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Suicidal Thoughts, Plans, and Attempts by Non-Metropolitan and Metropolitan Residence

Kathi Harp
University of Kentucky, Kathi.harp@uky.edu

Tyrone F. Borders
University of Kentucky, ty.borders@uky.edu

Rural & Underserved Health Research Center

University of Kentucky
111 Washington Ave.
Lexington, KY 40536
ruhrc.uky.edu

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Kathi Harp, PhD and Tyrone F. Borders, PhD

Key Findings

- Mean prevalence rates for suicidal thoughts, plans, and attempts were significantly higher ($P < .05$) among residents of non-metropolitan than large metropolitan counties.
- The adjusted odds of suicidal thoughts, plans, and attempts did not improve significantly from 2010 to 2016 among residents of any county type.
- The study findings suggest that suicide prevention interventions should be further targeted toward non-metropolitan counties. However, new interventions may need to be specifically developed to meet the unique needs of residents in non-metropolitan counties.

Background

Suicide is among the leading causes of death in the U.S.[1] and suicide rates in non-metropolitan (rural) counties have historically exceeded those in metropolitan (urban) counties.[2-4] A recent Centers for Disease Control and Prevention (CDC) report found that suicide occurred at much higher rates in rural than in urban areas of the country from 2001-2015.[2] Information about the prevalence and correlates of suicidal thoughts, plans, and non-fatal attempts could complement existing knowledge based on suicide rates and better inform the implementation of suicide prevention programs across non-metropolitan and metropolitan areas. This study examined the prevalence of suicidal thoughts, plans, and attempts by year (2010-2016) and county type (non-metropolitan, small metropolitan, and large metropolitan).

Study Objectives

1. To compare trends in the prevalence of suicidal thoughts, plans, and attempts among residents of non-metropolitan, small metropolitan, and large metropolitan areas.
2. To identify demographic, social, and economic factors associated with suicidal thoughts, plans, and attempts among residents of non-metropolitan, small metropolitan, and large metropolitan areas.

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Methods

Data.

Data from the National Survey on Drug Use and Health (NSDUH) for the years 2010-2016 were used for this analysis. Our analyses were restricted to adults ages 18 years and older as the NSDUH survey questions asking about suicidal thoughts and behaviors are not assessed in the adolescent population.[i] We combined seven years of NSDUH data from 2010-2016 into a single dataset to examine trends over time as well as examine differences in the prevalence of past-year suicidal thoughts, plans, and attempts among non-metropolitan (unweighted N=58,275; weighted N= 259,338,039), small metropolitan (unweighted N=98,725; weighted N= 501,711,588), and large metropolitan adults (unweighted N=124,202; weighted N=901,054,153).

Dependent Variables.

Participants were asked the following three questions about past-year suicidal thoughts, plans, and attempts, all of which had dichotomous, *yes* or *no* responses:

Suicidal thoughts. "At any time in the past 12 months, that is from [DATEFILL] up to and including today, did you seriously think about trying to kill yourself?"

Suicidal plans. "During the past 12 months, did you make any plans to kill yourself?"

Suicidal attempts. "During the past 12 months, did you try to kill yourself?"

Independent Variables.

Non-metropolitan (outside a metropolitan statistical area), small metropolitan (a metropolitan area with <1 million persons), and large metropolitan (a metropolitan area with ≥ 1 million persons) county designations were determined for the NSDUH based on Rural/Urban Continuum Codes. In addition to study year (2010-2016) and county type, we included other variables that may be associated with past-year suicidal thoughts, plans, or attempts. Demographics included age (18-25, 26-34, 35-49, 50-64, and 65+ years), gender, and race/ethnicity (white, Hispanic, black/African American, Asian, Native American, Pacific Islander, and multiracial). Additional social and economic variables included total annual income (<$20k, $20k-$49,999k, $50k-$74,999, and >$75k), educational attainment (<high school degree, high school graduate, some college, and college graduate), and marital status (married, widowed, divorced or separated, and never married). We also included whether the individual had ever served in the U.S. military.

Statistical Analysis.

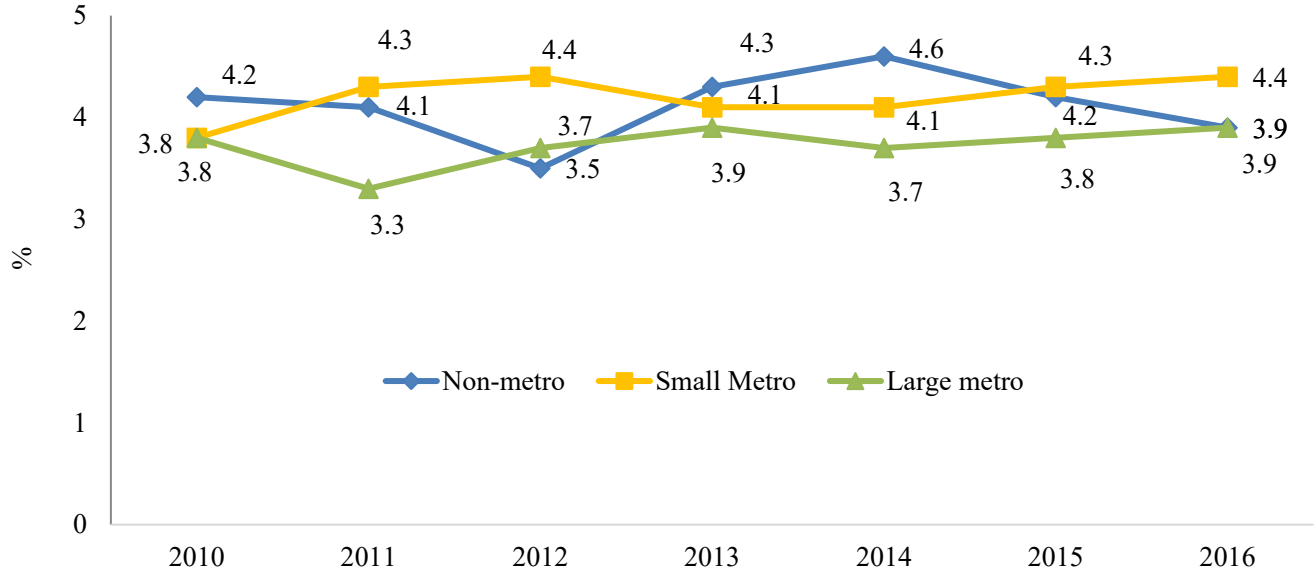
Descriptive and bivariate analyses were used to examine the prevalence of suicidal thoughts, plans, and attempts among individuals in non-metropolitan, small metropolitan, and large metropolitan counties for the years 2010-2016. We then ran 4 logistic regression models for each of the 3 suicide variables for a total of 12 models. We first examined factors associated with suicidal thoughts, plans, or attempts, with county type included in the models as a dummy variable. Non-metropolitan county type was the reference group, meaning that adjusted odds ratios for small and large metropolitan county types should be interpreted in comparison to non-metropolitan counties. Non-metropolitan county type was the reference group, meaning that adjusted odds ratios for small and large metropolitan county types should be interpreted in comparison to non-metropolitan counties. This preliminary model was used to determine if county type was a significant predictor of each suicide-related variable. We then ran regression models for each suicide variable stratified by county designation (i.e., the first model examined predictors of suicidal thoughts among individuals in non-metropolitan counties, the next model examined predictors among small metropolitan counties, and the third model examined predictors in large metropolitan counties). All analyses accounted for the NSDUH's sampling scheme and weights.

Findings

Suicidal Thoughts.

The overall mean prevalence of suicidal thinking from 2010-2016 was significantly higher ($P < .05$) among non-metropolitan and small metropolitan adults (4.1% and 4.2%, respectively) than large metropolitan adults (3.7%). Figure 1 displays the prevalence of suicidal thoughts for by year and county type. Prevalence rates of past-year suicidal thoughts remained fairly stable for all county types over time.

Figure 1. Prevalence (%) of Past-Year Suicidal Thoughts by County Type, 2010-2016



Note: For suicidal thoughts, Unweighted =279,807; weighted N=1,654,910,777

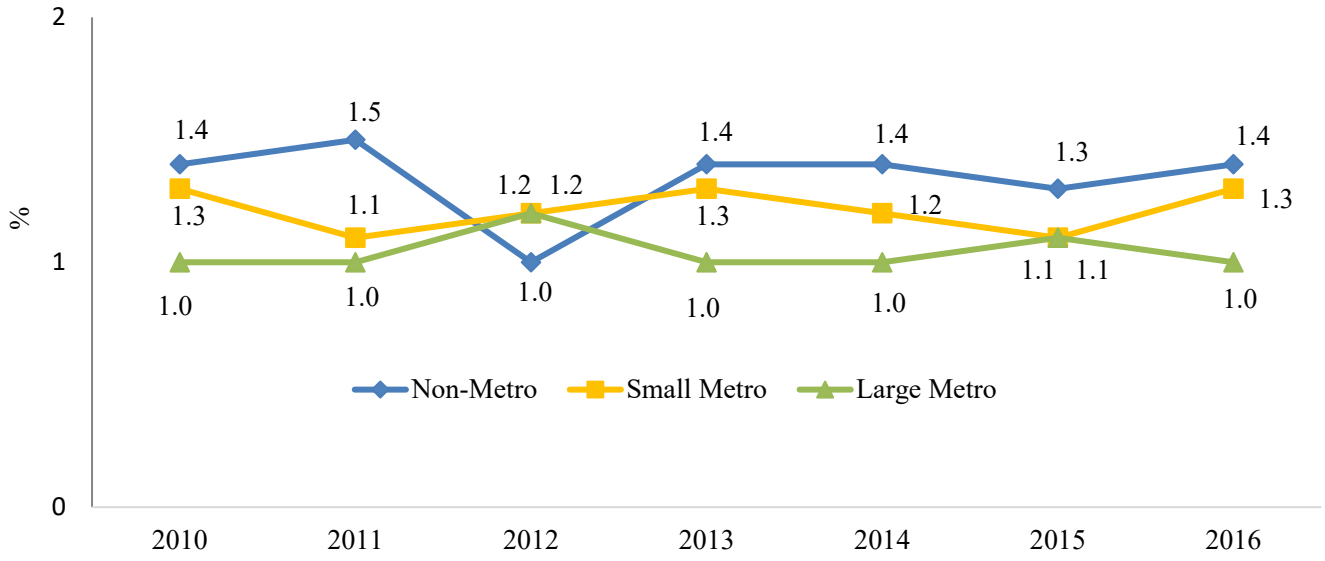
Appendix Table 1 shows that the adjusted odds of suicidal thoughts did not differ significantly between residents of large or small metropolitan counties compared to residents of non-metropolitan counties. Among the full sample, the adjusted odds of suicidal thoughts were comparable across 2010 and 2015, but the adjusted odds were significantly higher (OR 1.11, 95% CI: 1.01-1.23) in 2016 relative to 2010. Older age, male gender, higher income, and a history of military service were associated with lower odds of suicidal thoughts. African Americans, Pacific Islanders, Asians, and Hispanics had lower odds of suicidal thoughts than whites; those identifying themselves as multiracial had higher odds of suicidal thoughts than whites. Persons with high school and college degrees had lower odds of suicidal thoughts than those without a high school degree.

Stratified analyses revealed some similarities as well as some differences in the factors associated with suicidal thoughts among residents of large metropolitan, small metropolitan, and non-metropolitan areas. Among non-metropolitan adults, the adjusted odds of suicidal thoughts did not differ between 2010 and any year thereafter. We highlight here additional selected findings from the stratified analyses and refer readers to Table 1 to see all the significant adjusted odds ratios, noting that odds ratios that are positively associated with suicidal thoughts are highlighted in yellow and those that are negatively associated with suicidal thoughts are highlighted in blue. Among adults in small metropolitan counties, the adjusted odds of suicidal thoughts were higher in 2012, 2015, and 2016 than in 2010. Among large metropolitan residents, the adjusted odds of suicidal thoughts were slightly lower in 2011 than 2010, but no differences were found in any year thereafter. Age, income, African American race, Hispanic ethnicity, and being a college graduate were consistently associated with lower adjusted odds of suicidal thoughts across county types.

Suicidal Plans.

The overall mean prevalence of suicidal plans from 2010-2016 varied significantly ($P < .001$) by county type and was highest among residents of non-metropolitan (1.3%) counties. Figure 2 displays trends in the prevalence of suicidal plans by county type for each year from 2010-2016. Rates of past-year suicidal plans remained stable for each county type between the years 2010 and 2016.

Figure 2. Prevalence (%) of Past-Year Suicidal Plans by County Type, 2010-2016



Note: For suicidal plans, unweighted N=279,781; weighted N=1,654,710,453

Appendix Table 2 shows that the adjusted odds of suicidal plans did not differ significantly between residents of large or small metropolitan counties compared to residents of non-metropolitan counties. Among the full sample, the adjusted odds of suicidal plans were comparable across 2010 and 2016. We highlight here selected findings from the stratified analyses and refer readers to Table 2 to see all the factors that are significantly associated with the adjusted odds of suicidal plans after controlling for covariates, or all other variables in the model. Older age was associated with lower odds of suicidal plans among non-metropolitan, small metropolitan, and large metropolitan residents. Persons who were divorced or never married had higher odds of suicidal plans than those who were married. Higher income was associated with lower odds of suicidal plans for each county type. African Americans and Hispanics had lower odds of suicidal plans than whites across each county type. Having a college degree and any military service were associated with lower adjusted odds of suicidal plans among residents of non-metropolitan and large metropolitan areas, but not among residents of small metropolitan areas.

Suicidal Attempts.

The overall mean prevalence of suicidal attempts from 2010-2016 did not vary significantly by county type. Figure 3 displays the prevalence of suicidal attempts by county type for each year from 2010-2016.

Figure 3. Prevalence (%) of Past Year Suicidal Attempts by County Type, 2010-2016

Appendix Table 3 shows that the adjusted odds of suicidal attempts did not differ significantly between residents of large or small metropolitan counties compared to residents of non-metropolitan counties. We highlight here selected findings from the stratified analyses and refer readers to Table 3 to see all the factors that are significantly associated with the adjusted odds of suicidal attempts after controlling for covariates, or all other variables in the model. Among those living in large metropolitan counties, the adjusted odds of suicidal attempts were significantly higher in 2011, 2012, 2014, and 2015 relative to 2010. Older age was associated with lower odds of suicidal attempts among non-metropolitan, small metropolitan, and large metropolitan residents, such that the odds of a past-year suicide attempt decrease as people age. Persons who were divorced had higher odds of suicidal attempts than married persons across each county type. Some college education and having a college degree were associated with lower adjusted odds of suicidal attempts across all county types. Any military service was associated with lower odds of suicidal attempts among non-metropolitan and small metropolitan residents, but not among large metropolitan residents.

[i] *Technical Note*: For years 2002-2014, NSDUH measured county type using the *2003* Rural-Urban Continuum Codes (RUCCs); however, beginning in 2015, NSDUH began using the *2013* RUCCs. Because the 2013 RUCCs used different census data and made changes to statistical area definitions, county measures in 2015-2016 were determined using different data; however, the definitions for non-metropolitan, small metropolitan, and large metropolitan county designation have not changed over time.

Conclusions and Potential Policy Implications

Key findings and potential implications for prevention, intervention, and research are highlighted below:

1. The prevalence of suicidal planning is highest among adults residing in non-metropolitan counties. Also, the adjusted odds of suicidal thoughts, plans, and attempts did not improve among residents of non-metropolitan counties from 2010 to 2016. Coupled with prior evidence indicating that non-metropolitan areas have higher suicide rates,[2] these findings suggest that suicide prevention interventions should be further targeted toward non-metropolitan counties.
2. Rural residents may benefit from a rural-specific strategy for addressing suicide. As noted in a recent National Advisory Committee on Rural Health and Human Services report,[5] the 2012 National Strategy for Suicide Prevention[6] does not explicitly address suicide in non-metropolitan areas. The same report notes that only 50% (12 of 24) of suicide prevention programs listed in the Substance Abuse and Mental Health Services Administration (SAMHSA) database have actually been delivered in non-metropolitan areas.[6]
3. Among residents of non-metropolitan areas, having ever served in the military was protective against suicidal thoughts, plans, and attempts. However, the exact mechanism explaining this relationship is unclear. Given that individuals in this study who had a history of military service also had higher educational attainment than those with no service history, it may be that education mediates the relationship between military service and suicidal thoughts and behaviors, such that those in the military are more likely to pursue additional education, thereby reducing their risk. Another possible explanation could be due to selection bias. Compared to the general population, individuals with current or former military experience are more likely to die from a suicide *attempt* and also more likely to use a handgun.[7] Because individuals surveyed as part of the NSDUH are living, and because surveillance data on suicide deaths cannot be linked to NSDUH data due to participant confidentiality, this is a limitation of the present study and is an area where additional research could be useful for determining the mechanism(s) at work and how this might be channeled in ways that reduce suicidal thoughts and behaviors among those in non-metropolitan areas.

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Contact Information

Ty Borders, PhD, Director, Rural and Underserved Health Research Center
email: ty.borders@uky.edu website: http://ruhrc.uky.edu

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APPENDIX

Table 1. Logistic Regressions of Past-Year Suicidal Thoughts

Variable	Full Sample OR (95% CI)	Non-Metro. OR (95% CI)	Small Metro. OR (95% CI)	Large Metro. OR (95% CI)
County Type (ref=non-metro)				
Small Metro	1.07 (0.99-1.16)	-	-	-
Large Metro	1.06 (0.98-1.15)	-	-	-
Year (ref=2010)				
2011	0.97 (0.88-1.08)	0.97 (0.76-1.22)	1.17 (0.98-1.38)	0.86 (0.74-0.99)[a]
2012	1.02 (0.91-1.15)	0.81 (0.62-1.07)	1.19 (1.01-1.41)[a]	1.00 (0.85-1.18)
2013	1.07 (0.95-1.21)	1.05 (0.82-1.34)	1.10 (0.91-1.32)	1.06 (0.89-1.26)
2014	1.07 (0.96-1.18)	1.11 (0.88-1.38)	1.12 (0.96-1.31)	1.02 (0.88-1.19)
2015	1.09 (0.98-1.21)	1.04 (0.83-1.30)	1.19 (1.02-1.38)[a]	1.05 (0.90-1.23)
2016	1.11 (1.01-1.23)[a]	0.97 (0.77-1.23)	1.21 (1.03-1.43)[a]	1.09 (0.94-1.27)
Age	0.75 (0.73-0.78)[c]	0.75 (0.70-0.79)[c]	0.78 (0.75-0.82)[c]	0.74 (0.70-0.77)[c]
Male (ref=female)	0.91 (0.85-0.97)[b]	0.89 (0.77-1.02)	0.83 (0.75-0.92)[c]	0.96 (0.88-1.04)
Marital status (ref=married)				
Widowed	1.08 (0.88-1.34)	0.97 (0.66-1.43)	0.80 (0.58-1.11)	1.37 (1.01-1.88)[a]
Div/Sep	1.89 (1.73-2.06)[c]	1.76 (1.48-2.08)[c]	2.03 (1.77-2.33)[c]	1.83 (1.57-2.12)[c]
Never married	1.55 (1.44-1.67)[c]	1.47 (1.25-1.74)[c]	1.55 (1.40-1.71)[c]	1.57 (1.40-1.75)[c]
Income	0.82 (0.80-0.85)[c]	0.80 (0.75-0.86)[c]	0.80 (0.77-0.84)[c]	0.84 (0.80-0.87)[c]
Race/Ethnicity (ref=white)				
African American	0.59 (0.54-0.63)[c]	0.57 (0.45-0.71)[c]	0.60 (0.51-0.69)[c]	0.59 (0.53-0.66)[c]
Native Am/AK Native	1.17 (0.92-1.48)	1.05 (0.71-1.57)	1.14 (0.70-1.86)	1.44 (0.87-2.39)
Pacific Islander	0.50 (0.34-0.74)[c]	0.43 (0.16-1.13)	0.60 (0.39-0.92)[a]	0.46 (0.25-0.85)[b]
Asian	0.69 (0.60-0.80)[c]	1.19 (0.45-3.14)	0.56 (0.43-0.73)[c]	0.71 (0.59-0.84)[c]
>1 race (non-Hispanic)	1.25 (1.09-1.44)[b]	0.97 (0.67-1.40)	1.29 (1.04-1.59)[a]	1.31 (1.08-1.58)[b]
Hispanic	0.56 (0.52-0.61)[c]	0.57 (0.43-0.74)[c]	0.55 (0.48-0.63)[c]	0.57 (0.50-0.64)[c]
Education (ref=<HS)				
H.S. graduate	0.87 (0.79-0.97)[b]	0.82 (0.68-1.01)	0.86 (0.74-0.99)[a]	0.91 (0.80-1.04)
Some college	0.98 (0.89-1.08)	0.82 (0.68-0.99)[a]	0.99 (0.85-1.15)	1.05 (0.92-1.19)
College graduate	0.78 (0.71-0.87)[c]	0.75 (0.60-0.94)[b]	0.84 (0.70-0.99)[a]	0.79 (0.68-0.90)[c]
Any military service (ref=no)	0.77 (0.67-0.87)[c]	0.64 (0.50-0.86)[b]	0.73 (0.60-0.89)[b]	0.86 (0.70-1.06)

[a]$P < .05$, [b]$P < .01$, [c]$P < .001$

Note: Yellow indicates a factor associated with higher odds of a suicide variable; blue indicates a factor associated with lower odds of a suicide variable.

Table 2. Logistic Regressions of Past-Year Suicidal Plans

Variable	Full Sample OR (95% CI)	Non-Metro. OR (95% CI)	Small Metro. OR (95% CI)	Large Metro. OR (95% CI)
County Type (ref=non-metro)				
Small Metro	0.98 (0.85-1.13)	-	-	-
Large Metro	0.93 (0.80-1.08)	-	-	-
Year (ref=2010)				
2011	0.93 (0.75-1.15)	1.04 (0.66-1.65)	0.86 (0.61-1.21)	0.93 (0.67-1.30)
2012	1.02 (0.84-1.23)	0.67 (0.41-1.11)	0.94 (0.68-1.29)	1.22 (0.89-1.68)
2013	1.01 (0.83-1.23)	1.01 (0.62-1.65)	0.97 (0.70-1.35)	1.04 (0.77-1.42)
2014	1.02 (0.85-1.21)	0.98 (0.63-1.52)	0.91 (0.66-1.24)	1.11 (0.84-1.48)
2015	1.04 (0.86-1.25)	0.95 (0.62-1.46)	0.83 (0.60-1.15)	1.24 (0.94-1.64)
2016	1.04 (0.86-1.24)	1.06 (0.68-1.64)	1.05 (0.77-1.43)	1.02 (0.79-1.33)
Age	0.71 (0.67-0.75)[c]	0.69 (0.63-0.75)[c]	0.74 (0.68-0.79)[c]	0.71 (0.65-0.77)[c]
Male (ref=female)	0.84 (0.76-0.92)[c]	0.94 (0.75-1.17)	0.86 (0.73-1.01)	0.80 (0.69-0.92)[b]
Marital status (ref=married)				
Widowed	1.10 (0.77-1.56)	1.24 (0.63-2.44)	0.82 (0.46-1.48)	1.25 (0.75-2.09)
Div/Sep	2.38 (2.05-2.76)[c]	1.98 (1.45-2.71)[c]	2.42 (1.88-3.11)[c]	2.55 (2.00-3.25)[c]
Never married	1.60 (1.40-1.83)[c]	1.30 (1.01-1.66)[a]	1.53 (1.21-1.94)[c]	1.77 (1.43-2.19)[c]
Income	0.76 (0.72-0.81)[c]	0.76 (0.68-0.85)[c]	0.72 (0.67-0.79)[c]	0.79 (0.73-0.86)[c]
Race/Ethnicity (ref=white)				
African American	0.69 (0.60-0.80)[c]	0.51 (0.35-0.75)[c]	0.71 (0.54-0.92)[b]	0.73 (0.59-0.89)[b]
Native Am/AK Native	1.48 (0.91-2.41)	1.47 (0.75-2.89)	1.06 (0.46-2.44)	2.09 (0.74-5.85)
Pacific Islander	0.40 (0.18-0.88)[a]	0.39 (0.10-1.46)	0.47 (0.18-1.21)	0.36 (0.08-1.54)
Asian	0.76 (0.56-1.03)	0.16 (0.07-0.39)[c]	0.67 (0.35-1.31)	0.84 (0.59-1.20)
>1 race (non-Hispanic)	1.27 (1.01-1.61)[a]	1.22 (0.67-2.21)	1.07 (0.69-1.65)	1.45 (1.10-1.93)[b]
Hispanic	0.56 (0.49-0.64)[c]	0.49 (0.34-0.71)[c]	0.54 (0.44-0.67)[c]	0.59 (0.48-0.73)[c]
Education (ref=<HS)				
H.S. graduate	0.84 (0.72-0.97)[a]	0.88 (0.66-1.18)	0.85 (0.67-1.07)	0.81 (0.65-1.02)
Some college	0.92 (0.79-1.07)	0.83 (0.63-1.08)	0.96 (0.75-1.24)	0.94 (0.75-1.17)
College graduate	0.64 (0.54-0.74)[c]	0.56 (0.37-0.83)[b]	0.77 (0.59-1.01)	0.59 (0.47-0.74)[c]
Any military service (ref=no)	0.68 (0.55-0.84)[c]	0.62 (0.39-0.97)[a]	0.76 (0.53-1.08)	0.66 (0.47-0.94)[a]

[a]$P < .05$, [b]$P < .01$, [c]$P < .001$

Note: Yellow indicates a factor associated with higher odds of a suicide variable; blue indicates a factor associated with lower odds of a suicide variable.

Table 3. Logistic Regressions of Past-Year Suicidal Attempts

Variable	Full Sample OR (95% CI)	Non-Metro. OR (95% CI)	Small Metro. OR (95% CI)	Large Metro. OR (95% CI)
County Type (ref=non-metro)		-	-	-
Small Metro	0.93 (0.78-1.12)	-	-	-
Large Metro	0.92 (0.76-1.12)			
Year (ref=2010)				
2011	1.10 (0.83-1.46)	0.69 (0.37-1.25)	0.80 (0.51-1.27)	1.66 (1.11-2.50)[b]
2012	1.14 (0.88-1.48)	0.72 (0.39-1.34)	0.96 (0.59-1.59)	1.60 (1.08-2.37)[a]
2013	1.18 (0.87-1.59)	0.83 (0.42-1.68)	1.16 (0.68-1.99)	1.42 (0.96-2.12)
2014	1.09 (0.82-1.44)	0.85 (0.46-1.57)	0.75 (0.45-1.26)	1.54 (1.04-2.30)[b]
2015	1.30 (0.98-1.72)	0.68 (0.36-1.26)	1.28 (0.84-1.95)	1.75 (1.18-2.61)[b]
2016	1.24 (0.94-1.64)	0.83 (0.46-1.49)	1.27 (0.83-1.92)	1.49 (0.98-2.27)
Age	0.65 (0.60-0.71)[c]	0.57 (0.49-0.66)[c]	0.64 (0.56-0.75)[c]	0.68 (0.61-0.77)[c]
Male (ref=female)	0.73 (0.63-0.84)[c]	0.88 (0.66-1.16)	0.62 (0.50-0.77)[c]	0.75 (0.62-0.92)[b]
Marital status (ref=married)				
Widowed	1.42 (0.87-2.32)	2.39 (0.94-6.10)	1.56 (0.75-3.23)	0.97 (0.42-2.25)
Div/Sep	2.50 (1.95-3.22)[c]	1.94 (1.22-3.08)[b]	3.50 (2.47-4.97)[c]	2.21 (1.37-3.56)[c]
Never married	1.64 (1.32-2.04)[c]	1.13 (0.75-1.69)	1.80 (1.24-2.62)[b]	1.79 (1.29-2.47)[c]
Income	0.76 (0.70-0.81)[c]	0.82 (0.69-0.97)[a]	0.73 (0.67-0.81)[c]	0.75 (0.67-0.85)[c]
Race/Ethnicity (ref=white)				
African American	0.89 (0.74-1.08)	1.05 (0.68-1.63)	1.16 (0.79-1.70)	0.75 (0.56-1.00)[a]
Native Am/AK Native	1.53 (0.79-2.96)	1.17 (0.68-2.03)	1.06 (0.43-2.57)	3.13 (0.81-12.18)
Pacific Islander	0.62 (0.21-1.82)	0.67 (0.11-4.14)	0.27 (0.11-0.68)[b]	0.80 (0.18-3.54)
Asian	1.32 (0.88-2.00)	0.22 (0.07-0.71)[b]	1.09 (0.48-2.46)	1.39 (0.86-2.25)
>1 race (non-Hispanic)	1.15 (0.86-1.53)	1.30 (0.62-2.70)	0.79 (0.48-1.30)	1.38 (0.94-2.01)
Hispanic	0.74 (0.63-0.87)[c]	0.77 (0.48-1.25)	0.71 (0.52-0.97) [a]	0.73 (0.57-0.94)[b]
Education (ref=<HS)				
H.S. graduate	0.70 (0.58-0.84)[c]	0.72 (0.48-1.08)	0.75 (0.55-1.02)	0.66 (0.50-0.89)[b]
Some college	0.59 (0.48-0.73)[c]	0.65 (0.43-0.99)[a]	0.59 (0.39-0.87)[b]	0.58 (0.42-0.80)[c]
College graduate	0.36 (0.27-0.47)[c]	0.26 (0.13-0.48)[c]	0.36 (0.25-0.52)[c]	0.37 (0.25-0.56)[c]
Any military service (ref=no)	0.68 (0.49-0.92)[b]	0.49 (0.25-0.97)[a]	0.56 (0.33-0.95)[a]	1.01 (0.84-1.20)

[a]$P < .05$, [b]$P < .01$, [c]$P < .001$

Note: Yellow indicates a factor associated with higher odds of a suicide variable; blue indicates a factor associated with lower odds of a suicide variable.