Families, Socioeconomic Status, and Suicide: Combined Effects on Mortality

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Abstract

Both family support systems and advantaged socioeconomic status (SES) inhibit the risk of death. Independently, these factors are particularly salient for suicide, but it is less clear how they combine to affect mortality. Using National Health Interview Survey data from 1986 to 2004 (N = 1,306,100), prospectively linked to mortality through 2006, reveals a *process of compensation* in the way work status and family combine to affect suicide: unemployed individuals experience more suicide protection from family support systems than do employed ones. But a *process of reinforcement* occurs in the combined effects of education and family: the more highly educated experience more protection from the family than do less educated persons. Both pathways hold most strongly for men and younger persons. The findings demonstrate how families and SES may combine to affect mortality in unique ways.

Families, Socioeconomic Status, and Suicide: Combined Effects on Mortality

Mortality is a social process (Cockerham 2007; Phelan et al. 2004). A substantial body of research documents the effects of social support and social relationships on health and mortality prospects generally (Berkman and Glass 2000; House, Landis and Umberson 1988). The evidence strongly establishes that social isolation kills (House 2001) and that risks of death and some forms of ill health decrease with increased social ties. Family and household relations represent a burgeoning focus in this line of research (Carr and Springer 2010). Those who are married, for example, are often more satisfied in all aspects of life, are healthier, and live longer. Spouses provide social support in stressful situations and impart an enhanced sense of meaning and obligation in life (Umberson 1992; Waite and Gallagher 2001). The presence of other family members, especially children (Umberson and Montez 2010), can further strengthen these ties. Indeed, it has been empirically demonstrated for over a century that social connectedness can decrease the risk of death (Durkheim [1897] 1951).

Socioeconomic status (SES) has also long been linked with health and mortality prospects. Employment, higher educational attainment, and economic assets are associated with better health and longer lives (Hayward et al. 2000; Rogers et al. 1996; Williams and Collins 1995). Advantaged socioeconomic groups are positioned to purchase better health, have access to the latest technological advances and knowledge about healthy living, and have arguably more to gain by practicing healthy habits (Glied and Lleras-Muney 2008; Pampel, Krueger and Denney 2010). The more advantaged one is, the longer one can expect to live (Pappas et al. 1993).

Higher SES also extends life by creating additional networks of social support and integration (Berkman and Glass 2000; House, Landis and Umberson 1988; Link and Phelan

1995). Social support is sometimes a powerful intervening mechanism for individual health, providing a buffer against social disadvantages that might otherwise manifest in poorer health outcomes (Gorman and Sivaganesan 2007; House 1981; Lantz et al. 2005). But despite this conceptually clear connection, relatively little work has concentrated on the interactive effects that SES and social support may exert on mortality. This is especially relevant for suicide, given its strong contemporary ties to both social support and SES (Stack 2000a; Stack 2000b).

As a leader of premature mortality in the United States over the last 50 years, suicide has aroused continued concern from policy makers, researchers, and public health officials alike. Accounting for nearly 35,000 deaths in the United States in 2008 (Miniño, Xu and Kochanek 2010), the seemingly individual act of suicide is inherently social. At the center of social theories of suicide risk are variations in the quality and number of relationships people have with others around them (Durkheim [1897] 1951). These relationships are established and maintained within primary social institutions, including the family and the workplace. Despite theoretical links to domestic support systems, very few studies have examined suicide within varying familial environments (Denney 2010; Qin, Agerbo and Mortensen 2003). As a consequence of this and other gaps in the literature, we know little about how family life and SES, two major components of individuals' lives, interact to contribute to or inhibit mortality generally and suicide specifically.

THE COMBINED INFLUENCE OF HOUSEHOLDS AND SES: POTENTIAL MECHANISMS

Households broadly represent an individual's immediate social environment, the daily arena for social support and integration. Households can include spouses, friends, children, other relatives, and even hired caretakers; here, the terms household, family, and living arrangement are used

interchangeably. These formations contribute collectively or structurally to individual health and mortality. Individual SES is also important for determining current and future health. The theoretical work connecting social support and integration to mortality prospects suggests that families and individual status may combine in processes of compensation or reinforcement. Work to date, however, largely treats them as independent forces.

Compensation – Filling a Void

Mortality research generally finds the family to be an oasis of comfort and stability in hard times. Families provide needed support systems and connect persons to collective life through responsibilities felt toward the group. The most important social ties for health and longevity are built and maintained within the household (Carr and Springer 2010), and they reveal the social character of mortality (Berkman, Leo-Summers and Horwitz 1992; Rogers 1996). Strong family relationships benefit immune, endocrine, and cardiovascular functions (Umberson and Montez 2010), and they reduce physiological wear and tear on the body experienced through chronic stress (McEwen 1998; Seeman et al. 2002). Persons in compromised socioeconomic states often lack such ties, experience unhealthy levels of stress, engage more often in harmful behaviors, and die sooner than their more advantaged counterparts (Link and Phelan 1995; Pampel, Krueger and Denney 2010; Phelan et al. 2004; Rogers, Hummer and Nam 2000). Thus socioeconomically disadvantaged people, if they do have household ties, may benefit especially from these ties.

Integration is a distinctively collective phenomenon, depending upon the degree to which persons are bonded to others—what Durkheim ([1897] 1951) termed social integration—and also the degree to which persons occupy states that are compatible with contemporary social norms and expectations—what Gibbs and Martin (1964) refer to as status integration. This social

phenomenon represents a core element of individuals' lives and protects against ill health and mortality generally (Berkman and Glass 2000) and suicide specifically.

Persons who lack good jobs, good pay, and higher education also lack social cohesion (Mirowsky and Ross 2003; Phelan et al. 2004). And the more one's identity deviates from established norms, the lower one's well-being (Gibbs 2000; Gibbs and Martin 1964). Unemployment is a rarely occupied position and one that is not approved of or desired. For most people, work goes a long way toward creating identity and maintaining a script for navigating everyday life. Not working reduces status and involvement in collective life, increasing mortality risk while decreasing structure (Kposowa 2001; Rogers, Hummer and Nam 2000). Similarly, higher educational attainment corresponds with higher social status and better health (Marmot 2004; Mirowsky and Ross 2003). Thus, those who don't work or who possess low levels of education may compensate for heightened health risks through the family.

Reinforcement – Two States Are Better Than One

There are also reasons to believe that household formation and SES may reinforce each other in their combined impact on mortality (House 1981). That is to say, two positive states together may be better than the sum of the two separately.

In the U.S. and other developed nations, persons with higher SES live longer and healthier lives (Rogers, Hummer and Nam 2000; Williams and Collins 1995). They are also more likely to marry, have children, and maintain more harmonious and uninterrupted family lives—another independent contributor to better health. Thus, are the SES advantages for mortality entirely independent of domestic support systems? Benefits from more advantaged

SES could in some ways rely on family support (Schnittker 2007). If so, both family support and advantaged SES together reinforce each other and exert special positive effects on mortality.

In the case of suicide, theories about education may help draw this argument out. Increasing educational attainment is positive in many respects for individuals (Marmot 2004; Mirowsky and Ross 2003), but has been historically and theoretically linked with increased risk of suicide (Durkheim [1897] 1951; Masaryk [1881] 1970; Morselli 1882). Durkheim and others suggested that educational attainment reflected increasing individualism and a consequent disconnect from social life. This premise has given contemporary suicide researchers reason to believe the effects of employment and education may not be the same, as employment is usually itself an indicator of connection to others. Even so, research on the effects of education on suicide at the individual level are quite limited compared to investigations on the employment-suicide link (Stack 2000a).

More education and employment are in fact good for health and mortality generally (Mirowsky and Ross 2003; Rogers, Hummer and Nam 2000). If more education and working reduce suicide risk, it may be because higher SES generally provides greater sense of autonomy and control over life (Marmot 2004). But the positive effects of SES, in particular educational attainment, may depend heavily upon support systems that can counter potential deficiencies created in the pursuit of individual investment. Further, many jobs involve work that provides little autonomy and much stress and those combinations can be lethal (Matthews and Gump 2002). Thus, any benefits associated with employment may also depend on supportive environments at home. If so, then interactions between family integration and SES would show that support gained through domestic life is more important for those with higher SES.

Independence – Important but Separate

Finally, the effects of social support and integration garnered both in the home and through socioeconomic positioning might be distinct enough to create important but separate effects on health and mortality. To date, this is the approach taken by the majority of researchers concerned with the topic (Denney 2010; Gibbs 2000; Gibbs and Martin 1964; Hughes and Waite 2002; Lleras-Muney 2005; Rogers, Hummer and Nam 2000). Households and the relationships built within them provide systems of support unmatched in nearly any other area of life (Berkman and Glass 2000). And higher SES provides economic stability, self-fulfillment, and improved social relations that correspond with better health and longer lives (Rogers, Hummer and Nam 2000).

This focus on independent effects is especially clear in the literature on suicide. Research focusing on domestic relationships and suicide are robust, well documented, and wide-ranging. Married persons are less likely than unmarried persons to commit suicide (Kposowa 2000; Kposowa, Breault and Singh 1995), persons in larger families are less likely than persons in smaller families (Denney et al. 2009), and persons with children are less likely than persons without children (Denney 2010; Qin, Agerbo and Mortensen 2003).

Contemporary research has generally showed increased suicide risk among more disadvantaged groups (Stack 2000a) and this is somewhat inconsistent with historical positions on education and suicide (Durkheim [1897] 1951). However, the majority of the recent findings are based on indicators of SES other than education. Most available evidence documents increased suicide risk for the unemployed (Stack 2000a) and for those who are not active in the work force (Denney et al. 2009). There are exceptions, most notably, high rates of suicide among health professionals such as doctors, nurses, and dentists (Stack 2001). Recent empirical work on education and suicide, however, is quite limited and has produced inconsistent findings (Denney et al. 2009; Kposowa, Breault and Singh 1995; Stack 2000b).

Although generally supportive, family and household relations do not always exert positive effects on individual health and well-being (Seeman 2000). Some relationships are bad for health, and that can be especially true in family settings. That could be reflected in suicide patterns if individual propensity to suicide is not related to how households are configured, but research generally finds reduced suicide risks for individuals living in households with other relatives (Denney 2010; Qin, Agerbo and Mortensen 2003). However, it may be that families and individual SES independently affect the risk of death. If this is the case, interactions between family and SES effects will provide virtually no new information about mortality risk.

Gender and Age Considerations in the Study of Suicide

Finally, the rates of and contributors to suicide are very different by gender and age, and tests of theoretical arguments must consider such variation. Men die from suicide in the United States at a rate four times that of women (Miniño, Xu and Kochanek 2010). Research on health and mortality generally finds that family living, and particularly the benefits associated with marriage, are more important for men than women (Umberson 1992; Waite and Gallagher 2001). This pattern also holds for suicide (Stack 2000a; Stack 2000b). At the same time, men's notions of status center largely on areas outside the home (Shiner et al. 2009), for example on educational status and employment outlook. Consequently, the combined effects of household formation and SES on suicide mortality may be most pronounced for men.

Suicide generally rises with age, but the slope varies by gender. Suicide peaks for women in middle age and for men in the elderly years (Stack 2000b). Aggregate analyses of suicide rates show that age patterns of suicide are related to period and cohort effects, as individuals find themselves competing for good jobs, compatible mates, and general stability in life (Pampel 1996; Phillips et al. 2010). Studies explaining age differences in suicide at the individual level

are limited (Stack 2000b) but consistently point to the importance of social connections through employment prospects and family life, for example. Generally, research on mortality finds social support systems most important in older populations (Berkman, Leo-Summers and Horwitz 1992; Seeman 2000). While domestic relations are extremely important for the elderly, SES may matter less. Elderly persons may choose—or at least be expected—to retire; and assistance programs may make it less necessary for them to work. Elderly persons also experienced periods characterized by much lower educational expectations.

Younger persons, in contrast, can be greatly affected by education and work status. As they lack seniority and experience, the young are often the first to be let go in times of high unemployment. Further, most young people work or attend school, so those who are unemployed, out of the labor force, or not pursuing education find themselves in infrequently occupied social positions (Gibbs 2000). Lack of control over an important area of life and reduction in status may influence young persons to take desperate measures (Trovato and Vos 1990). Therefore, if household relations and SES combine to affect mortality risk, they may do so more clearly for younger than for older persons.

In sum, theories suggest that areas of life that provide support and integration importantly reduce the risk of death. A process of compensation occurs if support from the home fills a void left by compromised SES. A process of reinforcement occurs if the two areas combine synergistically to reduce risk further for the most advantaged.

METHODS

Data

The data come from combining multiple years of the National Health Interview Survey (NHIS), linked to prospective mortality through the Linked Mortality Files (LMF). The Integrated Health

Interview Series (IHIS), an initiative through the Minnesota Population Center at the University of Minnesota, streamlines an otherwise arduous data construction process and provides the complete data set used here (Minnesota Population Center 2010). NHIS years include 1986 through 2004, and LMF cover 1986 through 2006. Designed as a cross-sectional household survey, the NHIS annually collects information from approximately 30,000 to 40,000 households, obtaining response rates consistently at or above 90% (NCHS various years).

The National Center for Health Statistics (NCHS) recently completed its fourth mortality follow-up with NHIS respondents (NCHS 2009). To create the LMF, NCHS uses a probabilistic mortality matching scheme that assigns weights to multiple factors including social security number, first and last name, and date of birth. The public-use release matches closely with the private-use data requiring special permissions for use (Lochner et al. 2008). Importantly, because of confidentiality concerns public-use mortality data include deaths only for those over age 17. Accordingly, respondents under age 18, comprising 28% of the original sample and 6% of all suicides in 2008 (Miniño, Xu and Kochanek 2010), are included in the construction of household variables (described below) and are subsequently dropped.

An additional 3% of cases are dropped because they are missing data on the key variables used in the empirical analyses or because NCHS designates them as ineligible to be linked to prospective mortality; ineligibles are cases whose records include insufficient identifying data, such as name and social security number, to create a mortality record (NCHS 2009). For the years used here, fewer than 3% of cases are deemed ineligible in any single year, and NCHS (2009) provides weights that adjust for the exclusion of ineligible records. The final data set includes information on 1,306,100 adults aged 18 or older residing within 712,853 households. The records are linked to 1,751 suicide deaths through 2006.

Measures

The dependent variable, suicide mortality, is coded 1 for suicidal death, defined in the World Health Organization's (2007) 10th revision of the *International Statistical Classification of Diseases, Injuries, and Causes of Death* (ICD-10) as death from intentional self-harm (codes X60-X84); it is coded 0 for all other respondents, who either survived the follow-up or died from other causes. Although the classification of a death as suicide rests on individuals with varying levels of medical knowledge and training (Timmermans 2005), Pescosolido and Mendelsohn (1986) have demonstrated that suicide is not misreported in a systematic way.

The NHIS collects a core set of sociodemographic, socioeconomic, and health measures (NCHS various years). However, the amount of detail sometimes varies from year to year; to maintain consistency across all years, this study uses some more broadly defined variables. Age is included as a continuous variable ranging from age 18 to age 85 and older. Stratified analyses examine relationships for two broad age groups, 18 to 59 and 60 and older.

Gender is coded dichotomously with women as the referent, and multivariate analyses stratify models separately for men and women. Race is also a dichotomous variable, with non-Hispanic white as the referent. Separate dummy variables capture educational attainment and work status, with referents of greater than high school and employed, respectively. Only some years of the NHIS contain more detailed measures of education (NCHS various years), so the less detailed measure is used to allow investigation over the entire study period. Though not ideal, the education dummy variable captures important differences in status. Work status separates employed individuals from those who reported that they were unemployed or not in the labor force. Separate analyses show little difference in suicide risk for the unemployed and for those not in the labor force, so the two are combined.

Compared to work and education, income has less effect on suicide mortality (Denney et al. 2009; Kposowa, Breault and Singh 1995; Stack 2000a). Thus, income is included primarily as a control measure. For the NHIS, the reference person reports the total income of the household in categories defined by NCHS, and that value is assigned to each individual living in the dwelling. To approximate a continuous measure of income, the midpoint of each category is taken and a median value for the open-ended category is estimated (Parker and Fenwick 1983). The value is then adjusted to account for varying purchasing power among families of differing sizes (see Van der Gaag and Smolensky 1982), and the consumer price index is used to regulate changes in purchasing power over time. To estimate missing income data for approximately 18% of the sample, a number of covariates in the data, including a less detailed measure of income indicating above or at or below $20,000, are used. Stochastic variation is incorporated into the predicted values of income to better represent variability in the actual income data (see Gelman and Hill 2007). A logged transformation of the continuous measure is included in the multivariate models to account for its skewed distribution; models were estimated with and without the missing income data and no discernible differences appeared.

The NHIS person files include no measures on mental health, but research suggests that individuals giving subjective reports consider many dimensions of overall health (Idler, Hudson and Leventhal 1999; Schnittker 2005). Thus, self-rated health is included in models as a broad indicator of current health; it is measured continuously from 0, poor health, to 4, excellent health. Controlling for health status also helps with issues of selection, as individuals in poor health at baseline may also lack social and economic resources and be more prone to suicide. The NHIS lacks other measures, such as retrospective health status, to deal with selection issues.

To take advantage of the household nature of the NHIS data, multiple variables—including marital status and household size—are used to identify household types. Each household in the NHIS is assigned a unique numeric identifier, as is each person; in combination, these numbers enable the analyst to ascertain who lives in which household. Then, a series of steps identifies the configuration of the household. First, a variable identifies households that included children under age 18. Second, a variable indicates whether a marriage existed within the household. A third variable records whether households include other nonchild relatives, and a fourth, whether unrelated persons reside in the dwelling. Because suicide is a relatively rare cause of death, the types of households included in the analyses are limited to those that capture critical aspects of domestic integration. Married-couple families without children, married-couple families with children under the age of 18, unmarried families with children under the age of 18, and unmarried families without children are included. Unmarried families include adults who are not currently married but may have been divorced or widowed, as well as those never married. Family types with and without children can include other nonchild relatives and unrelated adults. Separate analyses of the more intricate family types do not alter interpretations. For example, separating married-couple-only households from married-couple households with other relatives or unrelated persons produces much the same results. Some household configurations are more common than others, but all household configurations used in the analysis represent the living situation of at least 5.0% of the sample (see Appendix A for information on household types for the full sample, for suicide victims, and by gender, age, work status, and education). For all household types in the multivariate analyses, the reference category is an individual living alone.

Estimation

Multivariate analyses investigating the relationships among individual characteristics, household living arrangements, and suicide employ a Cox Proportional Hazard framework (Allison 1984). The Cox models are particularly useful because they do not impose a distribution of death across age, nor do they require the analyst to choose a particular form for the times of survival specified (Allison 1984). The model declares the hazard rate for the *j*th respondent as

$$h(t|x_j) = h_0(t) \exp(x_j\beta_x),$$

where the coefficients β_x are estimated from the data using a partial likelihood approach (Hoffman 2004).

The Cox model does assume that the hazard of experiencing an event is proportional, or constant, over time. Tests of the proportionality assumption following a generalization formulated by Grambsch and Therneau (1994) reveal that the assumption is violated for the full model, but not for models stratified by gender and age. These results, together with evidence suggesting that Cox estimates are sturdy despite proportionality assumptions when based on large nationally representative samples (Therneau and Grambsch 2000), provide some confidence in the techniques used here.

Further robustness checks included examining only those suicides that occurred within 5 years of interview, and testing for differences between an early period (1986 to 1994) and a late period (1996 to 2004). The results from these models are available upon request and are much the same as those presented here. All results from the Cox Proportional Hazard analyses are reported as hazard ratios (HRs). Stata 11.1 (StataCorp 2009) incorporates sample weights and estimates robust standard errors that account for the NHIS stratified and clustered sampling design (NCHS various years).

Finally, the research questions require stratifying models by gender and age, and by work status and educational level. To evaluate effects across groups, interaction models are estimated and Wald tests are calculated using the results from those models, a procedure that is referred to as the generalized linear model solution to compare model results (Hoffman 2004). The Wald test is distributed χ^2 and provides the analyst with some important flexibility. Wald tests provide a method to evaluate both differences across all household types and differences across specific types. Degrees of freedom are equal to the total number of household types for the former (four) and equal to one for the latter. If a process of compensation occurs, supportive household formations will reduce suicide risk more for those in compromised socioeconomic states (not working, or having less education). If reinforcement occurs, the opposite will be observed—those in advantaged socioeconomic states will benefit more from supportive household types. Finally, if households and SES exert independent effects on mortality risk, no significant differences across groups will be observed.

RESULTS

Table 1 provides weighted means of the individual and household-level covariates for the full sample and for those who committed suicide over the follow-up period. The average age for those who committed suicide is slightly older than the average age of the sample, and over three-quarters of suicides occurred among the younger group, those aged 18 to 59. There are large disparities between the full sample and those who committed suicide by gender and race. Notably, as in national trends (Miniño, Xu and Kochanek 2010), the overwhelming majority of those in the sample who committed suicide were white, making detailed analyses by racial group difficult. Other individual-level differences between the full sample and those who committed

suicide are more modest but are also consistent with current knowledge (Denney et al. 2009; Stack 2000a; Stack 2000b).

(Table 1 about here)

Table 1 reveals important differences in living arrangements between the full sample and those who committed suicide. While 15% of the sample is composed of single persons living alone, 22% of individuals who died from suicide lived alone. Along the same lines but less strikingly, 28% of the sample lived in married households without children, and those persons accounted for 31% of all suicides. In contrast, over 40% of the full sample lived in households that included a marriage and children, and those persons accounted for only 35% of suicides. Finally, multiperson households without a marriage, both with and without children, accounted for smaller proportions of both the full sample and the suicide deaths.

Table 2 provides hazard ratios (HR) of the individual and household covariates first for the full sample and then separately for men, women, younger persons (age 18 to 59), and older persons (age 60 and older). For the full sample, compared to a single person living alone, persons living in households that included other members experienced reduced risks of suicide. The key individual-level variables, work status and education, show that both not working and having less education increased suicide risk compared to working and having more education, respectively. Notably, the full model was estimated first without the SES measures (not shown) and then with them to check for the effects of SES on the household types; no significant mediating effects were found. For parsimony, the full model with all covariates is presented. Other individual-level controls in the full model show that men were at over five times the risk of suicide compared to women; nonwhites experienced a 57% reduced risk compared to whites; income had little effect; and risk decreased as individuals rated their health more positively.

(Table 2 about here)

Models by gender in Table 2 show that living arrangements affected suicide risk slightly differently for men and for women, but the Wald tests show that the differences are not significant. Further, both men and women who were not working were likelier to commit suicide over the follow-up compared to their working counterparts. But while less educated men showed a higher risk of suicide than more educated men, the education effect is reversed among women. The other control variables have similar and expected relationships for both men and women.

The age-specific models show that younger and older persons experience significantly different protective effects from household living arrangement (χ^2=12.2, $p \leq .05$). Though it is rare for older persons to live with children under the age of 18 (see Appendix A), when they do, their risk of suicide is reduced 74% in married-couple households with children and 60% in unmarried households with children. These reductions are significantly greater than those experienced by younger persons. Not working increased the risk for both younger and older persons. But while less education increased risk among younger persons, education had no effect on older persons' suicide mortality. In all, Table 2 suggests that family living, work status, and education have important independent effects on suicide mortality. To address their combined effects, we turn to the results in Tables 3 and 4.

Table 3 presents results from Cox analysis testing the combined effects of household formation and work status. Panel A provides support for the compensation perspective; it shows that those who were not working experienced more risk reduction from supportive household formations over the follow-up than did those who were (χ^2=13.4, $p \leq .01$). For those not working, compared to living alone, living in married-couple-with-children households reduced their risk of suicide by 55% and living with children but without marriage reduced it by 36%. By

comparison, working individuals reduced their risk of suicide by 47% when living in married-couple households with children but experienced no reduced risk in unmarried households with children. The Wald tests provide evidence that these differences are significant, particularly for households that included children.

(Table 3 about here)

Panels B-E in Table 3 show that for those not working the process of compensation is particular to men's risk. Indeed, men who were not working benefited more from household living arrangements than men who were working (χ^2=10.3, $p \leq .05$). These differences were most pronounced in homes that included children. Panel D also shows overall that a similar effect exists for younger persons (χ^2=7.9, $p \leq .10$), but the household-type-specific HRs and significance tests fail to delineate clearly where the advantage occurs. No significant differences exist between working women and those not working (Panel C) or for older persons (Panel E), suggesting that household formations and work status exert independent effects among these groups.

Table 4 presents Cox results testing the combined effects of household type and educational attainment. In accord with the reinforcement perspective, Panel A shows that more educated persons experienced greater reductions to suicide risk via supportive household formations than did less educated persons (χ^2=16.0, $p \leq .01$). These reductions were concentrated in households that included a marriage. More educated persons experienced significantly greater reductions to risk in married-couple households with (65%) and without children (52%) than did less educated persons (44% and 20% respectively).

(Table 4 about here)

These effects, once again, prove to be subgroup specific. Panels B-E of Table 4 show that the greater protective effect of the family for more educated persons is specific to men (χ^2=14.5, $p \leq .01$), and to a lesser degree, younger persons (χ^2=8.0, $p \leq .10$). For more educated men, compared to less educated men, differences are most pronounced for those living in married-couple households. Comparing across columns in Panel B shows that more highly educated men experienced 38% reduced risk in married-couple households without children and 64% reduced risk in married-couple households with children, while less educated men experienced 24% and 44% reduced risks, respectively. Differences in younger persons were most pronounced for those living in married-couple households with children (χ^2=6.9, $p \leq .01$). More highly educated younger persons in this household type experienced a 65% reduction to suicide risk, compared to 38% for less educated younger persons.

Panel C shows that women's risks of suicide were reduced across various household types and those risks did not generally differ by education. One notable exception occurred for more highly educated women living in unmarried households without children. Results from Table 2 indicate that less education provided a protection against suicide for women. Table 4, Panel C, shows that more highly educated women who lived in unmarried households without children experienced a moderately significant 74% reduction in mortality risk, while less educated women in similar households experienced no reduction (χ^2=3.4, $p \leq .10$). This provides some limited evidence that highly educated women compensate for the increased suicide risk that education brings through support garnered in the home.

Finally, Panel E shows that a significant difference between less and more educated older persons exists (χ^2=10.3, $p \leq .05$), but examining differences across household types obscures this finding. While more educated older persons benefit more from living in married-couple

households without children than less educated older persons, the opposite is true in unmarried households with children. The data set includes few suicide cases in older person households split by educational attainment (see Appendix A). Analyses using only a more general unmarried household type (with or without children) still exhibited a consistent moderately significant effect. The contradictory results may be partially explained by the lack of an education effect for older persons in Table 2.

DISCUSSION

Sources of social support and integration, including those found in the home and through individual placement in the socioeconomic system, are central contributors to mortality. Results on twenty years of U.S. data linked to prospective mortality suggest that household support systems and individual SES combine to influence suicide risk.

For those not working, household status compensated for their increased risk of death. The combined effects of education and household support, however, revealed a process of reinforcement: more educated persons experienced more protection from the household than did less educated persons. Upon closer inspection, support for theoretical arguments suggesting combined influence was strongest among men, and to a lesser degree, younger persons. Support through household relations is essential for men who are out of the labor force—it is a last line of protection against the potential loss of meaning and social ties through work. This protection was particularly salient for men in households that included children. Children in the household may replace structure typically provided through work. This process of compensation can be, perhaps, more readily explained by following the logic and findings of the relationships between disadvantage and health. Social support and greater resources are better for long-term health and mortality prospects. It is reasonable to deduce that a deficiency in one area may lead persons to

depend more heavily on another. Doing so explicitly recognizes the importance of considering both SES and family type in tandem rather than separately.

More elusive is an explanation of why more educated persons might experience more protection via support from the home than less educated persons. A definitive answer is beyond the scope of the evidence provided here, but classic sociological theory (Durkheim [1897] 1951) suggests that education may be accompanied by a general loss of social connectedness, making domestic relationships all the more essential for more educated individuals. Therefore, those experiencing a net protection from more education may be those for whom its obvious earnings and health benefits (Marmot 2004; Mirowsky and Ross 2003) are not offset by loss of social support—that is, those who have also achieved solid familial integration. The combined effects of household composition and education were, once again, most clearly related to men's risk. In general, the SES and household suicide risks for women appear independent.

Supportive household formations—especially households that include children—are very important for reducing the risk of suicide for older people. The integration that older persons lose when they leave the labor force is important as well, but education does little to affect suicide among them. Overall, the evidence suggests that households and SES act independently to affect risk for older persons. For younger persons, both factors are important for suicide risk, and there is some limited evidence to suggest that the two combine to shape mortality in much the same way as for men: home support compensates for employment voids, and household composition and educational attainment reinforce each other. These results, however, are based on two very broad age groups. Additional work is needed to compare age groups in more detail and consider period and cohort effects, as a recent study finds that members of particular cohorts have experienced increases in suicide over specific, and recent, periods (Phillips et al. 2010).

A summary measure of SES may obfuscate meaningful differences in the way it interacts with household formation. Disentangling the relationships between family and SES measures may prove especially fruitful in examining combining and competing social and economic risks across a number of health and mortality outcomes. Such disaggregation is especially timely given current debates surrounding the ever-changing definition of family (Powell et al. 2010), as well as turbulent economic conditions across the U.S. and abroad.

The NHIS-LMF is large and nationally representative, but not without its limitations. The public-use release of mortality data limits the amount of information on the deceased (Lochner et al. 2008); more detail at time of death would allow tests of the effects of changing status from interview to death. Further, the cross-sectionality of the NHIS limits investigation of issues of selection. Measures of health before and after a change in work status might better capture relationships, as those not working are also likely in poorer mental health (Platt 1984). Finally, core NHIS data do not include measures for other established predictors of mortality. Some of the more important considerations in the study of suicide specifically include migration (Wadsworth and Kubrin 2007), religiosity (Ellison, Burr and McCall 1997), genetic propensities (Brent and Mann 2005), and cultural norms relating to suicide acceptability (Cutright and Fernquist 2000).

Research on social contributors to health has shifted productively away from historical doctrines that first centered solely on structural, and later on individual, forces (Cockerham 2007). Researchers are increasingly realizing that explanations lie somewhere in the middle ground. Structure and agency combine to affect health and mortality in ways that diverge across groups and at diverse stages of life. The more investigators recognize this subtle but important fact, the closer we will come to understanding the social determinants of health and mortality.

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Table 1. Weighted Means of Individual Characteristics and Living Arrangements, for the Full Sample and for Those Who Died of Suicide Over the Follow-up Period, U.S. Adults, 1986-2006.

	Full Sample (N=1,306,100)	***Suicide Deaths (N=1,751)***
Individual Characteristics		
Age	44.4	44.7
18 to 59	0.78	0.77
60 and older	0.22	0.23
Gender (men=1)	0.48	0.80
Race (non-Hispanic white=1)	0.76	0.87
Education		
high school or less	0.54	0.61
more than high school	0.46	0.39
Work Status		
unemployed or not in the labor force	0.35	0.39
working	0.65	0.61
Household income less than or equal to $20,000	0.27	0.35
Self-rated health	2.80	2.54
Family / Household Living Arrangement		
single living alone	0.15	0.22
married couple without children	0.28	0.31
married couple with children	0.42	0.35
unmarried with children	0.10	0.09
unmarried without children	0.05	0.03

Source: NHIS-LMF 1986-2006

Table 2. Cox Proportional Hazard Ratios and Wald Tests of Interactions for the Risk of Suicide Mortality, by Gender and Age.

	Full Model		Men		Women		Test: Men vs. Women[a]	Age 18 to 59		Age 60 and older		Test: Younger vs. Older[b]
Family / Household Living Arrangement												
single living alone (ref)							χ^2=3.0					χ^2=12.2*
married couple without children	0.69	**	0.64	**	0.74	+	χ^2=0.2	0.70	**	0.61	**	χ^2=0.1
married couple with children	0.51	**	0.51	**	0.44	**	χ^2=0.1	0.54	**	0.26	**	χ^2=8.8**
unmarried with children	0.79	*	0.81	+	0.65	*	χ^2=0.1	0.82	+	0.40	*	χ^2=3.1+
unmarried without children	0.58	**	0.51	**	0.83		χ^2=2.3	0.59	**	0.56		χ^2=0.1
Individual Characteristics												
Work status (working, ref)												
unemployed or not in the labor force	1.50	**	1.47	**	1.69	**		1.43	**	1.68	**	
Education (more than high school, ref)												
high school or less	1.18	**	1.33	**	0.77	*		1.20	**	1.11		
Logged household income	1.02		1.02		1.01			1.01		1.03		
Age (continuous)	0.99	*	1.01		0.98	**		0.99		1.02	*	
Gender (female, ref)												
male	5.16	**	--		--			4.46	**	8.59	**	
Race (non-Hispanic white, ref)												
non-white	0.43	**	0.44	**	0.39	**		0.43	**	0.47	**	
Self-rated health	0.77	**	0.79	**	0.69	**		0.75	**	0.81	**	
Log likelihood	-22387.8		-16766.7		-4400.9			-16859.7		-4596.5		

Source: NHIS-LMF 1986-2006

+ $p \leq .10$; * $p \leq .05$; ** $p \leq .01$

[a] These tests come from a model that pools men and women and tests the significance of interactions between gender and the household living arrangements. Tests are provided for the living arrangements as a whole with df = 4 and for the individual arrangements with df = 1.

[b] These tests come from a model that pools younger and older persons and tests the significance of interactions between age and the household living arrangements. Tests are provided for the living arrangements as a whole with df = 4 and for the individual arrangements with df = 1.

Table 3. Cox Proportional Hazard Ratios and Wald Tests of Interactions for the Risk of Suicide Mortality, by Work Status, Gender, and Age.[a]

	Working		Not working		Test: Working vs. Not working[b]
	Panel A. Full Sample				
Family / Household Living Arrangement					
single living alone (ref)					χ^2=13.4**
married couple without children	0.65	**	0.72	**	χ^2=0.1
married couple with children	0.53	**	0.45	**	χ^2=2.8$^+$
unmarried with children	0.88		0.64	**	χ^2=4.8*
unmarried without children	0.58	*	0.56	*	χ^2=0.1
Log likelihood	-13082.2		-8189.8		
	Panel B. Men				
	Working		Not working		Test: Working vs. Not working[b]
Family / Household Living Arrangement					
single living alone (ref)					χ^2=10.3*
married couple without children	0.66	**	0.61	**	χ^2=0.1
married couple with children	0.55	**	0.44	**	χ^2=4.0*
unmarried with children	0.92		0.69	$^+$	χ^2=3.9*
unmarried without children	0.55	*	0.44	**	χ^2=0.6
Log likelihood	-10519.9		-5415.9		
	Panel C. Women				
	Working		Not working		Test: Working vs. Not working[b]
Family / Household Living Arrangement					
single living alone (ref)					χ^2=4.1
married couple without children	0.61	*	0.81		χ^2=0.9
married couple with children	0.46	**	0.35	**	χ^2=0.1
unmarried with children	0.78		0.45	*	χ^2=1.0
unmarried without children	0.75		0.86		χ^2=0.2
Log likelihood	-1965.9		-2202.6		
	Panel D. Age 18 to 59				
	Working		Not working		Test: Working vs. Not working[b]
Family / Household Living Arrangement					
single living alone (ref)					χ^2=7.9$^+$
married couple without children	0.67	**	0.74		χ^2=0.8
married couple with children	0.55	**	0.47	**	χ^2=1.2
unmarried with children	0.90		0.70	$^+$	χ^2=2.4
unmarried without children	0.58	*	0.58		χ^2=0.1
Log likelihood	-12192.4		-3903.2		
	Panel E. Age 60 and older				
	Working		Not working		Test: Working vs. Not working[b]
Family / Household Living Arrangement					
single living alone (ref)					χ^2=3.3
married couple without children	0.40	**	0.66	**	χ^2=2.1
married couple with children	0.16	**	0.29	**	χ^2=0.6
unmarried with children	0.56		0.35	*	χ^2=0.3
unmarried without children	0.71		0.54		χ^2=0.1
Log likelihood	-638.1		-3782.6		

Source: NHIS-LMF 1986-2006

$^+$ $p \leq .10$; * $p \leq .05$; ** $p \leq .01$

[a] All models control for individual level sociodemographic, socioeconomic, and health covariates.

[b] These tests come from models that pool working and not working individuals from the demographic subgroup presented. The tests are provided for the living arrangements as a whole with df = 4 and for the individual living arrangements with df = 1.

Table 4. Cox Proportional Hazard Ratios and Wald Tests of Interactions for the Risk of Suicide Mortality, by Educational Attainment, Gender, and Age.[a,b]

	Panel A. Full Sample								
	More than high school		High school or less		More vs. Less educated[c]				
Family / Household Living Arrangement									
single living alone (ref)					χ^2=16.0**				
married couple without children	0.48	**	0.80	*	χ^2=10.6**				
married couple with children	0.35	**	0.56	**	χ^2=12.8**				
unmarried with children	0.65	*	0.82		χ^2=0.4				
unmarried without children	0.34	**	0.57	*	χ^2=1.7				
Log likelihood	-13082.2		-7077.0						
	Panel B. Men					**Panel C. Women**			
	More than high school		High school or less		More vs. Less educated[c]	More than high school		High school or less		More vs. Less educated[c]
Family / Household Living Arrangement									
single living alone (ref)					χ^2=14.5**					χ^2=5.6
married couple without children	0.42	**	0.76	*	χ^2=10.9**	0.67	+	0.66	+	χ^2=0.1
married couple with children	0.36	**	0.56	**	χ^2=9.7**	0.31	**	0.35	**	χ^2=2.1
unmarried with children	0.75		0.86		χ^2=0.2	0.48	+	0.51	*	χ^2=0.4
unmarried without children	0.36	**	0.40	**	χ^2=0.1	0.26	+	1.14		χ^2=3.4+
Log likelihood	-5091.5		-8690.5			-1594.4		-2150.9		
	Panel D. Age 18 to 59					**Panel E. Age 60 and older**				
	More than high school		High school or less		More vs. Less educated[c]	More than high school		High School or less		More vs. Less educated[c]
Family / Household Living Arrangement										
single living alone (ref)					χ^2=8.0+					χ^2=10.3*
married couple without children	0.49	**	0.86		χ^2=1.6	0.45	**	0.70	*	χ^2=4.5*
married couple with children	0.55	**	0.47	**	χ^2=6.9**	0.17	**	0.30	**	χ^2=1.4
unmarried with children	0.60	*	0.96		χ^2=1.5	0.95		0.21	**	χ^2=3.2+
unmarried without children	0.35	*	0.53	+	χ^2=2.5	0.25		0.70		χ^2=1.0
Log likelihood	-5663.6		-7684.9			-1121.7		-3238.6		

Source: NHIS-LMF 1986-2006

+ $p \leq .10$; * $p \leq .05$; ** $p \leq .01$

[a] All models control for individual level sociodemographic, socioeconomic, and health covariates.

[b] All analyses by education are limited to respondents 25 years and older. N = 1,138,009 and Suicides = 1,548.

[c] These tests come from models that pool less and more educated individuals from the demographic subgroup presented. The tests are provided for the living arrangements as a whole with df = 4 and for the individual living arrangements with df = 1.

Appendix A. Weighted Means for Living Arrangements and for Those Who Died from Suicide over the Follow Up Period, by Gender, Age, Work Status, and Education.

Panel A. Men										
	Full Sample		Working		Not Working		High School or less		More than High School	
Family / Household Living Arrangement	(N = 608,401; S = 1,388)[a]		(N = 446,849; S = 889)		(N = 161,552; S = 499)		(N = 338,252; S = 892)		(N = 270,149; S = 496)	
	Sample	Suicides	Sample	Suicides	Sample	Suicides	Sample	Suicides	Sample	Suicides
single living alone	0.14	0.22	0.13	0.19	0.17	0.26	0.12	0.17	0.16	0.30
married couple without children	0.29	0.32	0.24	0.24	0.44	0.46	0.30	0.33	0.29	0.29
married couple with children	0.45	0.35	0.52	0.46	0.26	0.18	0.45	0.38	0.46	0.34
unmarried with children	0.07	0.08	0.06	0.08	0.08	0.07	0.08	0.09	0.04	0.05
unmarried without children	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.02
Panel B. Women										
	Full Sample		Working		Not Working		High School or less		More than High School	
Family / Household Living Arrangement	(N = 697,699; S = 363)		(N = 392,618; S = 174)		(N = 305,081; S = 189)		(N = 407,486; S = 209)		(N = 290,213; S = 154)	
	Sample	Suicides	Sample	Suicides	Sample	Suicides	Sample	Suicides	Sample	Suicides
single living alone	0.16	0.23	0.13	0.21	0.21	0.25	0.16	0.19	0.17	0.28
married couple without children	0.26	0.30	0.23	0.24	0.30	0.35	0.27	0.28	0.25	0.33
married couple with children	0.40	0.30	0.44	0.35	0.33	0.26	0.38	0.33	0.42	0.26
unmarried with children	0.13	0.13	0.15	0.16	0.12	0.09	0.15	0.15	0.11	0.10
unmarried without children	0.05	0.04	0.05	0.04	0.04	0.05	0.04	0.05	0.05	0.03
Panel C. Age 18 to 59										
	Full Sample		Working		Not Working		High School or less		More than High School	
Family / Household Living Arrangement	(N = 1,017,723; S = 1,332)		(N = 778,635; S = 996)		(N = 239,088; S = 336)		(N = 540,505; S = 800)		(N = 477,218; S = 532)	
	Sample	Suicides	Sample	Suicides	Sample	Suicides	Sample	Suicides	Sample	Suicides
single living alone	0.12	0.20	0.12	0.19	0.10	0.23	0.09	0.13	0.15	0.29
married couple without children	0.21	0.22	0.21	0.21	0.18	0.23	0.19	0.21	0.22	0.23
married couple with children	0.51	0.44	0.51	0.47	0.51	0.36	0.53	0.49	0.50	0.38
unmarried with children	0.11	0.11	0.10	0.10	0.16	0.14	0.14	0.13	0.08	0.07
unmarried without children	0.05	0.03	0.05	0.03	0.05	0.04	0.05	0.04	0.05	0.03
Panel D. Age 60 and older										
	Full Sample		Working		Not Working		High School or less		More than High School	
Family / Household Living Arrangement	(N = 288,377; S = 419)		(N = 60,832; S = 67)		(N = 227,545; S = 352)		(N = 205,233; S = 301)		(N = 83,144; S = 118)	
	Sample	Suicides	Sample	Suicides	Sample	Suicides	Sample	Suicides	Sample	Suicides
single living alone	0.27	0.29	0.21	0.29	0.29	0.29	0.29	0.27	0.26	0.34
married couple without children	0.53	0.62	0.56	0.58	0.52	0.63	0.50	0.63	0.58	0.58
married couple with children	0.11	0.05	0.15	0.07	0.10	0.05	0.11	0.06	0.09	0.04
unmarried with children	0.05	0.02	0.05	0.03	0.05	0.01	0.05	0.01	0.03	0.03
unmarried without children	0.04	0.02	0.03	0.03	0.04	0.02	0.05	0.03	0.03	0.01

Source: NHIS-LMF 1986-2006

[a] 'N' represents the actual sample size for the category and 'S' represents the number of suicides.