Clinical Significance of Psychotic Experiences in the General Population

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ABSTRACT

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Epidemiological studies have demonstrated that the prevalence of psychotic disorders is

exceeded by that of sub-threshold psychotic experiences, which are phenomenologically

similar to threshold psychosis but of less intensity or associated impairment. Recent

research has highlighted the potential clinical significance of psychotic experiences with

regards to psychological distress, service utilization, psychiatric comorbidities, and suicide

risk. The aims of this three paper dissertation are to: 1) determine risk for suicidal

behavior among respondents with psychotic experiences; 2) examine the prevalence of

psychotic experiences among respondents with common mental disorders, and describe

the clinical significance of these symptoms when occurring in the context of common

mental disorders; and 3) evaluate factors associated with the persistence or remission of

psychotic experiences in the general population. For all three papers, data were drawn

from the Collaborative Psychiatric Epidemiology Surveys (n=20,013), composed of the

National Comorbidity Survey-Replication, National Latino and Asian American Study, and

National Survey of American Life. Psychotic experiences and other clinical variables were

assessed using the World Health Organization Composite International Diagnostic

Interview, version 3.0. Analyses consisted primarily of logistic regression models, with

effect sizes calculated as adjusted odds ratios. Psychotic experiences were found to be

associated with elevated risk for suicidal ideation and suicide attempts, and with multiple

co-morbidities with common mental health conditions. The persistence of psychotic

experiences over time was primarily associated with the type of symptom experienced (i.e. hearing voices) and with marital status. Co-morbid mental health conditions, although extensive, did not predict the persistence of psychotic experiences, although persistent psychotic experiences were associated with ongoing suicide risk. Together, these data support the clinical significance of sub-threshold psychotic experiences among a large general population sample of adults in the United States. The most clinically notable features of psychotic experiences are that they indicate drastically elevated risk for suicide attempts (particularly severe attempts with intent to die) and the presence of multiple co-morbid mental health conditions. These findings will have clinical utility in highlighting unique needs of individuals with sub-threshold psychotic symptoms, and will have public health value in identifying a significant risk factor for severe suicidal behavior that may be easily screened in the general population as well as in clinical settings.

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Chapter I

<u>Introduction: Psychotic Experiences</u>

As early as 1969, John S. Strauss proposed that hallucinations and delusions, the characteristic positive symptoms of psychosis, occur along a continuum in the population (Strauss, 1969). Schizophrenia and other psychotic disorders nonetheless continue to be diagnosed as discrete entities. However, the continuum model of psychosis has received considerable attention and renewed interest since being revisited (van Os et al., 2000), and has subsequently received extensive empirical support (Linscott & van Os, 2010; 2013). Lifetime prevalence rates of 'sub-threshold' psychotic experiences (i.e. below threshold required for a diagnosis of a psychotic disorder in terms of intensity, frequency, or insight; American Psychiatric Association, 2013) have been estimated to be approximately 8%, compared to an estimated 3% for full psychotic disorders, with symptoms among psychosis-prone individuals either remitting, persisting, or developing into a full disorder over time (van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009).

Psychotic experiences as clinical phenomena

Psychotic experiences resemble the symptoms of schizophrenia and other psychotic disorders, but are more common in the general population and believed to be of lesser intensity, duration, and associated impairment (van Os et al., 2009). "Sub-threshold" does not necessarily denote an absence of clinical significance, but rather that the particular symptoms are below the categorical thresholds used to identify the presence of psychotic disorder. Several meta-analyses confirm the value of epidemiological studies of these experiences in elucidating the etiology of psychosis and its pattern of occurrence in the population (Linscott & van Os, 2010; 2013). Less attention has been given to the clinical

significance of these sub-threshold experiences, although recent studies have suggested

that they may be precursors to threshold psychotic disorder (Dominguez, Wichers, Lieb,

Wittchen, & van Os, 2011; Fisher et al., 2013; Hanssen, Bak, Bijl, Vollebergh, & van Os, 2005;

Poulton et al., 2000; Werbeloff et al., 2012), useful indicators of co-morbidity (van Nierop et

al., 2012; Varghese et al., 2011; Wigman et al., 2012) and suicidality (Fisher et al., 2013;

Kelleher et al., 2012a; Nishida et al., 2010; Saha et al., 2011a), and clinically impairing in

their own right (Armando et al., 2010; Bak et al., 2003; 2005; DeVylder, Oh, Corcoran, &

Lukens, in press; Murphy, Shevlin, Houston, & Adamson, 2012; Yung et al., 2006; 2009).

It would be consistent with a continuum model of psychosis to assume that need for

care and clinical significance associated with psychosis is likewise continuous. That is,

clinical need may be associated with the entire range of psychotic experiences rather than

solely with diagnosable psychotic disorders. Alternatively, it is possible that the purported

clinical significance is due to confounding given that psychotic experiences are associated

with many risk factors for psychopathology in general, and that common mental health

conditions such as affective, anxiety, and substance use disorders are frequently present in

people who report psychotic experiences. In this scenario, the psychotic experiences may

be a clinically insignificant artifact that manifests more commonly in individuals who are

otherwise at greater risk for psychopathology and in greater need for clinical treatment.

The goal of this dissertation is to further explore the clinical significance of

psychotic experiences in the general population, using data from the Collaborative

Psychiatric Epidemiology Surveys (CPES; Alegría, Jackson, Kessler, & Takeuchi, 2007a).

CPES is a national household survey of 20,013 adults, age 18 and over. CPES data is

assembled from three constituent surveys conducted in the United States: 1) the National

Comorbidity Survey-Replication, a nationally representative sample (Alegría, Jackson, Kessler, & Takeuchi, 2007b; Kessler et al., 2004), 2) the National Latino and Asian American Study, a national area probability sample with supplements for adults of Latino and Asian national origin (Alegría et al., 2004; Alegría & Takeuchi, 2007), and 3) the National Survey of American Life, a nationally representative sample of African-Americans, with Afro-Caribbean and non-Hispanic white adults drawn from the same source population and of similar socioeconomic status (Jackson et al., 2004; 2007). This publicly available data set has several features that make it particularly amenable to these research questions, in that it assesses psychotic experiences and psychiatric diagnoses using the reliable World Health Organization Composite International Diagnostic Interview (WHO-CIDI; Kessler & Üstün, 2004) assessment, in that it assesses not only current (12-month) but also lifetime prevalence of disorders as well as suicidality, in that it assesses numerous potential environmental and psychosocial risk factors, and finally in that it assesses clinical treatment, help-seeking behavior, and need for care.

Dissertation aims and hypotheses

This three-paper dissertation explores the clinical significance of psychotic experiences in the general population in terms of suicidality, co-morbidities with common mental health conditions, and persistence of symptoms over time, with a precursor paper exploring the validity of the measurement of psychotic experiences in this sample. The hypothesis of the first paper is that psychotic experiences will be associated with increased risk for suicidal thoughts and behavior, based on prior studies of psychotic experiences in adolescents, with the competing null hypothesis that associations with suicidality arise following clinical onset of schizophrenia and other psychotic disorders, and therefore

would not be found for population-level psychotic experiences. The hypothesis of the second paper is that psychotic experiences will be associated with a range of common mental disorders, and particularly multi-comorbidity, although limited prior research suggests that these associations may be limited exclusively to post-traumatic stress disorder. The third study is more exploratory in nature, predicting that persistence of psychotic experience will be related to sociodemographic and clinical factors, with particular attention given to the role of co-morbidities and suicidal behaviors analyzed in the primary two papers.

Sub-threshold psychotic experiences are likely highly prevalent among recipients of social work services, as they are in the population as a whole, but their clinical meaning has been largely unexplored, particularly from a social work perspective. These papers together will expand our current knowledge base on the clinical significance of sub-threshold psychotic experiences, and will guide social work and public health efforts to appropriately respond to such experiences.

Chapter II

Descriptive Data, Cultural Validity, and Social Desirability Biases

Epidemiological studies have shown that the prevalence of psychotic disorders is far exceeded by that of sub-threshold psychotic experiences, which are phenomenologically similar to threshold psychosis but of less intensity or associated impairment (Linscott & van Os 2010; 2013; van Os et al., 2009). The most recent meta-analytic estimates report that psychotic experiences occur with a lifetime prevalence of 7.2% and median annual incidence of 2.5% in the general population, with substantial variance in prevalence estimates reflecting methodological differences between studies (Linscott & van Os, 2013). Despite this wide methodological variance there have been very few attempts to formally assess the validity of measures of psychotic experiences, although the limited existent research has supported the use of self-report screens as valid measures of clinician-assessed psychotic or psychosis-like experiences (Kelleher, Harley, Murtagh, & Cannon, 2011). It is crucial to have clinically and culturally valid measures of psychotic experiences given their importance as significant phenomena that may further indicate the incipient onset of more severe mental health conditions.

This dissertation measures sub-threshold psychotic experiences using the psychosis screen from the World Health Organization Composite International Diagnostic Interview (WHO-CIDI), version 3.0 (Kessler & Üstun, 2004). Information on the validity of this measure primarily comes from analysis of its validity through reassessment of positive screens with clinical interview in the predominantly European-American NCS-R. In this analysis, clinicians classified 16.8% of respondents endorsing psychotic experiences as "probable" cases of non-affective psychosis, with non-affective psychosis diagnoses

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disproportionately applied in greater numbers to individuals with delusional experiences, as opposed to visual or auditory hallucinations (Kessler et al., 2005a). Remaining positive screens were identified by clinicians primarily as either "possible" cases (19.2%), culturally appropriate (32.1%), or "odd but not psychotic" (26.6%).

It is not known how these findings would generalize to the NLAAS (Asians and Latinos in the United States) and NSAL (African Americans and Afro-Caribbeans in the United States) samples, which vary from the NCS-R primarily in terms of ethnicity and did not include the clinical reappraisal interviews. The frequency with which clinicians determined psychotic experiences to be "culturally appropriate" in the NCS-R would suggest that cultural and possibly ethnic differences may influence responses to screen items. Several studies have shown ethnic difference in prevalence of psychotic experiences (Johns et al., 2002; 2004; King et al., 2005; Morgan et al., 2009) but it is not known if this is due to true prevalence differences or due to cross-cultural variance in the validity of psychosis screens. Of note, prevalence of schizophrenia likewise varies by ethnicity even when assessed using clinical interview, with African-Americans in particular at greatest risk for schizophrenia in the United States (Bresnahan et al., 2007). Nuevo and colleagues (2009) found a wide range of prevalence estimates across countries (from 0.8% to 31.4%) using the WHO-CIDI psychosis screen, version 3.0, although these symptoms were uniformly associated with poorer health status regardless of overall prevalence. This suggests a similar level of clinical significance across the nations studied, although similar analyses have not yet been published across ethnicities within a single nation.

The validity of psychosis screens may also be influenced by social desirability bias, the tendency of respondents to answer questions in a way that may be viewed favorably by

others (Crowne & Marlowe, 1960; King & Bruner, 2000). Social desirability bias is common in research on mental health (e.g. Davis, Thake, & Vilhena, 2010; Soubelet & Salthouse, 2011), and can produce false positive associations or obscure true relationships (Ganster, Hennesseey, & Luthans, 1983; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Psychotic experiences are publicly stigmatized as socially undesirable behaviors (Schomerus, Matschinger, & Angermeyer, 2013; Yang et al., 2013), particularly among African-Americans (Anglin, Link, & Phelan, 2006), and as such may be hidden by respondents and underreported across the population. Although certain early psychosis proneness scales were developed to minimize social desirability bias (Chapman et al., 1994), there are no prior published studies directly examining the relationship between social desirability and self-reported psychotic experiences.

Prior to describing the three studies that are the focus of the dissertation, it is necessary to establish basic descriptive data for psychotic experiences, as the primary variables of interest in all three papers, including their prevalence, frequency, and average age of onset. Lifetime prevalence of psychotic experiences was expected to approximate that found in meta-analyses (i.e. 7.2%; Linscott & van Os, 2013). In addition, this precursor chapter will be used to discuss the cross-cultural validity of the measurement of psychotic experiences in these data, as well as the possible role of social desirability biases in endorsing items assessing these experiences. Cross-cultural validity would be supported by similar associations between psychotic experiences and both treatment-seeking and social desirability across ethnic groups.

Method

Participants

Data for this dissertation were drawn from the National Comorbidity Survey-Replication (NCS-R; Alegría et al., 2007b; Kessler et al., 2004), National Latino and Asian American Study (NSAAL; Alegría et al., 2004; Alegría & Takeuchi, 2007) and the National Survey of American Life (NSAL; Jackson et al., 2004; Jackson et al., 2007). These studies collectively compose the Collaborative Psychiatric Epidemiology Surveys (CPES; Alegría et al., 2007a), creating a total sample of 20,013 adults drawn from households in the contiguous United States. Of these, the psychosis screen was administered to a random sub-sample of the respondents of part II[1] of the NCS-R (n=2322), all respondents of the NLAAS (n=4644), and all non-white respondents of the NSAL (n=4995). An additional 38 participants refused or responded with "don't know" to at least one of the psychosis screen items and were therefore excluded, although notably 9 (23.7%) of these participants endorsed at least one psychotic experience, suggesting that people with psychotic experiences may have been more likely to refuse response to these items. Planned exclusion criterion for all studies was the presence of a threshold psychotic disorder, including self-reported schizophrenia or diagnoses of Bipolar I or Bipolar II disorder (Entire data set: *n*=318; of participants with psychosis screen: *n*=180). Diagnosis of bipolar

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[1] Part I of the NCS-R was a nationally representative sample of households in the 48 contiguous United States. Respondents were selected into part II in three strata: 1) all participants who met lifetime criteria for any mental disorder, met subthreshold criteria and sought treatment, or reported a lifetime suicide plan or suicide attempt; 2) 59% of Part I respondents who ever met subthreshold criteria for a mental disorder, ever sought mental health treatment, ever experienced suicidal ideation, or recently used psychotropic medications; and 3) 25% of the remaining Part I sample. Weights were adjusted so that Part II likewise constituted a nationally representative sample when weighted appropriately (Kessler et al., 2004).

I and bipolar II are assessed using the World Health Organization Composite International Diagnostic Interview (WHO-CIDI). Diagnosis of schizophrenia is based on self-report as diagnoses of schizophrenia by lay interviewers were considered unreliable in these data and were not released to the public (Kessler et al., 2005a). The final sample among the entire CPES data set, excluding respondents with diagnosable psychotic disorders or missing data for psychosis screen items, consisted of 11744 participants (NCS-R: n=2233; NLAAS: n=4622; NSAL: n=4889).

Analysis: rationale, procedure, and description of measures

The first step of this introductory chapter was to establish prevalence and descriptive data for all measures assessed in the psychosis screen, among the entire sample using the full CPES data set (n=11744) and for each constituent survey. Psychosis screen items included presence or absence of any psychotic experience (lifetime and past 12-months), of six specific psychotic experiences (lifetime only; see Table 1), number of lifetime incidents of each psychotic experience, number of days with psychotic experiences in the past 12 months, and age of psychotic experience onset. I also tested for associations between 12-month psychotic experiences and age, given that past research in adolescents has shown that prevalence of current psychotic experiences declines with increasing age, although their clinical significance increases (Kelleher et al., 2011).

The next step of this precursor analysis was to establish the prevalence of psychotic experiences by ethnicity. In this dissertation, ethnicity is divided into the following groups: African-American, Afro-Caribbean, Asian, Caucasian, Latino, and other. Of note, these groups are heterogeneous with individuals from multiple nationalities and cultures, but were collapsed into five broad categories to increase statistical power. Prevalence rates for

Table 1. Psychotic experiences assessed with the WHO-CIDI psychosis screen, with associated interviewer prompts.

Symptom	Prompt
Visual hallucination	The first thing is seeing a vision -- that is, seeing something that other people who were there could not see. Did you ever see a vision that other people could not see?
Auditory hallucination	The second thing is hearing voices that other people could not hear. I don't mean having good hearing, but rather hearing things that other people said did not exist, like strange voices coming from inside your head talking to you or about you, or voices coming out of the air when there was no one around. Did you ever hear voices?
Thought insertion	The third thing is really two. One is believing that some mysterious force was inserting many different strange thoughts -- that were definitely not your own thoughts - directly into your head by means of x-rays or laser beams or other methods. The other is believing that your own thoughts were being stolen out of your mind by some strange force. Did you ever have either of these mind control experiences?
Thought control	The fourth unusual thing is feeling that your mind was being taken over by strange forces with laser beams or other methods that were making you do things you did not choose to do. Did you ever have a time when you felt that your mind was being taken over by strange forces?
Telepathy	The fifth thing is believing that some strange force was trying to communicate directly with you by sending special signs or signals that you could understand but that no one else could understand. Sometimes this happens by special signs coming through the radio or television. Did you ever experience these kinds of attempts at communication from strange forces?
Delusions of persecution	Sixth, did you ever believe that there was an unjust plot going on to harm you or to have people follow you that your family and friends did not believe was true?

psychotic experiences may vary across ethnicities, either due to true ethnic disparities in risk for psychosis or due to a variety of cultural factors, including cultural and linguistic variation in understanding and interpreting the meaning of the items, and how they deviate from normative experiences. Although it is not possible to entirely disentangle these two confounded explanations for any ethnic disparities based on these data, it can be predicted that ethnic disparities in psychotic experiences would not vastly differ from those found in threshold psychotic disorder, where prevalence tends to be 2- to 3-fold greater among African-Americans compared to Caucasians (Bresnahan et al., 2007). Ethnic disparities in psychotic experiences have not been formally tested in the United States, but prior studies

from the United Kingdom have confirmed that they resemble the disparities found in schizophrenia, such that black Caribbean and African individuals are at greater risk relative to Caucasians (Johns et al., 2002; 2004; King et al., 2005; Morgan et al., 2009). Logistic regression, using dummy coded variables for each ethnicity (Caucasian as reference group, to be consistent with prior studies of ethnic disparities in psychosis), will be used to test for differences in risk for lifetime and 12-month psychotic experiences between ethnic groups. To further distinguish possible causes for any identified disparities, associations between psychotic experiences and treatment-seeking will be tested within each ethnic group using logistic regression, with the prediction that the association will be of similar magnitude if each group is endorsing, on average, symptoms that carry a similar degree of clinical significance.

The final series of analyses tested for social desirability biases in the endorsement of psychotic experiences. CPES includes a 10-item social desirability scale with items derived from the Marlowe-Crowne social desirability scale (Crowne & Marlowe, 1960) and the Zuckerman personality scales (Zuckerman & Link, 1968), with adequate internal consistency in this sample (Cronbach's alpha=0.68). Each of the 10 items is coded as true or false and summed into a total score. In the entire CPES data set, logistic regression was used to test for associations between social desirability scale scores and both lifetime and 12-month psychotic experiences, to examine potential social desirability biases. This was likewise tested within specific ethnic groups, and separately within males and females, to determine whether the influence of social desirability biases vary by ethnicity or gender for the psychosis screen items. Associations between the social desirability scale and

individual psychotic experience subtypes were also tested in the entire sample, to

determine whether particular symptoms are more susceptible to social desirability biases.

All analyses were two-tailed, with results considered statistically significant at

alpha=0.05.

Table 2. Prevalence and other descriptive data for psychotic experiences across survey.

Measure	Value	CPES	NCS-R	NLAAS	NSAL
Prevalence					
Lifetime	% (SE)	8.7 (0.4)	8.7 (0.9)	8.7 (0.6)	11.1 (0.7)
12-m	% (SE)	2.7 (0.2)	2.9 (0.5)	2.9 (0.4)	3.8 (0.4)
Symptom Subtype					
Visual hallucinations					
Prevalence	% (SE)	6.1 (0.3)	6.0 (0.6)	5.7 (0.4)	8.3 (0.6)
# of instances	M (SD)	8.0 (1.1)	7.5 (1.4)	8.5 (1.4)	8.3 (1.2)
Auditory hallucinations					
Prevalence	% (SE)	3.8 (0.3)	3.8 (0.6)	4.0 (0.4)	4.7 (0.5)
# of instances	M (SD)	13.9 (1.9)	13.5 (2.8)	10.2 (1.0)	13.3 (2.3)
Thought insertion					
Prevalence	% (SE)	0.3 (0.1)	0.2 (0.1)	0.5 (0.2)	0.3 (0.1)
# of instances	M (SD)	12.7 (0.1)	6.4 (0.0)	19.4 (0.2)	18.2 (0.2)
Thought control					
Prevalence	% (SE)	0.1 (0.0)	0.1 (0.0)	0.2 (0.1)	0.2 (0.1)
# of instances	M (SD)	12.3 (0.8)	9.7 (0.0)	14.2 (0.0)	7.3 (3.1)
Telepathy					
Prevalence	% (SE)	0.6 (0.1)	0.7 (0.2)	0.8 (0.2)	0.5 (0.1)
# of instances	M (SD)	11.0 (1.7)	10.7 (3.8)	15.6 (0.1)	12.3 (1.6)
Delusions of persecution					
Prevalence	% (SE)	0.7 (0.1)	0.5 (0.1)	0.8 (0.2)	1.1 (0.3)
# of instances	M (SD)	9.2 (1.1)	16.1 (1.3)	6.2 (0.0)	9.4 (2.7)
Onset & Frequency					
Age of onset	M (SD)	25.1 (1.0)	26.9 (1.6)	21.7 (1.2)	23.3 (0.8)
# of instances	M (SD)	25.7 (8.1)	27.7 (10.5)	18.3 (3.9)	17.4 (4.6)
# days (12-m) *	M (SD)	37.6 (6.5)	36.4 (7.6)	21.4 (6.3)	23.6 (10.6)

Note: Number of days in past year is among people who have had psychotic experiences in the past year.

Results

Prevalence and characteristics of psychotic experiences

Descriptive data for psychotic experiences is presented in Table 2. Lifetime and 12-

month psychotic experiences were highly prevalent in this sample, with similar prevalence

across the three constituent data sets. Visual and auditory hallucinations were

substantially more common than the four classes of delusional experiences across all data sets. The average age of onset was in the mid twenties, and most people that reported psychotic experiences endorsed numerous instances over the lifetime and past year.

Table 3. Prevalence of psychotic experiences by ethnicity.

	Lifetime	12-m
African-American	11.6 (0.9)	4.1 (0.4)
Afro-Caribbean	10.7 (1.5)	5.1 (0.9)
Asian	6.3 (0.5)	1.7 (0.4)
Caucasian	7.6 (0.7)	2.1 (0.3)
Latino	9.5 (0.7)	3.2 (0.5)
Other	15.5 (12.6)	0.3 (0.3)

Note: Prevalence values are presented as weighted % (SE)

Validity of the WHO-CIDI psychosis screen across cultural groups

Lifetime and 12-month psychotic experience prevalence rates are presented in Table 3. Relative to the Caucasian reference group, African-Americans, OR[95% CI]=1.60[1.23-2.07], Afro-Caribbeans, OR[95% CI]=1.46[1.01-2.11], and Latinos, OR[95% CI]=1.28[1.00-1.63] were all more likely to report lifetime psychotic experiences. The pattern was similar for 12-month psychotic experiences, which again were more prevalent among African-Americans, OR[95% CI]=1.95[1.32-2.88] and Afro-Caribbeans, OR[95% CI]=2.48[1.54-3.98], but not Latinos, OR[95% CI]=1.53[0.98-2.38]. Asians and 'other' did not significantly differ from Caucasians in terms of prevalence of lifetime or 12-month psychotic experiences. With the exception of the 'other' ethnicity category, psychotic experiences were associated with approximately 3-fold greater odds of seeking treatment odds (OR range: 2.21-3.68) compared to respondents who did not report psychotic experiences (Table 4), suggesting that the clinical significance of these symptoms was similar across ethnic groups.

Table 4. Association between psychotic experiences and treatment seeking within each ethnic group.

	Treatment-seeking (lifetime)	
	OR [95% CI]	Wald χ^2
Total sample	2.46 (2.00-3.02)	73.19, $p<0.001$
African-American	2.61 (2.07-3.30)	65.98, $p<0.001$
Afro-Caribbean	3.68 (2.11-6.40)	21.60, $p<0.001$
Asian	2.31 (1.42-3.74)	11.64, $p=0.001$
Caucasian	3.00 (1.87-4.79)	21.34, $p<0.001$
Latino	2.21 (1.55-3.16)	19.45, $p<0.001$
Other	20.06 (1.29-312.34)	4.65, $p=0.031$

Note: Odds ratios are unadjusted. Degrees of freedom = 1 for all Wald X2 tests.

Social desirability biases

Social desirability was not associated with reported psychotic experiences in the total sample (including individual symptoms; data not shown), although associations varied across ethnicities (Table 5). Psychotic experiences were associated with higher

Table 5. Associations between social desirability and reported lifetime psychotic experiences within the entire sample and subgroups based on survey, gender, and ethnicity.

	PE +	PE -	Statistics
Lifetime PE			
CPES total	2.15 (0.08)	2.15 (0.04)	F(165)=0.00, $p=0.965$
NCS-R	1.98 (0.15)	2.08 (0.06)	F(42)=0.36, $p=0.550$
NLAAS	2.18 (0.12)	2.53 (0.08)	**F(69)=6.62, $p=0.012$**
NSAL	2.32 (0.09)	1.99 (0.05)	**F(54)=10.23, $p=0.002$**
Gender			
Male	2.35 (0.12)	2.12 (0.05)	F(165)=3.03, $p=0.084$
Female	2.01 (0.12)	2.18 (0.05)	F(165)=1.51, $p=0.22$
Ethnicity			
African-American	2.28 (0.10)	2.01 (0.05)	**F(165)=5.87, $p=0.017$**
Afro-Caribbean	1.66 (0.16)	1.93 (0.08)	F(165)=3.17, $p=0.077$
Asian	2.41 (0.30)	2.23 (0.09)	F(165)=0.30, $p=0.582$
Caucasian	2.14 (0.12)	2.01 (0.06)	F(165)=1.08, $p=0.301$
Latino	2.20 (0.13)	2.62 (0.09)	**F(165)=7.70, $p=0.006$**
Other	0.17 (0.18)	2.27 (0.52)	F(165)=21.58, $p<0.001$

Notes: Values indicate mean (sd) social desirability score. All statistics are Wald F tests, based on general linear model with adjustments for complex sampling design. Bold indicates significance, $p<0.05$.

social desirability scores in the NSAL data set, and with lower social desirability scores in the NLAAS data set. This appears to be explained by ethnic differences, with African-Americans showing a positive association with social desirability and Latinos showing a

negative association. Social desirability was not differentially related to reporting of psychotic experiences within any other ethnic group, or between males and females.

Discussion

Psychotic experiences

The estimated lifetime and 12-month prevalence of psychotic experiences in the CPES data set, and in all three constituent surveys, was similar to that found in prior studies, where the most recent meta-analysis suggests a lifetime prevalence of 7.2% (Linscott & van Os, 2013). However, the prevalence of hallucinatory experiences (visual hallucinations and hearing voices) was far greater than that of delusional experiences in these data, which is not typical across all prior studies, although a similar prevalence pattern (favoring hallucinations) was recently found in a study using clinician interview (Zammit et al., 2013), suggesting that hallucinations may in fact be the more prevalent form of psychotic experience. Alternatively, delusional experiences may be underreported in these data. One possible explanation is that the wording of the delusion items lends itself to a greater threshold of psychopathology, whereas the hallucination experiences may appear more normative. This cannot be tested directly in these data but does have face validity based on review of the prompts associated with each psychosis screen item. Also, it has previously been shown in the NCS-R that the delusion items are of greater severity, and are less likely to be deemed "culturally appropriate" or "odd but not psychotic" (Kessler et al., 2005a). Alternatively, respondents may view these delusional experiences as more pathological or stigmatized, although one would then expect them to be differentially related to social desirability relative to the hallucination items, which was not the case.

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Previous research has suggested that hallucination items are more valid indicators of the presence of psychotic experiences in population samples, but this has only been shown in adolescents (Kelleher et al., 2011) and may not generalize to this adult sample.

The average age of onset of psychotic experiences in this sample is at the upper range of typical age of onset for psychotic disorders (Thompson, Pogue-Geile, & Grace, 2004), likely reflecting the exclusion of adolescents and children. Prior studies have suggested that sub-threshold psychotic experiences are much more prevalent in childhood, when they are generally not pathological, compared to adolescence, when they are less common but associated with extensive comorbidity (Kelleher et al., 2012a). That is, these experiences tend to become less common but more clinically significant over the early life course. If this trajectory of declining prevalence does extend into adulthood, then that would suggest that the age of onset should be during childhood or adolescence for most respondents with lifetime psychotic experiences. It is likely that the estimated age of onset is subject to some recall bias in these surveys, although it is within a reasonable range that would be predicted for a valid measure of psychotic experiences based on the continuum model (van Os et al., 2009).

Psychotic experiences were assessed in these data using lay-administered interviews. Meta-analysis has produced a median lifetime prevalence estimate of 11.9% among studies using self-report measures versus 3.8% with interviews (Linscott & van Os, 2013). The prevalence presented in these data is more in line with that found in self-report studies. Lay-administered interviews may be conceived as an approximation of self-report in that they do not involve clinician judgment; this may explain the higher prevalence (relative to the meta-analytic median) of psychotic experiences in these data relative to

other interview studies. One possible explanation is that lay-administered interviews may have high false positive rates. In a clinical re-appraisal study, Kessler and colleagues (2005b) found in a subset of this data set that many psychotic experiences were better classified as "culturally appropriate" or "odd but not psychotic." However, this does not negate their significance, as even false positive screens of psychotic experiences are known to share risk factors with threshold psychosis (van Nierop et al., 2011) and to be predictive of schizophrenia onset (Kaymaz et al., 2012).

Kessler and colleagues (2005b) previously reported on the prevalence of psychotic experiences in the NCS-R data set. Of note, prevalence estimates for the NCS-R in this analysis are slightly lower than those previously presented. Kessler and colleagues did not exclude participants who were missing single items on the screen, whereas those respondents were excluded in the present study, which would explain our lower prevalence given that the excluded participants had a higher prevalence of psychotic experience (i.e. those that refused to answer some questions were more likely to positively endorse other symptoms).

Cultural validity

Lifetime and 12-month prevalence of psychotic experiences were both found to vary by ethnicity, with African-Americans and Afro-Caribbeans both having higher prevalence using each time frame and Latinos additionally having a higher prevalence when considering lifetime only. Prevalence of psychotic experiences is known to vary by ethnicity (Linscott & van Os, 2010; van Os et al., 2009), although most support for this association has come from one racial group in one country (Black Caribbean and African individuals residing in the United Kingdom; Johns et al., 2002; 2004; King et al., 2005; Morgan et al.,

2009), with the same measure of psychotic experiences (Psychosis Screening

Questionnaire; PSQ, Bebbington & Nayani, 1995), limiting generalizability. However,

studies of schizophrenia have shown that this ethnic disparity extends to the United States,

where black individuals are likewise at greater risk for psychosis (Bresnahan et al., 2007),

to a similar magnitude as found in the present analysis. This suggests that ethnic disparities

extend across the continuum of psychosis in the United States.

Alternatively, the experiences being endorsed in response to psychosis screen items

may be more normative in particular cultures, rather than pathological. Previous analysis

of the NCS-R suggest that this may explain as many as one third of the hallucinatinatory

experiences but fewer of the delusional experiences (Kessler et al., 2005a). Associations

between psychotic experiences and treatment-seeking were tested *within* each ethnic

group to control for varying clinical significance across ethnic groups; if respondents were

endorsing normative experiences as 'psychotic' due to poor cultural validity of the items

than we would not expect these experiences to be associated with treatment-seeking. This

was not found to be the case; rather, psychotic experiences were associated with a greater

than 2-fold increase in odds of seeking treatment across every ethnicity. Similar effect sizes

have been found in prior studies that did not test separately within ethnic groups

(DeVylder et al., in press; Murphy et al., 2012).

In contrast to the generally consistent results between African-Americans, Afro-

Caribbeans, Asians, Caucasians, and Latinos, the 'other' ethnic group showed some very

unusual patterns. The lifetime prevalence of psychotic experiences was particularly high in

this group (15.5%) whereas the 12-month prevalence was extremely low (0.3%). In

addition, the magnitude of association between psychotic experiences and treatment-

seeking was approximately 8-fold greater for the 'other' group compared to the entire sample or any individual ethnicity, although this estimate may be unreliable given the exceedingly large confidence interval of the odds ratio (1.29-312.34). This finding may be considered tentative due to the limited sample size of the 'other' group (and consequent low statistical power and questionable reliability of the outcome), this may also reflect true differences in the threshold of endorsing psychotic experiences, with the 'other' group only positively endorsing psychosis items in reference to significant and notable experiences.

Social desirability biases

No social desirability biases were found when considering the whole sample, neither for psychotic experiences as a whole or for individual symptoms. However, there were associations within specific surveys, which subsequent analysis showed were due to ethnic differences in the association between psychotic experiences and social desirability. Interestingly, the direction of the association varied, with a positive association among African-Americans and a negative association among Latinos. A speculative interpretation is that greater social desirability biases among African Americans may be related to more forthcoming answers, whereas the same biases in Latinos may be lead to the denial of stigmatized conditions. Regardless of the explanation, this variability in the effects of social desirability biases should be considered when interpreting any ethnic differences found in the subsequent papers.

Conclusions & considerations: is the WHO-CIDI a valid measure of psychotic experiences?

The measure of psychotic experiences used in these surveys appears to be valid given that prevalence and age of onset fall in the expected range based on past studies (reviewed in Linscott & van Os, 2010; 2013; van Os et al., 2009). Prevalence patterns

between ethnicities parallel those found in the United Kingdom for psychotic experiences (Johns et al., 2002; 2004; King et al., 2005; Morgan et al., 2009) and those found in the United States for schizophrenia (Bresnahan et al., 2007). Also, psychotic experiences were similarly associated with treatment within each ethnic group, suggesting that the measure consistently evaluates clinically significant symptoms across cultures. Finally, social desirability biases appear to have minimal influence on results except when considering individual ethnic groups. Clinical reappraisal of positive psychosis screens, as was previously done with the NCS-R (Kessler et al., 2005a) would have been the ideal way to test cultural validity, but unfortunately was not carried out with the NLAAS and NSAL and was not possible in this secondary analysis.

Although these preliminary results generally support the psychosis screen as a valid measure of psychotic experiences, they also highlight some limitations in the data that need to be considered when interpreting subsequent results. First, the prevalence of delusional experiences is low compared to hallucinatory experiences in this sample and compared to the prevalence of delusional experiences in past studies (Linscott & van Os, 2013). It is possible that the threshold for endorsing these items is at a more severe point along the psychosis continuum, and may produce differential results when considering hallucinations and delusions separately. The lower prevalence of delusional experiences also means that the variable representing the presence or absence of *any* psychotic experience will be disproportionately indicative of hallucinations, which are relatively common, rather than delusions, which are comparatively rare. A second point pertaining to the psychosis screen is that the age of onset is higher than expected, given that psychotic experiences are generally believed to onset in children or adolescents (who were not

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included in these surveys); however, this is not a key variable of interest in the remainder of the dissertation. Two final points pertain to ethnicity in this data set. First, the measure of psychotic experiences among the 'other' group follows a distinct pattern from the remaining ethnic groups, possibly due to heterogeneity or small sample size of this group. Regardless, any findings that specifically pertain to the 'other' ethnic group should be considered tentative. Finally, although social desirability is not related to psychotic experiences in the entire sample, it is related within African-Americans and Asians, and therefore will be considered for analyses specifically assessing associations within ethnic groups.

Chapter III

Suicidal Ideation and Attempts

Suicide is a leading cause of preventable death in the United States and worldwide, accounting globally for nearly one million deaths annually (Beaglehole, Irwin, & Prentice, 2003), with approximately 0.4-0.6% of the United States population attempting suicide each year (Kessler, Berglund, Borges, Nock, & Wang, 2005a). Psychiatric disorders are present in nearly all individuals who report suicidal thoughts or behavior (Bertolote & Fleischmann, 2002; Kessler et al., 2005b), with schizophrenia accounting for approximately 14% of completed suicides worldwide (Bertolote, Fleischmann, De Leo, & Wasserman, 2004). It is conceivable that vulnerability towards suicide may extend beyond categorical diagnostic boundaries to broader pathological phenotypes. This paper aims to examine the association between sub-threshold psychosis and suicidal thoughts and behavior.

Suicidality in psychotic disorders

Suicide is a common cause of death associated with psychotic disorders, with a 5% estimated lifetime prevalence of completed suicide among people with schizophrenia (Palmer, Pankratz, & Bostwick, 2005). Compared to people without psychotic disorders, those with schizophrenia are more likely to make attempts using higher-risk methods (Koeda et al., 2012) and with greater intent to die (Harkavy-Friedman et al., 1999). Threshold psychotic disorder is also prospectively associated with increased risk for later suicide among individuals previously hospitalized for suicide attempts or ideation (Wenzel et al., 2011). Risk for completed suicide is greater among individuals with delusions (Fenton, McGlashan, Victor, & Blyler, 1997) and generally lower among those with hallucinations (Hawton, Sutton, Haw, Sinclair, & Deeks, 2005), although attempts are

sometimes made directly in response to command hallucinations (Harkavy-Friedman et al., 2003; Wong et al., 2013). Risk for suicidal behavior among those with schizophrenia may also be elevated in the context of substance use (Hawton et al., 2005) and depression, although significant risk remains in the absence of depression as well (Harkavy-Friedman, Nelson, Venarde, & Mann, 2004). Additional risk factors for suicide among people with schizophrenia are younger age, male gender, and higher level of education (Hor & Taylor, 2010).

Of note, symptoms do not have to be long-standing to lead to suicidal thoughts or behavior: risk for completed suicides as well as thoughts, plans, and attempts is greatest in schizophrenia following the first psychotic episode (Bertelsen et al., 2007; Dutta et al., 2010), and risk for suicide is comparable between chronic conditions, including schizophrenia and bipolar disorder, and brief psychotic states, including ICD-10 acute and transient psychotic disorders (duration 1-3 months, similar to DSM-IV 'brief psychotic disorder'). The increased suicide risk following the first psychotic episode, however, is also suggestive that suicidality may be a reaction to the diagnosis, onset of the clinical condition, or the disruption in social, familial, and role function that frequently accompanies onset. There has been mixed evidence that suicide risk may be greater among individuals with more insight into the illness (Lincoln, Lullmann, & Rieff, 2007; Lopez-Morinigo, Ramos-Ríos, David, & Dutta, 2012) and superior neurocognitive function (Kim, Jayathilake, & Meltzer, 2003), further suggesting that suicidality may reflect initial awareness of psychosis onset. If such is the case, the association between psychosis and suicide may not extend to the sub-threshold range of the psychosis continuum.

Psychosis continuum

There is now strong evidence that psychosis occurs on a population-level continuum, with a substantially greater prevalence of psychotic experiences relative to full psychotic disorders (Linscott & van Os, 2010; 2013; van Os et al., 2009). These symptoms alone have rather poor predictive value for identifying individuals who will later develop schizophrenia (Schultze-Lutter et al., in press; Werbeloff et al., 2012), but may be clinically relevant in themselves. Studies have shown that psychotic experiences are associated with psychological distress (Armando et al., 2010; Cohen & Marino, 2013; Yung et al., 2006; 2009), as well as greater need for care and utilization of mental health services (Bak et al., 2005; DeVylder et al., in press; Murphy et al., 2012). They also are associated with greater severity of affective and anxiety disorders, although this has only been shown in adolescents and young adults and may not generalize across the life course (Kelleher et al., 2012a; 2013a; Wigman et al., 2012). Given the drastically elevated rates of suicide and suicide-related behavior among individuals with psychotic disorders, it can be predicted that suicidality may also be associated with the sub-threshold range of the psychosis continuum.

Suicidality with psychotic experiences

There has been limited research on suicidality among individuals with psychotic experiences. One population-based study of adolescents in Ireland found that psychotic experiences were associated with approximately 10-fold odds of any suicidal behavior, including ideation, plans, or attempts, particularly among youth with co-occurring depressive disorders, and were further associated with greatly increased odds (OR=19.6) of suicide plans or attempts among those with ideation (Kelleher et al., 2012b). Similar but weaker associations were identified between psychotic experiences and suicidal ideation

(OR=3.1) and self-harm behaviors (OR=3.1) among adolescents in Japan (Nishida et al., 2010) and between specifically delusional experiences and suicidal thoughts and behavior among adults in Australia (Saha et al., 2011a). In a prospective cohort study in New Zealand, 11-year olds who were assessed as having psychotic experiences were more likely to attempt suicide by age 38, controlling for demographic and clinical factors (Fisher et al., 2013). A prospective relationship between psychotic experiences and suicidality has likewise been recently shown in adolescents, where 20% of those reporting psychotic experiences subsequently attempt suicide over the following year (OR=11.3; Kelleher et al., 2013b).

The population-based research on associations between psychotic experiences and suicidality is in concurrence with findings from clinical high risk cohort studies (i.e. samples of help-seeking youth with psychotic experiences, with enriched recruitment criteria to maximize risk for schizophrenia; Miller et al., 2003), where as many as 1/3 of respondents endorse suicidal ideation over a one-week period (DeVylder et al., 2012), and in clinical samples of adolescents at a public mental health outpatient service (Kelleher et al., 2013a) and among adults presenting with attenuated hallucinations in a psychiatric emergency setting (Penagaluri, Walker, & El-Mallakh, 2010).

Specific aims

The purpose of this study is to examine the association between 12-month psychotic experiences and concurrent suicidal ideation and suicide attempts among a large general population sample of adults living in the United States. Several specific aims will be addressed. First, prevalence of suicide ideation and attempts will be compared between those with and without psychotic experiences, with the hypothesis that there would be a

positive association between psychotic experiences and suicidality in this sample, as suggested by prior studies (Fisher et al., 2013; Kelleher et al., 2012b; 2013b; Nishida et al., 2010; Saha et al., 2011a). Second, associations with suicidality were tested separately for delusional experiences and hallucinations to determine whether these associations varied by symptom subtype. Third, psychotic experiences were recoded according to number of days impaired over the past year, in order to test for a dose-response relationship between psychotic experiences and suicidality, which would support a causal link between the two clinical phenomena. Forth, exploratory moderation analyses tested whether any relationship between suicidality and psychotic experiences varies by the presence of co-occurring mental disorders or by selected demographic factors. Psychotic experiences may be particularly associated with suicidality when occurring in the context of depressive and anxiety disorders, given that they are known to modify the severity of these disorders in young adults (Wigman et al., 2012). The association may also be more pronounced among males and individuals with higher education, as has been found in threshold psychotic disorders (Hor & Taylor, 2010). Finally, I tested for an association between psychotic experiences and greater severity of suicidality, both by testing for risk of suicide attempts among the subgroup endorsing ideation, and for intent to die among the subgroup endorsing attempts. Given that threshold psychosis is associated with severe attempts (Harkavy-Friedman et al., 1999; Koeda et al., 2012), it was predicted that this would also hold true for psychotic experiences. Alternatively, if suicidality in threshold psychosis is a reaction to illness onset then this association should not generalize to individuals with sub-threshold symptoms.

Method

Participants

The Collaborative Psychiatric Epidemiology Surveys (CPES; Alegría et al., 2007a) is a national household survey of 20,013 adults, age 18 and over. CPES data is assembled from three constituent surveys conducted in the United States: 1) the National Comorbidity Survey-Replication (NCS-R), a nationally representative sample (Alegría et al., 2007b; Kessler et al., 2004), 2) the National Latino and Asian American Study (NLAAS), a national area probability sample with supplements for adults of Latino and Asian national origin (Alegría et al., 2004; Alegría & Takeuchi, 2007), and 3) the National Survey of American Life (NSAL), a nationally representative sample of African-Americans, with Afro-Caribbean and non-Hispanic white adults drawn from the same source population and of similar socioeconomic status (Jackson 2004; 2007). All surveys utilized multi-stage clustered sampling designs (Heeringa et al., 2004). Respondents were included if they were assessed with the non-affective psychosis screen, which was administered to a random sub-sample of the respondents of the NCS-R (n=2322), all respondents of the NLAAS (n=4644), and all non-white respondents of the NSAL (n=4995). Because the focus of this study is on sub-threshold psychosis, participants were excluded if they had a lifetime psychotic disorder, defined as a self-reported a lifetime diagnosis of schizophrenia or meeting WHO-CIDI criteria for lifetime bipolar disorder. Participants were also excluded if they were missing data for any of the variables of interest. The final sample for this study consisted of 11,716 respondents.

Measures

Demographics

Demographic information (age, sex, race, years of education, employment status, marital status) was reported by respondents. Age was recoded into three groups (18-29 years, 30-44 years, 45 years or greater). The age range of the oldest group was very wide to accommodate the low frequency of 12-month psychotic experiences among older adults in this sample (Borges et al., 2006). Race was coded into five categories (non-Latino black, non-Latino white, Latino, Asian, and other); low prevalence of psychosis and suicidality precluded analysis using more specific groupings by nationality. Years of education was broadly coded into two categories representing participants who did not attend college and those who attended at least some college. Marital status was coded as married, single (i.e. never married), or previously married, which included people who were divorced, separated, or widowed. Employment status was coded as currently employed, currently unemployed, or not in the labor force.

Social desirability

Social desirability was measured through the sum score of a 10-item (true/false) scale, with items derived from the Marlowe-Crowne social desirability scale (Crowne & Marlowe, 1960) and the Zuckerman personality scale (Zuckerman & Link, 1968).

Psychotic experiences

Psychotic experiences were assessed in the CPES data set out using the WHO-CIDI 3.0 psychosis screen, which improved on previous epidemiological psychosis assessments by reducing the frequency of false positives (Kessler et al., 2005a). Respondents were asked to report the lifetime presence of six specific psychotic experiences from the WHO-CIDI 3.0 psychosis screen including two types of hallucinations (visual and auditory hallucinations) and four types of delusional experiences (thought insertion, thought

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control, telepathy, and delusions of persecution). Responses were excluded if the experience took place in the context of falling asleep, dreaming, or substance use. Those with any lifetime experiences were asked whether the psychotic experiences had taken place in the past 12 months, and how many days they occurred during that 12-month period.

CIDI diagnoses

CIDI diagnoses are widely utilized in psychiatric epidemiology studies, having been used to establish national and international prevalence estimates of many psychiatric disorders (e.g. Kessler et al., 1994; 2005c; 2005d; 2007), and are generally in concordance with diagnoses determined through clinical interview using the Structured Clinical Interview for DSM-IV diagnoses (Haro et al., 2006). Clinical variables of interest were 12-month diagnoses of axis I disorders, as defined by the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV). Affective disorders included include major depressive disorder and dysthymia. Anxiety disorders included generalized anxiety disorder, agoraphobia with and without panic disorder, panic disorder, social phobia, and post-traumatic stress disorder. Drug use disorders included drug abuse and dependence, and alcohol use disorders included both alcohol abuse and dependence.

Suicidality

The suicidality section of the interview was provided as a written self-report module for respondents literate in English, 81.4% (se=1.4), which has been shown to facilitate accurate reporting of socially undesirable behaviors (Turner et al., 1998). The remaining respondents, 17.4% (se=1.4) were asked the suicidality items orally. Suicidality variables were collapsed across response type as prevalence of suicidal ideation and

suicide attempts did not vary by mode of response. Respondents reported whether they had ever seriously thought about committing suicide and whether they had ever attempted suicide. They were then asked whether each of these events had ever occurred during the 12-month period prior to the interview. Positive responses were confirmed through follow-up questions assessing the time of first and last thoughts or attempts, number of lifetime instances, and subjective seriousness of attempts. Past year suicidal ideation and suicide attempt measures were recorded as dichotomous (present/absent) variables. Intent to die was assessed among those who attempted suicide by asking respondents whether their most recent attempt was best described as "a serious attempt to kill myself and it was only luck that I did not succeed," with positive responses classified as severe attempt with intent to die, in contrast to positive responses to "I tried to kill myself, but I knew the method was not fool-proof," or "my attempt was a cry for help, I did not want to die." Because intent was only assessed for the most recent attempt and respondents may have made multiple attempts in the past year (with degree of intent known to vary across attempts; Nock & Kessler, 2006), suicide attempts were coded in the primary analysis to include all self-reported attempts, regardless of level of intent. A secondary analysis of severity of suicidality, described below, then tested between those with and without intent to die during their most recent attempt.

Statistical analyses

All analyses were conducted using the complex sample features of SPSS version 21. Design-based analyses were used to estimate standard errors that accounted for the complex multistage clustered design of the CPES sample. All statistical estimates were weighted using CPES sampling weights to account for individual-level sampling factors

including non-response and unequal probabilities of selection. Modified weights were created for the purpose of this study, in which NCS-R respondents were additionally weighted proportionately to the inverse of their odds of being randomly selected from the NCS-R pool to receive the psychosis screen (i.e. 5692/2322=2.4513). Subsequent analyses revealed negligible differences in results regardless of which weight variable was used. Therefore, all results will be presented using the original CPES weight included in the data set, which was calculated with close attention to sampling parameters and which consistently yielded more conservative results in the following analyses.

Primary analyses

The prevalence of each 12-month suicidality outcome was assessed among those with and without 12-month psychotic experiences. Odds ratios were calculated using blocked hierarchical logistic regression. First, bivariate logistic regression analyses were used to determine whether those with psychotic experiences were at increased risk for both measures of suicidality, with significance tested using Wald chi-square tests, two-tailed alpha = 0.05. In the second block, the logistic regression analyses were repeated with adjustments for potential demographic confounders, given that prevalence of both psychotic experiences and suicidality are known to vary across demographic groups in the population (Kessler et al., 2005a; 2005b; Linscott & van Os, 2010; 2013). Demographic and social desirability factors were included as potential confounders if they were significantly associated with both 12-month psychotic experiences and either suicidality variable at least at a broad trend level (alpha=0.15). In the third and final block, clinical variables were added (diagnosis of a depressive, anxiety, or substance use disorder) as predictors to determine whether associations with psychotic experiences were independent of other

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mental health conditions, which have been shown to frequently co-occur with psychotic experiences in previous epidemiological studies (Kelleher et al., 2012a; Varghese et al., 2011; Wigman et al. 2012). Using the fully adjusted model, adjusted odds ratios were calculated for the association between subtypes of psychotic experiences (visual or auditory hallucinations, delusional experiences) and indicators of 12-month suicidal ideation and attempts, to determine whether associations between psychotic experiences and suicidality were primarily driven by a particular symptom class.

Dose-response relationship

Next, psychotic experience exposure was recoded based on the number of days of reported psychotic experiences in the past year, rather than the simple dichotomous presence or absence of any psychotic experience, in order to test for a dose-response relationship between psychotic experiences and suicidality. This was tested using logistic regression analyses with predictor variables indicating never (0 days; reference group), rarely (1-2 days/year), occasionally (3-11 days/year), or at greater than monthly (12 or more days/years) instances experiencing psychotic symptoms in the past year, using the fully adjusted model. A dose-response relationship would be indicated if the odds ratios associated with suicidal ideation and suicide attempts progressively increase as the number of days of psychotic experiences increases, with a significant linear trend. Dose-response relationships were examined for frequency of any psychotic experience (hallucinations and delusions) and then separately for frequency of hallucinations only.

Moderation analyses

The relationship between psychotic experiences and suicidal ideation and suicide attempts was further explored through several moderation analyses. Data were stratified

to test for moderation by sex and level of education using the fully adjusted model (demographics and clinical variables), given known sex and educational attainment differences in suicidality among people with psychotic disorders (Hawton et al., 2000; Hor & Taylor, 2010). Determining moderating sociodemographic factors would buttress clinical and public health efforts to allocate resources to those at greatest risk. Data were stratified by the presence or absence of affective, anxiety, drug use, or alcohol use disorders, with the prediction that psychotic experiences may have a greater effect on suicide attempts in individuals who have comorbid conditions that are themselves known to be associated with suicidality (Borges et al., 2000; Rihmer, 2007). This also allowed examination of whether psychotic experiences have an independent effect on suicide attempts in individuals with no comorbid psychiatric condition. Analyses stratified by clinical variables were adjusted for demographic but not diagnostic variables. Stratified associations were reported as odds ratios, with significance tested using Wald χ^2 tests, two-tailed alpha=0.05.

Progression along the continuum of suicidal behavior

A final set of regression analyses examined the role of psychotic experiences in the progression towards more severe suicidal behavior. First, data were restricted only to those reporting 12-month suicidal ideation. Within this subsample, logistic regression was used to determine whether individuals with suicidal ideation who also report psychotic experiences are at increased odds making a suicide attempt compared to those with suicidal ideation alone. Second, data were restricted only to those reported 12-month suicide attempts. Within this second subsample, logistic regression was used to determine whether individuals with severe attempts with intent to die were more likely endorse12-

month psychotic experiences. Associations were reported as odds ratios, with significance tested using Wald chi-square tests, two-tailed alpha=0.05.

Population attributable risk

Given the potential impact of suicide attempts on the health of the population, the population attributable risk was calculated from the OR, (OR-1)/OR x prevalence of psychotic experience exposure (Hennekens, Buring, & Mayrent, 1987), among those with any attempts and specifically for severe attempts. This provided an estimate of the percentage of attempts that could be prevented if psychotic experiences were removed from the population, assuming a causal relationship. In addition, positive predictive value (PPV) of 12-month psychotic experiences for predicting suicide attempts was calculated (separately for any attempts and for severe attempts only), first in the entire sample and then in a subsample limited to respondents who had endorsed 12-month suicidal ideation, given that it would be clinically useful to have indicators of future attempts among respondents expressing ideation.

Results

Descriptives and demographics

The sample was weighted to be nationally representative of U.S. households based on year 2000 census data, with some divergence from census due to the exclusion of subjects with psychotic disorders or who otherwise did not respond to items, as described above. Most notably, many respondents from the predominantly Caucasian NCS-R sample were not assessed for psychosis, leaving ethnic minorities overrepresented in the present

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sample relative to the U.S. population. Descriptive data for the sample is provided in Table

6. Modified CPES weights produced a sample for which more closely resembled the

Table 6. Sample characteristics

	$N = 11716$	Weighted % (SE)
Age		
18-29	2943	24.1 (1.0)
30-44	4140	31.1 (0.8)
45+	4633	44.9 (1.3)
Sex		
Male	4838	48.2 (0.8)
Female	6878	51.8 (0.8)
Race		
White, non-Latino	1619	51.8 (2.2)
Black, non-Latino	4997	18.8 (1.0)
Latino	2914	19.9 (1.5)
Asian	2110	8.1 (0.7)
Other	76	1.4 (0.2)
Marital status		
Married	6125	58.3 (1.1)
Never married	2972	21.6 (0.9)
Previously married	2619	20.1 (0.9)
Education		
HS grad or less	6183	52.7 (1.3)
Some college +	5533	47.3 (1.3)
Employment status		
Employed	7699	63.6 (1.0)
Unemployed	947	7.0 (0.5)
Not in labor force	3070	29.4 (0.9)
Diagnosis (12)		
Depressive disorder	882	7.2 (0.4)
Anxiety	1271	10.4 (0.5)
Drug abuse/dependence	111	1.1 (0.1)
Alcohol abuse/dependence	231	2.3 (0.2)
None	9778	84.0 (0.7)
Psychotic experiences (12)		
Hallucination (only)	340	2.0 (0.2)
Delusion (only)	30	0.2 (0.0)
Both	56	0.4 (0.1)
None	11290	97.4 (0.2)
Suicide (12)		
Ideation	237	2.0 (0.2)
Attempt (any)	47	0.4 (0.1)
Severe attempt	23	0.1 (0.0)

Note: values represent weighted percentage (standard error).
Diagnoses, psychotic experiences, and suicide are not composed of mutually exclusive categories

sociodemographic profile of the U.S. based on the 2000 Census; however, data will only be presented using the original CPES weights given negligible differences in results when applying the modified weights.

The twelve-month prevalence of psychotic experiences was 2.6% (SE=0.2), which primarily consisted of hallucinations. Suicide ideation was more prevalent among those unemployed or not in the labor force, χ^2(df=2)=11.56, p=0.003. Married respondents were less likely to report psychotic experiences, χ^2(df=2)=22.84, p<0.001, suicide attempts, χ^2(df=2)=8.22, p=0.016, and suicidal ideation, χ^2(df=2)=34.68, p<0.001. Younger adults were more likely to endorse suicidal ideation, χ^2(df=2)=25.71, p<0.001, attempts, χ^2(df=2)=10.73, p=0.005, and psychotic experiences, χ^2(df=2)=6.91, p=0.032. Psychotic

Figure 1. Prevalence of common mental disorders among respondents with or without psychotic experiences, suicidal ideation, and suicide attempts. Prevalence of each disorder is significantly greater among respondents reporting each of these three variables. SA = suicide attempts, SI = suicidal ideation, PE = psychotic experiences.
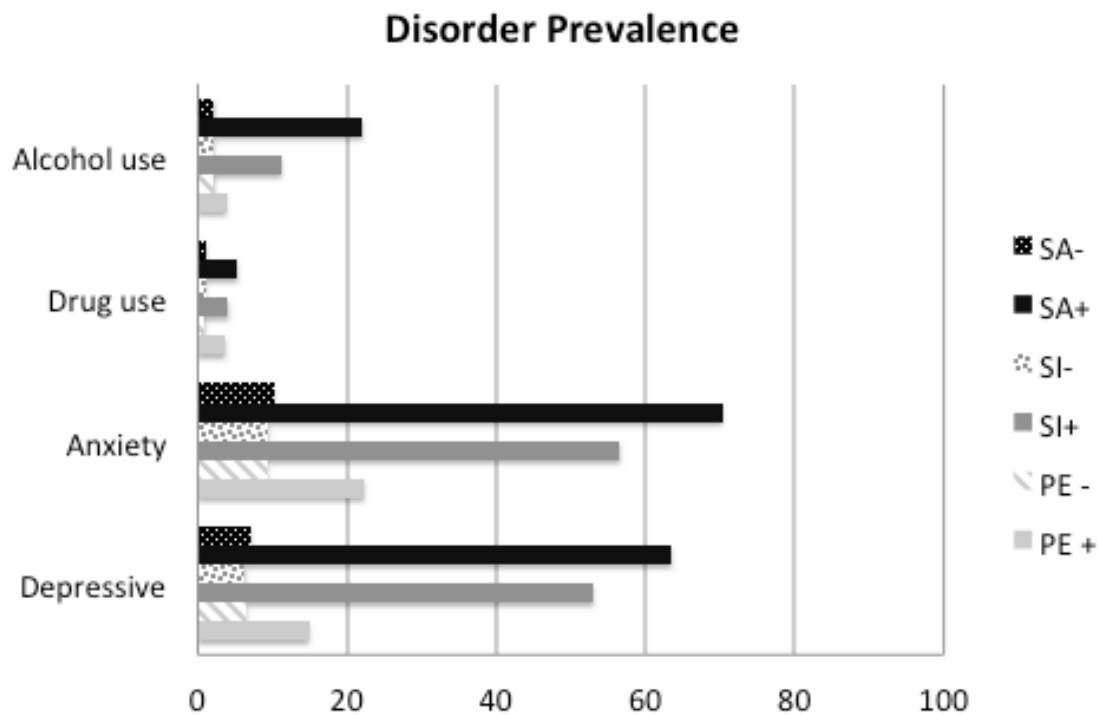
experiences were more common among black and Latino respondents, χ^2(df=4)=30.00, p<0.001, and suicide attempts, χ^2(df=4)=7.06, p=0.133, (but not ideation, χ^2(df=4)=1.48, p=0.830) also varied on race at the trend level. Suicidality and psychosis variables did not vary between males and females or by employment status (data not shown). Social desirability scores did not vary between participants endorsing or not endorsing psychotic experiences, M(SD)=2.15(0.08) versus 2.15(0.04), F(165)=0.00, p=0.965, or suicide attempts, M(SD)=1.77(0.27) versus 2.15(0.04), F(165)=2.01, p=0.158, but were lower for those endorsing suicidal ideation, M(SD)=1.68(0.08) versus 2.16(0.04), F(165)=32.27, p<0.001. All diagnoses were significantly more prevalent among respondents with psychotic experiences, suicidal ideation, or suicide attempts (Figure 1). According to criteria described above, race, marital status, and age were therefore included in subsequent models as potential confounders, as were variables indicating the presence or absence of depressive, anxiety, drug use, and alcohol use disorders.

Table 7. Associations between psychotic experiences and concurrent suicidal ideation and suicide attempts

	Suicidal ideation n=237	Suicide attempt n=47
Respondents with psychotic experiences		
n	35	9
% (SE)	8.8 (2.4)	2.7 (1.0)
Unadjusted		
OR [95% CI]	5.24 [2.85-9.62]	9.48 [3.98-22.62]
Wald χ^2	28.84, p<0.001	26.11, p<0.001
Demographics-adjusted[1]		
OR [95% CI]	4.25 [2.28-7.89]	7.79 [2.97-20.41]
Wald χ^2	21.21, p<0.001	17.68, p<0.001
Clinical-adjusted[2]		
OR [95% CI]	2.49 [1.01-6.13]	3.37 [1.17-9.70]
Wald χ^2	3.97, p=0.046	5.16, p=0.023

Note:
[1] Adjusted for age, race, and marital status
[2] Adjusted for demographic variables as well as 12-month depressive disorders, anxiety disorders, alcohol use disorders, and drug use disorders

Psychotic experiences and suicidality

In the unadjusted analyses, individuals reporting psychotic experiences were

approximately five-fold more likely to report suicidal ideation and nearly 10-fold more

likely to report a suicide attempt over the corresponding 12-month period. This pattern

was consistent across the entire age range (Figure 2). These associations remained

significant when adjusting for demographic factors and for co-occurring clinical conditions

(Table 7). Psychotic experiences were then split into subtypes to determine whether these

associations were primarily driven by sub-threshold delusions, hallucinations, or both.

Both measures of suicidality were associated with hallucinations but not delusions, which

appeared to be specific to the co-occurrence of visual and auditory hallucinations rather

Figure 2. Prevalence of suicidal ideation and suicide attempts by presence or absence of psychotic experiences across three age groups. PE+ signifies respondents with psychotic experiences, and PE- signifies those without.
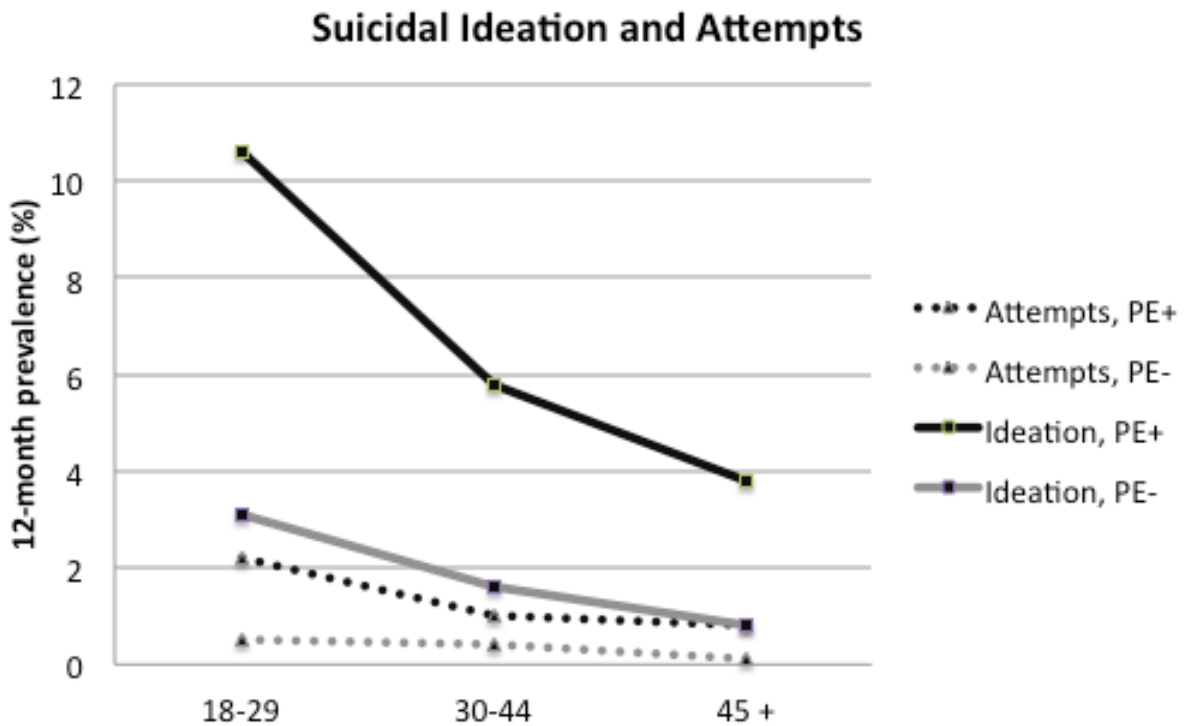
than either type in isolation (Table 8). Psychotic experiences were then subdivided based

on the number of days in the past years on which psychotic experiences had occurred, in

Table 8. Association between specific psychotic experience subtypes and suicidal behaviors

	n	Suicidal ideation	Suicide attempt
Psychotic experiences			
None	11290	-	-
Hallucinations only	340	**2.38 (1.22-4.65)**	**5.82 (2.16-15.63)**
Delusions only	30	0.21 (0.03-1.59)	na
Hall & Del	56	7.61 (0.55-104.64)	1.42 (0.27-7.62)
Post-hoc analysis			
No hallucinations	11320	-	-
Visual hallucination	166	1.13 (0.42-3.04)	0.94 (0.12-7.61)
Hearing voices	101	1.12 (0.20-6.31)	3.60 (0.33-39.64)
Voices & visual	129	**11.97 (2.75-52.14)**	**13.60 (4.74-38.99)**

Note: All analyses are fully adjusted for demographic and clinical variables. Bold font indicates significant associations.

order to test for dose-response relationships. When sub-divided by number of days,

psychotic experiences were not significantly associated with suicidal ideation or suicide

attempts, and the pattern of effect sizes was not consistent with a dose-response

relationship between psychotic experiences and either suicidality outcome. However, when

excluding respondents with delusional experiences (which were not associated with

psychotic experiences in the primary analysis), frequency of hallucinations was associated

with risk for suicide attempts (but not ideation) in a dose-response fashion, confirmed with

a significant test for linear trend (Table 9).

Moderation analyses

When divided by sex, psychotic experiences were significantly associated with suicidal ideation, χ^2(df=1)=6.78, p=0.009, OR[95% CI]=3.96[1.40-11.25], and suicide attempts, χ^2(df=1)=16.92, p<0.001, OR[95% CI]=7.43[2.84-19.44] among females, but

Table 9. Tests of dose-response relationships between frequency of psychotic experiences (total and hallucinations-only) and measures of suicidal behavior.

	n	Suicidal ideation	Suicide attempt
Any psychotic experience			
Never	11290	-	-
Rarely	192	1.61 (0.54-4.82)	1.85 (0.22-15.45)
Occasionally	108	5.47 (0.75-40.12)	4.53 (0.74-27.74)
> Monthly	77	0.87 (0.24-3.17)	3.99 (0.66-24.27)
Linear trend		X2(df=1)=0.12, p=0.73	X2(df=1)=2.71, p=0.10
Hallucinations only			
Never	11416	-	-
Rarely	169	2.08 (0.74-5.86)	4.03 (0.79-20.41)
Occasionally	83	2.36 (0.35-15.99)	**7.89 (1.05-59.24)**
> Monthly	48	1.72 (0.54-5.54)	**9.75 (1.89-50.27)**
Linear trend		X2(df=1)=0.69, p=0.41	**X2(df=1)=8.18, p=0.004**

Note: All analyses are fully adjusted for demographic and clinical variables. Bold font indicates significant associations.

were not significantly associated with ideation, χ^2(df=1)=0.16, p=0.90, OR[95% CI]=0.92[0.27-3.14], or attempts, χ^2(df=1)=0.09, p=0.77, OR[95% CI]=1.41[0.14-13.86], among males. Psychotic experiences were only significantly associated with suicidal ideation, χ^2(df=1)=4.83, p=0.028, OR[95% CI]=5.32[1.19-23.88], and suicide attempts χ^2(df=1)=12.86, p<0.001, OR[95% CI]=8.01[2.55-25.20], among those with at least some college education, compared to no college (ideation: χ^2(df=1)=0.44, p=0.51, OR[95% CI]=1.34[0.56-3.22]; attempts: χ^2(df=1)=0.00, p=0.96, OR[95% CI]=0.95[0.16-5.55]). Psychotic experiences were associated with greater risk for suicidal ideation both among respondents with co-occurring diagnosable disorders, χ^2(df=1)=5.20, p=0.023, OR[95%

CI]=1.92[1.09-3.38], and without co-occurring disorders, χ^2(df=1)=6.49, p=0.011, OR[95%

CI]=7.25[1.56-33.64]. Moderation analysis of suicide attempts by the presence or absence

of co-occurring disorders could not be conducted as there were no suicide attempts among

respondents who did not also meet criteria for DSM-IV depressive, anxiety, or substance

use disorders.

Severity of suicidality

Two additional analyses were conducted to determine whether psychotic

experiences were associated with more severe suicidal behavior. First, the sample was

limited to those reporting 12-month suicidal ideation to test whether psychotic

experiences were associated with attempts among those who already had suicidal

thoughts. Among this group, psychotic experiences were not significantly associated with

increased odds for a suicide attempt in bivariate analyses, but were associated with more

than 3-fold greater odds of making an attempt when adjusting for demographic and clinical

Table 10. Associations between psychotic experiences and suicide attempt among the subsample of respondents who reported suicidal ideation over the past 12-months.

Analysis	Statistics
Unadjusted	
OR [95% CI]	2.36 [0.69-8.09]
Wald χ^2	1.88, p=0.170
Demo-adjusted[1]	
OR [95% CI]	2.95 [0.93-9.40]
Wald χ^2	3.41, p=0.065
Clinical-adjusted[2]	
OR [95% CI]	3.49 [1.05-11.58]
Wald χ^2	4.22, p=0.040

Note:
[1] Adjusted for age, race, and marital status
[2] Adjusted for demographic variables as well as 12-month depressive disorders, anxiety disorders, alcohol use disorders, and drug use disorders

covariates (Table 10). By comparison, depressive disorders, OR[95% CI]=1.67[0.62-4.52], anxiety disorders, OR[95% CI]=1.57[0.40-6.09], alcohol use disorders, OR[95% CI]=2.10[0.58-7.59], and drug use disorders, OR[95% CI]=1.64[0.24-11.17], were not predictive of suicide attempts among those with ideation. Subsequent analyses in which confounders were individually added to the bivariate model identified depressive disorder (which is inversely correlated with psychotic experiences among people with suicidal ideation) as the suppression variable responsible for the attenuated relationship between psychotic experiences and suicide attempts in the unadjusted analysis.

Table 11. Prevalence of 12-month psychotic experiences among respondents making a severe suicide attempt in the past year

	Severe attempt[1] n=23
Psychotic experiences	
n	7
% (SE)	36.1 (14.7)
No psychotic experiences	
n	16
% (SE)	63.9 (14.7)
Statsitsics[2]	
OR [95% CI]	5.09 [0.51-50.73]
Wald χ^2	2.00, p=0.157

Note:
[1] Severe attempt is defined as attempts made with intention and expectation of death
[2] Unadjusted due to low frequency of severe attempts

The sample was then further limited to those with a 12-month suicide attempt. Most respondents with psychotic experiences who made attempts specifically made attempts with intent to die (7/8; weighted % (SE)=76.8 (21.0)), and psychotic experiences were present in more than 1/3 of all severe suicide attempts and were associated with substantially greater odds of reporting an intent to die during the most recent suicide

attempt, although this association was not significant, likely due to the low frequency of severe attempts in this sample (Table 11).

Population attributable risk

Measured as population attributable risk, 17.53% of total suicide attempts and 29.01% of severe suicide attempts annually could be attributed to the presence of psychotic experiences during the concurrent period, assuming a causal relationship. The positive predictive value of psychotic experiences for suicide attempts (with any level of intent) was 2.11% in the entire sample and 25.7% in the subsample endorsing past-year suicidal ideation. Specifically for severe suicide attempts, the PPV was 1.64% in the entire sample and 20.0% among respondents endorsing past-year suicidal ideation.

Discussion

In support of the primary hypotheses, 12-month psychotic experiences were associated with more than three-fold greater odds of suicide attempts during the concurrent period in a general population sample of adults, and more than two-fold greater odds of suicidal ideation, even when controlling for potential demographic and clinical confounders. This is consistent with prior studies of suicidality among individuals with psychotic experiences, which have demonstrated cross-sectional associations between psychotic experiences and suicidal ideation, plans, attempts, and deliberate self-harm in adolescents (Kelleher et al., 2012b; Nishida et al., 2010) and in adults (Saha et al., 2011a), and longitudinally in adolescence (Kelleher et al., 2013b) and from childhood into adulthood (Fisher et al., 2013). The association between psychotic experiences and suicidal acts was very similar in magnitude to that identified in two cross-sectional cohorts by

Kelleher and colleagues (unadjusted OR=9.48 in this study, OR=9.0 and 8.5 in their two

samples; 2012b), despite the older age group of this sample (adults rather than

adolescents) and lower prevalence of psychotic experiences, which consisted

predominantly of auditory hallucinations in both studies. These findings are therefore in

concurrence with their conclusion that: "while psychotic symptoms in general decline with

age, their relationship with suicidal behavior does not show the same decline" (page 1281,

Kelleher et al., 2012b).

Individual subtype analysis revealed that the association with suicide attempts was

specific to sub-threshold hallucinations, particularly the co-occurrence of visual and

auditory hallucinations, with risk for attempts increasing in a dose-response fashion with

increasing frequency of hallucinations. Exposure to hallucinations-only was likewise

associated with suicidal ideation, when delusional experiences were excluded. The

symptom make-up of this sample appears similar to that of Kelleher and colleagues'

(2012b) study of suicidality and psychosis, in that it was predominantly hallucinations with

delusions being less common and generally only occurring in the context of hallucinations.

Hallucinations were likewise the most common psychotic experience subtype in the study

by Nishida and colleagues (2010), and auditory hallucinations were the only symptom

assessed in the recent prospective cohort study by Kelleher and colleagues (2013b), both of

which showed associations between psychotic experiences and suicidality. However, Saha

and colleagues (2011a) found a close association between delusional experiences and

suicidal behaviors, in contrast to this sample in which the 'delusions only' group had no

suicide attempts and was actually at reduced odds for suicidal ideation relative to the

general population. The prevalence of delusional experiences was far greater in the study

by Saha and colleagues, and it is likely that the discrepancy in findings reflects variation in the definition and measurement of delusions. Of note, assessment of psychotic experiences using semi-structured clinician interview has produced similar distribution of symptom types as that found in our study (i.e. predominantly hallucinations, low prevalence of delusional experiences), supporting the validity of our subtype measures (Zammit et al., 2013).

Respondents with psychotic experiences also reported greater severity of suicidal behavior in two separate tests. Specifically, people with psychotic experiences were at 3.5 times the odds of a suicide attempt among those who reported ideation, and nearly five times the odds of a severe attempt with intent to die among those who made an attempt, although this second test was not statistically significant, likely due to lack of power related to the small size of the subsamples of interest. In contrast, other clinical diagnoses typically associated with suicide, including depressive disorders and substance use disorders, were *not* associated with increased severity of suicidal behavior, suggesting that psychotic experiences may uniquely serve as indicators of risk for attempts among respondents with ideation.

No prior studies have specifically examined intent to die among people with psychotic experiences. Intent to die is of notable clinical significance as it is associated with more lethal behaviors and the greater likelihood of a subsequent completed suicide (Nock & Kessler, 2006). Kelleher et al. (2012b) likewise found a significant association between psychotic experiences and more severe suicidal behaviors (plans or attempts) among individuals who reported ideation, although to an even greater magnitude (OR=19.6). This was also consistent with findings from the National Comorbidity Survey that non-affective

psychosis was associated with intent to die among respondents reporting suicide attempts (Nock & Kessler, 2006). In a sample of adolescents, Nishida and colleagues (2010) described associations between psychotic experiences and deliberate self-harm behaviors (without intent to die). Deliberate self-harm was rare among respondents endorsing psychotic experiences in this sample, most of who made attempts with serious intent to die.

Moderation by comorbidities

The association between psychotic experiences and suicide attempts was limited to respondents with co-morbid DSM-IV diagnoses of depressive, anxiety, or substance use disorders. This is in concurrence with Kelleher and colleagues' (2012b) finding of increased risk for broadly defined suicidal behavior (ideation, plans, or attempts) associated with psychotic experiences specifically among adolescents with depressive, anxiety, or childhood-onset disorders. Notably, there were no suicide attempts in the absence of a co-occurring diagnosable disorder regardless of the presence of psychotic experiences, although psychotic experiences were associated with suicidal ideation in this subgroup.

Direction of causality

The relationship between psychotic experiences and suicidality may reflect either a causal relationship, such that the experience of psychotic symptoms directly leads to suicidal thoughts and behavior, or it may reflect the presence of shared underlying risk factors. A causal relationship would imply that intervening directly with psychotic experiences could reduce the prevalence of suicidal behaviors. In the absence of a causal relationship, psychotic experiences may nonetheless serve as useful risk indicators of suicidality that can be quickly screened in the clinical setting.

This study tested for a dose-response relationship between days of total psychotic experiences or hallucinations and risk for suicidal ideation and attempts, proposing that a dose-response relationship would be evidence for a causal association. When limiting the exposure category to hallucinations, a dose-response relationship (significant linear trend) was found for suicide attempts but not suicidal ideation. This is in agreement with stronger evidence for causality from the prospective cohort study by Fisher and colleagues (2013), who recently demonstrated that childhood psychotic experiences are associated with a four-fold greater risk for suicide attempts or completed suicides by age 38, and the prospective cohort study of adolescents by Kelleher and colleagues (2013b), showing that psychotic experiences are associated with an 11-fold greater odds of suicide attempts over the subsequent year.

Alternatively, both psychotic experiences and suicidality may both serve as non-diagnosis-specific indicators of severe psychopathology, and may relate to shared risk factors such as childhood trauma or victimization. These factors were not assessed in the present study and therefore could not be included as potential confounds in the regression models. However, two prior studies have tested associations between psychotic experiences and suicidality controlling for trauma and victimization, which did not explain the association in either case (Nishida et al., 2010; Saha et al., 2011a). It is therefore unlikely that associations between psychosis and suicidality will be explained entirely by shared risk factors. Other possible common causes that have not been sufficiently explored include general psychological distress (Chamberlain, Goldney, Delfabbro, Gill, & Dal Grande, 2009; Saha, Scott, Varghese, & McGrath, 2011b) and emotional reactivity to routine stress (Palmier-Claus, Taylor, Gooding, Dunn, & Lewis, 2012).

Suicide in schizophrenia and other psychotic disorders

Certain aspects of suicidality among individuals with psychotic disorders, particularly elevated risk following the first episode (Bertelsen et al., 2007; Dutta et al., 2010), associations with insight (Lincoln, Lullmann, & Rieff, 2007; Lopez-Morinigo et al., 2012), and associations with cognitive function (Kim et al., 2003), may suggest that suicidal thoughts and behavior are a reaction to onset or related functional disruptions. Examining suicidality among individuals with sub-threshold psychosis provides a critical test for this explanation. The presented findings that the association between psychosis and suicide extends to the sub-threshold range of the psychosis continuum are not consistent with the hypothesis that suicidality in psychotic disorders is entirely a reaction to the illness itself (although this can still be a contributing factor in those with threshold psychotic disorder). Instead, these findings are more consistent with a direct link between suicidality and psychosis, either through shared genetic or environmental risk factors or possibly through a causal relationship, as discussed above.

Public health impact

The presented results implicate psychotic experiences as indicators of suicide attempts during the concurrent period, particularly severe attempts. Psychotic experiences were found to be present in an estimated 36.1% of all severe suicide attempts with intent and expectation to die, with a population attributable risk of 29.01%. These estimates assume a causal relationship between psychotic experiences and suicidal behavior, which has recently been supported through two prospective studies (Fisher et al., 2013; Kelleher et al., 2013b). Regardless of whether the causality assumption is valid, which could not be tested in these cross-sectional data, psychotic experiences may nonetheless serve as useful

indicators of future attempts. Further, the number of suicide attempts associated with

psychotic experiences is likely an underestimate of the true population given that only

living participants could be interviewed in these household surveys, excluding detection of

completed suicide attempts. Given that attempts associated with psychotic experiences

were of the most severe quality and greatest degree of intent, and that non-affective

psychosis is associated with completed versus attempted suicide (Beautrais, 2001), it is

likely that there would have been a substantially greater prevalence of undetected

completed suicides in the psychotic experience group compared to the general population.

Despite the high prevalence of severe suicide attempts among people with psychotic

experiences, the PPV was still low within the entire sample, limiting the usefulness of these

symptoms alone as predictors of suicide attempts. However, PPV increased greatly

(20.00% versus 1.64%) when limiting the sample to those with 12-month suicidal ideation,

suggesting that they may be highly useful in predicting attempts among those who are

already expressing ideation. Clinical contact is common immediately preceding completed

suicides (Luoma, Martin, & Pearson, 2002), making it feasible to prevent more severe

suicidal behavior if those at greatest risk can be identified.

Practice implications

The estimates described above would suggest that identifying people with psychotic

experiences and intervening appropriately and effectively could potentially reduce the

annual prevalence of severe suicide attempts in the United States by approximately one

third. Psychotic experiences are primarily predictive of attempts when they occur among

people with suicidal ideation. The vast majority of individuals reporting concurrent

psychotic experiences and suicide attempts met diagnostic criteria for affective, anxiety, or

substance use disorders. An efficient approach therefore may be for social workers to screen for psychotic experiences among individuals in treatment for these disorders, identifying an elevated risk group for psychotic experience-related suicidality. The moderation analyses presented here can further guide the definition of the high-risk group, as psychotic experiences appear to be predominantly related to suicide attempts among women and among individuals with at least some college education. Even with appropriate screening and detection protocols in place, prevention of suicide attempts will depend on the development of effective interventions tailored towards this high-risk group. Future development of such approaches can draw from known efficacious interventions for suicidality among people with depression, anxiety, or psychosis, including cognitive behavior therapy for suicide prevention (Stanley et al., 2009). Given the limited public awareness of sub-threshold psychosis, psychoeducation approaches may likewise be valuable in maintaining and reinforcing social support for individuals with psychotic experiences (Chen & Lukens, 2011), and may reduce the risk of associated suicide attempts (Bergmans & Links, 2002).

Strengths, limitations, and conclusions

Strengths of this study include the large population-level sample, multiple measures of suicidality including intent to die (which had not been assessed in prior studies of psychotic experiences & suicidality), and data on clinical diagnoses and a broad range of potentially confounding demographic variables. Further, this is only the second study to directly assess the population attributable risk for suicide attempts among respondents with psychotic experiences (Kelleher et al., 2013b), and the first to do so in adults, which is

highly valuable in assessing the utility of screening for psychotic experiences as a means to identify individuals at clinical risk for suicide.

There are several potential limitations as well. First, this is a household survey that did not sample individuals who were institutionalized or homeless, where the prevalence of both psychotic experiences and suicidality may be greater. The use of in-person interviews rather than a national registry or interviews with family informants, for example, also precluded the detection of completed suicides. Second, psychotic experiences, suicidality, and clinical diagnoses were assessed through trained lay interview rather than by experienced clinicians. The use of 12-month rather than lifetime measures biases the measures towards more severe cases of psychotic experiences, suicidality, and diagnoses, yet allowed analysis of concurrent relationships between clinical phenomena. Suicide attempts and psychotic experiences may be two particularly stigmatized experiences, and therefore may have been a reporting bias such that those who were more likely to report one were also more likely to report the other, although this is unlikely to explain these data given that neither measure was significantly associated with social desirability scores. It is also a potential limitation that neither the presence of commands nor other qualitative aspects of hallucinations (or other psychotic experiences) could be assessed in these data. Hallucinations vary in their relation to suicidality depending on whether they are persecutory commands or otherwise (Harkavy-Friedman et a., 2003), and case reports have likewise suggested that qualitative content may be more important than quantitative (Siris & Acosta, 2012). However, one prior study suggested that command hallucinations only explain a small minority of suicidal cases among those with psychotic experiences (Kelleher et al., 2012b). Finally, several potential shared causal factors were

not available for all respondents and therefore were not included in the analysis, including

childhood trauma exposure and general psychological distress. However, prior studies

have shown that trauma exposure and victimization cannot fully explain the relationship

between psychotic experiences and suicidality (Nishida et al., 2010; Saha et al., 2011a).

This study, taken in context of prior research that has generally yielded consistent

results using varying demographic samples, definitions of psychotic experiences, and

definitions of suicidal behavior (Fisher et al., 2013; Kelleher et al., 2012b; Nishida et al.,

2010; Saha et al., 2011a), strongly supports an association between psychotic experiences

and suicidal thoughts and behavior. Most importantly, it implicates psychotic experiences

as either an indicator or causal agent in progression towards greater severity of suicidality,

particularly in that they predict attempts among those with ideation and that they are

present in more than one third of respondents reporting severe suicide attempts with

intent to die. No other clinical variable, including depressive and substance use disorders,

reliably distinguished those who made attempts from those who did not among the

subsample of respondents with 12-month ideation. It would be very useful in future studies

to identify factors that distinguish people with psychotic experiences who do attempt

suicide from those who do not, as has been done in schizophrenia (Harkavy-Friedman et

al., 1999), which could then be used to improve their positive predictive validity and,

consequently, their utility in screening for risk of severe suicidal behavior. Future studies

also should continue to build on existing evidence that there is a causal relationship

between psychotic experiences and suicidality (Fisher et al., 2013; Kelleher et al., 2013b). If

the relationship is causal than interventions can address psychotic experiences directly,

thereby reducing distress associated with these symptoms as well as risk for suicidal

behavior. If the relationship is not causal then psychotic experiences are nonetheless useful

clinical indicators of severe suicidal behavior. Clinical screens can be implemented

accordingly, and interventions can be developed to prevent suicidal behavior among

individuals with psychotic experiences in the general population. Either approach, properly

implemented, has great potential public health benefits in reducing risk of death or

disability associated with severe suicide attempts and other suicidal behavior.

Chapter IV

Comorbidities with Common Mental Health Conditions

Comorbidities with common mental health conditions are common in schizophrenia

(Buckley, Miller, Lehrer, & Castle, 2009; Tsai & Rosenheck, 2013) and its risk states

(Addington et al., 2011a; DeVylder et al., 2012; Fusar-Poli, Nelson, Valmaggia, Yung, &

McGuire, 2012a), complicating presentation of the disorder and its treatment. Psychosis is

now widely believed to occur on a continuum in the population, with an estimated 7.2% of

the general population experiencing sub-threshold psychotic experiences at some point in

their lifetimes (Linscott & van Os, 2013). Co-morbidity of common mental health conditions

(i.e. non-psychotic disorders that tend to be highly prevalent in the population, including

major depressive disorder, anxiety disorders, post-traumatic stress disorder, substance use

disorders) among people with psychotic experiences may indicate clinical significance in

two ways. First, it can directly indicate that those with psychotic experiences have more

extensive mental health difficulties and therefore also greater potential need for treatment.

Secondly, it has been suggested that the presence of psychotic experiences in common

mental disorders may be associated with greater clinical need than that associated with the

primary diagnosis alone.

Psychotic experiences among individuals with specific diagnoses

Population-based studies of co-morbidity have generally focused on the prevalence

of psychotic experiences among people with particular primary diagnoses, finding

widespread associations. For example, prevalence of psychotic experiences is greater in

adults with major depressive disorder or any anxiety disorder in Europe (van Nierop et al.,

2012; Wigman et al., 2012) and Australia, with or without inclusion of post-traumatic

stress disorder (PTSD) (Saha et al., 2012; Varghese et al., 2011), which is no longer classified as an anxiety disorder (American Psychiatric Association, 2013). PTSD itself is associated in cross section specifically with delusional experiences (Scott, Chant, Andrews, Martin, & McGrath, 2007), consistent with other studies showing elevated prevalence of trauma exposure history among individuals reporting psychotic experiences (Johns et al., 2004; Kelleher et al., 2008; Lataster et al., 2006). In addition, psychotic experiences are likewise associated with substance use disorders, including both alcohol and drug dependence in England (Johns et al., 2004). Others studies have shown associations with drug use across a broad range of substances (opiate, cannabis, alcohol, tobacco; Degenhardt & Hall, 2001) and particularly cannabis use (Rössler et al., 2007). Only two studies have suggested that there may be a limit to this extensive co-morbidity between psychotic experiences and common mental disorders. In one prospective study, Fisher and colleagues (2013) showed that childhood psychotic experiences only significantly predicted the future onset of PTSD among common disorders (and schizophrenia), not of *persistent* depressive, anxiety, or substance use disorders. Among adolescents, Kelleher and colleagues (2012a) likewise found no association between psychotic experiences and anxiety disorders, but did present significant associations with affective and behavioral disorders. Of note, the samples for all of the above studies were racially homogenous, either primarily or entirely white respondents from Europe, Australia, or New Zealand.

Psychotic experiences in the context of general psychopathology

One possible explanation for widespread associations between psychotic experiences and nearly all classes of psychopathology is that risk for psychosis may increase with greater severity of mental health difficulties, regardless of the particular

quality of such impairment. Overall severity of psychopathology may be indicated by

quantifying the number of co-occurring disorders, or by measuring symptom severity

within disorders or phenotypic dimensions. Several studies have found dose-response

relationships between severity of co-morbidities and risk for psychotic experiences. Among

children and adolescents in Ireland, risk for psychotic experiences appears to increase

linearly as the child meets criteria for an increasing number of diagnosable conditions,

replicated across four population data sets using different categories of disorder and

means of assessment (Kelleher et al., 2012a) and among a help-seeking clinical sample

(Kelleher et al., 2013a). Similarly, within a single disorder, risk for delusional experiences

increases with increasing severity of major depression (Saha et al., 2012). These findings,

coupled with the widespread associations with specific mental health conditions, suggest

that the quantitative extent of psychopathology (i.e. number of comorbid diagnoses) may

be as important or more important than the qualitative nature of psychopathology (i.e.

presence of particular comorbid diagnoses) in determining risk for psychotic experiences.

Outcomes in the context of primary diagnoses

Psychotic experiences not only occur frequently within common disorders, but also

may impact their clinical significance. This has been demonstrated among young adults

with major depression and anxiety disorders, where psychotic experiences are associated

with a more persistent illness course, publicly apparent illness behavior, and greater

utilization of services (Wigman et al., 2012). Kelleher and colleagues (2013a) found that

psychotic experiences were related to suicidal behaviors among adolescents with affective,

anxiety, or behavioral disorders, although this study did not find an association with

suicidal thoughts. Other studies have shown that psychotic experiences are associated with

increased utilization of services even when adjusting for co-morbid conditions (DeVylder et al., in press; Murphy et al., 2012), although one analysis found no added effect of psychotic experiences on treatment-seeking when statistically adjusting for the severity of depressive symptoms over the concurrent period (Kobayashi, Nemoto, Murakami, Kashima, & Mizuno, 2011). In addition, psychosis is associated with impairment in cognition (Heinrichs & Zakzanis, 1998; Krabbendam, Arts, van Os, & Aleman, 2005; Rund, 1998), even in prodromal (Fusar-Poli et al., 2012b) and first episode psychosis (Mesholam-Gately, Giuliano, Goff, Faraone, & Seidman, 2009), as well as role function (Cornblatt et al., 2007; Rinaldi et al., 2010), suggesting that psychotic experiences may be associated with poor cognitive function and role impairment within the context of common disorders, although this has not previously been tested.

Ethnic differences in co-morbidities with psychosis

All studies of comorbidities between psychotic experiences and general mental health conditions, reviewed above, have been conducted with samples consisting entirely or nearly entirely of white respondents, with the exception of two studies of treatment-seeking, both of which including comorbid conditions as potential confounds rather than primary variables of interest (in Japan, Kobayashi et al., 2011; in the United States with oversampling of Asians, Latinos, African-Americans, and Afro-Caribbeans, DeVylder et al., in press). Generalizability of findings of comorbidity across racial and ethnic groups is therefore unknown. However, threshold schizophrenia is known to occur worldwide (Tandon, Keshavan, & Nasrallah, 2008), and sub-threshold psychotic experiences were identified in all 52 countries of the World Health Organization's World Health Survey

(Nuevo et al., 2012). As such, the psychosis continuum is likely a universal phenomenon, conceivably with a similar clinical profile across disparate cultural and ethnic groups.

Aims and hypotheses

This dissertation paper examines mental health comorbidities, specifically depressive, anxiety, trauma, and substance use disorders among adults reporting psychotic experiences in the general population, using four population-level datasets including one nationally representative survey and three surveys of distinct ethnic groups in the United States. Replicating results across different ethnicities supports the cross-cultural generalizability of findings, whereas significant variation in the magnitude or type of comorbidity would support ethnic differences. The primary hypothesis was that psychotic experiences would be highly prevalent across disorders and across surveys, and would be increasingly prevalent with greater co-morbidity in a dose-response fashion. A strong dose-response relationship with multi-morbidity (i.e. number of subtypes of disorder) in the context of weak relationships with individual disorders would be consistent with the proposition that psychosis may derive from more extensive and severe psychopathology rather than from specific types of disorder (i.e. quantity rather than quality). Alternatively, if Fisher and colleague's (2013) suggestion is correct that psychotic experiences are specifically related to post-traumatic stress disorder (and schizophrenia), then prevalence of psychotic experiences would be hypothesized to only be independently associated with this disorder and should not increase in a dose-response fashion with an increasing number of co-morbid conditions. The secondary aim was to examine the added clinical significance of psychotic experiences among people with co-occurring disorders in terms of suicide risk, cognitive impairment, role impairment, and service utilization, with the

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prediction that psychotic experiences would be associated with increased impairment and service utilization, as found in young adults (Wigman et al., 2012). Alternatively, the true clinical need may be carried by the primary diagnosis, with psychotic experiences representing qualitative distinctions that do not necessarily indicate greater severity or need for care beyond that of the co-morbid disorder (Kobayashi et al., 2011). Finally, it was hypothesized that findings would be consistent across all surveys since there is no clear a priori evidence or reason to expect that psychotic experiences vary in terms of clinical need and co-morbidities across ethnic groups, although this prediction was tentative given that all prior research had been conducted with predominantly white samples.

Method

Participants

The analyses presented in this paper were conducted separately with four samples drawn from three general population surveys from the United States. The surveys used similar methodology and sampling design, and collectively compose the Collaborative Psychiatric Epidemiology Surveys (CPES; Alegría et al., 2007a). The four samples are drawn from 1) the National Comorbidity Survey-Replication (NCS-R; Alegría et al., 2007b; Kessler et al., 2004), 2) the National Latino and Asian American Study (NLAAS; Alegría et al., 2004; Alegría & Takeuchi, 2007), and 3) the National Survey of American Life (NSAL; Jackson et al., 2004; 2007). All surveys utilized multi-stage sampling designs, drawing participants from households in the 48 contiguous states. The NCS-R is a nationally representative survey of 9282 individuals (predominantly Caucasian, reflecting the general population of the United States), of which a random subsample (*n*=2322) completed the psychosis

screen. The NLAAS is a survey of Latino (n=2554) and Asian Americans (n=2095), which was analyzed as two separate samples (divided by ethnicity) for the purposes of this paper. Finally, the NSAL is a nationally representative sample of African-American households (n=3570), with Afro-Caribbean (n=1621) and Caucasian (n=891) respondents drawn from the same source neighborhoods, although Caucasians were not assessed with the psychosis screen. Because the focus of this study is on sub-threshold psychosis, participants were excluded if they had a lifetime psychotic disorder, conservatively defined as a self-reported a lifetime diagnosis of schizophrenia or meeting WHO-CIDI criteria for lifetime bipolar disorder (regardless of presence of psychosis). Participants were also excluded if they were missing data for any of the variables of interest, including sociodemographic confounders. Following exclusion, the sample sizes and percent included for each survey were: NCS-R: n=2216 (95.4%); NLAAS Latino: n=2539 (99.4%); NLAAS Asian: n=2077 (99.1%); NSAL: n=4884 (94.1%).

Measures

Demographic variables (age, sex, race, foreign birth, education, employment status, and marital status) were self-reported by respondents. Psychotic experiences were assessed using the WHO-CIDI 3.0 psychosis screen, which included items assessing: 1) visual hallucinations, 2) auditory hallucinations, 3) thought insertion, 4) thought control, 5) telepathy, and 6) delusions of persecution. Psychotic experiences were excluded if the experience took place solely in the context of falling asleep, dreaming, or substance use.

Respondents were assessed for lifetime DSM-IV axis I disorders using the World Mental Health Composite International Diagnostic Interview (WHO-CIDI), a widely used and reliable structured interview assessment for diagnosis (Haro et al., 2006; Wittchen,

1994). Participants were coded positive for affective disorders if they met criteria for major

depressive disorder or dysthymia; for anxiety disorders if they met criteria for generalized

anxiety disorder, agoraphobia with and without panic disorder, panic disorder, or social

phobia; for substance use disorders if meeting criteria for abuse or dependence of alcohol

or other substances; and individually for post-traumatic stress disorder, which is no longer

classified as an anxiety disorder in the most recent edition of the Diagnostic and Statistic

Manual for Mental Disorders (DSM-5; American Psychiatric Association, 2013).

Respondents were also assessed on four outcome variables, indicating lifetime

treatment seeking, lifetime suicide attempts, cognitive function, and role function.

Treatment-seeking was defined as having ever seen a mental health professional (lifetime),

which included a psychiatrist, psychologist, clinical social worker, or other medical (e.g.

general practitioner, nurse practitioner) or counseling professional (e.g. counselor,

psychotherapist, spiritual advisor) seen for mental health reasons. Respondents were

asked whether they had ever attempted suicide, either as part of a written self-report

module (for respondents literate in English), which has been shown to facilitate accurate

reporting of suicidal behavior (Turner et al., 1998), or orally for those not literate in

English. Cognitive function and role function (i.e. time out of role) were assessed using

World Health Organization Disability Assessment Schedule (WHO-DAS) scales. WHO-DAS

items were highly skewed and were therefore recoded into dichotomous variables

indicating high impairment (as close as possible to the top 20% of impairment on that

measure among the sample), in accordance with past studies of psychosis in these data

(Kessler et al., 2005a).

Analyses

All analyses were conducted using the complex sample features of SPSS version 21. All statistical estimates were weighted using sampling weights for the corresponding survey, in order to account for individual-level sampling factors including non-response and unequal probabilities of selection. Design-based analyses were used to estimate standard errors that accounted for the complex multistage clustered design of each survey. The analytic plan was conducted independently but following identical procedures for each of the four surveys (NCS-R, NLAAS Latino sample, NLAAS Asian sample, NSAL). Post-hoc analyses tested for differences between the Afro-Caribbean and African American subsamples of the NSAL in terms of comorbidities with psychotic experiences; all main results were in the same direction and of similar effect size magnitude. NSAL results are therefore presented as a single set of analyses.

Descriptive data for demographic variables and prevalence of psychotic experiences, by diagnosis, were reported across all four samples. Demographic variables (age, sex, foreign birth, marital status, employment status, education) were first independently compared between participants with and without psychotic experiences using bivariate logistic regression, in order to identify potential confounder variables. Associations between each diagnostic group (depressive, anxiety, substance use, and PTSD) were tested using logistic regression, first without adjustment as separate bivariate analyses, and then together in a single model (with adjustment for demographic confounds) in order to assess independent associations between each diagnostic category and psychotic experiences. Diagnostic categories were then summed to create a measure of multi-morbidity, in order to test for a dose-response relationship between the number of disorder subtypes and risk for psychotic experiences. This was likewise tested using

Table 12. Descriptive data for all variables, divided by data set.

Variable	NCS-R *N*=2216	NLAAS (Asians) *N*=2077	NLAAS (Latinos) *N*=2539	NSAL *N*=4884
Continuous				
Age	46.45	39.03	38.03	42.46
Categorical				
Sex				
Male	47.9 (1.5)	47.4 (1.1)	51.4 (1.4)	44.3 (0.8)
Female	52.1 (1.5)	52.6 (1.1)	48.6 (1.4)	55.7 (0.8)
Race				
White, non-Latino	73.0 (2.4)	-	-	-
Black, non-Latino	12.4 (1.5)	-	-	100.0 (0.0)
Latino	11.1 (1.7)	-	100.0 (0.0)	-
Asian	1.3 (0.3)	100.0 (0.0)	-	-
Other	2.2 (0.4)	-	-	-
Foreign-born				
Yes	6.8 (1.0)	76.1 (3.1)	57.3 (2.4)	6.8 (0.4)
No	93.2 (1.0)	23.9 (3.1)	42.7 (2.4)	93.2 (0.4)
Marital status				
Married	56.0 (1.6)	68.8 (1.6)	64.2 (1.4)	42.7 (1.0)
Never married	21.3 (1.4)	22.9 (1.2)	21.3 (1.2)	31.5 (1.2)
Previously married	22.7 (1.4)	8.3 (0.9)	14.5 (1.0)	25.8 (0.8)
Education				
HS grad or less	51.4 (1.7)	32.0 (2.0)	68.5 (1.5)	60.9 (1.6)
Some college +	48.6 (1.7)	68.0 (2.0)	31.5 (1.5)	39.1 (1.6)
Employment status				
Employed	62.1 (1.5)	64.0 (1.5)	63.2 (1.8)	67.8 (1.1)
Unemployed	6.3 (0.8)	6.2 (0.7)	7.5 (0.9)	10.0 (0.7)
Not in labor force	31.6 (1.4)	29.8 (1.5)	29.3 (2.0)	22.2 (0.9)
Diagnoses (lifetime)[1]				
Depressive disorder	14.6 (1.0)	9.2 (1.0)	14.3 (0.8)	10.8 (0.6)
Anxiety disorder	16.6 (0.9)	8.6 (0.9)	12.9 (0.9)	12.1 (0.6)
PTSD	5.5 (0.5)	1.9 (0.4)	4.5 (0.5)	8.6 (0.5)
Substance use disorder	12.8 (0.7)	3.8 (0.6)	11.1 (1.3)	10.8 (0.7)
None	66.3 (1.3)	83.0 (1.3)	70.7 (1.5)	70.4 (0.9)
Suicide attempt (lifetime)				
Yes	0.3 (0.1)	0.1 (0.1)	0.3 (0.1)	0.2 (0.1)
No	99.7 (0.1)	99.9 (0.1)	99.7 (0.1)	99.8 (0.1)
Treatment (lifetime)				
Yes	41.4 (1.3)	14.0 (1.1)	19.6 (1.1)	29.9 (1.0)
No	58.6 (1.3)	86.0 (1.1)	80.4 (1.1)	70.1 (1.0)
Cognitive impairment				
Yes	9.4 (0.7)	7.2 (0.7)	6.4 (0.8)	13.0 (0.6)
No	90.6 (0.7)	92.8 (0.7)	93.6 (0.8)	87.0 (0.6)
Role impairment				
Yes	19.5 (0.9)	12.3 (0.9)	14.6 (0.8)	26.9 (1.0)
No	80.5 (0.9)	87.7 (0.9)	85.4 (0.8)	73.1 (1.0)
Psychotic experiences				
Yes	8.6 (0.9)	6.2 (0.6)	9.6 (0.8)	11.1 (0.7)
No	91.4 (0.9)	93.8 (0.6)	90.4 (0.8)	88.9 (0.7)

Notes: values indicate weighted % (standard error)
[1] Diagnoses are not mutually exclusive

logistic regression (excluding variables indicating specific diagnoses), with adjustment for potential demographic confounds.

A final set of analyses compared participants with and without psychotic experiences among a limited sample consisting solely of those who met lifetime diagnostic criteria for any depressive, anxiety, or substance use disorder, or PTSD, in order to examine whether psychotic experiences modified the severity of common disorders in terms of cognitive impairment, role impairment, suicide risk, and whether they were associated with utilization of services. Respondents with and without psychotic experiences were compared separately on each outcome measure using logistic regression, with adjustment for potential demographic confounders. A second set of outcome analyses additionally controlled for the number of co-morbid mental health conditions.

Table 13. Prevalence of psychotic experience by diagnosis and diagnostic category, across each data set.

	NCS-R	NLAAS (Asian)	NLAAS (Latino)	NSAL
No diagnosis	6.4 (1.2)	5.2 (0.7)	6.7 (0.5)	8.0 (0.5)
Depressive	15.7 (2.1)	10.0 (2.4)	16.6 (2.5)	21.4 (2.9)
Major depression	15.4 (1.9)	9.3 (2.4)	16.2 (2.5)	21.6 (3.0)
Dysthymia	30.1 (7.7)	19.0 (7.5)	23.1 (6.7)	20.3 (6.3)
Anxiety	14.8 (1.9)	12.6 (2.2)	15.9 (2.6)	21.5 (2.1)
Generalized anxiety disorder	15.1 (2.8)	17.5 (8.1)	13.9 (3.9)	28.2 (5.2)
Agoraphobia with panic	17.0 (5.6)	6.0 (5.6)	19.3 (6.1)	15.0 (3.3)
Agoraphobia without panic	18.6 (5.7)	4.4 (4.2)	17.5 (4.9)	17.7 (3.6)
Panic disorder	16.5 (3.8)	12.7 (4.6)	21.5 (5.6)	33.9 (4.4)
Social phobia	15.0 (2.2)	11.1 (3.4)	15.2 (3.1)	18.5 (2.8)
PTSD	18.1 (3.9)	19.2 (9.1)	22.0 (5.2)	25.1 (2.9)
Substance	14.2 (2.2)	16.4 (4.1)	22.0 (5.2)	18.7 (2.7)
Alcohol abuse	13.6 (2.3)	17.8 (4.5)	18.6 (4.1)	16.9 (2.4)
Alcohol dependence	15.7 (3.3)	-	22.3 (4.9)	18.0 (3.5)
Drug abuse	15.8 (3.1)	5.6 (3.3)	23.0 (6.0)	22.7 (4.1)
Drug dependence	19.4 (6.3)	6.6 (0.6)	39.3 (10.4)	37.8 (6.8)

Note: Values indicate weighted percentage (standard error). No respondents endorsed both drug abuse and psychotic experiences in the Asian sample.

Statistical significance was assessed for all tests using Wald χ^2, with two-tailed

alpha=0.05. Effect sizes were reported as unadjusted (bivariate analyses) or adjusted

(multiple logistic regression analyses) odds ratios (OR) with 95% confidence intervals (CI).

Table 14. Odds ratios indicating difference in risk for psychotic experiences within a particular diagnostic category.

Diagnosis	Psychotic Experiences: OR [95% CI]	Statistics, p
NCS-R		
None	0.45 [0.29-0.70]	χ^2(df=1)=13.17, p<0.001
Depressive	2.32 [1.54-3.47]	χ^2(df=1)=17.51, p<0.001
Anxiety	2.17 [1.51-3.12]	χ^2(df=1)=18.57, p<0.001
PTSD	2.51 [1.48-4.27]	χ^2(df=1)=12.27, p<0.001
Substance	1.95 [1.27-2.99]	χ^2(df=1)=9.89, p=0.002
Asian		
None	0.44 [0.26-0.75]	χ^2(df=1)=9.75, p=0.002
Depressive	1.77 [0.98-3.22]	χ^2(df=1)=3.73, p=0.053
Anxiety	2.40 [1.49-3.86]	χ^2(df=1)=13.82, p<0.001
PTSD	3.73 [1.07-13.05]	χ^2(df=1)=4.48, p=0.034
Substance	3.16 [1.65-6.03]	χ^2(df=1)=12.81, p<0.001
Latino		
None	0.36 [0.23-0.55]	χ^2(df=1)=21.79, p<0.001
Depressive	2.15 [1.53-3.02]	χ^2(df=1)=20.66, p<0.001
Anxiety	1.98 [1.39-2.83]	χ^2(df=1)=15.09, p<0.001
PTSD	2.84 [1.55-5.20]	χ^2(df=1)=11.85, p=0.001
Substance	2.64 [1.43-4.87]	χ^2(df=1)=10.01, p=0.002
NSAL		
None	0.38 [0.30-0.49]	χ^2(df=1)=65.05, p<0.001
Depressive	2.47 [1.74-3.52]	χ^2(df=1)=26.24, p<0.001
Anxiety	2.54 [1.96-3.29]	χ^2(df=1)=52.16, p<0.001
PTSD	3.09 [2.28-4.19]	χ^2(df=1)=54.96, p<0.001
Substance	2.02 [1.47-2.79]	χ^2(df=1)=54.96, p<0.001

Note: Odds ratios are unadjusted
CI = confidence interval, df = degrees of freedom, OR = odds ratio, SE = standard error

Results

Descriptive data for all demographic and clinical variables in each data set, which

differed primarily in terms of ethnic make-up, are presented in Table 12. Psychotic

experiences, comorbid diagnoses, treatment, and suicide are all notably uncommon among

the Asian-American sample compared to others, possibly limiting statistical power for

further analysis with this group. Prevalence of psychotic experiences was numerically

greater in the context of every individual disorder and diagnostic subtype, across all data

sets, with the exception of agoraphobia (without panic disorder) among the Asian sample

(Table 13). All remaining analyses utilized diagnostic subtypes (depressive, anxiety, PTSD,

substance) rather than individual disorders. In unadjusted bivariate analyses, lifetime

prevalence of psychotic experiences was significantly greater among respondents with

each subtype of mental health condition (depressive, anxiety, and substance use disorders,

and PTSD diagnosis) compared to the remainder of the sample, across all four data sets

(Table 14).

Relationships were then tested between each diagnostic category and psychotic

experiences using a fully adjusted model, which controlled for demographic variables as

well as each remaining subtype of mental disorder. In the fully adjusted model, odds for

psychotic experiences were still greater within each data set and each mental health

condition, except for depressive disorders in the NLAAS Asian data set (Table 15).

Table 15. Final adjusted model of the association between each diagnostic category and psychotic experiences, within each data set.

	NCS-R	NLAAS (Asian)	NLAAS (Latino)	NSAL
Clinical variables				
None (reference)	-	-	-	-
Depressive	**1.70 [1.15-2.53]**	0.98 [0.45-2.17]	**1.62 [1.16-2.27]**	**1.71 [1.14-2.56]**
Anxiety	**1.56 [1.08-2.26]**	1.53 [0.77-3.02]	1.35 [0.89-2.05]	**1.76 [1.31-2.36]**
PTSD	1.46 [0.82-2.60]	2.41 [0.55-10.55]	1.77 [0.93-3.38]	**2.15 [1.58-2.93]**
Substance	**1.85 [1.15-2.96]**	1.95 [0.90-4.21]	**2.14 [1.19-3.87]**	**1.44 [1.05-1.98]**
Confounder variables				
Age	0.99 [0.98-1.01]	1.00 [0.98-1.02]	1.01 [1.00-1.02]	1.00 [0.99-1.01]
Sex (ref: male)	**1.84 [1.22-2.78]**	0.82 [0.54-1.26]	1.06 [0.82-1.37]	0.99 [0.78-1.26]
Foreign-born (ref: no)	1.18 [0.66-2.12]	0.73 [0.46-1.16]	0.82 [0.53-1.26]	0.81 [0.54-1.21]
Marital (ref: married)	-	-	-	-
Never married	1.36 [0.78-2.35]	1.50 [0.83-2.70]	**1.84 [1.33-2.55]**	1.21 [0.90-1.64]
Previously married	1.35 [0.77-2.37]	1.57 [0.72-3.44]	1.14 [0.82-1.57]	**1.53 [1.05-2.23]**
Education (ref: no college)	0.80 [0.55-1.16]	1.46 [0.98-2.18]	1.48 [0.91-2.39]	1.03 [0.77-1.39]
Employm. (ref: employed)	-	-	-	-
Unemployed	1.15 [0.51-2.59]	**2.61 [1.15-5.88]**	1.09 [0.53-2.23]	**1.47 [1.04-2.06]**
Not in labor force	1.22 [0.79-1.88]	**0.54 [0.33-0.90]**	1.02 [0.70-1.49]	**1.64 [1.18-2.27]**

Note: Values presented as OR [95% CI], with each OR adjusted for the remaining clinical conditions as well as sociodemographic factors. Significant associations are presented in bold.
CI = confidence interval; OR = odds ratio

However, the effect sizes were reduced relative to those from the unadjusted analyses and many were no longer statistically significant. Specifically, adjusted associations were only significant with depressive disorders in the NCS-R, NLAAS Latino, and NSAL samples, with anxiety disorders in the NCS-R and NSAL samples, with PTSD in the NSAL sample, and with substance use disorders in the NCS-R, NLAAS, and NSAL samples. Sociodemographic associations with psychotic experiences likewise varied across the data sets, with respondents reporting psychotic experiences more likely to be female in the NCS-R only, less likely to be foreign-born in the NLAAS Asian, NLAAS Latino, and NSAL, more likely to be never married in the NLAAS Latino only, previously married in the NSAL, and unemployed in the NLAAS Asian and NSAL, and more likely to be out of the labor force in the NSAL but less likely in the NLAAS Asian. Consistent with the elevated risk for psychotic experiences among respondents with mental disorders, prevalence of mental disorders was likewise high among respondents with psychotic experiences, although psychotic experiences without comorbidities were notably more common among Asian-Americans (Table 16).

Table 16. Prevalence of disorders among respondents with PE

	NCS-R	NLAAS (Asians)	NLAAS (Latinos)	NSAL
None	48.8 (5.3)	69.7 (5.9)	49.0 (5.6)	50.7 (2.6)
Depressive	26.4 (3.9)	14.6 (3.7)	24.7 (2.6)	20.7 (2.7)
Anxiety	28.4 (3.0)	17.3 (3.7)	21.3 (3.0)	23.2 (1.9)
PTSD	11.5 (2.3)	5.9 (3.1)	10.2 (2.1)	19.4 (2.0)
Substance	21.1 (3.5)	10.0 (2.9)	22.5 (6.0)	18.1 (2.1)

Note: Values indicate % (standard error)

The next set of analyses tested for a dose-response relationship between the number of subtypes of common mental disorders and odds for psychotic experiences.

There was a significant linear relationship between the number of co-morbid conditions

and psychosis risk across all four data sets (Table 17).

Finally, each data set was examined for associations between psychotic experiences

and clinically significant outcome variables among respondents with co-occurring

diagnosable disorders. There was a general pattern of more severe clinical and functional

outcomes among respondents with psychotic experiences (Figure 3), although this was not

statistically significant across all analyses. Specifically, respondents with psychotic

experiences were significantly more likely to be classified as having high cognitive

Table 17. Logistic regression tests for dose-response relationships between increasing numbers of comorbid diagnoses and odds of psychotic experiences

# of diagnoses	Psychotic experience prevalence, %(SE)	Psychotic experiences: OR [95% CI]	Statistics, p
NCS-R			χ^2(df=3)=39.01, p<0.001
0	6.4 (1.2)	-	-
1	10.4 (1.6)	1.70 [1.01-2.87]	-
2	15.5 (2.1)	2.62 [1.58-4.33]	-
3+	25.0 (4.6)	5.04 [2.91-8.73]	-
Lin trend			χ^2(df=1)=38.85, p<0.001
Asian			χ^2(df=3)=8.27, p=0.041
0	5.2 (0.7)	-	-
1	8.7 (2.2)	1.53 [0.76-3.08]	-
2	17.2 (5.1)	2.62 [1.10-6.23]	-
3+	16.9 (5.8)	2.46 [0.89-6.86]	-
Lin trend			χ^2(df=1)=4.28, p=0.039
Latino			χ^2 (df=3)=32.14, p<0.001
0	6.7 (0.5)	-	-
1	14.9 (2.9)	2.30 [1.36-3.90]	-
2	20.5 (3.8)	3.59 [2.23-5.77]	-
3+	18.7 (5.2)	3.09 [1.47-6.47]	-
Lin trend			χ^2 (df=1)=10.05, p=0.002
NSAL			χ^2 (df=3)=97.58, p<0.001
0	8.0 (0.5)	-	-
1	15.0 (2.0)	1.93 [1.39-2.66]	-
2	21.6 (2.8)	3.05 [2.10-4.44]	-
3+	37.0 (5.7)	6.13 [3.87-9.69]	-
Lin trend		-	χ^2(df=1)=64.25, p<0.001

Note: All analyses are fully adjusted for all potential sociodemographic confounders

impairment (NCS-R, NLAAS Latino, NSAL, but not NLAAS Asian) and high role impairment

(NLAAS Asian, NLAAS Latino, but not NCS-R or NSAL) in some but not all surveys. Those with psychotic experiences were also more likely to have made a lifetime suicide attempt in the NCS-R, NLAAS Latino, and NSAL, but not in the NLAAS Asian. Finally, psychotic experiences were significantly associated with greater utilization of services in the NCS-R and NSAL, but not in either NLAAS sample. Associations were slightly attenuated but largely unchanged when controlling for multi-morbidity (Figure 4).

Figure 3. Odds ratios for outcomes associated with psychotic experiences among respondents with a common mental disorder. Odds ratio values are displayed on a logarithmic scale.
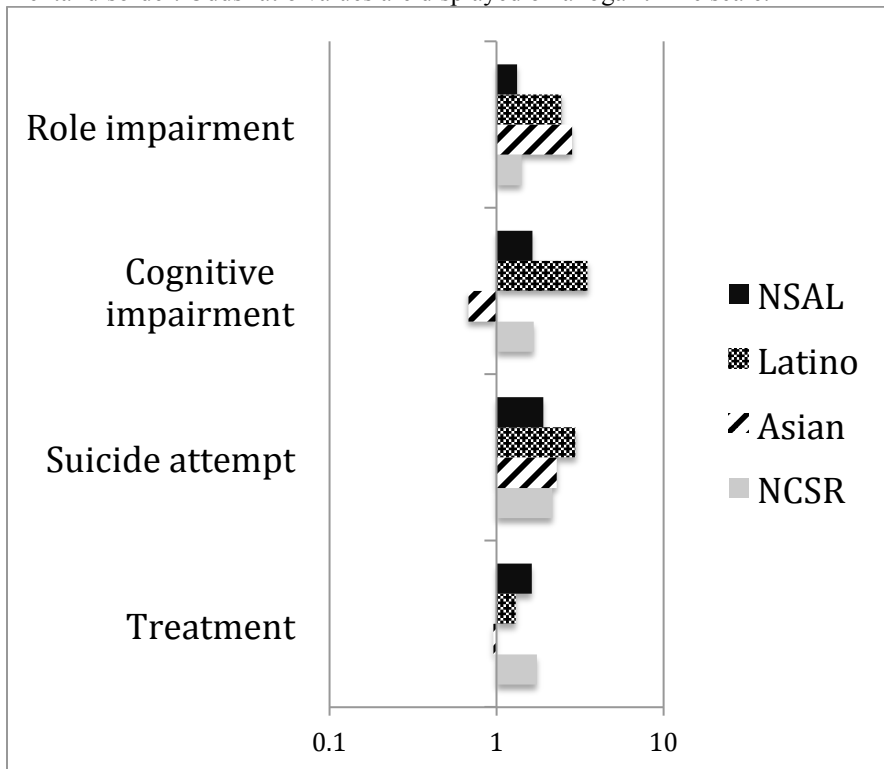
Figure 4. Odds ratios for outcomes associated with psychotic experiences among respondents with a common mental disorder, with adjustments for multi-morbidity. Odds ratio values are displayed on a logarithmic scale.
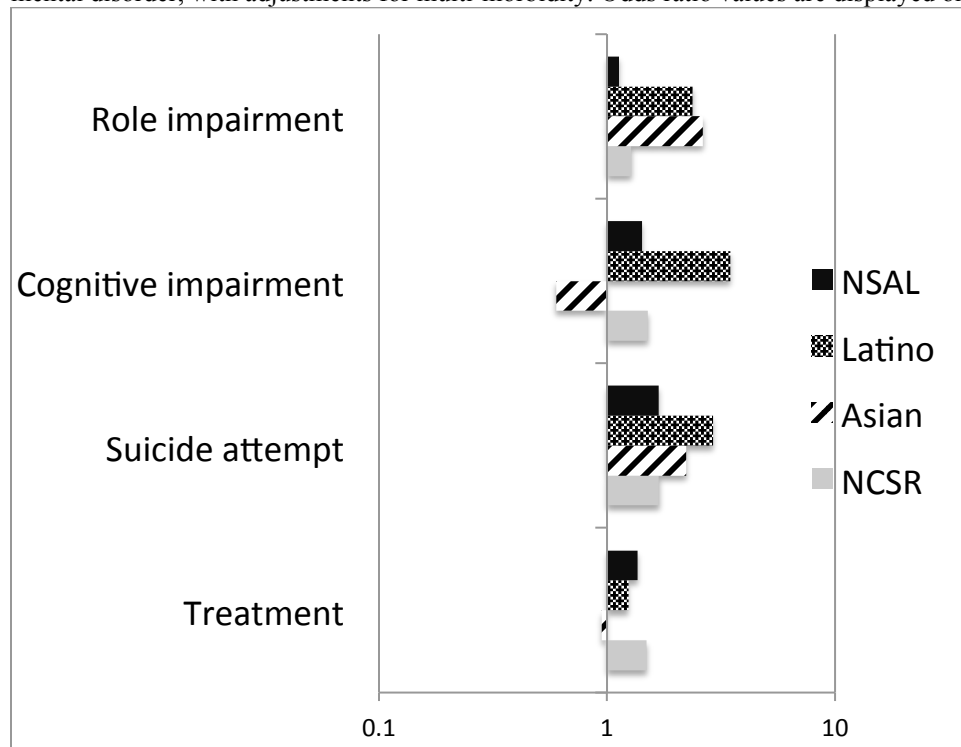
Discussion

Main findings

There is increasing evidence that sub-threshold psychotic experiences occur frequently in the general population, particularly among individuals with one or more other diagnosable disorders (Johns et al., 2004; Kelleher et al., 2012a; Saha et al., 2012; Scott et al., 2007; van Nierop et al., 2012; Varghese et al., 2011; Wigman et al., 2012). In this analysis, there were widespread moderate associations with psychotic experiences across all types of psychopathology, replicated in four data sets including a nationally representative sample and three samples within specific ethnic groups. These associations were consistently weakened and only variably significant, although still in the predicted direction, when controlling for sociodemographic confounders and, perhaps more importantly, the remaining subtypes of disorder. However, the relationship between the

extent of co-morbidity (i.e. number of subtypes of diagnosable disorders) was robust to

controls for sociodemographic factors, exhibiting a strong linear relationship across all four

data sets, suggesting that psychotic experiences may specifically be related to the quantity

(number of co-occurring disorders) rather than the quality (specific diagnoses) of co-

occurring mental health conditions. Finally, psychotic experiences modify the clinical

severity of common mental disorders in terms of increased risk for suicide attempts and

cognitive impairment in these data across all groups except Asian-Americans, with more

variable findings for treatment-seeking behavior and role impairment.

Is psychosis risk related to the quality of or the degree of psychopathology?

The prevalence of psychotic experiences was elevated in the context of every

individual diagnosis and diagnostic category examined, across all samples, with a single

exception (Agoraphobia without panic disorder among Asian-Americans). Several studies

have now tested for associations between psychotic experiences and specific psychiatric

diagnoses, generally finding significantly greater prevalence of psychotic experiences

among those with the disorder in question compared to those without the disorder,

regardless of what that particular disorder may be (i.e. depressive, anxiety, and substance

use disorders, and PTSD; Johns et al., 2004; Saha et al., 2012; Scott et al., 2007; van Nierop

et al., 2012; Varghese et al., 2011; Wigman et al., 2012) The notable exception is the recent

study by Fisher and colleagues (2013), in which childhood psychotic experiences were

prospectively associated with schizophrenia and PTSD in adulthood, but not with

persistent anxiety or depressive disorders or substance dependence. However, even in

their analyses, prevalence of each class of disorder was higher among respondents with

childhood psychotic experiences (anxiety: RR=1.47; depression: RR=1.50; substance

dependence: RR=1.91), and may not have been statistically significant due to low power (i.e. psychotic experiences with anxiety: n=5; with depression: n=4; with substance dependence: n=6). Overall therefore, the literature points to widespread associations between psychotic experiences and psychopathology in general, with few convincing examples of null associations. Given that the data presented here likewise demonstrate consistent associations with every disorder subtype (in bivariate analysis) it would be parsimonious to conclude that the odds of psychotic experiences are increased in the context of psychopathology in general, not any particular subtype of mental health condition. Such non-specific comorbidity has likewise been found among people with schizophrenia, a population with an elevated prevalence of comorbidity across the entire spectrum of mental health conditions (Buckley et al., 2009), and among individuals with a family history of schizophrenia, who are likewise at elevated risk for a broad range of psychiatric disorders (Dean et al., 2010; DeVylder & Lukens, 2013)

Although psychosis may not be related to the *type* of co-occurring psychopathology, it may be related to the *severity* of co-occurring psychopathology, as indicated by the number of co-occurring disorders. Such an explanation is consistent with the linear dose-response relationship identified here across all four data sets, which is likewise in concurrence with past studies showing that odds for psychotic experiences increase with more extensive multi-morbidity (Kelleher et al., 2012a; 2013a) and with greater severity within a single diagnosis (Saha et al., 2012). There is substantially more evidence (below) that psychosis and common mental disorders share risk factors than there is that psychosis causes the emergence of co-occurring conditions (or vice versa), suggesting this relationship may highlight the utility of psychotic experiences as indicators of extensive

comorbidity and clinical significance, but not necessarily as causes. This appears to point

to a construct of sub-threshold psychosis as an independent syndrome or dimension of

psychopathology, the risk for which is increased with greater extent of comorbidity but

which is not bound to a single class of disorder.

Mechanisms of multi-morbidity

There are numerous potential explanations for the co-occurrence of psychosis with

common mental health disorders, none of which could be distinguished based on the

presented data but should be explored in future studies. The onset of psychosis is now

widely attributed to epigenetic mechanisms, such that the presence of particular genes may

make someone more vulnerable to the development of psychosis, but additional

environmental exposures are necessary for the expression of these genes and the

consequent presentation of symptoms (van Os, Rutten, & Poulton, 2008). Similar gene-

environment interactions are believed to explain a broad range of mental health conditions

(Rutter, Moffitt, & Caspi, 2006), thereby explaining the paradox that 1) environmental

exposures are known to lead to onset of certain mental health conditions, yet 2) not

everyone exposed to these factors develops a mental health condition (Caspi & Moffitt,

2006). Recent evidence has shown that diagnostically disparate mental health conditions

(i.e. schizophrenia, autism, attention-deficit hyperactivity disorder, bipolar disorder, and

major depressive disorder) share genetic risk-loci (Cross-Disorder Group of the Psychiatric

Genomics Consortium, 2013), confirming through genetic analysis what had previously

been concluded from research with twins (Kendler, Prescott, Myers, & Neale, 2003). As

such, inherited genes may exert pleiotropic effects such that a common set of 'risk' genes

may lead to different and seemingly disparate phenotypic expressions (Weiser, van Os, &

Davidson, 2005), which may then be more or less consistent with particular diagnostic criteria.

In addition to shared genetic vulnerabilities, psychosis and common mental health conditions also share environmental risk factors. For example, childhood trauma may lead to post-traumatic stress disorder (e.g. Cloitre et al., 2009), but is also more prevalent among people with depressive and anxiety disorders (Douglas et al., 2010; Hovens et al., 2010), substance abuse disorders (Douglas et al., 2010; Ducci et al., 2009; Medrano, Zule, Hatch, & Desmond, 1999; Wilsnack, Vogeltanz, Klassen, & Harris, 1997), and notably among people with psychotic experiences (Arseneault et al., 2011; Galletly et al., 2011; Mackie, Castellanos-Ryan, & Conrod, 2011; Soosay et al., 2012). Similar non-specific associations are found with social support, employment status, socioeconomic status, and other known risk factors for psychotic experiences (Linscott & van Os, 2013).

Psychosis and common mental disorders also share substrates of neural dysfunction, which may mediate the relationship between genetic and environmental risk factors and symptom presentation. For example, the dysfunction of the hypothalamic-pituitary-adrenal (HPA) axis plays a critical role in the onset of schizophrenia in the neurobiological diathesis-stress model, in that chronic activation of the HPA-axis (possibly due to impaired inhibition from the hippocampus and prefrontal cortex) may lead to sensitization of the dopamine system, behaviorally manifested as psychotic symptoms (Corcoran et al., 2003; Walker & DiForio, 1997). However, PTSD is likewise characterized by sensitization of the HPA axis (Yehuda, 2001), and alcohol use disorders are characterized by impaired inhibition of the HPA axis (Thayer et al., 2006). HPA axis dysfunction is also present in major depression (Pariante & Lightman, 2008) and anxiety

disorders (Kallen et al., 2008), including panic disorder (Abelson et al., 2007) and social phobia (Condren et al., 2002), among others. Other potential shared neural substrates across psychosis and common disorders may include prefrontal cortex function, hippocampal damage, and abnormalities in dopamine circuits.

It is also conceivable that psychiatric disorders can causally lead from one to another. For example, an ongoing debate regarding schizophrenia etiology focuses on the role of substance abuse (particularly cannabis) in the onset of symptoms (Casadio, Fernandes, Murray, & Di Forti, 2011). Similarly, anxiety disorders may lead to the subsequent onset of depressive disorder, or vice-versa (Lamars et al., 2011). Although it is parsimonious to assume that multi-morbidity is caused by shared risk factors, it is possible that it is caused by shared risk factors *in addition to* interactive effects between diagnoses (or dimensions of symptoms). Pilot analysis of temporal order of diagnoses and psychotic experiences in this sample based on retrospective estimates of age of onset did not appear reliable or consistent across data sets (data not shown), leaving this an open question that would be better answered using prospective cohort data.

Clinical significance of psychotic experiences

Psychotic experiences occurring in the context of diagnosable mental disorders increase risk for suicide attempts across all samples studied except the Asian sample, for which there was likely insufficient statistical power given the lower prevalence of both psychotic experiences and suicide attempts among this ethnic group. Several studies have now supported a link between sub-threshold psychosis and suicidal ideation (Nishida et al., 2010; Saha et al., 2011) and attempts (Fisher et al., 2013; Kelleher et al., 2012b; 2013b; Saha et al., 2011). This finding is therefore unsurprising, but is notable as the first study to

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find this association specifically in respondents with co-occurring disorders. Wigman and colleagues (2012) tested for an association between psychotic experiences and suicidal ideation among respondents with major depression or anxiety disorders but found no association. This discrepancy may be explained by the difference in measures of suicidality; Kelleher and colleagues (2013a) recently suggested that psychotic experiences may be related to attempts but not ideation because they primarily affect the more severe range of the suicidality spectrum; this is likewise supported by the analysis in paper 1 of this dissertation.

Psychotic experiences were likewise associated with cognitive impairment in all data sets except the NLAAS Asian sample. Cognitive impairment is a well-known component of threshold psychosis (Heinrichs & Zakzanis, 1998) as early as the first psychotic episode (Mesholam-Gately et al., 2009) and the antecedent prodromal period (Fusar-Poli et al., 2012b), and has been proposed as a causal agent contributing to the onset of psychotic symptoms (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001). The presence of cognitive impairment at and prior to first episode psychosis would suggest that it is a component of the broader psychosis phenotype and therefore should be present among respondents with sub-threshold psychosis, as was shown here. Cognitive remediation therapies have been effective in reducing cognitive impairment, symptom severity, and functional impairment in schizophrenia (McGurk, Twamley, Sitzer, McHugo, & Mueser, 2007) and likewise may benefit individuals with sub-threshold psychotic experiences, particularly when they occur in the context of common mental disorders.

Other forms of clinical significance are difficult to determine in these data, given the generally inconsistent findings across data sets. Treatment-seeking was only marginally

more common among people with psychotic experiences, in contrast to a prior study with these data showing that treatment-seeking was substantially more common among those with psychotic experiences when including respondents *without* co-occurring disorders (DeVylder et al., in press). The association between sub-threshold psychosis and treatment-seeking behavior has been debated in the field. Studies controlling for co-occurring diagnoses have found significant relationships between psychosis and service utilization (DeVylder et al., in press; Murphy et al., 2012), whereas a study controlling for *severity* of co-occurring psychopathology did not find a relationship between psychosis and treatment (Kobayashi et al., 2011). Time out of role is similarly difficult to interpret, as it is only significantly associated with psychosis among the Asian and Latino samples. Psychotic experiences may therefore be associated with additional role function impairment above and beyond that associated with the primary diagnoses, although this should be replicated in future studies.

Psychosis co-morbidities across ethnic groups

The four data sets examined in this paper all were drawn from the same source country using similar methods, with ethnicity as the primary factor distinguishing each sample. No single prior study has attempted to replicate findings with psychotic experiences across ethnic groups. In this analysis, findings were largely consistent, particularly in that psychotic experiences were associated 1) with all classes of psychopathology in bivariate analyses and 2) with multi-morbidity in a dose-response fashion, across all four samples. Findings pertaining to clinical outcomes were more variable, most notably that psychotic experiences were not associated with suicide attempts or cognitive impairment among Asians, as they were across all other samples.

Prior research on psychotic experience among Asian-Americans is essentially non-existent with the exception of one study showing that psychosis prevalence is related to the experience of acculturative stress (DeVylder et al., 2013a), making it difficult to interpret this cross-ethnic difference. The association between psychosis and suicide attempts is similar in terms of effect size across all ethnic groups, and may only be insignificant among Asians due to insufficient power (i.e. prevalence rates of suicide attempts, psychotic experiences, and common mental disorders are all lower in Asians). This would not explain the absence of associations with cognitive dysfunction or treatment seeking in the Asian sample, however. The only other study to show a *lack* of association between psychotic experiences and service utilization was conducted in Tokyo, Japan (Kobayashi et al., 2011). More research is needed to determine whether psychotic experiences, or more precisely, the subjective experiences prompting a respondent to respond positively to a psychosis screen, are qualitatively different among Asians or Asian-Americans compared to other ethnic groups, particularly in terms of their clinical significance.

Strengths, limitations, and conclusions

The primary strength of this study is the use of four large general population data sets with varying ethnic composition, allowing multiple replications and cross-cultural validation within a single study. Further, diagnoses and the presence of psychotic experiences were both determined using the WHO-CIDI interview, widely considered a valid measure for use in general population survey samples. However, despite validation with clinical interviews (Haro et al., 2006), which themselves may be fallible, the assessment of psychiatric diagnoses and psychosis using lay interviews may be subject to misclassification. Epidemiologists have intermittently argued for the use of psychometric

measures of psychopathology rather than categorical diagnoses (e.g. Dohrenwend, 1990), which may produce more valid measured when administered by lay-interviewers, and indeed would have been consistent with the assumption, inherent in studying sub-threshold psychosis, that psychopathology is continuously distributed in the population. Controversy over the validity of single diagnoses in lay-administered surveys is offset by the use of subgroups of disorders, rather than individual diagnoses. A further potential limitation is that PTSD and anxiety disorders are separated based on DSM-5 guidelines, although the diagnoses in the surveys utilized DSM-IV criteria. This was done to test the alternative hypothesis that psychotic experiences may be specifically related to PTSD (Fisher et al., 2013), and to be consistent with current conventions (American Psychiatric Association, 2013). Overall, concerns over measurement are partially allayed by the study design, which allowed up to four replications of any significant findings; measurement limitations, which would generally introduce random error, are unlikely to sufficiently explain several replications of a statistical association.

This study provides strong evidence that psychotic experiences are associated with multi-morbidity of common mental health conditions, both in the general population of the United States and across specific ethnic groups. Associations between psychotic experiences and clinical outcomes were more tenuous and are in need of replication, particularly given the substantial clinical importance of the association between psychotic experiences and both suicide attempts and cognitive impairment among individuals with common mental health conditions.

Chapter V

<u>The Persistence of Psychotic Experiences</u>

The prevalence of sub-threshold psychotic experiences in the general population is known to far surpass that of threshold psychotic disorders, such as schizophrenia, consistent with a population-level continuum model of psychosis (Linscott & van Os, 2010; 2013; van Os et al., 2009). Despite not being of sufficient severity to meet categorical diagnostic criteria, these symptoms may nonetheless cause impairment. Previous studies have shown that they are associated with psychological distress (Armando et al., 2010; Cohen & Marino, 2013; Saha et al., 2011b; Yung et al., 2006), pathological co-morbidities (Johns et al., 2004; Kelleher et al., 2012a; Saha et al., 2012; Scott et al., 2007; van Nierop et al., 2009; Varghese et al., 2011; Wigman et al., 2012; Fisher et al., 2013), suicidal thoughts (Fisher et al., 2013; Kelleher et al., 2012b; 2013b; Nishida et al., 2010; Saha et al., 2011), need for care (Bak et al., 2005; DeVylder et al., in press), and treatment-seeking (DeVylder et al., in press; Murphy et al., 2012). As such, these psychotic experiences constitute a high-risk exposure for a broad range of negative outcomes, and persistence of these experiences can be interpreted as prolonged exposure to this risk state. In addition, prospective longitudinal studies have shown that persistence of psychotic experiences predict later severe mental health outcomes, including schizophrenia, post-traumatic stress disorder, substance use, and suicidal behavior (Cougnard et al., 2007; Dhossche, Ferdinand, Van der Ende, Hofstra, & Verhulst, 2002; Dominguez et al., 2011; Fisher et al., 2013; Werbeloff et al., 2012).

Risk factors associated with the lifetime prevalence of psychotic experiences are reasonably well-established, and generally consistent with known risk factors for threshold

psychotic disorders (Linscott & van Os 2010; van Os et al., 2009), with the most consistent

risk factors across studies including belonging to an ethnic minority group, being

unmarried, and using alcohol or other substances (Linscott & van Os, 2013). However, it

cannot be assumed that factors associated with onset of a mental health condition are also

associated with its persistence, an assumption violated even in disorders of seemingly clear

etiology such as post-traumatic stress disorder (Dohrenwend, Yager, Wall, & Adams, 2013).

Psychotic experiences appear to be transient and short-lived among adults in the

population (De Loore et al., 2011; Hanssen et al., 2005), with most symptom subtypes

declining in prevalence with increasing age (Rössler et al., 2007), although relatively few

studies have directly examined factors related to persistence versus remission of psychotic

experiences over time. Prospective cohort and population studies have linked persistence

of psychotic experiences to psychological factors such as daily life stress reactivity (Collip

et al., 2013), environmental and sociodemographic factors including substance use, ethnic

minority status, trauma exposure, and victimization (Mackie et al., 2011; Wigman et al.,

2011), as well as financial, judicial, and relationship problems (Rössler et al., 2007), and

characteristics of the psychotic experiences themselves, with the co-occurrence of

hallucinations and delusions associated with greater risk for persistence (De Loore et al.,

2011; Smeets et al., 2012; 2013).

In addition to associations with the onset of threshold psychotic disorder (Hanssen

et al., 2005), persistent psychotic experiences have also been associated with clinical and

functional outcomes. Specifically, Rössler and colleagues (2007) found a wide range of poor

functional outcomes among the respondents with persistent psychotic experiences,

including unemployment and other occupational problems, financial problems, marital

issues and separation, and police intervention and incarceration. Clinical outcomes associated with persistent psychotic experiences include depressive symptoms, emergence of novel psychotic experiences (i.e. delusions among respondents with hallucinations at baseline), and general psychological distress among adolescents (De Loore et al., 2011), as well as current mental health treatment (Wigman et al., 2011).

Because the persistence of psychotic experiences over time may lead to psychological distress, role impairment, and severe mental health conditions, it would be of clinical interest to understand what factors are associated with their remission in the general population. In this study, I have selected respondents from the Collaborative Psychiatric Epidemiology Surveys (CPES; Alegría et al., 2007a) who reported psychotic experiences with a prior to past year (PPY) onset and, among these respondents, tested for demographic and clinical predictors of persistence. The aims of this study are to distinguish the relative importance of sociodemographic factors and clinical factors, including characteristics of the psychotic experiences themselves, in determining the course of these symptoms overtime. A secondary aim is to test the hypothesis that persistent psychotic experiences would be associated with clinical outcomes, including current treatment, suicidality, and impaired function. Finally, all analyses were tested separately with a limited subsample consisting of respondents with PE onset at least 10 years prior to the date of the interview, to specifically examine predictors and outcomes associated with long-term persistence, which may have greater clinical significance due to the prolonged period of exposure.

Method

Participants

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The Collaborative Psychiatric Epidemiology Surveys (CPES; Alegría et al., 2007a)

consist of data from three one-time cross-sectional surveys conducted in the United States

with similar methodologies and content: 1) the National Comorbidity Survey-Replication

(Alegría et al., 2007b; Kessler et al., 2004), 2) the National Latino and Asian American Study

(Alegría et al., 2004; Alegría & Takeuchi, 2007), and 3) the National Survey of American Life

(Jackson et al., 2004; 2007). All surveys utilized multi-stage sampling designs, and were

conducted February 2001 to December 2003. The total CPES data set included 20,013

respondents. Only those who experienced psychotic experiences PPY were included in this

study. Participants were excluded if they had a lifetime diagnosis of a psychotic disorder or

if they were age 65 or older, to be consistent with prior studies of psychotic experiences

(van Os et al., 2009). The final sample included 921 participants, all of whom had reported

psychotic experiences with onset more than one year prior to the interview.

Measures

Demographic variables (age, sex, race, immigration status, education, employment

status, and marital status) were self-reported by respondents. Respondents were assessed

for lifetime DSM-IV axis I disorders using the World Mental Health Composite International

Diagnostic Interview (WHO-CIDI), a widely used and reliable structured interview

assessment for diagnosis (Wittchen, 1994). Participants were coded positive for lifetime

affective disorders if they met criteria for major depressive disorder or dysthymia; for

lifetime anxiety disorders if they met criteria for generalized anxiety disorder, agoraphobia

with and without panic disorder, panic disorder, or social phobia; for lifetime substance

use disorders if meeting criteria for abuse or dependence of alcohol or other substances;

and individually for lifetime post-traumatic stress disorder.

Respondents were also asked to report on clinical outcomes including suicidality and treatment-seeking behavior. Suicidality was recorded as the presence or absence of current (past 12-months) suicide attempts. Treatment-seeking was defined as having seen a mental health professional (past 12-months), with mental health professional broadly-defined as a psychiatrist, psychologist, clinical social worker, or other medical (e.g. general practitioner, nurse practitioner) or counseling professional (e.g. counselor, psychotherapist, spiritual advisor) seen for mental health reasons. WHO-DAS scales were used to assess current function, in the domains of cognitive, social, mobility, self-care, role performance, and time out of role. WHO-DAS items were highly skewed and were therefore recoded into dichotomous variables indicating high impairment (as close as possible to the top 20% of impairment on that measure among the sample), in accordance with past studies of psychosis in these data (Kessler et al., 2005a).

All participants had endorsed lifetime presence of at least one psychotic experience from the WHO-CIDI 3.0 psychosis screen, which included 1) visual hallucinations, 2) auditory hallucinations, 3) thought insertion, 4) thought control, 5) telepathy, and 6) delusions of persecution. Psychotic experiences were excluded if the experience took place in the context of falling asleep, dreaming, or substance use. A similar set of questions inquired the presence or absence of psychotic experiences over the 12-mont period prior to the interview, with those who endorsed any of the six symptoms over the past 12 months being grouped as have *persistent* psychotic experiences and those without psychotic experiences over the past 12 months having *remitted* psychotic experiences. Age of onset was estimated by the participants and was used to calculate years since onset.

Analyses

All analyses were conducted using the complex sample features of SPSS version 21. All statistical estimates were weighted using CPES sampling weights to account for individual-level sampling factors including non-response and unequal probabilities of selection. Design-based analyses were used to estimate standard errors that accounted for the complex multistage clustered design of the CPES sample. All logistic regression analyses were adjusted *a priori* for age and sex.

The analytic design of this case-control study was planned such that cases were defined as those who experienced at least one instance of psychotic experiences over the past 12-months (the *persistent* group), and controls defined as those who have not experienced symptoms in the past 12-months (the *remitted* group). Differences in demographic (age, sex, ethnicity, foreign-birth, marital status, employment status, education), clinical (lifetime DSM-IV diagnoses of affective, anxiety, substance use disorders, post-traumatic stress disorder), and psychosis-related (e.g. specific symptoms, number of different psychotic experience subtypes) variables between those with and without current psychotic experiences were tested using Wald chi-square tests, with two-tailed alpha set at 0.05. Analyses were carried out separately for 1) the entire sample and 2) respondents with > 10 years (relative to the interview) since initial psychotic experience onset, in order to identify general predictors of persistence as well as predictors of long-term (10+ year) persistence of psychotic experiences.

All variables that were significantly associated with current psychotic experiences in bivariate analysis were entered into a multiple logistic regression model to test their adjusted associations with 12-month psychotic experiences, both in the total sample and in

the long-term persistence subsample. For all the multiple logistic regression analyses, significance was tested using Wald chi-square tests, with two-tailed alpha set at 0.05.

A second set of analyses compared the groups with persistent versus remitted psychotic experiences on several outcomes related to current function. Groups were compared on current (12-month) treatment seeking, suicidal ideation, and suicide attempts, and on six WHODAS scales assessing function over the past 30-days (self-care, cognitive, mobility, role impairment, social interaction, and time out of role). Odds ratios for all outcomes were derived using logistic regression analyses, adjusted for age and sex, with significance tested using Wald chi-square tests, with two-tailed alpha set at 0.05.

Table 18. Bivariate comparison of sociodemographics between participants reporting persistence or remission of psychotic experience

Variable	n	Entire sample (N= 921)			n	> 10 years since onset (N= 577)		
		Persistent n=308	Remitted n=613	OR [95% CI]		Persistent n=173	Remitted n=404	OR [95% CI]
Age (mean, SE)	921	36.4 (0.8)	38.9 (0.6)	**0.98 [0.97-1.00]**	577	38.1 (0.8)	42.7 (0.6)	**0.97 [0.95-0.98]**
Sex								
Male	341	45.6 (4.0)	39.9 (2.9)	-	220	38.5 (4.7)	42.0 (3.2)	-
Female	580	54.4 (4.0)	60.1 (2.9)	0.79 [0.53-1.17]	357	61.5 (4.7)	58.0 (3.2)	1.16 [0.69-1.93]
Race								
White, non-Latino	133	40.4 (4.7)	44.9 (3.8)	-	85	34.4 (4.3)	46.4 (4.1)	-
Black, non-Latino	432	28.7 (3.1)	25.1 (2.3)	1.23 [0.75-2.01]	265	32.0 (3.3)	24.0 (2.6)	**1.70 [1.00-2.91]**
Latino	254	24.4 (4.7)	2.7 (2.4)	1.08 [0.52-2.24]	158	25.2 (3.8)	21.7 (2.9)	1.34 [0.62-2.88]
Asian	97	6.2 (1.5)	6.8 (1.1)	0.89 [0.40-2.02]	68	8.0 (2.8)	7.9 (1.5)	1.10 [0.35-3.44]
Other	5	0.2 (0.2)	0.5 (0.3)	0.46 [0.05-4.71]	1	0.5 (0.0)	0.0 (0.0)	*na*[1]
Foreign								
No	636	81.5 (2.5)	81.5 (2.2)	-	373	79.9 (3.5)	79.0 (2.8)	-
Yes	281	18.5 (2.5)	18.5 (2.2)	0.93 [0.58-1.50]	202	20.1 (3.5)	21.0 (2.8)	0.82 [0.41-1.65]
Marital status								
Married	422	39.3 (4.0)	56.1 (3.2)	-	294	44.7 (4.6)	63.3 (3.9)	
Single	293	40.1 (4.4)	24.5 (3.0)	**2.12 [1.17-3.84]**	135	25.4 (3.3)	15.9 (2.8)	**1.67 [1.01-2.78]**
Previously married	206	20.6 (2.6)	19.4 (2.6)	**1.59 [1.00-2.55]**	148	29.9 (4.6)	20.8 (3.4)	**2.34 [1.25-4.39]**
Employment								
Employed	602	72.1 (3.0)	66.2 (2.3)	-	396	75.3 (3.7)	67.5 (2.9)	-
Unemployed	99	8.3 (2.1)	7.4 (1.2)	0.97 [0.50-1.89]	45	3.4 1.2)	5.7 (1.4)	0.42 [0.16-1.12]
Not in labor force	219	19.6 (2.9)	26.3 (2.3)	0.74 [0.49-1.12]	136	21.3 (3.7)	26.8 (2.9)	0.84 [0.51-1.38]
Education								
No college	475	57.0 (3.9)	47.0 (2.8)	-	274	53.9 (4.8)	42.6 (3.5)	-
> some college	445	43.0 (3.9)	53.0 (2.8)	**0.68 [0.48-0.95]**	303	46.1 (4.8)	57.4 (3.5)	**0.61 [0.40-0.91]**

Note:
Bold font indicates significance
[1] Not calculable due to low frequency of "other" race in the long-term remitted group

Table 19. Bivariate comparison of clinical variables between participants reporting persistence or remission of psychotic experience

Variable	n	Entire sample (*N*= 921) Persistent n=308	Remitted n=613	OR [95% CI]	n	> 10 years since onset (*N*= 577) Persistent n=173	Remitted n=404	OR [95% CI]
Affective disorder								
No	686	70.5 (4.0)	69.9 (2.9)	-	444	67.7 (4.2)	72.2 (4.2)	-
Yes	235	29.5 (4.0)	30.1 (2.9)	1.01 [0.60-1.71]	133	32.3 (4.2)	27.8 (4.2)	1.27 [0.68-2.36]
Anxiety disorder								
No	663	69.1 (4.0)	69.6 (2.1)	-	423	61.2 (4.7)	71.2 (2.0)	-
Yes	258	30.9 (4.0)	30.4 (2.1)	1.08 [0.69-1.69]	154	38.8 (4.7)	28.8 (2.0)	**1.77 [1.07-2.92]**
PTSD								
No	780	84.6 (3.0)	85.9 (1.9)	-	497	80.9 (5.4)	85.3 (2.3)	-
Yes	141	15.4 (3.0)	14.1 (1.9)	1.16 [0.75-1.80]	80	19.1 (5.4)	14.7 (2.3)	1.39 [0.71-2.69]
Substance disorder								
No	756	77.1 (3.8)	75.8 (3.6)	-	479	75.6 (4.5)	75.3 (4.3)	-
Yes	165	22.9 (3.8)	24.2 (3.6)	0.92 [0.52-1.61]	98	24.4 (4.5)	24.7 (4.3)	1.08 [0.49-2.39]

Note: Bold font indicates significance

Results

Among the entire sample (N=921), 28.1% (se=2.5) experienced persistent psychotic experiences, while 21.3% (se=2.0) experienced long-term persistence in the group with initial onset of more than 10 years prior to the interview. Demographic variables were associated with total persistence and long-term persistence, with greater odds for persistence associated with being unmarried or previously married, and lower odds associated with older age and college education; black respondents were also at greater odds of long-term persistence, but not in the total sample (Table 18). Increased risk for long-term persistence was associated with lifetime diagnosis of an anxiety disorder (Table 19). Finally, odds for both total and long-term persistence were greater for respondents experiencing auditory hallucinations (hearing voices) and those experiencing multiple symptom subtypes; one delusional experience, thought control, was additionally associated with persistence in the long-term subgroup but not in the total sample (Table 20).

Table 20. Bivariate comparison of psychosis-related variables between participants reporting persistence or remission of psychotic experience

Variable	*n*	Entire sample (*N*= 921) Persistent n=308	Remitted n=613	OR [95% CI]	*n*	> 10 years since onset (*N*= 577) Persistent n=173	Remitted n=404	OR [95% CI]
Auditory hallucinations								
No	533	44.6 (4.9)	61.7 (2.4)	-	340	45.8 (5.1)	63.3 (2.5)	-
Yes	388	55.4 (4.9)	38.3 (2.4)	**2.13 [1.38-3.30)**	237	54.2 (5.1)	36.7 (2.5)	**2.43 [1.53-3.87]**
Visual hallucinations								
No	265	34.5 (3.4)	30.4 (3.0)	-	136	27.6 (3.8)	25.2 (3.1)	-
Yes	656	65.5 (3.4)	69.6 (3.0)	0.83 [0.55-1.24]	441	72.4 (3.8)	74.8 (3.1)	0.74 [0.48-1.14]
Thought insertion								
No	878	93.3 (2.2)	97.0 (1.1)	-	549	88.1 (3.2)	97.6 (0.8)	-
Yes	43	6.7 (2.2)	3.0(1.1)	2.16 [0.79-5.92]	28	11.9 (3.2)	2.4 (0.8)	**6.15 [2.37-15.97]**
Thought control								
No	293	97.7 (0.7)	98.7 (0.5)	-	562	97.7 (0.9)	98.6 (0.2)	-
Yes	28	2.3 (0.7)	1.3 (0.5)	1.66 [0.65-4.21]	15	2.3 (0.9)	1.4 (0.2)	1.58 [0.77-3.23]
Telepathy								
No	851	88.3 (3.4)	93.0 (1.4)	-	541	88.9 (3.0)	94.7 (1.2)	-
Yes	70	11.7 (3.4)	7.0 (1.4)	1.55 [0.64-3.73]	36	11.1 (3.0)	5.3 (1.2)	2.09 [0.90-4.86]
Persecutory delusions								
No	847	89.0 (2.7)	92.5 (1.4)	-	547	94.7 (1.0)	94.5 (1.0)	-
Yes	74	11.0 (2.7)	7.5 (1.4)	1.44 [0.63-3.27]	30	5.3 (1.0)	5.5 (1.0)	1.12 [0.65-1.91]
# of different PE								
1	667	63.3 (4.6)	78.8 (2.1)	-	420	58.7 (5.2)	80.2 (2.2)	-
2	200	24.1 (3.0)	17.7 (2.1)	**1.68 [1.04-2.72)**	125	29.4 (3.7)	15.8 (2.7)	**2.68 [1.42-5.07]**
3+	54	12.6 (4.1)	3.5 (1.2)	**4.20 [1.38-12.79)**	32	11.9 (2.7)	4.0 (1.6)	**4.19 [1.55-11.38]**
Linear trend				χ^2 (df=1)=6.51, p=0.11				**χ^2 (df=1)=8.18, p=0.004**

Note: Bold font indicates significance

Significant bivariate predictors (of either long-term or total persistence) were entered into two separate multiple logistic regression models (including the same predictor variables), which significantly predicted persistence among both the total sample and the long-term subgroup (Table 21). Specifically, persistence was associated with auditory hallucinations and remission was associated with being married. Among the total sample only, at least some college education was additionally associated with remission. Among the long-term subsample only, age was additionally associated with persistence of psychotic experiences such that odds of persistence decreased with increasing age.

Table 21. Logistic regression models of persistence versus remission for the total sample and the long-term persistence subsample.

| Variable	Total sample OR [95% CI]	Statistics	Long-term persistence OR [95% CI]	Statistics
Gender (female)	ns	ns	ns	ns
Ethnicity (black)	ns	ns	ns	ns
Age (10 years)*	ns	ns	0.68 [0.54-0.86]	χ^2(df=1)=11.13, p=0.001
Marital status (married)	0.53 [0.35-0.82]	χ^2(df=1)=8.53, p=0.005	0.53 [0.30-0.93]	χ^2(df=1)=5.08, p=0.024
College	0.66 [0.49-0.89]	χ^2(df=1)=7.50, p=0.006	ns	ns
Anxiety disorder	ns	ns	ns	ns
Hearing voices	1.82 [1.12-2.92]	χ^2(df=1)=6.23, p=0.013	1.64 [1.11-2.45]	χ^2(df=1)=6.21, p=0.013
Mind control experience	ns	ns	ns	ns
Multiple PE subtypes	ns	ns	ns	ns
Intercept		ns		ns
Model		χ^2(df=12)=34.62, p<0.001		χ^2(df=10)=26.17, p=0.004

Note: All listed variables were included in both models, data presented for significant variables only.
Odds ratios for age are calculated based on change in odds of persistence for every 10 year increase in age.
ns = not statistically significant.

The persistent and remitted groups did not significantly vary on any of the six WHO-DAS function scales (self-care, cognitive, mobility, role impairment, social interaction, time out of role) or on current suicidal ideation, whether tested using the entire sample or the long-term subsample (data not shown). However, respondents with persistent symptoms were significantly more likely to report a recent suicide attempt (Figure 5), both in the total sample, Wald χ^2(df=1)=5.28, p=0.022, OR[95% CI]=3.92 [1.21-12.72], and the long-term subsample, Wald χ^2(df=1)=8.87, p=0.003, OR[95% CI]=30.85 [3.12-305.24]. Persistent symptoms were likewise associated with current (past 12-month) treatment seeking (Figure 6), in both the total sample, Wald χ^2(df=1)=11.81, p=0.001, OR[95% CI]=2.23 [1.40-3.54], and likewise in the long-term subsample, Wald χ^2(df=1)=15.15, p<0.001, OR[95% CI]=2.42 [1.54-3.83].

Figure 5. Prevalence of past-year suicide attempts among respondents with persistent and remitted psychotic experiences.
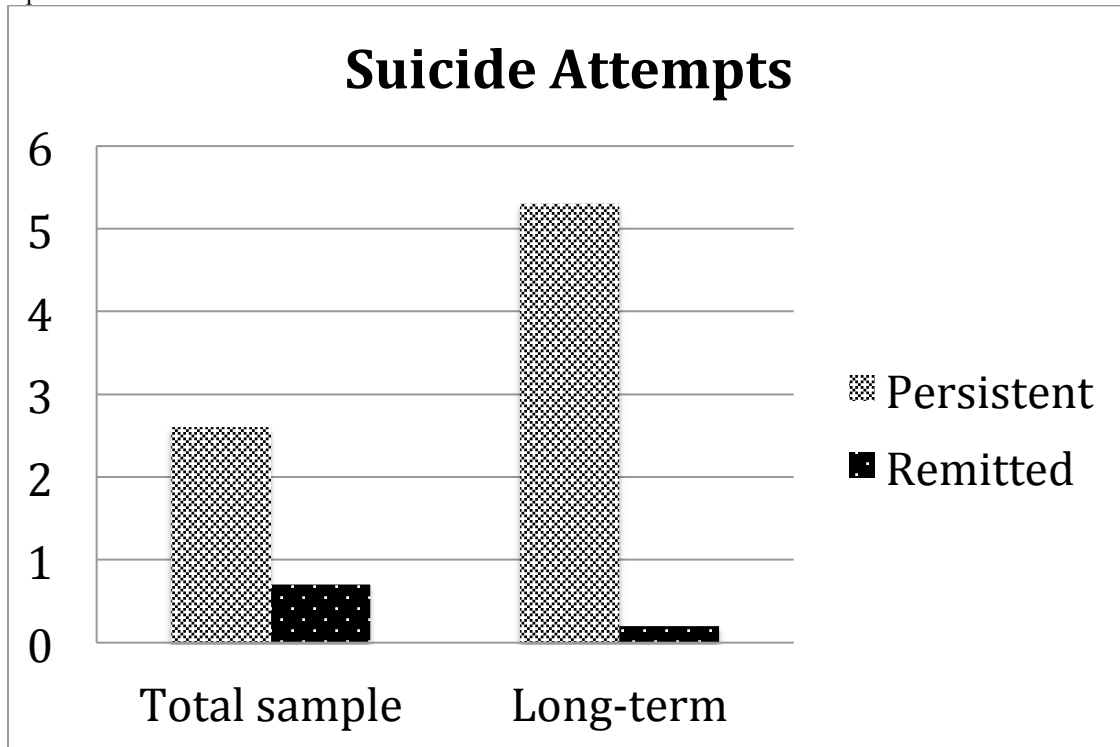
Figure 6. Prevalence of past-year treatment-seeking among respondents with persistent and remitted psychotic experiences.
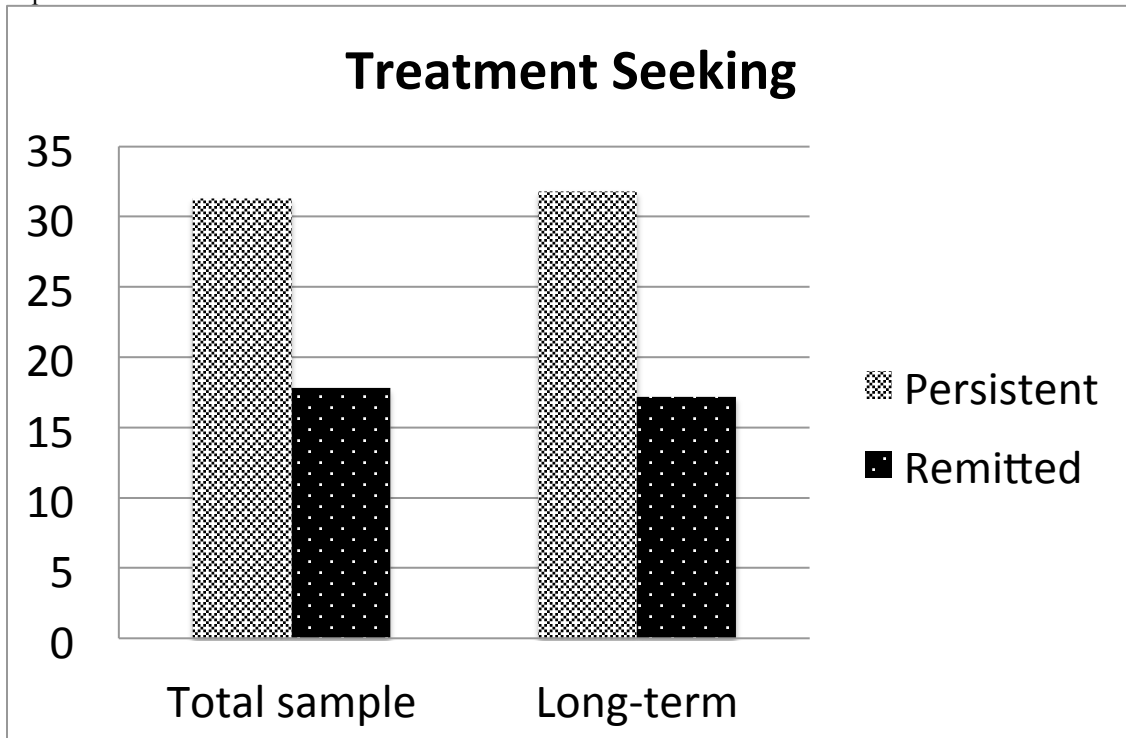
Discussion

Persistence versus remission of psychotic experiences

The persistence of sub-threshold psychotic experiences over time is of significant clinical interest as it may cause prolonged psychological distress and increased risk for severe mental health outcomes. In this population sample, psychotic experiences persisted for a sizable minority of respondents (28.1%), with more than one in five reporting long-term persistence of greater than ten years. This level of persistence is generally in concurrence with prospective cohort studies, which have found that psychotic experiences decline in prevalence with age (Rössler et al., 2007) and therefore tend to remit over time. Of incident cases of psychotic experiences among adults, only 8% still reported sub-threshold psychosis 1 year later with an additional 8% with clinical psychotic outcomes (Hanssen et al., 2005). Persistence may be somewhat greater in adolescents, with 27% of adolescents reporting auditory hallucinations at baseline still reporting symptoms two years later (De Loore et al., 2011), although this may reflect the elevated overall prevalence of psychotic experiences in this age group (Kelleher et al., 2011).

Sociodemographic predictors of psychosis persistence

Marital status is the most notable sociodemographic predictor of psychosis persistence in this sample, with married respondents having approximately one half the odds of persistence compared to those who are previously (i.e. divorced, separated, or widowed) or never married. Being unmarried was likewise linked to both the lifetime prevalence and annual incidence of psychotic experiences in meta-analyses (Linscott & van Os, 2013), and has been associated with the onset (Agerbo, Byrne, Eaton, & Mortensen, 2004; Tien & Eaton, 1992) and course (Farina, Garmezy, & Barry, 1963) of schizophrenia,

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potentially explained by a combination of both social causation (lack of marital support increasing risk for psychosis) and social selection (psychosis typically onsets during adolescents or young adult hood and may disrupt relationships). Rössler and colleagues (2007) previously identified associations between persistent psychotic experiences and separation from a partner, as well as conflict within the household, which the authors attributed to being a consequence of prolonged mental health difficulties. The association between marriage and psychosis may also be consistent with a social causation explanation, such that symptoms may be more likely to remit among individuals with consistent social support. Marriage can be considered a form of social support, which can protect against the effect of stress on symptom exacerbation, as articulated in the diathesis-stress model (Corcoran et al., 2003; Nuechterlein & Dawson, 1984). Prospective studies have supported a causal relationship between social support and recovery from psychotic disorders (Pernice-Duca & Onaga, 2009) and, conversely, between insufficient support and readmission to inpatient treatment (Bergen, Hunt, Armitage, & Bashir, 1998; Norman et al., 2005). It is likely therefore that a reciprocal relationship consisting of social causation and social selection exists between marital status and psychosis persistence. These explanations, however, cannot be distinguished using a retrospective analysis of cross-sectional data.

Remission of psychotic experiences was also associated with having at least some college education, although this was not true for long-term persistence, suggesting that higher education may have some protective effect against transient psychotic symptoms but may have declining influence over longer periods. Age was associated specifically with the long-term persistence of psychotic experiences, with a decline in risk for ongoing

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persistence (of > 10 years) as respondents aged, consistent with the known peak in psychosis risk in younger adulthood (Rössler et al., 2007; Thompson et al., 2004).

Clinical predictors of psychosis persistence

Self-reported psychotic experiences in the population vary in terms of the specific symptoms experienced and in terms of their profile of psychiatric co-morbidity. Although depressive, anxiety, and substance use disorders are common among individuals with psychotic experiences (Fisher et al., 2013; Johns et al., 2004; Kelleher et al., 2012a; Saha et al., 2012; Scott et al., 2007; van Nierop et al., 2009; Varghese et al., 2011; Wigman et al., 2012), none of these disorders were independently associated with persistence of psychotic experiences over time. Instead, persistence was predicted by the presence specifically of sub-threshold auditory hallucinations. Psychotic experiences typically remit over time, in these data as well as prior studies (De Loore et al., 2011; Hanssen et al., 2005; Rössler et al., 2007), making it useful to know which symptom subtypes are more likely to persist and therefore more likely to lead to or indicate prolonged impairment in terms of co-morbidities, psychological distress, or suicide risk. Further, persistent hallucinations may be particularly clinically relevant as they potentially lead to threshold psychotic disorder (Smeets et al., 2012).

Psychosis persistence and suicide risk

Ongoing persistence of psychotic experiences was associated with greater risk for a recent suicide attempt, in concurrence with several past studies (Fisher et al., 2013; Kelleher et al., 2012b; 2013b; Nishida et al., 2010; Saha et al., 2011). Earlier in this dissertation it was demonstrated that 12-month psychotic experiences are associated with concurrent suicidal ideation and suicide attempts, particularly those with intent to die. This

expands on that finding by showing that, even among those with psychotic experiences, those with *persistent* psychotic experiences are at elevated risk for suicidal behavior, even more than 10 years after initial onset. Fisher and colleagues (2013) likewise showed, using a prospective cohort design, that psychotic experiences are associated with future risk for suicide attempts.

Treatment seeking

Persistence of psychotic symptoms among adults was associated with treatment-seeking over the 12-month period prior to the interview, as had previously been shown in a population cohort of adolescents in the Netherlands (Wigman et al., 2011). Twelve-month psychotic experiences have previously been shown to be associated with increased service utilization and need for care among this sample (DeVylder et al., in press) and in a similar population sample in the United Kingdom (Murphy et al., 2012); this expands the prior finding to show that respondents with current psychotic experiences are more than twice as likely to seek care compared not only to the general population (as previously shown) but even when compared to others who have remitted psychotic experiences. This further supports an interpretation that it is the psychotic experiences themselves (or other temporally concurrent difficulties, such as consequent impairments in function) that lead to treatment seeking.

Practice implications

Psychotic experiences are associated with a broad range of clinical outcomes, supporting the need for clinical guidelines regarding assessment and treatment of these symptoms. Assuming that persistent psychotic symptoms carry greater clinical need due to prolonged exposure of the risk state, this analysis suggests that auditory hallucinations and

thought control experiences should be given particular clinical attention. Brief screening tools for clinical purposes may be more efficient if focus is limited to these experiences. The finding that marital status influences the odds of remission may guide intervention for people with sub-threshold auditory hallucinations. This tentatively suggests that encouragement of positive familial relationships other forms of social support may provide similar effects. Psychotic experiences tend to be associated with social withdrawal (Kelleher et al., 2013a) and other factors that may limit social support (approximating negative symptoms in schizophrenia). This can be addressed clinically by building familial support through interventions such as family psychoeducation (Lukens & Thorning, 2010), or by buttressing non-familial social support through social skills training (Kurtz & Mueser, 2008). Treatment should also address the elevated suicide risk among persons with persistent psychotic experiences, potentially through regular screenings (Mann et al., 2005), which are known to be safe even in high-risk populations (Gould et al., 2005). For those with substantial ideation or suicide plans, cognitive behavioral therapy may be an efficacious approach to suicide prevention (Stanley et al., 2009). Directed interventions for psychotic experiences are feasible even though these symptoms do not meet diagnostic thresholds, given that those with persistent psychotic experiences are nonetheless significantly more likely to be in treatment.

Limitations & conclusions

The primary limitation of this paper is the analysis of retrospective reports of psychosis onset based on cross-sectional data, which is not ideal for assessing predictors of change over time. Recall biases may influence the estimated onset of psychotic experiences, as well as other lifetime variables that were entered as predictors in the models. The

primary concern is that experiences reported as having onset "prior to the past year" may be misreported, particularly for respondents with an initial onset approximately at that one-year point, or those with unclear onset (e.g. gradual increase in severity of sub-threshold symptoms over time). This is alleviated somewhat by looking only at those with long-term persistence, who are less likely to be misclassified due to recall errors. Given the limited availability of prospective longitudinal data on psychotic experiences in the general population, particularly in the United States, this approximation of a longitudinal analysis may nonetheless provide useful guidance in the development of future prospective cohort studies.

A second limitation is the low prevalence of delusional experiences relative to hallucinations, which has previously been attributed to differences in threshold of severity between these dichotomous items (Kessler et al., 2005a), although a study using clinical interviews with a different sample likewise found elevated prevalence of hallucinatory experiences (Zammit et al., 2013). If delusional items are of greater severity then the analysis may be biased towards identifying delusional experiences as predictors of persistence. This is unlikely to explain these findings because, first, delusional experiences were not uniformly predictive of persistence, and second, auditory hallucinations were the primary predictor of persistence. Nonetheless, limitations in lay-administered assessment of psychotic experiences should be considered when interpreting these and other survey results.

An additional limitation is the exclusion of notable psychological predictors such as impaired tolerance to daily stress, which has also been linked to persistence of psychotic experiences (Collip et al., 2013). Stress sensitivity was not measured across all surveys

included in the present data set, although heightened stress sensitivity is generally

correlated with several clinical variables included in the present model, including

depressive and anxiety disorders (Caspi et al., 2003; Salmon, 2001).

The presented results confirm past findings from prospective cohort studies that

psychotic experiences tend to remit over time (De Loore et al., 2011; Hanssen et al., 2005;

Rössler et al., 2007), while specifying that auditory hallucinations bestow particular risk for

long-term persistence. The analysis also builds on Rössler and colleagues' (2007) finding

that marital status is associated with psychosis persistence, although it remains unclear if

this is due to social causation or social selection. Surprisingly, lifetime psychiatric co-

morbidities had no effect on persistence, despite their frequent co-occurrence in this

sample and in others (Fisher et al., 2013; Johns et al., 2004; Kelleher et al., 2012a; Saha et

al., 2012; Scott et al., 2007; van Nierop et al., 2009; Varghese et al., 2011; Wigman et al.,

2012). As predicted, persistence does appear to be related to greater clinical need in terms

of treatment-seeking and suicide risk. Future studies therefore should continue to identify

predictors of persistence versus remission and further explore clinical services for those

with persistent psychotic experiences, with a particular emphasis on suicide prevention.

Chapter VI

Conclusions: The Significance of Psychotic Experiences for

Social Work, Public Health, and Health Care Policy

Main findings of the dissertation

The goal of this dissertation was to address three broad aims: 1) to determine the risk for suicidal behavior associated with psychotic experiences; 2) to examine psychosis comorbidity and multi-morbidity with common mental health conditions, and describe the clinical significance of these symptoms when occurring in the context of common mental disorders; and 3) to evaluate factors associated with the persistence or remission of psychotic experiences in the general population.

As predicted, psychotic experiences were associated with both increased risk and increased severity of suicidal behavior. Suicide risk appears to be a part of the broader psychosis phenotype and not simply a reaction to the onset of threshold psychotic disorder. The finding that psychosis is linked especially to severe attempts with intent to die highlights the potential public health significance of screening for these experiences among people reporting suicidal ideation.

Likewise as predicted, psychotic experiences were associated with extensive co-morbidities across diagnoses, supporting the notion of broad etiological and clinical overlap between psychosis and common mental health conditions. This argues against the notion that psychosis is associated with or predicts a constrained set of closely related mental health conditions, but is in concurrence with recent epidemiological studies and with genetic evidence for overlapping diagnostic categories. Non-specific associations with mental health conditions would suggest that psychosis may be the product of increasingly

severe psychopathology rather than specific types of psychopathology, which was indeed found to be the case. This was notably replicated across multiple ethnic groups, several of which have previously received minimal attention in the research literature on sub-threshold psychosis.

Interestingly, none of these comorbidities were predictive of the long-term persistence of sub-threshold psychosis, which was better explained by the type of symptoms (auditory hallucinations) and marital status. While this is consistent with the diathesis stress model and the known importance of social support in schizophrenia and in mental health in general, it stands in contrast to the relatively stronger emphasis on biological and clinical factors (i.e. co-occurring conditions and symptoms) in the literature. As expected based on findings from the first study, the relationship between psychosis and suicide attempts was again present for respondents with persistent psychotic experiences compared to remitted psychotic experiences, and grew in magnitude when looking exclusively at those with long-term persistence. Treatment-seeking behavior, on the other hand, appeared to remain stably associated with psychotic experiences regardless of duration.

Implications for clinical social work practice

Adults with psychotic experiences are more than twice as likely to seek treatment relative to the general population, and are more likely to report an unmet need for care (DeVylder et al., in press). It is therefore likely that a substantial portion of adults with psychotic experiences are already in some way involved in the mental health system, regardless of the extent to which these experiences are reported to their treating clinicians.

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Interventions for sub-threshold psychosis can therefore be directed towards clinical populations with presently undetected or untreated psychotic experiences.

The first step in this process is detection. Psychosis screens have typically been developed for epidemiological and other research studies, although attempts have been made more recently to develop screens for clinical use (Liu et al., 2013). Screening for psychotic experiences can identify clients with high clinical need, regardless of any distress associated with the experiences themselves. Multi-morbidity and suicide are both highly relevant clinical phenomena that should be given highest priority in treatment. A single brief screen (for example, see Kelleher et al., 2011; Liu et al., 2012) can efficiently indicate the need to assess for and potentially intervene with these significant conditions.

Further research will be needed to maximize the clinical utility of assessing for sub-threshold psychosis, particular in regards to identifying moderating and mediating factors relating psychosis to suicide risk. An initial attempt was made in this dissertation, showing that risk was heightened among college-educated and female respondents, particularly those experiencing a concurrence of auditory and visual hallucinations. It is likely that there are additional undetected moderators, both for suicide and multi-morbidity, which can be used to identify clients at maximal clinical risk

The extensive multi-morbidity between sub-threshold psychosis and every subtype of and nearly every individual mental health condition tested argues for dimensional models of mental health and illness. The clinical corollary of such models would be non diagnosis-specific treatment, where interventions are tailored to clusters of symptoms or distressing experiences rather than to treating individual diagnostic entities (Barnett et al., 2012). This is very much in tune with social work ideals of person-centered care and

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engagement based on concerns of the individuals in treatment, even when intervening with severe and persistent mental illness (Rapp, 1998). Categorical diagnostic constructs have limited utility if they overlap so extensively with each other that interventions cannot meaningfully be tailored to one diagnosis at the exclusion of others. A feasible alternative is to focus on symptom dimensions or clusters, including psychosis but also, for example, internalizing symptoms, externalizing symptoms, and the continuum of substance use. Prior research has suggested that psychotic experiences may enhance the severity and clinical need among individuals with specific diagnoses of major depressive disorder or an anxiety disorder, in terms of more persistent course, more observable illness behavior, greater utilization of services, and greater co-occurrence of substance use (Wigman et al., 2012). It may therefore be more clinically appropriate to approach psychosis as a relatively independent dimension of mental health and illness that permeates across diagnostic categories.

Psychosocial interventions currently utilized by social workers tend to be more focused on the subjective needs of the person in care rather than specific symptoms or diagnoses. Cognitive behavioral therapy may be useful in addressing factors that are associated with the exacerbation of sub-threshold psychosis, such as heightened stress sensitivity (DeVylder et al., 2013b), and may serve the dual purpose of addressing psychotic symptoms (van der Gaag et al., 2012) and suicidal behavior (Stanley et al., 2009). Psychoeducation likewise improves outcomes in threshold psychosis (Lukens & Thorning, 2010; McFarlane et al., 1995), and may be particularly valuable in supporting individuals with psychotic experiences and their families, given the paucity of public information on sub-threshold psychosis. In contrast, pharmaceutical interventions known to be efficacious

among people with psychotic disorders, particularly antipsychotic medications, are known to be poorly tolerated in people with sub-threshold symptoms. Specifically, they are met with high rates of non-adherence, discontinuation, and outright refusal to initiate treatment, and have not been conclusively shown to prevent the progression of psychosis (Addington & Heinssen, 2012).

Implications for public health

The practice implications described above have potential to meaningfully impact public health in the area of suicide prevention. It is notoriously difficult to predict suicide attempts using common clinical measures and assessment techniques (Roos, Sareen, & Bolton, 2013), although the predictive validity of assessment tools may be improving (Posner et al., 2011). In this dissertation analysis, psychotic experiences were the primary predictor of severe suicide attempts among respondents with suicidal ideation, surpassing the positive predictive value of depressive disorders, substance use disorders, and anxiety disorders. This information can be used either 1) to further improve the predictive validity of existing suicide-risk assessments by including items related to psychotic experiences, or 2) to justify the use of direct assessments of psychotic experiences as a proxy for suicide risk among those with ideation. Either approach has potential to significantly reduce the prevalence of suicide attempts in the general population, particularly attempts with intent to die. Brief screening tools, which tend to be self-report and completed in several minutes (Kelleher et al., 2011; Liu et al., 2012), may provide invaluable information on suicide risk.

Considerations when intervening with sub-threshold psychosis

It is clear based on the results presented here as well as prior studies that psychotic experiences carry clinical significance, even when considered to be at a "sub-threshold"

level of severity. Their assessment in the clinical setting may allow detection of individuals at elevated risk for some of the most severe mental health outcomes, including multiple comorbid conditions, schizophrenia, and suicide. However, the potential benefits of intervention are accompanied by potential costs, particularly when a condition or set of symptoms carries a label related to psychosis.

There has been little discussion in the field regarding how to best approach psychotic experiences clinically. However, the closely related construct of "clinical high-risk" for psychosis (i.e. sub-threshold psychotic symptoms in addition to age range requirements and recent decline in function) has received considerable attention as a hotly debated diagnosis considered for inclusion in the DSM-5 (e.g. Carpenter, 2009; Corcoran, First, & Cornblatt, 2010; Ruhrmann, Schultze-Lutter, & Klosterkötter, 2010; Woods, Walsh, Saksa, & McGlashan, 2010). A primary concern is that sub-threshold psychosis would be used as an "at-risk" syndrome for schizophrenia, despite the lack of a significant evidence base regarding prevention of schizophrenia among this population (Corcoran et al., 2010). Although many youth meeting clinical high-risk criteria experience significant impairment and distress (Ruhrmann et al., 2010), as with people with psychotic experiences (Bak et al., 2005; DeVylder et al., in press), it is likely that clinicians will interpret these designations as risk syndromes rather than as clinically meaningful conditions in themselves. In other words, clinicians may focus on trying to prevent schizophrenia rather than addressing distress associated with the sub-threshold psychosis syndrome. The most significant problem that may arise, then, is over-prescription of anti-psychotic medications to a population that is at relatively low risk of developing schizophrenia, regardless of intervention (Corcoran et al., 2005; 2010). This problem is of some concern for clinical

high-risk populations who truly are at notably elevated risk for schizophrenia, but may be of extensively greater significance if it likewise affected people with psychotic experiences, who are at notably lower risk (Werbeloff et al., 2012).

These concerns will be minimized if alternative treatments are developed for sub-threshold psychosis that do not include prescription of potentially dangerous medications. Several steps have been taken towards this goal, with promising results for the efficacy of psychosocial interventions including cognitive behavioral therapy and supportive therapy (Addington et al., 2011b; Morrison et al., 2004; 2007), as well as mild pharmacological agents including Omega-3 tablets (Amminger et al., 2010). However, even with the development of effective psychosocial treatments, it is possible that these time- and resource-intensive treatments may be differentially accessible to people of higher socioeconomic status and less accessible to ethnic minority groups that tend to have restrained access to health and mental health resources (Phelan & Link, 2005). This in particular may include African-Americans, who are more likely to believe that mental health treatment is unnecessary (Anglin, Alberti, Link, & Phelan, 2008), further exacerbating existing ethnic disparities in psychosis prevalence (Bresnahan et al., 2007).

The word 'psychosis' is not only loaded with implications for treatment but also implications for acceptability within the general population. Any potential benefit of social work intervention must be weighed against the potential harm of stigmatization. Whether stigma is prominent for psychosis risk states remains a largely unanswered question, although there is evidence that similar "risk" syndromes are associated with familial stigma and discrimination from insurance carriers (Yang, Wonpat-Borja, Opler, & Corcoran, 2010). However, people that hold the belief that psychosis occurs on a continuum are reported to

have reduced feelings of stigma towards those with mental illness, specifically less need for social distance (Schomerus et al., 2013). It is conceivable that acceptance of continuum models of psychosis may attenuate feelings of stigma in the general population in such a way that may provide some counterbalance to the stigma felt by individuals with sub-threshold psychotic symptoms.

Policy recommendations

Taking into account these potential benefits for social work practice and public health, while likewise considering the potential downside to recognizing and acting on these sub-threshold symptoms, several policy recommendations can be made. First, support for dimensional models of psychopathology encourage an expansion of primary care for mental health. Psychotic experiences are clinically meaningful even when they do not meet DSM-5 thresholds for psychotic disorders. Proactive services would allow these to be addressed as part of routine treatment. Mental health parity, proposed by Bill Clinton (Sturm & McCullough, 1998) and implemented by Barack Obama through the Affordable Care Act (Barry & Huskamp, 2011), provides the structural foundation for the expansion of primary care in mental health. However, the Supreme Court ruling striking down the state mandated expansion of Medicaid (Jost & Rosenbaum, 2012), along with the subsequent refusal of 25 states to expand their Medicaid programs leaves a substantial gap in coverage for lower income Americans in those states. Accessibility to care, therefore, will continue to be strongly related to socioeconomic status in much of the country. Even an expansion of mental health primary care would be disproportionately available to higher income Americans across much of the United States, reinforcing existing socioeconomic disparities in psychosis-related care. Further attempts need to be made to ensure that any efficacious

treatment are not available only for those who are white, male, college-educated, or of higher SES, all of which were associated with reduced risk for psychotic experiences in these data.

Once interventions have been tested and have been made available for people with sub-threshold psychosis, policies should be put in place to ensure that these individuals have access to evidence-based treatments and to prevent them from being improperly prescribed anti-psychotic medications. The overuse of anti-psychotics among people who do not meet criteria for threshold psychosis and who likely will not develop a psychotic disorder is a central concern as psychotic experiences become recognized as independent clinical phenomena (Corcoran et al., 2005; 2010). This would be considered an 'off-label' use of such medications, given that they have not been specifically tested among people with sub-threshold psychosis, which is being increasingly targeted and prosecuted by the federal government. Most notably, the pharmaceutical company Johnson & Johnson agreed to pay over $2 billion for actively promoting the off-label use of Risperdal, a common anti-psychotic medication, among several vulnerable populations (Thomas, 2013). Stricter policies and continued enforcement of existing policies around the misuse of prescription medications, particularly anti-psychotics, would alleviate much of the concern regarding improper treatment for people with sub-threshold psychosis.

Concerns of stigma related to a "sub-threshold psychosis" label likewise may be addressed through policy change. More research is needed to support the relationship between continuum beliefs and stigma; specifically, we do not know if educating people on continuums of mental health would lead to reductions in stigma (as a causal relationship), or if people who tend to hold such beliefs likewise hold less stigmatizing attitudes (as an

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association). However, this does provide a potential avenue for public education as a means to reduce stigma related to treatment for sub-threshold psychosis while likewise alleviating public stigma towards people with psychotic disorders. Strides may also be made by eliminating and replacing highly-stigmatized terminology altogether. For example, van Os (2009) recommended the term "salience syndrome" to capture the entire psychosis continuum, both as a more accurate term based on current knowledge of psychosis etiology, and as a term that is not associated with iatrogenic stigma. It has also been argued that changing the name to a more biologically-based and readily translatable term or phrase, such as "neuro-emotional integration disorder" may improve cross-cultural validity and facilitate public education (Levin, 2006). In Japan, the name was changed from "mind-split-disease" to "integration disorder" following similar logic (Sato, 2006), which appeared to attenuate the implicit stereotype associating schizophrenia with criminality (Takahashi et al., 2009). This remains a debated issue, with changes in terminology argued by some to be premature (Lieberman & First, 2007).

Future research directions

There are many unanswered questions regarding the phenomenology of sub-threshold psychosis, its associated clinical significance, and appropriate approaches to prevention, intervention, and treatment. A central problem in this dissertation and all other studies of psychotic experiences to date is the lack of qualitative data regarding the true nature of the experience underlying a 'yes' response to items on psychosis screens. This population is predominantly known from large epidemiological datasets; determining the true clinical significance of these psychotic experiences will require a further understanding of what the experiences actually mean to the person that reports them.

Quantitative methods of psychosis assessment may also be improved, particularly those that account for false positive due to reporting of culturally normative phenomena or experiences that are merely odd or unusual (Kessler et al., 2005a).

Perhaps the most important finding in this dissertation is the strong and robust association between psychotic experiences and suicidal behavior, particularly severe suicide attempts. Like many rare behaviors, suicide attempts with intent to die are difficult to predict. Having a new indicator for incipient risk of such behaviors can be invaluable, if shown to be reliable and implementable in social work practice. It would be useful to test the association between psychotic experiences and suicidal behavior in a prospective study to help determine whether there is a causal relationship. It would also be useful to distinguish those with psychotic experiences who do make attempts from those who do not, as has previously been done for schizophrenia (Harkavy-Friedman et al., 1999). In addition, putative shared risk factors can continue to be explored, including exposure to bullying and emotional reactivity to stressful life events.

Finally, usefulness of findings regarding clinical significance is entirely dependent on their application in the clinical setting. This will require the modification of existing psychosis screens, developed and used primarily in research, for efficient and reliable use in the clinical setting. Stigma regarding treatment for sub-threshold psychosis would need to be better understood and addressed as a potential barrier to intervention. In particular, it should be tested whether educating the general population on continuum models of psychopathology reduces stigmatizing attitudes towards people that fall anywhere on the psychosis spectrum. Finally, efficacious interventions need to be developed that can best serve individuals with psychotic experiences. Many people with psychotic experiences in

this dataset were already in treatment or expressed the need to seek help (DeVylder et al., in press). Psychotic experiences therefore occur frequently in social work settings, regardless of whether or not they are presently being detected, and are associated with a range of severe mental health outcomes. Individuals deserve efficacious treatments that can alleviate distress associated with these experiences and prevent the onset of more severe conditions, efforts that may in turn improve the health of the population by reducing the occurrence of multi-morbidities and by reducing the prevalence of suicidal thoughts and behavior.

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