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RESEARCH ARTICLE

Differences in U.S. Suicide Rates by Educational Attainment, 2000–2014

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Introduction: The purpose of this study was to document the association between education and suicide risk, in light of rising suicide rates and socioeconomic differentials in mortality in the U.S.

Methods: Differentials and trends in U.S. suicide rates by education were examined from 2000 to 2014 using death certificate data on 442,135 suicides from the National Center for Health Statistics and Census data. Differences in the circumstances and characteristics of suicide deaths by education were investigated using 2013 data from the National Violent Death Reporting System for nine states. Analyses were conducted in 2016.

Results: Between 2000 and 2014, men and women aged ≥25 years with at least a college degree exhibited the lowest suicide rates; those with a high school degree displayed the highest rates. Men with a high school education were twice as likely to die by suicide compared with those with a college degree in 2014. The education gradient in suicide mortality generally remained constant over the study period. Interpersonal/relationship problems and substance abuse were more common circumstances for less educated decedents. Mental health issues and job problems were more prevalent among college-educated decedents.

Conclusions: The findings highlight the importance of social determinants in suicide risk, with important prevention implications.

INTRODUCTION

Age-adjusted suicide rates rose by 24% between 2000 and 2014 in the U.S., with the increase especially pronounced among those aged 45–64 years. For middle-aged men, rates rose by 43% over this period and by 63% for women, although death by suicide remains far more common among men.[1] This substantial increase in suicide, alongside rising death rates from drug and alcohol poisonings, has been large enough to produce a marked upturn in all-cause mortality among white middle-aged Americans.[2]

The current epidemic of rising suicide and drug abuse has affected some groups more than others—namely, those who are less educated. The increases in suicide rates for those aged 40–60 years between 2000 and 2005 were confined to those who lacked a college degree.[3] By 2013, suicide rates for those aged 45–54 years had risen for all educational groups, but the increases were substantially larger for the less educated. In 1999, suicide rates for those aged 45–54 years with a high school degree or less were 1.7 times greater than those with a college degree, but that differential increased to 2.4 by 2013.[2] These trends have contributed to widening socioeconomic disparities in mortality.[4]

Following the famous Whitehall study of British civil servants,[5] a flurry of research investigated the relationship between SES and morbidity and mortality, revealing the importance of education in shaping health status, health-related behaviors, and psychosocial factors. These studies document the recent widening of the educational

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gradient in mortality in Western countries, emphasizing not only differences in the prevalence of risk behaviors such as tobacco and alcohol use but also differential returns to risk factors, suggesting there may be important differences in access and ability to benefit from health care and medical information.[6–8]

The nature of educational differences in suicide, however, is poorly understood. Durkheim[9] observed a positive association between educational attainment and suicide rates in 19th-century Europe, although his theory of suicide focused more on the role of religion and secularization than education. More recent studies report mixed findings on the education–suicide link, with variation by cohort and race.[10] Most document a higher suicide risk among those with less education,[11–13] yet others report the opposite.[14,15] In light of this limited information, the goal of this study is to (1) examine the differential and annual trends in suicide rates by educational attainment between 2000 and 2014, a period when U.S. suicide rates rose significantly and that encompasses the Great Recession; and (2) describe the ways in which the circumstances and other characteristics of suicide differ by educational attainment.

METHODS

To investigate trends in suicide by educational attainment, annual age-adjusted suicide rates by educational attainment were constructed for all people aged ≥25 years from 2000 to 2014. Suicide rates were age adjusted using 5-year age groups and the U.S. 2000 standard population.[16] Suicide rates among individuals aged <25 years were not examined because many have not completed their formal education by that age. Information on the number of suicide deaths by education was obtained from death certificates compiled by the National Center for Health Statistics. Over the study period, 461,331 suicide deaths occurred in the U.S. among individuals aged ≥25 years. However, data on educational attainment were missing for 4.4% and 3.9% of these male and female suicide decedents, respectively; these deaths were excluded from analyses. Education was measured according to major milestones: less than high school (0–11 years of education); high school degree (12 years); some college (13–15 years); and college degree or more (≥16 years). Some supplemental analyses are conducted for the native-born population, defined as those born in one of the 50 states and indicated on death certificates. Those deaths missing information on place of birth (1.34%) were excluded from the analysis. Data on the population aged ≥25 years by year, education, and nativity were gathered from the American Community Survey.

A joinpoint analysis was applied to compute average annual rates of change and to identify significant changes in trends by education.[17] Because the increases in suicide have been especially pronounced among the middle-aged, trends in annual suicide rates by education were also examined for those aged 35–54 years. All rates were computed separately by gender.

The National Violent Death Reporting System (NVDRS) was used to learn about circumstances surrounding suicide deaths by education level. NVDRS is an incident-based violent death surveillance system established by the Centers for Disease Control and Prevention (CDC) to assist states and local communities in violence prevention efforts.[18] The system links information on violent deaths from multiple sources, including medical examiner and coroner reports, toxicology reports, law enforcement records, supplemental homicide reports, and death certificates. By 2013, a total of 18 states participated in the program, but information on educational attainment was incomplete for some states.[a] Only half (nine) of the states had fairly complete information on education, with ≥95% of suicide deaths including reports on education. Thus, the analysis of NVDRS data was restricted to the 5,172 suicides that occurred in 2013 in Kentucky, New Jersey, New Mexico, Ohio, Oklahoma, Oregon, South Carolina, Utah, and Wisconsin.

A major strength of NVDRS is the existence of comprehensive circumstance information on all violent fatalities. Participating states are trained by CDC to identify the presence of a core set of defined circumstances through careful examination of detailed information from the various sources listed above. These circumstance variables record the presence/absence of important risk factors for suicide, such as substance abuse problems, mental health issues, and relationship difficulties, among others. Following prior work,[19] the circumstances were classified into three conceptual groups: personal circumstances, which relate to the decedent's mental and physical health; interpersonal circumstances, which capture circumstances pertaining to the decedent's relationships to other people; and external circumstances, which relate to problems the decedent may have had with outside factors such as employment and the legal system. These circumstances are not mutually exclusive, as a given incident may involve multiple circumstances. CDC routinely engages in quality improvement activities to ensure the accuracy of the circumstance data.[20]

Characteristics that measure the extent to which a suicide was planned were considered: whether the decedent left a note, expressed an intention to die by suicide, or had a history of suicide attempts. Finally, differences in the manner of death (firearm, poisoning, suffocation, other) by education were examined. Chi-square tests were used to identify statistically significant differences. The possibility that these characteristics may have changed over time (2005–2013) by education was investigated, but no notable patterns were found.

RESULTS

Over the study period, 442,135 suicides occurred among individuals aged ≥25 years and with information on their educational attainment (Appendix, available online). Men and women aged ≥25 years who possess a college degree or higher consistently exhibited the lowest rates of suicide whereas those with a high school degree displayed the highest rates. The differential was substantial for men; a college degree halved the risk of death by suicide relative to those who had a high school

[a]Participating states are not required to include all death certificate items for inclusion in NVDRS.

degree only in 2014 ($p<0.05$). However, education did not have a linear association with suicide, as both men and women who did not complete high school displayed lower rates of suicide than those with a high school diploma ($p<0.05$).

For all educational groups and both genders, suicide rates increased over the study period. Among men, the suicide rate for those with a high school degree rose from 31.5 per 100,000 in 2000 to 38.9 in 2014 ($p<0.05$). Rates grew rapidly for this group between 2005 and 2014 (average annual percentage change, 2.4%). For those with a college degree, the rates increased from 13.7 in 2000 to 16.9 in 2014; growth was most rapid for these men during the period of the Great Recession (2006–2010; average annual percentage change, 4.8%). The education gradient in suicide, however, did not change over this period (Figures 1A and 1B).

Overall patterns are similar among those aged 35–54 years. Among middle-aged women, a college degree confers significant protection against suicide, with rates lower on the order of 2–3 per 100,000 relative to the next group ($p<0.05$). Between 2000 and 2008, women with some college had lower suicide rates than those without a high school diploma, but beginning in 2009 in the wake of the Great Recession, those with some college exhibited higher suicide rates than those without a high school degree (differences are not statistically significant). Among women, suicide rates increased for all educational groups since 2010, but more for those with a high school education so that the education gradient grew

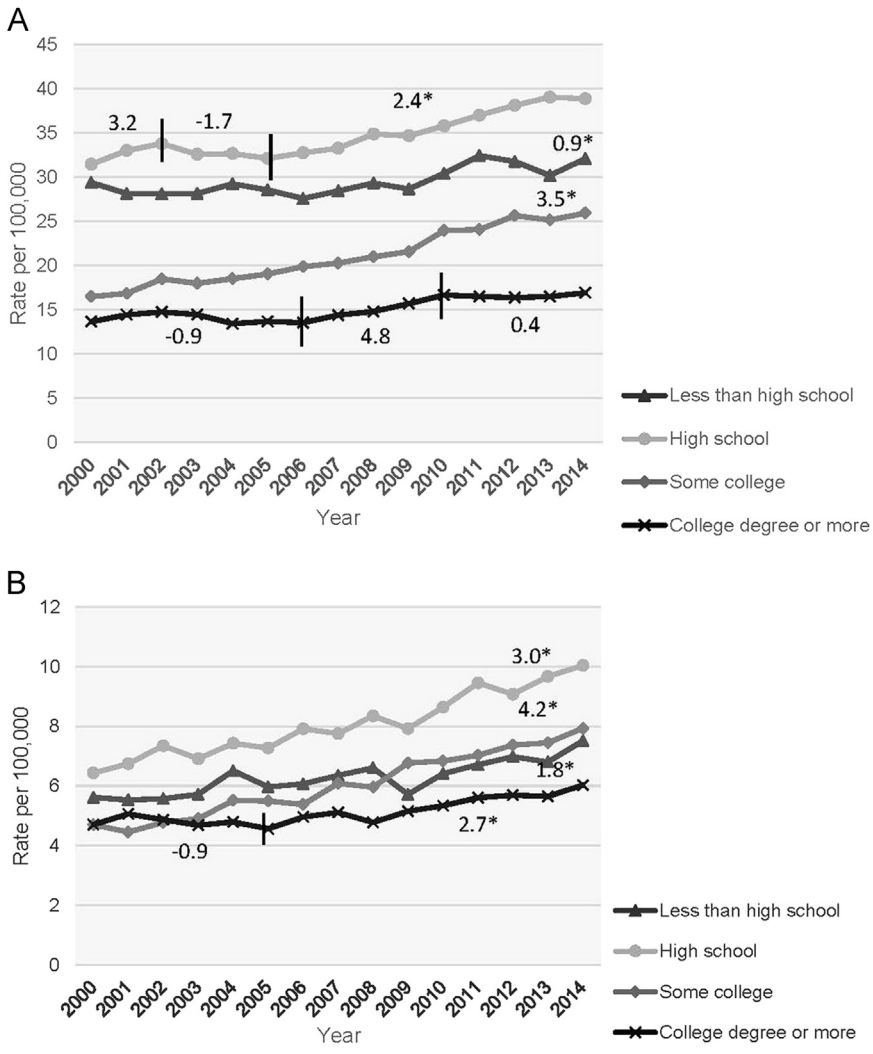

Figure 1. Age-adjusted (A) male suicide rate (346,650 suicide deaths) and (B) female suicide rate (95,485 suicide deaths) by educational group among those aged ≥25 years, U.S., 2000–2014.

Note: Vertical lines indicate year in which joinpoint analysis identified a significant change in suicide trends. Average annual percentage change (AAPC) in suicide rates is displayed for each educational group and sub-period.

*AAPC is significantly different from 0 at $p<0.05$.

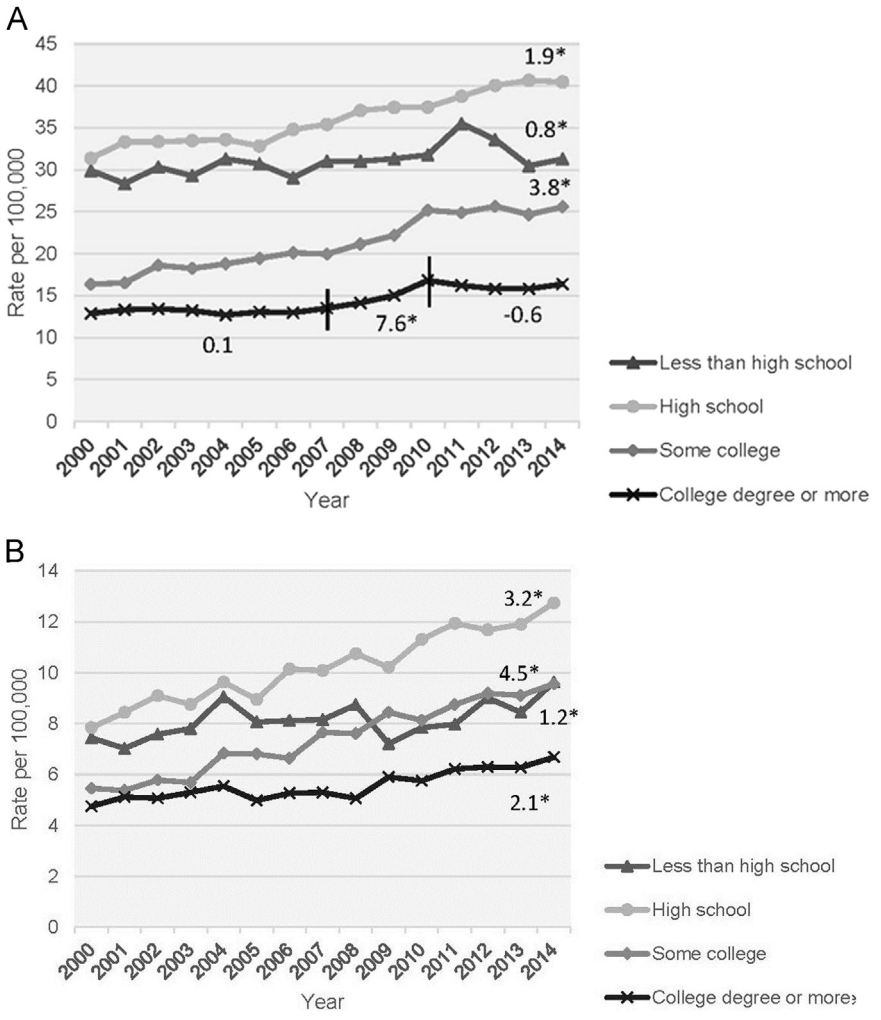

Figure 2. (A) Male suicide rate (155,393 suicide deaths) and (B) female suicide rate (49,680 suicide deaths) by educational group among those aged 35–54 years, U.S., 2000–2014.

Note: Vertical lines indicate year in which joinpoint analysis identified a significant change in suicide trends. Average annual percentage change (AAPC) in suicide rates is displayed for each educational group and sub-period.

*AAPC is significantly different from 0 at $p < 0.05$.

slightly for this demographic group over the study period. For middle-aged men without a college degree, suicide rates increased fairly steadily between 2000 and 2014. For those with a college degree, however, suicide rates increased dramatically between 2007 and 2010 (average annual percentage change, 7.6%) but were stable prior to 2007 and slightly declined post 2010 (Figures 2A and 2B).

Table 1 displays characteristics of suicide decedents aged ≥25 years by education and gender, using 2013 NVDRS data. Results were similar for suicide decedents aged 35–54 years (data not shown). Given national patterns in suicide by education, a distinction was made only between those with at least a college degree and those without a degree. Although the overall prevalence of personal circumstances was not different by education, significant differences in specific personal circumstances were apparent. Less educated male and female suicide decedents were less likely to have had a mental health problem, such as clinical depression, and to have sought treatment for mental health concerns than their more educated counterparts. In the case of men, those without a college degree with a mental health problem were less likely to receive treatment for that problem. Note, however, that endorsement or lack thereof of items in NVDRS may not be entirely accurate (e.g., those with no endorsement of current treatment may in fact have been receiving it). Yet, less educated suicide decedents were more likely to have substance abuse circumstances than those with a college degree.

Table 1. Characteristics (%) of Suicide Deaths, by Education and Sex, Aged ≥25 Years, 2013

	Males				Females			
		College degree				College degree		
Circumstances	Total	No	Yes	*p*-value	Total	No	Yes	*p*-value
Personal	78.8	78.7	79.3	0.718	86.6	86.7	86.9	0.951
Physical health problem	23.3	23.1	24.5	0.438	22.2	23.0	19.0	0.195
MH problem	40.1	39.0	45.4	**0.002**	64.0	62.8	69.2	0.071
In treatment for MH problem[a]	25.3	23.7	33.6	**0.000**	45.2	43.8	51.1	**0.048**
Substance abuse problem	14.7	16.1	7.8	**0.000**	18.7	20.5	10.9	**0.001**
MH problem but no MH treatment	37.6	40.2	26.1	**0.000**	30.2	31.2	26.1	0.220
Interpersonal	44.7	46.3	36.5	**0.000**	43.3	45.6	32.6	**0.000**
Family relationship problem	8.0	8.5	5.5	**0.009**	11.5	11.6	10.9	0.750
Argument preceded death	15.1	16.6	7.5	**0.000**	15.2	16.8	8.1	**0.001**
Intimate partner problem	30.8	32.2	23.3	**0.000**	21.9	22.9	17.2	0.063
External	34.0	34.0	34.0	0.973	22.2	21.4	25.8	0.154
Job problems	14.7	14.0	18.5	**0.002**	9.7	8.6	14.5	**0.008**
Financial problems	13.4	13.3	13.5	0.897	9.5	10.2	6.3	0.079
Planning and intent								
History of prior attempts	15.2	15.6	13.2	0.127	33.7	33.9	32.6	0.703
Left note	34.1	31.6	46.4	**0.000**	39.6	38.2	45.7	**0.039**
Disclosed intent	24.9	25.7	20.8	**0.009**	25.2	26.0	21.3	0.140
Method								
Firearm	59.2	59.9	55.8	**0.049**	32.2	33.2	27.6	0.108
Poisoning	11.3	11.1	12.5	0.308	36.7	37.2	34.4	0.428
Suffocation	23.4	23.6	22.3	0.503	23.1	22.1	27.6	0.080
Other	6.1	5.5	9.4	**0.000**	8.0	7.5	10.4	0.147
Number of suicide deaths	3,987	3,329	658		1,185	964	221	

Source: National Violent Death Reporting System, 2013.
Note: Boldface indicates statistical significance ($p < 0.05$).
[a]Based on the entire study population, regardless of whether a mental health problem was endorsed.
MH, mental health.

Interpersonal issues (relationship problems with intimate partners and other family members and arguments) were more often identified as circumstances in suicides for those without a college degree. Nearly a third (32.2%) of male decedents without a degree were experiencing intimate partner problems before their death, compared with less than a fourth (23.3%) of those with a college degree. The circumstances related to an argument may also be linked to impulsivity and planning, as it measures whether or not an argument or conflict was thought to have led to the death. Job problems, which constitute either difficulties with a current job or with joblessness, were relatively more common for college-educated men and women. Financial difficulties were more prevalent among less-educated women (p=0.08) (Table 1).

Decedents differed somewhat by educational status in characteristics related to suicidal planning. Less educated men were more likely to have previously disclosed their suicidal intent to others, whereas more educated decedents were more likely to have left a note. Decedents with less education were somewhat more likely to have a history of prior attempts, but the differences were not significant. There were minimal differences in method of suicide by education. Men without a college degree were more likely to die by firearm than those with a degree. More educated men were more likely to use some other means (e.g., jumping or vehicular impact). More educated women were more likely to use suffocation as a means (p=0.08) than those without a degree. National-level patterns of suicide method by education and sex were generally consistent with those reported for the nine NVDRS states in 2013.

DISCUSSION

This study is the first to examine the relationship between education and suicide over an extended period that

encompassed the Great Recession of 2007–2009 and how circumstances surrounding suicide vary by education. The findings reveal an important differential—both men and women with a college degree exhibit the lowest rates of suicide, a pattern that held constant between 2000 and 2014. To the extent that education engenders self-efficacy, strengthens various forms of human, social, and cultural capital, and is linked to greater access to and use of mental health services, higher levels may improve well-being and reduce suicidal behavior.

The association between education and suicide risk is not linear. Men and women with a high school diploma consistently display the highest rates of suicide, greater than those without a high school degree. This pattern may be explained partly by the fact that the population with no high school degree includes a disproportionate share of foreign-born residents, for whom low educational attainment is less of a marker. Suicide trends between 2000 and 2013 for native-born men by education reveal that rates were highest for those without a high school diploma (Appendix Figures 1 and 2, available online). Rates for native-born men with a high school degree were lower but similar and, in some years, not significantly different from those without a diploma. However, nativity does not appear to provide an explanation for the education patterns among women. Native-born women with a high school degree exhibited significantly higher suicide rates than those without a high school diploma across the entire time period (excluding 2004, 2007, and 2012). Cross-national research reports similar non-linear associations between education and suicide for women.[12]

A possible disjuncture between norms and expectations (in Durkheim's[9] terms, anomie) offers another possible explanation. Those with a high school diploma, especially those born before the 1970s, were socialized to expect that degree to bring certain economic opportunities. Working-class middle-aged individuals today were often raised by parents who lacked a college degree and yet were able to achieve a solid middle-class standard of living. Fundamental changes in the U.S. economy (a decline in manufacturing jobs and rising inequality) have left many working-class Americans vulnerable, as revealed in part by surveys showing that a substantial proportion report that they are worse off than their parents and worse than they expected to be in their present life stage.[21]

The analysis of differences in suicide circumstances by education reveals four important distinctions in the types of precipitating stressors experienced by decedents. First, interpersonal problems (problems with intimate partners or family members) were far more likely to have been present in suicide deaths among those without a college degree. Prior work documents the important predictive effect of SES on the quality and stability of relationships, with more disadvantaged couples experiencing greater financial strain, producing family stress and reporting less satisfaction with their relationship.[22] The association is likely causal (disadvantage produces stress and marital difficulties ensue) and also due to selection (individual experiences from childhood and adolescence can affect both educational attainment and family relationships).[23]

The second distinction relates to substance abuse, an important risk factor for suicide and more prevalent among less educated decedents. Those with less education may be more likely to have experienced adverse childhood experiences (e.g., abuse and neglect) and to face diminished opportunities leading to substance abuse,[24,25] and the literature on education and mortality points to the differential use of alcohol and tobacco as one of the most important drivers of the educational gradient. Consistent with these findings, substance abuse was a more significant issue among the less educated with regard to suicide completion.

The third difference relates to mental health. Although lower levels of mental health problems were documented among those with less education, these conditions may be undermeasured and undertreated among those with less education, who may have reduced access to health care and different care-seeking behaviors. One piece of evidence consistent with this notion is that, conditional on the identification of a mental health problem, male decedents with less education were less likely to have received mental health treatment.

Finally, job problems, though a less common precipitating circumstance surrounding suicide in general, were more often present in suicide deaths of those with a college degree. Undoubtedly, the employment conditions and prospects for those lacking a college degree are less favorable, yet the identity of those with a college degree is likely more closely intertwined with work so that job problems pose a greater threat to well-being and self-worth and are perhaps less expected.[26] The Great Recession of 2007–2009 had widespread adverse effects, but the national-level findings revealing a pronounced increase in suicide rates for college-educated men (middle-aged in particular) limited to the recessionary period are consistent with this notion.

Limitations

There are several cautions regarding these conclusions. Studies[27] demonstrate that the education level reported on death certificates may be inaccurate for 28% of deaths. Over-reporting of those having high school and college degrees is especially common; thus, the suicide rates for these two educational groups may be higher than they

should. Trends over time by educational attainment, however, are unlikely to be affected. In addition, the measurement of education in NVDRS is incomplete, and the sample of states on which this analysis is based may not be representative of the U.S. population. Furthermore, NVDRS circumstance data are limited to completed suicides, and despite NVDRS quality control features, circumstances may not always be fully reported. Finally, future studies that incorporate additional measures of SES, including income and occupation, would provide greater insight into the nexus between socioeconomic disadvantage and suicidal behavior.

CONCLUSIONS

The study findings offer insight into the important connection between education and suicide, during a period when levels of suicide and economic inequality have been rising. The differences in circumstances surrounding suicide deaths by education level highlight the greater volatility and fragility in the daily lives of those experiencing socioeconomic disadvantage, with important implications for prevention. Health and social policies may provide important opportunities to address some of these social determinants. The coverage expansion accompanying health reform extended access to behavioral health treatment to millions starting in 2014.[28] Policies that support low income families (e.g., paid family leave and increased minimum wage laws) may also play an important role in reducing risk factors for suicide among the less educated.

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2017.04.010.

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