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ORIGINAL ARTICLE

Clinical significance of psychotic experiences in the context of sleep disturbance or substance use

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Background. Psychotic experiences (PE) are commonly reported in the general population, where they are associated with elevated clinical need and functional impairment. Research studies typically exclude PE that occur in the context of sleep or substance use (PE-SS), based on the assumption that they are normative within these contexts. This is the first study to formally test clinical and functional outcomes associated with PE that occur in the context of sleep or substance use.

Method. Data from the Collaborative Psychiatric Epidemiology Surveys ($n = 11\,776$) were used to assess the associations between both PE and PE-SS and a broad range of outcomes, including psychiatric co-morbidity, suicidal behavior, mental health treatment utilization and World Health Organization (WHO) domains of function, using logistic regression analyses. Lifetime PE and PE-SS were mutually exclusive categories, assessed using the WHO Composite International Diagnostic Interview psychosis screen.

Results. PE were associated with all 10 clinical and functional outcomes. Similarly, respondents reporting PE-SS had greater clinical need and impaired function relative to controls, which was significant for seven of the 10 outcome variables. When directly compared, the PE and PE-SS groups differed only in their associations with role function (greater impairment for PE) and self-care (greater impairment for PE-SS).

Conclusions. PE-SS were associated with a broad range of clinical and functional outcomes in this large general population sample. These associations were similar to those found for PE. Future studies should investigate relative differences between sleep- and substance-induced PE.

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Key words: Collaborative Psychiatric Epidemiology Surveys, epidemiology, psychosis, sleep, substance use.

Introduction

An estimated 7.2% of the general population report subthreshold psychotic experiences (PE) but do not meet criteria for a diagnosable psychotic disorder (Linscott & van Os, 2013). Prior research has shown PE to be clinically meaningful (Oh *et al.* 2015) and independently associated with need for care and help-seeking behavior (Murphy *et al.* 2012; DeVylder *et al.* 2014*b*), despite typically being of less intensity and persistence relative to symptoms of diagnosable psychotic disorders (van Os *et al.* 2009). Specifically, epidemiological studies have shown PE to be robust indicators of suicide risk (Kelleher *et al.* 2012*b*, 2013; Fisher *et al.* 2013; Capra *et al.* 2015; DeVylder *et al.* 2015; Koyanagi *et al.* 2015; Martin *et al.* 2015), psychiatric morbidity (Kelleher *et al.* 2012*a*; Wigman *et al.* 2012; DeVylder *et al.* 2014*a*) and functional impairment (Kessler *et al.* 2005; Wigman *et al.* 2014; Kelleher *et al.* 2015).

Epidemiological studies of PE have typically excluded experiences that occurred in the context of sleep or substance use (PE-SS) based on the assumption that unusual perceptions or thoughts that occur in these contexts differ from other PE in their clinical significance (e.g. Kelleher *et al.* 2012*a*, *b*, 2013; DeVylder *et al.* 2015; McGrath *et al.* 2015). To our knowledge, just one study to date has investigated PE attributed to sleep or fever as a distinct category, specifically in relation to risk for psychotic disorder (Zammit *et al.* 2014). However, beyond the single outcome of psychotic disorder, to our knowledge, there has been no research to date to assess the clinical and functional significance of PE that occur in the context of sleep or substance use, or research to compare PE-SS with other PE.

This study used data from the Collaborative Psychiatric Epidemiology Surveys (CPES) to examine the clinical and functional significance of PE that

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occurred in the context of sleep or substance use (PE-SS). Specifically, we tested the relationship between both PE and PE-SS with (i) anxiety disorders, (ii) depressive disorders, (iii) suicidal ideation, (iv) suicide attempts, (v) social functioning, (vi) cognitive functioning, (vii) time out of role, (viii) self-care, (ix) mobility and (x) mental health service utilization. We then tested whether the strength of these associations significantly varied between PE and PE-SS. We hypothesized based on prior research that PE would be related to all clinical and functional outcomes and explored whether PE-SS differed from PE in relation to these outcomes.

Method

Participants

The CPES dataset consists of three lay-administered national household surveys using similar methodology and sampling design, comprising a total sample of 20 013 adults (age 18+ years). Full details of the CPES study methodologies are available elsewhere (Heeringa *et al.* 2004). In brief, the National Comorbidity Survey – Replication (Kessler *et al.* 2004) is a nationally representative sample of 9282 adults, of which a random subsample ($n = 2322$) completed the psychosis screen. The National Latino and Asian American Study (NLAAS; Alegría *et al.* 2004) is a representative sample of Latino and Asian American households ($n = 4649$). The National Survey of American Life (Jackson *et al.* 2004) is a nationally representative sample of African-American households ($n = 3570$), with Afro-Caribbean ($n = 1621$) and Caucasian ($n = 891$; not assessed with psychosis screen) individuals drawn from the same source neighborhoods. Respondents were included if they completed the psychosis screen and excluded if they had a lifetime diagnosis of bipolar disorder (based on clinical interview; not assessed in NLAAS) or schizophrenia (based on self-report), in an effort to maintain focus on subthreshold psychosis rather than psychotic disorder, as done in prior studies with this and other datasets (e.g. DeVylder *et al.* 2014*a*, *b*; McGrath *et al.* 2015). The final sample consisted of data from $n = 11\,776$ respondents.

Measures

PE were assessed using the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI) 3.0 psychosis screen, which includes two items assessing hallucination-like experiences (visual hallucinations, auditory hallucinations) and four items assessing delusion-like experiences (thought insertion, thought control, telepathy, delusions of persecution). Respondents who endorsed PE were asked whether the experiences took place in the context of falling asleep or substance use. PE were coded as a three-level categorical variable indicating: (1) no PE; (2) PE only in the context of sleep or substance use (PE-SS); and (3) PE, at least one of which occurred outside of the context of sleep or substance use. The sample was divided into three discrete groups based on this categorization. All analyses focused on lifetime psychotic symptoms given that follow-up questions regarding age of onset, frequency and 12-month prevalence were not assessed for PE-SS.

Lifetime suicidal ideation and attempts were assessed using the WHO-CIDI suicidality module. This module was administered in written form for respondents literate in English, 81.4% (S.D. = 1.4%) of the weighted sample, given that written assessments facilitate accurate reporting of socially undesirable or stigmatized behaviors (Turner *et al.* 1998). The remaining respondents were assessed orally in their primary language, if other than English. Suicide-related outcomes were collapsed across response type, as per previous analyses with these data (DeVylder *et al.* 2015). Specific items assessed whether respondents had ever seriously thought about committing suicide and whether they had ever attempted suicide, and positive responses were verified through follow-up questions regarding the timing and frequency of events.

Functional impairment over a 30-day recall period was assessed using the WHO Disability Assessment Schedule indicators of social function, cognitive function, time out of role, self-care and mobility (each dichotomized into low or high impairment, with high impairment defined as the lowest 20% of scores; Kessler *et al.* 2005).

Lifetime diagnoses of depressive and anxiety disorders were assessed using WHO-CIDI modules, based on Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) criteria. Respondents were coded positive for depressive disorders if they met criteria for either major depression or dysthymia. Respondents were coded positive for anxiety disorders if they met criteria for generalized anxiety disorder, agoraphobia with or without panic disorder, panic disorder, social phobia or post-traumatic stress disorder.

Mental health treatment utilization was coded as a dichotomous variable indicating whether respondents had seen any mental health professional during their lifetimes. 'Mental health professional' was broadly defined to include psychiatrists, psychologists, clinical social workers or other counseling professionals seen for mental health reasons, as per previous analyses with these data (DeVylder *et al.* 2014*b*).

Additional information on the coding of each measure is provided in online Supplementary Table S1.

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Table 1. *Descriptive weighted data, presented for each subset of respondents*

	PE		PE-SS		Controls		Statistical comparisons: p[a]	
	n	% (S.E.)	*n*	% (S.E.)	*n*	% (S.E.)	PE *v.* PE-SS	PE *v.* PE-SS *v.* controls
Demographics								
Age, years							0.712	0.547
18–29	324	27.1 (1.9)	84	25.8 (3.8)	2545	23.7 (1.1)		
30–44	370	28.4 (2.2)	112	32.5 (4.5)	3677	31.4 (0.9)		
⩾45	474	44.5 (2.6)	140	41.7 (6.5)	4050	44.9 (1.4)		
Sex							0.026	0.007
Female	744	59.4 (2.5)	185	45.5 (5.0)	5975	51.2 (0.8)		
Race/ethnicity							0.155	0.003
White, non-Latino	170	45.1 (3.4)	29	33.6 (6.3)	1451	53.0 (2.2)		
Black, non-Latino	558	24.9 (2.0)	142	24.3 (3.7)	4311	18.1 (1.0)		
Latino	318	21.7 (1.9)	105	30.6 (4.4)	2502	19.4 (1.5)		
Other	122	8.2 (2.1)	60	11.5 (2.0)	2008	9.5 (0.8)		
Educational attainment							0.079	0.005
<High school	322	24.2 (2.7)	124	39.3 (6.2)	2351	21.4 (6.2)		
High school graduate	328	29.0 (2.6)	99	28.3 (5.1)	2986	30.8 (1.0)		
Some college	325	28.6 (2.2)	75	19.7 (4.2)	2528	25.0 (0.9)		
>College graduate	192	18.2 (2.1)	38	12.7 (4.6)	2394	22.8 (1.1)		
Household income							0.388	<0.001
Less than $20 000	470	36.1 (3.2)	129	31.7 (4.5)	3068	23.9 (1.0)		
$20 000–39 999	307	23.1 (2.3)	84	21.2 (3.0)	2497	22.1 (0.9)		
$40 000–59 999	127	12.5 (1.7)	45	15.5 (3.1)	1545	17.2 (0.8)		
$60 000–79 999	112	11.7 (1.6)	20	8.3 (2.7)	1130	12.4 (0.6)		
$80 000 or more	151	16.6 (1.9)	58	23.3 (5.7)	2001	24.4 (1.1)		
Substance use							0.413	<0.001
Lifetime DSM-IV disorder	197	21.3 (2.5)	56	24.2 (2.9)	909	10.3 (0.6)		
Clinical/functional outcomes								
Service utilization (lifetime)							0.204	<0.001
Mental health treatment	598	55.3 (2.4)	198	47.8 (5.5)	7521	33.1 (0.9)		
Suicide (lifetime)								
Suicide ideation	267	23.2 (2.2)	65	19.4 (3.8)	899	9.1 (0.5)	0.436	<0.001
Suicide attempts	14	1.1 (0.4)	4	0.3 (0.2)	22	0.2 (0.1)	0.024	<0.001
Morbidity (lifetime)								
Depressive disorder[b]	284	26.8 (2.6)	69	17.9 (4.2)	1333	13.0 (0.7)	0.080	<0.001
Anxiety disorder[c]	408	34.5 (2.1)	94	27.7 (4.1)	1669	16.6 (0.8)	0.155	<0.001
WHO-DAS function								
Mobility	345	28.6 (2.1)	69	27.2 (5.6)	1390	14.7 (0.8)	0.824	<0.001
Self-care	82	7.4 (1.2)	29	13.7 (5.8)	369	3.9 (0.4)	0.170	0.002
Time out of role	431	35.2 (2.4)	97	25.6 (3.2)	1926	18.3 (0.6)	0.038	<0.001
Social function	165	12.0 (1.3)	28	6.4 (1.7)	520	4.5 (0.4)	0.027	<0.001
Cognitive function	265	20.6 (1.9)	61	18.2 (3.7)	902	8.4 (0.5)	0.590	<0.001

PE, Psychotic experiences; PE-SS, PE that occur in the context of sleep or substance use; S.E., standard error; DSM, Diagnostic and Statistical Manual of Mental Disorders, fourth edition; WHO-DAS, World Health Authority Disability Assessment Schedule.

[a] All statistical tests are unadjusted weighted Wald χ^2 tests.

[b] Depressive disorders included major depressive disorder or dysthymia.

[c] Anxiety disorder included generalized anxiety disorder, agoraphobia with and without panic disorder, panic disorder, social phobia and post-traumatic stress disorder.

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Table 2. *Specific symptoms within PE and PE-SS groups*

Specific symptoms	PE	PE-SS	Wald χ^2, p[a]
Visual hallucinations	73.6 (1.8)	63.4 (3.4)	13.23, $p = 0.007$*
Auditory hallucinations	46.1 (2.8)	38.5 (3.5)	5.97, $p = 0.140$
Thought insertion	4.1 (0.7)	2.5 (1.5)	1.79, $p = 0.435$
Thought control	1.7 (0.4)	4.2 (1.8)	7.26, $p = 0.053$
Telepathy	7.6 (1.1)	4.1 (1.5)	4.99, $p = 0.131$
Delusions of persecution	8.2 (1.1)	9.7 (2.2)	0.75, $p = 0.540$

Data are given as weighted estimate of percentage (standard error).

PE, Psychotic experiences; PE-SS, PE that occur in the context of sleep or substance use.

[a] Wald tests compare the prevalence of each specific symptom (unadjusted) between the PE and PE-SS groups. Some participants categorized within the PE group may have also experienced PE-SS for some symptom subtypes.

* $p < 0.05$.

Data analysis

Logistic regression analyses were used to test for associations between PE, PE-SS and clinical and functional outcomes. Primary analyses were *a priori* adjusted for demographics (age, race/ethnicity, sex, income and education) and lifetime diagnosis of any substance use disorder. Adjustments were made for substance use to reduce the likelihood that any clinical correlates of PE-SS are simply secondary to and better explained by a primary substance use disorder. Sensitivity analyses were run adjusting for any lifetime use of any illicit substance (rather than substance use disorder), which did not significantly affect any results. All analyses used a design-based approach with Taylor series linearization, conducted with SPSS (USA) complex samples features utilizing CPES sampling weights to account for individual-level sampling factors including non-response and unequal probabilities of selection.

Results

Descriptive demographic and clinical data by PE group, as well as unadjusted between-group statistical comparisons, are provided in Table 1. The weighted lifetime prevalence of PE was 8.7% (S.E. = 0.4%), and PE-SS was 2.5% (S.E. = 0.3%). Most symptom subtypes were similarly prevalent among the PE and PE-SS groups, although visual hallucination-like experiences were more common in the PE group (Table 2).

Individuals with PE demonstrated statistically significant odds for greater impairment on all 10 clinical and functional outcomes compared with controls. Individuals with PE-SS also demonstrated greater odds for all 10 outcomes, seven of which were statistically significant, including (i) anxiety disorders, (ii) suicidal thoughts, (iii) cognitive function, (iv) self-care, (v) mobility, (vi) time out of role and (vii) treatment utilization. Analyses to compare the PE and PE-SS groups on all 10 outcomes showed a significant difference in only two measures: time out of role (greater time out of role for PE) and self-care (greater impairment for PE-SS). Individuals with PE and PE-SS did not differ significantly on any of the other eight outcomes measures (Table 3; see also online Supplementary Table S2).

Discussion

In a population sample of 11 776 individuals, PE and PE-SS were associated with a broad range of clinical and functional outcomes. Specifically, both individuals with PE and PE-SS, compared with controls, demonstrated greater odds for (i) anxiety disorders, (ii) suicidal ideation, (iii) impaired cognitive functioning, (iv) greater time out of role, (v) impaired self-care, (vi) impaired mobility and (vii) mental health service utilization. Individuals with PE, which were notably more prevalent than PE-SS, additionally demonstrated greater odds for (i) depressive disorders, (ii) suicide attempts and (iii) impaired social function.

Direct comparison of individuals with PE with individuals with PE-SS demonstrated significant differences in two of the 10 outcomes, although most odds ratios were greater than 1 for PE compared with PE-SS. Specifically, respondents with PE were more likely to experience greater time out of role, whereas those with PE-SS were more likely to have difficulty with self-care. The reasons for these differences are not readily apparent given the lack of prior empirical literature on PE-SS. One possibility is that substance use facilitates coping with psychological distress (which may be particularly true for non-white individuals in the USA, which make up the majority of our PE-SS group; Jackson *et al.* 2010) among people who are vulnerable to PE, meaning that individuals with PE who do not use substances may be at greater risk for role impairment. It is possible that substance use may also facilitate social functioning in those with PE-SS *v.* PE (which was marginally significantly different, $p = 0.053$) by alleviating co-morbid anxiety, for example (similar to alcohol use disorder; Crum & Pratt, 2001), although this is likewise speculative pending replication and further exploration of mechanisms. Reverse causality may also be possible, in that better role functioning may increase the odds for PE-SS rather than PE among vulnerable individuals, assuming greater time in role is

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Table 3. *Odds ratios derived from statistical analyses comparing PE and PE-SS groups with controls, and with each other, for all clinical and functional outcomes*[a]

Clinical/functional outcomes	PE-SS *v.* controls	PE *v.* controls	PE *v.* PE-SS
Service utilization (lifetime)			
Mental health treatment	2.24 (1.29–3.89)**	2.49 (1.94–3.21)***	1.12 (0.58–2.17)
Suicide (lifetime)			
Suicide ideation	2.22 (1.27–3.88)**	2.53 (1.85–3.47)***	1.12 (0.63–1.99)
Suicide attempts	1.13 (0.29–4.37)	3.47 (1.56–7.75)**	2.03 (0.54–7.64)
Morbidity (lifetime)			
Depressive disorder	1.43 (0.78–2.62)	2.17 (1.69–2.79)***	1.50 (0.81–2.78)
Anxiety disorder	1.90 (1.22–2.98)**	2.33 (1.83–2.95)***	1.33 (0.80–2.20)
WHO-DAS function[b]			
Mobility	2.35 (1.37–4.03)**	2.19 (1.72–2.79)***	0.90 (0.49–1.62)
Self-care	3.96 (1.59–9.86)**	1.66 (1.05–2.63)*	0.38 (0.15–0.96)*
Time out of role	1.46 (1.02–2.10)*	2.11 (1.69–2.64)***	1.58 (1.04–2.41)*
Social function	1.41 (0.80–2.48)	2.39 (1.72–3.31)***	1.84 (0.99–3.44)†
Cognitive function	2.41 (1.44–4.04)***	2.48 (1.87–3.29)***	1.09 (0.61–1.97)

Data are given as odds ratio (95% confidence interval).

PE, Psychotic experiences; PE-SS, PE that occur in the context of sleep or substance use; WHO-DAS, World Health Authority Disability Assessment Schedule.

[a] Analyses for each outcome are adjusted for age, sex, race/ethnicity, income, education and lifetime substance use disorder.

[b] Function scales are coded so that a positive variable indicates functional impairment. Therefore, odds ratios greater than one indicate greater odds of impairment on a particular domain of function, whereas odds ratios less than one indicate lower odds of impairment on that domain.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

† $p < 0.1$.

associated with a greater likelihood that the individual will encounter situations in which substances are accessible and encouraged through peer influence (e.g. Ennett *et al.* 2006), or will lead to sleep disturbance due to employment or educational responsibilities. This may also explain the association between PE-SS and greater impairment in self-care, given that poor sleep habits and substance use may both be considered indicators of poor self-care. We also cannot rule out type 1 error given the number of statistical tests. Type II error is also possible given the low frequency of some variables within the smaller PE-SS group, particularly suicide attempts. Suicide attempts were significantly more common among those with PE compared with PE-SS in the unadjusted analysis but this was no longer significant in the regression models, possibly due to the low frequency ($n = 4$) of suicide attempts among those with PE-SS. This should be further tested in other samples, given the primacy of suicide risk in the clinical significance of PE (e.g. Kelleher *et al.* 2012*b*, 2013; DeVylder *et al.* 2015).

The findings of the current study demonstrate that, as a group, PE that occur in the context of sleep or substance use are clinically significant and are associated with most of the poor outcomes that have been demonstrated for PE more generally. This is clinically important, given that clinicians may generally believe that PE-SS are normative and, therefore, do not merit particular attention. Our findings that PE-SS are related to negative health outcomes would suggest that such symptoms should receive greater clinical attention when reported. Unfortunately, it was not possible to differentiate between PE in the context of sleep and PE in the context of substance use in the current study. Therefore, we are unable to comment on the relative significance of sleep *v.* substance use; rather, we can only draw conclusions about both sleep- and substance-related PE as a group. Future research should further investigate both individually.

A potential limitation is that some respondents with PE could have been included in the PE-SS group because they recalled or reported only incidences that occurred in the context of sleep or substance rather than other incidences outside of this context. Another potential limitation may be statistical power, despite the large sample size, given the relatively low prevalence of PE-SS. We cannot make causal claims based on these data, due to the cross-sectional nature of the data, as well as the possibility that any associations between PE-SS and clinical or functional outcomes may be driven by sleep disturbances or substance use in of themselves, not by the accompanying psychosis-like

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symptoms. Future studies may further shed light on this issue by testing for whether substance use disorders vary in clinical significance depending on the presence of co-occurring PE.

Strengths of this study include the use of a large general population sample, compiled from three constituent surveys, and the use of the WHO-CIDI, which allows direct comparison between PE and PE-SS. Other psychosis screens and clinical interviews typically entirely exclude PE-SS, or do not formally differentiate them from PE, meaning that the WHO-CIDI psychosis screen is probably the only currently available tool that can make this comparison.

PE-SS are clinically meaningful phenomena and share many of the same clinical correlates as PE. Nonetheless, PE-SS also showed differences from other PE in terms of role function and self-care, which may also point to some differences in terms of clinical significance. Replication of the above results will be valuable. Furthermore, future research should also investigate the relative differences between sleep- and substance-related PE, which are not distinguished in the current iteration of the WHO-CIDI psychosis screen.

Supplementary material

For supplementary material accompanying this paper visit http://dx.doi.org/10.1017/S0033291716000271

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Declaration of Interest

None.

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