Understanding Recent Changes in Suicide Rates Among the Middle-aged: Period or Cohort Effects?

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SYNOPSIS

Objective. We examined trends in suicide rates for U.S. residents aged 40 to 59 years from 1979 to 2005 and explored alternative explanations for the notable increase in such deaths from 1999 to 2005.

Methods. We obtained information on suicide deaths from the National Center for Health Statistics and population data from the U.S. Census Bureau. Age- and gender-specific suicide rates were computed and trends therein analyzed using linear regression techniques.

Results. Following a period of stability or decline, suicide rates have climbed since 1988 for males aged 40–49 years, and since 1999 for females aged 40–59 years and males aged 50–59 years. A crossover in rates for 40- to 49-year-old vs. 50- to 59-year-old males and females occurred in the early 1990s, and the younger groups now have higher suicide rates. The post-1999 increase has been particularly dramatic for those who are unmarried and those without a college degree.

Conclusions. The timing of the post-1999 increase coincides with the complete replacement of the U.S. population's middle-age strata by the postwar baby boom cohorts, whose youngest members turned 40 years of age by 2005. These cohorts, born between 1945 and 1964, also had notably high suicide rates during their adolescent years. Cohort replacement may explain the crossover in rates among the younger and older middle-aged groups. However, there is evidence for a period effect operating between 1999 and 2005, one that was apparently specific to less-protected members of the baby boom cohort.

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The year 2005 marked the sixth year in a row of a striking increase in the suicide rate for middle-aged people in their 40s and 50s. News reports,[1–3] government documents,[4] the Internet,[5] and one previous scientific report[6] have noted this trend in an age group that has previously received little attention for its risk of suicide. Although the implicit interpretation of these reports has been age-related, we explored two alternative interpretations.

One explanation is based on birth cohort membership—the upward trend may be due to the already higher suicide rates of cohorts entering midlife during this period, and may, therefore, be only a temporary increase for this age group. Another possibility is that the increase is due to social or historical events occurring during the time period—a so-called period effect. Because suicide rates increased only among those aged 40–65 years,[6] however, the period effect would seem to be limited to those in middle age. Successful efforts aimed at stemming the continued increase could rest on understanding these distinctions. We sought to determine whether the increase was primarily cohort-specific, part of a larger period effect, or some combination of the two.

Compared with the voluminous scientific literature on adolescents, and to a lesser extent on elderly people, research on suicide among the middle-aged has been relatively rare. Indeed, major reports do not focus on this age group at all.[7] Looking at patterns over the life course prior to 2000, age-specific suicide rates for males show a rapid increase in adolescence and young adulthood, a leveling-off or plateau for rates in middle age, and then an increase again in old age. Rates for U.S. females, albeit at a much lower absolute level than those for males, show a similar increase in adolescence and young adulthood, but in contrast to men, rates continue to rise in middle age before declining at older ages.[8,9] Because of this inverted-U configuration for females, middle age is the period when male and female rates tend to be most similar, although males still have rates more than twice those of females.

Studies indicate that historically, the risk of suicide has declined among the middle-aged. Among males aged 45–64 years, rates declined from approximately 60 men per 100,000 in 1930 to fewer than 30 per 100,000 by 1986.[9] Rates for females aged 45–64 years show more cyclical fluctuation, but they also decreased from about 13 women per 100,000 in 1930 to about eight per 100,000 by 1986.[9] Thus, the absence of attention to suicides among the middle-aged has to some extent been due to the overall picture of stability or decline in their rates for previous decades, at the same time that more troubling increases were occurring for adolescents and the elderly.

Because of the consistent patterns revealing moderate suicide rates among middle-aged people, there has been little theoretical attention devoted to this period of the life course. Some have applied Durkheim's theory of suicide—that the nature of individuals' ties to society affects the risk of suicide[10,11]—to explain the middle-aged pattern of stability in suicide rates among men. One study,[12] for example, observed that middle-aged males are normatively in the midst of their family and work lives, at their peak of social integration, and, hence, at a lower risk of suicide than they were before these midlife levels of achievement were reached or than they will be when the losses of old age emerge. Among women, by the 1980s, the mid-century pattern of family orientation had given way to labor-force participation levels much more like those of men.[9] To the extent that recent social role, economic, or other changes have eroded these traditional midlife protections for both males and females, they provide a period explanation for the post-1999 surge in suicide rates.

A cohort explanation, by contrast, would suggest that the recently observed higher rates represent a suicide risk carried uniquely by those cohorts now occupying middle age. People aged 40–49 and 50–59 years in 2005 were born between 1946 and 1964, the postwar baby boom cohort birth years. This cohort, especially males, had notably high rates of suicide while in adolescence.[13] Writing in the mid-1980s, scholars[14,15] drew attention to the birth cohort membership of those with the newly high rates and predicted continued high rates, arguing that those in exceptionally large cohorts are subject to a number of disadvantages that persist throughout the life course, such as greater competition for limited resources (e.g., in schools and the labor market). Others adopted a psychological/cultural approach[16] rather than using cohort size as a mechanism, or emphasized generational identity[17] or the high rates of depression[18,19] and substance abuse[20] among baby boomers, but all noted that something about cohort membership put this group at a continued high risk for the future. Thus, there have been previous cohort-based interpretations of the high adolescent suicide rates for those presently in middle age.

In this article, we explored whether the steady increase in suicides since 1999 among the middle-aged is more characteristic of possible period effects or of birth-cohort membership. A previous report showed that the increase is limited to white males and females, with no evidence of increases among African Americans or other racial/ethnic groups.[6] Thus, we

examined patterns by gender, education, and marital status, but not by race/ethnicity, to see how widespread the increases are and if any groups are at particularly high risk.

METHODS

Data

Mortality data. Information on deaths from suicide by age group and gender was obtained from the National Vital Statistics System.[21,22] We focused only on suicide victims who resided in the U.S. at the time of death. The time period of primary interest (1979–2005) spans the use of both the Ninth and 10th International Classification of Diseases, but the revision does not affect the classification of suicide deaths.[23] Our estimate of the number of suicides by demographic characteristics is unavoidably an undercount due to misclassification of some suicides as accidental or as undetermined in official mortality data.[24–26] However, we do not expect such errors to alter the analysis of trends in suicide rates over time;[24,27] studies reveal that misclassification (e.g., coroners who underreport suicides) in one year tends to occur similarly in subsequent years.

Death certificates have always recorded the age and gender of the decedent, but in more recent years, have started to gather additional data. The U.S. death registration system began to collect information on marital status in 1979 and on educational attainment in 1985. We determined the number of suicides by age group, gender, and marital status or educational attainment for the period of the increase (2000–2005). Information was missing on marital status for less than 1.0% of death certificates and on educational attainment for 5.7% of death certificates for suicide victims aged 40–59 years during this period.

Population data. We obtained estimates of the total mid-year resident U.S. population from the Census Bureau.[28] The Bureau provides population counts by age (in five-year intervals) and gender for each census year, and intercensal estimates of population size for these demographic groups. We used these numbers to compute suicide rates by age group and gender.

The Census Bureau also provides estimates of population size by marital status and educational attainment. We calculated suicide rates by these characteristics for 2000 and 2005, two years for which we could obtain reliable estimates of population size. The 2000 population estimates came from the 2000 Census, which included questions on marital status and educational attainment in its long form administered to one in six U.S. households. The 2005 population estimates by marital status and educational attainment were derived from the American Community Survey, initiated by the Census Bureau in 2004 and given in 2005 to nearly three million U.S. households.[29]

Analytic plan

We began by analyzing trends from 1979 to 2005 in age- and gender-specific suicide rates (the number of suicides in an age-gender group divided by the mid-year population in that age-gender group). We distinguished between younger middle-aged (those aged 40–49 years) and older middle-aged (those aged 50–59 years); we used 10-year age groups to facilitate interpretation of trends. We reported the average annual percent change (AAPC) in suicide rates and determined the statistical significance of trends using linear regression techniques. We estimated the AAPC by fitting a least squares regression line to the natural logarithm of the rates and using calendar year as a regressor variable: ln (rate) = $a + b$ (calendar year); the AAPC = 100 ($e^b - 1$), where ln = natural logarithm, a = model intercept, b = model slope, and e = exponential function.[30]

To identify the possible role of cohort and period effects in explaining the post-1999 surge in middle-aged suicide, we reviewed historical patterns of age-specific suicide rates by birth cohort, comparing the four five-year baby boom birth cohorts with those that preceded them. In this historical review only, we used five-year birth cohorts to maximize information on the trends that emerged since 1999.

Finally, we considered differences and changes in suicide rates by marital status and educational attainment for age-gender groups in the most recent time period (2000–2005). As we did not have reliable population data disaggregated by marital status or education for 2001–2004, we reported the overall percentage change in rates within each group over the time period and used t-tests to assess statistical significance of patterns within and among groups.[31]

RESULTS

Overall trends

During the last two decades of the 20th century, suicide rates had been falling among all age groups. For those aged 65 years and older, declines began in the mid-1980s and for those aged 15–24 years, declines began in the early 1990s.[32] Among middle-aged women, the decline began a little earlier, with suicide rates for women in both ranges of middle age (40–49 years and 50–59 years) decreasing fairly steadily from the early 1980s through the late 1990s. The decline was more substantial among older middle-aged women (2.7%

average annual rate of decline [AARD] from 1982 to 1998, $p<0.01$) than for women in the younger middle-age range (1.7% AARD, $p<0.01$). For older middle-aged men, as was the case for other age groups, the start of the decline was later, around 1987, but from then until 1998, the AARD was also substantial (1.2%, $p<0.01$). For men aged 40–49 years, however, suicide rates remained fairly stable during this period—they did not experience the declines we observed for most other segments of the population. In fact, beginning in 1988, suicide rates for men aged 40–49 years began a slight upward trajectory (Figure 1).

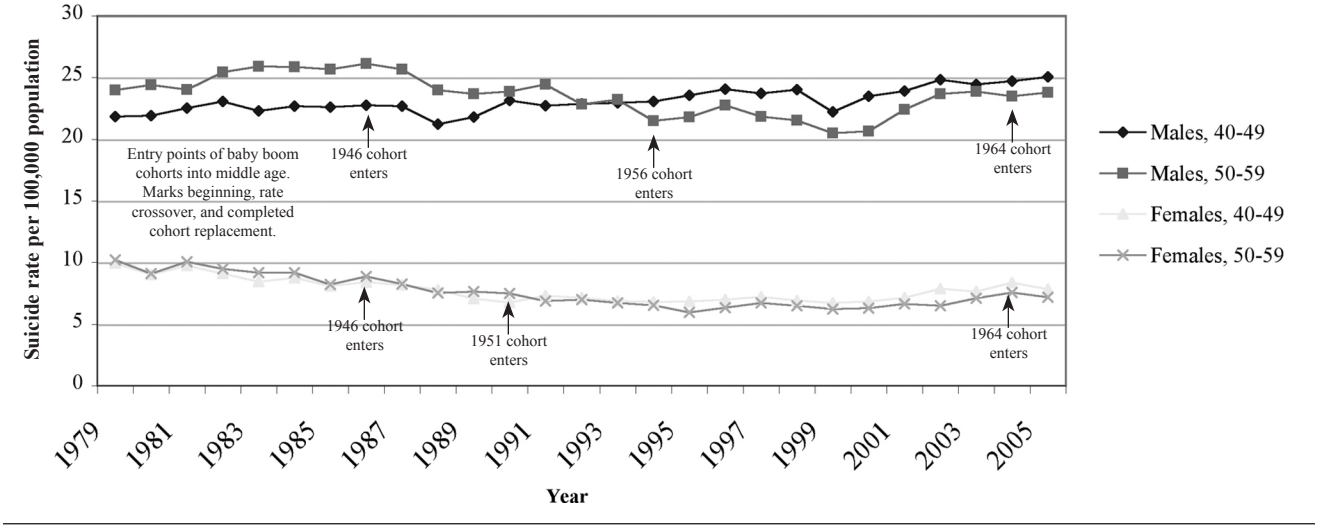
As a result of these trends, a distinct crossover for the rates of younger and older middle-aged people occurred in the early 1990s, ending the traditional pattern of higher rates for the older middle-aged group. Although there is a much smaller absolute difference for the two groups of women, the crossovers occurred for both men and women at almost the same time. Whereas 50- to 59-year-olds had experienced a greater risk of dying from suicide during the 1980s, the pattern had reversed by 1991 for women and by 1994 for men; 40- to 49-year-olds began experiencing higher rates of suicide, and this age-specific difference has continued to the present. Notably, beginning in 1986, the first waves of baby boomers began to move into the middle-age range of 40–49 years. The 1946 birth cohort turned 40 in 1986; by 1996, the 40- to 49-year-old group was composed entirely of baby boomers born from 1946 to 1955. The crossover had already occurred by then, at the year of the entry of the 1951 birth cohort for women, and of the 1954 birth cohort for men.

Consistent with previously reported findings,[4,6] we saw that the sustained decline in suicide rates for males aged 50–59 years and both groups of middle-aged females ended in 1999 when rates began to increase markedly. For men, the risk of suicide increased between 1999 and 2005 at a faster rate for 50- to 59-year-olds (2.8%, $p<0.01$) than for those in the younger age ranges (1.7%, $p<0.01$). For women, rates of increase were similar, with average annual rates of increase of 3.4% ($p<0.01$) for 40- to 49-year-olds and 3.1% ($p<0.01$) for 50- to 59-year-olds. By 2005, when the 1964 birth cohort reached its 40s, the baby boom generation occupied the entire range of middle age (ages 40 to 59).

Age-specific suicide rates over the life course by birth cohort

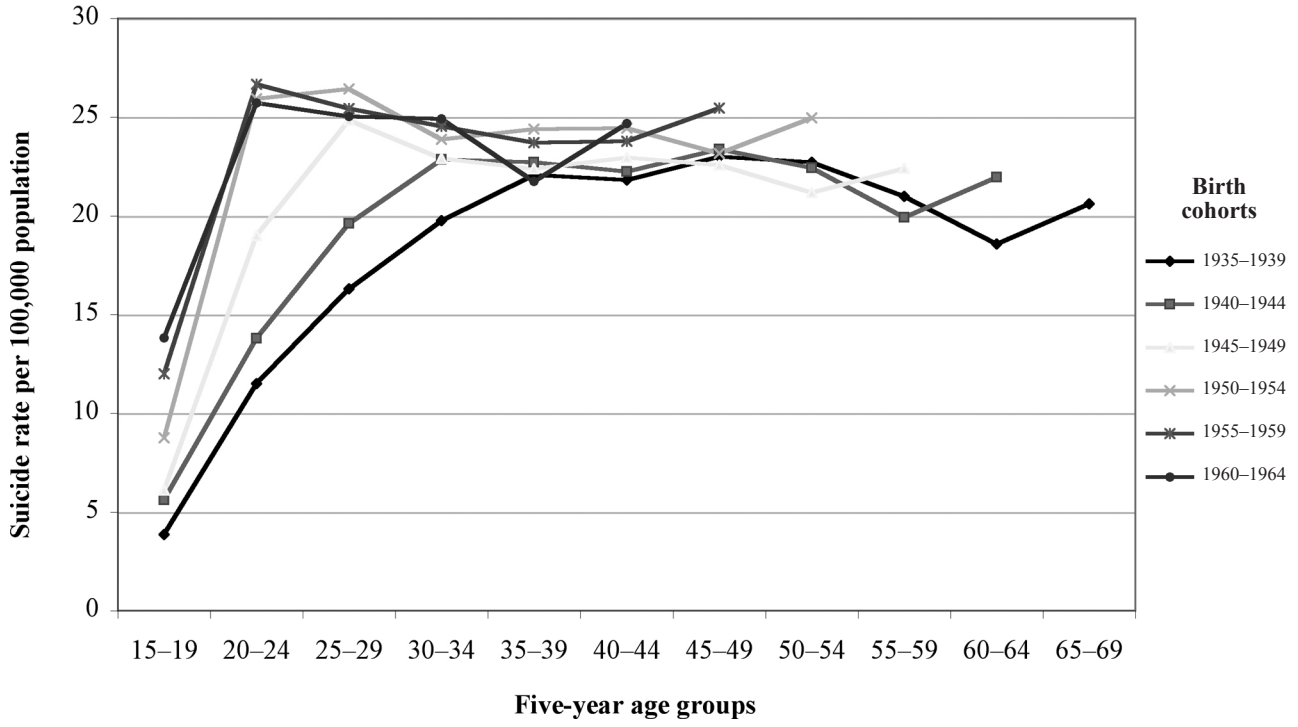
When put into the larger context of birth cohorts going back to 1935, there is evidence for both cohort replacement and period effects in driving the 1979–2005 trends in age-specific suicide rates for males (Figure 2a). The general pattern of suicide risk over the life course is similar for the various male birth cohorts—rapidly rising rates during adolescence and young adulthood, and relative stability in middle age. However, compared with those born between 1935 and 1944, male baby boomers (particularly those born later than 1950) exhibited greater suicide rates in adolescence and young adulthood, and those born during the 1950s experienced higher suicide rates at every age, compared with earlier birth cohorts. As these male boomers entered the middle-age ranges,

Figure 1. U.S. suicide rates by gender and age group, 1979–2005[a]



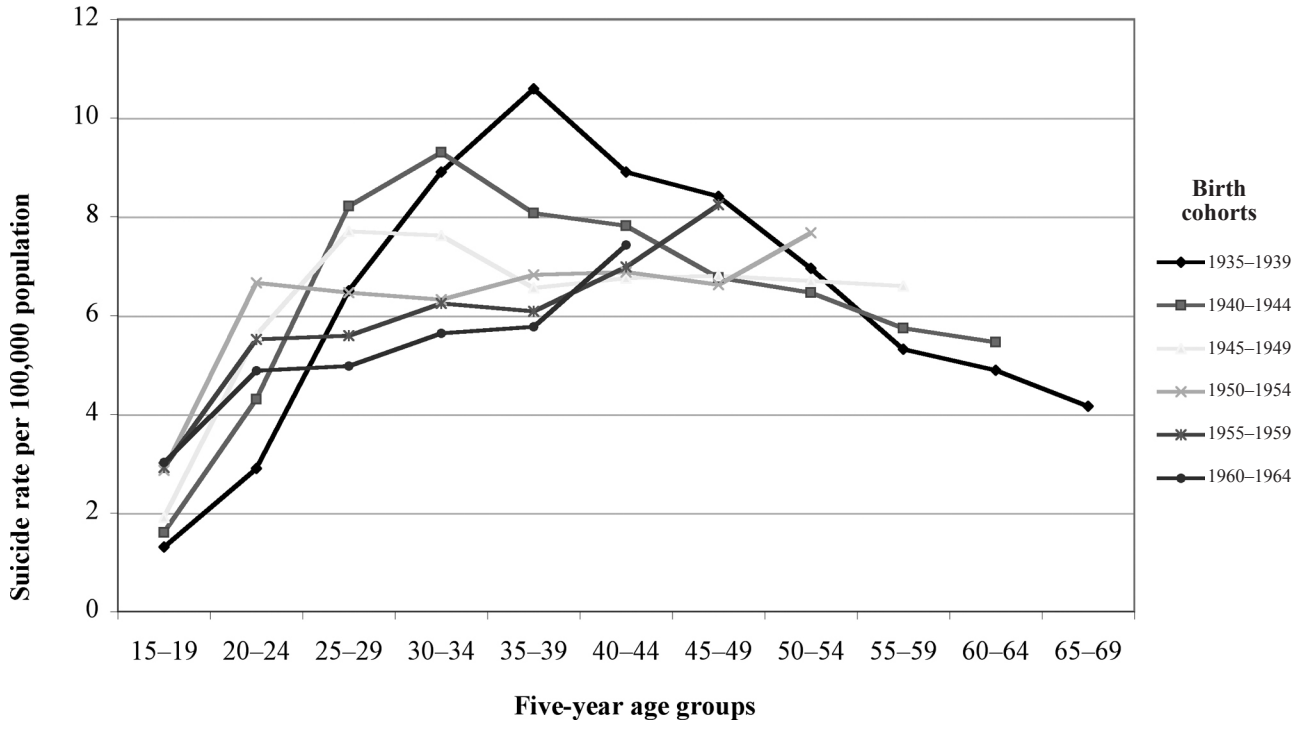
[a]Source: National Vital Statistics System

Figure 2a. Age-specific suicide rates for men by birth cohort: U.S., 1935–1964[a]



[a]Rates computed using National Vital Statistics System and U.S. Census data from 1950 to 2005

Figure 2b. Age-specific suicide rates for women by birth cohort: U.S., 1935–1964[a]



[a]Rates computed using National Vital Statistics System and U.S. Census data from 1950 to 2005

they brought with them this elevated risk for suicide, and, hence, the steadily rising rate of suicide since the late 1980s among males aged 40–49 years.

Yet, cohort replacement alone cannot explain the post-1999 increase in suicide rates. All middle-aged males, including those in their early 60s (born prior to 1945), experienced an unexpected uptick in suicide rates between 2000 and 2005, during a period in the life course when rates have historically been stable. Although suicide rates for men aged 65–69 years also increased during the 2000–2005 period, this rise was less unusual, as suicide rates traditionally increase for males in old age.

Female baby boomers also showed rates during adolescence and young adulthood that exceeded those of the 1935–1939 and 1940–1944 cohorts, but by contrast showed lower rates in their late 20s, 30s, and 40s (Figure 2b). As with the males, we saw the sharp increase for females during the 2000–2005 period, albeit only for the 1950 through 1964 birth cohorts. These patterns are consistent with the notion of a new, increasing risk of suicide among the middle-aged, both male and female, during the most recent period.

Trends by marital status

As expected, the risk of suicide was substantially larger for unmarried than for married people—in 2005, unmarried middle-aged men were 3.5 times as likely to die from suicide as married middle-aged men, and the relative risk of suicide for unmarried middle-aged women was 2.5 to 2.8 times that of married middle-aged women. When we disaggregated patterns for the period 2000–2005 by marital status, we found that the increasing trend held across all married and unmarried segments of the middle-aged population, although the increase was statistically significant only for unmarried people (both males and females) and for married women aged 40–49 years. We also observed larger increases from 2000 to 2005 among unmarried relative to married people for all subgroups, but none of the differences in the rate of increase between the two marital status groups was statistically significant (Table 1).

Trends by educational attainment

We also found interesting distinctions when we considered suicide rates by educational attainment in these cohorts. Suicide rates were highest among less educated people, consistent with prior research.[33–35] Moreover, the educational differential in suicide rates tended to be greater for men than for women. For example, males aged 40–49 years in 2005 with a high school diploma or less education (≤high school) had a risk of suicide about 2.0 times that of those with some college and 2.6 times that of those with at least a college degree. The comparable numbers for females aged 40–49 years with ≤high school were 1.5 times greater than those with some college and 2.0 times greater than those with at least a college degree (Table 2).

Suicide rates were higher to begin with and also increased sharply from 2000 to 2005 for middle-aged men and women who lacked a college degree. For those with ≤high school, the increase in suicide rates from 2000 to 2005 ranged from 12% to 27%. Among

Table 1. U.S. suicide rates by gender, age, and marital status, 2000 and 2005[a]

	Suicide rate per 100,000 population			
Demographic	*2000*	*2005*	*Difference (2000–2005)*	*Percent change (95% CI)*
Males aged 40–49 years				
Unmarried	45.85	51.04	5.19	11.3 (6.0, 16.7)[b]
Married	14.12	14.80	0.68	4.8 (−1.2, 10.8)
Males aged 50–59 years				
Unmarried	43.95	51.97	8.02	18.2 (11.3, 25.2)[b]
Married	13.56	14.28	0.71	5.3 (−1.6, 12.1)
Females aged 40–49 years				
Unmarried	12.26	14.16	1.89	15.4 (5.4, 25.5)[b]
Married	4.36	4.98	0.62	14.3 (3.3, 25.2)[b]
Females aged 50–59 years				
Unmarried	10.56	12.01	1.45	13.8 (1.9, 25.6)[b]
Married	4.34	4.83	0.49	11.3 (−1.2, 23.8)

[a]Source: National Vital Statistics System and U.S. Census Bureau

[b]Statistically significant at $p<0.05$

CI = confidence interval

Table 2. U.S. suicide rates by gender, age, and educational attainment, 2000 and 2005[a]

Demographic	Suicide rate per 100,000 population			
	2000	2005	Difference (2000–2005)	Percent change (95% CI)
Males aged 40–49 years				
Education level (in years)				
≤12	31.23	34.89	3.66	11.7 (6.5, 16.9)[b]
13–15	15.17	17.65	2.48	16.3 (6.9, 25.8)[b]
≥16	13.57	13.46	−0.11	−0.8 (−10.5, 8.9)
Males aged 50–59 years				
Education level (in years)				
≤12	24.42	31.03	6.61	27.0 (19.8, 34.3)[b]
13–15	14.31	18.55	4.24	29.6 (18.0, 41.2)[b]
≥16	16.29	16.61	0.33	2.0 (−7.6, 11.6)
Females aged 40–49 years				
Education level (in years)				
≤12	8.54	9.83	1.29	15.1 (4.8, 25.4)[b]
13–15	5.07	6.55	1.48	29.2 (13.7, 44.8)[b]
≥16	4.51	5.03	0.52	11.6 (−5.6, 28.7)
Females aged 50–59 years				
Education level (in years)				
≤12	6.23	7.30	1.07	17.1 (4.0, 30.2)[b]
13–15	5.00	6.60	1.60	32.0 (13.5, 50.6)[b]
≥16	6.60	6.21	−0.39	−5.9 (−21.9, 10.2)

[a]Source: National Vital Statistics System and U.S. Census Bureau

[b]Statistically significant at $p<0.05$

CI = confidence interval

men and women with some college but no degree, the increases during this short period were even more dramatic; for example, the suicide rate increased about 30% for both men and women aged 50–59 years. Yet, for men and women with a college or graduate degree, we found no evidence for an increase in suicide rates during this time period. Indeed, for the more educated younger male and older female baby boomers, the suicide rate actually appears to have declined (although the decreasing trend was not statistically significant).

DISCUSSION

Our analysis of suicide rates among the middle-aged for the period 1979–2005 showed a substantial increase in suicides by men aged 50–59 years and women aged 40–59 years between 1999 and 2005, following a period of stability or decline in rates for these groups. Suicide rates also increased for younger middle-aged men between 1999 and 2005, but we found that this increase was better characterized as a continuation of previous, ongoing trends for this group. The post-1999 increase for all cohorts was found among both married and unmarried members, although the risks were higher for unmarried people. The rise was particularly dramatic for those without a college degree, while those with a college degree appeared largely protected from the trend. The timing of the increase coincided with the complete replacement of the U.S. population's middle-age strata by the postwar baby boom cohorts, whose youngest members turned 40 years of age in 2004.

If these trends continue, they are cause for concern. Male baby boomers have yet to reach old age, the period of the male life course at highest risk for suicide; if they continue to set historically high suicide rates as they did in adolescence and now in middle age, their rates in old age could be very high indeed. Female baby boomers have not reached the peak set by the 1935–1939 cohort in their late 30s, but their trajectory is opposite to the inverted U-shape shown by all earlier cohorts, and they seem poised to exceed the high of previous cohorts. One could argue that a higher rate of selection for suicide in middle age could lead to a subsequently lower rate in old age; however, a similar argument regarding selective survival does not appear to have held true for boomers whose rates were also exceptionally high in adolescence. Moreover,

the current middle-age trends in this unusually large cohort mean that more people, particularly siblings and other age-peers, are experiencing more untimely and tragic losses than ever before.

Hu et al.[6] concluded that "the epidemiology of suicide has changed," and based on our findings, we would concur. Our results suggest that cohort replacement drives some of the 1986–2005 trends in middle-aged suicide rates, particularly for males aged 40–49 years, but the post-1999 increase is indicative of a new, increased risk for suicide among baby boom cohorts as well as males in their early 60s. Virtually all middle-aged groups experienced a pronounced uptick in their suicide rates during this time period, at a stage in the life course when rates have historically been stable (for men) or beginning to decline (for women). This recent surge cannot be explained by cohort replacement, although perhaps the baby boom cohort is particularly susceptible to whatever new conditions emerged during this time period. We can only speculate about what those conditions may have been.

Past research indicates that those in middle age may be vulnerable to economic stress, and evidence suggests unstable economic conditions between 1999 and 2005. Unemployment rates in the U.S. rose between 2000 and 2003 at the same time that middle-aged suicide rates increased rapidly. In addition, rates of bankruptcy increased between 1991 and 2007, in part because of changes in the law, but with personal financial consequences nevertheless. The median age of people filing for bankruptcy rose by seven years, from 36.5 to 43.0 between 1991 and 2007, suggesting a possible increase in financial strain among the middle-aged during this period.[36] Moreover, the nature of work appears to have changed for men, with declines in long-term employment and increases in short-term employment (less than one year of tenure) for males as they enter their 30s and beyond.[37] We might expect that boomers without a college degree would suffer most from these unfavorable conditions, particularly with ever-increasing proportions in subsequent cohorts receiving college degrees and providing competition.

Another possibility is suggested by a recent report indicating that the percentage of those aged 45–64 years with multiple chronic diseases increased from 13% in 1996 to 22% in 2005, with a concomitant rise in out-of-pocket spending for health-care services.[38] The burden of disease falls disproportionately on those who are less educated, the group also least likely to have adequate employer-based health insurance. Given their heretofore unprecedentedly high levels of life expectancy and overall health, the baby boom cohorts may not have anticipated the rapid onset and economic burden of chronic illness in middle age.

Careful monitoring of these trends is essential for future research. An adequate test of the hypothesis of a cohort-specific effect must await post-baby boom cohort data through 2010 at least, with a release date not earlier than 2013. Future research might be given a head start if state-level data are available prior to the release of the compiled federal data; identifying states where the trends have been most pronounced might provide a guide to the best lead indicators.

A second approach for future research would be to analyze simultaneously the effect of individual and cohort-level characteristics on suicide risk using hierarchical linear modeling techniques and integrating what has previously been studied only at one level or the other. Finally, much more research attention should be given to what appears to be a shifting pattern of gender differences. The dramatic changes in women's roles taking place during the early and middle adulthood of baby boomer women, and their unusual and more rapid rate of increase in suicide in the middle-age ranges, compared with men, suggest a complex interacting pattern of social change and aging.

CONCLUSIONS

We conclude with the caution that this increase has occurred over a relatively short period of time and only further research will tell if it is sustained. Certainly, in current times, the economic crisis is a force that may increase suicide rates across all age groups, particularly those in later midlife and those contemplating retirement. Indeed, a recent Pew poll finds that the current recession is impacting those aged 50–64 years most severely, with respondents in this age range more likely to have incurred substantial investment losses and to report they will have difficulty affording retirement.[39] Effective public health programs for the prevention of this disturbing new increase in suicides, in a period of the life course previously thought to be stable and relatively protected from suicide, and in age strata now occupied by extraordinarily large numbers of people, require considerable further research.

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