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Anxiety and depressive disorders are associated with delusional-like experiences: a replication study based on a national mental health survey

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Abstract

Objectives

There is growing evidence that delusional-like experiences (DLE) are associated with common mental disorders. In particular, a National Mental Health survey conducted in Australian during 2007 reported an association between DLE and both anxiety disorder and major depressive disorder (MDD). However, the previous study did not examine this association with respect to subtypes of anxiety disorder nor with severity of MDD. The aim of this study was to examine the associations between DLE, and anxiety disorder and MDD in more detail based on an independent population sample.

Design

Cross-sectional study

Setting

Subjects were drawn from the Australian Survey of Mental Health and Wellbeing 1997 using a stratified multistage area sampling of persons living in private dwellings in all States and Territories of Australia.

Participants

Approximately 13,600 private dwellings were initially selected with one person aged 18 years or over from each dwelling invited to participate. In total, 10,641 individuals participated in the survey.

Primary and secondary outcome measures

The Composite International Diagnostic Interview (CIDI) was used to identify individuals with DLE and DSM IV lifetime diagnoses of anxiety disorders and MDD. The influence of various anxiety disorders and MDD on DLE was assessed with logistic regression.

Results

Having a lifetime diagnosis of either any anxiety disorder or MDD was significantly associated with the endorsement of DLE. The association was found for each of the main anxiety disorders when examined separately. There was a dose response relationship between increasing severity of MDD and higher odds of DLE endorsement.

Conclusions

Delusional-like experiences are associated with a wide range of anxiety disorders and are more prevalent in those with MDD. Understanding the relationship between DLE, anxiety disorders and depression may provide insights into shared pathways that underpin both psychotic disorders and common mental disorders.

INTRODUCTION

There is now robust evidence indicating that hallucinations and delusional-like experiences (DLE) are common in the general population. In recent years the field has focused on the demographic and clinical correlates of hallucinations and DLE.[1-9] Of particular interest, there is a growing body of evidence reporting an association between DLE endorsement and common mental disorders such as anxiety disorders and major depressive disorder (MDD). For example, panic attacks during adolescence were significantly associated with increased levels of DLE among young adults.[10] In the NEMESIS study, subjects with obsessive compulsive symptoms were more likely to develop incident psychotic symptoms three years later.[11] Conversely, a Swiss-based cohort reported that young adults with psychotic-like experiences were significantly more likely to later develop common mental disorders such as anxiety disorders and MDD.[12] A German community-based study found an association between social phobia, social anxiety and DLE.[13] While a US primary-care based sample reported that those who reported psychotic-like experiences were more likely to have generalized anxiety disorders and panic disorders.[14]

Trauma exposure with or without post-traumatic stress disorder has been associated with DLE.[7] Two Australian studies[9,15,16] have found significant associations between DLE, and broadly-defined anxiety disorders, however to date these studies did not report on subtypes of anxiety disorders. In light of the evidence linking DLE with a wide range of different types of anxiety disorders, the evidence suggests that DLE are nonspecifically associated with anxiety disorders.

With respect to depression, several studies have found that individuals with depression are significantly more likely to endorse DLE.[9,15-17] Studies also show that DLE requiring clinical care were progressively more likely to occur with greater levels of affective dysregulation (depressive symptoms and hypo-manic symptoms).[18] Importantly, there was a significant association between severity of depressive symptoms and persistence of psychotic symptoms.

Based on an independent national survey, we had the opportunity to replicate our previous findings with respect to the association between DLE and (a) broadly defined anxiety disorders, and (b) MDD.[9] In addition, we were able to explore the association between DLE and a range of specific anxiety disorders. Furthermore, we were able to examine if severity of major depressive disorder influenced the risk of endorsement of DLE.

METHODS

Participants

The data were drawn from the 1997 National Survey of Mental Health and Wellbeing conducted in Australia by the Australian Bureau of Statistics (ABS) from a representative sample (random stratified multistage area sampling) of persons living in private dwellings in all States and Territories of Australia. Details of the survey methodology were published elsewhere.[19] In brief, approximately 13,600 private

dwellings were initially selected with one person aged 18 years or over from each dwelling invited to participate. In total, 10,641 individuals participated in the survey, representing a response rate of 78%. Interviews were carried out by trained interviewers from the ABS, a statutory body responsible for conducting such surveys using ethical protocols that include written informed consent.

Assessment of delusional-like experiences and DSM-IV diagnoses

Mental disorders were assessed by a modified version of the Composite International Diagnostic Interview (CIDI)[20] which yielded diagnoses of DSM-IV disorders. Details of the DLE are given in Appendix 1. Briefly, within the CIDI there are three items related to identifying individuals who may be psychotic (*G Items*: “screening items”) each followed by a probe item. The items covered the following features of psychotic disorders: delusions of control, thought interference and passivity (Question 1 and 1a); delusions of reference or persecution (Question2 and 2a); and grandiose delusions (Question 3 and 3a). There was no item to assess hallucinations.

Based on CIDI-derived DSM-IV criteria, we identified subjects who had lifetime diagnoses of: (a) an anxiety disorder, (b) major depressive disorder. Anxiety disorders included panic disorder with or without agoraphobia, social phobia, generalised anxiety disorder (GAD), obsessive compulsive disorder (OCD), and agoraphobia without panic disorder. MDD was classified as 'mild', 'moderate' or 'severe’ without psychotic features.

To ascertain trauma exposure, the CIDI elicits responses from 10 questions pertaining to past exposure to traumatic events. Details of the trauma variables have been published previously by our group.[7]

In keeping with our previous analyses[1-9] individuals who screened positively for schizophrenia (i.e. respondents who reported 'Yes' to the item "*Had been told at any time by a psychiatrist that they had schizophrenia*") were excluded from the analyses (n=87) leaving a total of 10,554 subjects for this study.

Statistical analysis

To examine the association between delusional-like experiences, and anxiety disorders and MDD, logistic models were fitted to the data while adjusting for various confounding factors. Because sex and age are associated with DLE,[16,21] we included these as covariates in the main analyses. In keeping with our previous studies, we included a range of CIDI-derived, potential confounding variables in Model 2. These include substance misuse,[22] marital status, and migrant status,[23] educational status, employment status and family income, and trauma exposure.[2,4,6,7,23] As co-morbidity frequently occurs between anxiety disorders and MDD, we also adjusted for the presence of the other psychiatric diagnoses under investigation (i.e. the association between MDD and DLE was adjusted for the presence of anxiety disorders, and the association between anxiety disorders and DLE was adjusted for the presence of Major Depressive Disorder).

For secondary analyses, we repeated the main analyses excluding the second screen items ("Have you ever had a feeling that people were too interested in you?") because clinical experience suggests that this is a common experience in social anxiety.

The sample was weighted to adjust for differential probabilities of selection within households, over-sampling of population subgroups and non-response to match census population distribution on a number of geographic and socio-demographic variables. The initial weights were calibrated against known population estimates. Replicate weight variables were developed using the Jack-knife procedure of replication (i.e., the analysis was repeated after one subject was dropped and then the standard error was derived from the distribution of results from all ''minus one'' resamples).[24] Analyses were performed using Proc *Surveylogistic*[25] which is designed to analyse complex survey sample using SAS (version 9.2;Cary, NC: SAS Institute). Chi-square test-for-linear trend was used to assess dose-response relationships between the exposure variables and DLE.

RESULTS

Of the 10 554 subjects surveyed, 11.6% (n=1276) positively endorsed one or more DLE items (Table 1). There was a weak effect of females being more likely to endorse DLE than males (Odd Ratio (OR) 1.05; 95% Confidence Intervals (CI) 1.04-1.05). The prevalence of lifetime diagnosis of any anxiety disorder was 4.9% (n=580), and the prevalence of lifetime depressive disorders was 5.3% (n=651).

Insert Table 1 about here

As predicted, the main analyses showed that those with any anxiety disorder and participants who had lifetime diagnosis of MDD were significantly more likely to endorse delusional-like experiences. Those with anxiety disorders were two to three times more likely to endorse both DLE screen and probe items (Table 2), and those with a diagnosis of major depressive disorder were also two to three times more likely to endorse DLE screen and probe items.

Insert Table 2 about here

Concerning the subtypes of anxiety disorders, each disorder was significantly associated with DLE screen items, and there were no marked differences in the effect sizes between the different disorders (Table 3). There was a dose response relationship between the severity of the MDD and DLE in which severe depression showed twice the odds of endorsement of DLE screen items compared with a diagnosis of mild major depressive disorder with a significant linear trend (X^2=44.19, p<.0001). Broadly similar (but less precise) associations were also found for probe items.

Insert Table 3 about here

In the secondary analysis, when we conducted the models using two DLE items (G1 & G3), the pattern of significant association for major anxiety and depressive disorders remained unchanged (data not shown).

DISCUSSION

Individuals with a life time diagnosis of major depressive disorder or an anxiety disorder were significantly more likely to report DLE compared to those without these disorders. We found that each subtype of anxiety disorder was associated with DLE, and there were no marked differences in the effect sizes for these associations (the confidence intervals around these associations overlapped). Based on this same sample, we have previously demonstrated with trauma exposure with Post-traumatic Stress Disorder is associated with DLE.[7] Our new findings add additional weight to the conclusion that a range of disorders with prominent anxiety symptoms are associated with DLE.

As predicted, there was also a dose response relationship between severity of MDD and DLE. All associations remained significant when adjusted for associated co-morbidity with anxiety, alcohol and illicit substance misuse and any traumatic life events indicating that the associations are independent of co-morbid psychiatric illnesses, and selected environmental and demographic risk factors. Similar associations were previously reported from another (independent) Australian population survey,[9] and more broadly with other population samples.[15-17]

The mechanisms linking DLE with anxiety disorder and MDD remain unclear. However, there is evidence to suggest that shared familial factors may contribute to these findings. Based on a large, population-based sample (n = 8841), we found that regardless of the presence of a mental illness experienced by the respondents, those who reported a family history of depressive disorder in a first-degree relative had an increased odds of endorsing DLE (Adjusted odds ratio 1.53; 95% CI 1.19-1.96). With respect to the presence of a first degree relative with an anxiety disorder and DLE, similar odds were identified (Adjusted OR 1.59; 95%CI 1.23-2.05). Thus, the presence of an anxiety disorder of MDD in respondents, or the presence of a family history of either disorder in otherwise well individuals, are both associated with DLE. As the genetic architecture of anxiety and mood disorders is unravelled, it will be of interest to explore if common polymorphisms linked to these disorders are also associated with DLE.

With respect to more proximal mechanisms, it is reasonable to presume that anxiety disorders or major depressive disorder lead to heightened vulnerability for the onset of delusional-like experiences. While the causal pathway is unknown, it may stem through destabilizing effects of severe anxiety or depression on emotional and cognitive functioning[26,27] which may lead to aberrant assignment of salience and delusional experiences.[28] However, it is also possible that acute psychotic episodes can precede and predict anxiety or depressive disorders.[11]

The study has several limitations. Importantly, this study was cross-sectional and therefore, it was not possible to establish the direction of causality between anxiety and

depressive disorder, and DLE. While the CIDI has some information about the age of onset for some diagnoses, we do not have information on the age of onset of the DLE. While the interviewers were trained, the diagnoses of MDD and anxiety disorders were not validated by clinical assessment. However, the CIDI is generally regarded as having good psychometric properties for common mental disorders.[29] Comorbidity between anxiety disorders and MDD is common, and while we included adjustments in the our models to attempt to account for this feature, the complex nature of the relationships between DLE, MDD and anxiety disorders could reduce the accuracy of the odds ratios.[30] We had a small number of screen and probe items to measure delusional-like experiences and there were no items for hallucinations. However, previous general population studies have found a strong association between the presence of DLE and hallucination.[23,31-33]

Clinicians treating mild anxiety and mood disorders may not routinely screen for psychotic-like experiences. However, there is now robust and consistent evidence indicating that those with anxiety disorders and MDD have an increased risk of DLE. In light of the association between DLE and suicidal ideation/behaviour,[3] the presence of DLE has important clinical implications. Understanding the relationship and time course between DLE, anxiety and depression may provide insights into shared pathways that underpin both psychotic disorders and common mental disorders.

Competing interest None

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Contributors JM, SS and JS have directly participated in the planning and execution of the study. SS analysed the data. All authors have critically read, and approved the final version submitted.

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Data sharing statement The data is available from the Australian Bureau of Statistics

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Table 1. Descriptive statistics of delusional-like experiences (Screen items), anxiety disorder and major depressive disorder (n=10,554)

Exposure	Sample	Delusional-like experiences endorsement	
	n (%)	No (%)	Yes (%)
Total sample	10,554 (100.00)	9278 (88.44)	1276 (11.56)
Anxiety and depressive disorders			
No Anxiety disorders	9974 (95.13)	8900 (85.16)	1074 (9.97)
[1]Any Anxiety disorders: lifetime	580 (4.87)	378 (4.29)	202 (16.88)
No Major depressive disorder	9903 (94.66)	8834 (84.76)	1069 (9.89)
[2]Any Major depressive disorder: lifetime	651 (5.34)	444 (4.77)	207 (16.78)

Major depressive disorder based on CIDI DSM diagnosis
[2]Anxiety disorders based on CIDI DSM diagnosis

Table 2. Association between delusional-like experiences, and anxiety disorders and major depressive disorder (n=10,554)

Disorders	Delusional-like experiences			
	Screen items		Probe items	
	Model 1[1] OR[3] (95% CI[4])	Model 2[2] OR[3] (95% CI[4])	Model 1[1] OR[3] (95% CI[4])	Model 2[2] OR[3] (95% CI[4])
Anxiety disorders: lifetime[@]	**3.88 (2.92, 5.16)***	**2.43 (1.91, 3.09)***	**3.36 (1.86, 6.05)***	**2.12 (1.27, 3.54)***
Major depressive disorder: **Lifetime[#]**	**3.63 (2.75, 4.79)***	**2.17 (1.65, 2.86)***	**2.91 (1.84, 4.59)***	**1.63 (1.10, 2.42)***

[1]Model 1= Adjusted for age and sex
[2]Model 2= Adjusted for age, sex, marital status, migrant status, income, employment status, educational status, any alcohol use/dependence disorders, any drug use/dependence disorders, and any traumatic life events
(in Model 2 anxiety disorders were adjusted for major depressive disorder and vice versa)
[@#]Anxiety and depressive disorders were based on CIDI DSM diagnosis

[3]OR=Odds ratio; [4]CI= Confidence Interval
*significance: $p<0.001$

Table 3. Association between delusional-like experiences, and different individual exposure to lifetime anxiety disorders, and major depressive disorder (n=10,554)

		Delusional-like experiences			
		Screen items		Probe items	
	Number	Model 1[2]	Model 2[3]	Model 1[2]	Model 2[3]
Anxiety disorders	(%, SE[1])	OR[4] (95% CI[5])	OR[4] (95% CI[5])	OR[4] (95% CI[5])	OR[4] (95% CI[5])
Panic disorder with/without agoraphobia	124 (1.02, 0.12)	**4.56 (2.51, 8.33)***	**2.40 (1.03, 5.63)***	**2.55 (1.13, 5.78)***	1.54 (0.77, 3.08)
General anxiety	311 (2.57, 0.23)	**3.69 (2.57, 5.29)***	**2.09 (1.50, 2.93)***	**3.05 (1.41, 6.58)***	1.77 (0.89, 3.51)
Obsessive compulsive disorder	77 (0.69, 0.12)	**5.19 (2.69, 10.03)***	**2.97 (1.50, 5.88)***	**4.60 (1.81, 11.74)***	**2.68 (1.05, 6.84)***
Agoraphobia without panic disorder	60 (0.49, 0.06)	**5.18 (2.72, 9.85)***	**3.49 (1.95, 6.28)***	**7.02 (3.73, 13.19)***	**4.65 (1.98, 10.89)***
Social phobia	160 (1.35, 0.14)	**4.14 (2.81, 6.11)***	**2.29 (1.63, 3.24)***	**4.15 (1.93, 8.91)***	**2.39 (1.06, 5.43)***
Major Depressive disorder					
Mild	297 (2.52, 0.20)	**2.96 (1.82, 4.82)***	**1.97 (1.15, 3.37)***	**2.37 (1.39, 4.04)***	1.49 (0.88, 2.53)
Moderate	190 (1.52, 0.14)	**3.29 (1.81, 6.01)***	1.89 (0.98, 3.70)	**2.73 (1.27, 5.84)***	1.53 (0.79, 2.96)
Severe	164 (1.29, 0.12)	**5.73 (3.96, 8.30)***	**3.03 (2.11, 4.35)***	**4.25 (2.01, 8.99)***	**1.99 (1.02, 3.91)***
Trend		X^2=111.83, p<.0001	X^2=44.19, p<.0001	X^2=21.19, p<.0001	X^2=6.04, p<.001

[1]SE= Standard error of estimates; [2]Model 1= Adjusted for age and sex; [3]Model 2= Adjusted for age, sex, marital status, migrant status, income, employment status, educational status, any alcohol use/dependence disorders, any drug use/dependence disorders, and any traumatic life events (in Model 2 anxiety disorders were adjusted for major depressive disorder and vice versa)
[4]OR=Odds Ratio; [5]CI= Confidence Interval; *significance: p<0.001

Appendix 1 CIDI Screen items and Probes for delusional-like experiences[1] (n=10,554[2])

Item G1:
In the past 12 months, have you felt that your thoughts were being directly interfered with or controlled by another person?
If yes, G1A:
Did it come about in a way that many people would find hard to believe, for instance, through telepathy?

Item G2:
In the past 12 months, have you had a feeling that people were too interested in you?
If yes, G2A:
In the past 12 months, have you had a feeling that things were arranged so as to have a special meaning for you, or even that harm might come to you?

Item G3:
Do you have any special powers that most people lack?
If yes, G3A:
Do you belong to a group of people who also have these powers?

Item G4:
Has a doctor ever told you that you may have schizophrenia?

[1]Screen items (lifetime) with answer (Yes/No): 'Any screen' items required 'Yes' answers to all three questions G1, G2 & G3.
#Probe items (lifetime) with answer (Yes/No): 'Any probe' items required 'Yes' answers to G1A and G2A, and 'No' answer to G3A.
[2]sample excludes item G4 (*Has a doctor ever told you that you may have schizophrenia*?) (n=87)

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Article summary

Article focus

The study was undertaken in order

1. to examine the association between delusional-like experiences (DLE), and (a) broadly defined anxiety disorders, and (b) major depressive disorders (MDD),
2. to explore the association between DLE and a range of specific anxiety disorders, and
3. to examine if severity of major depressive disorder influenced the risk of endorsement of DLE

Key message

1. Having a lifetime diagnosis of either any anxiety disorder or major depressive disorders (MDD) was significantly associated with the endorsement of delusional-like experiences (DLE).
2. The association was found for each of the main anxiety disorders when examined separately.
3. There was a dose response relationship between increasing severity of MDD and higher odds of DLE endorsement

Strengths and limitations

Strength:

1. The data were drawn from the nationally representative sample from the Australia general population

Limitation:

1. Cross-sectional study

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Abstract

Objectives

There is growing evidence that delusional-like experiences (DLE) are associated with common mental disorders. In particular, a National Mental Health survey conducted in Australian during 2007 reported an association between DLE and both anxiety disorder and major depressive disorder (MDD). However, the previous study did not examine this association with respect to subtypes of anxiety disorder nor with severity of MDD. The aim of this study was to examine the associations between DLE and both anxiety disorder and MDD in more detail based on an independent population sample.

Design

Cross-sectional study

Setting

Subjects were drawn from the Australian Survey of Mental Health and Wellbeing 1997 using a stratified multistage area sampling of persons living in private dwellings in all States and Territories of Australia.

Participants

Approximately 13,600 private dwellings were initially selected with one person aged 18 years or over from each dwelling invited to participate. In total, 10,641 individuals participated in the survey.

Primary and secondary outcome measures

The Composite International Diagnostic Interview (CIDI) was used to identify individuals with DLE and DSM IV lifetime diagnoses of anxiety disorders and MDD. The influence of various anxiety disorders and MDD on DLE was assessed with logistic regression.

Results

Having a lifetime diagnosis of either any anxiety disorder or MDD was significantly associated with the endorsement of DLE. The association was found for each of the main anxiety disorders when examined separately. There was a dose response relationship between increasing severity of MDD and higher odds of DLE endorsement.

Conclusions

Delusional-like experiences are associated with a wide range of anxiety disorders and are more prevalent in those with MDD. Understanding the relationship between DLE, anxiety disorders and depression may provide insights into shared pathways that underpin both psychotic disorders and common mental disorders.

INTRODUCTION

There is now robust evidence indicating that hallucinations and delusional-like experiences (DLE) are common in the general population. In recent years the field has focused on the demographic and clinical correlates of hallucinations and DLE.[1-9] Of particular interest, there is a growing body of evidence reporting an association between DLE endorsement and common mental disorders such as anxiety disorders and major depressive disorder (MDD). For example, panic attacks during adolescence were significantly associated with increased levels of DLE among young adults.[10] In the NEMESIS study, subjects with obsessive compulsive symptoms were more likely to develop incident psychotic symptoms three years later.[11] Conversely, a Swiss-based cohort reported that young adults with psychotic-like experiences were significantly more likely to later develop common mental disorders such as anxiety disorders and MDD.[12] A German community-based study found an association between social phobia, social anxiety and DLE,[13] while a US primary-care based sample reported that those who reported psychotic-like experiences were more likely to have generalized anxiety disorders and panic disorders.[14]

Trauma exposure with or without post-traumatic stress disorder has been associated with DLE.[7] Several Australian studies[9,15,16] have found significant associations between DLE, and broadly-defined anxiety disorders, however to date these studies did not report on subtypes of anxiety disorders. In light of the evidence linking DLE with a wide range of different types of anxiety disorders, the evidence suggests that DLE are nonspecifically associated with anxiety disorders.

With respect to depression, several studies have found that individuals with depression are significantly more likely to endorse DLE.[9,15-17] Studies also show that DLE requiring clinical care were progressively more likely to occur with greater levels of affective dysregulation (depressive symptoms and hypo-manic symptoms).[18] Importantly, there was a significant association between severity of depressive symptoms and persistence of psychotic symptoms.

While longitudinal studies are required to explore the temporal sequence between depression, anxiety and DLE, we had the opportunity to replicate our previous findings with respect to the cross-sectional association between DLE and (a) broadly defined anxiety disorders, and (b) MDD.[9] Based on our previous studies, we predicted that those with anxiety disorder or major depression disorder would be more likely to endorse DLE. In addition, we were able to explore the association between DLE and a range of specific anxiety disorders. Furthermore, we were able to examine if severity of major depressive disorder influenced the risk of endorsement of DLE – we predicted that those with more severe MDD would be more likely to endorse DLE compared to those with milder forms of MDD.

METHODS

Participants

The data were drawn from the 1997 National Survey of Mental Health and Wellbeing conducted in Australia by the Australian Bureau of Statistics (ABS) from a representative sample (random stratified multistage area sampling) of persons living in private dwellings in all States and Territories of Australia. Details of the survey methodology were published elsewhere.[19] In brief, approximately 13,600 private dwellings were initially selected with one person aged 18 years or over from each dwelling invited to participate. In total, 10,641 individuals participated in the survey, representing a response rate of 78%. Interviews were carried out by trained interviewers from the ABS, a statutory body responsible for conducting such surveys using ethical protocols that include written informed consent.

Assessment of delusional-like experiences and DSM-IV diagnoses

Mental disorders were assessed by a modified version of the Composite International Diagnostic Interview (CIDI)[20] which yielded diagnoses of DSM-IV disorders. Briefly, within the CIDI there are three items related to identifying individuals who may be psychotic (*G Items*: "screening items"). For those who endorsed the screen item, a follow-up item was used to further explore the delusional-like nature of the experiences ("probe items"). Full details of the screen and probe items are provided in Appendix 1. The items covered the following features of psychotic disorders: delusions of control, thought interference and passivity (Question 1 and 1a); delusions of reference or persecution (Question 2 and 2a); and grandiose delusions (Question 3 and 3a). There was no item to assess hallucinations.

Based on CIDI-derived DSM-IV criteria, we identified subjects who had lifetime diagnoses of: (a) an anxiety disorder, (b) major depressive disorder. Anxiety disorders included panic disorder with or without agoraphobia, social phobia, generalised anxiety disorder (GAD), obsessive compulsive disorder (OCD), and agoraphobia without panic disorder. For those with MDD, allocation to subtypes was based on the total number of particular 'depressive' symptoms with the duration of at least two weeks. Full details of the symptom list and related rules to deal with multiple episodes can be found in the full report. [21] In brief, mild MDD was characterised by the presence of at least four symptoms, moderate MDD with at least six symptoms, and severe MDD with at least eight symptoms. These subtypes of MDD were mutually exclusive.

To ascertain trauma exposure, the CIDI elicits responses from 10 questions pertaining to past exposure to traumatic events. Details of the trauma variables have been published previously by our group.[7]

In keeping with our previous analyses[1-9] individuals who screened positively for schizophrenia (i.e. respondents who reported 'Yes' to the item "*Had been told at any time by a psychiatrist that they had schizophrenia*") were excluded from the analyses (n=87) leaving a total of 10,554 subjects for this study.

Statistical analysis

To examine the association between DLE and both anxiety disorders and MDD, logistic models were fitted to the data while adjusting for various confounding factors. Because

sex and age are associated with DLE,[16,22] we included these as covariates in the main analyses. In keeping with our previous studies, we included a range of CIDI-derived, potential confounding variables in Model 2. These include substance misuse,[23] marital status, and migrant status,[24] educational status, employment status and family income, and trauma exposure.[2,4,6,7,24] As co-morbidity frequently occurs between anxiety disorders and MDD, we also adjusted for the presence of the other psychiatric diagnoses under investigation (i.e. the association between MDD and DLE was adjusted for the presence of anxiety disorders, and the association between anxiety disorders and DLE was adjusted for the presence of Major Depressive Disorder).

For secondary analyses (a sensitivity analysis), we repeated the main analyses excluding the second screen items ("Have you ever had a feeling that people were too interested in you?") because clinical experience suggests that this is a common experience in social anxiety.

The sample was weighted to adjust for differential probabilities of selection within households, over-sampling of population subgroups and non-response to match census population distribution on a number of geographic and socio-demographic variables. The initial weights were calibrated against known population estimates. Replicate weight variables were developed using the Jack-knife procedure of replication (i.e., the analysis was repeated after one subject was dropped and then the standard error was derived from the distribution of results from all ''minus one'' resamples).[25] Analyses were performed using Proc *Surveylogistic*[26] which is designed to analyse complex survey sample using SAS (version 9.3; Cary, NC: SAS Institute). Chi-square test-for-

linear trend was used to assess dose-response relationships between the exposure variables and DLE.

RESULTS

Of the 10 554 subjects surveyed, 11.6% (n=1276) positively endorsed one or more DLE items (Table 1). There was a weak effect of females being more likely to endorse DLE than males (Odd Ratio (OR) 1.05; 95% Confidence Intervals (CI) 1.04-1.05). The prevalence of lifetime diagnosis of any anxiety disorder was 4.9% (n=580), and the prevalence of lifetime depressive disorders was 5.3% (n=651).

Insert Table 1 about here

As predicted, the main analyses showed that those with any anxiety disorder and participants who had lifetime diagnosis of MDD were significantly more likely to endorse delusional-like experiences. Those with anxiety disorders were two to three times more likely to endorse both DLE screen and probe items (Table 2), and those with a diagnosis of major depressive disorder were also two to three times more likely to endorse DLE screen and probe items.

Insert Table 2 about here

Concerning the subtypes of anxiety disorders, each disorder was significantly associated with DLE screen items, and there were no marked differences in the effect sizes between the different disorders (Table 3). There was a dose response relationship between the severity of the MDD and DLE in which severe depression showed twice the odds of endorsement of DLE screen items compared with a diagnosis of mild major depressive disorder with a significant linear trend (X^2=44.19, p<.0001). Broadly similar (but less precise) associations were also found for probe items.

Insert Table 3 about here

In the secondary analysis, when we conducted the models using two DLE items (G1 & G3), the pattern of significant association for major anxiety and depressive disorders remained unchanged (data not shown).

DISCUSSION

Individuals with a lifetime diagnosis of major depressive disorder or an anxiety disorder were significantly more likely to report DLE compared to those without these disorders. We found that each subtype of anxiety disorder was associated with DLE, and there were no marked differences in the effect sizes for these associations (the confidence intervals around these associations overlapped). Based on this same sample, we have previously demonstrated that trauma exposure without Post-traumatic Stress Disorder

was associated with DLE.[7] Our new findings add additional weight to the conclusion that a range of disorders with prominent anxiety symptoms are associated with DLE.

As predicted, there was also a dose response relationship between severity of MDD and DLE. All associations remained significant when adjusted for associated co-morbidity with anxiety, alcohol and illicit substance misuse and any traumatic life events indicating that the associations are independent of co-morbid psychiatric illnesses, and selected environmental and demographic risk factors.

The mechanisms linking DLE with anxiety disorder and MDD remain unclear. However, there is evidence to suggest that shared familial factors may contribute to these findings. Based on a large, population-based sample (n = 8841), we found that regardless of the presence of a mental illness experienced by the respondents, those who reported a family history of depressive disorder in a first-degree relative had an increased odds of endorsing DLE (Adjusted odds ratio 1.53; 95% CI 1.19-1.96). With respect to the presence of a first degree relative with an anxiety disorder and DLE, similar odds were identified (Adjusted OR 1.59; 95%CI 1.23-2.05). Thus, the presence of an anxiety disorder of MDD in respondents, or the presence of a family history of either disorder in otherwise well individuals, are both associated with DLE. As the genetic architecture of anxiety and mood disorders is unravelled, it will be of interest to explore if common polymorphisms linked to these disorders are also associated with DLE.

With respect to more proximal mechanisms, it is reasonable to presume that anxiety disorders or major depressive disorder lead to heightened vulnerability for the onset of delusional-like experiences. While the causal pathway is unknown, it may stem from destabilizing effects of severe anxiety or depression on emotional and cognitive functioning[27,28] which may lead to aberrant assignment of salience and delusional experiences.[29] However, it is also possible that acute psychotic episodes can precede and predict anxiety or depressive disorders.[11]

The study has several limitations. Importantly, this study was cross-sectional and therefore, it was not possible to establish the direction of causality between anxiety and depressive disorder, and DLE. While the CIDI has some information about the age of onset and the presence of the disorder in the past year, we do not have this information for the DLE. Prospective studies would be best suited to explore the temporal sequence of the variables of interest. While the interviewers were trained, the diagnoses of MDD and anxiety disorders were not validated by clinical assessment. However, the CIDI is generally regarded as having good psychometric properties for common mental disorders.[30] Comorbidity between anxiety disorders and MDD is common, and while we included adjustments in the our models to attempt to account for this feature, the complex nature of the relationships between DLE, MDD and anxiety disorders could reduce the accuracy of the odds ratios.[31] We had a small number of screen and probe items to measure delusional-like experiences and there were no items for hallucinations. However, previous general population studies have found a strong association between the presence of DLE and hallucinations.[24,32-34]

There is now robust and consistent evidence indicating that those with anxiety disorders and MDD have an increased risk of DLE. For example, clinicians involved in the care of those with primary diagnoses of anxiety disorder or depression may not routinely enquire about DLE. In light of the association between DLE and suicidal ideation/behaviour,[3] the presence of these experiences may suggest that clinical care plans place greater emphasis on the detection and management of suicidal ideation. It is too early to be making such recommendations with confidence. However, understanding the relationship and time course between DLE, and anxiety and depression may provide insights into shared pathways that underpin both psychotic disorders and common mental disorders. Once we understand these causal pathways, potential clinical implications warrant closer scrutiny.

Competing interest None

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Contributors JM, SS and JS have directly participated in the planning and execution of the study. SS analysed the data. All authors have critically read, and approved the final version submitted.

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Table 1. Descriptive statistics of delusional-like experiences (Screen items), anxiety disorder and major depressive disorder (n=10,554)

Exposure	Sample	Delusional-like experiences endorsement	
	n (%)	No (%)	Yes (%)
Total sample	10,554 (100.00)	9278 (88.44)	1276 (11.56)
Anxiety and depressive disorders			
No Anxiety disorders	9974 (95.13)	8900 (85.16)	1074 (9.97)
[1]Any Anxiety disorders: lifetime	580 (4.87)	378 (4.29)	202 (16.88)
No Major depressive disorder	9903 (94.66)	8834 (84.76)	1069 (9.89)
[2]Any Major depressive disorder: lifetime	651 (5.34)	444 (4.77)	207 (16.78)

[1]Anxiety disorders based on CIDI DSM diagnosis
[2]Major depressive disorder based on CIDI DSM diagnosis

Table 2. Association between delusional-like experiences, and anxiety disorders and major depressive disorder (n=10,554)

Disorders	Delusional-like experiences			
	Screen items		Probe items	
	Model 1[1] OR[3] (95% CI[4])	Model 2[2] OR[3] (95% CI[4])	Model 1[1] OR[3] (95% CI[4])	Model 2[2] OR[3] (95% CI[4])
Anxiety disorders: lifetime[@]	3.88 (2.92, 5.16)*	2.43 (1.91, 3.09)*	3.36 (1.86, 6.05)*	2.12 (1.27, 3.54)*
Major depressive disorder: Lifetime[#]	3.63 (2.75, 4.79)*	2.17 (1.65, 2.86)*	2.91 (1.84, 4.59)*	1.63 (1.10, 2.42)*

[1]Model 1= Adjusted for age and sex
[2]Model 2= Adjusted for age, sex, marital status, migrant status, income, employment status, educational status, any alcohol use/dependence disorders, any drug use/dependence disorders, and any traumatic life events
(in Model 2 anxiety disorders were adjusted for major depressive disorder and vice versa)
[@#]Anxiety and depressive disorders were based on CIDI DSM diagnosis

[3]OR=Odds ratio; [4]CI= Confidence Interval
*significance: $p<0.001$

Table 3. Association between delusional-like experiences, and different individual exposure to lifetime anxiety disorders, and major depressive disorder (n=10,554)

		Delusional-like experiences			
		Screen items		Probe items	
	Number	Model 1[2]	Model 2[3]	Model 1[2]	Model 2[3]
Anxiety disorders	(%, SE[1])	OR[4] (95% CI[5])	OR[4] (95% CI[5])	OR[4] (95% CI[5])	OR[4] (95% CI[5])
Panic disorder with/without agoraphobia	124 (1.02, 0.12)	**4.56 (2.51, 8.33)***	**2.40 (1.03, 5.63)***	**2.55 (1.13, 5.78)***	1.54 (0.77, 3.08)
General anxiety	311 (2.57, 0.23)	**3.69 (2.57, 5.29)***	**2.09 (1.50, 2.93)***	**3.05 (1.41, 6.58)***	1.77 (0.89, 3.51)
Obsessive compulsive disorder	77 (0.69, 0.12)	**5.19 (2.69, 10.03)***	**2.97 (1.50, 5.88)***	**4.60 (1.81, 11.74)***	**2.68 (1.05, 6.84)***
Agoraphobia without panic disorder	60 (0.49, 0.06)	**5.18 (2.72, 9.85)***	**3.49 (1.95, 6.28)***	**7.02 (3.73, 13.19)***	**4.65 (1.98, 10.89)***
Social phobia	160 (1.35, 0.14)	**4.14 (2.81, 6.11)***	**2.29 (1.63, 3.24)***	**4.15 (1.93, 8.91)***	**2.39 (1.06, 5.43)***
Major Depressive disorder					
Mild	297 (2.52, 0.20)	**2.96 (1.82, 4.82)***	**1.97 (1.15, 3.37)***	**2.37 (1.39, 4.04)***	1.49 (0.88, 2.53)
Moderate	190 (1.52, 0.14)	**3.29 (1.81, 6.01)***	1.89 (0.98, 3.70)	**2.73 (1.27, 5.84)***	1.53 (0.79, 2.96)
Severe	164 (1.29, 0.12)	**5.73 (3.96, 8.30)***	**3.03 (2.11, 4.35)***	**4.25 (2.01, 8.99)***	**1.99 (1.02, 3.91)***
Trend		X^2=111.83, p<.0001	X^2=44.19, p<.0001	X^2=21.19, p<.0001	X^2=6.04, p<.001

[1]SE= Standard error of estimates; [2]Model 1= Adjusted for age and sex; [3]Model 2= Adjusted for age, sex, marital status, migrant status, income, employment status, educational status, any alcohol use/dependence disorders, any drug use/dependence disorders, and any traumatic life events (in Model 2 anxiety disorders were adjusted for major depressive disorder and vice versa)
[4]OR=Odds Ratio; [5]CI= Confidence Interval; *significance: p<0.001

Appendix 1 CIDI Screen items and Probes for delusional-like experiences[1] (n=10,554[2])

Item G1:
In the past 12 months, have you felt that your thoughts were being directly interfered with or controlled by another person?
If yes, G1A:
Did it come about in a way that many people would find hard to believe, for instance, through telepathy?

Item G2:
In the past 12 months, have you had a feeling that people were too interested in you?
If yes, G2A:
In the past 12 months, have you had a feeling that things were arranged so as to have a special meaning for you, or even that harm might come to you?

Item G3:
Do you have any special powers that most people lack?
If yes, G3A:
Do you belong to a group of people who also have these powers?

Item G4:
Has a doctor ever told you that you may have schizophrenia?

[1]Screen items (lifetime) with answer (Yes/No): 'Any screen' items required 'Yes' answers to all three questions G1, G2 & G3.
#Probe items (lifetime) with answer (Yes/No): 'Any probe' items required 'Yes' answers to G1A and G2A, and 'No' answer to G3A.
[2]sample excludes item G4 (*Has a doctor ever told you that you may have schizophrenia*?) (n=87)

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Anxiety and depressive disorders are associated with delusional-like experiences: a replication study based on a national mental health survey

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Article summary

Article focus

The study was undertaken in order

1. to examine the association between delusional-like experiences (DLE), and (a) broadly defined anxiety disorders, and (b) major depressive disorders (MDD),
2. to explore the association between DLE and a range of specific anxiety disorders, and
3. to examine if severity of major depressive disorder influenced the risk of endorsement of DLE

Key message

1. Having a lifetime diagnosis of either any anxiety disorder or major depressive disorders (MDD) was significantly associated with the endorsement of delusional-like experiences (DLE).
2. The association was found for each of the main anxiety disorders when examined separately.
3. There was a dose response relationship between increasing severity of MDD and higher odds of DLE endorsement

Strengths and limitations

Strength:

1. The data were drawn from the nationally representative sample from the Australia general population

Limitation:

1. Cross-sectional study

Abstract: 293 words
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Anxiety and depressive disorders are associated with delusional-like experiences: a replication study based on a national mental health survey

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Subjects were drawn from the Australian Survey of Mental Health and Wellbeing 1997 using a stratified multistage area sampling of persons living in private dwellings in all States and Territories of Australia.

Participants

Approximately 13,600 private dwellings were initially selected with one person aged 18 years or over from each dwelling invited to participate. In total, 10,641 individuals participated in the survey.

Primary and secondary outcome measures

The Composite International Diagnostic Interview (CIDI) was used to identify individuals with DLE and DSM IV lifetime diagnoses of anxiety disorders and MDD. The influence of various anxiety disorders and MDD on DLE was assessed with logistic regression.

Results

Having a lifetime diagnosis of either any anxiety disorder or MDD was significantly associated with the endorsement of DLE. The association was found for each of the main anxiety disorders when examined separately. There was a dose response relationship between increasing severity of MDD and higher odds of DLE endorsement.

Conclusions

Delusional-like experiences are associated with a wide range of anxiety disorders and are more prevalent in those with MDD. Understanding the relationship between DLE, anxiety disorders and depression may provide insights into shared pathways that underpin both psychotic disorders and common mental disorders.

INTRODUCTION

There is now robust evidence indicating that hallucinations and delusional-like experiences (DLE) are common in the general population. In recent years the field has focused on the demographic and clinical correlates of hallucinations and DLE.[1-10] Of particular interest, there is a growing body of evidence reporting an association between DLE endorsement and common mental disorders such as anxiety disorders and major depressive disorder (MDD). For example, panic attacks during adolescence were significantly associated with increased levels of DLE among young adults.[11] In the NEMESIS study, subjects with obsessive compulsive symptoms were more likely to develop incident psychotic symptoms three years later.[12] Conversely, a Swiss-based cohort reported that young adults with psychotic-like experiences were significantly more likely to later develop common mental disorders such as anxiety disorders and MDD.[13] A German community-based study found an association between social phobia, social anxiety and DLE,[14] while a US primary-care based sample reported that those who reported psychotic-like experiences were more likely to have generalized anxiety disorders and panic disorders.[15]

Trauma exposure with or without post-traumatic stress disorder has been associated with DLE.[7] Several Australian studies[10,16] have found significant associations between DLE, and broadly-defined anxiety disorders, however to date these studies did not report on subtypes of anxiety disorders. In light of the evidence linking DLE with a wide range of different types of anxiety disorders, the evidence suggests that DLE are nonspecifically associated with anxiety disorders.

With respect to depression, several studies have found that individuals with depression are significantly more likely to endorse DLE.[9,10,16,17] Studies also show that DLE requiring clinical care were progressively more likely to occur with greater levels of affective dysregulation (depressive symptoms and hypo-manic symptoms).[18] Importantly, there was a significant association between severity of depressive symptoms and persistence of psychotic symptoms.

While longitudinal studies are required to explore the temporal sequence between depression, anxiety and DLE, we had the opportunity to replicate our previous findings with respect to the cross-sectional association between DLE and (a) broadly defined anxiety disorders, and (b) MDD.[10] Based on our previous studies, we predicted that those with anxiety disorder or major depression disorder would be more likely to endorse DLE. In addition, we were able to explore the association between DLE and a range of specific anxiety disorders. Furthermore, we were able to examine if severity of major depressive disorder influenced the risk of endorsement of DLE – we predicted that those with more severe MDD would be more likely to endorse DLE compared to those with milder forms of MDD.

METHODS

Participants

The data were drawn from the 1997 National Survey of Mental Health and Wellbeing conducted in Australia by the Australian Bureau of Statistics (ABS) from a representative sample (random stratified multistage area sampling) of persons living in private dwellings in all States and Territories of Australia. Details of the survey methodology were published elsewhere.[19] In brief, approximately 13,600 private dwellings were initially selected with one person aged 18 years or over from each dwelling invited to participate. In total, 10,641 individuals participated in the survey, representing a response rate of 78%. Interviews were carried out by trained interviewers from the ABS, a statutory body responsible for conducting such surveys using ethical protocols that include written informed consent.

Assessment of delusional-like experiences and DSM-IV diagnoses

Mental disorders were assessed by a modified version of the Composite International Diagnostic Interview (CIDI)[20] which yielded diagnoses of DSM-IV disorders. Briefly, within the CIDI there are three items related to identifying individuals who may be psychotic (*G Items*: "screening items"). For those who endorsed the screen item, a follow-up item was used to further explore the delusional-like nature of the experiences ("probe items"). Full details of the screen and probe items are provided in Appendix 1. The items covered the following features of psychotic disorders: delusions of control, thought interference and passivity (Question 1 and 1a); delusions of reference or persecution (Question 2 and 2a); and grandiose delusions (Question 3 and 3a). There was no item to assess hallucinations.

Based on CIDI-derived DSM-IV criteria, we identified subjects who had lifetime diagnoses of: (a) an anxiety disorder, (b) major depressive disorder. Anxiety disorders included panic disorder with or without agoraphobia, social phobia, generalised anxiety disorder (GAD), obsessive compulsive disorder (OCD), and agoraphobia without panic disorder. For those with MDD, allocation to subtypes was based on the total number of particular 'depressive' symptoms with the duration of at least two weeks. Full details of the symptom list and related rules to deal with multiple episodes can be found in the full report. [21] In brief, mild MDD was characterised by the presence of at least four symptoms, moderate MDD with at least six symptoms, and severe MDD with at least eight symptoms. These subtypes of MDD were mutually exclusive.

To ascertain trauma exposure, the CIDI elicits responses from 10 questions pertaining to past exposure to traumatic events. Details of the trauma variables have been published previously by our group.[7,8] In keeping with our previous analyses [1-10] individuals who screened positively for schizophrenia (i.e. respondents who reported 'Yes' to the item "*Had been told at any time by a psychiatrist that they had schizophrenia*") were excluded from the analyses (n=87) leaving a total of 10,554 subjects for this study.

Statistical analysis

To examine the association between DLE and both anxiety disorders and MDD, logistic models were fitted to the data while adjusting for various confounding factors. Because sex and age are associated with DLE,[9,10,22] we included these as covariates in the main

analyses. In keeping with our previous studies, we included a range of CIDI-derived, potential confounding variables in Model 2. These include substance misuse,[23] marital status, and migrant status,[24] educational status, employment status and family income, and trauma exposure.[2,6-8] As co-morbidity frequently occurs between anxiety disorders and MDD, we also adjusted for the presence of the other psychiatric diagnoses under investigation (i.e. the association between MDD and DLE was adjusted for the presence of anxiety disorders, and the association between anxiety disorders and DLE was adjusted for the presence of Major Depressive Disorder).

For secondary analyses (a sensitivity analysis), we repeated the main analyses excluding the second screen items ("Have you ever had a feeling that people were too interested in you?") because clinical experience suggests that this is a common experience in social anxiety.

The sample was weighted to adjust for differential probabilities of selection within households, over-sampling of population subgroups and non-response to match census population distribution on a number of geographic and socio-demographic variables. The initial weights were calibrated against known population estimates. Replicate weight variables were developed using the Jack-knife procedure of replication (i.e., the analysis was repeated after one subject was dropped and then the standard error was derived from the distribution of results from all ''minus one'' resamples).[25] Analyses were performed using Proc *Surveylogistic*[26] which is designed to analyse complex survey sample using SAS (version 9.3; Cary, NC: SAS Institute). Chi-square test-for-

linear trend was used to assess dose-response relationships between the exposure variables and DLE.

RESULTS

Of the 10 554 subjects surveyed, 11.6% (n=1276) positively endorsed one or more DLE items (Table 1). There was a weak effect of females being more likely to endorse DLE than males (Odd Ratio (OR) 1.05; 95% Confidence Intervals (CI) 1.04-1.05). The prevalence of lifetime diagnosis of any anxiety disorder was 4.9% (n=580), and the prevalence of lifetime depressive disorders was 5.3% (n=651).

Insert Table 1 about here

As predicted, the main analyses showed that those with any anxiety disorder and participants who had lifetime diagnosis of MDD were significantly more likely to endorse delusional-like experiences. Those with anxiety disorders were two to three times more likely to endorse both DLE screen and probe items (Table 2), and those with a diagnosis of major depressive disorder were also two to three times more likely to endorse DLE screen and probe items.

Insert Table 2 about here

Concerning the subtypes of anxiety disorders, each disorder was significantly associated with DLE screen items, and there were no marked differences in the effect sizes between the different disorders (Table 3). There was a dose response relationship between the severity of the MDD and DLE in which severe depression showed twice the odds of endorsement of DLE screen items compared with a diagnosis of mild major depressive disorder with a significant linear trend (X^2=44.19, p<.0001). Broadly similar (but less precise) associations were also found for probe items.

Insert Table 3 about here

In the secondary analysis, when we conducted the models using two DLE items (G1 & G3), the pattern of significant association for major anxiety and depressive disorders remained unchanged (data not shown).

DISCUSSION

Individuals with a lifetime diagnosis of major depressive disorder or an anxiety disorder were significantly more likely to report DLE compared to those without these disorders. We found that each subtype of anxiety disorder was associated with DLE, and there were no marked differences in the effect sizes for these associations (the confidence intervals around these associations overlapped). Based on this same sample, we have previously demonstrated that trauma exposure without Post-traumatic Stress Disorder

was associated with DLE.[7] Our new findings add additional weight to the conclusion that a range of disorders with prominent anxiety symptoms are associated with DLE.

As predicted, there was also a dose response relationship between severity of MDD and DLE. All associations remained significant when adjusted for associated co-morbidity with anxiety, alcohol and illicit substance misuse and any traumatic life events indicating that the associations are independent of co-morbid psychiatric illnesses, and selected environmental and demographic risk factors.

The mechanisms linking DLE with anxiety disorder and MDD remain unclear. However, there is evidence to suggest that shared familial factors may contribute to these findings.[9]

In the current study we were not able to examine the temporal sequence between the variables of interest – for example, we do not know if anxiety or depressive symptoms preceded the onset of DLE or vice versa. Unfortunately, the delusional like experience have no information about age of onset nor presence during the last twelve months. Thus, while the CIDI has some information about the age of onset and the presence of the disorder in the past year, the lack of comparable data for the DLE compromises out ability to infer temporal sequence. Longitudinal studies will be required to explore this particular research question. The reliance on life-time measures of both DLE and mental disorders is also problematic, as it is known that respondents tend to under-report true lifetime prevalence estimates.[27] While the interviewers were trained, the diagnoses of MDD and anxiety disorders were not validated by clinical assessment.

However, the CIDI is generally regarded as having good psychometric properties for common mental disorders.[28] Comorbidity between anxiety disorders and MDD is common, and while we included adjustments in the our models to attempt to account for this feature, the complex nature of the relationships between DLE, MDD and anxiety disorders could reduce the accuracy of the odds ratios.[29] We had a small number of screen and probe items to measure delusional-like experiences and there were no items for hallucinations. However, previous general population studies have found a strong association between the presence of DLE and hallucinations.[24,30-32]

There is now robust and consistent evidence indicating that those with anxiety disorders and MDD have an increased risk of DLE. For example, clinicians involved in the care of those with primary diagnoses of anxiety disorder or depression may not routinely enquire about DLE. In light of the association between DLE and suicidal ideation/behaviour,[3] the presence of these experiences may suggest that clinical care plans place greater emphasis on the detection and management of suicidal ideation. A recent study based on adolescents found that most individuals (57 to 80% depending on age) who reported psychotic-like experiences (e.g. hallucinations and/or DLE), had at least one diagnosable non-psychotic psychiatric disorder.[33] We agree with these authors, who note that psychotic symptoms appear to be important risk markers for a wide range of non-psychotic mental health disorders.

Competing interest None

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Contributors JM, SS and JS have directly participated in the planning and execution of the study. SS analysed the data. All authors have critically read, and approved the final version submitted.

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Table 1. Descriptive statistics of delusional-like experiences (Screen items), anxiety disorder and major depressive disorder (n=10,554)

Exposure	Sample	Delusional-like experiences endorsement	
	n (%)	No (%)	Yes (%)
Total sample	10,554 (100.00)	9278 (88.44)	1276 (11.56)
Anxiety and depressive disorders			
No Anxiety disorders	9974 (95.13)	8900 (85.16)	1074 (9.97)
[1]Any Anxiety disorders: lifetime	580 (4.87)	378 (4.29)	202 (16.88)
No Major depressive disorder	9903 (94.66)	8834 (84.76)	1069 (9.89)
[2]Any Major depressive disorder: lifetime	651 (5.34)	444 (4.77)	207 (16.78)

[1]Anxiety disorders based on CIDI DSM diagnosis
[2]Major depressive disorder based on CIDI DSM diagnosis

Table 2. Association between delusional-like experiences, and anxiety disorders and major depressive disorder (n=10,554)

Disorders	Delusional-like experiences			
	Screen items		Probe items	
	Model 1[1] OR[3] (95% CI[4])	Model 2[2] OR[3] (95% CI[4])	Model 1[1] OR[3] (95% CI[4])	Model 2[2] OR[3] (95% CI[4])
Anxiety disorders: lifetime[@]	3.88 (2.92, 5.16)*	2.43 (1.91, 3.09)*	3.36 (1.86, 6.05)*	2.12 (1.27, 3.54)*
Major depressive disorder: Lifetime[#]	3.63 (2.75, 4.79)*	2.17 (1.65, 2.86)*	2.91 (1.84, 4.59)*	1.63 (1.10, 2.42)*

[1]Model 1= Adjusted for age and sex
[2]Model 2= Adjusted for age, sex, marital status, migrant status, income, employment status, educational status, any alcohol use/dependence disorders, any drug use/dependence disorders, and any traumatic life events
(in Model 2 anxiety disorders were adjusted for major depressive disorder and vice versa)
[@#]Anxiety and depressive disorders were based on CIDI DSM diagnosis

[3]OR=Odds ratio; [4]CI= Confidence Interval
*significance: $p<0.001$

Table 3. Association between delusional-like experiences, and different individual exposure to lifetime anxiety disorders, and major depressive disorder (n=10,554)

		Delusional-like experiences			
		Screen items		Probe items	
	Number	Model 1[2]	Model 2[3]	Model 1[2]	Model 2[3]
Anxiety disorders	(%, SE[1])	OR[4] (95% CI[5])	OR[4] (95% CI[5])	OR[4] (95% CI[5])	OR[4] (95% CI[5])
Panic disorder with/without agoraphobia	124 (1.02, 0.12)	**4.56 (2.51, 8.33)***	**2.40 (1.03, 5.63)***	**2.55 (1.13, 5.78)***	1.54 (0.77, 3.08)
General anxiety	311 (2.57, 0.23)	**3.69 (2.57, 5.29)***	**2.09 (1.50, 2.93)***	**3.05 (1.41, 6.58)***	1.77 (0.89, 3.51)
Obsessive compulsive disorder	77 (0.69, 0.12)	**5.19 (2.69, 10.03)***	**2.97 (1.50, 5.88)***	**4.60 (1.81, 11.74)***	**2.68 (1.05, 6.84)***
Agoraphobia without panic disorder	60 (0.49, 0.06)	**5.18 (2.72, 9.85)***	**3.49 (1.95, 6.28)***	**7.02 (3.73, 13.19)***	**4.65 (1.98, 10.89)***
Social phobia	160 (1.35, 0.14)	**4.14 (2.81, 6.11)***	**2.29 (1.63, 3.24)***	**4.15 (1.93, 8.91)***	**2.39 (1.06, 5.43)***
Major Depressive disorder					
Mild	297 (2.52, 0.20)	**2.96 (1.82, 4.82)***	**1.97 (1.15, 3.37)***	**2.37 (1.39, 4.04)***	1.49 (0.88, 2.53)
Moderate	190 (1.52, 0.14)	**3.29 (1.81, 6.01)***	1.89 (0.98, 3.70)	**2.73 (1.27, 5.84)***	1.53 (0.79, 2.96)
Severe	164 (1.29, 0.12)	**5.73 (3.96, 8.30)***	**3.03 (2.11, 4.35)***	**4.25 (2.01, 8.99)***	**1.99 (1.02, 3.91)***
Trend		X^2=111.83, p<.0001	X^2=44.19, p<.0001	X^2=21.19, p<.0001	X^2=6.04, p<.001

[1]SE= Standard error of estimates; [2]Model 1= Adjusted for age and sex; [3]Model 2= Adjusted for age, sex, marital status, migrant status, income, employment status, educational status, any alcohol use/dependence disorders, any drug use/dependence disorders, and any traumatic life events (in Model 2 anxiety disorders were adjusted for major depressive disorder and vice versa)
[4]OR=Odds Ratio; [5]CI= Confidence Interval; *significance: p<0.001

Appendix 1 CIDI Screen items and Probes for delusional-like experiences[1] (n=10,554[2])

Item G1:
In the past 12 months, have you felt that your thoughts were being directly interfered with or controlled by another person?
If yes, G1A:
Did it come about in a way that many people would find hard to believe, for instance, through telepathy?

Item G2:
In the past 12 months, have you had a feeling that people were too interested in you?
If yes, G2A:
In the past 12 months, have you had a feeling that things were arranged so as to have a special meaning for you, or even that harm might come to you?

Item G3:
Do you have any special powers that most people lack?
If yes, G3A:
Do you belong to a group of people who also have these powers?

Item G4:
Has a doctor ever told you that you may have schizophrenia?

[1]Screen items (lifetime) with answer (Yes/No): 'Any screen' items required 'Yes' answers to all three questions G1, G2 & G3.
#Probe items (lifetime) with answer (Yes/No): 'Any probe' items required 'Yes' answers to G1A and G2A, and 'No' answer to G3A.
[2]sample excludes item G4 (*Has a doctor ever told you that you may have schizophrenia*?) (n=87)