to twenty-four) were equal to those for prime-age adults and were only 25 percent below suicide rates for the elderly.

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1. Throughout the paper, we refer to the fifteen- to twenty-four-year-old age group as *youths.* We sometimes divide this into *teens* (ages fifteen to nineteen) and *young adults* (ages twenty to twenty-four).

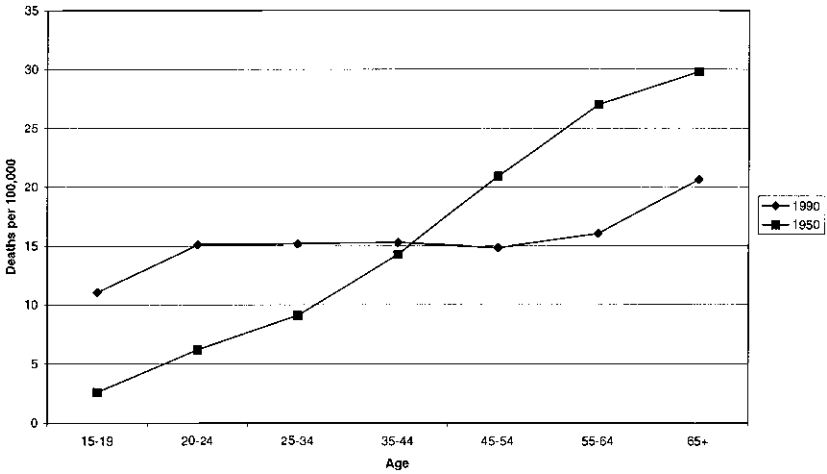

Fig. 5.1 Suicide rates by age, 1950 and 1990

Suicide is now the second or third leading cause of death for youths in the United States, Canada, Australia, New Zealand, and many countries of Western Europe.

If youth suicide is an epidemic, attempted suicide is even more so. For every teen who commits suicide (0.01 percent each year), four hundred teens report attempting suicide (4 percent per year), one hundred report requiring medical attention for a suicide attempt (1 percent per year), and thirty are hospitalized for a suicide attempt (0.3 percent per year).

Why have youth-suicide rates increased so much even as suicide among adults and the elderly has fallen? Why are there so many suicide attempts? It is easier to say what suicide is *not* than what it is. The U.S. rise in youth suicide has not been centered in America's troubled inner cities. The states with the largest increase in youth suicides between 1950 and 1990 are predominantly rural: Wyoming, South Dakota, Montana, New Mexico, and Idaho. The states with the most troubled inner cities in fact have the smallest increases: The District of Columbia, New Jersey, Delaware, Massachusetts, and New York. Indeed, when Durkheim wrote, suicide was primarily an urban phenomenon, but today youth suicides are 15 percent more prevalent in rural areas than in urban areas.[2]

This paper examines some of the economic and social roots of youth suicide and suicide attempts. Two stories illustrate our results. The first is reported by Rene Diekstra (1989, 16):

2. Durkheim ([1897] 1966) suggested that urban suicide was evidence for the role that traditional agrarian (and particularly Catholic) society plays in creating a well-functioning social environment.

It was around noon on 12 August 1969 that 19-year old Jurgen Peters climbed the ladder on the outside of the water tower in the German city of Kassel. By the time he reached the top, a number of people were already gathering where the young man was at.

It soon became clear that he intended to jump all the way down in an attempt to take his own life. Earlier that morning, Jurgen had been fired by his boss, a local garage owner for whom he worked as an apprentice mechanic. The reason had been that, upon being asked to test drive a client's car, he instead had gone joy riding and in the process had severely damaged that car as well as two others. Bystanders called the police, who in turn called the fire department for assistance. A fire ladder was put out to the top of the tower, and one of the firemen tried to talk Jurgen out of his plan, without success, however. Then a girl he had been dating and liked very much was asked to talk with him. She succeeded in persuading him to give up his attempt.

While stepping from the water tower onto the fire ladder and starting his descent, a couple of young men watching the scene began yelling: "Hey, coward, you don't even have the guts to jump, do you?" and similar provocative remarks. One could observe Jurgen hesitating, interrupting his descent. Then all of a sudden he climbed up the ladder, hopped on the top of the tower and almost in one movement jumped off it. He died on the spot.

The second was witnessed by one of the authors (see Norberg 1999). Between 30 December 1996 and 22 July 1997, there was a suicide epidemic in the white, predominantly low-income community of South Boston, Massachusetts. The area affected is an economically mixed and historically embattled community of about thirty thousand, somewhat physically isolated from the rest of the city. Although the community had been well represented in the city's and the state's political leadership for many years, its political influence seemed to be declining. The community was perceived by many observers, both insiders and outsiders, as having been deeply stressed and demoralized by recent and rapid social changes. Political and economic factors that have affected the community over the last generation include high rates of poverty, organized crime, and substance abuse and a history of political conflict with the rest of the city over school busing and public-housing integration. Within the previous three years, there had been new social stresses, including welfare reform, changes in the local political leadership, a major crackdown on the organized crime leadership in the community, and the privatization of city and state services, with a loss of public-sector jobs that had been the economic base for the community.

In addition to these general social stresses, there had been a concurrent drug epidemic that may have been intimately related to the suicide epidemic. A nationwide decrease in the price of heroin had resulted in an

increase in heroin use by even very young adolescents in South Boston in 1995 and 1996. Other adolescents, not drug users themselves, reported an increased feeling of anxiety in the face of the community's manifest inability to stop this increase in serious adolescent drug use. In early 1996, a fifteen-year-old boy died of an accidental drug overdose in one of the housing projects in the community. Just before this overdose, he had made a name for himself by stabbing a man who was accused of raping his sister. By report, more than a thousand people attended this boy's wake and funeral; teenagers tattooed his name on their bodies, and the project hallways are still full of graffiti recording his name. He seems to have been memorialized, in part, because his death was seen as symbolic of a general crisis in the community. The first suicide of the epidemic occurred in the same housing project, close to the one-year anniversary of his death.

By the end of the epidemic, there had been six hanging deaths, all young white males, along with forty-eight serious but nonlethal suicide attempts, including five nearly fatal hanging attempts resulting in medical intensive-care-unit hospitalizations (all young white males aged fifteen to seventeen), eight intentional overdoses serious enough to require medical hospitalization in addition to psychiatric care, at least thirty-five other hanging, overdose, and other self-injury attempts, and seventy-eight other crisis evaluations resulting in psychiatric hospitalizations among adolescents primarily aged fifteen to seventeen in this community. The affected adolescents were more likely to be white and male and more likely to be between the ages of fifteen and seventeen than children and youths receiving emergency psychiatric screenings in baseline years. Given an estimated population of about thirteen hundred teenagers in this community between the ages of fourteen and seventeen, this represents a thirty-eight-fold higher suicide rate in the community than the teen suicide rate for the country as a whole, at least a fivefold increase in cases requiring medical hospitalization, and a psychiatric hospitalization rate of almost 10 percent of the adolescents in the community in a single narrow age group. Nearly all the persons making suicide attempts during this time cited the completed suicides as one of the stressors affecting them. Thirty-six of the forty-eight serious attempters reported being close to at least one of the teens who died.

These two stories foreshadow several questions that we address in this paper: What social stressors (such as the lost job for Jurgen and the heroin epidemic in Boston) are associated with the rise in youth suicide? What is the role of other high-risk behavior (the joyride, stabbing a community violator) in prompting crises leading to suicide? What is the role of peer pressure or social contagion in youth suicide?

We examine these issues of suicide and suicide attempts using two sources of data. The first is Vital Statistics data on youth suicides. These data are available at the aggregate level since the turn of the century and at the micro level since 1968. We briefly describe national time trends since

1900 and examine state-level cross-sectional data for 1950 and 1990 and county-level cross-sectional data for 1990. National data record all deaths, but the attribution of deaths by cause is somewhat problematic. This is most important in distinguishing between suicides and accidental deaths. For example, a youth who dies of a self-inflicted gunshot wound may be considered either a suicide or the victim of an accidental death; many single-vehicle motor-vehicle fatalities are thought to be probable suicides, although they are usually classified as accidents. In prior years, when there was more stigma associated with suicide, the share of deaths coded as accidents was higher and the share coded as suicides lower. As we discuss below, we do not think that reporting changes materially affect our conclusions about the reasons for increasing suicide over time.

National data on attempted suicide by youths are not available. Instead, to study suicide attempts, we turn to the National Longitudinal Survey of Adolescent Health (AddHealth). The AddHealth study surveys a nationally representative sample of about twenty thousand teenagers, their parents, and their social peers. We examine data from the first wave of this study, which took place in 1996. The AddHealth survey asks youths about suicidal thoughts, suicide attempts, and whether the attempt required medical treatment. It also gathers a broad range of demographic and social information.

Our empirical analysis leads us to three conclusions. First, we argue that there is a fundamental distinction between suicide attempts and suicide completions. While successful suicide is usually the result of a strongly held intent to end one's life, most suicide attempts are probably not. Instead, many suicide attempts can best be seen as a strategic action on the part of youths to resolve conflicts within themselves, with parents, or with others. Youths have little direct economic or familial power, and, in such a situation, self-injury can act as a powerful distress signal. It can also serve to punish other persons (playing off others' empathetic or altruistic inclinations) or to embarrass or "blackmail" persons who "should" be altruistically inclined toward the victim, if the gesture draws the attention of outside authorities or other persons whose opinion matters to the reluctant altruist.

Many factors suggest that the bulk of suicide attempts are strategic. For example, women attempt suicide 50 percent more often than men but complete suicide six times less frequently. Attempted suicides peak for fifteen-year-olds, while rates of completed suicides climb sharply between ages fifteen and twenty. Finally, suicide attempts by youths are greater in families where youths may have more to gain from a shift in resources.

Second, we find strong evidence that social interactions are important in teen suicide. Teenagers are much more likely to attempt suicide when they know someone else who has attempted suicide, and suicides are "clumped" across areas in a way suggesting local spillovers. Spillovers may

occur in several ways: an attempt by one person may be more credible if it follows attempts by others; authorities may take a second suicide attempt more seriously than the first; people might learn about effective techniques from others (e.g., exactly how much medication it takes to get sick but not die); or youths may provoke other youths to attempt suicide if the alternative is bringing shame to one's group by a public display of stress. The presence of social interactions means that small differences in aggregate fundamentals can trigger large shifts in the number of youth suicides.

The importance of peer interaction in youth suicides was noted by Durkheim ([1897] 1966) a century ago and has been supported by other investigators in the current era (Gould et al. 1994). Contagion effects are far less evident for adults and the elderly, suggesting that social interactions are less important for these groups.

Third, we find that, to the extent that we can explain the rise in youth suicide over time, the most important aggregate variable explaining this change seems to be the increased share of youths living in homes with a divorced parent. To a lesser extent, higher female labor force participation rates also explain increased rates among males. Divorce rates at the county, state, and national levels are highly correlated with youth-suicide rates. The divorce rate is more highly correlated with youth suicides than is the share of children living with stepparents or the share of children in single-parent families (both divorced and never-married parents). Female labor force participation is another potential factor. Higher female labor force participation predicts higher rates of suicide, particularly for males. At the individual level, we find that family structure and parents' time budgets also seem to matter for youths' suicide attempts, albeit to a much less important degree than at the aggregate level for youth suicide. Both these factors predict youth suicide more strongly than they predict adult suicide.

We begin by presenting basic facts about youth suicides and suicide attempts. The second section discusses different theories about teen suicides. The third section presents data on suicide attempts from a nationally representative survey in 1996, and the fourth section examines county, state, and national data on completed suicides. The last section concludes.

5.1 Facts about Suicide

We begin with some basic facts about suicide to set the stage for our later analysis. While some of the facts are well-known, others are not.

5.1.1 Since 1950, Suicide Has Tripled among Youths and Fallen among Older Adults and the Elderly

Figure 5.1 above shows the change in suicide rates by age from 1950 to 1990. Suicide rates for youths tripled between 1950 and 1990, rising from

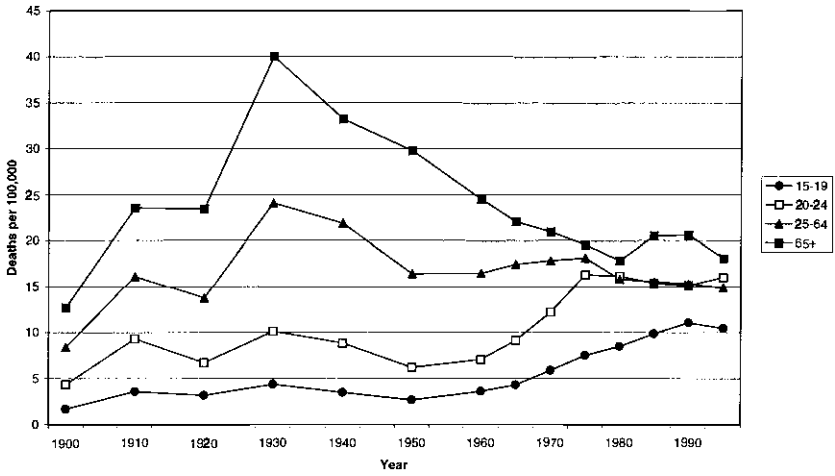

Fig. 5.2 Suicide rates by age over time

4.5 per 100,000 to 13.8 per 100,000. In contrast, suicide among adults has fallen by 10 percent and suicide among the elderly by half.

To highlight the differing trends by age, figure 5.2 shows suicide rates by age at decadal intervals over the twentieth century. Suicide rates first peaked about 1910. Suicide rates for adults and particularly the elderly rose again in the Great Depression and have fallen substantially since then. Total suicide rates in 1997 are the same as they were in 1950. Suicide rates for youths, in contrast, declined by 2.5 percent per year from their peak in 1908 through their trough in 1955 and since then have risen by 2.4 percent per year.

There is an increase in the youth-suicide rate for every single year of age, as shown in figure 5.3. Between 1970 and 1980, the percentage increase was roughly the same for all ages. Since 1980, suicide rates increased most rapidly among teenagers aged fifteen to nineteen.

One possible explanation for the rise in teen suicides is that teen deaths might have been coded as accidents in previous years. While this is certainly true to some extent, it does not change our findings materially. Figure 5.4 shows the suicide rate, the gun-accident deathrate, and the combined suicide and gun-accident rate for youths over time. Unfortunately, we cannot include motor-vehicle fatalities since motor-vehicle deaths change for so many other reasons over time (such as changes in car safety and legal driving speeds). The gun-accident rate declined over time but by nowhere near as much as the suicide rate increased. Thus, the rise in suicides and gun-accident deaths mirrors the rise in suicides alone.

The fact that suicide rates trend differently for young adults, older adults, and the elderly suggests that different factors may be at work for

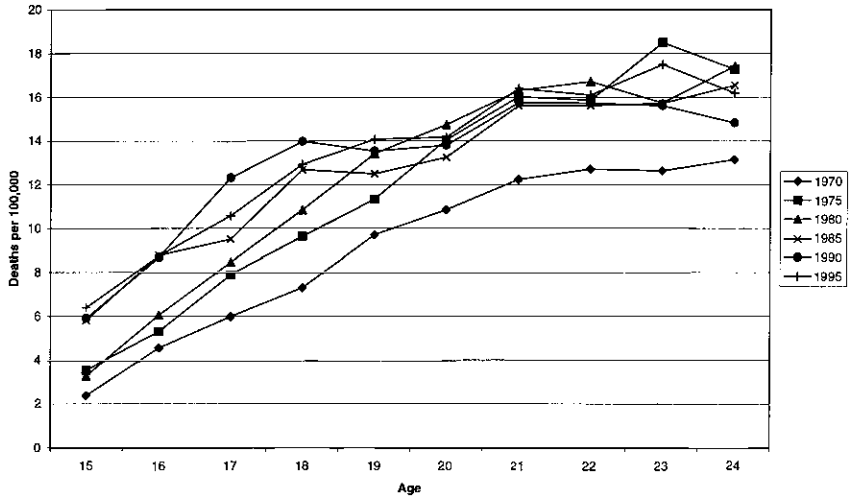

Fig. 5.3 Rates of teen suicide by year and age

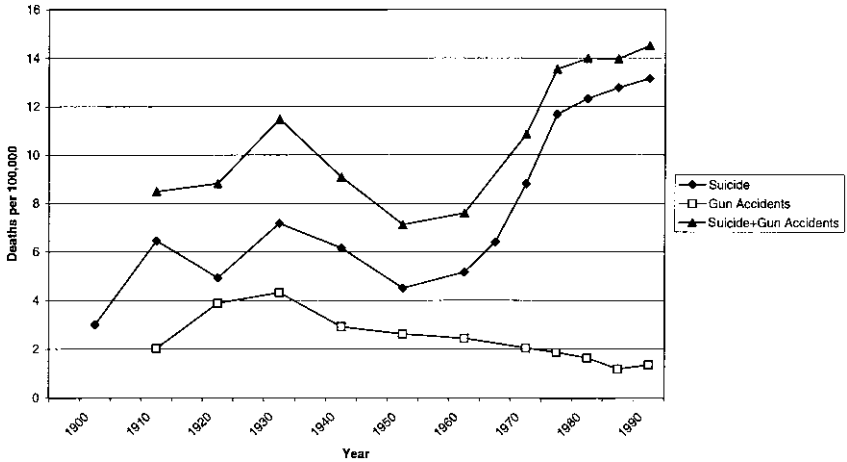

Fig. 5.4 Suicide and gun accidents among youths

the three groups in the population. This is true cross-sectionally as well. The correlation across states between youth- and adult- (elderly) suicide rates is only 0.46 (0.49), while the correlation between adult- and elderly suicide rates is 0.89.

5.1.2 Suicide Is the Third Leading Cause of Death among Youths

U.S. Vital Statistics records indicate that the annual suicide rate for youths (fifteen to twenty-four) is about thirteen per 100,000, or 0.01 per-

cent per year. Over the course of ten years, therefore, about 0.1 percent of youths will commit suicide. The leading cause of death for youths is accidents (an annual rate of 38.5 per 100,000 in 1995), followed by homicide (an annual rate of 20.3 per 100,000).

5.1.3 There Are about Two to Four Hundred Suicide Attempts among Youths for Every Completed Suicide

There are no national surveillance figures in the United States for suicide attempts; estimates therefore come from a few national surveys and from local surveillance. As with suicide deaths, there is ambiguity in measuring suicide attempts. There is wide variation in the lethality of intent; thus, the definition of *suicide attempt* varies considerably from one study to another. The term *parasuicide* is sometimes used to refer to self-injury with low likelihood of lethal outcome (e.g., superficial cutting, minor overdoses), and *deliberate self-harm* is sometimes used to refer collectively to self-injuries across the full spectrum of lethality of intent.

Our data on suicide attempts come from AddHealth. Suicide attempts in AddHealth (described in more detail below) are based on self-reports and leave the definition of *suicide attempt* open to the responding interviewee. Table 5.1 shows data from AddHealth on suicide thoughts and attempts and from Vital Statistics on successful suicides.

About 14 percent of youths report thinking of suicide in the past year, and 4 percent report attempting suicide. About 1 percent of youths reported being seen medically for a suicide attempt. Other data from the National Hospital Discharge Survey indicate that about 0.2 percent of youths are hospitalized for self-injury each year. As shown in the last column, these numbers are substantially greater than the rate of the suicides.

Table 5.1 **Suicide Thoughts, Attempts, and Completions among Youths, 1995 (%)**

	Thought About	Attempted	Seen Medically	Suicide Rate
All	14.2	4.0	1.0	.013
Male	11.8	2.5	.5	.022
Female	16.7	5.6	1.5	.004
White	14.7	4.3	1.0	.014
Black	11.4	3.4	1.0	.009
Other	14.5	3.7	.9	.013
Urban	14.5	5.0	1.3	.012
Rural	14.1	3.7	.9	.014
Above median income	14.4	3.7	.9	.011
Below median income	14.0	4.4	1.1	.015

Note: Figures in the first three columns are taken from AddHealth. Figures in the last column are taken from Vital Statistics.

There are about three hundred self-reported suicide attempts, about one hundred "medically seen" suicide attempts, and about sixteen medically hospitalized suicide attempts for every completed suicide.

These numbers in themselves suggest that not all teen suicide attempts are made by youths who truly wish to die. Many youths may instead be engaged in "strategic" suicide attempts—suicide attempts of varying severity, designed to get attention, to punish parents or other role models for perceived mistreatment, or to embarrass parents or other family members. Indeed, common sense suggests that succeeding at suicide is not all that difficult. After all, either a tall building or rope is often available, half of all households own a gun, and medications such as aspirin or acetomenophen are even easier to find and less frightening to use. As such, unsuccessful attempts must usually be thought of as actions that are, for the most part, designed to elicit a response other than one's own death. Successful attempts, on the contrary, most probably reflect a desire actually to end one's life. As such, we will discuss the theories of successful suicides and suicide attempts separately.

5.1.4 Girls Attempt Suicide More Often Than Boys; Boys Commit Suicide More Often Than Girls

Table 5.1 shows suicide rates for various demographic groups. The rate of suicide attempts is twice as high for girls as it is for boys, but the rate of successful suicides is six times higher for boys than it is for girls. Differences in suicide rates are evident throughout the life cycle. Figure 5.5 shows suicide rates by age and gender. Male suicide rates are roughly three

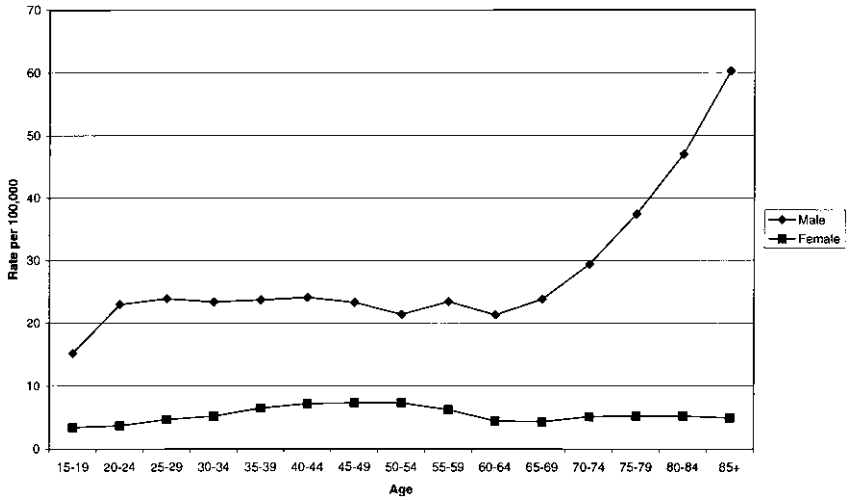

Fig. 5.5 Suicide rates by age and sex, 1997

Table 5.2 **Incidence of Suicide Thoughts in Past Year by Age (%)**

Age	AddHealth, 1995	Crosby, Cheltenham, and Sacks (1999), 1994
12	8.6	. . .
13	10.6	. . .
14	12.8	. . .
15	15.1	. . .
16	13.7	. . .
17	14.9	. . .
18	12.8	. . .
18–24	. . .	12.8
25–34	. . .	6.9
35–44	. . .	6.2
44–54	. . .	4.1
55–64	. . .	1.8
65+	. . .	1.0

times female rates for adults, before increasing dramatically after age sixty-five. Female rates, in contrast, have a relative peak in late middle age.

5.1.5 Suicide Attempts Decrease with Age after Adolescence

Table 5.2 shows suicide attempts by single year of age for youths (from AddHealth) and adults (from Crosby, Cheltenham, and Sacks 1999).[3] The peak age for suicide attempts is fifteen; attempt rates for eighteen-year-olds are 15 percent below the rate for fifteen-year-olds.[4] Suicidal thoughts decline in frequency from middle adolescence into adulthood and older years.

5.1.6 Rates of Suicide and Homicide Are Positively Correlated in the National Data

Figure 5.6 shows suicide and homicide rates over time. There is a clear positive correlation between the two. Both rates rose substantially from 1910 through 1930 and then fell through 1960. In both cases, rates rose again through 1975. Total suicide rates began to fall again in the mid-1980s, while homicide rates fell in the early 1980s, rose in the late 1980s and early 1990s, and then have again fallen since 1994. The association between suicide and homicide is even stronger for youths, as shown in figure 5.7. Both rates rose from 1910 through 1933, fell over the next twenty to thirty years, and then began a prolonged increase, with a recent fall in both beginning in 1994.

3. These data are from a recent telephone survey of a nationally representative sample of adults.

4. A peak at around age fifteen is also found for suicide attempts among girls in Oregon.

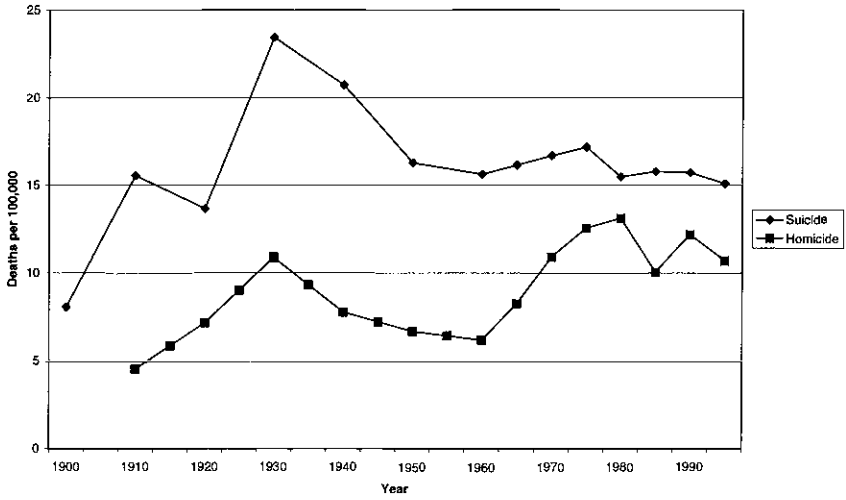

Fig. 5.6 Suicide and homicide rates

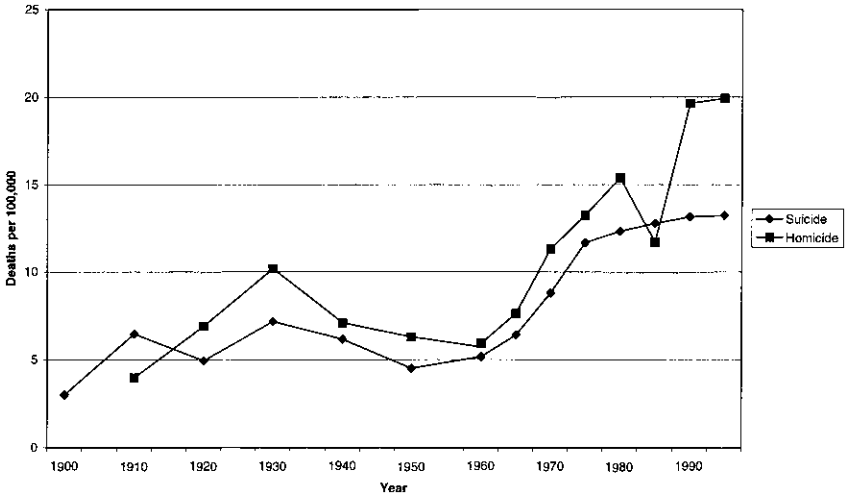

Fig. 5.7 Suicide and homicide rates for teens

5.1.7 Rural, Western States Have the Highest Youth-Suicide Rates and the Fastest Rate of Increase

Figure 5.8 shows the geographic dispersion in youth-suicide rates in 1950 and 1990. Table 5.3 shows the states with the highest and lowest suicide rates. Because Alaska and Hawaii were not states in 1950, they are not included in the figure. Suicide rates in 1990 are above those in 1950

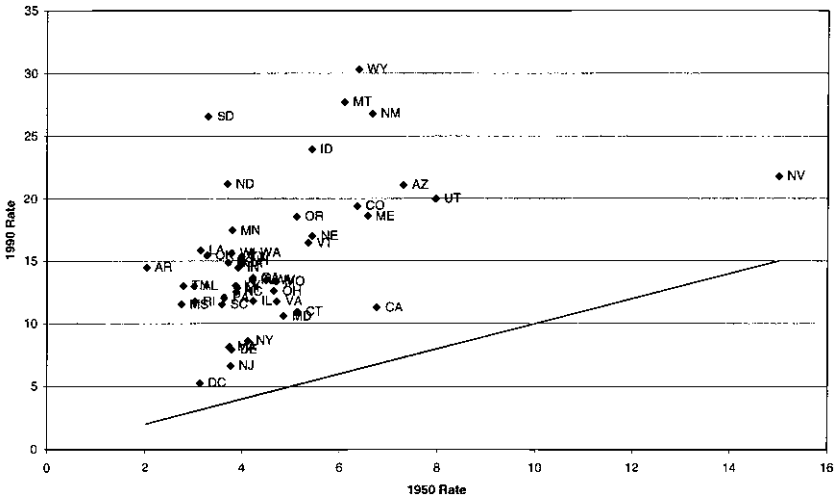

Fig. 5.8 Suicide rates in 1950 and 1990

Table 5.3 Suicide Rates for People 15–24 by State, 1950 and 1990

1950	Rate	1990	Rate
Nevada	15.0	Alaska	34.87
Utah	7.96	Wyoming	30.35
Arizona	7.25	Montana	27.73
California	6.77	New Mexico	26.82
New Mexico	6.67	South Dakota	26.57
. . .		. . .	
Rhode Island	3.03	New York	8.63
Alabama	3.02	Massachusetts	8.16
Tennessee	2.80	Delaware	7.94
Mississippi	2.75	New Jersey	6.65
Arkansas	2.03	District of Columbia	5.28

Source: Vital Statistics.

for all states. But there is substantial dispersion in changes in suicide rates over time. In 1950, suicide rates averaged 4.6 per 100,000, with a standard deviation of 2.0 (1.3 without Nevada). In 1990, the average rate was 15.3, with a standard deviation of 5.4.

Most surprisingly, suicide rates in 1990 are highest in rural, Mountain states and lowest in urban, Northeastern and Mid-Atlantic states. The highest suicide rates in 1990 are in Alaska, Wyoming, Montana, New Mexico, and South Dakota. This pattern became particularly pronounced between 1950 and 1990. Rates in Montana, New Mexico, and Wyoming were high in 1950 but not as far above average, those in South Dakota

actually below average. These states replaced states that were relatively rural in 1950 but became more urban over the time period: California, Utah, and Arizona.

The states with the lowest suicide rates also changed. In 1950, the lowest suicide rates were generally in Southern states (Alabama, Tennessee, Mississippi, and Arkansas). By 1990, the states with the lowest suicide rates were the District of Columbia, New Jersey, Delaware, Massachusetts, and New York.

The high rate of suicide in Mountain states does not appear to result from coding differences between accidents and suicides. The correlation between suicide rates and accidental deathrates for teens in 1990 is 0.50.

5.1.8 Blacks Attempt and Complete Fewer Suicides than Whites

Table 5.1 above shows racial differences in suicide attempts and suicide completions. Blacks attempt suicide about one-quarter less frequently than do whites and complete suicides about one-third less. The lower rate of suicide for blacks than for whites suggests that youth suicides are not just a result of poor economic prospects. By any measure, whites have much greater economic prospects than do blacks. This ethnic difference also argues against some family-composition explanations, such as the hypothesis that the lack of a father in the household leads to more youth suicides. However, during the 1980s, suicide rates increased most rapidly among young black males, so some changing factors are clearly important in this relation.

5.1.9 Economic Differences Are Moderately Correlated with Suicide Rates

The last rows of table 5.1 above show suicide thoughts and completions in urban and rural areas and between richer and poorer families.[5] Suicide thoughts are moderately higher in urban areas, although suicide rates are higher in rural areas. Youths in poorer families are more likely to attempt and complete suicide than youths in richer families. These economic differences are not overwhelmingly large; the difference between rich and poor areas, for example, is much smaller than the difference in suicide between blacks and whites and between boys and girls.

5.1.10 Teen Suicide Is Primarily Accomplished with Guns

Table 5.4 shows the methods that youths used to commit suicides in 1950 and 1990. In both years, the overwhelmingly large share of deaths results from guns. Guns were used in 50 percent of deaths in 1950 and 64 percent in 1990. Hanging is second most important in 1990, followed by

5. In the last rows, the suicide rate is based on whether the county had median income above or below average.

Table 5.4 **Method Used for Youth Suicides and Attempts (%)**

	Suicides		Attempts
Method	1950	1990	1988
Guns	50	64	.6
Hanging	14	19	1.6
Poison	27	6	82.0
Other	9	11	15.8

Source: Suicides are from U.S. Vital Statistics. Suicide attempt rates are from Andrus et al. (1991).

poison. Suicide rates by all methods except poison have increased over time. The increase is particularly pronounced for gun deaths.

The predominance of guns in teen suicides and the association between rural, mountainous states and suicide initially incline one toward a means theory of higher suicide rates: the availability of guns has increased youth suicides. The cross-state evidence suggests otherwise, however: if anything, we would expect that guns were relatively more available in rural, mountainous states in 1950 than in 1990.

In contrast to successful suicides, suicide attempters almost never use guns. Poison is used in over 80 percent of suicide attempts (e.g., drug overdoses).

5.2 Suicide among Youths: Theory

In explaining youth-suicide attempts and completions, we start off with two basic facts. The first fact is that people have variable feelings. Everyone has high and low moments. For youths, the variability of emotions is particularly great. Evidence suggests that the highs are higher and the lows lower for youths than for adults. The second fact is that youths do not have financial resources that they can use to influence others. Youths are still at the point in life where their consumption exceeds their net income.

These two facts suggest a number of different explanations for youth suicide. We group the alternative explanations into four categories. The first explanation is the *strategic suicide* theory: youths attempt suicide to signal others that they are unhappy or to punish others for their unhappiness. In this theory, suicide attempts are not primarily designed to result in death. Rather, they are a way for youths to influence others in nonfinancial ways. The second theory is the *depression theory:* at various points, youths become sufficiently unhappy that they "rationally" take their life. The third theory is the *contagion theory;* it is really an extension of the first two theories, suggesting that a "social multiplier" may amplify the effects of stressors leading to depression or may amplify the effects of factors leading to suicidal signaling as a method of conflict resolution among

youths. The fourth theory has less to do with events that produce suicide thoughts and more to do with the ability to carry out suicide plans. We term this the *instrumentality theory:* when youths become particularly unhappy, they commit suicide if the means to do so is readily available. Thus, youths with access to guns will, for the same level of unhappiness, have higher suicide rates than will youths without access to guns. We illustrate each of these potential effects in turn.

5.2.1 The Rational-Suicide Theory

Our first theory is the most conventional one: suicide is a means of "rationally" ending one's life when the expected value of the future utility of being alive is below the value of death. The rational-suicide theory was developed by Hamermesh and Soss (1974) as a way of explaining why suicide seemed to increase monotonically with age. We have already seen that this monotonic increase with age is no longer true generally. Indeed, it was not even true for women at the time that Hamermesh and Soss's original paper was written. We further show in the appendix that the simple prediction of rising suicide rates with age does not necessarily follow from a rational-suicide model. But the intuition holds. Suicide is more likely when the variability of happiness is high, when unhappiness is correlated over time, and when people have high discount rates. If there is hyperbolic discounting, then individuals may want to precommit not to kill themselves.

Suicide and depression are clearly correlated for youths, as we show below. The difficult question is how the rational-suicide theory can explain the increase in youth suicide over time. It is possible that discount rates have risen over time for the young; changes in such an enduring individual characteristic could be the result of important changes in family structure or social environment that determine the individual's development of the capacity to regulate impulse. It is also possible that mean utility levels in youths have declined over time. If this is the driving factor, however, it must concern goods that are not usually purchased in the market economy since the average purchasing power of families has not declined.[6] A particularly plausible explanation is that the variance of the utility distribution has increased. If the variance of utility is greater, more youths will fall below the utility level at which suicide is a rational action.

We examine this by considering the factors that lead to depression among youths. Work on happiness suggests that family connections tend to be particularly important in promoting happiness; for adolescents, the family may be an important buffer for the variability of emotions. Changes

6. Hamermesh and Soss (1974) find that suicide and income are correlated at the occupation level, but this relation is not that strong. Moreover, Durkheim's ([1897] 1966) earlier evidence suggests a negative relation between suicide and income.

in family relations may have decreased this buffering role. Thus, one candidate explanation for the rise in teenage suicides is the increase in single-parent families. Alternatively, divorce, the partial absence of a known father, and remarriage might be more important in producing teenage unhappiness than the absence of a parent entirely because of conflict between ex-partners, conflict with a stepparent, or conflict with a nonresident parent who may not be as available as the child desires. The child may experience greater feelings of rejection and unhappiness when certain parental resources appear to exist but are not being devoted to the child than when it is clear that parental resources have been exhausted. This may explain why youth suicides are lower among blacks than among whites and why the suicide rates among black youths have been rising.

The events that cause depression need not be rationally undertaken for the suicide itself to be rational. A youth who discounts hyperbolically may take actions that bring short-term pleasure but long-term costs—stealing a car, for example, and getting caught, or taking illegal drugs, or engaging in premarital sex and getting pregnant. The youth who was caught might prefer ex post not to have stolen the car, but, conditional on being caught, the teen then faces the prospect of coping with an acute, painful state in the present in which the magnitude of the present pain (negative utility) exceeds the (discounted) present value of the possibly brighter future once the acute pain is past. The hyperbolic discounter has even more trouble than the "ordinary" discounter in moderating present pain with the hope for future pleasure—just as he has trouble moderating present exuberance with the anticipation of future pain.

Much unhappiness in teens may be related to romantic issues. In the same way that divorce is closely linked with suicide among adults, increasingly early sexual intimacy may contribute to intense turbulence in the relationships between adolescent sex partners; disappointments, conflict, and rejection in these physically intimate relationships among immature partners may lead to acute despair. It is possible that increased sexual activity among teenagers, stimulated by a number of factors since the 1960s, including the increased availability of safer and more effective contraception, has been a cause of youth unhappiness and increased suicide.

Families may be important in preventing youths from undertaking these types of actions, and the decline of the traditional family type may thus have led to increased suicide through the resulting influence on impulsive, long-term detrimental behavior. It is important to note that engaging in these activities may increase happiness among youths on average but may still lead to more variance in happiness, resulting in more youth suicides.

Beyond the immediate family, membership in social organizations is also a strong correlate with happiness. The decline in social capital discussed by Putnam (2000) and Putnam, Leonardi, and Nanetti (1994) may have created a rise in teenage unhappiness; indeed, Durkheim ([1897]

1966) argued that traditional societies with tight social connections had lower suicide rates.

5.2.2 The Strategic-Suicide Theory

A second explanation for youth suicide may be that suicidal behavior is designed, not to produce death, but merely to signal unhappiness and thus change the distribution of family resources. We think of this theory as applying to attempted suicides more than to successful suicides. The value of suicide as a signal may be direct or indirect. In some cases, the signal will convince adults that children are truly unhappy, and, thus, parents will devote more monetary or time resources to the child. Such a signal may be particularly credible in a repeated interaction. In other cases, the parent might not want to distribute more resources to the child, but the internal or external psychic cost (perhaps embarrassment) at having a child attempt suicide will induce the parent to do so anyway. If parents are sufficiently powerful in all respects, then self-harm may offer the only means available to the child of punishing the parents.

To formalize this, we consider a child with utility function $V(T, Z)$, where T is the amount of time or money that the parent transfers to the child, and Z is a vector of other factors that influence child happiness. Parents derive utility from their own consumption $[U(Y - T)]$ and the happiness of their child $[aV(T, Z)]$. The child's happiness, Z, is known to the child but not to the parent.

Children who are unhappy may want more parental input.[7] If child utility cannot be observed by the parent, children need to signal this unhappiness. Suicide attempts are a credible signal if there is some probability that they succeed and if the utility loss from death is smaller for unhappy children. The appendix shows that, if parents have no observable information about child happiness, the equilibrium is where children with $Z < Z^*$ attempt suicide and children with $Z > Z^*$ do not. The appendix also shows that suicide attempts are more common where Y is higher and thus there are more resources that suicide can help transfer.

The intuition for these results is simple. Children will want to communicate their unhappiness to parents so that they can get more resources. Suicide is a signal of this because a child who is less happy values future life less than one who is happier. As a result, children know that attempting suicide will convince their parents that they are not happy. But, for the signal to be transmitted, it must be the case that sometimes the event happens—on occasion, the child must die.

This prediction that suicide attempts will be more common when parental resources are greater—because there is more to redistribute—is the

7. Formally, this is a statement that $d^2V/dTdz < 0$—the value of parental resources is greater when the child is exogenously less happy.

central prediction for the strategic-suicide theory. This is opposite to the pure-depression theory, according to which a lack of parental resources induces child unhappiness and thus increased suicide attempts. We test for strategic suicide by examining how suicide attempts are related to family structure and income.

5.2.3 The Contagion Theory

Durkheim argued that suicides are imitative. He gives the example of fifteen prisoners who hung themselves from exactly the same hook in a Parisian prison and argues that this shows the power of social imitation. Several epidemiological studies (e.g., Gould et al. 1994) suggest that social contagion is a stronger factor in teen suicides and suicide attempts than in those by adults. It is not surprising to find that adolescents seem to be particularly influenced by their peer group in this form of high-risk behavior.

Contagion may operate in several ways. A member of a group who commits suicide may cause grief and stress within the group; this stress may decrease the ability of the group to buffer the problems faced by other members of the group or make suicide among other members more rational. People may also learn from the suicidal behavior of others: they may gain more exact information about the pain or discomfort involved in a particular action, and they may gain information about its probable effectiveness in accomplishing some end.

An important mechanism may involve the increase in the signal value of a suicide if some aspects become stylized. If a fifteen-year-old boy commits suicide, then other fifteen-year-old boys may draw more than the usual amount of attention for similar behaviors. If one person attempts or completes suicide using a particular method, then others may draw more than the usual attention by using a similar method, within the time frame during which the environment is sensitized to respond. As the signal becomes more stylized, the "receiver" can become more sensitive in detecting the signal. As the signal reception increases in sensitivity, the minimum effective signal can become less intense: social contagion may therefore lead to an increase in frequency, but a decrease in severity, of suicide attempts. Since bad news is more often reported than good news, an increase in the effective group size to which adolescents are exposed (which could have occurred, e.g., through the growth of the role of television [e.g., Phillips and Carstensen 1986]) could directly contribute to a rise in the rate of suicide.

At a certain point, the environment may "catch on" to the changing significance of the stylized attempt and react to less severe attempts with less attention. This may reduce suicide attempts on the part of those with only a small desire to attempt suicide. But a more sinister form of social contagion may also be set in motion. Members of a group may collude

(covertly) to provoke an *escalation* of tactics leading to the martyrdom of at least one member of the group. One successful suicide (especially if widely advertised) may greatly refresh the credibility of the less lethal threats made by other members.

This may have been the basis for the provocations described in the case of Jurgen Peters. It is not so much that the other young men in the crowd were acutely suicidal—presumably they were a more or less random draw of young men who happened to be nearby, with no more than the average share of despair typical for young men in that community at that time—but they may have identified with Jurgen's age and gender, and each young man in the crowd might have expected his own reputation for possible dangerous action to rise with Jurgen's violent death. In fact, if they did not know him, his death may have been no loss to them at all—only an emblematic event that enhanced their own strategic position in the community.

The South Boston story also highlights many of these potential effects. The first teen's accidental death made him a martyr whom other teens wanted to imitate. And, as the seriousness of the epidemic grew, even hints of suicide thoughts would be taken more seriously.

5.2.4 The Instrumentality Hypothesis

The final theory is the instrumentality hypothesis—that access to lethal means increases suicides. This theory stresses the immediate costs and benefits of suicide, not the long-term forward-thinking behavior of the other models. In this theory, suicide is impulsive, and access to the appropriate method at the right time can determine whether a suicide occurs.

The instrumentality explanation is most commonly applied to access to guns. As we saw above, teenagers overwhelmingly commit suicides using guns. Brent et al. (1991) and Brent et al. (1993) show that adolescents who committed suicide were about four times as likely to live in a home with any gun than were a matched group of community or psychiatric controls and were thirty-two times more likely to have lived in a home where a gun was kept loaded. The availability of guns differs greatly over space and thus could explain some of the geographic distribution of youth suicide. Beyond firearms, there is some evidence that differences in access to lethal methods—tall buildings in Manhattan (Marzuk et al. 1992), coal gas in the United Kingdom—may be associated with differences in rates of completed suicide.

The counterhypothesis is that lethal means of one kind or another—for example, hanging or jumping from a height—are so widely available that a suicidal person will simply substitute one method for another, depending on which one is more accessible. A classic example is bridge barriers: if one bridge is fenced, the suicidal person may simply find another nearby bridge to use instead (O'Carroll and Silverman 1993).

The strongest evidence against the instrumentality theory is noted above: youth-suicide rates have increased the most in areas where guns have historically been the most plentiful—rural, Western states. The instrumentality theory would predict the opposite, that suicide rates would rise most in urban areas with high poverty, where guns have become increasingly common in more recent years.

There could be another, more subtle role for instrumentality, linked to the social-contagion models described above. Perhaps there has been an increase in nonlethal suicide attempts, driven by an increase in the availability of dangerous but usually nonlethal methods: for example, prescription psychotropic medications, which came into more common use starting in the 1960s.

5.3 Evidence on Suicide Attempts

We start our empirical analysis by looking at suicide attempts. We examine attempts with an eye to which of our four theories appears to offer the best prediction of adolescent self-injury.

The data that we use are from AddHealth. AddHealth is a nationally representative stratified random sample of U.S. high school students in the ninth to the twelfth grades; the survey is based on direct interviews with the adolescents themselves, their parents, and school administrators and covers a wide range of topics concerning risk and protective factors for high-risk adolescent behavior. Our sample consists of 17,004 adolescents between the ages of twelve and eighteen in 1996 for whom we have the necessary observations from the first wave of the AddHealth survey. The key features of the results presented here can also be observed when we consider outcomes in wave 2, but the 25 percent sample attrition between waves makes these results less statistically significant.

Our primary dependent variable is whether the youth reported a medically screened suicide attempt. We focus on medically screened attempts to get some measure of severity of attempt. Reporting issues may also influence whether some youths report less severe suicide attempts. We also examine reports of suicide attempts whether or not they were treated medically. Our results are very consistent across these two samples. We note one obvious feature of this sample: youths who successfully committed suicide are not in the sample. Thus, these data tell us about the determinants of "unsuccessful" suicide attempts only. Four percent of teens reported making a suicide attempt in wave 1, and 1 percent reported a suicide attempt that resulted in some kind of medical contact.[8]

We relate the probability that the teen has made a suicide attempt to a variety of factors reflecting the different theories outlined above. Table 5.5

8. In wave 2, 0.7 percent of teens reported making a medically screened attempt.

Table 5.5 Summary Statistics for Individual Data

Category	Variable Name	Mean	S.D.	Minimum	Maximum
Attempted suicide	Medically treated	1.0%		0	1
	Any attempt	4.0%		0	1
Demographics	Female	50.7%		0	1
	Black	22.3%		0	1
	Asian	7.8%		0	1
	Native American	3.5%		0	1
	Urban	31.5%		0	1
Age dummies	12	2.6%		0	1
	13	11.1%		0	1
	14	13.6%		0	1
	16	20.0%		0	1
	17	19.8%		0	1
	18	14.8%		0	1
Employment and income	Family receives public support	27.3%		0	1
	Annual family income (normalized)	.0	.9	−.88	18.47
	Mother's labor force participation	70.7%		0	1
Family structure	How often mother not home in evening	1.5	1.1	1	5
	How often father not home in evening	2.5	1.7	1	5
	Never knew father	4.0%		0	1
	Knew father, father not now in home	34.0%		0	1
	Stepfather in home	8.0%		0	1
Interaction with parents	Relationship with mother	1.5	1.1	0	5
	Relationship with resident father	.9	1.1	0	5
	Relationship with nonresident father	.2	.8	0	5
Sexual activity	Ever had intercourse	39.2%		0	1
	Ever raped (females only)	3.7%		0	1
Violence and delinquency	Delinquency score (normalized)	.0	1.0	−.75	7.97
	Violence: used weapon	.3	1.0	0	11
	Violence: got hurt	.2	.5	0	5
Drugs and alcohol	Ever use hard drug	7.4%		0	1
	Any problem with alcohol	35.0%		0	1
Participation	Total clubs	1.7	2.4	0	33
	Belongs to honor society	7.6%		0	1
	Participates in weekly sports	30.8%		0	1
	Hours/week watching television	2.3	.9	0	3
Contagion	Friend has attempted suicide	17.4%		0	1
	Friend has died by suicide	2.9%		0	1

Table 5.5 (continued)

Category	Variable Name	Mean	S.D.	Minimum	Maximum
	Relative has attempted suicide	4.4%		0	1
	Relative has died by suicide	.9%		0	1
Depression	Depression score (normalized)	.0	1.0	−2.41	5.85

Note: Data are from AddHealth. Sample size is approximately 18,000.

describes these variables and shows the means and (where appropriate) standard deviations. Our first measures are demographic controls: age (in single years), gender, ethnicity, and urban residence.

To capture family resources, we include family-income and employment variables. The strategic-suicide theory argues that more family resources should increase suicide attempts. The rational-suicide explanation argues that more family resources should decrease suicide attempts if lower levels of resources are associated with decreased happiness among youths.

We also include measures of family structure and interactions with parents: how often the mother and father are home in the evening; whether there is a father present physically or in the life of the teen; and the teen's relationship with the mother, with a resident father, and with a nonresident father. The relationship variables are measured on a five-point scale aggregating questions about the frequency of specific activities and interactions between the teen and the parent. The strategic-suicide theory suggests that having a father present but not around should increase suicide attempts, as should a worse relationship with parents. The depression theory suggests that being without a father entirely should be worse than having a parent around but not in the household.

We include a variety of measures of activities of the teen, including measures of sexual activity (a dummy variable for whether the teen has ever had sexual intercourse; a dummy for whether the teen has been raped), measures of violence and delinquency (a normalized delinquency score; whether the teen has ever used a weapon; and whether the teen was hurt by violence), measures of drug and alcohol use (dummies for hard drug use or alcohol problems), and participation in various clubs (the total number of clubs; membership in an honor society; whether the child participates in sports; and the number of hours per week spent watching television). These partly measure happiness and partly measure the potential for conflict. The happiness theory suggests that teens who engage in these activities but have bad outcomes should attempt suicide more.

A clear issue with these variables is the endogeneity problem: children who take drugs more, for example, may be more likely to attempt suicide

for other reasons. Without instruments for these teen activities, we cannot resolve the causality question.[9] We thus primarily think of these regressions as correlations more than a strict theory of causation. Some inferences can be made, however, by comparing the effect of different activities on suicide rates. The happiness explanation argues that teens who engage in these activities but suffer adverse outcomes (e.g., being arrested for drug use) would be more likely to commit suicide. Teens who engage in these activities but do not suffer adverse outcomes, however, would be no more likely to commit suicide.

We also include measures of social contagion: whether a relative or friend has attempted suicide and whether a relative or friend has successfully committed suicide. These variables permit particularly valuable tests of the social-contagion theory.[10]

Table 5.6 shows our regression results. We report OLS estimates for ease of interpretation; logit and probit models had very similar qualitative and quantitative results (when expressed as changes in probabilities). Recall that the dependent-variable mean is 1 percent, so small coefficients are to be expected. The first column of the table includes the basic demographic variables (which are included in all regressions) and the variables for family income and employment. The first row shows that girls are 0.8 percentage points, or 56 percent, more likely to report a relatively serious suicide attempt than are boys. This is consistent with the raw data described above: boys complete suicides more than girls, but girls attempt suicide more than boys. The next set of variables indicates ethnicity; Native American teens have 67 percent higher rates, Asian American teens have 23 percent higher rates, and African American teens have 10 percent lower suicide-attempt rates than white teens. These rates are not statistically significant, although they are statistically significant predictors of having attempted a suicide (whether or not it was medically treated).

There is a nonlinear relation between suicide attempts and age. Attempted suicides rise from age twelve to age fifteen (the omitted age dummy) and then decline. This stands in stark contrast to successful suicides, which rise sharply over these ages. One possible explanation for these results is that teenage independence increases at age sixteen, for example, the ability to drive. As such, the need either to signal parents or to punish them through self-damage may decrease with increasing age.

The next variables in the first column are for family economic status.

9. While AddHealth has a longitudinal component, even longitudinal data would not solve the endogeneity problem. It would still be necessary to know why teens start to engage in these activities.

10. One might worry somewhat about depression running in families and thus there being a common genetic component to suicide. Our results are similar for friends and relatives, however. One might also be worried about the self-selection of friends. Without instruments for one's friends (and it is not clear what such instruments might be), we do not have a way of addressing this issue.

Table 5.6 **Explaining Suicide Attempts among Youths (dependent variable: medically treated suicide attempt)**

Category	Variable Name	(1)	(2)	(3)	(4)	(5)	(6)
Demographics	Female	.008**	.008**	.010**	.005**	.008**	.008**
		(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
	Black	−.002	−.002	−.001	−.0002	−.001	−.001
		(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
	Asian	.002	.004	.005*	.003	.006**	.004
		(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
	Native American	.006	.005	.002	.004	.002	.001
		(.004)	(.004)	(.004)	(.004)	(.004)	(.004)
	Urban	−.001	−.001	−.001	−.0004	−.002	−.002
		(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Age dummies	12	−.006	−.005	.000	−.003	.001	.002
		(.005)	(.005)	(.005)	(.005)	(.005)	(.004)
	13	−.001	−.001	.002	−.0004	.002	.003
		(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
	14	−.001	−.001	.001	−.0003	.0003	.001
		(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
	16	.000	−.002	−.001	.0006	−.002	−.002
		(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
	17	.001	−.001	.000	.001	−.0006	−.001
		(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
	18	−.000	−.003	−.002	.000	−.0008	−.001
		(.003)	(.003)	(.003)	(.003)	(.003)	(.003)

(*continued*)

Table 5.6 (continued)

Category	Variable Name	(1)	(2)	(3)	(4)	(5)	(6)
Employment and income	Family receives public support	.004** (.002)	. . .	. . .	. . .	−.001 (.002)	−.002 (.002)
	Annual family income (normalized)	−.002** (.001)	. . .	. . .	. . .	−.001 (.001)	−.0008 (.0008)
	Mother's labor force participation	.005 (.002)	. . .	. . .	. . .	.001 (.001)	.001 (.002)
Family structure	How often mother not home in evening	. . .	.0002 (.0007)	. . .	. . .	−.0006 (.001)	−.001 (.001)
	How often father not home in evening	. . .	−.0000 (.007)	. . .	. . .	−.0000 (.001)	−.0001 (.001)
	Never knew father	. . .	.009** (.004)	. . .	. . .	.007 (.004)	.006 (.009)
	Knew father, father not now in home	. . .	.007** (.003)	. . .	. . .	.005* (.0025)	.005** (.0025)
	Stepfather in home	. . .	.002 (.003)	. . .	. . .	.0007 (.003)	.0000 (.003)
Interaction with parents	Relationship with mother	. . .	−.002** (.001)	. . .	. . .	−.0015** (.0007)	.001 (.0008)
	Relationship with resident father	. . .	.000 (.001)	. . .	. . .	.0006 (.001)	.001 (.001)
	Relationship with nonresident father	. . .	−.003** (.001)	. . .	. . .	−.002** (.001)	−.002 (.001)
Sexual activity	Ever had intercourse	. . .	. . .	.002 (.002)	. . .	.001 (.002)	.0007 (.003)
	Ever raped (females only)	. . .	. . .	.029** (.004)	. . .	.027** (.004)	.025** (.004)
Violence and delinquency	Delinquency score (normalized)	. . .	. . .	.005** (.001)	. . .	.005** (.001)	.003** (.001)
	Violence: used weapon	. . .	. . .	.004** (.001)	. . .	.001 (.001)	.001 (.001)

	Violence: got hurt	. . .	. . .	.015**	. . .	.014**	.013**
				(.002)		(.002)	(.002)
Drugs and alcohol	Ever use hard drug	. . .	. . .	.024**	. . .	.024**	.022**
				(.003)		(.003)	(.003)
	Any problem with alcohol	. . .	. . .	.003	. . .	.002	.001
				(.002)		(.002)	(.002)
Participation	Total clubs	. . .	. . .	.0000	. . .	−.000	.0000
				(.0004)		(.001)	(.0004)
	Belongs to honor society	. . .	. . .	−.002	. . .	−.0005	−.0004
				(.003)		(.003)	(.003)
	Participates in weekly sports	. . .	. . .	−.0006	. . .	−.0004	.0005
				(.002)		(.001)	(.002)
	Hours/week watching television	. . .	. . .	−.0003	. . .	−.0005	−.0005
				(.001)		(.0008)	(.0008)
Contagion	Friend has attempted suicide	. . .	. . .	. . .	.012**	.006**	.004**
					(.002)	(.002)	(.002)
	Friend has died by suicide	. . .	. . .	. . .	.039**	.030**	.029**
					(.004)	(.004)	(.005)
	Relative has attempted suicide	. . .	. . .	. . .	.022**	.016**	.014**
					(.004)	(.004)	(.004)
	Relative has died by suicide	. . .	. . .	. . .	.057**	.039**	.039**
					(.008)	(.008)	(.008)
Depression	Depression score (normalized)	. . .	. . .	. . .	. . .	. . .	.007**
							(.0007)
Missing data dummies	Parent questionnaire missing	.0008	.0008	−.0006	.001	.0005	.0000
		(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
	In-school questionnaire missing	.005**	.005**	.002	.005**	.003	.003**
		(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Summary statistics							
N		18,085	17,267	18,260	18,169	17,002	17,001
Adjusted R^2		.003	.0284	.034	.022	.044	.047

Note: Data are from AddHealth. Numbers in parentheses are standard errors.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

Increased income reduces suicide attempts. A one-standard-deviation increase in family income decreases the risk of suicide attempt by almost 40 percent. Similarly, individuals whose families receive welfare are 30 percent more likely to attempt suicide.[11] It is unclear whether the welfare variable is picking up an income effect or a stigma effect; 1996 (the year of the first wave of AddHealth) was the year in which welfare reform was enacted into law, and thus discussion of welfare in a negative context was prominent. The income variables generally support the happiness explanation over the strategic explanation.

The second regression replaces the economic variables with family-structure variables. Teens who live with a single parent have about twice the rate of suicide attempts of those in two-parent families, even when one of the parents is a stepparent. Most surprisingly, we find that teens who know their father but whose father is not now in the home are just as likely to attempt suicide as teens who never knew their father. This is suggestive evidence of the strategic theory: suicide attempts may be a means to get an absent father to pay more attention to his children.

As the next rows show, teens who engage in more activities with their mother and nonresident father are less likely to attempt suicide. There is no such effect for relationship with a resident father. A one-standard-deviation increase in time spent with a mother decreases the risk of suicide attempt by about 27 percent. This is a very substantial effect. The effect of time with the nonresident father but not the resident father again suggests a strategic motive.

The third regression considers the relation between adolescent suicide attempts and other kinds of adolescent behavior. Sexual activity, rape, drug use, alcohol problems, and being hurt in a fight are among the strongest behavioral predictors of suicide attempts. Girls who report being raped are much more likely to attempt suicide than are other girls. Hard drug use more than doubles the risk of suicide attempt. A one-standard-deviation increase in minor delinquency increases the risk of suicide attempt by 25 percent.

Teens who have hurt others are more likely to have attempted suicide, as are teens who have been hurt in conflicts. The latter effect is particularly large; teens who have been hurt in conflicts are 75 percent more likely to attempt suicide.[12] Perhaps self-injurious impulses lead to getting hurt in a fight. Alternatively, being fearful and bullied may precipitate self-injurious impulses.

Membership in an honor society or engaging in weekly sports provided protection from the risk of making a suicide attempt, although not statistically significantly so.

11. In regressions that separate effects by gender, the welfare effect was particularly important for girls.

12. In regressions by gender, boys who have been injured during a fight are two times as likely to attempt suicide.

The evidence is clearly consistent with the happiness theory; unhappiness may cause both suicide attempts and other high-risk behavior. However, the evidence is also consistent with a strategic model: high-risk behavior may lead to negative consequences; suicide attempts may mitigate negative consequences by enlisting a response from the social environment. The evidence could also reflect other factors—perhaps individual biological vulnerability, early development, or present environmental conditions—that jointly influence happiness, suicide attempts, and other high-risk behavior.

The next regression considers the possible effects of social contagion. Teens who know friends or family members who have attempted suicide are about three times more likely to attempt suicide than are teens who do not know someone who attempted suicide. As best we can tell, this finding is causal. When we examine wave 2 data, teens who had not already made a suicide attempt in wave 1 are more likely to attempt suicide if they have a friend or relative who attempted suicide. We also find that teens who have had a family member commit suicide are more likely to report a suicide attempt in wave 1, but only half as likely to make an attempt in wave 2, as other teens. This suggests a complex model of contagion, consistent with our strategic-suicide hypothesis: teens who have experienced the suicide of an intimate may be sufficiently aware of the pain that this causes that they are less likely to engage in a merely symbolic attempt.

There are also significant gender differences in the pattern of social contagion. In separate regressions for girls and boys, girls are more likely to make a suicide attempt if they know someone else who has made an *attempt;* boys are less affected by attempts of other people but more affected by knowing someone who *completed* suicide. This suggests a social mechanism for the difference in completed suicide rates for boys and for girls. Groups of boys may dare and shame each other into maintaining the group's reputation for courage or dangerousness. Girls may be more willing to imitate a "failed" suicide attempt because they do not require the same level of reputation for daring.

The fifth column includes all these different variables together. The results are generally consistent with the regressions including the variables separately. The factors most strongly related to suicide attempts are the interaction-with-parents variables, the teen-activities variables, and the contagion variables.

In the final regression of the table, we add a measure of depression to the regression. The "feelings" scale used in the AddHealth survey is a modification of the Center for Epidemiological Studies Depression Scale (CESD) (Radloff 1977). The CESD is one of the most widely used measures in mental health epidemiology; it has been used in thousands of studies, and its psychometric properties are well-known. The AddHealth measure has dropped two items from the original twenty, rephrased two items, and added one. In the present study, we have standardized the Add-

Health feelings scale with a mean of 0 and a standard deviation of 1. The effect is large; a one-standard-deviation increase in reported depression nearly doubles the suicide risk. More surprisingly, the other variables in the regression generally still affect suicide attempts, even when the depression variable is included. Most of the variables are smaller in magnitude in column 6 than in column 5, but they generally still predict suicide attempts. Thus, not all the effect of these variables on suicides is through their influence on happiness.

Table 5.7 presents estimates of similar models for the broader measure of whether the teen reported attempting suicide, independent of whether it was medically treated. For ease of interpretation, we report only the results including all the variables together (equivalent to col. 5 of table 5.6 above) and that regression including the measure of depression (equivalent to col. 6 of table 5.6).

The results are similar to, and perhaps even stronger than, the results for medically treated suicide attempts. The signs of the coefficients are generally similar, but, because the dependent variable has a much higher mean (4 percent), the coefficients are larger, and more of them are statistically significant. The most important variables predicting this measure of suicide attempts are interaction with the mother and particularly a nonresident father, teen variables such as drug use and having been raped, and the social-contagion variables. The age effects are also pronounced. Suicide attempts peak at age fourteen and then decline through age eighteen. Depression is clearly related to suicide attempts, but it does not fully explain this pattern of results.

5.3.1 The Roots of Depression

To understand the role of happiness in explaining suicide among youths, we consider the determinants of depression among teens. We have already seen the relation between the teen variables and attempted suicides, both with and without depression as a control. These auxiliary regressions will help us determine which of these variables influence suicide through their effect on depression. These variables are also useful as a test of our previous results. Since suicide attempts are relatively rare, it may be that these depression results are more reliable than our results for suicide attempts.

Table 5.8 relates the depression scale to the independent variables included in table 5.6 above. The first regression in table 5.8 shows the relation between our demographic characteristics and depression (recall that the index has a mean of 0 and a standard deviation of 1). The age effects are sizable and different than those for suicide attempts. Younger teens are much less likely to be depressed than are older teens, by about one-third of a standard deviation. Girls are more depressed than are boys. Again the effect is large—nearly one-quarter of a standard deviation. All the racial and ethnic minorities have higher rates of depression than do whites. Living in an urban area also increases depression.

Table 5.7 **Explaining Suicide Attempts among Youths (dependent variable: any suicide attempt)**

Category	Variable Name	(1)	(2)
Demographics	Female	.027**	.033**
		(.003)	(.015)
	Black	−.003	−.005
		(.004)	(.004)
	Asian	.016**	.007
		(.005)	(.005)
	Native American	.010	.006
		(.007)	(.008)
	Urban	.003	.001
		(.003)	(.003)
Age dummies	12	.001	.004
		(.009)	(.009)
	13	.003	.007
		(.005)	(.005)
	14	.009*	.011**
		(.005)	(.005)
	16	−.006	−.007
		(.005)	(.005)
	17	−.002	−.003
		(.005)	(.005)
	18	−.008	−.009*
		(.005)	(.005)
Employment and income	Family receives public support	.003	−.001
		(.004)	(.003)
	Annual family income (normalized)	−.0028*	−.0016
		(.0016)	(.0016)
	Mother's labor force participation	−.001	.001
		(.003)	(.003)
Family structure	How often mother not home in evening	−.0007	−.0017
		(.0015)	(.0014)
	How often father not home in evening	.001	.001
		(.001)	(.001)
	Never knew father	−.008	−.011
		(.008)	(.008)
	Knew father, father not now in home	.006	.007
		(.005)	(.005)
	Stepfather in home	.005	.001
		(.006)	(.006)
Interaction with parents	Relationship with mother	−.0029*	−.0011
		(.0015)	(.0015)
	Relationship with resident father	.001	.002
		(.002)	(.002)
	Relationship with nonresident father	−.006**	−.005**
		(.002)	(.002)
Sexual activity	Ever had intercourse	.000	−.002
		(.003)	(.003)
	Ever raped (females only)	.076**	.065**
		(.008)	(.008)

(*continued*)

Table 5.7 (continued)

Category	Variable Name	(1)	(2)
Violence and delinquency	Delinquency score (normalized)	.016**	.011**
		(.002)	(.002)
	Violence: used weapon	.009**	.009**
		(.002)	(.002)
	Violence: got hurt	.009**	.005
		(.003)	(.003)
Drugs and alcohol	Ever use hard drug	.067**	.062**
		(.006)	(.006)
	Any problem with alcohol	.013**	.009**
		(.003)	(.003)
Participation	Total clubs	.000	.001
		(.001)	(.001)
	Belongs to honor society	−.014**	−.010*
		(.006)	(.006)
	Participates in weekly sports	−.0062*	−.0059
		(.0038)	(.0037)
	Hours/week watching television	−.0032**	−.0028*
		(.0016)	(.0016)
Contagion	Friend has attempted suicide	.042**	.035**
		(.004)	(.004)
	Friend has died by suicide	.028**	.027**
		(.009)	(.009)
	Relative has attempted suicide	.041**	.034**
		(.008)	(.008)
	Relative has died by suicide	.023	.022
		(.017)	(.017)
Depression	Depression score (normalized)	. . .	.033**
			(.002)
Missing data dummies	Parent questionnaire missing	−.001	−.003
		(.004)	(.004)
	In-school questionnaire missing	−.001	−.002
		(.004)	(.004)
Summary statistics			
N		17,003	17,002
Adjusted R^2		.081	.106

Note: Data are from AddHealth. Numbers in parentheses are standard errors.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

Income is positively and strongly associated with happiness. Higher income reduces depression, and being on welfare increases depression. There is no effect of mother's labor force participation on depression. Economists may be surprised that the coefficient for income is not all that large. Absent fathers and mothers appear to be more important than income in predicting depression among teenagers.

Table 5.8 **Explaining Depression among Youths**

Category	Variable Name	(1)	(2)	(3)	(4)	(5)
Demographics	Female	.258**	.251**	.308**	.223**	.270**
		(.014)	(.014)	(.014)	(.014)	(.015)
	Black	.043**	.032**	.090**	.107**	.063**
		(.017)	(.018)	(.017)	(.017)	(.018)
	Asian	.228**	.234**	.269**	.228**	.294**
		(.027)	(.027)	(.026)	(.027)	(.026)
	Native American	.232**	.232**	.179**	.216**	.138**
		(.038)	(.039)	(.037)	(.038)	(.038)
	Urban	.074**	.070**	.077**	.096**	.042**
		(.015)	(.016)	(.015)	(.015)	(.015)
Age dummies	12	−.268**	−.203**	−.114**	−.224**	−.076**
		(.046)	(.047)	(.045)	(.046)	(.045)
	13	−.243**	−.191**	−.135**	−.232**	−.120**
		(.025)	(.027)	(.026)	(.027)	(.026)
	14	−.108**	−.082**	−.052**	−.097**	−.055**
		(.025)	(.026)	(.024)	(.025)	(.024)
	16	.054**	.027	.027	.062**	.029
		(.023)	(.023)	(.022)	(.023)	(.022)
	17	.072**	.023	.040*	.080**	.032
		(.023)	(.023)	(.022)	(.023)	(.023)
	18	.057**	−.009	.030	.078**	.029
		(.025)	(.025)	(.025)	(.025)	(.025)
Employment and income	Family receives public support	.196**	. . .	. . .	. . .	.106**
		(.017)				(.017)
	Annual family income (normalized)	−.051**	. . .	. . .	. . .	−.035**
		(.008)				(.007)
	Mother's employment status	−.074**	. . .	. . .	. . .	−.052**
		(.016)				(.016)

(*continued*)

Table 5.8 (continued)

Category	Variable Name	(1)	(2)	(3)	(4)	(5)
Family structure	How often mother not home in evening		.046**	. . .	. . .	.017**
			(.007)			(.006)
	How often father not home in evening		.021**	. . .	. . .	.030**
			(.006)			(.007)
	Never knew father	. . .	.189**	. . .	. . .	.103**
			(.042)			(.040)
	Knew father, father not now in home	. . .	.042*	. . .	. . .	−.024
			(.026)			(.025)
	Stepfather in home	. . .	.112**	. . .	. . .	−.093**
			(.030)			(.029)
Relationships with parents	Relationship with mother	. . .	−.087**	. . .	. . .	−.053**
			(.007)			(.007)
	Relationship with resident father	. . .	−.066**	. . .	. . .	−.050**
			(.008)			(.007)
	Relationship with nonresident father	. . .	−.039**	. . .	. . .	−.023**
			(.010)			(.010)
Sexual activity	Ever had intercourse	. . .	. . .	.091**	. . .	.049**
				(.016)		(.017)
	Ever raped	. . .	. . .	.401**	. . .	.326**
				(.037)		(.039)
Violence and delinquency	Delinquency score (normalized)	. . .	. . .	.188**	. . .	.166**
				(.008)		(.009)
	Violence: used weapon	. . .	. . .	−.003	. . .	−.015**
				(.007)		(.008)
	Violence: got hurt	. . .	. . .	.138**	. . .	.122**
				(.016)		(.016)

Drugs and alcohol	Ever use hard drugs	. . .	. . .	.199**	. . .	.160**
				(.027)		(.028)
	Ever had problems related to alcohol	. . .	. . .	.113**	. . .	.098**
				(.016)		(.016)
Participation	Total clubs	. . .	. . .	−.018**	. . .	−.014**
				(.003)		(.003)
	Belongs to honor society	. . .	. . .	−.165**	. . .	−.124**
				(.028)		(.028)
	Participates in weekly sports	. . .	. . .	−.043**	. . .	−.008
				(.018)		(.018)
	Hours/week watching television	. . .	. . .	−.018**	. . .	−.012
				(.007)		(.008)
Contagion	Friend has attempted suicide	. . .	. . .	. . .	.325**	.203**
					(.020)	(.020)
	Friend has died by suicide	. . .	. . .	. . .	.165**	.042
					(.045)	(.045)
	Relative has attempted suicide	. . .	. . .	. . .	.381**	.206**
					(.039)	(.038)
	Relative has died by suicide	. . .	. . .	. . .	.079	.033
					(.084)	(.082)
Missing-data dummies	Parent questionnaire missing	.084**	.035*	.049**	.076**	.062**
		(.019)	(.020)	(.018)	(.019)	(.019)
	In-school questionnaire missing	.124**	.119**	.024	.138**	.026
		(.017)	(.017)	(.018)	(.016)	(.018)
Summary statistics						
N		17,245	17,428	17,467	18,283	16,293
Adjusted R^2		.056	.078	.136	.073	.164

Note: Data are from AddHealth. Numbers in parentheses are standard errors.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

The second regression shows that the relationship with one's parents is a very strong determinant of teenage depression. Individuals who never knew their fathers are particularly likely to be depressed, even more so than those who know their father but whose father is not home. Note that these coefficients were about the same in the regressions for attempting suicide. Teens who report more interactions with their parents are much less likely to be depressed. This effect is large and supports the idea that parents' behavior can make a large difference to the happiness of teenagers.

The third regression shows that sexual activity predicts depression. One explanation for this is that romantic turmoil may increase the volatility of emotions, but there are certainly other explanations. Possibly, individuals who have not had sex live in more socially protective environments that fight depression in other ways. Use of drugs and alcohol is also related (not surprisingly) to depression. Again, the direction of causality for these variables is not completely clear. Delinquency is also correlated with depression. Having been hurt is a particularly strong positive predictor of depression, which may partially explain its earlier correlation with suicide attempts. Indeed, in table 5.5 above, the coefficient on having been hurt falls nearly by half when the depression variable is included. These variables may again reflect either direction of causality. It may be, for example, that delinquency leads people to be unhappy or that unhappiness makes delinquency seem relatively more attractive.

There is a significant relation between social interactions and depression. Teens who watch more television are more depressed than are teens that watch less television, and club membership is negatively related to depression. This corresponds well to the well-known correlation between organization membership and happiness in adult surveys. Honors society membership, sports participation, and religion all strongly reduce depression.

It is interesting that the maximum R^2 in our depression model is only 16 percent. The factors that we identify are related to depression, but, detailed as they are, there is substantial variance beyond these factors, and they work through other dimensions as well.

5.3.2 Summary

Our analysis of suicide attempts and teen depression leads us to three conclusions. First, we find clear evidence for the happiness theory. More depressed teens or teens with other problems leading to poor life prospects are more likely to attempt suicide than are other teens. This finding is not surprising. Second, there is strong evidence of social contagion; having a friend or relative attempt or commit suicide increases the risk that a given teen does as well. Third, there is suggestive evidence that the strategic theory is true as well. The age pattern of suicide attempts matches the predictions of the strategic theory—particularly in the light of opposite

findings for depression—as do factors such as the characteristics of an absent father.

5.4 Completed Suicides

Suicide attempts are only part of our interest. We are also interested in the determinants of youth suicide itself. In this section, we examine the factors that predict youth suicide.

As with suicide attempts, we face data problems when attempting to measure suicide completions. In the case of suicide completions, there are very few data on the characteristics of individuals who commit suicide. Death records contain some information but generally nothing about the individual's mood, relations with others, activities, etc. Some psychological-autopsy studies have been performed, but these, too, have problems: the samples are small and the information often sketchy.

Accordingly, we address the problem of suicide completions using a different tack. We examine suicide rates at the national, state, and county level and consider what factors explain differing levels of suicide at a point in time and differing changes in suicide rates over time. Our primary analysis is based on county-level average suicide rates for the period 1989–91. Individual counties are identified only if they have more than 100,000 people. We thus form a sample of all counties identified individually and group the remaining counties into one observation for each state. The result is a sample of 516 county groups. Analysis of county groups is necessarily less convincing than having individual data, but, in this circumstance, individual data are simply not available.

As noted above, suicide completions are very different from suicide attempts. The two behaviors involve different methods and demographic groups. Most psychological-audit studies find that people who successfully commit suicide intend to die, whereas most people who attempt suicide probably do not. Equivalently, we suspect that people who do not strongly want to die but do constitute a small share of total suicides. Accordingly, we move away from considerations of strategic suicide attempts in our analysis of completed suicides. We instead consider the factors that would lead to more people truly wishing to end their lives.

This leaves us with three principal theories of suicide to test: the rational theory; the contagion theory; and the instrumentality theory. We examine the evidence for each of these theories in this section.

5.4.1 A First Test of Contagion

We start by considering possible evidence of contagion in suicide rates. To do this, we borrow a technique from Glaeser, Sacerdote, and Scheinkman (1996) and examine the excess variance of suicide rates across areas. The idea is simple. If each individual has a probability p of committing

suicide, different areas will on average have a share p of people commit suicide, with some variance around that. Because p is a binomial variable, the variance of the theoretical suicide rate across areas is known. Contagion in suicide will make some counties have a higher suicide rate and other areas have a lower suicide rate. This would show up as an excess variance of the suicide rate across counties, even if the mean suicide rate is unaffected. Thus, a nonparametric test of suicide contagion is to compare the theoretical variance of suicide rates across counties with the actual variance of suicide rates across counties.

Formally, the test is the following. The social interaction index is defined as follows:

$$\text{social interactions index} = \frac{\text{var}\left[(p_j - p_{\text{US}})\sqrt{N_j}\right]}{p_{\text{US}}(1 - p_{\text{US}})}, \tag{1}$$

where N_j refers to the population of county j, p_j is the suicide rate in county j, and p_{US} is the suicide rate in the United States as a whole. If there are no social interactions, the index should take on a value of 1.

In evaluating youth suicides, the index value is 156—substantially above the expected value. For adult suicide, the index value is 50—still high but much smaller than that for youths. By comparison, comparable numbers for robbery and murder are 400 and 10, respectively. The implication is that teen suicide has significant social interactions, at least relative to adult suicide.

5.4.2 Explaining Suicide Rates across Counties

In the light of this result, we now look at several predictors of the youth-suicide rate across counties designed to proxy for our different theories. Variable descriptions and means are reported in table 5.9. We include basic demographic controls for urbanicity (dummy variables for large urban area, small urban area, farm) and the share of the area that is black, Native American, and Asian American. Our primarily explanatory variables are grouped into three categories. The first variable is the logarithm of median income in 1989, taken from the 1990 census. In our regressions for suicide attempts, income was significantly negatively associated with attempted suicide. The rational theory suggests that income should be negatively associated with completed suicides as well.

Our second variables are measures of family characteristics—the share of women in the county who are divorced, the share of children who are stepchildren, and the share of female-headed families. These variables are similar to the family-structure variables in our models for attempted suicide. It is important to note that these variables refer to current living status as of the time of the 1990 census. For example, the female divorce

Table 5.9 **Summary Statistics for County Data**

Variable	Mean
Youth-suicide rate (%)	12.6
Urbanicity:	
Large urban area (%)	64
Small urban area (%)	11
Farm (%)	1
Demographics:	
Black (%)	10
Native American (%)	1
Asian (%)	2
Economic:	
ln(median income) ($)	10.31
Family structure:	
% females currently divorced	9
% children living with stepparent	5
% households with female head	18
Means:	
Share who own guns (%)	44
Share who hunt (%)	8

Note: All observations are for 516 county groups, with the exception of gun ownership, which is present for 494 county groups.

rate is the share of women who are divorced and have not remarried. If the woman were remarried, she would report herself as married in the census. These measures are not ideal for our purpose—we would prefer to know the share of women who have ever been divorced, but this information is not available. About 9 percent of women are divorced, 5 percent of children live with a stepparent, and 18 percent of households are female headed.

Finally, to test the instrumentality theory, we include the share of people who own guns and the share of people who hunt. Gun ownership is measured at the state level in the National Opinion Research Center's General Social Survey (GSS) between 1972 and 1994. We aggregate these years to get precision; still, the variable is somewhat suspect because, while the GSS is designed to be representative at the national level, it is not representative at the state level. The share of people who hunt is measured at the county level by the U.S. Department of the Interior. Close to half of all people own a gun, while only 8 percent hunt.

Table 5.10 shows regressions relating these variables to youth-suicide rates. The first regression includes just urbanicity and demographic controls. The racial variables enter as expected. Percentage black is (insignificantly) negative, and percentage Native American is significantly positive. Percentage Asian is also positive. This corresponds with the basic ethnic patterns described above. We find no particular relation between

Table 5.10 **Explaining County Suicide Rates**

Variable	Youths (1)	(2)	(3)	(4)	(5)	(6)	(7)	Adults (8)
Urbanicity:								
Large urban	2.51	3.30	−2.23	.77	−1.61	−.19	−.83	−2.00
	(2.31)	(2.30)	(2.38)	(2.40)	(2.47)	(2.69)	(2.21)	(2.43)
Small urban	1.70	1.57	−4.60	−.89	−2.88	−2.99	−2.07	−5.24
	(4.51)	(4.46)	(4.50)	(4.54)	(4.53)	(5.69)	(4.03)	(4.34)
Farm	45.17**	23.98	57.11**	45.74**	19.98	45.63*	24.98	−14.83
	(23.46)	(23.97)	(22.81)	(23.27)	(24.95)	(24.65)	(23.47)	(18.8)
Population > 1,000,000	−1.01	−.75	−1.09	−.78	−.75	−.29	−.58	−.56
	(1.47)	(1.45)	(1.42)	(1.47)	(1.44)	(.75)	(1.27)	(.56)
Demographics:								
Black	−3.82	−7.67**	−4.67	−13.37**	2.55	−3.49	2.21	−5.97
	(3.03)	(3.19)	(2.93)	(4.49)	(5.11)	(5.13)	(4.86)	(3.96)
Native American	75.47**	69.86**	64.11**	68.60**	59.22**	56.47*	54.12**	25.50
	(13.72)	(13.67)	(13.43)	(13.77)	(13.35)	(30.45)	(11.83)	(15.53)
Asian	10.62*	13.63**	11.68**	13.27**	8.92	−37.83**	−19.17**	9.21
	(6.16)	(6.15)	(5.97)	(6.28)	(6.10)	(10.56)	(13.61)	(8.21)
Economic:								
ln(median income)	. . .	−5.72**	. . .	. . .	−10.19**	−1.84	−.054	−5.87*
		(1.63)			(2.62)	(3.38)	(2.77)	(3.55)

Social characteristics:								
% females now divorced	. . .	. . .	111.46**	. . .	162.22*	157.31**	170.31**	121.18**
			(19.01)		(30.80)	(24.99)	(28.51)	(28.58)
Female employment rate	. . .	. . .	. . .	6.56	10.69	−3.05	−10.16	.86
				(5.77)	(7.66)	(7.63)	(7.28)	(7.56)
Share stepchildren	. . .	. . .	. . .	63.58**	−108.77**	−107.77**	−63.33*	−21.52
				(25.76)	(37.46)	(39.54)	(34.02)	(39.74)
Share female head	. . .	. . .	. . .	27.40**	−36.74**	−15.95	−20.10	5.88
				(9.58)	(13.68)	(10.66)	(13.02)	(9.04)
Gun ownership:								
Share owning	. . .	. . .	. . .	. . .	. . .	6.14*	−6.61*	−1.61
						(3.76)	(3.77)	(3.79)
Share hunting	. . .	. . .	. . .	. . .	. . .	. . .	58.41*	18.40*
							(10.39)	(10.50)
Summary statistics:								
N	516	516	516	516	516	494	494	494
R^2	.078	.100	.137	.101	.168	.188	.234	.217

Note: Data are at the county level. Adults are aged 25–64. Numbers in parentheses are standard errors.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

urbanization and teen suicide across counties, but the percentage of the population living on farms positively predicts suicide.

As the second column shows, there is a negative effect of median income on suicide rates, just as the economic model of suicide predicts. As income increases by 25 percent (roughly one standard deviation), the suicide rate drops by nearly 1.4 per 100,000, 11 percent of the mean amount. This is a reasonably large effect. Controlling for income causes the coefficients on race and urban status to become significant.

The third regression shows the effect of the divorce rate in the county on suicide rates. The divorce rate is strongly positive and quantitatively important. As the divorce rate increases by 2 percent (one standard deviation), the suicide rate rises by two per 100,000, 18 percent of the baseline amount. The connection between divorce and suicide at the aggregate level is well-known; Durkheim makes much of it. The usual explanation for this relation is that divorced individuals are more likely to commit suicide. Clearly, this is not the explanation for teen suicides.

There are several possible explanations for the divorce variable. One hypothesis is that more women work when the divorce rate increases and that having mothers who work is bad for teens because it reduces the amount of attention that they receive from parents. The difference in female employment rates in the United States and Europe has been cited by some as a reason for higher suicide rates among teens in the United States compared to Europe. A second theory is that there are more female-headed families in areas where there are more divorces and that children in female-headed families are more likely to commit suicide. From the AddHealth data, we know that the relation between single-parent families and suicide attempts is not particularly strong, so we are somewhat skeptical of this theory. A second explanation is that there are more stepchildren when divorce rates are higher and that conflict between stepchildren and their stepparents increases suicide rates. Again, we saw in AddHealth that there was little effect of a relation with a resident father on suicide, so we are somewhat skeptical of this theory. A third explanation is that, when more families divorce, teens have poorer relationships—but some relationship—with their fathers, and this increases the risk of suicide. In the AddHealth data, the relationship with a nonresident father was strongly predictive of suicidal behavior. Glaeser and Glendon (1998) report that the persons who are most likely to own guns are adult males, especially in the age range of fathers of teenage children. The strategic-suicide theory predicts that access to some parental resources (in this case, access to the father's time or income) predicts higher rates of self-injury than access to the least parental resources. Strategic conflict with parents, or a combination of strategic conflict and access to a gun owned by an adult male, may explain the association between divorce and youth suicide. A final explanation is that

the divorce rate proxies for other factors in a community—social disorder, community conflict, general unhappiness, etc.—that influence youth-suicide rates.

To test these theories, we include measures of female labor force participation rates, the share of children who are stepchildren, and the share of families that are female headed. The fourth regression shows that the latter two variables are both related to suicide but that female labor force participation is not. The fifth column includes these three variables with the female divorce rate. Controlling for female divorce rates, the share of stepchildren and the share of female-headed families have a negative effect on youth suicides. Having a father who was once in the household appears to be more important for suicide than being without a father at all. Unfortunately, we do not have information at the county level on contact between children and absent fathers, so we cannot differentiate between that and other explanations of community factors. As such, the relation between the divorce rate and the youth-suicide rate remains something of a puzzle.

The next two columns show the relation between guns and youth suicide. There is mild evidence for the instrumentality theory. In areas where there is more hunting, suicide rates are higher. But this is not true of gun ownership in general, which we expect would be more closely related to youth suicide. Further, the increase in suicide in rural areas—despite the much more rapid increase in gun ownership in urban areas—casts doubt on the instrumentality theory.

The last column reports results for the suicide rate among adults. The same factors may, or may not, predict adult- and youth-suicide rates. We present the models primarily for comparison purposes. For adults, we find that income is a more significant predictor of suicide than it is for children. Comparing the seventh and eighth columns, the coefficient on income is small and statistically insignificant for youths but negative and statistically significant at the 10 percent level for adults. The greater income effect for adults matches the time-series evidence presented above. Female divorce rates are also related to suicide rates for adults, but the magnitude is one-third smaller than that for youths. This is again consistent with our theories and casual time-series evidence. Finally, we find no evidence that the other social characteristics affect adult-suicide rates and only weak evidence for the instrumentality theory.

5.4.3 Changes in Suicide Rates across States

A second test of these theories is to see whether they predict changes in suicide rates over time. The suicide rate started to increase in about 1950, so we consider data from 1950 to 1990. Data on suicide rates at the county level are not available prior to 1970. Accordingly, we focus on analysis at the state level. Such analysis is less than ideal; there were only forty-nine

states in 1950 (including Washington, D.C.), so our standard errors are large. We thus consider the state-level analysis to be more suggestive than definitive.

Table 5.11 reports regression results for changes in state suicide rates between 1950 and 1990. The first column reports results for youths, and the second column reports results for total suicides. The regressions do not include data on gun ownership or hunting; such information is not available over time. The specification is thus equivalent to column 5 of table 5.10 above. The income effects are consistent for youth suicides but not total suicides. In states where income increased least, the youth suicide rate rose more. Further, the magnitude of the coefficient on income is very similar in the two models of youth suicide. In contrast, income has no

Table 5.11 Explaining Changes in State Suicide Rates, 1950–90

				Youths	
Variable	Mean	Youth	Total	Male	Female
Urbanicity:					
Change in % farm	−.145	−13.48	−.99	−25.09	−6.15
		(11.18)	(9.58)	(20.62)	(6.80)
% annual population growth	.338	−13.02	−16.99	7.14	−16.01
		(26.4)	(22.6)	(48.74)	(16.07)
Change in % urban	.098	−2.35	19.10**	−4.97	3.21
		(9.1)	(7.8)	(16.74)	(5.52)
Demographics:					
Change in % black	.014	−20.22*	−24.26**	−17.64	−5.93
		(10.75)	(9.22)	(19.83)	(6.54)
Change in % Native American	.007	59.02	18.25	95.11	16.59
		(49.93)	(37.64)	(81.04)	(26.72)
Change in % other	.035	9.01	−5.38	16.16	5.02
		(14.73)	(12.63)	(27.18)	(8.97)
Economic:					
Change in log(median family income)	.763	−12.74**	1.58	−11.96*	−3.45
		(3.78)	(3.24)	(6.98)	(2.30)
Social characteristics:					
Change in % women currently divorced/widowed	.075	46.84	46.91	41.10	17.85
		(42.46)	(36.38)	(78.33)	(25.83)
Change in female labor force participation	.301	34.86**	−15.20	47.96**	3.65
		(12.83)	(11.00)	(23.68)	(7.81)
Mean of dependent variable		10.6	1.5	18.1	1.5
Summary statistics:					
N	49	49	49	49	49
R^2		.68	.58	.49	.37

Note: Data are at the state level; Alaska and Hawaii are not included. Numbers in parentheses are standard errors.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

effect on total suicides in the state model but is associated with suicide for adults in the cross-county model (the coefficient from the regression for adults equivalent to col. 5 is −11.60 [2.35]).

The coefficient on the female divorce rate is positive but not statistically significant. Compared to table 5.10, the magnitude is less than one-third as large. Increased female divorce rates are also positively related to overall suicides but not statistically significantly so. In contrast, the female labor force participation rate is significantly related to increases in youth-suicide rates. A 7 percent increase in female labor force participation rates (roughly one standard deviation in the cross section) raises youth-suicide rates by two per 100,000. This effect is not found for total suicides, only for youth suicides. This finding is different from the cross-county evidence, where female labor force participation is not related to youth suicide.

The last two columns differentiate between male and female youth suicides. The coefficients on income, divorce rates, and especially female labor force participation are greater for male suicides than for female suicides. Since male suicide rates have increased more than female suicide rates, this suggests that these results may contribute to the true explanation for rising suicide among youths.

5.4.4 Explaining the Rise in Youth Suicide

The natural question is which of these factors (if any) can explain the increase in youth suicide over time. We use our cross-county regressions to address this since we have more observations and controls with these data. This estimate also allows us to see how well a cross-sectional analysis can predict a time-series change, a valuable exercise in itself.

To address this question, we consider a simple decomposition. Knowing that $\text{pr(suicide)}_j = \Sigma_i \beta_j X_j^i$ where i indexes all the factors that determine suicide, then $\Delta\ \text{pr(suicide)} = \Sigma_i \beta_i \Delta X_i$. Thus, using our estimate of the importance of factors from the previous section, we will ask whether the change in observable variables is large enough to justify the observed overall change in suicide.

The AddHealth data suggested four variables that might seem to be robustly correlated with suicidal behavior at magnitudes that could explain the general rise in suicide: depression; delinquency; relationships with parents; and drug use. The cross-country analysis suggests that cross-sectional differences in teen suicide rates may be related to divorce rates, and both the AddHealth data and the cross-county data suggest that peer pressure or social contagion may amplify the effects of particular social stressors, with the result that adolescents may be affected by such community factors as the divorce rate even if their own individual families are not directly involved.

Since there are no really convincing data on teen depression over time, we know of no direct way to evaluate whether the rising suicide rates have

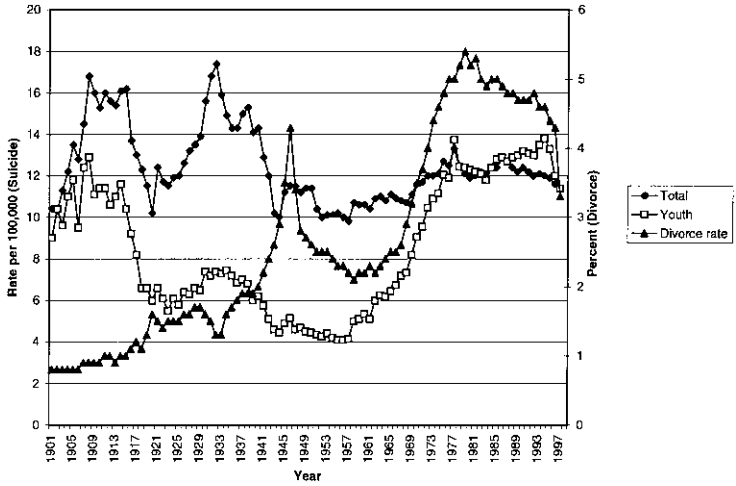

Fig. 5.9 Correlates of suicide rates

resulted from rising levels of teen depression. Indeed, Blanchflower and Oswald (2000) examine data from social surveys in the United States and Western Europe and conclude that mean "happiness" among youths has been increasing, not decreasing, over the last few decades. Of course, this is a statement about the median of the distribution, not the lower tail.

Delinquency and drug use have both risen significantly across this time period. We do not have good data on drug-use increase, and the importance of drugs cannot therefore be estimated. As shown above, there is a relation between the time-series movements of teen homicide and teen suicide. However, we cannot think about the changes in drug use, delinquency, and homicide as exogenous variation, so we leave this issue for further study.

Finally, although we have no national measures of the relationship between parents and children, we can measure the divorce rate. Between 1950 and 1990, the divorce rate rose from 2.3 percent to 8.8 percent. If we use the coefficient estimate from the third column of table 5.10, this suggests that there should have been an increase of 7.22 teenage suicides per 100,000 owing to the increase in the divorce rate. The actual increase was 10.5 suicides. Thus, if we believe this coefficient estimate, and if we treat the increase in the divorce rate as an exogenous variable, the rise in the divorce rate can explain more than two-thirds of the rise in teenage suicide.

Some confirmation of this theory is provided by aggregate time-series evidence. Figure 5.9 shows divorce rates and suicide rates in the twentieth century. In the first half of the century, the two do not seem to be highly correlated. Divorce rates were very low and rose only modestly (from 1 to

2 percent, exclusive of the post–World War II spike), while youth-suicide rates had a general downward trend. Since 1950, however, divorce rates and suicide rates track each other closely. Both were flat in the 1950s, rose in the late 1960s, and plateaued in the mid-1990s. It may be that, when divorce rates were high enough to be a significant factor in community life, trends in divorce rates became a significant driving factor for youths.

Clearly, these regressions and calculations should be taken with numerous shakers of salt, but they suggest that there is at least one coherent theory that can explain the basic facts. At a minimum, this theory deserves much further exploration.

5.5 Conclusion

Youth-suicide rates have tripled in the past three decades, and there are as many as four hundred suicide attempts for every suicide completion. Why the epidemic in youth suicide?

Our analysis of youth-suicide attempts and completions leads us to three conclusions. First, we find that suicide attempts are quite different from actual suicides and lend themselves to a strategic-suicide model. We interpret many youth-suicide attempts as signals of need or as ways to punish parents or other adults. Other suicide attempts are a result of bad things that happen to youths; the link between delinquency, drug use, sexual activity, victimization, and suicide is clear and strong. Some of these reflect the bad outcomes of risks that youths take, while others may be simply a product of the environments in which youths are raised.

It is harder to determine empirically whether completed suicides are the result of what we might consider to be strategic motivations. But we have found evidence for certain common factors that may have influenced the dramatic rise in youth suicide and what has probably been a rise in suicide attempts. The most important of these variables is the female divorce rate. In areas where more women are divorced, youth suicides are greater. This effect is large; if one takes the increase in divorce rates over time in consideration, one can explain as much as two-thirds of the increase in youth suicide.

Social contagion also plays a particularly important role in teen suicide and parasuicide. We find individual-level evidence of contagion in the Add-Health data and statistical evidence of nonrandom clustering in the county-level Vital Statistics. Contagion may involve the direct influence of one teen's suicidal behavior on another, or it may involve more indirect social and cultural processes, but, in either case, these "neighborhood effects" may multiply the effects of government policies or other exogenous shocks.

Economic opportunity plays a mixed role. The strategic-suicide model predicts that suicidal behavior may increase under circumstances where

there are greater resources to be accessed. On the other hand, rising labor force participation may have had a protective effect for young women, and higher income is associated with reductions in suicide at the county level.

The factors that we have identified all deserve more research, but we are reasonably certain that the final answer to this question will have to encompass the data and explanations that we put forth here.

Appendix

The Strategic-Suicide Theory

We show in this appendix that, if parents have no knowledge about child utility, and if transfers substitute for innate happiness, a signaling equilibrium can exist where all children with $Z < Z^*$ engage in a suicide attempt and all children with $Z > Z^*$ do not.

Consider a case where Z^* is the cutoff point for attempting suicide. In this equilibrium, the transfers conditional on attempting suicide solve $U'(Y - T) = aE[V'(T, Z)|Z < Z^*]$, and the transfers conditional on not attempting suicide solve $U'(Y - T) = aE[V'(T, Z)|Z > Z^*]$. We will denote the transfers conditional on attempting suicide as $\overline{T}(Z^*)$ and the transfers conditional on not attempting suicide as $\underline{T}(Z^*)$ for the same Z^*.

Then Z^* must be found so that individuals with that level of innate unhappiness (Z^*) are indifferent between attempting suicide and not, that is, $(1 - d)\ V[\overline{T}(Z^*), Z^*] = V[\underline{T}(Z^*), Z^*]$. From the assumption $d^2V/dTdZ < 0$, everyone with $Z > Z^*$ strictly prefers no suicide attempt, and everyone with $Z < Z^*$ strictly prefers a suicide attempt. In fact, because the prospect of loss of life becomes less important as the teen becomes more unhappy, even with some (bounded) positive values of $d^2V/dTdZ < 0$, it will still be the case that there is a single crossing property where the more unhappy gravitate toward suicide.

Finally, we must prove that there exists a level of Z^* where this signaling equilibrium occurs. In principle, this requires proving that there exists a level of Z^* where $(1 - d)\ V[\overline{T}(Z^*), Z^*] - V[\underline{T}(Z^*), Z^*]$ equals 0. We specifically assume that $V(T, 0) < 0$, so that the most unhappy teenagers would actually commit suicide for nonstrategic reasons, and that $dV(T, 1) > V_1(0, 1) \times Y$, so that the happiest person would never commit suicide. Furthermore, we assume that all the derivatives of $V(T, Z)$ are finite. From the concavity of $V(\cdot\ , \cdot)$, it follows that

$$\text{(A1)}\quad V_1[\underline{T}(Z^*), Z^*][\overline{T}(Z^*) - \underline{T}(Z^*)] - dV[\overline{T}(Z^*), Z^*] > (1 - d)V[\overline{T}(Z^*), Z^*] - V[\underline{T}(Z^*), Z^*] > V_1[\overline{T}(Z^*), Z^*][\overline{T}(Z^*) - \underline{T}(Z^*)] - dV[\overline{T}(Z^*), Z^*].$$

At $Z^* = 0$, the third term is clearly positive since $V(T, Z) < 0$. At $Z^* = 1$, the first term is clearly negative from $dV(T, 1) > V_1(0, 1) \times Y$. As such, $(1 - d)\ V[\overline{T}(Z^*), Z^*] - V[\underline{T}(Z^*), Z^*]$ goes from negative to positive as Z^* rises. The function is always continuous, so there must be at least one fixed point, from standard arguments. As such, as long as the happiest teenager will never attempt suicide and the least happy will always attempt suicide, there will exist an equilibrium where suicide serves as a signal. (In fact, there may exist multiple equilibria in this case if the function $[1 - d]\ V\{\overline{T}[Z^*], Z^*\} - V\{\underline{T}[Z^*], Z^*\}$ is not monotonic.)

The Rational-Suicide Model

To formalize the rational-suicide model, we assume that individuals live three periods (youth, midlife, and old age). In each period, individuals receive a utility level equal to μ_t. Individuals learn the utility that they will receive at the start of each period and at that point decide whether to commit suicide. Utility is assumed to follow a random walk: $\mu_t = \mu_{t-1} + \varepsilon_t$. For simplicity, consider the possibility that ε_t is a binary random variable that takes on values of ε and $-\varepsilon$ with equal probability. Individuals discount the future with a discount factor β (which includes the probability of death from other causes). The expected utility from death is normalized to 0.

In the last period, the individual commits suicide if $\mu_3 < 0$. In the second period, the individual's decision whether to commit suicide takes into account both current utility and the option value of living for a third period. Thus, this individual will commit suicide if second-period utility (if the individual does not commit suicide) is $\mu_2 < -\beta\varepsilon/(2 + \beta)$. In the first period, the individual will commit suicide if $\mu_1 < -(2\beta + \beta^2)\varepsilon/(4 + 2\beta + \beta^2)$.

Thus, the first-period suicide rate will be highest when random shocks are large or when discounting is very high. Obviously, anything that raises the mean level of unhappiness in the first period will also increase suicide.

Just as the basic model predicts, the cutoff for suicide becomes progressively less stringent as people age. The option value of living makes individuals less likely to respond to current happiness. But this does not mean that individuals will be more likely to commit suicide as they age. If $F(\cdot)$ describes the cumulative distribution of μ_1, then the number of suicides in the first period will be $F[-(2\beta + \beta^2)\varepsilon/(4 + 2\beta + \beta^2)]$. The number of suicides in the second period will be $0.5\{F[2\varepsilon/(2 + \beta)] - F[-(2\beta + \beta^2)\varepsilon/(4 + 2\beta + \beta^2)]\}$. There is no reason to think that the number of suicides will increase over time. In the first period, individuals first learn their unhappiness, and the optimal suicide strategy suggests that many of them should be expected to commit suicide initially, as long as there is significant persistence in happiness levels. Further algebra also shows that it is quite possible that the suicide rate declines between youth and middle age and then rises again in old age.

It is worth emphasizing that, in the rational-actor model, individuals in the future will be grateful if the marginal suicide is prevented. The marginal suicide is sacrificing a positive future expected utility to alleviate current unhappiness. Thus, the intertemporal intrapersonal conflict that is most associated with suicide occurs with exponential discounting.

With hyperbolic discounting, it will be the case that individuals would like to commit themselves not to commit suicide at some point in the future. For example, in the model outlined above, if discounting is hyperbolic and individuals discount one period ahead by a factor $\beta\delta$, then the suicide cutoff in the second period will be $\mu_2 < -\beta\delta\varepsilon/(2 + \beta\delta)$. However, with hyperbolic discounting, individuals in period 1 discount periods 2 and 3 by β, so, in period 1, individuals would like to ensure that they will commit suicide only if $\mu_2 < -\beta\varepsilon/(2 + \beta)$. As such, in period 1, individuals would like to prevent themselves from committing suicide in the future in some cases.

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