The Role of Medicolegal Systems in Producing Geographic Variation in Suicide Rates*

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Objectives. In this analysis, we ask whether there is systematic variation in the reporting of suicide by medicolegal system and if so whether this biases estimated effects of social correlates on suicide. *Methods.* With cause of death records (1999–2002) and 2000 Census data, we use negative binomial regression to analyze the effects of medicolegal system on suicide and nonsuicide mortality aggregated at county of occurrence. *Results.* We find that elected coroners have slightly lower official suicide rates than medical examiners (MEs; all of whom are appointed) and appointed coroners. In addition, we find that omitting medicolegal system does not bias estimates of the social determinants of suicide. *Conclusion.* Contrary to arguments that MEs' greater scientific training makes them more likely to underreport suicides, we conclude that appointed death investigators (MEs and appointed coroners) underreport suicide to a lesser degree than elected coroners, who are subject to greater public pressures that result in the misclassification of suicides.

Suicide is typically understood as an intensely private and personal act. Those seeking to explain it inevitably focus on the mental and emotional health of the individual. However, one of the strange facts about suicide is that it tends to cluster in specific populations and places. Suicide rates vary consistently across demographic groups and geographic areas, and these durable patterns of group- and place-level variation are not captured by individual-level explanations about psychological well-being. Indeed, such patterns suggest that social structural characteristics (e.g., economic status, social integration) are important determinants of suicide rates. Explaining variation in suicide rates speaks, therefore, to central themes in the social sciences concerning the role of social structure in human behavior.

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Perhaps the most influential sociological perspective on suicide is Durkheim's (2006) social integration–regulation theory, which holds that moderately strong ties binding individuals to their communities and families will reduce suicide rates. These ties are sources of social support (integration) that improve individuals' emotional well-being, and regulation that checks individual aspirations and thus the experience of frustrated ambitions. As Wray, Colen, and Pescosolido (2011) note, contemporary researchers emphasize the integration aspect of Durkheim's theory, and have frequently confirmed it in the United States with individual-, county-, and state-level analyses linking higher suicide rates to never-married and divorced individuals, high residential turnover, single-person households, the absence of religious communities, the child-to-women ratio, and urban areas (Baller and Richardson, 2002; Breault, 1986; Kposowa, Breault, and Singh, 1995; Pescosolido and Mendelsohn, 1986; Stack, 1980). Researchers have also found higher levels of suicide in the mountain states, which they attribute to higher levels of individualism and independence, and thus lower levels of social support and social integration (Shrira and Christenfeld, 2010). The regulation aspect of Durkheim's theory has led to predictions that high socioeconomic status (SES) is accompanied by less regulation and thus greater risk of suicide (Henry and Short, 1954). On the other hand, Burr, Hartman, and Matteson (1999) argue that because SES is inversely related to personal distress and mental health problems, high levels of SES and economic opportunity should prevent suicide, a finding that is borne out in other studies (Congdon, 2011; Kubrin, Wadsworth, and DiPietro, 2006; Rehkopf and Buka, 2006; Stack, 1980). In addition, epidemiologists have drawn attention to another factor that might facilitate an increase in suicide rates: the state-level availability of firearms (Miller, Azrael, and Hemenway, 2002).

Unfortunately, it is difficult to disentangle the social causes of suicide from the social causes of suicide misreporting. Suicide rates are measured by official death records, which are produced by medicolegal authorities who identify the cause of death by making judgments about whether or not the death was self-inflicted and intentional. The difficulties in making that determination with complete accuracy are well known. In most cases of suicide, there are no notes and no witnesses. This fact, coupled with the lingering stigma of suicide and the pressures that officials may feel from family members to reject suicide as an official cause of death, leads to widespread agreement among researchers that official death records underestimate the true number of suicides (Goldsmith et al., 2002). There is, however, less agreement about whether or not underreporting is systematically distributed across group and geographical boundaries. It is plausible that the same factors that are supposed to reduce suicide rates may affect suicide reporting because of pressures brought to bear on death investigators. Areas with structural or cultural characteristics that inhibit suicide (such as high levels of social integration or socioeconomic advantage) may facilitate survivors' applying pressure on death investigators to rule their loved one's death as an accident or as a death by an unknown cause. While this study cannot resolve this issue, it addresses a small piece of it: whether or not the type of death investigator is related to the social causes of suicide, and if accounting for this has consequences for our understanding of the social causes of suicide.

We focus on geographic variation in suicide rates. We examine rates of suicide by county of occurrence in the United States for the years 1999–2002 and the effects of variation in the medicolegal systems on the rates. Because death investigations are often carried out by county officials, it is plausible that geographic variation in death classification procedures affects county-level suicide rates and alters their relationship with social variables, thus making the use of official suicide data for sociological studies problematic (Douglas, 1967; Whitt, 2006; Claassen et al., 2010).

Medicolegal systems in the United States vary from state to state and often from county to county within a state. They can be distinguished along a number of lines, chief of which is whether determination of cause and/or manner of death is being made by a medical examiner (ME) or by a coroner. The legal definitions and requirements of coroners and MEs differ substantially from state to state, but generally MEs are required to have more professional expertise—a medical degree, or some training or certification in forensic pathology, or both—than are coroners. In addition, MEs are appointed to their position while coroners are very likely to be elected (Hanzlick, 2007).

Background

There is little doubt that medicolegal authorities in general are reluctant to make a determination of suicide. Even if suicide is the most probable cause of death, death investigators will often fall back on other causes of death (such as accident or unintentional self-harm) if there is ambiguity in the evidence (Timmermans, 2005). It is therefore a reasonable inference that suicide is underreported in most, if not all, jurisdictions. While this poses a problem for point estimates of suicide rates, it is not necessarily problematic for explaining geographic variation in suicide rates, so long as the underreporting is uniform across jurisdictions, or if the extent of underreporting is truly random and not related to social predictors of suicide. However, if underreporting is correlated with social predictors of suicide (what Pescosolido and Mendelsohn [1986] refer to as "systematic misreporting"), then our statistical models will suffer from omitted variable bias, and our estimates of the effects of social influences on suicide rates will be biased. Examining the extent to which official suicide rates suffer from systematic misreporting will add not only to our understanding of variation in suicide rates but also of the levels and variation in other causes of mortality—namely, accidental and undetermined causes—which will be inflated by the misclassification of suicide deaths (Pescosolido and Mendelsohn, 1986).

How might different medicolegal system affect the reporting of suicide? Previous research has suggested that coroners may be especially prone to suicide underreporting. Clarke-Finnegan and Fahy (1983) examined death records in Galway County, Ireland and found that the number of deaths that were probable suicides was 2.8 times the official suicide count. They argued that coroners are aware of the stigma of suicide and they called for the greater involvement in death investigations of forensic experts, whose technical expertise allegedly makes them less vulnerable to concerns about stigma. Pescosolido and Mendelsohn (1986) extrapolated from this argument the hypothesis that death investigators with more discretion to draw out the death investigation (such as calling an inquest) or to consider nonscientific evidence would be more prone to suicide underreporting. Death investigators with less discretion, such as MEs and appointed death investigators, would be more objective in their assessments and insulated from pressures from the community or from decedents' survivors to produce a nonsuicide classification. In short, according to this reasoning, MEs and appointed death investigators are more likely to be responsive to the norms of their *professional* community while coroners and elected death investigators are more vulnerable to pressures exerted by their *local* community.

Pescosolido and Mendelsohn (1986) tested this argument using 1971 data on the medicolegal systems of county groups and county group white suicide rates for different age and sex combinations for 1970–1971. They found that the effects of medicolegal characteristics usually had nonsignificant effects on reported suicide rates; the few significant effects were mixed. On the one hand, they found that elected death investigators reported fewer suicides for men aged 18–24. On the other hand, coroner offices tended to report more suicides for specific age-sex groups (men aged 18–24, women aged 25–44, and 65 and over). Moreover, they found little evidence that omitting medicolegal variables from regression models biases estimates of the effects of sociological determinants of suicide. This finding has been cited by numerous scholars defending the use of official suicide data (e.g., Andrés, 2005; Cutright and Fernquist, 2001; Kubrin, Wadsworth, and DiPietro, 2006; Stack and Kposowa, 2008; Wadsworth and Kubrin, 2007).

Pescosolido and Mendelsohn's findings about the negative effects of MEs on suicide rates led Timmermans (2005, 2006) to reconceptualize the implications of the organization of death investigation on official suicide rates. His ethnographic research led Timmermans to conclude that the need to safeguard their professional authority results in MEs adopting a high evidentiary standard for classifying a death as a suicide because falsely declaring a death to be a suicide is more damaging to MEs' professional authority than falsely declaring a death to be a nonsuicide. MEs also view evidence through a scientific, forensic lens, and as a result disregard biographical information suggesting a suicide unless there is clear forensic evidence pointing to that determination. In addition, MEs' technical expertise makes them more likely than coroners to uncover diseases that could be an alternate cause of death. This leads MEs to be especially prone to undercount the suicides of women who are more likely than men to overdose, a method of dying that can be easily mistaken for "natural" causes and for which intent is more difficult to establish.

Following Pescosolido and Mendelsohn, we reexamine the role of death investigation systems in the reporting of suicides. Since 1970, the year from which their data were drawn, many jurisdictions have replaced their coroner systems with MEs (Hanzlick and Combs, 1998). Concomitant with this expansion of the ME system have been national efforts, initiated by professional societies and federal government officials, to instill professional norms and standards for death certification among MEs (Combs, Parrish, and Ing, 1995). The increasing professionalization of death investigation systems might change their effects on suicide rates. If Timmermans (2005) is correct that the scientific outlook of MEs leads to greater suicide underreporting, then we should expect the negative effect of ME systems to be the same as or stronger than that found in Pescosolido and Mendelsohn (1986). On the other hand, the effect could be reversed, if Clarke-Finnegan and Fahy (1983) are correct that technical expertise leads to more confidence in a suicide classification. In either case, our interest lies in the extent to which the effects of context on official suicide rates are artifacts caused by systematic differences in underreporting across different medicolegal systems.

Methods

Data

This study uses U.S. county-level data from a number of sources. The mortality data are aggregated counts from the Multiple Cause of Death individual-level files covering the years 1999–2002. Because the determination that a death is the result of intentional self-harm is made generally in the county where the reported suicide took place, we aggregated the mortality data by the county of occurrence. While most suicides occur in the county of residence of the deceased, there are individual counties that appear to have relatively large proportions of nonresident suicides (see, e.g., the analyses of Las Vegas, Clark County, Nevada by Wray et al., 2008, 2012).

Data on the structural predictors of suicide are from Summary File 3 of the 2000 Census of Population and Housing; the 2000 Religious Congregations and Membership Study, which consists of data on the presence of adherents in various faith traditions in all U.S. counties; and the U.S. Department of Agriculture's 2003 rural-urban classifications of U.S. counties. Because there are stark gender disparities in suicide rates, suicide methods, and the predictors of suicide, we examine the official rates for all suicides, nonfirearm suicides, and firearm suicides separately for males and females (aged 15 and over), as other studies do (Pescosolido and Mendelsohn, 1986; Rockett, Samora, and Coben, 2006; Andres, 2005; Cutright and Fernquist, 2001; Denney et al., 2009).

Texas and Minnesota were not included in our analyses because of ambiguities over the jurisdiction of death investigators. In both of these states there is tremendous heterogeneity among the coroners, confounding a clear comparison of MEs, appointed coroners, and elected coroners. Of the 2,800 counties remaining, we eliminated 11 because their death investigation system changed from a coroner system to an ME system during the 1999–2002 period of our study and one other county owing to missing data, resulting in a final sample of 2,788 counties.

Measures

Mortality. This study has three primary outcomes: total suicide death rates, death rates from firearm suicide, and death rates from nonfirearm suicide. We analyze firearm suicides and nonfirearm suicides separately because the causes of these two types of suicides will be different (the availability of firearms should be positively associated with higher firearm suicide rates but not nonfirearm suicide rates) and because misclassified firearm suicides should be placed in different categories than misclassified nonfirearm suicides. In addition to suicide deaths, we analyze other death rates that could conceivably include misreported suicides, as we discuss below.

Medicolegal Variables. Based on Hanzlick (2007), U.S. counties were classified as having either an ME system, an elected coroner system, or an appointed coroner system (all ME counties had an appointed ME) and by whether coroners were required to be physicians. For our main analyses, we present the effects of having an ME, elected coroner, or an appointed coroner system, since our analyses suggest that having an appointed versus elected official is more important for understanding the effects of medicolegal systems than is requiring medical training versus not requiring medical training. We verified Hanzlick's data through Internet searches by consulting state statutes and Lexis-Nexis searches of local newspapers, and making phone inquiries to determine the type of system operating during the period 1999–2002. Counties' classifications were based on the most local office. For example, counties with a local coroner, located in a state with a state ME, were coded as having a coroner system.

Sociodemographics. Variables in our models representing levels of deprivation and social integration that are thought to structure suicide rates include sex-specific proportions of residents (15 years old or older) in the county who are living in poverty, who have never been married, and who are currently divorced. In addition, we include the median household income; the average number of years of schooling of residents 25 years old or older; the proportion of residents five years old or older who lived in a different home in 1995; the proportion of households consisting of only one individual; the ratio of the number of children aged 17 or younger to adult women aged 18 or older; the average age of all residents in the county; the proportion of individuals 16 years old or older in the labor force who are unemployed; the proportion of residents who are white; and the size of the county population (in 10,000s).

In this study, we control for the proportion of the county population who are adherents of evangelical Protestant and Catholic faiths; both are large tightly integrated religious groups with strong prohibitions on suicide. These variables as measured were obtained from the 2000 Religious Congregations and Membership Study.

All of the above variables are closely linked to those in Pescosolido and Mendelsohn's (1986) study. They represent variables used in a large number of other studies on the social determinants of suicide (Agerbo, Sterne, and Gunnell, 2007; Baller and Richardson, 2002; Burr, McCall, and Powell-Griner, 1994, 1997; Denney et al., 2009; Hempstead, 2006; Rehkopf and Buka, 2006; Stack, 1980; Wadsworth and Kubrin, 2007; Walker, 2009).

Recently, suicide researchers have paid attention to the availability of guns in a locale. They have found that household firearm ownership is related to suicide across countries and cities, states and regions within the United States, especially among youths and the elderly, as well as with changes over time in suicide rates (Miller and Hemenway, 1999; Ajdacic-Gross et al., 2006; Dahlberg, Ikeda, and Kresnow, 2004; Birckmayer and Hemenway, 2001; Kubrin and Wadsworth, 2009; Miller et al., 2006; Kaplan and Geling, 1998). The measurement of gun availability based on self-reporting or on the existence of gun regulations has obvious problems associated with illegal gun ownership. Azrael, Cook, and Miller (2004) document that the proportion of suicides that are firearm-related is a good proxy for the prevalence of gun ownership but only for states and large counties. In our analysis, we classify counties by the state proportion of suicides that are by firearms. An alternative measure of gun ownership, the state-level proportions of individuals who report owning a gun according to the 2001 and 2002 Behavioral Risk Fact Surveillance System (BRFSS) produced somewhat different results than the ones presented in the main analyses, but the substantive conclusion remains the same. These alternative results are presented in the Appendix.

Because of the prevalence of coroners in rural counties and MEs in urban places, we include the U.S. Department of Agriculture's 2003 nine-category rural-urban continuum classification of U.S. counties collapsed into three categories—*large city*, counties in a large metropolitan area containing more than 250,000 individuals; *rural*, counties in a nonmetropolitan area with an urban population of no more than 19,999 individuals; and the reference group, counties in metro areas having fewer than 250,000 population and nonmetro counties having urban populations of 20,000 or more. Finally, we control for the region of the country in which the county is located with *Mountain* as the reference category.

Analysis

In our analyses, suicide and nonsuicide deaths are treated as count outcomes necessitating the use of negative binomial regression. Because we analyze men and women separately, the total number of male or female individuals (respectively), aged 15 and over who reside in the county serve as exposure variables. Coefficients from the negative binomial regressions reflect the predicted change in the log suicide rates. Because we have data on the population of deaths in the United States (excepting Texas and Minnesota), we emphasize effect sizes over statistical significance.

Results

Table 1 contains the mean values for all variables in our analysis by whether a county has an ME, an elected coroner, or an appointed coroner. We regressed each continuous variable on office type and present the R^2 statistics; for categorical variables we present Cramér's V, a statistic roughly analogous to a correlation coefficient. All the predictor variables are significantly related to office type although the differences are, for the most part, fairly small. The major differences are as follows: (1) ME counties tend to have much larger populations than do coroner counties; (2) ME counties are more likely to be in the South than are coroner counties, and coroner counties are more likely to be in the Midwest than are ME counties; (3) counties with elected coroners also appear to be in states where guns are more available, than are counties with MEs and (especially) counties with appointed coroners.

Reported Suicide

In Tables 2–4, we present analyses of total suicides, nonfirearm suicides, and firearm suicides separately for females and males. Model 1 shows the effects of sociological predictors on county-level sex-specific suicide rates; Model 2 contains in addition the type of death investigation office (elected coroner and appointed coroner, with ME as the reference category). By controlling the relevant predictors of "true" suicide rates we can interpret the effects of office type as reflecting differences in underreporting suicide. Our analytic technique and interpretation of the results rest on the assumption that the misreporting of suicides consists overwhelmingly of underreports and that overreporting is minimal to nonexistent, an assumption consistent with other research (Stack, 2000). We examine the effects of death investigation systems on suicide reporting and whether omitting them from our models biases estimates of the effects of sociological variables. If suicide rates are biased by differences in reporting by different medicolegal systems, then the coefficients for the sociological variables should change from Model 1 to Model 2.

The results for Model 1 for each of the three outcome variables contain few surprises. Measures of social integration (or lack thereof) tend to affect official suicide rates in the expected direction. For both men and women, counties with higher proportions of never-married and divorced individuals, higher

TABLE 1

Summary Statistics: Variables Used in Analysis of Suicide Rates, U.S. Counties, 1999–2002

	Total Sample		ME ($N = 1,036$)	Elected Coroner ($N = 1,578$)	Appointed Coroner ($N = 174$)	R^{2}[b]	Cramér's
Variable	*M*	*SD*	*M*	*M*	*M*		V[a]
Suicide rates (deaths per 100,000 over age 15)							
Total suicide, females	5.215	6.699	5.824	4.912	4.343	0.005	
Total suicide, males	28.023	17.653	29.853	27.346	29.213	0.002[c]	
Nonfirearm suicide, females	2.900	5.453	3.338	2.605	2.800	0.004	
Nonfirearm suicide, males	8.295	7.932	9.029	7.669	9.608	0.008	
Firearm suicide, females	2.326	3.725	2.486	2.307	1.543	0.003	
Firearm suicide, males	19.727	14.706	19.824	19.677	19.604	0.000[c]	
Predictors							
Proportion below poverty level, females	0.145	0.063	0.136	0.154	0.122	0.029	
Proportion below poverty level, males	0.109	0.054	0.102	0.115	0.094	0.019	
Proportion never married, females	0.194	0.059	0.199	0.194	0.169	0.014	
Proportion never married, males	0.260	0.058	0.264	0.259	0.252	0.003	
Proportion divorced, females	0.099	0.022	0.102	0.099	0.083	0.050	
Proportion divorced, males	0.093	0.020	0.093	0.094	0.083	0.017	
Median income ($1,000s)	35.442	8.976	37.396	34.290	34.361	0.027	
Average years of schooling	12.351	0.723	12.457	12.259	12.561	0.022	
Proportion of movers	0.411	0.075	0.420	0.407	0.386	0.014	
Proportion of one-person households	0.254	0.040	0.254	0.252	0.281	0.032	
Child-to-woman ratio	0.670	0.126	0.648	0.684	0.683	0.018	
Average age	37.381	2.930	37.526	37.091	39.151	0.029	
Large city	0.241	—	0.319	0.207	0.098		0.123
Rural	0.543	—	0.459	0.574	0.759		
Small city/small urban population	0.216	—	0.222	0.219	0.144		
County population (10,000s)	9.107	29.628	14.42	6.167	4.139	0.019	
Unemployment rate	0.058	0.029	0.059	0.059	0.042	0.021	
Proportion of white	0.844	0.172	0.832	0.844	0.921	0.014	

TABLE 1—Continued

Variable	Total Sample		ME ($N = 1,036$)	Elected Coroner ($N = 1,578$)	Appointed Coroner ($N = 174$)	R^{2b}	Cramér's
	M	*SD*	*M*	*M*	*M*		V^a
Proportion of evangelicals	0.216	0.163	0.199	0.235	0.151	0.022	
Proportion of Catholic	0.130	0.146	0.126	0.125	0.195	0.013	
Proportion of suicides with firearm (state level)	0.595	0.097	0.580	0.610	0.545	0.040	
Mountain	0.101	—	0.074	0.124	0.035		0.277
New England–Mid Atlantic	0.077	—	0.105	0.068	0.000		
Pacific	0.058	—	0.071	0.056	0.006		
South	0.419	—	0.544	0.383	0.000		
Midwest	0.345	—	0.206	0.370	0.960		
Other mortality rates (deaths per 100,000 over age 15)							
Car accidents, females	17.439	18.666	15.763	18.042	21.952	0.007	
Car accidents, males	40.295	31.285	36.194	42.523	44.517	0.010	
Nonfirearm, noncar accidents, females	17.688	14.426	18.255	17.046	20.138	0.003	
Nonfirearm, noncar accidents, males	32.832	27.628	35.362	31.154	32.996	0.005	
Nonfirearm incidents of unknown intent, females	0.822	2.071	1.097	0.715	0.155	0.015	
Nonfirearm incidents of unknown intent, males	1.639	4.624	2.017	1.487	0.762	0.005	
All illnesses, females	1,005.953	439.641	1,023.182	974.892	1,185.062	0.014	
All illnesses, males	953.091	49.189	986.697	919.397	1,058.563	0.009	
Nonfirearm homicides, females	1.223	2.281	1.318	1.217	0.713	0.004	
Nonfirearm homicides, males	2.253	4.200	2.484	2.207	1.297	0.004	
Firearm accidents, females	0.174	1.684	0.133	0.206	0.124	0.000[c]	
Firearm accidents, males	1.075	2.935	0.822	1.272	0.799	0.006	
Firearm incidents of unknown intent, females	0.046	0.387	0.043	0.052	0.004	0.001[c]	
Firearm incidents of unknown intent, males	0.304	1.362	0.264	0.346	0.150	0.002[c]	
Firearm homicides, females	1.591	2.955	1.626	1.638	0.961	0.003	
Firearm homicides, males	4.910	8.203	5.366	4.916	2.147	0.008	

[a]Chi-square tests for all tabulations are significant, both *p*-values <0.0005.
[b]Unless otherwise noted, *F*-statistics for all regressions are significant, all *p*-values <0.02.
[c]*F*-statistic for regression is not significant at 0.05 level.

TABLE 2

Negative Binomial Regression Analysis of Total Suicides, U.S. Counties, 1999–2002

	Female		Male	
Variable	Model 1	Model 2	Model 1	Model 2
Proportion poor	−2.041***	−1.841***	−0.497*	−0.474*
Proportion single	2.288***	2.127***	0.607**	0.536**
Proportion divorced	5.989***	5.911***	4.136***	4.115***
Median household income ($10,000s)	−0.048*	−0.048*	−0.091***	−0.093***
Average years schooling	0.012	0.009	0.038**	0.035**
Proportion movers	0.749***	0.672***	0.277**	0.246*
Proportion one-person households	0.804	0.752	1.617***	1.571***
Child-to-women ratio	0.783***	0.712***	1.080***	1.027***
Average age	0.057***	0.052***	0.047***	0.044***
Large city	0.038	0.039	−0.001	−0.001
Rural	0.001	−0.004	−0.014	−0.014
Proportion unemployed	2.140***	1.871**	1.302***	1.213***
Proportion white	0.548***	0.526***	0.450***	0.432***
Proportion evangelicals	0.256**	0.317***	−0.048	−0.012
Proportion Catholic	−0.106	−0.054	−0.061	−0.035
New England/Mid-Atlantic	−0.552***	−0.538***	−0.423***	−0.413***
Pacific	−0.261***	−0.233***	−0.188***	−0.174***
South	−0.274***	−0.323***	−0.276***	−0.304***
Midwest	−0.483***	−0.468***	−0.394***	−0.387***
County population (10,000s)	0.000	0.000*	0.000***	−0.001***
Proportion suicides firearm-related (state level)	0.446***	0.661***	0.508***	0.623***
Elected coroner		−0.122***		−0.064***
Appointed coroner		−0.017		−0.011
Intercept	−9.921***	−9.851***	−8.229***	−8.193***

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

proportions of people who have moved in the previous five years, and higher ratios of children to women have higher official suicide rates. In addition, for men, we see that official suicide rates are higher in counties with a greater presence of single-person households (this effect occurs for female suicides as well, but it is of weaker magnitude and is not significant). We see some mixed results for measures of economic deprivation. As expected, counties with a lower median household income and a higher unemployment rate have higher official suicide rates. However, a higher proportion of individuals in poverty is associated with lower official suicide rates for both males and females, and the average level of education is associated with higher official suicide rates for males (the effect of education is much weaker and not significant for females).

TABLE 3

Negative Binomial Regression Analysis of Nonfirearm Suicides, U.S. Counties, 1999–2002

	Female		Male	
Variable	Model 1	Model 2	Model 1	Model 2
Proportion poor	−3.018***	−2.638***	−0.379	−0.356
Proportion single	3.530***	3.081***	0.879**	0.763**
Proportion divorced	6.103***	5.882***	4.700***	4.633***
Median household income ($10,000s)	−0.060*	−0.060*	−0.049**	−0.053**
Average years schooling	0.051	0.045	0.070***	0.065***
Proportion movers	1.058***	0.934***	0.779***	0.716***
Proportion one-person households	0.977	1.035*	2.286***	2.256***
Child-to-women ratio	0.962***	0.825***	1.293***	1.220***
Average age	0.070***	0.059***	0.050***	0.046***
County in large metropolitan area	0.013	0.016	0.003	0.003
County with small urban population	−0.052	−0.065	−0.135***	−0.138***
Proportion unemployed	2.222**	1.709*	0.841	0.707
Proportion white	0.619***	0.575***	0.162*	0.146
Proportion evangelicals	−0.032	0.041	−0.293***	−0.251**
Proportion Catholic	0.111	0.180	0.149*	0.181**
New England/Mid-Atlantic	−0.572***	−0.562***	−0.377***	−0.370***
Pacific	−0.285***	−0.238***	−0.202***	−0.179***
South	−0.262***	−0.345***	−0.246***	−0.281***
Midwest	−0.414***	−0.393***	−0.263***	−0.256***
County population (10,000s)	0.000	0.000	0.000	0.000**
Proportion suicides firearm-related (state level)	−0.591***	−0.297	−0.960***	−0.827***
Elected coroner		−0.199***		−0.089***
Appointed coroner		−0.093		−0.017
Intercept	−10.545***	−10.429***	−9.427***	−9.377***

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Most of these counterintuitive results disappear in models where each of these variables is the sole measure of economic well-being in a county, presented in Table 5. We note, however, that females' poverty continues to be associated with lower official suicide rates.

Our results also show that counties with a greater proportion of white people show higher official suicide rates, while the effects of the two religion variables are mixed: a greater presence of Catholics is associated with lower official firearm suicide rates (but not nonfirearm suicide rates); a larger proportion of evangelicals in a county is associated with higher official suicide rates for

TABLE 4

Negative Binomial Regression Analysis of Firearm Suicides, U.S. Counties, 1999–2002

	Female		Male	
Variable	Model 1	Model 2	Model 1	Model 2
Proportion poor	−2.264***	−2.295***	−1.033***	−1.009***
Proportion single	1.089	1.193	0.614**	0.561*
Proportion divorced	6.489***	6.535***	3.889***	3.864***
Median household income ($10,000s)	−0.137***	−0.138***	−0.149***	−0.151***
Average years schooling	−0.014	−0.014	0.037*	0.034
Proportion movers	0.652*	0.601*	0.177	0.161
Proportion one-person households	−0.478	−0.583	1.045***	1.013***
Child-to-women ratio	0.958***	0.950***	1.151***	1.113***
Average age	0.059***	0.059***	0.052***	0.050***
County in large metropolitan area	0.084**	0.084**	−0.004	−0.004
County with small urban population	0.052	0.051	0.031	0.031
Proportion unemployed	2.276**	2.340**	1.528***	1.457***
Proportion white	0.500***	0.516***	0.654***	0.638***
Proportion evangelicals	0.260	0.276*	−0.065	−0.037
Proportion Catholic	−0.547***	−0.544***	−0.204***	−0.182**
New England/Mid-Atlantic	−0.563***	−0.563***	−0.440***	−0.430***
Pacific	−0.147**	−0.144*	−0.151***	−0.141***
South	−0.264***	−0.263***	−0.276***	−0.299***
Midwest	−0.497***	−0.502***	−0.422***	−0.416***
County population (10,000s)	0.000	0.000	−0.001***	−0.001***
Proportion suicides firearm-related (state level)	2.885***	2.897***	1.607***	1.702***
Elected coroner		−0.006		−0.049***
Appointed coroner		0.110		−0.013
Intercept	−10.777***	−10.778***	−8.613***	−8.585***

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

females and lower official nonfirearm suicide rates for males. In addition, the results show a stark regional effect: counties in the mountain region of the United States have substantially higher official suicide rates than do counties in all other regions.

Finally, it is worth noting from Table 4 the strong effect that state-level gun availability has on official suicide rates, especially for females. A standard deviation increase in our proxy measure for gun ownership in a state ($SD = 0.097$, from Table 1) is associated with a 32.29 percent increase in the official firearm suicide rate [$e^{b(0.097)} = e^{2.885(.097)} = 1.3229$] for females, and a 16.87

percent increase in the official firearm suicide rate [$e^{1.607(.097)} = 1.1687$] for males.

Indicators for type of death investigation system, added in Model 2, represent differences in official suicide rates between elected coroner and appointed coroner counties, on the one hand, and the ME counties (the reference group) on the other. Table 2 shows that counties with elected coroners have significantly lower total suicide rates than counties with MEs, producing 11.49 percent smaller female suicide rates [$e^{-0.122} = 0.8851$] and 6.20 percent smaller male suicide rates [$e^{-0.064} = 0.9380$]. The differences between appointed coroners and MEs are small: for men and women, appointed coroners report about 1–2 percent smaller suicide rates than elected coroners [$e^{-0.017} = 0.9831$; $e^{-0.011} = 0.9891$] and these differences are not significant. We find a similar pattern in Table 3 for nonfirearm suicide rates for both males and females, and also for firearm suicide rates for males in Table 4. The only set of results that suggests MEs have lower suicide rates than coroners is for female firearm suicides; appointed coroners counties' female firearm suicide rates are 11.63 percent higher [$e^{0.110} = 1.1163$] than those for ME counties (a difference that is not significant), and there is barely any difference between elected coroner and ME counties (Table 4). Note that this pattern was not predicted by Timmermans, who argued that the coroner advantage in finding female suicides should lie primarily in nonfirearm deaths, such as deaths by drug overdose or drowning. Moreover, we shall see that when we compare female firearm nonsuicide deaths by office type, we find no evidence that the higher level of female firearm suicides in appointed coroner counties reflects more accurate suicide reporting.

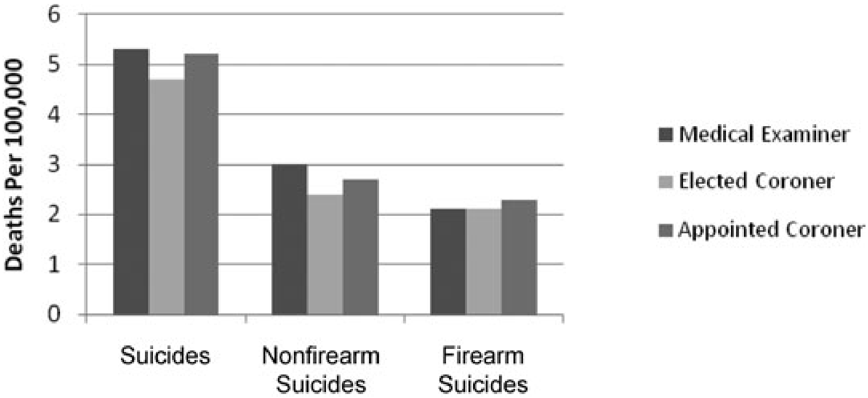
To give a sense of the magnitude of these differences, Figures 1 and 2 contain expected suicide rates for counties averaged on all predictors but differentiated by office type. Differences in office type do not produce substantial differences in official suicide rates. For females, an ME county has an official suicide rate of 5.26 deaths per 100,000, while an elected coroner county has an official suicide rate of 4.66 deaths. For males, the rates are 27.66 deaths per 100,000 in ME counties compared to 25.94 in elected coroner counties. In short, a county's medicolegal system for death investigation has significant effects on official suicide rates, but the effects are small.

Alternative Causes of Death

The significant, albeit small, effects of office type on official suicide rates in our results support the notion that elected coroners are more influenced by the stigma of suicide and prone to misclassify suicide deaths and that MEs are shielded from such influences. This is contrary to the findings of Pescosolido and Mendelsohn (1986) that MEs report fewer suicides than coroners. It also runs counter to the hypothesis advanced (but not tested) by Timmermans (2005) that MEs will be likely to underreport suicides more than coroners

FIGURE 1

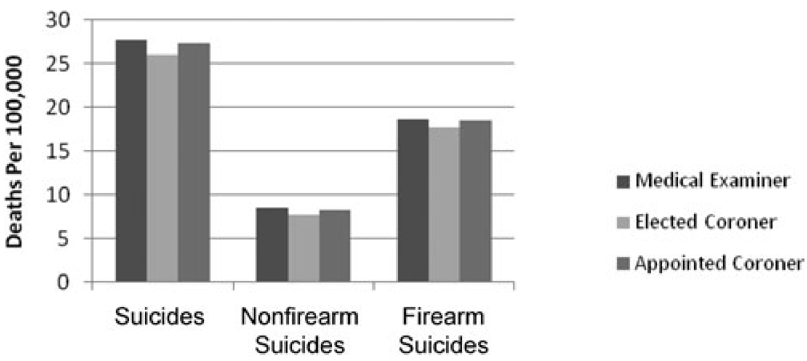
Suicide Mortality for Females, 1999—2002



NOTE: Expected rates are calculated from Model 2 presented in Tables 2–4. Expected rates represent a country average on all predictors except for office type.

FIGURE 2

Suicide Mortality for Males, 1999–2002



NOTE: Expected rates are calculated from Model 2 presented in Tables 2–4. Expected rates represent a country average on all predictors except for office type.

because they must satisfy stricter scientific standards to make suicide determinations. However, before concluding that our results reflect true differences in reporting, we must examine a plausible alternative interpretation, that is, that the effect of office type is spurious and therefore not a true misreporting effect. Some unobserved variable or variables, varying by office type, could be influencing true suicide rates.

TABLE 5

Effects of Economic Well-Being

	Females			Males		
Model/Predictor	Total Suicide	Nonfirearm Suicide	Firearm Suicide	Total Suicide	Nonfirearm Suicide	Firearm Suicide
Model 1						
Education	0.016	0.078***	−0.085***	−0.047***	0.022	−0.081***
Model 2						
Median household income	0.007	0.047***	−0.084***	−0.073***	−0.013	−0.114***
Model 3						
Sex-specific poverty	−0.712**	−1.772***	0.552	0.848***	0.099	1.067***
Model 4						
Unemployment	0.417	−1.087	2.369***	1.918***	0.601	2.437***

NOTE: All models control for proportion single, proportion divorced, proportion movers, proportion one-person households, child-to-women ratio, average age, large city, rural, proportion white, proportion evangelicals, proportion Catholic, region, county population, proportion suicides firearm-related, and office type.
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

To investigate this possibility, we looked at the effect of office type on death rates from causes other than suicide. If elected coroners are underreporting suicides, they must be overreporting other cause-of-death categories into which a suicide could possibly be misclassified. For nonfirearm suicides, these categories include car accidents, nonfirearm/noncar accidents (such as accidental overdoses, falls, and drownings), external events of unknown intent, illnesses, and nonfirearm homicides. Likewise, a firearm suicide could possibly be misclassified as a firearm accident, a firearm incident of unknown intent, or a firearm homicide.

Table 6 presents the coefficients for the presence of an elected coroner or an appointed coroner on the alternative cause-of-death categories, In addition, Table 6 contains the expected difference between an elected coroner county and an ME county and between an appointed coroner county and an ME county, measured in deaths per 100,000 people. The expected differences are calculated for counties having average values for all predictor variables. For example, the female nonfirearm suicide rate in an average county that has an elected coroner is 2.95 deaths per 100,000; the female nonfirearm suicide rate in an average county that has an elected coroner is 2.42 deaths per 100,000, a difference of 0.53 deaths per 100,000.

Since elected coroners report fewer male and female nonfirearm suicides than do MEs, they should report more deaths in other categories in which nonfirearm suicides would be mistakenly placed. In fact, elected coroners report more male and female car accident deaths, and female illness deaths

TABLE 6

Effect of Office Type on Suicide and Nonsuicide Mortality, U.S. Counties, 1999–2002

	Elected Coroner		Appointed Coroner	
Outcome	Coefficient	EC – ME (Deaths per 100,000)	Coefficient	AC – ME (Deaths per 100,000)
Female				
Nonfirearm suicides	−0.199***	−0.534	−0.093	−0.262
Car accidents	**0.012**	**0.192**	0.057	0.925
Nonfirearm, noncar accidents	−0.052**	−0.906	−0.047	−0.819
Nonfirearm incidents, intent undetermined	−0.213***	−0.165	−0.684***	−0.425
All illnesses	**0.001**	**0.555**	0.027	26.576
Nonfirearm homicides	**0.019**	**0.022**	−0.186	−0.193
Nonfirearm accidents, illnesses, homicides, and all illnesses	−0.002	−1.703	0.027	28.406
Firearm suicides	−0.006	−0.012	0.110	0.242
Firearm accident	0.171**	0.017	0.403	0.045
Firearm incident, intent undetermined	0.018	0.001	0.228	0.009
Firearm homicide	−0.045	−0.063	0.063	0.093
Firearm accidents, incidents, and homicides	−0.027	−0.042	0.068	0.111
Male				
Nonfirearm suicides	−0.089***	−0.717	−0.017	−0.147
Car accidents	**0.018**	**0.659**	0.062	2.300
Nonfirearm, noncar accidents	−0.102***	−3.194	−0.102	−3.180
Nonfirearm incidents, intent undetermined	−0.066	−0.092	−0.259	−0.328
All illnesses	−0.015	−13.812	−0.044	−40.361
Nonfirearm homicides	−0.044	−0.082	−0.067	−0.124
Nonfirearm accidents, illnesses, homicides, and all illnesses	−0.020	−20.362	−0.044	−43.965
Firearm suicides	−0.049***	−0.892	−0.013	−0.235
Firearm accident	**0.184*****	**0.160**	0.143	0.122
Firearm incident, intent undetermined	**0.105**	**0.024**	0.227	0.055
Firearm homicide	−0.099**	−0.343	−0.021	−0.074
Firearm accidents, incidents, and homicides	−0.042	−0.201	−0.006	−0.028

NOTE: Bolded coefficients are for causes of death in which suicides could have been misclassified. All regressions include predictor variables shown in Tables 2–4. **$p < 0.05$; ***$p < 0.01$.

and female nonfirearm homicides than do MEs. Note that for females, the expected difference between elected coroners and MEs for illnesses (0.555 deaths per 100,000) matches the expected difference for nonfirearm suicides (0.534 deaths). For males, the expected difference between elected coroners and MEs for car accidents (0.659 deaths) is close to the expected difference for nonfirearm suicides (0.717 deaths). If office type is affecting misreporting, our results suggest that female suicides are being misclassified most often as deaths from illness, and, to a lesser extent, car accidents and possibly (although not plausibly) nonfirearm homicides, while male true suicides are being misclassified most frequently as car accidents. While these effects of medicolegal system on nonsuicide deaths are not significant, they are worth reporting for two reasons. First, misclassified suicides are distributed among multiple causes of death, and thus it is not surprising that our models have less power to detect these effects as significant. Second, as we noted above, we are analyzing population data. Because we are not making inferences based on a sample, the issue of statistical significance is less important.

On the other hand, if the effects of office type on suicide rates are confounded by some unobserved true cause of mortality, we would see that elected coroners would report fewer suicide deaths *and* nonsuicide deaths, a pattern we see as well. In addition to reporting fewer nonfirearm suicide deaths, elected coroner counties report fewer male and female deaths caused by incidents of unknown intent, and fewer female deaths caused by noncar, nonfirearm suicides.

We see a similar ambiguity in the results for male firearm suicides. Elected coroners report fewer of these suicides (by 0.89 deaths per 100,000) and report significantly more firearm accidents and more (but not significantly more) firearm incidents of unknown intent. Therefore, it is possible that elected coroners are classifying true firearm suicides into either of these categories. However, elected coroners also report fewer firearm homicides, again raising the possibility of unmeasured county characteristics that influence both the true firearm suicide rate and the true firearm homicide rate.

The analyses of alternative causes of death also suggests that the higher levels of female firearm suicides in appointed coroner counties are not due to better procedures for finding suicide. Appointed coroner counties not only have more female firearm suicides than ME counties, they have more female firearm deaths across the board. If appointed coroner counties were truly accurately classifying female firearm suicides, then they should have fewer deaths in the other firearm-related death categories, but they do not. The higher levels of female firearm suicides in the appointed coroner counties reflect some unmeasured characteristic that probably affects true suicide rates.

In summary, the results of our analyses of nonsuicide death rates are consistent with two scenarios. One is that an unobserved variable produces higher true suicide rates, as well as rates of noncar accidental deaths, in counties with MEs. The other is that underreporting of suicide is greater among elected coroners who are misclassifying a small number of true suicides as car accidents, illnesses (for women only), and firearm accidents or incidents of unknown intent (for men only), but there is again an unobserved variable that produces lower rates of noncar accidental deaths among elected coroners.

Expertise or Independence?

Our results are consistent with a true misreporting effect resulting from the fact that MEs' technical expertise helps them uncover suicides, or gives them the confidence to make a suicide determination despite the objections of the decedents' survivors. Because appointed coroner counties are much more likely to require their coroners to have medical training (70 percent) than are elected coroner counties (4 percent), we might use a similar argument to explain why appointed coroner counties are similar to ME counties. Alternatively, the greater amount of underreporting among elected coroners may have less to do with training than with the fact that they are elected, which makes them more vulnerable to pressures put on them by the local community to make nonsuicide determinations.

To adjudicate between these explanations, we use a fourfold classification of counties, namely, those with elected physician coroners, elected nonphysician coroners, appointed physician coroners, and appointed nonphysician coroners. Note that "nonphysician coroner" counties may in practice have a physician coroner; however, the county laws do not legally require a coroner to have medical training. The results in Table 7 suggest that elected/appointed status matters much more for official suicide mortality rates than physician/nonphysician status. Elected coroners, regardless of their physician status, show smaller official suicide mortality rates than do MEs. Appointed physician coroner counties and appointed nonphysician coroner counties never have a suicide rate that is significantly different from ME counties. The results suggest that while underreporting may be more of a problem in appointed nonphysician coroner counties than in appointed physician coroner counties (at least for females), they also suggest that underreporting is more severe for elected physician coroner counties than for nonelected physician coroner counties.

Medicolegal Systems and Bias in the Effects of Social Determinants of Suicide

For more than a century empirical research on suicide linked the variation in rates across geographic areas to measures of social isolation and deprivation (e.g., see Wray, Colen, and Pescosolido, 2011). Researchers concerned about potential bias in official suicide rates were reassured by the work of Pescosolido and Mendelsohn (1986), which showed little or no change in the effects of social/structural variables when controlling for possible sources of

TABLE 7

Effects of Fourfold Coroner Typology on Suicide Mortality, U.S. Counties, 1999–2002

	Females			Males		
Predictor	Total Suicide	Nonfirearm Suicide	Firearm Suicide	Total Suicide	Nonfirearm Suicide	Firearm Suicide
Appointed nonphysician coroner	−0.088	−0.132	−0.011	0.010	−0.070	0.076
Appointed physician coroner	0.033	−0.055	0.187	−0.017	0.020	−0.050
Elected nonphysician coroner	−0.120***	−0.193***	−0.008	−0.060***	−0.080***	−0.048***
Elected physician coroner	−0.149**	−0.351***	0.079	−0.141***	−0.271***	−0.092*

NOTE: Medical examiner is reference category. All regressions control for predictors included in Tables 2–4.
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

misreporting. Our results offer similar reassurance. Returning to the analyses presented in Tables 2–4 and comparing the effects in Model 1 to those in Model 2, we see little evidence that omitting information about the medicolegal system biases estimates of the effects of social/structural variables on county suicide rates. Although we find small but significant effects of medicolegal systems on suicide rates, our analyses of county-level data in 2000 show no substantial changes in the effects of sociological predictors on suicide rates. We are confident that the effects of social isolation, deprivation, and the very strong effect of region (with mountain states having a much higher suicide rates than other regions) are not artifacts caused by the omission of at least one measure of systematic reporting bias—medicolegal system—as a control.

Conclusion

In this article, we tested arguments about how characteristics of death investigation offices affect official suicide rates. While some researchers argued that the professional expertise and autonomy of MEs and appointed death investigators meant they were less likely to underreport suicides (Clarke-Finnegan and Fahy, 1983), others argued that MEs' forensic methods and need to maintain professional authority leads them to discount biographical evidence suggesting a suicide and to require a very high standard of evidence in order to declare a suicide (Pescosolido and Mendelsohn, 1986; Timmermans, 2005). Pescosolido and Mendelsohn's (1986) findings indicate that in 1970, elected death investigators did indeed report fewer suicides (although only for young men), but to the extent that there were differences between coroners and MEs, MEs were more vulnerable to suicide underreporting than coroners.

Our results suggest that by 2000, elected officials were still reporting fewer suicides, not only for men but also for women, than appointed officials. In contrast to Pescosolido and Mendelsohn, we found that ME counties reported just as many suicides as appointed coroner counties, and somewhat more suicides than elected coroner counties. Why do we show that among appointed death investigators, MEs report about the same number of suicides as do coroners? We speculate that since the 1970s, the growth in the number of ME systems led to greater efforts to spread professional norms and techniques that may have led MEs to reach parity with appointed coroners in suicide underreporting.

We cannot definitively prove that differences in official suicide rates among MEs, appointed coroners, and elected coroners represent differences in underreporting. We have tentative evidence that elected coroners are misclassifying suicides as car accidents, illnesses (for females), and firearm accidents/incidents of unknown intent (for males). Future studies attempting to gauge suicide misreporting with more confidence will need to follow one of two strategies. First, they can add improved measures of county-level social conditions thought to influence true suicide rates. This would improve confidence that differences in suicide rates by office type are representing real misreporting effects. But it is difficult to imagine what existing social measures, available at the county level, would add substantially more analytical leverage than the ones included in this study. Second, future studies can do comparative fieldwork in different types of death investigation offices and describe how investigators approach possible suicide deaths, although such a study would require huge expenditures of time and effort, since suicides (or possible suicide deaths) are rare events.

These results will help researchers refine their thinking about the work that death investigators do. Timmermans (2005) argued that MEs, in order to shore up their professional credibility and authority, adopt a cognitive and perceptual template focusing on a high evidentiary standard and technical analyses of the body (leading to finding alternative possible causes of death) that leads to an undercounting of suicide. Since we find that ME counties' reported suicide rates are on par with those of appointed coroners, and higher than those of elected coroners, we suspect that Timmermans (2005) overstates the challenges that suicide reporting poses for MEs' professional authority, at least relative to coroners: MEs appear to be just as willing to declare a death as suicide as their appointed coroner counterparts. Our results suggest instead that the death investigators whose professional authority is most vulnerable at the local level are elected coroners, whose structural position makes them more likely to misclassify deaths as nonsuicides, perhaps out of acquiescence to decedents' survivors' aversion to the stigma of suicide.

One of the challenges in studying suicide is teasing out the social causes of suicide from the social causes of suicide misreporting. This study takes one step forward in doing this by examining if the effects of the social predictors of suicide are biased by omitting indicators for counties' medicolegal systems. In this study, we tested the effects of social predictors of suicide that are predicted by various theories, including Durkheim's social integration theory. As have many other studies (Baller and Richardson, 2002; Breault, 1986; Kposowa, Breault, and Singh, 1995; Pescosolido and Mendelsohn, 1986; Stack, 1980), we found that measures of social integration are associated with reduced suicide rates in U.S. counties. Along with other studies (Burr, Hartman, and Matteson, 1999; Congdon, 2011; Kubrin, Wadsworth, and DiPietro, 2006; Rehkopf and Buka, 2005; Stack, 1980), we found less evidence in favor of the argument (Henry and Short, 1954) that SES and economic opportunity are associated with higher levels of suicide. Median household income and the presence of employed individuals lead to lower suicide rates. Some of our predictors of affluence and economic opportunity are associated with higher suicide rates (such as higher education levels and lower levels of poverty for males); these appear to be artifacts of multicollinearity. The only effect of disadvantage that leads to lower poverty rates that does not appear to be an artifact is the effect of poverty for females. We also confirmed Miller, Azrael, and Hemenway's (2002) finding that the presence of firearms in a state is associated with higher levels of suicide.

The crucial finding of this study is that social science investigations into geographic variation in U.S. suicide rates are not biased by the omission of office type. This does not mean that researchers can assume that coefficients representing the effects of social factors on suicide rates are free of misreporting effects. Timmermans (2005) and Whitt (2006) argue that evidentiary standards for suicide can vary across jurisdictions, and even within jurisdictions over time, in ways that may not be captured by a simple typology distinguishing MEs from coroners. Gauging the extent of these biases in the reporting of suicide remains an important and difficult task.

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Appendix

An alternative set of regressions tests the sensitivity of our main conclusions to how gun ownership is measured. In this alternative set, gun ownership is

TABLE A1

Negative Binomial Regression Analysis of Total Suicides, U.S. Counties, 1999–2002 (Using BRFSS Measure of State-Level Gun Ownership)

	Female		Male	
Variable	Model 1	Model 2	Model 1	Model 2
Proportion poor	−1.926***	−1.726***	−0.478*	−0.463*
Proportion single	2.360***	2.194***	0.515**	0.443*
Proportion divorced	6.257***	6.257***	4.275***	4.287***
Median household income ($10,000s)	−0.034	−0.036	−0.090***	−0.093***
Average years schooling	−0.006	−0.007	0.031*	0.029*
Proportion movers	0.837***	0.738***	0.281**	0.245*
Proportion one-person households	0.602	0.576	1.564***	1.536***
Child-to-women ratio	0.726***	0.664***	1.008***	0.963***
Average age	0.060***	0.054***	0.044***	0.041***
County in large metropolitan area	0.042	0.043	0.001	0.001
County with small urban population	−0.003	−0.009	−0.017	−0.017
Proportion unemployed	2.093***	1.839**	1.284***	1.214***
Proportion white	0.515***	0.507***	0.424***	0.412***
Proportion evangelicals	0.228**	0.293**	−0.048	−0.016
Proportion Catholic	−0.111	−0.082	−0.078	−0.063
New England/Mid-Atlantic	−0.544***	−0.553***	−0.446***	−0.446***
Pacific	−0.249***	−0.231***	−0.190***	−0.181***
South	−0.252***	−0.288***	−0.256***	−0.274***
Midwest	−0.480***	−0.478***	−0.410***	−0.409***
County population (10,000s)	0.000	0.000	0.000***	0.000***
Proportion households with firearms in state	0.490***	0.532***	0.315***	0.335***
Elected coroner		−0.106***		−0.048***
Appointed coroner		−0.013		−0.007
Intercept	−9.919***	−9.859***	−8.228***	−8.201***

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

TABLE A2

Negative Binomial Regression Analysis of Nonfirearm Suicides, U.S. Counties, 1999–2002 (Using BRFSS Measure of State-Level Gun Ownership)

	Female		Male	
Variable	Model 1	Model 2	Model 1	Model 2
Proportion poor	−3.157***	−2.679***	−0.470	−0.434
Proportion single	3.728***	3.176***	1.115***	0.920**
Proportion divorced	5.953***	5.810***	4.424***	4.389***
Median household income ($10,000s)	−0.049	−0.052	−0.046**	−0.054**
Average years schooling	0.039	0.036	0.076***	0.072***
Proportion movers	1.222***	1.028***	0.841***	0.731***
Proportion one-person households	0.775	0.912	2.220***	2.222***
Child-to-women ratio	0.952***	0.809***	1.394***	1.293***
Average age	0.078***	0.064***	0.058***	0.050***
County in large metropolitan area	0.012	0.016	−0.003	−0.002
County with small urban population	−0.050	−0.064	−0.128***	−0.132***
Proportion unemployed	2.358**	1.751*	0.878	0.686
Proportion white	0.554***	0.535***	0.153	0.144
Proportion evangelicals	−0.092	0.009	−0.303***	−0.239**
Proportion Catholic	0.184	0.224*	0.204**	0.230***
New England/Mid-Atlantic	−0.487***	−0.514***	−0.308***	−0.319***
Pacific	−0.255***	−0.219***	−0.188***	−0.166***
South	−0.281***	−0.357***	−0.286***	−0.324***
Midwest	−0.373***	−0.370***	−0.224***	−0.225***
County population (10,000s)	0.000	0.000	0.000	0.000**
Proportion households with firearms in state	0.014	0.055	−0.460***	−0.434***
Elected coroner		−0.209***		−0.112***
Appointed coroner		−0.100		−0.026
Intercept	−10.546***	−10.423***	−9.428***	−9.365***

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

measured by the proportion of individuals in a state reporting that they have a gun in their household, according to the average of the 2001 and 2002 waves of the Behavioral Risk Fact Surveillance System (BRFSS). In this alternative set, presented in Tables A1–A2, elected coroners still have lower official suicide and nonfirearm suicide rates than do MEs, for both females and males. However, the negative effect of elected coroners on males' official firearm suicide rates is now gone. Moreover, there is a positive and significant effect of elected coroners on females' official firearm suicide rates. One implication of this finding is that MEs underreport firearm suicides for females. However, in the

TABLE A3

Negative Binomial Regression Analysis of Firearm Suicides, U.S. Counties, 1999–2002 (Using BRFSS Measure of State-Level Gun Ownership)

	Female		Male	
Variable	Model 1	Model 2	Model 1	Model 2
Proportion poor	−1.938**	−2.118***	−1.026***	−1.024***
Proportion single	0.929	1.126	0.312	0.303
Proportion divorced	7.605***	7.635***	4.317***	4.320***
Median household income ($10,000s)	−0.137***	−0.138***	−0.156***	−0.157***
Average years schooling	−0.031	−0.027	0.026	0.025
Proportion movers	0.447	0.431	0.104	0.099
Proportion one-person households	−0.952	−1.002	0.919**	0.912**
Child-to-women ratio	0.702*	0.738*	0.937***	0.929***
Average age	0.047***	0.051***	0.040***	0.040***
County in large metropolitan area	0.087**	0.088**	−0.001	−0.001
County with small urban population	0.040	0.041	0.025	0.025
Proportion unemployed	1.971*	2.231*	1.417***	1.409***
Proportion white	0.413**	0.452**	0.574***	0.572***
Proportion evangelicals	0.359**	0.325*	−0.028	−0.023
Proportion Catholic	−0.687***	−0.723***	−0.259***	−0.256***
New England/Mid-Atlantic	−0.753***	−0.757***	−0.535***	−0.535***
Pacific	−0.197**	−0.207***	−0.167***	−0.166***
South	−0.168**	−0.140*	−0.221***	−0.224***
Midwest	−0.607***	−0.620***	−0.487***	−0.487***
County population (10,000s)	0.000	0.000	−0.001***	−0.001***
Proportion households with firearms in state	1.357***	1.300***	0.772***	0.775***
Elected coroner		0.074**		−0.007
Appointed coroner		0.147		0.001
Intercept	−10.769***	−10.817***	−8.610***	−8.606***

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

cross-check presented in Table A4, we see no evidence that female firearm suicides are being misclassified somewhere else. Elected coroners have higher official female firearm suicide rates, yes, but they also have higher rates of female deaths from firearm accidents, firearm incidents of unknown intent, and firearm homicides. In other words, the positive effect of elected coroners on female firearm suicide rates is most likely spurious.

TABLE A4

Effect of Office Type on Suicide and Nonsuicide Mortality, U.S. Counties, 1999–2002 (Using BRFSS Measure of State-Level Gun Ownership)

	Elected Coroner		Appointed Coroner	
	Coefficient	EC – ME (Deaths per 100,000)	Coefficient	AC – ME (Deaths per 100,000)
Female				
Nonfirearm suicides	−0.209***	−0.561	−0.100	−0.283
Car accidents	***0.029***	***0.451***	0.066	1.060
Nonfirearm, noncar accidents	−0.038*	−0.650	−0.042	−0.733
Nonfirearm incidents, intent undetermined	−0.306***	−0.242	−0.760***	−0.489
All illnesses	***0.005***	***5.045***	0.033	32.688
Nonfirearm homicides	***0.039***	***0.045***	−0.163	−0.170
Nonfirearm accidents, illnesses, homicides, and all illnesses	***0.003***	***3.013***	0.034	34.762
Firearm suicides	0.074**	0.154	0.147	0.317
Firearm accident	0.276*	0.027	0.440	0.048
Firearm incident, intent undetermined	0.138	0.005	0.225	0.008
Firearm homicide	0.033	0.046	0.087	0.125
Firearm accidents, incidents, and homicides	0.052	0.081	0.091	0.144
Male				
Nonfirearm suicides	−0.112***	−0.906	−0.026	−0.216
Car accidents	***0.036****	***1.299***	0.070	2.583
Nonfirearm, noncar accidents	−0.081***	−2.518	−0.099*	−3.066
Nonfirearm incidents, intent undetermined	−0.181**	−0.260	−0.316	−0.426
All illnesses	−0.012	−11.342	−0.040	−36.946
Nonfirearm homicides	−0.034	−0.063	−0.057	−0.105
Nonfirearm accidents, illnesses, homicides, and all illnesses	−0.016	−16.597	−0.040	−39.932
Firearm suicides	−0.007	−0.123	0.001	0.014
Firearm accident	0.245***	0.214	0.134	0.110
Firearm incident, intent undetermined	0.160	0.037	0.230	0.054
Firearm homicide	−0.035	−0.122	0.007	0.023
Firearm accidents, incidents, and homicides	0.017	0.083	0.009	0.045

NOTE: Bolded coefficients are for causes of death in which suicides could have been misclassified. All regressions include predictor variables shown in Tables A1–A3.
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.