JAMA Psychiatry | Original Investigation

Association Between Psychotic Experiences and Subsequent Suicidal Thoughts and Behaviors

A Cross-National Analysis From the World Health Organization World Mental Health Surveys

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IMPORTANCE Community-based studies have linked psychotic experiences (PEs) with increased risks of suicidal thoughts and behaviors (STBs). However, it is not known if these associations vary across the life course or if mental disorders contribute to these associations.

OBJECTIVE To examine the temporal association between PEs and subsequent STBs across the life span as well as the influence of mental disorders (antecedent to the STBs) on these associations.

DESIGN, SETTING, AND PARTICIPANTS A total of 33 370 adult respondents across 19 countries from the World Health Organization World Mental Health Surveys were assessed for PEs, STBs (ie, ideation, plans, and attempts), and 21 *DSM-IV* mental disorders. Discrete-time survival analysis was used to investigate the associations of PEs with subsequent onset of STBs.

MAIN OUTCOMES AND MEASURES Prevalence and frequency of STBs with PEs, and odds ratios and 95% CIs.

RESULTS Of 33 370 included participants, among those with PEs (n = 2488), the lifetime prevalence (SE) of suicidal ideation, plans, and attempts was 28.5% (1.3), 10.8% (0.7), and 10.2% (0.7), respectively. Respondents with 1 or more PEs had 2-fold increased odds of subsequent STBs after adjusting for antecedent or intervening mental disorders (suicidal ideation: odds ratio, 2.2; 95% CI, 1.8-2.6; suicide plans: odds ratio, 2.1; 95% CI, 1.7-2.6; and suicide attempts: odds ratio, 1.9; 95% CI, 1.5-2.5). There were significant dose-response relationships of number of PE types with subsequent STBs that persisted after adjustment for mental disorders. Although PEs were significant predictors of subsequent STB onset across all life stages, associations were strongest in individuals 12 years and younger. After adjustment for antecedent mental disorders, the overall population attributable risk proportions for lifetime suicidal ideation, plans, and attempts associated with temporally prior PEs were 5.3%, 5.7%, and 4.8%, respectively.

CONCLUSIONS AND RELEVANCE Psychotic experiences are associated with elevated odds of subsequent STBs across the life course that cannot be explained by antecedent mental disorders. These results highlight the importance of including information about PEs in screening instruments designed to predict STBs.

JAMA Psychiatry. doi:10.1001/jamapsychiatry.2017.2647
Published online August 30, 2017.

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Supplemental content

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Prior studies suggest that psychotic experiences (PEs) are associated with an elevated risk of suicidal thoughts and behaviors (STBs). A 2016 meta-analysis by Honings et al[1] based on 21 studies reported a 3-fold increased risk of STBs in people with PEs (odds ratio [OR], 3.2; 95% CI, 2.3-4.4). Other studies have documented a significant dose-response relationship between the number of PEs and increased odds of STBs.[2-5] Worryingly, prospective studies of school-aged children have reported strong associations between PEs and suicide attempts, with children with PEs having an approximately 11-fold increased odds of suicide attempts during the following 12 months (OR, 11.3; 95% CI, 4.4-28.6) compared with those without PEs.[6]

Despite the growing body of evidence linking the presence of PEs with STBs, several research questions warrant closer attention. First, there is considerable variation in effect size estimates for these associations across studies, likely owing to differences in methods and analysis.[1,7,8] Thus, it would be informative to examine these associations across different sites using similar methods. Second, prior studies have documented that most common mental disorders are associated with increased odds of both PEs[9] and STBs.[10-12] However, it is unclear whether the presence of mental disorders explains the associations of PEs with subsequent STBs.[13] Third, although it has generally been assumed that mental disorders could increase the risk of each of 3 main STB outcomes (ie, ideation, plans, and attempts), recent studies have shown that only a subset of those with ideation also have suicide plans and attempts.[14-16] We examine the role of PEs with respect to the odds of transitioning between ideation, plans, and attempts. Fourth, there is evidence to suggest that the association between PEs and STBs may be stronger in samples based on children[6] compared with estimates based on adult samples.[1] Thus, it would be of interest to examine if the strength of the association between PEs and STBs differed across age groups within one study. If children and/or adolescents with PEs are differentially prone to STBs compared with older age groups, then this could have important clinical implications for screening in pediatric and adolescent settings.[6] Fifth, there is considerable uncertainty about the population attributable risk proportions (PARPs) for STBs that are associated with PEs. For example, DeVylder et al[16] reported that about 29% of suicide attempts were attributable to PEs among US adults. Kelleher et al[6] have found that 56% to 75% of suicide attempts among adolescents aged 13 to 16 years were attributable to PEs (however, these estimates were imprecise; OR, 67.50; 95% CI, 11.41-399.21). Accurate and age-range specific estimates of these PARPs are important for policy-making and prevention purposes.

Specifically, we aimed to examine the association between PEs (and related PE type and frequency metrics) and subsequent STBs across the life span and the influence of mental disorders on these associations. We also examined the associations between PEs, suicide plans and attempts among individuals with suicidal ideation, and the PARPs of various STBs.

Key Points

Question Are psychotic experiences associated with subsequent suicidal thoughts and behaviors (STBs), and do mental disorders (antecedent to the STBs) contribute to these associations?

Findings Based on 33 370 adult survey respondents drawn from 19 countries, those with psychotic experiences had 2-fold increased odds of subsequent STBs (after adjusting for mental disorders). Psychotic experiences were predictors of subsequent STB onset across all life stages; however, the strength of the association was strongest in individuals 12 years and younger.

Meaning Screening for psychotic experiences may assist in the prediction of subsequent STBs.

Method

Samples

The data were derived from 19 WHO World Mental Health (WMH) surveys, a coordinated set of community surveys administered in probability samples of adult respondents (18 years and older) in countries throughout the world[17] (eTable 1 in the Supplement). The weighted (by sample size) average response rate across the 19 surveys was 72.3%, with the highest response rate in Iraq (95.2%) and the lowest in France (45.9%). Further information on details of the procedure and the assessment of mental disorders can be found in the eMethods in the Supplement. A human subjects review board or ethics committee approved the survey protocol in each country (eTable 2 in the Supplement), and all respondents gave informed consent; the mode of consent (written vs oral) varied by survey.

Measures

Psychotic Experiences

The Composite International Diagnostic Interview Psychosis Module included questions about 6 PE types—2 related to hallucinatory experiences and 4 related to delusional experiences. We excluded PEs experienced while dreaming, half-asleep, or under the influence of alcohol or drugs (eTable 3A and B in the Supplement). In this article, we present estimates of STBs for "Any PEs" only (ie, not individual types of PEs). In addition, we included 2 key PE variables: (1) number of PE types; and (2) an annualized frequency metric based on the frequency of PE episodes (ie, the count of PE occurrences per year). We derived the latter by dividing the total number of PE episodes by the time since onset of the first PE (age at interview minus age at onset plus 1 in order to avoid zero as a denominator). Age at onset of PEs was also assessed.

Suicidality

Lifetime STBs were assessed using the Composite International Diagnostic Interview Suicidality Module.[17] Separate questions were asked about the lifetime occurrence of suicidal ideation ("Have you ever seriously thought about committing suicide?"), suicide plans ("Have you ever made a plan for committing suicide?"), and suicide attempt ("Have you ever

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Table 1. Lifetime Prevalence of Suicidal Ideation, Plans, and Attempts

Characteristic	Ideation		Plans		Attempts	
	No./Total No. (%)[a]	SE	No./Total No. (%)[a]	SE	No./Total No. (%)[a]	SE
STB prevalence	5106/33 370 (9.2)	0.2	2000/33 370 (3.1)	0.1	1771/33 370 (2.8)	0.1
PE status						
No PE	4165/30 882 (8.0)	0.2	1583/30 882 (2.6)	0.1	1388/30 882 (2.3)	0.1
Any PE	941/2488 (28.5)	1.3	417/2488 (10.8)	0.7	383/2488 (10.2)	0.7
No. of PE types (in those with PEs)						
Exactly 1 PE type	571/1706 (23.8)	1.4	236/1706 (8.6)	0.7	219/1706 (8.0)	0.7
Exactly 2 PE types	247/566 (35.4)	3.4	111/566 (12.8)	1.6	98/566 (12.1)	1.6
≥3 PE types	123/216 (57.5)	4.9	70/216 (28.8)	4.2	66/216 (27.9)	4.4
PE annualized frequency metric (in those with PEs)[b]						
≤0.3 Episodes/y	425/1259 (25.7)	1.9	183/1259 (9.6)	1.0	167/1259 (9.0)	1.0
>0.3 Episodes/y	516/1229 (31.7)	1.8	234/1229 (12.2)	1.1	216/1229 (11.5)	1.0

Abbreviations: PE, psychotic experience; STB, suicidal thoughts and behaviors.

[a] Numerators refer to the number of individuals with each suicidal outcome. Denominators refer to the number of individuals in the total sample or in the sample of those with/without PEs. Estimates are based on weighted data.

[b] Annualized PE (frequency of PE per year) = frequency of PE occurrences / (age at interview − age of onset of PE + 1).

attempted suicide?"). Information on the age at first occurrence for each of these outcomes was obtained retrospectively. Consistent with our goals of examining associations of PE with a continuum of suicidal behaviors, we considered each of these 3 primary outcomes in the total sample. In addition, we examined 3 secondary nested STB outcomes: (1) suicide plans among respondents with ideation; (2) suicide attempts among those with both ideation and a plan (ie, planned attempts); and (3) suicide attempts among respondents with ideation but without a plan (ie, unplanned attempts).

Statistical Analysis

The predictive associations of temporally prior PEs with each STB outcome were estimated using discrete-time survival models, with person-year as the unit of analysis. A person-year data set was constructed, where each year in the life of each respondent (up to and including the age of STB onset or age at interview, whichever came first) was treated as a separate observational record, with the year of STB onset coded as 1 and earlier years coded as 0. Psychotic experiences were coded as 1 a year after the first PE onset to ensure that a PE occurring in the same year as STBs did not count as a predictor. We first estimated models of PE and subsequent STBs adjusting for respondent's age at time of interview, sex, person-year dummies, and country. In addition, we built models adjusted for age at time of interview, sex, person-year dummies, country, and 21 antecedent mental disorders (ie, mental disorders that had onsets prior to the STBs) to examine the influence of mental disorders on the association between PEs and STBs. The joint significance test and test for linear trend were computed. We also conducted a post hoc analysis stratified by mental illness (yes/no) in examining whether the association between PEs and STBs was observed in both the groups.

Next, we reestimated the associations between PEs and subsequent STBs after stratifying the sample into 4 life course stages: childhood (12 years and younger), adolescence (aged 13-19 years), young adulthood (aged 20-29 years), and later adulthood (30 years and older). This allowed us to examine whether the associations varied across the life course and the strength of association (in early vs later years of life), given previous findings of large effect sizes among adolescents (ORs >10).[6,18] Finally, PARPS were calculated by converting the ORs obtained from the survival models as approximation of relative risk based on the assumption that the survival coefficients represented causal effects.[19]

As the WMH data are both clustered and weighted, the design-based Taylor series linearization implemented in SUDAAN software (RTI International) was used to estimate the SEs and evaluate the statistical significance of the coefficients. Survival coefficients and their SEs were exponentiated to generate ORs and 95% CIs. All statistical tests (Wald χ^2 based on discrete-time survival models) were evaluated using 2-sided tests. Statistical significance was set at $P < .05$.

Results

Prevalence of STBs

The lifetime prevalence (SE) of suicidal ideation, plans, and attempts in all respondents was 9.2% (0.2), 3.1% (0.1), and 2.8% (0.1), respectively (**Table 1**). Among 5106 individuals with suicidal ideation, 2000 (33.6%; SE, 0.9) reported a suicide plan. Among the subset of 2000 individuals with suicidal ideation with a plan, the prevalence of suicide attempts was 55.5% (SE, 1.5). Among the subset of 3106 individuals with suicidal ideation without a plan, the prevalence of suicide attempts was 17.0% (SE, 0.9). (The proportions for the nested suicide outcomes reflect different denominators; eTable 4 in the Supplement.) The lifetime prevalence of STBs was substantially higher among those with PEs compared with those without PEs (Table 1). Specifically, among respondents with PEs, the prevalence (SE) of suicidal ideation, plans, and attempts was 28.5% (1.3), 10.8% (0.7), and 10.2% (0.7), respectively, compared with 8.0% (0.2), 2.6% (0.1), and 2.3% (0.1) for respondents without PEs.

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Table 2. Associations Between Lifetime PEs and Subsequent Onset of Suicidal Ideation, Plans, and Attempts, With and Without Adjustment for Antecedent Mental Disorders

	OR (95% CI)					
	Ideation		Plans		Attempts	
Characteristic	Basic Demographic Adjustment[a]	Adjusted for Antecedent Mental Disorders[b]	Basic Demographic Adjustment[a]	Adjusted for Antecedent Mental Disorders[b]	Basic Demographic Adjustment[a]	Adjusted for Antecedent Mental Disorders[b]
PE status						
Any PE	3.0 (2.6-3.6)[c]	2.2 (1.8-2.6)[c]	3.4 (2.8-4.1)[c]	2.1 (1.7-2.6)[c]	3.1 (2.4-3.9)[c]	1.9 (1.5-2.5)[c]
No. of PE types						
Exactly 1 PE type	2.5 (2.0-3.1)[c]	1.9 (1.5-2.3)[c]	2.6 (2.0-3.3)[c]	1.8 (1.4-2.3)[c]	2.3 (1.7-3.2)[c]	1.6 (1.1-2.2)[c]
Exactly 2 PE types	3.7 (2.7-4.9)[c]	2.5 (1.8-3.3)[c]	3.6 (2.5-5.2)[c]	2.1 (1.5-3.1)[c]	3.3 (2.2-5.0)[c]	1.9 (1.2-3.0)[c]
≥3 PE types	7.1 (4.9-10.3)[c]	4.1 (2.9-5.9)[c]	11.1 (7.1-17.4)[c]	5.2 (3.1-8.7)[c]	10.3 (6.2-17.2)[c]	4.0 (2.2-7.3)[c]
Joint significance of the PE type measures						
χ^2_3	256.2	112.9	203.1	63.7	137.5	30.5
P value	<.001	<.001	<.001	<.001	<.001	<.001
Difference in the ORs of the PE type measures						
χ^2_2	24.3	14.7	32.4	15.0	26.0	7.6
P value	<.001	.001	<.001	.001	<.001	.02
Test for linear trend						
χ^2_1	15.0	13.2	20.6	14.3	24.7	14.6
P value	<.001	<.001	<.001	<.001	<.001	<.001
PE frequency metric						
>0.3 Episodes/y	3.5 (2.8-4.3)[c]	2.4 (2.0-3.0)[c]	3.8 (2.9-5.1)[c]	2.3 (1.7-3.0)[c]	3.0 (2.3-4.1)[c]	1.8 (1.3-2.5)[c]

Abbreviations: OR, odds ratio; PE, psychotic experience; STB, suicidal thoughts and behaviors.

[a] Psychotic experience (any PE, number of PE type, and frequency metric) was used as a predictor of STB outcomes in separate discrete-time survival models. These models control for age cohorts, sex, person-year dummies, and country.

[b] These models additionally control for 21 other antecedent mental disorders.

[c] Statistically significant at the *P* < .05 level (Wald χ^2 based on discrete-time survival models) using 2-sided tests.

Associations Between Lifetime PEs and Subsequent Onset of STBs

Compared with those without PEs, those with any PEs had 3-fold the odds of a subsequent first onset of each STB outcome after adjusting for demographic factors (**Table 2**), with adjusted ORs for suicidal ideation, plans, and attempts of 3.0 (95% CI, 2.6-3.6), 3.4 (95% CI, 2.8-4.1), and 3.1 (95% CI, 2.4-3.9), respectively. Overall, the PE-type metric was significant in predicting 3 STBs (χ^2 ranged between 137.5 and 256.2; $P < .001$). The tests for linear trend were also significant, with χ^2 ranging between 15.0 and 24.7, indicating that there was a dose-response relationship. The ORs for STBs among those experiencing 3 or more PE types ranged from 7.1 for ideation (95% CI, 4.9-10.3) to 11.1 for plans (95% CI, 7.1-17.4). There was also a 3-fold to 4-fold increased odds of various STBs in those with more frequent annualized PEs (more than 0.3 episodes per year) compared with those with less frequent annualized PEs (0.3 episodes or less per year), with ORs ranging from 3.0 for attempts (95% CI, 2.3-4.1) to 3.8 for plans (95% CI, 2.9-5.1).

When we adjusted for 21 antecedent mental disorders, the effect sizes attenuated but remained statistically significant. After adjustment, those with any PEs had twice the odds of subsequent onset of all 3 STBs. The significant dose-response relationship between higher PE frequency metrics and STBs also persisted.

When we restricted the analysis to the subset with suicidal ideation, the associations of any PEs with suicide plans and suicide attempts were not significant, indicating that PEs are associated with increased odds of suicidal ideation but not with an increased odds of planning or attempting suicide among those reporting suicide ideation (eTable 5 in the Supplement). As a post hoc analysis, we also repeated the analysis stratified by mental disorders (yes/no). While the 95% CIs were wider in the subgroup with no mental disorders, the general pattern of findings persisted (eTable 6 in the Supplement).

Associations Between Lifetime PEs and Subsequent Onset of STBs Across 4 Life Course Stages

Table 3 shows the associations between PEs and subsequent onset of STBs in 4 life course stages. In the basic demographic adjustment models, we found strong and significant associations between occurrence of PEs and subsequent onset of STBs in all 4 life course stages (childhood, adolescence, early adulthood, and later adulthood). The effect sizes were significantly higher in childhood compared with other age groups (ideation: $\chi^2 = 14.7$; $P < .001$; plans: $\chi^2 = 17.6$; $P < .001$; and attempts: $\chi^2 = 8.8$; $P = .003$). The ORs for suicidal ideation, plans, and attempts in childhood were 4.0 (95% CI, 2.3-6.8), 7.8 (95% CI, 3.4-17.9), and 5.4 (95% CI, 2.6-11.3), respectively. When adjusted for antecedent mental disorders, the pattern of associations remained significant though the effect sizes were attenuated.

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Table 3. Associations Between Lifetime Psychotic Experiences and Subsequent Onset of Suicidal Ideation, Plans, and Attempts in Each of 4 Life Course Stages, With and Without Adjustment for Antecedent Mental Disorders

Category	OR (95% CI)				Test for the Significance of the Slope Differences Across 4 Life Course Stages		Test for Significant Differences Between Childhood and Other Age Groups	
	Childhood (≤12 y)	Adolescence (Aged 13-19 y)	Young Adulthood (Aged 20-29 y)	Later Adulthood (≥30 y)	χ^2_3	*P* Value	χ^2_1	*P* Value
Basic Demographic Adjustments[a]								
Ideation	4.0 (2.3-6.8)	3.3 (2.6-4.2)	3.0 (2.3-3.9)	2.7 (2.0-3.6)	16.4	<.001	14.7	<.001
Plans	7.8 (3.4-17.9)	3.9 (2.9-5.3)	3.2 (2.3-4.5)	2.7 (1.8-3.9)	20.6	<.001	17.6	<.001
Attempts	5.4 (2.6-11.3)	3.0 (2.1-4.3)	3.1 (2.1-4.6)	3.1 (1.9-5.1)	10.8	.003	8.8	.01
Adjusted for Antecedent Mental Disorders[b]								
Ideation	2.8 (1.5-5.0)	2.4 (1.8-3.1)	2.3 (1.8-3.0)	1.9 (1.4-2.6)	21.2	<.001	19.2	<.001
Plans	5.5 (2.2-13.8)	2.5 (1.8-3.5)	2.2 (1.6-3.1)	1.7 (1.1-2.5)	26.1	<.001	22.2	<.001
Attempts	3.2 (1.4-7.6)	1.9 (1.3-2.9)	2.0 (1.3-3.1)	1.8 (1.0-3.2)	16.5	<.001	14.0	<.001

Abbreviation: OR, odds ratio.

[a] Any psychotic experience was used as a predictor of suicidal thoughts and behaviors outcomes in a discrete-time survival model controlling for age cohorts, sex, person-year dummies, and country.

[b] These models additionally control for 21 other antecedent mental disorders.

Table 4. Population Attributable Risk Proportions of Suicidal Ideation, Plans, and Attempts Owing to Psychotic Experiences in Each of 4 Life Course Stages, With and Without Adjustment for Antecedent Mental Disorders[a]

Category	Population Attributable Risk Proportions, %				
	Childhood (≤12 y)	Adolescence (Aged 13-19 y)	Young Adulthood (Aged 20-29 y)	Later Adulthood (≥30 y)	Overall
Basic Demographic Adjustments					
Ideation	14.1	10.6	9.7	8.2	8.4
Plans	27.6	13.6	11.0	8.5	11.0
Attempts	19.9	10.0	10.7	10.8	10.0
Adjusted for Antecedent Mental Disorders					
Ideation	9.0	6.9	6.5	4.6	5.3
Plans	20.0	7.6	6.3	3.6	5.7
Attempts	11.1	4.8	5.5	4.3	4.8

[a] Population attributable risk proportions = (p × (relative risk − 1)) / (p × (relative risk − 1) + 1), where p indicates the proportion of respondents in the sample with psychotic experiences.

PARPs Between PEs and STBs

The overall PARPs for suicidal ideation, plans, and attempts ranged between 8.4% and 11.0% (**Table 4**) in the basic demographic adjustment models. After adjustments for antecedent mental disorders, the overall PARPs were smaller, ranging from 4.8% to 5.7%. When examined across the life course, compared with older age groups, children 12 years and younger consistently had the highest PARPs (9.0%, 20.0%, and 11.1% for suicidal ideation, plans, and attempts, respectively) after adjustment for antecedent mental disorders.

Discussion

The results reported here are based on, to our knowledge, the largest and most detailed study of PEs and STBs reported to date. We found that community respondents who reported PEs had 2-fold increased odds of subsequent suicidal ideation, plans, and attempts after adjustment for antecedent mental disorders. These estimates are broadly consistent with several longitudinal studies[1,5,13,20] but slightly lower than the pooled estimate from a 2016 meta-analysis.[1] We also found a dose-response relationship between (1) higher numbers of PE types (in keeping with previous literature)[2-5] and (2) higher annualized PE frequency with subsequent STBs. Additionally, these results shed new light on 4 issues. First, the association between PEs and STBs persisted after adjustment for antecedent mental disorders. Second, among the subset of respondents reporting suicidal ideation, PEs did not contribute significantly to increased odds of subsequent suicide plans or attempts. Third, the association between PEs and STBs was most prominent in children 12 years and younger. Fourth, PEs accounted for an appreciable proportion of STBs (9%-20%) during childhood, even when adjusted for antecedent mental disorders. We discuss each of these in turn.

First, although the association between PEs and STBs was attenuated after adjustment for 21 antecedent mental disorders, appreciable ORs (at least 2-fold) were still found between PEs and STBs. These finding are consistent with previous studies[1,3,21] and lend weight to the hypothesis that the experience of PEs, even in the absence of mental disorders, may be sufficient to influence the subsequent onset of STBs. This is an important finding from a clinical point of view because it suggests that PEs may be a predictor of subsequent STBs even in individuals who do not meet criteria for mental disorders. In keeping with a 2017 commentary,[22] we do not propose that the presence of isolated

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PEs is sufficient to identify individuals with an ultrahigh risk of later transition to psychotic disorder; however, these individuals do have an increased risk of a range of other adverse outcomes, including STBs. Psychotic experiences and suicidality may share common risk factors (eg, traumatic life events or family history). Previous research found that the association between PEs and STBs persisted after adjusting for trauma and experiencing harm.[3,4] We hypothesize that as PEs are associated with both psychological distress[23] and disability,[24,25] these factors may be sufficient to contribute to the emergence of subsequent STBs. However, we note that it is conceivable that PEs and STBs may both emerge during a prodromal phase of a later mental disorder (ie, a disorder with an age at onset after prior STBs). Although this analysis is beyond the scope of the current article, such research could further reinforce the clinical utility of routine monitoring of PEs in at-risk samples. Future studies may wish to include measures of disorganized speech, which is a clinical feature of psychotic disorder not routinely included in PE assessment.

Second, we demonstrated, to our knowledge for the first time, that although PEs were associated with an overall increase in STBs, among those with suicidal ideation, they did not make an additional contribution to the subsequent transition to suicide plans or planned/unplanned attempts. In other words, while those with PEs had an increased odds of each of the 3 STB outcomes (ie, suicidal ideation, suicide plans, and suicide attempts), our findings suggest that the presence of PEs did not alter the odds of transition from suicidal ideation to planned or unplanned attempts. This general pattern is consistent with previous research that explored the associations of mental disorders and these nested STB outcomes.[11] However, the results are in contrast to DeVylder et al,[16] who found that respondents with PEs and suicidal ideation had more than 3-fold increased risk of attempting suicide. This discrepancy may reflect differences in methods related to the use of temporal ordering between the variables of interest.

Third, we found that PEs were associated with the subsequent onset of STBs in each of the 4 life course stages and that this pattern of associations persisted after adjustment for antecedent mental disorders. Mindful that PEs have a wide age-at-onset distribution (median [interquartile range], 26 [17-41] years),[26] our findings support the hypothesis that PEs are associated with an increased odds of subsequent STBs regardless of age. However, we confirmed that the association between PEs and STBs was indeed more prominent in childhood, consistent with previous findings based on longitudinal studies.[5,6,20,27] While our study was based on adult respondents (18 years and older), it is reassuring to note that the strong association between childhood-onset PEs and STBs has been confirmed in both broad cross-sectionally ascertained samples, like the WMH, and prospectively studied adolescent cohorts. Future studies may wish to explore biological and psychosocial factors that could explain why the association between PEs and subsequent STBs is stronger in young children compared with other age groups (eg, a differential sensitivity to stress[28,29]).

Finally, we showed that after adjustment for antecedent mental disorders, the overall PARP estimates (between 4.8% and 5.7%) were smaller than previously reported.[6,16] However, in children, the adjusted PARPs (between 9% and 20%) were similar to previously reported PARPs. We recommend caution when interpreting PARPs—these estimates assume causality between the variables of interest.[19] These findings lend weight to the recommendation by Kelleher et al[6] that clinicians should include PEs when assessing risk of STBs in young people and that future clinical and epidemiologic studies of STBs should include PE-related items in their risk factor battery.

Limitations

The current study has several strengths (large sample size, range of countries, uniform methods for data collection, temporally ordered variables, etc). However, it is important to note the study limitations. First, although we excluded people who were screened positive for possible psychotic disorders, the WMH surveys were administered by lay interviewers, and clinical validation of self-reported diagnoses of psychosis or mania was not available. Second, we also used retrospective reports of age at onset of the PEs, STBs, and mental disorders; although rigorously obtained,[30] this is subject to some level of recall bias. However, we note that 5 prospective studies have confirmed the association between PEs and subsequent STBs.[5,6,20,27,31] Third, the surveys were cross-sectional, and without additional follow-up, we were unable to examine the association between PEs and completed suicide. We are aware of 2 prospective community-based studies that explored this question, but both lacked sufficient power (ie, small number of completed suicides) to confidently estimate the influence of PEs on this outcome.[20,32] Fourth, it will be of interest to explore if particular types of PEs (eg, hallucinations or delusions) are differentially associated with STBs in future analyses.

Conclusions

We found that PEs were independently associated with subsequent STBs regardless of antecedent mental disorders. There were significant dose-dependent relationships between both number of PE types and annualized frequency of PEs with subsequent STBs. The association was found at all ages, with a stronger effect at younger ages, and were associated with appreciable PARPs. From a public health perspective, we speculate that the inclusion of PE items in routine screening tools could improve the prediction of suicide risk. Our study lends additional weight to the call for the routine inclusion of PE items when assessing STBs in both research and clinical settings.

ARTICLE INFORMATION

Accepted for Publication: July 11, 2017.

Published Online: August 30, 2017. doi:10.1001/jamapsychiatry.2017.2647

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Conflict of Interest Disclosures: In the past 3 years, Dr Kessler has received support for his epidemiological studies from Sanofi Aventis, was a consultant for Johnson & Johnson Wellness and Prevention, and served on an advisory board for the Johnson & Johnson Services Lake Nona Life Project. Kessler is a co-owner of DataStat, a market research firm that carries out health care research. No other disclosures were reported.

Funding/Support: The World Health Organization World Mental Health Survey Initiative is supported by the National Institute of Mental Health (grant R01 MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (grants R13-MH066849, R01-MH069864, and R01 DA016558), the Fogarty International Center (grant FIRCA R03-TW006481) , the Pan American Health Organization, Eli Lilly and Company, Ortho-McNeil Pharmaceutical, GlaxoSmithKline, and Bristol-Myers Squibb. The Argentina survey—Estudio Argentino de Epidemiología en Salud Mental—is supported by a grant from the Argentinian Ministry of Health (Ministerio de Salud de la Nación). The Colombian National Study of Mental Health is supported by the Ministry of Social Protection. The European Study of the Epidemiology of Mental Disorders project is funded by the European Commission (contracts QLG5-1999-01042, SANCO 2004123, and EAHC 20081308), the Piedmont Region (Italy), Fondo de Investigación Sanitaria of the Instituto de Salud Carlos III (grant FIS 00/0028), Ministerio de Ciencia y Tecnología (grant SAF 2000-158-CE), Departament de Salut de Generalitat de Catalunya via Instituto de Salud Carlos III (grants CIBER CB06/02/0046 and RETICS RD06/0011 REM-TAP), and other local agencies and by an unrestricted educational grant from GlaxoSmithKline. Implementation of the Iraq Mental Health Survey and data entry were carried out by the staff of the Iraqi Ministry of Health and Ministry of Planning, with direct support from the Iraqi survey team, with funding from both the Japanese and European Funds through the United Nations Development Group Iraq Trust Fund. The Lebanese Evaluation of the Burden of Ailments and Needs Of the Nation is supported by the Lebanese Ministry of Public Health, the World Health Organization (Lebanon), the National Institute of Health/Fogarty International Center (grant R03 TW006481-01), anonymous private donations to the Institute for Development, Research, Advocacy, and Applied Care, Lebanon, and unrestricted grants from Algorithm, AstraZeneca, Benta, Bella Pharma, Eli Lilly, GlaxoSmithKline, Lundbeck, Novartis, Servier, Phenicia, and Union Pharmaceutique d'Orient. The Mexican National Comorbidity Survey is supported by The National Institute of Psychiatry Ramon de la Fuente (grant INPRFMDIES 4280) and by the National Council on Science and Technology (grant CONACyT-G30544- H), with supplemental support from the PanAmerican Health Organization. Te Rau Hinengaro: The New Zealand Mental Health Survey is supported by the New Zealand Ministry of Health, Alcohol Advisory Council, and the Health Research Council. The Nigerian Survey of Mental Health and Wellbeing is supported by the World Health Organization (Geneva), the World Health Organization (Nigeria), and the Federal Ministry of Health of Nigeria. The Peruvian World Mental Health Study is funded by the National Institute of Health of the Ministry of Health of Peru. The Portuguese Mental Health Study is carried out by the Department of Mental Health, Faculty of Medical Sciences, Nova University of Lisbon, with collaboration of the Portuguese Catholic University, and is funded by Champalimaud Foundation, Gulbenkian Foundation, Foundation for Science and Technology, and Ministry of Health. The Romania World Mental Health study projects "Policies in Mental Health Area" and "National Study Regarding Mental Health and Services Use" were carried out by National School of Public Health and Health Services Management, with technical support by Metro Media Transilvania, the National Institute of Statistics–National Centre for Training in Statistics SC, Cheyenne Services, Statistics Netherlands, and were funded by the Ministry of Public Health with supplemental support of Eli Lilly Romania. The São Paulo Megacity Mental Health Survey is supported by the State of São Paulo Research Foundation (Thematic Project Grant 03/00204-3). The Shenzhen Mental Health Survey is supported by the Shenzhen Bureau of Health and the Shenzhen Bureau of Science, Technology, and Information. The US National Comorbidity Survey Replication is supported by the National Institute of Mental Health (grant U01-MH60220) with supplemental support from the National Institute of Drug Abuse, the Substance Abuse and Mental Health Services

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Administration, the Robert Wood Johnson Foundation (grant 044708), and the John W. Alden Trust. Dr McGrath received John Cade Fellowship APP1056929 from the National Health and Medical Research Council and Niels Bohr Professorship from the Danish National Research Foundation.

Role of the Funder/Sponsor: The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

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Disclaimer: The views and opinions expressed in this report are those of the authors and should not be construed to represent the views of the World Health Organization, other sponsoring organizations, agencies, or governments.

Additional Contributions: We thank the staff of the World Mental Health Data Collection and Data Analysis Coordination Centres for assistance with instrumentation, fieldwork, and consultation on data analysis.

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