

Socioeconomic determinants of suicide risk: Monroe County Florida Behavioral Risk Factor Surveillance Survey, 2016



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ABSTRACT

Background: Socioeconomic factors have been linked to suicide, but little research has explored the effects of these determinants on suicide risk in US populations. This population-based study assessed socioeconomic determinants of suicide risk to inform suicide assessment and intervention.

Method: Secondary analysis of the Monroe County Florida 2016 Behavioral Risk Factor Surveillance Survey suicide behavior questions among adult residents ($n = 528$). Univariate analysis and logistic regression assessed associations of self-reported socioeconomic status (education, employment, income, housing), health care access, quality of life, substance use, mental illness and suicide risk.

Result(s): Among respondents, 7.34% ($n = 49$, $CI = 4.27$ – 10.41) were at risk for suicide. Persons at risk reported more depression ($\chi^2 [1, n = 417] = 105.5, p = .001$), poorer mental health ($\chi^2 [2, n = 411] = 36.6, p = .001$), and more activity limitation due to health ($\chi^2 [1, n = 408] = 34.3, p = .001$) than those not at risk. Persons at risk were more likely to be renting homes (63.5%, $n = 19$, $CI = 43.53$ – 80.52) than persons not at risk (36.9%, $n = 86$, $CI = 28.53$ – 43.29).

Limitations: 32% missing data supports replication of study findings using larger data sets. Maximum likelihood estimation handled missing data in regression analyses. Low prevalence of suicide risk required collapsing some conceptually different categories.

Conclusion(s): Housing was a stronger socioeconomic predictor of suicide risk than income, employment, or education. This finding supports exploring housing status in suicide assessment and research.

1. Introduction

Suicide is the 10th leading cause of death in the U.S., and suicide rates increase yearly (Stone, Simon, & Fowler, 2018). Although we know the impact of suicide reaches beyond an individual into society (Luoma, Martin, & Pearson, 2002; Tidemalm, Langstrom, Lichtenstein, & Runeson, 2008), it is not clear how a community and its associated social context influences suicide risk (Judd, Cooper, Fraser, & Davis, 2006; Westman, Hasselström, Johansson, & Sundquist, 2003). Socioeconomic status (SES) is an important social determinant of health that is known to influence injury and mortality (Cubbin, LeClere, & Smith, 2000a; Cubbin, LeClere, & Smith, 2000b; Lorant, Kunst, Huisman, Costa, & Mackenbach, 2005; Milner, Niven, & LaMontagne, 2015). Suicide prevention interventions could possibly be improved if the role of SES in the context of suicide risk was better understood (Cubbin et al., 2000a; Lorant et al., 2005; Pompili, 2018).

Studies investigating the relationship between SES and suicide found SES to be an important risk factor for suicide outcomes (Cubbin

et al., 2000a, 2000; Hempstead & Phillips, 2015; Lorant et al., 2005; Page, Morrell, Taylor, Carter, & Dudley, 2006; Phillips & Nugent, 2014; Pompili et al., 2014; Stein, Gennuso, Ugboaja, & Remington, 2017). Yet, some of these studies have produced conflicting findings (Cubbin et al., 2000b; Denney, Rogers, Krueger, & Wadsworth, 2009; Lewis & Sloggett, 1998; Lorant et al., 2005; Milner et al., 2015; Page et al., 2006). For instance, some studies found no association with SES and suicide (Cubbin et al., 2000b), others associated lower levels of SES with suicide (Cubbin et al., 2000a; Denney et al., 2009; Hempstead & Phillips, 2015; Lewis & Sloggett, 1998; Lorant et al., 2005; Milner et al., 2015; Phillips & Nugent, 2014; Pompili et al., 2014), and one found that suicide rates increased with higher levels of SES (Page et al., 2006). These conflicting findings make it difficult to understand exactly what aspects of SES contribute to suicide (Cubbin et al., 2000a; Denney et al., 2009; Lewis & Sloggett, 1998; Lorant et al., 2005; Milner et al., 2015). Further, although studies exploring SES and suicide exist, the majority of these studies focus on the relationship between SES and suicide outcomes, rather than exploring how SES contributes to overall suicide

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risk (Kim, Kim, Choi, Lee, & Park, 2016).

This paper explores the role of SES in suicide risk using population-based data from a Florida county with high suicide rates. Monroe County, home of the Florida Keys, is a rural area located outside of the large urban area of Miami, where suicide is the 5th leading cause of death for people under age 65, and where many socioeconomic factors found to be related to suicide are present (Denney, Wadsworth, Rogers, & Pampel, 2015; Florida Department of Health in Monroe County [FDHMC], 2017; Stein et al., 2017). Some examples of socioeconomic factors associated with suicide are lower paying jobs, increased alcohol use and limited access to mental health care (Stein et al., 2017). These factors have similarly been associated with increased rural suicide rates outside other large U.S. urban areas as well (Denney et al., 2015; Stein et al., 2017).

The high rates of suicide in the Florida Keys may be the product of wealth disparities resulting in health inequalities that increase suicide risk (Braveman, Egerter, & Williams, 2011; Lynch, Kaplan, & Shema, 1997; World Health Organization [WHO], 2010). Health inequalities can lead to worsening disease states or injury outcomes, such as suicide (Black, Morris, Smith, & Townsend, 1980; Marmot, Rose, Shipley, & Hamilton, 1978). Suicide risk is known to be influenced by mental and physical determinants, such as unmanaged mental health conditions, and some chronic and/or debilitating illnesses (Russell, Turner, & Joiner, 2009; Yoshimasu, Kiyohara, Miyashita, & Stress Research Group of the Japanese Society for Hygiene, 2008). However, what is not well understood, is the effect of wealth disparities on suicide risk in the context of mental and physical illnesses, and physical disabilities (Judd et al., 2006; Page et al., 2006; Westman et al., 2003). For instance, the social determinants that contribute to wealth disparities may also contribute to health inequalities that lead to suicide risk. These associations could be better understood by applying the determinants of health model to assess suicide risk using population-based data (Dasgupta, Beletsky, & Ciccarone, 2018).

The purpose of this study was to identify socioeconomic determinants associated with suicide risk in the Florida Keys by conducting a secondary analysis of the Monroe County Behavior Risk Factor Surveillance System (BRFSS) 2016 data. Specifically, this study addressed the following three research aims: (1) estimate the 2016 prevalence of adult suicide risk in Monroe County and associated sociodemographic characteristics, socioeconomic structural determinants (education, employment, income, and housing) and socioeconomic intermediary determinants (behavior, biological and psychosocial); (2) examine associations among sociodemographic characteristics, socioeconomic structural determinants and socioeconomic intermediary determinants and suicide risk among 2016 Monroe County, Florida adult residents; and (3) examine the interaction of socioeconomic structural determinants with gender, race/ethnicity and health care access on suicide risk among Monroe County, Florida adult residents, and was guided by the Social Determinants of Health conceptual model.

2. Conceptual model

Fig. 1 depicts the adaptation of the WHO Commission on Social Determinants of Health conceptual model that guided the analysis of this study (World Health Organization [WHO], 2010). The conceptual model depicts how different structural determinants of SES (education, employment, and income) contribute to wealth, and how wealth influences the intermediary social determinants (behavioral, biological, and psychosocial) that contribute to outcomes of health inequality, and could result in suicide risk (World Health Organization [WHO], 2010). The adaptation of this model to assess suicide risk is supported by Durkheim's theory of social integration that explains how different social inequalities can result in suicide (Durkheim, Simpson, & Spaulding, 1952). The conceptual progression of these determinants is described next.

2.1. Socioeconomic structural determinants

The socioeconomic structural determinants in this model consists of education, employment, income and housing. *Education* qualifies an individual for *employment*, which leads to *income* and, in turn, results in *wealth* (Braveman et al., 2011; Kessler, Borges, & Walters, 1999; Lynch et al., 1997; Wilkinson & Marmot, 2003; World Health Organization [WHO], 2010). Education, employment and income have been associated with suicide inconsistently, with lower levels of education, unemployment and low income contributing to higher rates of suicide in some studies (Cubbin et al., 2000a; Kessler et al., 1999; Milner et al., 2015), and higher levels of education, employment, and higher income associated with suicide in other studies (Cubbin et al., 2000b). One possibility for the notable, yet inconsistent findings is that these structural determinants are not consistent measures of wealth. Instead, as per the CSDH model guiding this study, the combined influence of education, employment and income contribute to wealth.

A better measure of SES could be the outcome of the different levels of education, employment and income that reflect an individual's wealth (World Health Organization [WHO], 2010). Wealth equates to an individual's SES, as well purchasing power to obtain material resources, such as home ownership. *Housing status*, owning or renting a home, was used as a measure of wealth in this study. The use of housing status as a measure of wealth is consistent with other studies investigating the association of SES and suicide that found wealth, as measured by material assets, to be the SES measure most associated with suicide (Braveman et al., 2011; Lewis & Sloggett, 1998; Lorant et al., 2005; Lynch et al., 1997; Wilkinson & Marmot, 2003; World Health Organization [WHO], 2010).

Stigma and discrimination could possibly interact with SES and contribute to increased suicide risk in many social contexts, including Monroe County. The social constructions of race, ethnicity and gender form foundations of stigma, division and discrimination (Krieger, 2002; World Health Organization [WHO], 2010). Therefore race, ethnicity and gender were assessed as moderating factors of SES and suicide risk in this study (Krieger, 2002, 2005; World Health Organization [WHO], 2010). Gender, race/ethnicity, and health care access were assessed as moderators of the effects of socioeconomic determinants on suicide risk.

The structural socioeconomic determinants that contribute to an individual's SES could also be moderated by health care access (Braveman et al., 2011; Lynch et al., 1997). Different social classes, as moderated by health care system access, could lead to different exposures and health-compromising vulnerabilities (Braveman et al., 2011; Lynch et al., 1997). Compromised health leads to illness, which then feeds back upon the individual's social status by reducing income, employment and wealth, which establishes an individual's social status (Braveman et al., 2011; Lynch et al., 1997). Therefore health care access was also assessed as a moderating factor of SES and suicide risk in this study.

2.2. Socioeconomic intermediary determinants of suicide risk

The socioeconomic intermediary determinants of health are influenced by socioeconomic structural determinants that contribute to an individual's social class, as moderated by health system access (Braveman et al., 2011; Lynch et al., 1997; Wilkinson & Marmot, 2003; World Health Organization [WHO], 2010). Different social classes, as moderated by health care system access, can lead to different exposures and health-compromising vulnerabilities (Braveman et al., 2011; Lynch et al., 1997; Wilkinson & Marmot, 2003; World Health Organization [WHO], 2010). Compromised health leads to illness, which then in return, feeds back upon the individual's social class by reducing income, employment opportunities and wealth which establishes an individual's level of social class (Lynch et al., 1997, Braveman et al., 2011; Wilkinson & Marmot, 2003; World Health Organization [WHO], 2010).

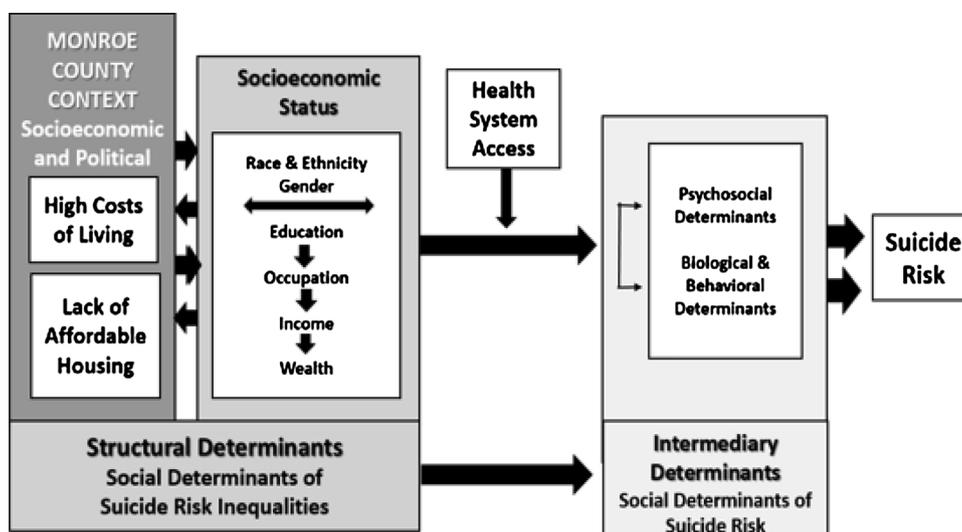


Fig. 1. Adaptation of the Social Determinants of Health Model (WHO, 2010).

Several behavioral, psychosocial and biological intermediary determinants of health have been associated with suicide risk. Examples of the psychosocial determinants associated with suicide risk are mental illness, such as *depression*, bipolar disorder and anxiety, and *unmanaged mental health* conditions (Bertolote & Fleischmann, 2002; Kim, 2016; Luoma et al., 2002). Subsequently, worsening psychosocial disorders can lead to behavioral determinants that are also associated with an increased risk for suicide, such as *lack of exercise* or *substance use* (Luoma et al., 2002; Tidemalm et al., 2008). *Worsening health conditions* and *activity limitations* caused by physical illness are biological determinants that are also associated with increased suicide risk (Khatoun, Khalid, Fatima, & Minhas, 2015; Kim, 2016).

3. Methods

A secondary analysis of Monroe County, Florida 2016 BRFSS data was conducted to assess the socioeconomic structural and intermediary determinants of suicide risk among adult residents. BRFSS is one of the United States' primary sources of health information used to set health goals and monitor public health progress at national, state, and local levels. BRFSS uses a complex non-probability based sampling method that includes stratification and cluster sampling to collect uniform, generalizable, county-level data every three years from the non-institutionalized U.S. civilian population greater than 18 years of age in the state of Florida (Centers for Disease Control & Prevention, 2013). Trained interviewers, using a computer-assisted random-digit dialing telephone interviewing (CATI) system, collect data from a standardized questionnaire throughout the year, on a monthly basis, from the US adult population with landline telephones and/or cellphones (Centers for Disease Control & Prevention, 2013; Florida Department of Health, 2016). Responses are weighted according to the respondent's probability of selection, and the age, sex, and race/ethnicity-specific distribution of the population using post-census projections for each state, county and territory (Centers for Disease Control & Prevention, 2013). Detailed weighting and analytic methodologies have been previously published (Florida Department of Health, 2016; Pierannunzi, Hu, & Balluz, 2013).

The BRFSS questionnaire consists of 3 parts: (1) core questions asked in all 50 states, the District of Columbia, Puerto Rico, Guam, and the US Virgin Islands; (2) supplemental modules, which are a series of questions on specific topics (i.e. adult asthma history, intimate partner violence, mental health) that a state can choose to include in their survey; and (3) questions added by the states individually. Potential study participants are informed prior to the interview that the survey is

being conducted by the health department, with the purpose of the study being to “gather information about the health of the state’s residents.” All BRFSS questionnaires, data, and reports are available at <http://www.cdc.gov/brfss/>. Additionally, cell phone sampling and follow-up mail surveys were added to the BRFSS sampling methods in 2010 (Centers for Disease Control & Prevention, 2013). All collected data are submitted to the Centers for Disease Control for editing, processing, weighting, and reliability-checking at the end of each month throughout the survey year (Florida Department of Health, 2016). Details of the validity and reliability of the BRFSS survey methodology have been previously published (Centers for Disease Control & Prevention, 2013).

3.1. Study measures

The independent variables used to assess suicide risk are discussed within each respective socioeconomic determinant subgroup of structural and intermediary. Although not discussed here, all measures used included response options of “don’t know/Not sure” and “Refused”. Demographic characteristics used to help describe the population included age in years (18–44, 45 and greater) and marital status (married/unmarried couple, single, widowed).

3.2. Lifetime suicide risk

Lifetime suicide risk (yes = 1, no = 0) was constructed using the revised Suicidal Behaviors Questionnaire (SBQ-R) items 1, 3 and 4 (Guitierrez & Osman, 2008; Osman et al., 2001). A cutoff score of two on SBQ-R item 1 was used for suicide risk (Osman et al., 2001). In a validity study of the SBQ-R, a score of two for SBQ-R item 1 produced the best sensitivity and specificity when compared to the Beck Hopelessness Scale (sensitivity: 100%; specificity: 96%) (Osman et al., 2001). Additionally, if respondents reported ever telling someone they would suicide (Item 3), or thinking they would die by suicide one day (Item 4), then those respondents were also included in the suicide risk subpopulation. The SBQ-R total score could not be calculated because item 2 was not administered in the survey correctly. Therefore, responses to items 1, 3 and 4 only were included to determine the risk subpopulation. Construct validity of these questions supports this approach (Crosby, Gfroerer, Han, Ortega, & Parks, 2011; Osman et al., 2001; Substance Abuse & Mental Health Services Administration [SAMHSA], 2016, 2017).

3.3. Structural determinants

Structural determinants of interest included gender (men, women), race and ethnicity (White, non-Hispanic; other races, non-Hispanic; Hispanic), education (did not graduate college, graduated college), employment (employed, unemployed or unable to work, retired), income (less than \$35,000; \$35,000 or greater), and housing status (owning a home, renting a home or other arrangements). As discussed previously, housing status was used as a proxy measure for wealth in this study. For purposes of this study, less wealth was defined as homeownership response options of renting or other arrangements (1), and more wealth was defined as a homeownership response of own (0). Previous studies establishing associations between housing status and suicidality support the validity of this approach (Lewis & Sloggett, 1998; Lorant et al., 2005).

3.4. Behavioral, physical and psychosocial Intermediary determinants

The socioeconomic behavioral and physical intermediary determinants were assessed using five questions: (1) “during the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?”; (2) “would you say that in general your health is” (excellent, very good, good, fair, poor); (3) “during the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work or recreation?”; (4) “considering all types of alcoholic beverages, how many times during the past 30 days did you have (5 for men, 4 for women) or more drinks on an occasion?”; and (5) “during the past 30 days, how many times have you driven when you’ve had perhaps too much to drink?”

Responses to the exercise question were used to create the “no exercise” variable (yes, no). Responses to the general health question were used to create the “fair to poor health” variable of yes and no. Responses to the activity limitation due to health question were used to create the “activity limitation” variable dichotomized as yes (1 day or more days of activity limitation due to health) and no (0 days of no activity limitation due to health). Responses to the number of drinks on any occasion question were used to create the “binge drinking” variable dichotomized as (yes, no). Responses to the drinking and driving question were used to create the “drinking and driving” variable dichotomized as (yes, no).

The psychosocial intermediary determinant was assessed using two BRFSS questions: (1) “has a doctor, nurse, or other health professional ever told you that you have a depressive disorder (including depression, major depression, dysthymia, or minor depression)?”; and (2) “now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?”. The question assessing lifetime diagnosis of depression was used for the depression variable (yes, no). Number of days in the past 30 when mental health was not good was a continuous variable that was transformed into a three category variable of: zero days; 1–13 days; and 14+ days (Centers for Disease Control & Prevention, 2013).

Access to health care was assessed using two questions: (1) “do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, government plans such as Medicare, or Indian Health Service?” (yes, no), and (2) “was there a time in the past 12 months when you needed to see a doctor but could not because of cost?” (yes, no).

3.5. Analysis

3.5.1. Aim 1

Prevalence estimates, standard errors, and 95% confidence intervals of suicide risk were generated using a series of univariate analyses that incorporated weights and strata to account for the complex survey

design. Chi-square tests of significance assessed whether certain sociodemographic characteristics and different socioeconomic structural and intermediary determinants were associated with an increased risk for adult suicide among 2016 Monroe County, Florida residents. Significance was assessed using an alpha level of $\leq .05$. These univariate analyses and chi square tests of significance were performed using SAS 9.4 (SAS Institute Inc, Cary, NC, 2012). All responses of “don’t know” and “not sure” were treated as

3.5.2. Aim 2

Logistic regression analyses were conducted with Mplus (v7.11) using maximum likelihood estimates to address issues of missing data (Horton & Kleinman, 2007). Significance was assessed using an alpha level of $\leq .05$. A logistic regression model was conducted in which all theorized predictors of wealth (education, employment, and income) were entered into a model. Next, hierarchical logistic regression was used to build 4 successive models that progressed from the socioeconomic structural determinants of suicide risk, to the socioeconomic intermediary determinants of suicide risk, and ended with a model that included all significant socioeconomic structural and intermediary determinants of suicide risk. In the first model, all structural determinants identified as significantly associated with suicide risk in the univariate analysis were regressed on suicide risk. In the second model, all behavioral and biological intermediary determinants identified as significantly associated with suicide risk in the univariate analysis were regressed on suicide risk. The third model combined the psychosocial determinants that were significantly associated with suicide risk through univariate analysis with only the behavioral and biological determinants that remained significant in model two. The fourth model was constructed of only the significant structural and intermediary determinants of suicide risk identified in the first three models.

3.5.3. Aim 3

Moderation effects were assessed for gender, race/ethnicity, and health care access with socioeconomic structural determinants on suicide risk (Judd et al., 2006; Westman et al., 2003). Four logistic regression models were used to assess whether the interaction term involving significant socioeconomic structural determinants and gender, race/ethnicity and the two different measures of health care access barriers (insurance and cost) were associated with suicide risk in Monroe County.

4. Results

4.1. Population characteristics

The 2016 Monroe County data set contained 528 respondents 18 years and older (Table 1). Most of these respondents were white (70%). Over a third had graduated college (37%), and most were either employed (64%) or retired (22%). Of those reporting income, 41% earned less than \$35,000 per year. Half of the population (51%) were married or a non-married couple.

4.2. Aim 1: univariate analysis

About a third of the population (32%; $n = 109$, $CI = 26.5\text{--}38.4$) did not respond to the suicide risk items. Of those who responded, 7.3% ($n = 49$, $CI = 4.3\text{--}10.4$) were at risk for suicide (Table 1). Those at risk for suicide were more likely to be renters ($\chi^2 [1, n = 418] = 12.9, p = .012$) than those not at risk for suicide. Those at risk for suicide reported significantly more unemployment ($\chi^2 [3, n = 417] = 52.6, p \leq .001$), more depression ($\chi^2 [1, n = 417] = 105.5, p \leq .001$), less exercise ($\chi^2 [1, n = 419] = 14.7, p = .009$), and poorer general health ($\chi^2 [1, n = 417] = 14.3, p = .011$) and mental health ($\chi^2 [2, n = 411] = 36.6, p \leq .001$), as well as more activity limitation due to health ($\chi^2 [1, n = 408] = 34.3, p \leq .001$) than those not at risk for

Table 1
Prevalence estimates of suicide risk by sociodemographic characteristics and socioeconomic structural determinants of suicide risk, Monroe County Florida BRFSS 2016.

Determinants	Monroe County			Suicide Risk			No Suicide Risk			p
	No. In Sample	% ^a	(95% CI)	No. In Sample	% ^a	(95% CI)	No. In Sample	% ^a	(95% CI)	
Overall (weighted)	528 (65,411)			49 (4,802)	7.3	4.3-10.4	370 (39,407)	60.3	54.1-66.4	
Gender										
Men	244	53.2	47.1-59.2	22	41.7	20.1-63.3	165	50.2	42.3-58.0	0.47
Women	283	46.8	40.8-52.9	27	58.3	36.7-79.9	205	49.8	42.0-57.6	
Age Group (yrs)										
18-44	79	27.2	21.8-32.7	6	21.8	4.0-39.6	42	79.0	72.6-85.3	0.93
> 45	449	72.8	67.4-78.2	43	78.2	60.4-96.0	328	70.4	63.8-89.2	
Race/Ethnicity										
White, non-Hisp. ^b	405	70.2	63.3-76.0	40	78.8	61.4-96.1	305	77.9	71.2-84.6	0.78
Other race(s), non-Hisp. ^b	27	7.5	3.9-11.1	4	2.6	0.0-5.6	13	5.4	1.0-9.8	
Hispanic	85	22.4	17.3-27.4	5	18.6	1.3-35.8	45	16.3	11.1-22.1	
Education										
< College Grad	303	62.7	56.7-68.7	27	65.1	45.0-85.1	206	59.1	51.4-66.9	0.59
College Grad	224	37.3	31.3-43.3	22	34.9	14.8-55.0	164	40.9	33.1-48.6	
Housing Status^c										
Own	370	55.1	49.2-61.1	30	36.5	28.5-43.3	283	64.1	56.7-71.5	0.01
Rent/other	153	44.9	39.0-50.8	19	63.5	43.5-83.5	86	35.9	28.5-43.3	
Income										
< \$35,000	139	41.4	34.6-48.2	19	54.1	29.4-78.9	81	32.9	24.8-40.9	0.09
\$35,000 or more	280	58.6	51.8-65.4	21	45.9	21.1-70.6	220	67.1	59.1-75.2	
Employment Status^c										
Employed	261	64.6	58.9-70.2	20	49.3	27.5-71.2	175	64.0	56.9-71.1	0.00
Unemployed/ unable to work	63	13.2	9.1-17.3	12	31.7	11.8-51.7	34	8.3	5.3-11.2	
Retired	200	22.2	17.5-27.0	17	18.9	2.6-35.3	159	27.7	21.0-34.5	
Marital Status										
Married/ Couple	284	50.6	45.5-57.7	15	33.8	13.1-54.5	218	57.6	49.7-65.5	0.11
Single	160	39.5	33.3-45.8	24	55.5	33.5-77.4	95	34.0	26.2-41.8	
Widowed	77	8.8	5.2-12.6	9	10.8	0.0-23.7	54	8.3	4.3-12.4	

^a Weighted percentages.

^b Hisp. is abbreviation for Hispanic.

^c Predictors included in hierarchical regression models.

suicide (Tables 1 and 2).

4.3. Aim 2: logistic regression of less wealth

The structural determinants of education, employment and income were regressed onto renting. As can be seen from the regression results in Table 3, the three structural socioeconomic determinants remained significant, with those having less than a college degree ($B = 1.02, SE = 0.345, p = .003$), employed ($B = 2.095, SE = 0.535, p \leq .001$) and making less than \$35,000 per year ($B = 1.484, SE = 0.379, p \leq .001$) were significantly associated with renting.

4.4. Aim 2: hierarchical logistic regression of socioeconomic determinants

Model 1 regressed the socioeconomic structural determinants identified as significant in the chi-square analysis of education and housing status onto suicide risk. As can be seen from the regression results in Table 4, Model 1, only renting a home remained significant ($B = 1.207, SE = 0.597, p = .043$).

Model 2 regressed the significant socioeconomic behavioral and biological intermediary determinants identified as significant in the univariate analysis onto suicide risk. As can be seen from the regression results in Table 4, Model 2, only activity limitation due to health remained significant ($B = 2.207, SE = 0.853, p = .010$).

Model 3 regressed the significant intermediary determinants from Model 2 and the significant psychological intermediary determinants identified as significant in the univariate analysis onto suicide risk. As

can be seen from the regression results in Table 4, Model 3, only two variables remained significant: depression ($B = 2.371, SE = 0.779, p = .002$) and greater than 14 mentally unhealthy days per month ($B = 2.387, SE = 0.928, p = .010$) when controlling for all other variables.

Model 4 regressed the significant intermediary determinants from Model 3 and the significant structural determinants from model 1 onto suicide risk. As can be seen in Table 4, Model 4, both depression ($B = 2.369, SE = 0.858, p = .006$) and greater than 14 mentally unhealthy days per month ($B = 2.387, SE = 0.928, p = .011$) remained significant. Depression increased the odds of suicide risk 10.7 times ($CI = 10.7, 57.4$) and greater than 14 mentally unhealthy days per month increased the odds of suicide risk by 7.6 times ($CI = 1.6, 36.4$) when controlling for all other variables.

4.5. Aim 3: moderation

The tests for moderation were conducted by gender, race/ethnicity and health care access (cost and insurance) of the effects of significant structural determinants on suicide risk. No interaction terms remained significant when entered into regression models testing moderation ($p \geq 0.18$).

5. Discussion

The prevalence of Monroe County suicide risk observed in the 2016 BRFSS data is over 3% higher than national and Florida State-level

Table 2
Prevalence estimates of suicide risk by biological and psychological intermediary determinants of suicide risk, Monroe County Florida BRFSS 2016.

Determinants	Monroe County			Suicide Risk			No Suicide Risk			p
	No. In Sample	% ^a	(95% CI)	No. In Sample	% ^a	(95% CI)	No. In Sample	% ^a	(95% CI)	
Overall (weighted)	528 (65,411)			49 (4,802)	7.3	4.3-10.4	370 (39,407)	60.3	54.1-66.4	
Depression^b										
Yes	62	11.2	7.3-15.1	22	54.2	32.5-75.8	24	5.0	1.7-8.3	0.00
No	464	88.8	84.9-92.7	27	45.8	24.2-67.4	344	95.0	91.7-98.2	
Exercise past 30 days^b										
Yes	385	69.7	64.2-75.2	32	43.8	22.6-65.0	275	71.7	65.0-78.5	0.00
No	142	30.3	24.8-35.8	17	56.1	35.0-77.4	95	28.3	21.5-35.0	
Health Care Coverage < 65										
Yes	217	65.1	58.1-72.1	21	68.5	43.7-93.3	151	71.0	62.0-79.9	0.85
No	70	34.9	27.9-41.9	7	31.4	6.7-56.3	35	29.0	20.1-38.0	
No Health Care Access - Cost										
Yes	64	15.9	11.3-20.4	7	22.7	3.5-42.0	36	11.4	6.4-16.3	0.16
No	462	84.1	79.6-88.7	42	77.3	58.0-96.5	334	88.6	83.7-93.6	
General Health^b										
Good or Better	443	85.3	80.8-89.8	36	65.1	44.1-86.1	314	86.7	81.8-91.7	0.01
Fair or Poor	82	14.7	10.2-19.2	13	34.9	13.9-55.9	54	13.3	8.3-18.2	
Not good mental health^b										
Zero days per month	397	74.5	69.8-79.7	26	49.8	28.0-71.6	292	79.1	72.9-85.3	0.00
1-13 days per month	73	15.6	11.0-20.1	10	17.9	1.4-34.4	47	15.0	9.4-20.5	
14+ days per month	49	9.9	6.3-13.5	13	32.3	12.2-52.4	23	5.9	2.4-9.4	
Activity Limitation^b										
Yes	107	18.9	13.9-23.9	22	56.5	34.5-78.5	73	17.4	11.6-23.3	0.00
No	376	81.1	76.1-86.2	25	43.5	21.5-65.5	288	82.6	76.7-88.4	
Binge Drinking										
Yes	93	22.1	16.9-27.3	13	26.0	6.7-45.4	65	22.7	16.3-29.0	0.73
No	397	78.0	72.8-83.2	35	74.0	54.7-93.3	296	77.3	70.9-83.7	

^a Weighted percentages.

^b Predictors included in hierarchical regression models.

Table 3
Logistic regression of socioeconomic structural determinants of less wealth in Monroe County Florida, BRFSS 2016.

Structural Determinants	B	SE	OR	95% CI
Education, Occupation & Income				
Less than college degree	1.020	0.345	2.8 [*]	1.4, 5.5
College Grad (ref)	1.00	1.00	1.00	1.00
Unemployed/disabled	1.105	0.636	3.0	0.9, 10.5
Employed	2.095	0.535	8.1 ^{**}	2.8, 23.2
Retired (ref)	1.00	1.00	1.00	1.00
Less than \$35,000 per year	1.484	0.379	4.4 ^{**}	2.1, 9.3
\$35,000 or more (ref)	1.00	1.00	1.00	1.00

* p value of ≤ 0.05.

** p value of ≤ 0.001.

estimates of suicide risk (Substance Abuse & Mental Health Services Administration [SAMHSA], 2016, 2017). Those at risk for suicide in Monroe County were more likely to be renters and less likely to own a home when compared to those not at risk for suicide. The percentage of cost-burdened households in Monroe County (those paying more than 30% of income for rent or mortgage) exceeds statewide estimates by 8%, and Monroe County has a higher percentage of renters (44%) than the rest of Florida (33%) (Florida Department of Health in Monroe County [FDHMC], 2017).

Over 19% of Monroe County households pay more than 50% of monthly household income for housing (Florida Department of Health in Monroe County [FDHMC], 2017). Housing instability is defined as paying more than 50% of household income on housing, and having difficulty paying rent (Kushel, Gupta, Gee, & Haas, 2006). In this study,

of all the socioeconomic structural determinants of suicide risk, housing status was the most strongly associated. Renting a home was significantly associated with a more than 3-fold increase in suicide risk. Further, the structural determinants of lacking a college education, being employed but making less than \$35,000 a year were also significantly associated with renting in the Monroe County population. Therefore, the study findings obtained here in the context of available county level data regarding housing costs, suggesting that housing instability could be a socioeconomic determinant contributing to suicide risk.

This is the first study to assess housing and suicide risk using individual-level U.S. population-based data. The findings from this study are consistent with other European studies that also used housing as an indicator for SES when exploring suicide in both probability and non-probability based samples (Fowler, Gladden, Vagi, Barnes, & Frazier, 2015; Lorant et al., 2005; Shaw, 2004). In contrast to these European studies, U.S. studies tend to use education, employment status, and yearly salary as indicators of SES, which may be a contributing factor to the mixed findings, as the relationships between education, income and employment with various diseases are known to differ depending on the health outcome of interest (Ansari, Carson, Ackland, Vaughan, & Serraglio, 2003; Geyer, Hemström, Peter, & Vågerö, 2006). For example, it is reasonable to expect that education achieved early in life may not solely predict economic success and accumulation of wealth later in life (Lorant et al., 2005). In contrast, most home ownership requires achieving a certain level of financial credit and accruing a certain amount of financial resources. Therefore, measures of wealth accumulation, such as housing status, may be a better predictor of the relationship between SES and suicide risk than other socioeconomic determinants, such as education, employment status or yearly income.

The psychosocial intermediary determinants of mental illness were

Table 4

Logistic regression of structural and intermediary determinants on suicide risk in Monroe County Florida, BRFSS 2016.

Structural Determinants		B	SE	OR	95% CI
Model 1. Education & Wealth	Less than college degree	0.227	.0632	1.3	0.4, 4.3
	College Grad (ref)	1.00	1.00	1.00	1.00
	Renting	1.207	0.597	3.3*	1.0, 10.8
	Home ownership (ref)	1.00	1.00	1.00	1.00
Intermediary Determinants		B	SE	OR	95% CI
Model 2. Behavioral, and Biological Determinants	No exercise in past month	1.278	0.785	3.6	0.8, 16.7
	Exercised in past month (ref)	1.00	1.00	1.00	1.00
	Fair to poor health	-1.443	0.906	0.2	0.0, 1.4
	Good health (ref)	1.00	1.00	1.00	1.00
	Activity limitation due to health	2.207	0.853	9.1*	1.7, 48.4
Model 3. Psychosocial & Significant Behavioral & Biological Determinants	No activity limitation due to health (ref)	1.00	1.00	1.00	1.00
	Activity limitation due to health	0.589	0.722	1.8	0.4, 7.4
	No activity limitation due to health (ref)	1.00	1.00	1.00	1.00
	Depression	2.371	0.779	10.7*	2.3, 49.3
	No depression (ref)	1.00	1.00	1.00	1.00
Model 4. Structural & Intermediary Determinants	14+ mentally unhealthy days per months	2.387	0.928	10.9*	1.8, 67.0
	< 14 mentally unhealthy days per months (ref)	1.00	1.00	1.00	1.00
	Renting	-0.131	0.741	0.9	0.2, 3.8
	Home Ownership (ref)	1.00	1.00	1.00	1.00
	Depression	2.369	0.858	10.7*	2.0, 57.4
	No depression (ref)	1.00	1.00	1.00	1.00
	14+ mentally unhealthy days per months	2.030	0.799	7.6*	1.6, 36.5
	< 14 mentally unhealthy days per months (ref)	1.00	1.00	1.00	1.00

*p value of ≤ 0.05 .**p value of ≤ 0.001 .

other important determinants of suicide risk in this study, and depression is one of the most prevalent mental health conditions treated in Monroe County (Florida Department of Health in Monroe County [FDHMC], 2017). This finding is not surprising given that depression is a well-established determinant of suicide risk (Isometsä, 2001; Mann et al., 2005; Yoshimasu et al., 2008; Cavanagh, Carson, Sharpe, & Lawrie, 2003). However, the current study's findings shed further light on this well-known relationship in that the association between worsening mental health conditions, as indicated as greater than 14 mentally unhealthy days per month, and suicide risk remained independent from depression. These findings suggest that proper diagnosis and treatment of depression and other unmanaged mental health conditions could help reduce suicide risk. The robustness of this finding is supported by other studies documenting depression and worsening health conditions as being associated with suicide, despite differences in sampling and measurement of depression and suicide risk (Khatoon et al., 2015; Kim, 2016). Further, when assessed together, psychosocial intermediary determinants of mental illness explained the association between socioeconomic structural determinants and suicide risk, providing support for the adaptation of the conceptual model applied in this study to assess suicide risk.

A strength of this study is that the measure of suicide risk (SBQ-R) had undergone psychometric testing (Osman et al., 2001), and was recommended for this type of research in other evaluative studies assessing the feasibility and effectiveness of suicide risk measures in population-based studies (Burless & De Leo, 2001). However, population-based suicide risk estimates using the SBQ-R measure, such as this study, could result in different estimates of suicide risk that are potentially driven by differences in measurement approach (e.g., lifetime risk versus 12-month risk), rather than actual differences in population suicide risk (Crosby et al., 2011; Substance Abuse & Mental Health Services Administration [SAMHSA], 2016, 2017). Therefore, future research is needed using the SBQ-R measure in other population-based studies.

This study has some limitations. First, the outcome variable of suicide risk had about 30% missing data, which could lead to unstable estimates and misrepresentation of statistical relationships. However, Maximum Likelihood estimation was used to handle missing data

(Horton & Kleinman, 2007). Next, the low prevalence of suicide risk in our sample made identifying significant differences in subgroups more difficult due to wide confidence intervals, which required collapsing some conceptually different categories. Additionally, the small risk group limited controlling for age and other sociodemographic within models due to unstable estimates (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). Nevertheless, consistent with prior literature, differences in suicide risk were observed to be associated with housing, depression, and greater than 14 mentally unhealthy days per month. These consistencies provide support for the validity of these findings despite the collapsing that was necessitated and that controlling for other sociodemographic characteristics was limited.

Despite these limitations, the findings of this study have implications for practice, policy and future research. With respect to practice, health practitioners should consider assessing the socioeconomic status, such as housing conditions, of clients as part of the screening for suicide risk. Also, housing assistance agencies could be an additional resource for the promotion of suicide risk awareness and assistance programs among lower socio-economic groups. Additionally, lower socio-economic groups need improved access to psychiatric care. Therefore, a means to improve access to this type of care would be for health practitioners to promote policies that improve mental health coverage in low-cost healthcare plans. Future research could benefit from using measures of wealth and material accumulation, such as housing, in studies of suicide risk (Lewis & Sloggett, 1998; Lorient et al., 2005). However, this study could not evaluate whether decreasing suicide risk would correspondingly decrease county suicide rates. Hence, future studies should examine the association between population-based suicide risk and suicide rates using multi-level modeling of macro and individual level measures of suicide risk and rates, and including measures of wealth accumulation such as housing status. Additionally, the effects of SES on suicidal behavior may vary over the life course. Therefore, future research should explore the interaction with age and SES on suicide risk. Finally, more longitudinal designed studies are needed to determine the temporal association of increasing suicide risk in association with increasing suicide rates, and the possibility of intermediary socioeconomic determinants mediating the association of structural socioeconomic determinants on suicide risk.

Contributors

Dr. Summer DeBastiani designed the study, conducted the analyses and contributed substantial writing and editing to all aspects of the paper.

Dr. Anne Norris advised the study and contributed writing to every section of the paper and substantial edits.

Mrs. Kerr participated in the selection of the measures, data analyses and contributed substantial editing to all aspects of the paper. The submitting author is also required to make a brief statement concerning each named author's

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