



Depression moderates the relationships between hallucinations, delusions, and suicidal ideation: The cumulative effect of experiencing both hallucinations and delusions



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ABSTRACT

Suicide is a leading cause of preventable death in the United States and worldwide, with symptoms of depression and psychosis relating to increases in risk for ideation, attempt, and completion. This study examined moderating effects of depression in the relationships between three categories of psychotic symptoms (experiencing only hallucinations, only delusions, and both hallucinations and delusions) and suicidal ideation. Data ($n = 12,195$) were obtained from the cross-sectional Collaborative Psychiatric Epidemiology Surveys data which include large general population-based samples of households in the United States. Data were examined using Structural Equation Modeling (SEM) in Mplus 8. Approximately 19% of the sample met criteria for major depression and 13% reported having the experience of suicidal ideation. Only 16% of the sample reported having a diagnosis of schizophrenia and/or a psychotic disorder. Depression functioned as a moderator and among those who experienced depression, increases in all psychotic symptom categories significantly related to increased likelihood of experiencing suicidal ideation. Among those who were not depressed, increases in two psychotic symptom categories (only hallucinations and both hallucinations and delusions) were significantly related to greater likelihood of experiencing suicidal ideation. Findings emphasize the high-risk for ideation among individuals who experience hallucinations or delusions, with the cumulative effect of experiencing both hallucinations and delusions being most harmful in relation to the likelihood of experiencing suicidal ideation; particularly so among those who were depressed. Assessment of risk factors for suicidal ideation is imperative given its relationship to the potential of suicide attempt and/or completion.

1. Introduction

Suicide is a leading cause of preventable death in the United States and worldwide (Kelleher et al., 2013). Previous research indicates that between 70% and 95% of individuals who complete suicide had a diagnosable mental illness at the time of death (Black and Andreasen, 2014; Kaplan and Harrow, 1999; Montross et al., 2005; National Institute of Mental Health, 2010). Nearly 50% of individuals in the general population who end life by suicide see a primary care provider within a month of suicidal death (Luoma et al., 2002), yet suicide risk assessment is consistently difficult in practice (Mann and Currier, 2007; Windfuh and Kapur, 2011). Various risk factors relate to suicidal ideation, attempt, and completion among the general population,

including but not limited to age, gender, race, physical illness, psychiatric disorder, past trauma, stressful life events, family history of suicide, and previous suicide attempt (Miles, 1977; Runeson, 1989; Suominen et al., 2004; Nock et al., 2008; Rajalin et al., 2013; Franklin et al., 2017).

The relationships between suicidal outcomes (suicidal ideation, attempt, and completion) and depression are well documented (Hor and Taylor, 2010; Wasserman et al., 2009) and data show 6.7% of the adult population have experienced a major depressive episode within the past year (Substance Abuse and Mental Health Services Administration, 2017). Risk for ideation, attempt, and completion, however, extends beyond structured diagnostic criteria including depression with various psychiatric symptoms relating to suicidal outcomes, including and

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especially psychosis (Aleman and Denys, 2014; Coentre et al., 2010). Psychotic symptoms are reported by approximately 5%–8% of the adult general population and most often include the experience of hallucinations and/or delusions (Linscott and van Os, 2013; Yates et al., 2019). In contrast with psychotic symptoms within schizophrenia (i.e. positive and negative symptoms), individuals with subthreshold psychotic symptoms within the general population often have a greater capacity for reality testing (Linscott and van Os, 2013). Though symptoms may or may not relate to the development of a psychotic disorder, literature suggests that there is an increased risk for poorer psychiatric outcomes including the potential for suicidal ideation, attempt, and completion among those with subthreshold psychotic symptoms (Yates et al., 2019).

The relationship between psychosis and suicidal outcomes have received greater attention in the literature with studies indicating that hallucinations and delusions relate to increased risk for ideation, attempt, and completion (Bornheimer, 2019; Bornheimer and Jaccard, 2017; Connell et al., 2016; Fisher et al., 2013; Sharifi et al., 2015; Kelleher et al., 2014; Bromet et al., 2017; Kjelby et al., 2015; Fjalko et al., 2006; Fujita et al., 2015; Saha et al., 2011). While much of the research to date focuses on clinical samples, a recent systematic review and meta-analysis by Yates and colleagues (2018) synthesized these relationships across 10 studies that used nationally representative samples. Findings indicated that individuals who reported having psychotic symptoms (e.g. hallucinations and delusions) were at increased risk for suicidal ideation by 2-fold, attempt by 3-fold, and completion by 4-fold as compared to those who did not have psychotic symptoms. In addition, a longitudinal study following 9242 adolescents in the general population found that psychotic symptoms in adolescence (particularly hallucinations and delusions) were significantly associated with increased risk of subsequent substance use disorder and suicide attempt (Cederlof et al., 2017). Further supporting the potency of subthreshold psychotic symptoms in the general population, similar results were found by Bromet et al. (2017) who examined data from the World Mental Health Surveys across 19 countries and found psychotic symptoms to be significantly associated with elevated odds of subsequent suicidal thoughts and behaviors across the life course.

Despite prominent findings in the literature regarding the independent relationships between suicidal ideation, hallucinations, and delusions, little is currently known about the cumulative effect of experiencing both hallucinations and delusions in relation to suicidal ideation. Additionally, given the role that depression plays in suicide risk overall (Nock et al., 2008) and within psychotic disorder populations (McGinty et al., 2018; Barrett et al., 2010; Zalpuri and Rothschild, 2016), the relationships between depression, hallucinations, delusions, and suicidal ideation warrant explorations within the general population. Given the presence of multiple psychiatric disorders (mood, impulse-control, substance use, psychotic, personality disorder) further increase risk for suicide (Nock et al., 2015; Kessler et al., 1999; Mann et al., 1999), we hypothesize that the presence of multiple symptoms of psychosis will similarly increase risk for ideation. The present study aimed to examine if depression moderates the relationship between three categories of psychotic symptoms (experiencing only hallucinations, only delusions, and both hallucinations and delusions) and suicidal ideation within a general population-based sample in the United States.

2. Methods

This study used the Collaborative Psychiatric Epidemiology Surveys (CPES) data which include large general population-based samples of households in the United States between 2001 and 2003 (Alegría et al., 2001–2003). The CPES combines three national surveys, conducted by the University of Michigan's Survey Research Center of the Institute for Social Research: 1) National Comorbidity Survey Replication (NCS-R; Kessler et al., 2004), 2) National Survey of American Life (NSAL;

Jackson et al., 2004), and, 3) National Latino and Asian American Survey (NLAAS; Alegria et al., 2004). All surveys gathered epidemiological data on distributions, correlates, and risk factors for mental illness within the general population, with particular focus on under-represented racial and ethnic groups (Alegría et al., 2001–2003; Pennell et al., 2004). Participants included adults over the age of 18 in the United States residing in households, thus excluding those in institutions or military bases. The present study only included participants who received the psychosis assessment (screener randomly administered to a subsample in NCS-R, given to all other than White participants in NSAL, and given to all in NLAAS), resulting in a total sample of 12,195 with participants from the NCS-R ($n = 2355$), NSAL ($n = 5191$), and NLAAS ($n = 4649$).

2.1. Measurement

All measurement within the CPES utilized a modified version of the World Mental Health Composite Interactional Diagnostic Interview (WMH-CIDI) (Kessler and Ustun, 2004).

Psychosis was measured by the World Health Organization Composite International Diagnostic Interview (WHO-CIDI) version 3.0 psychosis screen (Kessler et al., 2005). The screener assessed for 6 specific symptoms of psychosis in a lifetime: visual hallucinations, auditory hallucinations, thought insertion, thought control, telepathy, and persecution. Participants were specifically asked about these 6 symptoms being experienced outside of falling asleep, dreaming, or substance use. Response categories either 0 didn't experience or 1 did experience. Items were categorized into 3 groups: participants who only experienced hallucinations, only delusions, and both hallucinations and delusions; all coded as 0 or 1.

Depression was measured by the DSM-IV World Mental Health Composite International Diagnostic Interview (WMH-CIDI) in a lifetime. This is a structured assessment administered by a trained interviewer to detect psychiatric disorders based upon criteria of the DSM-IV in which participants responded yes or no to the experience of 9 distinct symptoms of depression in a lifetime. Major depressive disorder and major depressive episode criteria require the presence of 5 or more of the 9 symptoms of depression (depressed mood, loss of interest or pleasure, difficulty concentrating, changes in appetite or weight, changes in sleep, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive guilt, and suicidal thoughts and behavior) including depressed mood and/or loss of interest or pleasure (American Psychiatric Association, 2000). As a result, the construct of depression was treated as a dichotomous variable in which one either 0 doesn't meet criteria (not depressed) or 1 meets criteria (depressed).

Suicidal ideation was measured by a single item assessing if one has seriously thought about suicide in a lifetime. The single item was included in a suicide screener that was administered by a trained interviewer. Response categories either 0 didn't experience or 1 did experience. Suicide plan and attempt were not examined due to low base rates in the sample.

Data were examined using Structural Equation Modeling (SEM) in Mplus 8 using a robust (Huber-White) maximum likelihood algorithm to deal with nonnormality and variance heterogeneity. Exogenous variables included the 3 psychotic symptom categories (experiencing only hallucinations, only delusions, and both hallucinations and delusions) and the endogenous variable included suicidal ideation. Depression (met diagnostic criteria or not) represented the dichotomous moderating variable in the multiple group analysis. Covariates included race/ethnicity, gender, age, and education. Race/ethnicity included the following categories: Asian, Hispanic/Latino, African-American/Black, White, and Other. Gender was either male or female. Education included: 0–11 years, 12 years, 13–15 years, or greater than or equal to 16 years. Missing data, though minimal, were treated using Full Information Maximum Likelihood (FIML) methods. The fit of the

Table 1
Characteristics of the sample.

Characteristic	n	%
Age (M ± SD)	12,195	42.23 ± 16.07
Household Income	12,162	\$48,037.13 ± \$45,709.08
Gender		
Male	5032	41.3
Female	7163	58.7
Race		
African American/Black	5320	43.6
White	1707	14.0
Asian	2129	17.5
Hispanic/Latino	2957	24.2
Other	82	0.7
Marital Status		
Married or cohabiting	6315	51.8
Divorced, separated or widowed	2761	22.6
Never married	3111	25.5
Years of Education		
0–11 years	2916	23.9
12 years	3567	29.2
13–15 years	3024	24.8
Greater than or equal to 16 years	2688	22.0
Work Status		
Employed	7968	65.3
Unemployed	995	8.2
Not in labor force	3212	26.3
U.S. Citizenship		
Were born a citizen	1583	13.0
Became a citizen through naturalization	1544	12.7
Depression		
Meets criteria for depression	2300	18.9
Does not meet criteria for depression	9895	81.1
Suicidal Ideation (lifetime)		
Experienced	1328	10.9
Not experienced	8900	73.0
Psychotic Diagnosis (lifetime) related to:		
Schizophrenia/psychosis	23	0.2
Manic-depression/mania	15	0.1
Emotions/nerves/mental health	26	0.2
Physical illness/injury	5	0.0
Medication/drugs/alcohol	4	0.0
Other	71	0.6
Depressive Disorder (lifetime)		
Given diagnosis	1933	15.9
Not given diagnosis	10,090	82.7
Anxiety Disorder (lifetime)		
Given diagnosis	3779	31.0
Not given diagnosis	8241	67.6
Alcohol-related Disorder (lifetime)		
Given diagnosis	1101	9.0
Not given diagnosis	10,910	89.5
Drug-related Disorder (lifetime)		
Given diagnosis	702	5.8
Not given diagnosis	11,308	92.7
Psychotic Symptom Categories (lifetime)		
Hallucinations only	1274	10.4
Delusions only	119	1.0
Both hallucinations and delusions	200	1.6

N = 12,195.

model was evaluated using both global and focused fit indices. Global fit evaluations included Chi-Square, Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), Root Mean Square of Approximation (RMSEA) and focused fit included standardized residuals and modification indices. All estimates were weighted using sampling weights of the CPES (Alegria et al., 2007) to account for sampling (e.g. selection and nonresponse).

3. Results

Demographic characteristics of the sample are reported in Table 1. On average, participants were 42.23 years of age (Standard Deviation (SD) = 16.07) and most often female (n = 7,163, 58.7%). The majority

identified as African-American/Black (n = 5,320, 43.6%), married (n = 6,315, 51.8%), and employed (n = 7,968, 65.4%). The average annual household income was reported as \$48,037 (SD = 45,709). Approximately 2300 participants (18.9%) were depressed based upon the criteria discussed in the measurement section above and 1328 (11%) reported having the experience of suicidal ideation. As for the psychotic symptom categories, 1274 participants (10.4%) experienced only hallucinations, 119 (1.0%) only delusions, and 200 (1.6%) both hallucinations and delusions. Of the sample, 23 (0.2%) were given a diagnosis of schizophrenia and/or psychotic disorder.

Global fit indices pointed towards good model fit ($\chi^2 = 19.09$, $df = 10$, p -value = .30; CFI = 0.975, RMSEA = 0.012, p -value for close fit = 0.992, standardized RMR = 0.010) and focused fit indices (standardized residuals and modification indices) revealed no points of stress on the model. Unstandardized parameter estimates for the structural model paths with margins of error in parentheses are presented in Fig. 1, with values of those with depression reported first. Hallucinations alone, delusions alone, and both hallucinations and delusions accounted for 7% of the variance in suicidal ideation for participants who were depressed and 2% for participants who weren't depressed.

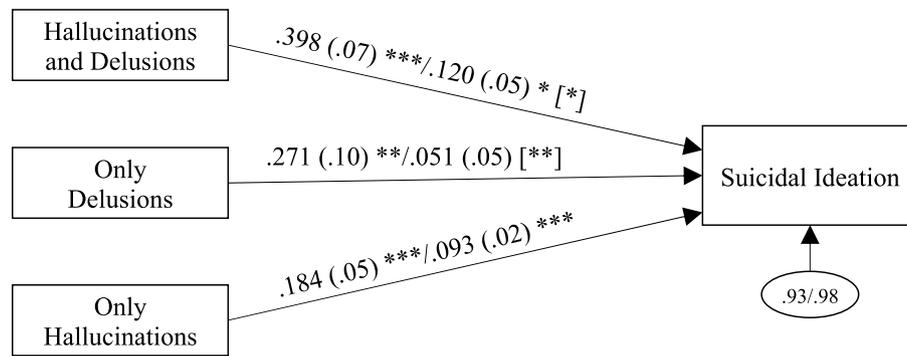
For participants who were depressed, there was a significant relationship between all psychotic symptom categories (experiencing only hallucinations, only delusions, and both hallucinations and delusions) and suicidal ideation while holding covariates (race, gender, education, and age) constant. As each of the three psychotic symptom categories increased, there were associated independent increases in the likelihood of experiencing suicidal ideation by 18%–40%, with the largest increase being the combination of experiencing both hallucinations and delusions. Specifically, participants who experienced both hallucinations and delusions on average experienced an associated 40% increase in the likelihood of experiencing suicidal ideation, holding all other variables constant ($b = 0.398$, standard error (SE) = 0.070, critical ratio (CR) = 5.68, $p < .001$).

For participants who weren't depressed, there was a significant relationship between two of the psychotic symptom categories (experiencing only hallucinations and both hallucinations and delusions) and suicidal ideation while holding covariates (race, gender, education, and age) constant. As hallucinations and delusions increased, there were associated independent increases in the likelihood of experiencing suicidal ideation by 9%–12%, with the largest increase relating to the combination of experiencing both hallucinations and delusions. Specifically, participants who experienced both hallucinations and delusions on average experienced an associated 12% increase in the likelihood of experiencing suicidal ideation, holding all other variables constant ($b = 0.120$, SE = 0.054, CR = 2.25, $p < .05$).

Differences in paths between the two groups can be seen in Table 2. Significant differences were present in the relationship between suicidal ideation, experiencing only delusions, and both hallucinations and delusions, independently, by depression (depressed versus not depressed). Specifically, and presented in Fig. 2 bar graph, those who were depressed and experienced only delusions had a greater increase in the likelihood of experiencing suicidal ideation than those who weren't depressed and experienced only delusions ($b = -0.219$, SE = 0.11, CR = -2.04, $p < .05$). Similarly, those who were depressed and experienced both hallucinations and delusions had a greater increase in the likelihood of experiencing suicidal ideation than those who weren't depressed and experienced only delusions ($b = -0.278$, SE = 0.09, CR = -3.13, $p = .01$). Lastly, those who were depressed and experienced only hallucinations experienced a greater increase in the likelihood of experiencing suicidal ideation than those who weren't depressed and experienced only delusions, yet, this was a trend towards significance at the 0.05 level ($b = -0.091$, SE = 0.05, CR = -0.091, $p = .07$).

4. Discussion

These results emphasize relationships between experiencing only



Notes: values for those with depression are reported first and separated by ‘/’ ; significant differences between paths by depression status are reported in ‘[]’
 *p<.05, **p<.01, ***p<.001

Fig. 1. Model results illustrating pathways of the relationships between psychotic symptom categories and suicidal ideation by depression status.

hallucinations, only delusions, both hallucinations and delusions, depression, and suicidal ideation in a lifetime within a general population-based national sample. Echoing with prior research that hallucinations and delusions relate to suicidal ideation (Bromet et al., 2017; Cederlof et al., 2017; Yates et al., 2019), this study further reveals that the cumulative effect of having both hallucination and delusion experiences is most harmful, and especially so among those who had experienced depression in their lifetime. While much of the literature to date focuses on hallucinations, delusions, depression, and suicidal ideation within clinical samples (often in which the majority have schizophrenia spectrum or other psychotic disorders), the current study highlights the complex nature of these symptoms in relation to suicidal ideation within a population-based sample.

Study results indicate the experience of having both hallucinations and delusions in a lifetime associated with the greatest increase in the likelihood of experiencing suicidal ideation. While the single experience of having hallucinations or delusions may increase risk for suicidal ideation, individuals who experience both hallucinations and delusions should receive enhanced attention by providers in assessing their risk of suicidality. Furthermore, study results also stress the importance to account for depressive symptoms while evaluating suicide risk among individuals who have experienced hallucinations and/or delusions. Individuals in this study who experienced depression had a significantly higher risk of also experiencing suicidal ideation regardless of their psychotic symptom presentation (only hallucinations, or only delusions, or both combined). Notably, the association between experiencing only delusions and suicidal ideation in a lifetime was present among those who were depressed but not among those who weren't depressed. This finding highlights the heterogeneous nature of individuals' psychotic symptoms in relation to their risk of suicidality.

These results have several clinical implications. First, given the prevalence of psychotic symptoms in the general population (Linscott

and van Os, 2010; Yates et al., 2019) and literature indicating that almost 50% of individuals who end life by suicide in the general population make contact with primary care within a month of death (Luoma et al., 2002), assessment of risk factors for suicide is imperative in both primary and behavioral healthcare settings. Given the complex and heterogeneous nature of the relationships between hallucinations, delusions, depression, and suicidal outcomes (including ideation and attempt), comprehensive assessment including clinical information being gathered from both primary and behavioral healthcare providers is imperative. Future longitudinal research is needed with the goal of developing meaningful clinical markers of suicide risk for individuals in the general population with psychotic symptoms and procedures for assessment that can be adopted in practice.

Second, realizing the moderating effect of depression in these data, study results also highlight the importance of assessing for and managing depression among individuals with psychosis (particularly hallucinations and/or delusions). With previous research establishing a strong comorbidity between psychosis and depression (Hor and Taylor, 2010; Wasserman et al., 2009), this study further elevates the significance of addressing depression among individuals with psychotic symptoms from a suicide prevention perspective. Results from this study suggest a significantly reduced likelihood of suicidal ideation among individuals who had experienced psychotic symptoms in a lifetime and not depression. Most interestingly, experiencing delusions alone without depression in a lifetime wasn't associated with increased chance of experiencing suicidal ideation.

The current study must be considered in light of several potential limitations. First, the CPES project was not conducted to address the aims of the current study, thus, measurement was constrained. While suicidal ideation was measured by one item, future research would include an established multi-item scale to increase variability as suicidality functions on a spectrum. The psychosis measurement tool

Table 2
 Parameter estimates of model paths by depression status.

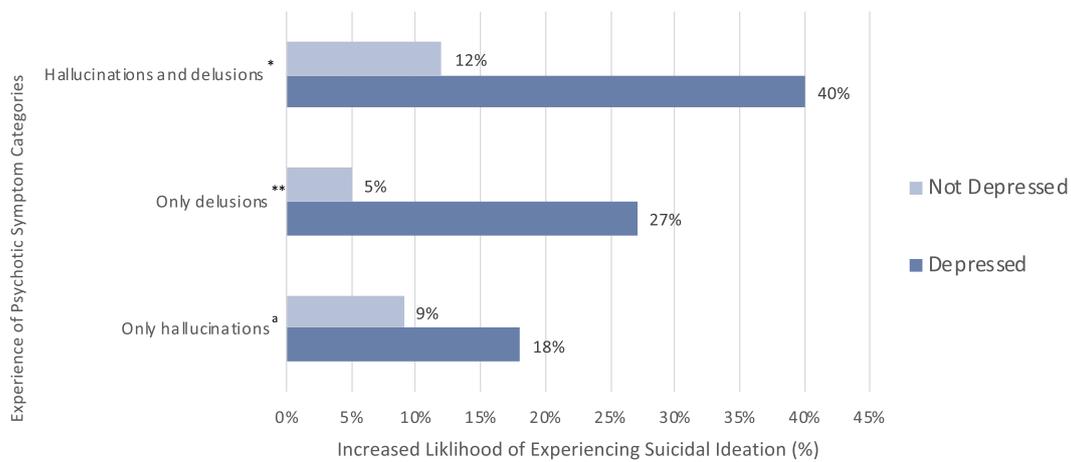
Pathway	Depressed				Not Depressed				Diff ^a
	b	SE	CR	p	b	SE	CR	p	
Hallucinations and Delusions ON Suicidal Ideation	.398	.07	5.68	***	.120	.05	2.25	*	*
Only Delusions ON Suicidal Ideation	.271	.10	2.82	**	.015	.05	1.07		**
Only Hallucinations ON Suicidal Ideation	.184	.05	3.98	***	.093	.02	4.63	***	^b

SE = standard error; CR = critical ratio.

*p < .05, **p < .01, ***p < .001.

^a Difference between paths by depression status.

^b Trend toward significance at the .05 level (p = .07).



Note: path differences are represented by asterisks

* $p < .05$, ** $p < .01$

^a non-significant trend ($p = .07$)

Fig. 2. Bar graph of moderation model results illustrating relationships between psychotic symptom categories and suicidal ideation by depression status.

included items identifying 6 specific symptoms of psychosis in a lifetime and future research would include an established multi-item scale to allow for examinations of other psychotic symptoms in addition to hallucinations and delusions (e.g. disorganization). The construct of depression was treated as a dichotomous variable in which one either met criteria or doesn't meet criteria, thus, not allowing for examinations of depression severity and its relationships to suicidal ideation. Second, and stemming from methodological constraints in the dataset, psychosis, depression, and suicidal ideation were all measured in a lifetime; thus, causality and temporality cannot be established. For example, it is possible that individuals could have experienced suicidal ideation prior to onset of psychosis. Also, in thinking about timing of symptoms, for example, it is possible that depression in an earlier phase of life functions as a distal risk factor that many years later may relate to ideation due to the development of suicide schema that is later activated. As a result, findings must be interpreted with the awareness of lifetime measurement and future research should utilize prospective longitudinal data to examine the potential of causal and temporal relationships. Third, self-report and social desirability are common concerns in mental health research and should be considered in the current study, particularly so when focusing on the topic of suicide. Fourth, the cumulative effect of having both hallucinations and delusions represent the presence of symptoms experienced in participants' lives as opposed to severity of symptoms independently and their combination. Future research should examine severity of symptoms and their combined effects. Lastly, the current study examined suicidal ideation and was not able to include attempt and/or completion due to low base rates in the data. Future research should examine these relationships with attempt and completion as outcomes.

In sum, relationships between psychotic symptoms and suicidal ideation among participants in the current study varied as a function of depression status; thus, experiencing hallucinations and/or delusions and depression are important risk factors for suicidal ideation. Future research is suggested to adopt a longitudinal design with use of more comprehensive measurement of suicidal outcomes (ideation, attempt, completion), depression, and psychosis.

Conflicts of interest

The authors have no conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2019.06.014>.

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