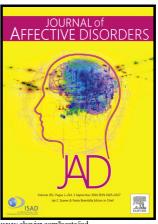# Author's Accepted Manuscript

Individual and Area-Level Risk Factors for suicidal ideation and attempt in people with Severe Depression

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Individual and Area-Level Risk Factors for suicidal ideation and attempt in people with

Severe Depression

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Abstract

Introduction

Previous research has identified several risk factors that are strongly associated with suicidal

behavior in patients with severe depression. However, the effects of area-level characteristics

on suicidal ideation and attempt in this population remain unclear.

Methods

The Clinical Record Interactive Search database (CRIS) was used to identify 2,587 patients with severe depression who received secondary mental health services from the Camden & Islington NHS Foundation Trust. Stepwise multivariable logistic regression models were used to examine associations between socio-demographic characteristics, clinical variables, area-level measures, and suicidal ideation and attempt as separate outcomes.

Results

Both suicidal ideation and attempts were common among this cohort of severely depressed individuals (70.5% and 37.7%, respectively). While several individual socio-demographic and clinical characteristics were associated with both outcomes, particularly past psychiatric admission (suicidal ideation: adjusted OR=2.86, 95% CI: 2.26-3.62; suicide attempt: adjusted OR=4.00, 95% CI: 3.30-4.89), neither social deprivation nor ethnic density (measured at the area-level) was associated with risk for either outcome.

Limitations

Data were not collected specifically for research purposes and hence information on some potential confounders was not available. Additionally, information was restricted to individuals who accessed secondary mental health services in a defined catchment area and period. The study therefore does not take into account individuals who did not access mental health services.

Conclusions

The variation in risk for suicidal ideation and attempt among severely depressed individuals is explained by differences in individual socio-demographic and clinical characteristics, most notably past psychiatric admission and substance misuse, and not by area-level measures.

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Keywords: suicidal ideation, suicide attempt, social deprivation, ethnic density

Introduction

Suicidal behavior exists on a continuum, ranging from suicidal thoughts and attempts to death by suicide. Suicide is one of the leading causes of death worldwide, accounting for about 800,000 deaths each year (World Health Organization, 2014) with about 150 million people attempting suicide globally. In the UK, non-fatal suicide attempts appear to be very common, with 140,000 documented episodes per year (Office of National Statistics, 2014).

One of the major precursors of suicide and suicidal behavior is having a psychiatric disorder, particularly severe depression (Hawton and van Heeringen, 2009). The lifetime risk of suicide attempt among individuals with severe depression is estimated to be 16%-40% (Oquendo et al., 2006) as compared with 2.7% in the general population (Nock et al., 2008). The presence and severity of symptoms of depression are strongly associated with attempted suicide. Specifically, the risk of suicide attempts among patients with severe depression is eight times greater during a major depressive episode compared to a full remission period (Sokero et al., 2005). Suicidal ideation is also extremely prevalent among individuals with severe depression and seems to be one of the preconditions for suicide attempts (Sokero et al., 2003).

The risk for suicidal behavior is multifactorial. Several studies have examined individual-level risk factors for suicidal behavior, mainly suicide attempts, in people with severe depression. Risk factors strongly associated with suicide attempts in this population include male sex (Ruengorn et al., 2012), younger age (Bolton et al., 2010; Holma et al., 2010; Sokero et al., 2003), comorbid psychiatric disorders (Bolton et al., 2010), negative life events (Chan et al., 2011), being unmarried (Bolton et al., 2010; Holma et al., 2010), having lower

income (Bolton et al., 2010) and poor social support (Holma et al., 2010; Sokero et al., 2003).

In addition to focusing on individual risk factors, research on suicide in the general population has also examined characteristics of the environment of individuals that relate to suicidal behavior. These studies examined area-level indicators of deprivation and found higher rates of death by suicide in deprived areas (Kennedy et al., 1999; Rehkopf and Buka, 2006). High levels of deprivation are associated with unhealthy lifestyles, impaired quality of life, high rates of disability and physical illness, decreased life expectancy, poor educational attainment, poor living conditions, and high levels of crime and violence (Social Exclusion Unit, 2004). British ecological data suggest that area-level factors are important: between 1981-1991 the greatest increases in suicide rates were in areas of increasing deprivation over that period (Whitley et al., 1999). However, at an individual level, a 5-year record linkage study in Northern Ireland showed that differences in the rates of suicide across different areas were mainly due to the individual characteristics of the population rather than the differences in area-level indicators (O'Reilly et al., 2008). Further UK evidence suggests that after adjusting for individual factors, there was no association between risk of self-harm repetition and area-level indicators of deprivation (Johnston et al., 2006) . Analysis of Danish registry data confirms this, showing that the risk for suicide in individuals living in poorer areas was greatly reduced after controlling for the individual-level differences (Agerbo et al., 2007).

To date, many studies have explored the epidemiology of suicidal behavior in people with severe depression but without separating out individual and area-level influences. A review of suicidal behavior in major depressive disorder (Oquendo et al., 2006) concluded that while an array of predictive indicators for suicidal acts has been identified, future studies must assess a comprehensive set of putative risk factors and examine their relative importance in predicting risk. There is a need for a broader understanding of the contribution of individual and area-level characteristics, so that an appropriate balance of suicide prevention strategies

can be developed. The present study seeks to examine the association between individual socio-demographic and clinical characteristics and area-level measures (social deprivation and ethnic density) on suicidal ideation and suicide attempt in severely depressed individuals, using routinely collected electronic health records from the Camden and Islington NHS Foundation Trust (C&I NHS FT).

Methods

Data for this study were obtained from C&I NHS FT using the Clinical Record Interactive Search (CRIS) tool. CRIS is an application developed to enable routinely collected electronic health records to be used in research, using an explicit de-identification process (Fernandes et al., 2013). C&I NHS FT is a large mental health provider serving a geographic catchment area of two inner-city London boroughs, and approximately 440,000 residents. The database contains full but anonymized information from over 100,000 mental health service users. Studies using CRIS received ethical approval from the NRES Committee East of England - Cambridge Central (14/EE/0177).

Sample

Using the C&I database, a cohort of 4,197 individuals meeting the following criteria were identified:

- Presentation to secondary mental health services at C&I NHS FT between 2008-2014
- Primary diagnosis of severe depressive episode (ICD-10 F32.1, F32.2, F32.3) or recurrent severe depressive episode (F33.1, F33.2, F33.3)

From this sample, 363 patients who had a past or concurrent primary diagnosis of Non Affective psychotic disorders (ICD-10 F20-F29) were excluded from the study, as psychotic disorders are strongly associated with risk of suicidal behavior (Palmer et al., 2005). An

additional 1,247 patients were excluded due to missing data. Thus, the final analytic sample included 2,587 patients. Rates of both suicidal ideation and suicide attempt were higher in those with complete data *vs*. those excluded for missing data (ideation: 70.5% *vs*. 63.4%, respectively, p<.001; attempts: 37.7% *vs*. 31.9%, respectively, p<.001), suggesting that suicidal behavior was not underrepresented in the analytic sample.

Measures

Outcomes - suicidal ideation and attempt

Data on lifetime suicidal ideation and attempt was drawn from two clinical sources: the Health of the Nation Outcome Scales (HoNOS) and the risk assessment. HoNOS is a validated instrument (Wing et al., 1998) used by professionals to assess health and functioning in individuals with mental health problems. It comprises 12 items that assess domains such as psychiatric symptoms, alcohol/drug use and social functioning. Every item is rated on a Likert-style scale, ranging from 0 (no problem) to 4 (severe problem). The HoNOS contain an item assessing non-accidental self-injury, with separate ratings for suicidal ideation and attempt.

The C&I NHS FT risk assessment is an electronic form used to gather information on the presence or absence of any historical or current risk factors that might predict adverse outcomes among patients that are in contact with secondary mental health services. It is a structured assessment that takes the form of tick-boxes recording specific risk factors such as suicidal ideation, self-neglect or thoughts of violence (Wu et al., 2012). This study made use of the items recording suicidal ideation and attempt.

Individual and area-level exposures

Individual-level demographic variables, including sex, age, ethnicity and marital status, were extracted from structured fields within CRIS. Similarly, previous psychiatric admissions were

extracted from inpatient records, to derive a binary variable. Additional clinical variables were extracted from the HoNOS, including lifetime substance misuse (problem drinking or drug-taking), physical illness or disability, and psychotic symptoms (the existence of hallucinations/delusions). All HoNOS items were dichotomized to indicate the presence or absence of the condition/symptom.

The Index of Multiple Deprivation (IMD) was used to estimate area-level social deprivation. The IMD combines information from 38 distinct indicators into seven separate domains of deprivation (income; employment; health and disability; education, skills and training; barriers to housing and services; living environment and crime) to create an individual score of deprivation for each area. The measure of deprivation derived is a relative ranking of the 32,482 Lower Super Output Areas in England (LSOAs), with higher scores indicating higher levels of deprivation. These LSOAs characteristically have an average population of 1,500 people (about 400 households) (Department of Communities and Local Government, 2011). Based on IMD scores of 326 local authorities in England, Camden is the 74th and Islington is the 14th most deprived local authority. Both boroughs have heterogeneous levels of social deprivation with scores ranging from 7.7-51.2 in Camden LSOAs and 15.2-59.1 in Islington LSOAs. Within Camden there are areas that are within the 10% most deprived areas in England and some areas that are in the 20% least deprived (London Borough of Camden, 2016). The variation in the levels of deprivation within both boroughs is large, highlighting the inequalities between different population groups and places (London Boroughs of Camden and Islington, 2015).

Area-level ethnic density scores were obtained from national Census data (Office of National Statistics, 2011). In the Census ethnic density is reported at the LSOA level as the percentage of people from 5 separate ethnic groups living in a given area: White, Black/Black British, Asian/Asian British, Mixed, and Other. Overall, in greater London, 60.7% of the population

are White and 39.3% are Black, Asian, and minority ethnic (BAME). The proportion of white people is slightly higher in the two boroughs included in this study: Camden - 66.5% white, 33.5% BAME; Islington - 68.3% white, 31.7% BAME (Office of National Statistics, 2011).

We created a variable that linked the ethnic group of each patient to the ethnic density value for that ethnic group in their local area. Thus, every patient received an ethnic density estimate that corresponded to the proportion of people from their own ethnic group who resided in their neighborhood. Area-level deprivation and ethnic density scores were obtained by linking the LSOA code of the patient's latest permanent address as recorded in routine patient registration data with national data. For the purposes of this study, IMD and ethnic density scores were categorized into quartiles.

Statistical Analyses

Our main outcomes were defined as the presence of suicidal ideation or attempts, as recorded on either the HoNOS or the risk assessment. Descriptive statistics for the entire study sample and for those with/without suicidal behavior were examined. Next, stepwise multivariable logistic regression models were fitted for each of the outcome variables (suicidal ideation and attempt). Socio-demographic characteristics (sex, age, ethnicity and marital status) were entered at the first step of the logistic regression analysis. At the second step, clinical variables (physical illness or disability, comorbid anxiety disorder, comorbid substance misuse, psychotic symptoms and previous psychiatric admission) were added to the model. Finally, in the third step, area-level measures (social deprivation and ethnic density) were added. Associations were expressed as odds ratios (OR) and their corresponding 95% confidence intervals (CI). The -2 log likelihood was used to measure how well the models fitted the data, with smaller values indicating a better fit.

Data were analyzed using SPSS version 22.0 (IBM Corp., 2013).

Results

The mean age of the sample in 2014 was 52.0 (SD=18.0, range: 19-101, 23.2% above the age of 65); 40.4% were men. The majority of the study participants were white (80.1%) and unmarried (77.7%: 54.3% single, 16.2% divorce / separated and 7.2% widowed). The average IMD score of patients included in this study was 31.2 (SD=11.2, range 7.7-59.1). A quarter of the patients had comorbid anxiety disorder, and 10% had comorbid substance misuse. Suicidal ideation was more common than suicide attempt, with 70.5% (n=1,824) of the sample reporting lifetime suicidal ideation and 37.7% (n=975) having attempted suicide at least once. The demographic and clinical characteristics of the entire sample and of those with/without suicidal behavior are described in Table 1.

The results of the stepwise multivariable logistic regression procedure predicting suicidal ideation are presented in Table 2. All the demographic variables entered in the first step were significantly associated with suicidal ideation: male sex, younger age, white ethnic origin and being unmarried all increased the odds of suicidal ideation. The clinical variables entered in the second step added significantly to the overall fit of the model (χ^2 for change in -2 log likelihood=207.54, p<.001). While marital status was no longer significantly associated with suicidal outcomes in this step, the variables physical illness or disability, comorbid anxiety disorder, comorbid substance misuse, and previous psychiatric admission all increased the odds of suicidal ideation. The presence of psychotic symptoms was not associated with suicidal ideation in this sample of severely depressed patients. The addition of area-level measures in the final step did not contribute significantly to the overall fit of the model. The significant predictors of suicidal ideation in the final step were: previous psychiatric admission (adjusted OR=2.86, 95% CI:2.26-3.62), comorbid substance misuse (adjusted OR=2.42, 95% CI: 1.62-3.63), comorbid anxiety disorder (adjusted OR=1.88, 95% CI:1.50-

2.36), physical illness or disability (adjusted OR=1.63, 95% CI:1.33-2.00), male sex (adjusted OR=1.31, 95% CI:1.09-1.58), and younger age (adjusted OR=0.98, 95% CI:0.97-0.99).

The results of the stepwise multivariable logistic regression procedure predicting suicide attempt are presented in Table 3. In the first step, younger age, white ethnic origin, and being unmarried all increased the odds of suicide attempt, with a similar trend observed for male sex. The clinical variables entered in the second step added significantly to the overall fit of the model (χ^2 for change in -2 log likelihood=303.60, p<.001). Physical illness or disability, comorbid anxiety disorder, comorbid substance misuse, and previous psychiatric admission were all associated with suicide attempt, while psychotic symptoms were not. The addition of area-level measures in the final step did not contribute significantly to the overall fit of the model. The significant predictors of suicide attempt in the final step were: previous psychiatric admission (adjusted OR=4.00, 95% CI: 3.30-4.89), comorbid substance misuse (adjusted OR=2.13, 95% CI: 1.60-2.85), being unmarried (adjusted OR=1.27, 95% CI: 1.02-1.58), comorbid anxiety disorder (adjusted OR=1.26, 95% CI: 1.04-1.54), physical illness or disability (adjusted OR=1.22, 95% CI: 1.01-1.47), and younger age (adjusted OR=0.98, 95% CI:0.97-0.99).

Discussion

This study examined the association between individual socio-demographic and clinical characteristics and area-level measures (social deprivation and ethnic density) on suicidal ideation and attempt in severely depressed psychiatric patients in inner city London. Amongst the participants included in this study, 70% had experienced lifetime suicidal ideation, and 37% had attempted suicide.

In keeping with previous research, several risk factors associated with suicidal behavior in severely depressed individuals were replicated (Bolton et al., 2010; Chan et al., 2014; Holma et al., 2010; Sokero et al., 2003). Specifically, factors related to suicidal ideation and attempt in the current study were previous psychiatric admissions, comorbid anxiety disorders, comorbid substance misuse, physical illness or disability, younger age and being unmarried. In this study male sex was associated with suicidal ideation but not suicide attempt. However, neither social deprivation nor ethnic density (both measured at the area-level) was significantly associated with suicidal ideation or attempt. While this is the first study, to the best of our knowledge, to examine the association between area-level measures and suicidality in patients with severe depression, findings from the general population are mixed. In contrast with our results, several ecological studies reported strong associations between area-level deprivation and suicide rates in the general population (Kennedy et al., 1999; Rehkopf and Buka, 2006; Whitley et al., 1999), though a study in Northern Ireland showed that variation in rates of suicide across different areas are mainly due to individual characteristics rather than area-level indicators (O'Reilly et al., 2008).

This body of evidence suggests that variation in the risk for suicidal behavior among severely depressed individuals is better explained by differences in their individual socio-demographic and clinical characteristics than by area-level measures.

Strengths & Limitations

This study has several limitations. Firstly, the data were obtained from routinely collected electronic clinical records. This means that the data was not collected for research purposes, and lacked complete information on potential confounding factors such as occupation, education, whether the patient lives alone, and history of suicidality in family. Consequently, it was not possible to control for all likely confounders. Secondly, information used for this study was restricted to those individuals who sought help and accessed secondary mental health services from C&I NHS FT. Therefore, the study doesn't take into account individuals who were not referred to or who did not access mental health services. Approximately 30% of eligible patients were removed from the analyses due to missing data. While rates of both suicidal ideation and suicide attempt were higher in those with complete data, it is difficult to know whether the exclusion of these patients affected the study findings. Moreover, since the routine recording of electronic health records commenced in 2008, important information on events before that date may have been omitted, such as any prior psychiatric admissions. Finally, as this was a cross-sectional study, it was not possible to be clear about the chronology of events. Thus, some covariates, such as psychiatric admission or incident substance misuse, may have occurred downstream of the event of interest.

These limitations notwithstanding, this study confirmed the importance of several socio-demographic and clinical risk factors for suicidal ideation and attempt in a large UK sample of severely depressed individuals. The generalizability of our findings is strengthened because diagnoses were retrieved from real-world routinely recorded clinical information, and are therefore directly relevant to patients in other secondary care settings. Moreover, as patients included in this study resided in two diverse inner-city boroughs with heterogeneous social deprivation levels, we would regard our findings as generalizable to other urban settings in the UK.

Conclusions

Our study supports previous evidence suggesting that individual socio-demographic and clinical characteristics explain variation in the risk for suicidal ideation and attempt among severely depressed individuals more than area-level measures. This would suggest that suicide prevention interventions targeted at such individual characteristics hold more promise than those influencing area-level measures. Attention to modifiable risk factors for suicidality, such as comorbid substance misuse or anxiety, and physical illness or disability, is recommended as part of the routine care of severely depressed psychiatric patients, with anticipated benefits to mental and physical health, and social functioning.

References

Agerbo, E., Sterne, J.A., Gunnell, D.J., 2007. Combining individual and ecological data to determine compositional and contextual socio-economic risk factors for suicide. Soc Sci Med 64, 451-461.

Bolton, J.M., Pagura, J., Enns, M.W., Grant, B., Sareen, J., 2010. A population-based longitudinal study of risk factors for suicide attempts in major depressive disorder. Journal of psychiatric research 44, 817-826.

Chan, L.F., Maniam, T., Shamsul, A.S., 2011. Suicide attempts among depressed inpatients with depressive disorder in a Malaysian sample. Psychosocial and clinical risk factors. Crisis 32, 283-287.

Chan, L.F., Shamsul, A.S., Maniam, T., 2014. Are predictors of future suicide attempts and the transition from suicidal ideation to suicide attempts shared or distinct: a 12-month prospective study among patients with depressive disorders. Psychiatry research 220, 867-873.

Department of Communities and Local Government., 2011. The English Indices of Deprivation 2010.

Fernandes, A.C., Cloete, D., Broadbent, M.T., Hayes, R.D., Chang, C.K., Jackson, R.G., Roberts, A., Tsang, J., Soncul, M., Liebscher, J., Stewart, R., Callard, F., 2013. Development and evaluation of a de-identification procedure for a case register sourced from mental health electronic records. BMC medical informatics and decision making 13, 71.

Hawton, K., van Heeringen, K., 2009. Suicide. Lancet 373, 1372-1381.

Holma, K.M., Melartin, T.K., Haukka, J., Holma, I.A., Sokero, T.P., Isometsa, E.T., 2010. Incidence and predictors of suicide attempts in DSM-IV major depressive disorder: a five-year prospective study. The American journal of psychiatry 167, 801-808.

IBM Corp., 2013. IBM SPSS Statistics for Windows. IBM Corp., Armonk, NY.

Johnston, A., Cooper, J., Webb, R., Kapur, N., 2006. Individual- and area-level predictors of self-harm repetition. Br J Psychiatry 189, 416-421.

Kennedy, H.G., Iveson, R.C., Hill, O., 1999. Violence, homicide and suicide: strong correlation and wide variation across districts. Br J Psychiatry 175, 462-466.

London Borough of Camden., 2016. Camden Joint Strategic Needs Assessment 2014/15 LBC, London.

London Boroughs of Camden and Islington., 2015. Widening the focus: tackling health inequalities in Camden & Islington. Camden and Islington Public Health, London.

Nock, M.K., Borges, G., Bromet, E.J., Alonso, J., Angermeyer, M., Beautrais, A., Bruffaerts, R., Chiu, W.T., de Girolamo, G., Gluzman, S., de Graaf, R., Gureje, O., Haro, J.M., Huang, Y., Karam, E., Kessler, R.C., Lepine, J.P., Levinson, D., Medina-Mora, M.E., Ono, Y., Posada-Villa, J., Williams, D., 2008. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. Br J Psychiatry 192, 98-105.

Office of National Statistics., 2011. Current LSOA boundaries post 2011.

Office of National Statistics., 2014. Suicides in the United Kingdom, 2012 Registrations.

O'Reilly, D., Rosato, M., Connolly, S., Cardwell, C., 2008. Area factors and suicide: 5-year follow-up of the Northern Ireland population. Br J Psychiatry 192, 106-111.

Oquendo, M.A., Currier, D., Mann, J.J., 2006. Prospective studies of suicidal behavior in major depressive and bipolar disorders: what is the evidence for predictive risk factors? Acta psychiatrica Scandinavica 114, 151-158.

Palmer, B.A., Pankratz, V.S., Bostwick, J.M., 2005. The lifetime risk of suicide in schizophrenia: a reexamination. Arch Gen Psychiatry 62, 247-253.

Rehkopf, D.H., Buka, S.L., 2006. The association between suicide and the socio-economic characteristics of geographical areas: a systematic review. Psychol Med 36, 145-157.

Ruengorn, C., Sanichwankul, K., Niwatananun, W., Mahatnirunkul, S., Pumpaisalchai, W., Patumanond, J., 2012. Factors related to suicide attempts among individuals with major depressive disorder. Int J Gen Med 5, 323-330.

Social Exclusion Unit, Office of the Deputy Prime Minister., 2004. Mental health and social exclusion: Social Exclusion Unit report.

Sokero, T.P., Melartin, T.K., Rytsala, H.J., Leskela, U.S., Lestela-Mielonen, P.S., Isometsa, E.T., 2003. Suicidal ideation and attempts among psychiatric patients with major depressive disorder. J Clin Psychiatry 64, 1094-1100.

Sokero, T.P., Melartin, T.K., Rytsala, H.J., Leskela, U.S., Lestela-Mielonen, P.S., Isometsa, E.T., 2005. Prospective study of risk factors for attempted suicide among patients with DSM-IV major depressive disorder. Br J Psychiatry 186, 314-318.

Whitley, E., Gunnell, D., Dorling, D., Smith, G.D., 1999. Ecological study of social fragmentation, poverty, and suicide. BMJ 319, 1034-1037.

Wing, J.K., Beevor, A.S., Curtis, R.H., Park, S.B., Hadden, S., Burns, A., 1998. Health of the Nation Outcome Scales (HoNOS). Research and development. Br J Psychiatry 172, 11-18.

World Health Organization., 2014. Preventing suicide: A global imperative.

Wu, C.Y., Chang, C.K., Hayes, R.D., Broadbent, M., Hotopf, M., Stewart, R., 2012. Clinical risk assessment rating and all-cause mortality in secondary mental healthcare: the South London and Maudsley NHS Foundation Trust Biomedical Research Centre (SLAM BRC) Case Register. Psychol Med 42, 1581-1590.

Table 1. Distribution of socio-demographic and clinical characteristics in the study sample

	Total sample	Suicidal ideation		Suicide attempt	
		No	Yes	No	Yes
		n (%)			

Sex	M	1046 (40.4%)	267 (35.0%)	779 (42.7%)	626 (38.8%)	420 (43.1%)
	F	1541 (59.6%)	496 (65.0%)	1045 (57.3%)	986 (61.2%)	555 (56.9%)
Ethnicity	White	2072 (80.1%)	599 (78.5%)	1473 (80.8%)	1279 (79.3%)	793 (81.3%)
	Non-white	515 (19.9%)	164 (21.5%)	351 (19.2%)	333 (20.7%)	182 (18.7%)
Marital status	Married	578 (22.3%)	207 (27.1%)	371 (20.3%)	406 (25.2%)	172 (17.6%)
	Unmarried	2009 (77.7%)	556 (72.9%)	1453 (79.7%)	1206 (74.8%)	803 (82.4%)
Physical illness or disability	No	1185 (45.8%)	377 (49.4%)	808 (44.3%)	750 (46.5%)	435 (44.6%)
	Yes	1402 (54.2%)	386 (50.6%)	1016 (55.7%)	862 (53.5%)	540 (55.4%)
Comorbid anxiety disorder	No	1930 (74.6%)	636 (83.4%)	1294 (70.9%)	1232 (76.4%)	698 (71.6%)
	Yes	657 (25.4%)	127 (16.6%)	530 (29.1%)	380 (23.6%)	277 (28.4%)
Comorbid substance misuse	No	2326 (89.9%)	732 (95.9%)	1594 (87.4%)	1515 (94.0%)	811 (83.2%)
	Yes	261 (10.1%)	31 (4.1%)	230 (12.6%)	97 (6.0%)	164 (16.8%)
Psychotic symptoms	No	1808 (69.9%)	583 (76.4%)	1225 (67.2%)	1183 (73.4%)	625 (64.1%)
	Yes	779 (30.1%)	180 (23.6%)	599 (32.8%)	429 (26.6%)	350 (35.9%)
Previous psychiatric admissions	No	1831 (70.8%)	648 (84.9%)	1183 (64.9%)	1321 (81.9%)	510 (52.3%)
	Yes	756 (29.2%)	115 (15.1%)	641 (35.1%)	291 (18.1%)	465 (47.7%)
Social deprivation	Q1 (least)	851 (24.8%)	283 (26.6%)	568 (24.0%)	564 (25.9%)	287 (22.9%)
	Q2	861 (25.1%)	251 (23.6%)	610 (25.8%)	537 (24.7%)	324 (25.9%)
	Q3	865 (25.2%)	257 (24.2%)	608 (25.7%)	551 (25.3%)	314 (25.1%)
	Q4 (most)	850 (24.8%)	273 (25.7%)	577 (24.4%)	523 (24.0%)	327 (26.1%)
Ethnic density	Q1 (least)	857 (25.0%)	287 (27.0%)	570 (24.1%)	561 (25.8%)	296 (23.6%)
	Q2	859 (25.1%)	268 (25.2%)	591 (25.0%)	546 (25.1%)	313 (25.0%)
	Q3	844 (24.6%)	231 (21.7%)	613 (25.9%)	512 (23.5%)	332 (26.5%)
	Q4 (most)	867 (25.3%)	278 (26.1%)	589 (24.9%)	556 (25.6%)	311 (24.8%)

Table 2. Risk factors for suicidal ideation in severely depressed patients

	Step I	Step II	Step II

	Step I	Step II	Step II
		OR (95% CI)	
Sex (M)	1.36 (1.14-1.63)	1.30 (1.08-1.57)	1.31 (1.09-1.58)
Age	0.98 (0.97-.99)	0.98 (0.97-.99)	0.98 (0.97-0.99)
Ethnicity (white)	1.33 (1.07-1.65)	1.40 (1.11-1.76)	1.57 (0.99-2.48)
Marital status (unmarried)	1.31 (1.07-1.60)	1.21 (0.98-1.49)	1.20 (0.97-1.48)
Physical illness or disability		1.63 (1.33-2.00)	1.63 (1.33-2.00)
Comorbid anxiety disorder		1.86 (1.48-2.33)	1.88 (1.50-2.36)
Comorbid substance misuse		2.42 (1.62-3.62)	2.42 (1.62-3.63)
Psychotic symptoms		1.17 (0.95-1.45)	1.18 (0.95-1.46)
Previous psychiatric admissions		2.86 (2.26-3.62)	2.86 (2.26-3.62)
Social deprivation Q1			1
Q2			1.14 (0.88-1.48)
Q3			1.06 (0.80-1.39)
Q4			0.92 (0.69-1.23)
Ethnic density Q1			1.18 (0.74-1.89)
Q2			0.96 (0.72-1.27)
Q3			1.19 (0.90-1.57)
Q4			1
-2 LL	3042.86	2835.32	2829.00
χ^2		207.54***	6.32

***P<.001

Table 3. Risk factors for suicide attempt in severely depressed patients

Sex (M)	1.17 (1.00-1.38)	1.13 (0.95-1.35)	1.14 (0.95-1.36)
Age	0.98 (0.97-.99)	0.98 (0.97-.99)	0.98 (0.97-0.99)
Ethnicity (white)	1.24 (1.01-1.53)	1.22 (0.98-1.53)	1.39 (0.90-2.13)
Marital status (unmarried)	1.45 (1.18-1.77)	1.27 (1.02-1.57)	1.27 (1.02-1.58)
Physical illness or disability		1.23 (1.02-1.49)	1.22 (1.01-1.47)
Comorbid anxiety disorder		1.26 (1.03-1.53)	1.26 (1.04-1.54)
Comorbid substance misuse		2.16 (1.62-2.88)	2.13 (1.60-2.85)
Psychotic symptoms		1.08 (0.89-1.31)	1.07 (0.89-1.31)
Previous psychiatric admissions		3.98 (3.28-4.83)	4.00 (3.30-4.89)
Social deprivation Q1			1
Q2			1.19 (0.92-1.53)
Q3			1.01 (0.77-1.32)
Q4			1.16 (0.88-1.54)
Ethnic density Q1			1.20 (0.77-1.85)
Q2			1.02 (0.77-1.34)
Q3			1.15 (0.89-1.50)
Q4			1
-2 LL	3366.40	3062.80	3057.13
χ^2		303.60***	5.67

***P<.001

Highlights
- Suicidal ideation and attempts are common among severely depressed individuals (70.5% and 37.7%, respectively, in the current study).
- Risk of suicidal ideation and attempt in patients with severe depression is associated with individual-level risk factors rather than area-level indicators.

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- Psychiatric admission and substance misuse are strongly associated with suicidal behavior.