



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

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12 Anxiety and depressive disorders are associated with delusional-like  
13 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 Australia 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

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3 Having a lifetime diagnosis of either any anxiety disorder or MDD was significantly  
4 associated with the endorsement of DLE. The association was found for each of the  
5 main anxiety disorders when examined separately. There was a dose response  
6 relationship between increasing severity of MDD and higher odds of DLE endorsement.  
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## 10 11 **Conclusions**

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14 Delusional-like experiences are associated with a wide range of anxiety disorders and  
15 are more prevalent in those with MDD. Understanding the relationship between DLE,  
16 anxiety disorders and depression may provide insights into shared pathways that  
17 underpin both psychotic disorders and common mental disorders.  
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## 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.<sup>1-9</sup> 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.<sup>10</sup> In the NEMESIS study, subjects with obsessive compulsive symptoms were more likely to develop incident psychotic symptoms three years later.<sup>11</sup> 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.<sup>12</sup> A German community-based study found an association between social phobia, social anxiety and DLE.<sup>13</sup> 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.<sup>14</sup>

Trauma exposure with or without post-traumatic stress disorder has been associated with DLE.<sup>7</sup> Two Australian studies<sup>9,15,16</sup> 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.

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3 With respect to depression, several studies have found that individuals with depression  
4 are significantly more likely to endorse DLE.<sup>9,15-17</sup> Studies also show that DLE requiring  
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6 clinical care were progressively more likely to occur with greater levels of affective  
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8 dysregulation (depressive symptoms and hypo-manic symptoms).<sup>18</sup> Importantly, there  
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10 was a significant association between severity of depressive symptoms and persistence  
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12 of psychotic symptoms.  
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20 Based on an independent national survey, we had the opportunity to replicate our  
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22 previous findings with respect to the association between DLE and (a) broadly defined  
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24 anxiety disorders, and (b) MDD.<sup>9</sup> In addition, we were able to explore the association  
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26 between DLE and a range of specific anxiety disorders. Furthermore, we were able to  
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28 examine if severity of major depressive disorder influenced the risk of endorsement of  
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30 DLE.  
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## 39 **METHODS**

### 40 **Participants**

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43 The data were drawn from the 1997 National Survey of Mental Health and Wellbeing  
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45 conducted in Australia by the Australian Bureau of Statistics (ABS) from a  
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47 representative sample (random stratified multistage area sampling) of persons living in  
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49 private dwellings in all States and Territories of Australia. Details of the survey  
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51 methodology were published elsewhere.<sup>19</sup> In brief, approximately 13,600 private  
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3 dwellings were initially selected with one person aged 18 years or over from each  
4 dwelling invited to participate. In total, 10,641 individuals participated in the survey,  
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6 representing a response rate of 78%. Interviews were carried out by trained interviewers  
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8 from the ABS, a statutory body responsible for conducting such surveys using ethical  
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10 protocols that include written informed consent.  
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## 14 15 16 17 **Assessment of delusional-like experiences and DSM-IV diagnoses** 18 19

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22 Mental disorders were assessed by a modified version of the Composite International  
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24 Diagnostic Interview (CIDI)<sup>20</sup> which yielded diagnoses of DSM-IV disorders. Details of  
25  
26 the DLE are given in Appendix 1. Briefly, within the CIDI there are three items related to  
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28 identifying individuals who may be psychotic (*G Items*: “screening items”) each followed  
29  
30 by a probe item. The items covered the following features of psychotic disorders:  
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32 delusions of control, thought interference and passivity (Question 1 and 1a); delusions  
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34 of reference or persecution (Question 2 and 2a); and grandiose delusions (Question 3  
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36 and 3a). There was no item to assess hallucinations.  
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44 Based on CIDI-derived DSM-IV criteria, we identified subjects who had lifetime  
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46 diagnoses of: (a) an anxiety disorder, (b) major depressive disorder. Anxiety disorders  
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48 included panic disorder with or without agoraphobia, social phobia, generalised anxiety  
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50 disorder (GAD), obsessive compulsive disorder (OCD), and agoraphobia without panic  
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52 disorder. MDD was classified as 'mild', 'moderate' or 'severe' without psychotic  
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54 features.  
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3 To ascertain trauma exposure, the CIDI elicits responses from 10 questions pertaining  
4 to past exposure to traumatic events. Details of the trauma variables have been  
5 published previously by our group.<sup>7</sup>  
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12 In keeping with our previous analyses<sup>1-9</sup> individuals who screened positively for  
13 schizophrenia (i.e. respondents who reported 'Yes' to the item "*Had been told at any*  
14 *time by a psychiatrist that they had schizophrenia*") were excluded from the analyses  
15 (n=87) leaving a total of 10,554 subjects for this study.  
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## 22 23 24 **Statistical analysis** 25

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28 To examine the association between delusional-like experiences, and anxiety disorders  
29 and MDD, logistic models were fitted to the data while adjusting for various confounding  
30 factors. Because sex and age are associated with DLE,<sup>16,21</sup> we included these as  
31 covariates in the main analyses. In keeping with our previous studies, we included a  
32 range of CIDI-derived, potential confounding variables in Model 2. These include  
33 substance misuse,<sup>22</sup> marital status, and migrant status,<sup>23</sup> educational status,  
34 employment status and family income, and trauma exposure.<sup>2,4,6,7,23</sup> As co-morbidity  
35 frequently occurs between anxiety disorders and MDD, we also adjusted for the  
36 presence of the other psychiatric diagnoses under investigation (i.e. the association  
37 between MDD and DLE was adjusted for the presence of anxiety disorders, and the  
38 association between anxiety disorders and DLE was adjusted for the presence of Major  
39 Depressive Disorder).  
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3 For secondary analyses, we repeated the main analyses excluding the second screen  
4 items (“Have you ever had a feeling that people were too interested in you?”) because  
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6 clinical experience suggests that this is a common experience in social anxiety.  
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12 The sample was weighted to adjust for differential probabilities of selection within  
13 households, over-sampling of population subgroups and non-response to match census  
14 population distribution on a number of geographic and socio-demographic variables.  
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16 The initial weights were calibrated against known population estimates. Replicate  
17 weight variables were developed using the Jack-knife procedure of replication (i.e., the  
18 analysis was repeated after one subject was dropped and then the standard error was  
19 derived from the distribution of results from all “minus one” resamples).<sup>24</sup> Analyses  
20 were performed using Proc *Surveylogistic*<sup>25</sup> which is designed to analyse complex  
21 survey sample using SAS (version 9.2; Cary, NC: SAS Institute). Chi-square test-for-  
22 linear trend was used to assess dose-response relationships between the exposure  
23 variables and DLE.  
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## 41 RESULTS

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

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3 In the secondary analysis, when we conducted the models using two DLE items (G1 &  
4 G3), the pattern of significant association for major anxiety and depressive disorders  
5 remained unchanged (data not shown).  
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## 10 11 12 13 **DISCUSSION** 14

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18 Individuals with a life time diagnosis of major depressive disorder or an anxiety disorder  
19 were significantly more likely to report DLE compared to those without these disorders.  
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21 We found that each subtype of anxiety disorder was associated with DLE, and there  
22 were no marked differences in the effect sizes for these associations (the confidence  
23 intervals around these associations overlapped). Based on this same sample, we have  
24 previously demonstrated with trauma exposure with Post-traumatic Stress Disorder is  
25 associated with DLE.<sup>7</sup> Our new findings add additional weight to the conclusion that a  
26 range of disorders with prominent anxiety symptoms are associated with DLE.  
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39 As predicted, there was also a dose response relationship between severity of MDD  
40 and DLE. All associations remained significant when adjusted for associated co-  
41 morbidity with anxiety, alcohol and illicit substance misuse and any traumatic life events  
42 indicating that the associations are independent of co-morbid psychiatric illnesses, and  
43 selected environmental and demographic risk factors. Similar associations were  
44 previously reported from another (independent) Australian population survey,<sup>9</sup> and more  
45 broadly with other population samples.<sup>15-17</sup>  
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3 The mechanisms linking DLE with anxiety disorder and MDD remain unclear. However,  
4 there is evidence to suggest that shared familial factors may contribute to these  
5 findings. Based on a large, population-based sample (n = 8841), we found that  
6 regardless of the presence of a mental illness experienced by the respondents, those  
7 who reported a family history of depressive disorder in a first-degree relative had an  
8 increased odds of endorsing DLE (Adjusted odds ratio 1.53; 95% CI 1.19-1.96). With  
9 respect to the presence of a first degree relative with an anxiety disorder and DLE,  
10 similar odds were identified (Adjusted OR 1.59; 95%CI 1.23-2.05). Thus, the presence  
11 of an anxiety disorder or MDD in respondents, or the presence of a family history of  
12 either disorder in otherwise well individuals, are both associated with DLE. As the  
13 genetic architecture of anxiety and mood disorders is unravelled, it will be of interest to  
14 explore if common polymorphisms linked to these disorders are also associated with  
15 DLE.  
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36 With respect to more proximal mechanisms, it is reasonable to presume that anxiety  
37 disorders or major depressive disorder lead to heightened vulnerability for the onset of  
38 delusional-like experiences. While the causal pathway is unknown, it may stem through  
39 destabilizing effects of severe anxiety or depression on emotional and cognitive  
40 functioning<sup>26,27</sup> which may lead to aberrant assignment of salience and delusional  
41 experiences.<sup>28</sup> However, it is also possible that acute psychotic episodes can precede  
42 and predict anxiety or depressive disorders.<sup>11</sup>  
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55 The study has several limitations. Importantly, this study was cross-sectional and  
56 therefore, it was not possible to establish the direction of causality between anxiety and  
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3 depressive disorder, and DLE. While the CIDI has some information about the age of  
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5 onset for some diagnoses, we do not have information on the age of onset of the DLE.  
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8 While the interviewers were trained, the diagnoses of MDD and anxiety disorders were  
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10 not validated by clinical assessment. However, the CIDI is generally regarded as having  
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12 good psychometric properties for common mental disorders.<sup>29</sup> Comorbidity between  
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14 anxiety disorders and MDD is common, and while we included adjustments in the our  
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16 models to attempt to account for this feature, the complex nature of the relationships  
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18 between DLE, MDD and anxiety disorders could reduce the accuracy of the odds  
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20 ratios.<sup>30</sup> We had a small number of screen and probe items to measure delusional-like  
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22 experiences and there were no items for hallucinations. However, previous general  
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24 population studies have found a strong association between the presence of DLE and  
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26 hallucination.<sup>23,31-33</sup>

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34 Clinicians treating mild anxiety and mood disorders may not routinely screen for  
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36 psychotic-like experiences. However, there is now robust and consistent evidence  
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38 indicating that those with anxiety disorders and MDD have an increased risk of DLE. In  
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40 light of the association between DLE and suicidal ideation/behaviour,<sup>3</sup> the presence of  
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42 DLE has important clinical implications. Understanding the relationship and time course  
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44 between DLE, anxiety and depression may provide insights into shared pathways that  
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46 underpin both psychotic disorders and common mental disorders.  
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15 final version submitted.  
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25 **Data sharing statement** The data is available from the Australian Bureau of  
26 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 n (%)	Delusional-like experiences endorsement	
		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)
<sup>1</sup> 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)
<sup>2</sup> Any Major depressive disorder: lifetime	651 (5.34)	444 (4.77)	207 (16.78)

Major depressive disorder based on CIDI DSM diagnosis

<sup>2</sup>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 <sup>1</sup>	Model 2 <sup>2</sup>	Model 1 <sup>1</sup>	Model 2 <sup>2</sup>
	OR <sup>3</sup> (95% CI <sup>4</sup> )	OR <sup>3</sup> (95% CI <sup>4</sup> )	OR <sup>3</sup> (95% CI <sup>4</sup> )	OR <sup>3</sup> (95% CI <sup>4</sup> )
Anxiety disorders: lifetime <sup>@</sup>	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 <sup>#</sup>	3.63 (2.75, 4.79)*	2.17 (1.65, 2.86)*	2.91 (1.84, 4.59)*	1.63 (1.10, 2.42)*

<sup>1</sup>Model 1= Adjusted for age and sex

<sup>2</sup>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)

<sup>@#</sup>Anxiety and depressive disorders were based on CIDI DSM diagnosis

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

<sup>1</sup>SE= Standard error of estimates; <sup>2</sup>Model 1= Adjusted for age and sex; <sup>3</sup>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)

<sup>4</sup>OR=Odds Ratio; <sup>5</sup>CI= Confidence Interval; \*significance:  $p<0.001$

## Appendix 1 CIDI Screen items and Probes for delusional-like experiences<sup>1</sup> (n=10,554<sup>2</sup>)

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### 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?

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<sup>1</sup>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.

<sup>2</sup>sample excludes item G4 (*Has a doctor ever told you that you may have schizophrenia?*) (n=87)



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

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Manuscript ID:	bmjopen-2012-001001.R1
Article Type:	Research
Date Submitted by the Author:	30-Mar-2012
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<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Epidemiology, Mental health
Keywords:	EPIDEMIOLOGY, MENTAL HEALTH, Adult psychiatry < PSYCHIATRY, Schizophrenia & psychotic disorders < PSYCHIATRY

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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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9 *Abstract: 293 words*

10 *Main text: 2145 (excluding tables and references)*

11 *Tables 3*

12 *Appendices: 1*

13 *Key words: Delusional-like experiences, Anxiety disorders, Depressive disorders*

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

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21 James Scott <sup>1,2,3,4</sup>

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23 Daniel Varghese<sup>5</sup>

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25 John McGrath <sup>1,4,6</sup>

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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 Australia 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

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

16  
17 Delusional-like experiences are associated with a wide range of anxiety disorders and  
18 are more prevalent in those with MDD. Understanding the relationship between DLE,  
19 anxiety disorders and depression may provide insights into shared pathways that  
20 underpin both psychotic disorders and common mental disorders.  
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## 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.<sup>1-9</sup> 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.<sup>10</sup> In the NEMESIS study, subjects with obsessive compulsive symptoms were more likely to develop incident psychotic symptoms three years later.<sup>11</sup> 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.<sup>12</sup> A German community-based study found an association between social phobia, social anxiety and DLE,<sup>13</sup> 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.<sup>14</sup>

Trauma exposure with or without post-traumatic stress disorder has been associated with DLE.<sup>7</sup> Several Australian studies<sup>9,15,16</sup> 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.

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9 With respect to depression, several studies have found that individuals with depression  
10 are significantly more likely to endorse DLE.<sup>9,15-17</sup> Studies also show that DLE requiring  
11 clinical care were progressively more likely to occur with greater levels of affective  
12 dysregulation (depressive symptoms and hypo-manic symptoms).<sup>18</sup> Importantly, there  
13 was a significant association between severity of depressive symptoms and persistence  
14 of psychotic symptoms.  
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21 While longitudinal studies are required to explore the temporal sequence between  
22 depression, anxiety and DLE, we had the opportunity to replicate our previous findings  
23 with respect to the cross-sectional association between DLE and (a) broadly defined  
24 anxiety disorders, and (b) MDD.<sup>9</sup> Based on our previous studies, we predicted that  
25 those with anxiety disorder or major depression disorder would be more likely to  
26 endorse DLE. In addition, we were able to explore the association between DLE and a  
27 range of specific anxiety disorders. Furthermore, we were able to examine if severity of  
28 major depressive disorder influenced the risk of endorsement of DLE – we predicted  
29 that those with more severe MDD would be more likely to endorse DLE compared to  
30 those with milder forms of MDD.  
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## 44 **METHODS**

### 45 **Participants**

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

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33 Mental disorders were assessed by a modified version of the Composite International  
34 Diagnostic Interview (CIDI)<sup>20</sup> which yielded diagnoses of DSM-IV disorders. Briefly,  
35 within the CIDI there are three items related to identifying individuals who may be  
36 psychotic (*G Items*: “screening items”). For those who endorsed the screen item, a  
37 follow-up item was used to further explore the delusional-like nature of the experiences  
38 (“probe items”). Full details of the screen and probe items are provided in Appendix 1.  
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40 The items covered the following features of psychotic disorders: delusions of control,  
41 thought interference and passivity (Question 1 and 1a); delusions of reference or  
42 persecution (Question 2 and 2a); and grandiose delusions (Question 3 and 3a). There  
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50 was no item to assess hallucinations.  
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9 Based on CIDI-derived DSM-IV criteria, we identified subjects who had lifetime  
10 diagnoses of: (a) an anxiety disorder, (b) major depressive disorder. Anxiety disorders  
11 included panic disorder with or without agoraphobia, social phobia, generalised anxiety  
12 disorder (GAD), obsessive compulsive disorder (OCD), and agoraphobia without panic  
13 disorder. For those with MDD, allocation to subtypes was based on the total number of  
14 particular 'depressive' symptoms with the duration of at least two weeks. Full details of  
15 the symptom list and related rules to deal with multiple episodes can be found in the full  
16 report.<sup>21</sup> In brief, mild MDD was characterised by the presence of at least four  
17 symptoms, moderate MDD with at least six symptoms, and severe MDD with at least  
18 eight symptoms. These subtypes of MDD were mutually exclusive.  
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29 To ascertain trauma exposure, the CIDI elicits responses from 10 questions pertaining  
30 to past exposure to traumatic events. Details of the trauma variables have been  
31 published previously by our group.<sup>7</sup>  
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36 In keeping with our previous analyses<sup>1-9</sup> individuals who screened positively for  
37 schizophrenia (i.e. respondents who reported 'Yes' to the item "*Had been told at any*  
38 *time by a psychiatrist that they had schizophrenia*") were excluded from the analyses  
39 (n=87) leaving a total of 10,554 subjects for this study.  
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## 46 **Statistical analysis**

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49 To examine the association between DLE and both anxiety disorders and MDD, logistic  
50 models were fitted to the data while adjusting for various confounding factors. Because  
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9 sex and age are associated with DLE,<sup>16,22</sup> we included these as covariates in the main  
10 analyses. In keeping with our previous studies, we included a range of CIDI-derived,  
11 potential confounding variables in Model 2. These include substance misuse,<sup>23</sup> marital  
12 status, and migrant status,<sup>24</sup> educational status, employment status and family income,  
13 and trauma exposure.<sup>2,4,6,7,24</sup> As co-morbidity frequently occurs between anxiety  
14 disorders and MDD, we also adjusted for the presence of the other psychiatric  
15 diagnoses under investigation (i.e. the association between MDD and DLE was  
16 adjusted for the presence of anxiety disorders, and the association between anxiety  
17 disorders and DLE was adjusted for the presence of Major Depressive Disorder).  
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27 For secondary analyses (a sensitivity analysis), we repeated the main analyses  
28 excluding the second screen items (“Have you ever had a feeling that people were too  
29 interested in you?”) because clinical experience suggests that this is a common  
30 experience in social anxiety.  
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36 The sample was weighted to adjust for differential probabilities of selection within  
37 households, over-sampling of population subgroups and non-response to match census  
38 population distribution on a number of geographic and socio-demographic variables.  
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41 The initial weights were calibrated against known population estimates. Replicate  
42 weight variables were developed using the Jack-knife procedure of replication (i.e., the  
43 analysis was repeated after one subject was dropped and then the standard error was  
44 derived from the distribution of results from all “minus one” resamples).<sup>25</sup> Analyses  
45 were performed using Proc *Surveylogistic*<sup>26</sup> which is designed to analyse complex  
46 survey sample using SAS (version 9.3; Cary, NC: SAS Institute). Chi-square test-for-  
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9 linear trend was used to assess dose-response relationships between the exposure  
10 variables and DLE.  
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## 12 13 14 **RESULTS**

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18 Of the 10 554 subjects surveyed, 11.6% (n=1276) positively endorsed one or more DLE  
19 items (Table 1). There was a weak effect of females being more likely to endorse DLE  
20 than males (Odd Ratio (OR) 1.05; 95% Confidence Intervals (CI) 1.04-1.05). The  
21 prevalence of lifetime diagnosis of any anxiety disorder was 4.9% (n=580), and the  
22 prevalence of lifetime depressive disorders was 5.3% (n=651).  
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34 As predicted, the main analyses showed that those with any anxiety disorder and  
35 participants who had lifetime diagnosis of MDD were significantly more likely to endorse  
36 delusional-like experiences. Those with anxiety disorders were two to three times more  
37 likely to endorse both DLE screen and probe items (Table 2), and those with a  
38 diagnosis of major depressive disorder were also two to three times more likely to  
39 endorse DLE screen and probe items.  
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9 Concerning the subtypes of anxiety disorders, each disorder was significantly  
10 associated with DLE screen items, and there were no marked differences in the effect  
11 sizes between the different disorders (Table 3). There was a dose response relationship  
12 between the severity of the MDD and DLE in which severe depression showed twice the  
13 odds of endorsement of DLE screen items compared with a diagnosis of mild major  
14 depressive disorder with a significant linear trend ( $\chi^2=44.19$ ,  $p<.0001$ ). Broadly similar  
15 (but less precise) associations were also found for probe items.  
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28 In the secondary analysis, when we conducted the models using two DLE items (G1 &  
29 G3), the pattern of significant association for major anxiety and depressive disorders  
30 remained unchanged (data not shown).  
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## 36 DISCUSSION

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40 Individuals with a lifetime diagnosis of major depressive disorder or an anxiety disorder  
41 were significantly more likely to report DLE compared to those without these disorders.  
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43 We found that each subtype of anxiety disorder was associated with DLE, and there  
44 were no marked differences in the effect sizes for these associations (the confidence  
45 intervals around these associations overlapped). Based on this same sample, we have  
46 previously demonstrated that trauma exposure without Post-traumatic Stress Disorder  
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9 was associated with DLE.<sup>7</sup> Our new findings add additional weight to the conclusion  
10 that a range of disorders with prominent anxiety symptoms are associated with DLE.  
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14 As predicted, there was also a dose response relationship between severity of MDD  
15 and DLE. All associations remained significant when adjusted for associated co-  
16 morbidity with anxiety, alcohol and illicit substance misuse and any traumatic life events  
17 indicating that the associations are independent of co-morbid psychiatric illnesses, and  
18 selected environmental and demographic risk factors.  
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25 The mechanisms linking DLE with anxiety disorder and MDD remain unclear. However,  
26 there is evidence to suggest that shared familial factors may contribute to these  
27 findings. Based on a large, population-based sample (n = 8841), we found that  
28 regardless of the presence of a mental illness experienced by the respondents, those  
29 who reported a family history of depressive disorder in a first-degree relative had an  
30 increased odds of endorsing DLE (Adjusted odds ratio 1.53; 95% CI 1.19-1.96). With  
31 respect to the presence of a first degree relative with an anxiety disorder and DLE,  
32 similar odds were identified (Adjusted OR 1.59; 95%CI 1.23-2.05). Thus, the presence  
33 of an anxiety disorder of MDD in respondents, or the presence of a family history of  
34 either disorder in otherwise well individuals, are both associated with DLE. As the  
35 genetic architecture of anxiety and mood disorders is unravelled, it will be of interest to  
36 explore if common polymorphisms linked to these disorders are also associated with  
37 DLE.  
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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<sup>27,28</sup> which may lead to aberrant assignment of salience and delusional experiences.<sup>29</sup> However, it is also possible that acute psychotic episodes can precede and predict anxiety or depressive disorders.<sup>11</sup>

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.<sup>30</sup> 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.<sup>31</sup> 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.<sup>24,32-34</sup>

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9 There is now robust and consistent evidence indicating that those with anxiety disorders  
10 and MDD have an increased risk of DLE. For example, clinicians involved in the care of  
11 those with primary diagnoses of anxiety disorder or depression may not routinely  
12 enquire about DLE. In light of the association between DLE and suicidal  
13 ideation/behaviour,<sup>3</sup> the presence of these experiences may suggest that clinical care  
14 plans place greater emphasis on the detection and management of suicidal ideation. It  
15 is too early to be making such recommendations with confidence. However,  
16 understanding the relationship and time course between DLE, and anxiety and  
17 depression may provide insights into shared pathways that underpin both psychotic  
18 disorders and common mental disorders. Once we understand these causal pathways,  
19 potential clinical implications warrant closer scrutiny.  
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### 31 **Competing interest** None

32  
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34  
35 **Funding** This research received no specific grant from any funding agency in the  
36 public, commercial or not-for-profit sectors.  
37  
38

39 **Contributors** JM, SS and JS have directly participated in the planning and execution  
40 of the study. SS analysed the data. All authors have critically read, and approved the  
41 final version submitted.  
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45 **Provenance and peer review** Not commissioned; externally peer reviewed  
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48 **Data sharing statement** The data are available from the Australian Bureau of  
49 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 n (%)	Delusional-like experiences endorsement	
		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)
<sup>1</sup> 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)
<sup>2</sup> Any Major depressive disorder: lifetime	651 (5.34)	444 (4.77)	207 (16.78)

<sup>1</sup>Anxiety disorders based on CIDI DSM diagnosis

<sup>2</sup>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 <sup>1</sup> OR <sup>3</sup> (95% CI <sup>4</sup> )	Model 2 <sup>2</sup> OR <sup>3</sup> (95% CI <sup>4</sup> )	Model 1 <sup>1</sup> OR <sup>3</sup> (95% CI <sup>4</sup> )	Model 2 <sup>2</sup> OR <sup>3</sup> (95% CI <sup>4</sup> )
Anxiety disorders: lifetime <sup>ⓐ</sup>	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 <sup>#</sup>	3.63 (2.75, 4.79)*	2.17 (1.65, 2.86)*	2.91 (1.84, 4.59)*	1.63 (1.10, 2.42)*

<sup>1</sup>Model 1= Adjusted for age and sex

<sup>2</sup>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)

<sup>ⓐ#</sup>Anxiety and depressive disorders were based on CIDI DSM diagnosis

<sup>3</sup>OR=Odds ratio; <sup>4</sup>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)**

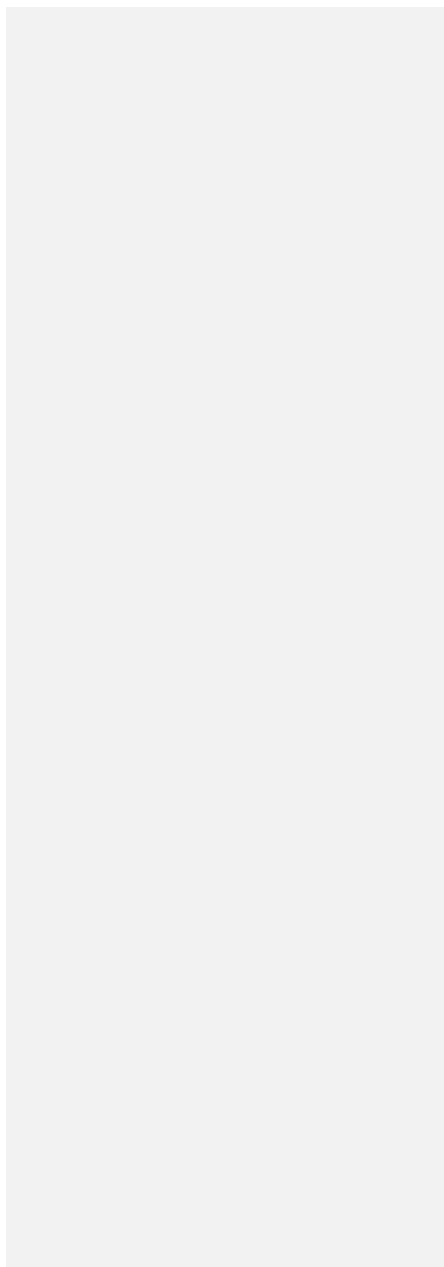
	Delusional-like experiences				
		Screen items	Probe items		
	Number	Model 1 <sup>2</sup>	Model 2 <sup>3</sup>	Model 1 <sup>2</sup>	Model 2 <sup>3</sup>
	(%, SE <sup>1</sup> )	OR <sup>4</sup> (95% CI <sup>5</sup> )	OR <sup>4</sup> (95% CI <sup>5</sup> )	OR <sup>4</sup> (95% CI <sup>5</sup> )	OR <sup>4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

<sup>1</sup>SE= Standard error of estimates; <sup>2</sup>Model 1= Adjusted for age and sex; <sup>3</sup>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)

<sup>4</sup>OR=Odds Ratio; <sup>5</sup>CI= Confidence Interval; \*significance:  $p<0.001$

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For peer review only



## Appendix 1 CIDI Screen items and Probes for delusional-like experiences<sup>1</sup> (n=10,554<sup>2</sup>)

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### 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?

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<sup>1</sup>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.

<sup>2</sup>sample excludes item G4 (*Has a doctor ever told you that you may have schizophrenia?*) (n=87)





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

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2012-001001.R2
Article Type:	Research
Date Submitted by the Author:	25-Apr-2012
Complete List of Authors:	Saha, Sukanta; The Park Centre for Mental Health, Queensland Centre for Mental Health Research Scott, James; The Park Centre for Mental Health, Queensland Centre for Mental Health Research Varghese, Daniel; Princess Alexandra Hospital, McGrath, John; University of Queensland, Queensland Brain Institute
<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Epidemiology, Mental health
Keywords:	EPIDEMIOLOGY, MENTAL HEALTH, Adult psychiatry < PSYCHIATRY, Schizophrenia & psychotic disorders < PSYCHIATRY

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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

Main text: 1994 (excluding tables and references)

Tables 3

Appendices: 1

Key words: Delusional-like experiences, Anxiety disorders, Depressive disorders

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 Australia 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

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

16  
17 Delusional-like experiences are associated with a wide range of anxiety disorders and  
18 are more prevalent in those with MDD. Understanding the relationship between DLE,  
19 anxiety disorders and depression may provide insights into shared pathways that  
20 underpin both psychotic disorders and common mental disorders.  
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## 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.<sup>1-10</sup> 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.<sup>11</sup> In the NEMESIS study, subjects with obsessive compulsive symptoms were more likely to develop incident psychotic symptoms three years later.<sup>12</sup> 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.<sup>13</sup> A German community-based study found an association between social phobia, social anxiety and DLE,<sup>14</sup> 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.<sup>15</sup>

Trauma exposure with or without post-traumatic stress disorder has been associated with DLE.<sup>7</sup> Several Australian studies<sup>10,16</sup> 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.

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9 With respect to depression, several studies have found that individuals with depression  
10 are significantly more likely to endorse DLE.<sup>9,10,16,17</sup> Studies also show that DLE  
11 requiring clinical care were progressively more likely to occur with greater levels of  
12 affective dysregulation (depressive symptoms and hypo-manic symptoms).<sup>18</sup>  
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14 Importantly, there was a significant association between severity of depressive  
15 symptoms and persistence of psychotic symptoms.  
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21 While longitudinal studies are required to explore the temporal sequence between  
22 depression, anxiety and DLE, we had the opportunity to replicate our previous findings  
23 with respect to the cross-sectional association between DLE and (a) broadly defined  
24 anxiety disorders, and (b) MDD.<sup>10</sup> Based on our previous studies, we predicted that  
25 those with anxiety disorder or major depression disorder would be more likely to  
26 endorse DLE. In addition, we were able to explore the association between DLE and a  
27 range of specific anxiety disorders. Furthermore, we were able to examine if severity of  
28 major depressive disorder influenced the risk of endorsement of DLE – we predicted  
29 that those with more severe MDD would be more likely to endorse DLE compared to  
30 those with milder forms of MDD.  
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## 41 42 43 44 **METHODS**

### 45 46 47 **Participants**

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

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33 Mental disorders were assessed by a modified version of the Composite International  
34 Diagnostic Interview (CIDI)<sup>20</sup> which yielded diagnoses of DSM-IV disorders. Briefly,  
35 within the CIDI there are three items related to identifying individuals who may be  
36 psychotic (*G Items*: “screening items”). For those who endorsed the screen item, a  
37 follow-up item was used to further explore the delusional-like nature of the experiences  
38 (“probe items”). Full details of the screen and probe items are provided in Appendix 1.  
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40 The items covered the following features of psychotic disorders: delusions of control,  
41 thought interference and passivity (Question 1 and 1a); delusions of reference or  
42 persecution (Question 2 and 2a); and grandiose delusions (Question 3 and 3a). There  
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50 was no item to assess hallucinations.  
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9 Based on CIDI-derived DSM-IV criteria, we identified subjects who had lifetime  
10 diagnoses of: (a) an anxiety disorder, (b) major depressive disorder. Anxiety disorders  
11 included panic disorder with or without agoraphobia, social phobia, generalised anxiety  
12 disorder (GAD), obsessive compulsive disorder (OCD), and agoraphobia without panic  
13 disorder. For those with MDD, allocation to subtypes was based on the total number of  
14 particular 'depressive' symptoms with the duration of at least two weeks. Full details of  
15 the symptom list and related rules to deal with multiple episodes can be found in the full  
16 report.<sup>21</sup> In brief, mild MDD was characterised by the presence of at least four  
17 symptoms, moderate MDD with at least six symptoms, and severe MDD with at least  
18 eight symptoms. These subtypes of MDD were mutually exclusive.  
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29 To ascertain trauma exposure, the CIDI elicits responses from 10 questions pertaining  
30 to past exposure to traumatic events. Details of the trauma variables have been  
31 published previously by our group.<sup>7,8</sup> In keeping with our previous analyses<sup>1-10</sup>  
32 individuals who screened positively for schizophrenia (i.e. respondents who reported  
33 'Yes' to the item "*Had been told at any time by a psychiatrist that they had*  
34 *schizophrenia*") were excluded from the analyses (n=87) leaving a total of 10,554  
35 subjects for this study.  
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## 46 **Statistical analysis**

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48 To examine the association between DLE and both anxiety disorders and MDD, logistic  
49 models were fitted to the data while adjusting for various confounding factors. Because  
50 sex and age are associated with DLE,<sup>9,10,22</sup> we included these as covariates in the main  
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9 analyses. In keeping with our previous studies, we included a range of CIDI-derived,  
10 potential confounding variables in Model 2. These include substance misuse,<sup>23</sup> marital  
11 status, and migrant status,<sup>24</sup> educational status, employment status and family income,  
12 and trauma exposure.<sup>2,6-8</sup> As co-morbidity frequently occurs between anxiety disorders  
13 and MDD, we also adjusted for the presence of the other psychiatric diagnoses under  
14 investigation (i.e. the association between MDD and DLE was adjusted for the presence  
15 of anxiety disorders, and the association between anxiety disorders and DLE was  
16 adjusted for the presence of Major Depressive Disorder).  
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26 For secondary analyses (a sensitivity analysis), we repeated the main analyses  
27 excluding the second screen items (“Have you ever had a feeling that people were too  
28 interested in you?”) because clinical experience suggests that this is a common  
29 experience in social anxiety.  
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35 The sample was weighted to adjust for differential probabilities of selection within  
36 households, over-sampling of population subgroups and non-response to match census  
37 population distribution on a number of geographic and socio-demographic variables.  
38 The initial weights were calibrated against known population estimates. Replicate  
39 weight variables were developed using the Jack-knife procedure of replication (i.e., the  
40 analysis was repeated after one subject was dropped and then the standard error was  
41 derived from the distribution of results from all “minus one” resamples).<sup>25</sup> Analyses  
42 were performed using Proc *Surveylogistic*<sup>26</sup> which is designed to analyse complex  
43 survey sample using SAS (version 9.3; Cary, NC: SAS Institute). Chi-square test-for-  
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9 linear trend was used to assess dose-response relationships between the exposure  
10 variables and DLE.  
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## 12 13 14 **RESULTS**

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18 Of the 10 554 subjects surveyed, 11.6% (n=1276) positively endorsed one or more DLE  
19 items (Table 1). There was a weak effect of females being more likely to endorse DLE  
20 than males (Odd Ratio (OR) 1.05; 95% Confidence Intervals (CI) 1.04-1.05). The  
21 prevalence of lifetime diagnosis of any anxiety disorder was 4.9% (n=580), and the  
22 prevalence of lifetime depressive disorders was 5.3% (n=651).  
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34 As predicted, the main analyses showed that those with any anxiety disorder and  
35 participants who had lifetime diagnosis of MDD were significantly more likely to endorse  
36 delusional-like experiences. Those with anxiety disorders were two to three times more  
37 likely to endorse both DLE screen and probe items (Table 2), and those with a  
38 diagnosis of major depressive disorder were also two to three times more likely to  
39 endorse DLE screen and probe items.  
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9 Concerning the subtypes of anxiety disorders, each disorder was significantly  
10 associated with DLE screen items, and there were no marked differences in the effect  
11 sizes between the different disorders (Table 3). There was a dose response relationship  
12 between the severity of the MDD and DLE in which severe depression showed twice the  
13 odds of endorsement of DLE screen items compared with a diagnosis of mild major  
14 depressive disorder with a significant linear trend ( $\chi^2=44.19$ ,  $p<.0001$ ). Broadly similar  
15 (but less precise) associations were also found for probe items.  
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28 In the secondary analysis, when we conducted the models using two DLE items (G1 &  
29 G3), the pattern of significant association for major anxiety and depressive disorders  
30 remained unchanged (data not shown).  
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## 36 DISCUSSION

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38 Individuals with a lifetime diagnosis of major depressive disorder or an anxiety disorder  
39 were significantly more likely to report DLE compared to those without these disorders.  
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42 We found that each subtype of anxiety disorder was associated with DLE, and there  
43 were no marked differences in the effect sizes for these associations (the confidence  
44 intervals around these associations overlapped). Based on this same sample, we have  
45 previously demonstrated that trauma exposure without Post-traumatic Stress Disorder  
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9 was associated with DLE.<sup>7</sup> Our new findings add additional weight to the conclusion that  
10 a range of disorders with prominent anxiety symptoms are associated with DLE.  
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14 As predicted, there was also a dose response relationship between severity of MDD  
15 and DLE. All associations remained significant when adjusted for associated co-  
16 morbidity with anxiety, alcohol and illicit substance misuse and any traumatic life events  
17 indicating that the associations are independent of co-morbid psychiatric illnesses, and  
18 selected environmental and demographic risk factors.  
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25 The mechanisms linking DLE with anxiety disorder and MDD remain unclear. However,  
26 there is evidence to suggest that shared familial factors may contribute to these  
27 findings.<sup>9</sup>  
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33 In the current study we were not able to examine the temporal sequence between the  
34 variables of interest – for example, we do not know if anxiety or depressive symptoms  
35 preceded the onset of DLE or vice versa. Unfortunately, the delusional like experience  
36 have no information about age of onset nor presence during the last twelve months.  
37  
38 Thus, while the CIDI has some information about the age of onset and the presence of  
39 the disorder in the past year, the lack of comparable data for the DLE compromises out  
40 ability to infer temporal sequence. Longitudinal studies will be required to explore this  
41 particular research question. The reliance on life-time measures of both DLE and  
42 mental disorders is also problematic, as it is known that respondents tend to under-  
43 report true lifetime prevalence estimates.<sup>27</sup> While the interviewers were trained, the  
44 diagnoses of MDD and anxiety disorders were not validated by clinical assessment.  
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9 However, the CIDI is generally regarded as having good psychometric properties for  
10 common mental disorders.<sup>28</sup> Comorbidity between anxiety disorders and MDD is  
11 common, and while we included adjustments in the our models to attempt to account for  
12 this feature, the complex nature of the relationships between DLE, MDD and anxiety  
13 disorders could reduce the accuracy of the odds ratios.<sup>29</sup> We had a small number of  
14 screen and probe items to measure delusional-like experiences and there were no  
15 items for hallucinations. However, previous general population studies have found a  
16 strong association between the presence of DLE and hallucinations.<sup>24,30-32</sup>  
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26 There is now robust and consistent evidence indicating that those with anxiety disorders  
27 and MDD have an increased risk of DLE. For example, clinicians involved in the care of  
28 those with primary diagnoses of anxiety disorder or depression may not routinely  
29 enquire about DLE. In light of the association between DLE and suicidal  
30 ideation/behaviour,<sup>3</sup> the presence of these experiences may suggest that clinical care  
31 plans place greater emphasis on the detection and management of suicidal ideation. A  
32 recent study based on adolescents found that most individuals (57 to 80% depending  
33 on age) who reported psychotic-like experiences (e.g. hallucinations and/or DLE), had  
34 at least one diagnosable non-psychotic psychiatric disorder.<sup>33</sup> We agree with these  
35 authors, who note that psychotic symptoms appear to be important risk markers for a  
36 wide range of non-psychotic mental health disorders.  
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48 **Competing interest** None  
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15 final version submitted.  
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19 **Provenance and peer review** Not commissioned; externally peer reviewed  
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23 **Data sharing statement** The data are available from the Australian Bureau of  
24 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 n (%)	Delusional-like experiences endorsement	
		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)
<sup>1</sup> 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)
<sup>2</sup> Any Major depressive disorder: lifetime	651 (5.34)	444 (4.77)	207 (16.78)

<sup>1</sup>Anxiety disorders based on CIDI DSM diagnosis

<sup>2</sup>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 <sup>1</sup> OR <sup>3</sup> (95% CI <sup>4</sup> )	Model 2 <sup>2</sup> OR <sup>3</sup> (95% CI <sup>4</sup> )	Model 1 <sup>1</sup> OR <sup>3</sup> (95% CI <sup>4</sup> )	Model 2 <sup>2</sup> OR <sup>3</sup> (95% CI <sup>4</sup> )
Anxiety disorders: lifetime <sup>ⓐ</sup>	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 <sup>#</sup>	3.63 (2.75, 4.79)*	2.17 (1.65, 2.86)*	2.91 (1.84, 4.59)*	1.63 (1.10, 2.42)*

<sup>1</sup>Model 1= Adjusted for age and sex

<sup>2</sup>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)

<sup>ⓐ#</sup>Anxiety and depressive disorders were based on CIDI DSM diagnosis

<sup>3</sup>OR=Odds ratio; <sup>4</sup>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)**

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

<sup>1</sup>SE= Standard error of estimates; <sup>2</sup>Model 1= Adjusted for age and sex; <sup>3</sup>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)

<sup>4</sup>OR=Odds Ratio; <sup>5</sup>CI= Confidence Interval; \*significance:  $p<0.001$

## Appendix 1 CIDI Screen items and Probes for delusional-like experiences<sup>1</sup> (n=10,554<sup>2</sup>)

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### 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?

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<sup>1</sup>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.

<sup>2</sup>sample excludes item G4 (*Has a doctor ever told you that you may have schizophrenia?*) (n=87)