Psychiatry Research 235 (2016) 69–76

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

A comparison of the nature and correlates of panic attacks in the context of Panic Disorder and Social Anxiety Disorder

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ARTICLE INFO

Article history:
Received 22 May 2015
Received in revised form
19 November 2015
Accepted 27 November 2015
Available online 30 November 2015

Keywords:
Panic attacks
Social Anxiety Disorder
Panic Disorder

ABSTRACT

Panic attacks occurring outside of Panic Disorder are not well-understood despite their inclusion as a diagnostic specifier in the Diagnostic and Statistical Manual for Mental Disorders (DSM-5). This study compares panic attacks in the context of Panic Disorder compared to social anxiety in terms of their symptom frequency, severity, and clinical correlates. Method: Participants (n=404) were interviewed using the Anxiety Disorders Interview Schedule (ADIS-IV-L; Brown et al., 1994), from which we analyzed interviewer ratings of panic attacks and panic attack symptoms, as well as other demographic and clinical characteristics. Results: Panic attacks in the context of Panic Disorder were characterized by a greater number and severity of symptoms compared to panic attacks in the context of Social Anxiety Disorder, and were associated with a history of traumatization, inpatient psychiatric treatment, and benzodiazepine use. Social anxiety panic attacks were associated with reduced physical health concerns. Cognitive panic attack symptoms were more prevalent in Panic Disorder and were associated with a variety of poor clinical correlates. Conclusions: Panic attacks in the context of Panic Disorder are more severe than those in social anxiety, and this may be driven by cognitive disturbances during those attacks.

1. Introduction: the nature and correlates of panic attacks occurring in the context of Panic Disorder and Social Anxiety Disorder

According to DSM-5 diagnostic criteria (American Psychiatric Association, 2013; APA), panic attacks are episodes of intense fear or terror with rapid onset of at least four physiological (e.g., heart racing, difficulty breathing, nausea) or cognitive (e.g., fear of going crazy, fear of dying, fear of losing control) symptoms. Although panic attacks are most commonly associated with Panic Disorder, they are a ubiquitous phenomenon (Barlow, 1988) and occur across an array of disorders including other anxiety disorders, as well as mood, substance use, psychotic spectrum, and personality disorders. For a number of disorders, the presence of panic attacks indicates increased symptom severity, higher rates of comorbidity and suicidality, and poorer treatment response (American Psychiatric Association, 2013). For this reason, panic attacks are recognized as a diagnostic specifier in DSM-5 (e.g., Social Anxiety Disorder, Panic Attack Specifier, or Major Depressive Disorder, Panic Attack Specifier) when a comorbid Panic Disorder diagnosis is not warranted.

Despite the wealth of literature that the presence of panic attacks in DSM-5 disorders outside of PD are clinically informative, little is known about the extent to which they resemble or differ from those that characterize PD, as the vast majority of research on panic attacks has been conducted with PD patients. The current study aims to compare the nature and correlates of panic attacks that occur within the context of PD with those within the context of Social Anxiety Disorder (SAD), a prevalent anxiety disorder that can occur with or without the presence of panic attacks.

One key difference between panic attacks occurring within the context of PD and those occurring within SAD is whether they are unexpected or expected in nature (Barlow et al., 1994; Craske et al., 2010; Rachman et al., 1987). Unexpected panic attacks, or attacks for which there is no obvious trigger or cue, are an essential element of PD. Such attacks are characterized by perceived lack of prediction and control, which is theorized to contribute to the high levels of overall anxious apprehension found in PD (Barlow, 1988; Craske, 1991; Craske et al., 1995). Expected panic attacks, for which there is an obvious trigger or cue, include the panic attacks that reliably occur in response to phobic stimuli (e.g., public speaking for the person with SAD).

The limited data that does exist regarding the symptom

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http://dx.doi.org/10.1016/j.psychres.2015.11.048
0165-1781/

characteristics of expected and unexpected panic attacks is mixed. Across the anxiety disorders, one study reported that unexpected attacks in the context of PD were associated with higher symptom frequency, but few intensity differences, compared to expected attacks in other anxiety disorders (Barlow et al., 1985). Compared to SAD panic attacks in particular, PD panic attacks were characterized by more severe dizziness, fears of losing control, fears of going crazy, and dysregulated breathing (Barlow et al., 1985; Rapee et al., 1992). However, when comparing unexpected to expected attacks across all anxiety disorders, no symptom severity differences were found after accounting for symptom frequency (Barlow et al., 1985). Expected attacks in SAD are associated with increased severity of the disorder even after controlling for the presence of PD (Jack et al., 1999), but this study did not have a PD alone comparison group. Should further investigation reveal reliable differences between expected panic attacks within SAD and unexpected panic attacks within PD, then the diagnostic specification of panic attack may be improved by distinguishing between them.

Research on the clinical correlates of panic attacks is widespread, although the majority of studies do not distinguish between expected and unexpected panic attacks. Such research has found that the presence of panic attacks in general confer risk for the later development of an anxiety disorder as well as an array of other psychological disorders (Batelaan et al., 2012; Goodwin et al., 2004a; Goodwin and Gotlib, 2004b; Goodwin et al., 2004c; Wilson and Hayward, 2005) and are associated with greater severity of these disorders (Goodwin et al., 2004c). In addition, a large body of research has found a link between panic attacks and poor outcomes across a variety of psychological health and quality of life variables such as suicidality (even after controlling for depression and borderline personality disorder), physical health, use of medications, and inpatient treatment (Batelaan et al., 2012; Brown et al., 2010; Klerman et al., 1991). In addition to exploring differences in the nature of panic attacks, this study aims to investigate whether the clinical correlates of panic attacks occurring in PD differ from those occurring in SAD. Should clinical correlates between the two types of panic attacks differ, this would provide further justification for a diagnostic specification that distinguishes between expected and unexpected panic attacks.

The current study compared unexpected panic attacks in the context of PD and expected panic attacks in the context of SAD to provide a better understanding of panic attacks occurring outside of the context of Panic Disorder. First, similarities and differences in symptom presentation and intensity were explored. We hypothesized that unexpected attacks would be characterized by greater frequency of individual panic attack symptoms and more intense cognitive dysregulation than expected attacks based on the prior literature (Barlow et al., 1985; Rapee et al., 1992). Second, panic symptom frequency or severity was predicted by type of panic attack (i.e., unexpected panic attack in PD vs expected panic attack in SAD). We hypothesized that severity and frequency of panic attack symptoms would be differentially predicted by panic attack type, with greater frequency and severity of symptoms in unexpected (i.e., PD) versus expected (i.e. SAD) panic attacks. Thirdly, panic attack symptoms were analyzed along a linear dimension that was calculated to capitalize on categorization of expected and unexpected attacks based on symptom severity. These analyses were exploratory in nature and no specific hypotheses were made. Then, panic symptom severity was used to predict panic attack type, and we hypothesized that greater symptom severity would classify participants into PD versus SAD attacks. Next, severity of panic attacks (calculated by summing the severity scores for each of the 14 panic attack symptoms) within the context of each disorder was analyzed in relation to a variety of important clinical outcomes, including suicidality and medication use. Given that unexpected panic attacks are associated with higher anxiety than expected panic attacks, we hypothesized that panic attacks in PD would have stronger associations with adverse clinical indicators, such as suicidality and history of inpatient and outpatient treatment, than expected panic attacks in the context of SAD. Finally, in order to determine whether the presence of panic attacks within SAD conferred greater risk of disorder severity and clinical correlates, SAD participants with and without panic attacks were compared in terms of severity of diagnosis and clinical correlates. Based on the prior literature demonstrating that expected panic attacks were less severe than unexpected attacks, we hypothesized that the presence of panic attacks would not confer greater risk in these analyses.

2. Method

2.1. Participants

Participants ($n=556$) were recruited throughout the Los Angeles, CA area between 1993 and 2013 for enrollment in various treatment studies in the Anxiety Disorders Research Center at the University of California, Los Angeles. A subsample of 404 participants (73%) reported experiencing panic attacks and was thus included in the present study. The participants with panic attacks averaged 34.4 years old ($SD=9.7$, range$=18-62$), and were predominantly Caucasian (67%; 11.4% Latino/Hispanic; 7% Asian; 14.6% other). The sample contained slightly more females (52.7%) than males (47.3%). There were no differences by principal panic type in age ($F(1,105)=0.02$, $p=0.88$), but there were differences in ethnicity ($\chi 2=37.2$, $p<0.001$, with the SAD group (54% Caucasian) more diverse than the PD group (75% Caucasian) and gender ($\chi 2=5.49$, $p<0.05$), with the SAD group having more males (56%) than females, and the PD group having more females than males (56%). Therefore, these demographic variables were used as covariates whenever possible. Differences based on analyses with the covariates are reported. Diagnoses represented in the sample include PD ($n=297$), SAD ($n=225$), specific phobia, ($n=196$), major depression ($n=140$), and generalized anxiety disorder ($n=193$), among others.

2.2. Measures

Anxiety Disorders Interview Schedule (ADIS-IV-L; Brown et al., 1994). All participants were administered the ADIS-IV-L to determine eligibility to participate in the studies. The ADIS-IV-L is a highly reliable and valid semi-structured interview that assesses the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000) symptoms of anxiety, mood, substance use disorders, and psychosis (Brown et al., 2001). The interview also assesses demographic information, medical history, and relevant psychosocial variables. Each disorder assigned by the interviewer is given a clinician severity rating (CSR), using a scale from 0 (not at all) to 8 (very severe) to represent severity of symptoms, distress and impairment (with 3 representing probable/subthreshold and 4 representing clinical case). A CSR of 4 or greater indicates a clinically significant presentation of the disorder. The ADIS-IV-L was administered by either doctoral-level graduate students or highly-trained bachelor-level research assistants, all of whom demonstrated reliability over three consecutive interviews before being certified as interviewers, and were subsequently supervised by licensed clinical psychologists. All of the interviews were audio-recorded and a total of 78 were reviewed to establish inter-rater reliability across the included studies. On principal diagnoses, inter-rater reliability was excellent (kappa range=0.93–1.00) whereas ratings were moderately reliable for secondary diagnoses (kappa range=0.52 –1.00).

All interviews were conducted prior to the publication of DSM-5 , but the DSM-5 panic attack symptom checklist is essentially identical to the DSM-IV-TR list. Each of 14 panic attack symptoms was rated in the context of PD and SAD. These symptoms include: heart palpitations, sweating, trembling/shaking, shortness of breath, choking, chest pain, chest discomfort, nausea or stomach distress, chills/hot flushes (and/or blushing in SAD only), dizziness, feelings of unreality, fear of dying, fear of going crazy, and fear of doing something uncontrolled. The DSM-IV-TR lists only 13 panic attack symptoms because fear of going crazy and fear of doing something uncontrolled are collapsed into one symptom. Each symptom was rated using a scale from 0 (not at all) to 8 (very severe). All endorsed symptoms, regardless of severity, were counted for frequency. The ADIS-IV-L interviewer rated symptoms of unexpected panic attacks within the PD section of the interview: that is, interviewers instructed participants to only rate the panic attack symptoms for attacks that began on "out of the blue" or in unexpected situations. In contrast, interviewers rated symptoms of expected panic attacks within SAD (i.e., only those cued by social situations). Thus, all panic attack symptom data recorded with regard to PD were for unexpected attacks and all panic attack symptom data recorded with regard to SAD were for expected attacks.

Demographic and medical data were analyzed to determine the clinical correlates of panic attacks. Binary variables were as follows: education (0=less than high school degree, 1=high school degree or greater), physical health concerns ("Have you had a lot of physical problems in your life?" rated at 0=no, 1=yes), smoking ("Are you a smoker?" rated as 0=no, 1=yes), relationship status (0=not in a relationship, 1=in a relationship), current prescription for benzodiazepines (0=no, 1=yes), history of inpatient treatment ("Have you ever been hospitalized for any anxiety, depression, substance use, or any other emotional problem?"; 0=no, 1=yes), history of outpatient treatment ("Have you ever received outpatient treatment or evaluations for any emotional or personal difficulties?" rated as 0=no, 1=yes), history of trauma exposure ("Have you ever experienced a traumatic or life threatening event such as assault, rape, seeing someone badly injured or killed, combat accidents, or natural or man-made disasters?" rated as 0=no, 1=yes), and family history of psychiatric illness ("Has anyone in your immediate, biological family ever been treated or hospitalized for psychiatric problem?" rated as 0=no, 1=yes). A suicide item, "Over the past 2 weeks, have you experienced thoughts about death or hurting yourself?", was rated on a Likert scale from 0 (indicating no such thoughts) to 8 (extremely frequent, distressing, and impairing thoughts).

2.3. Procedure

Participants were recruited for studies using flyers and advertisements around the Los Angeles area as well as referrals from area clinicians. Some studies focused on PD, some focused on SAD, and some focused on all anxiety disorders. All studies allowed for the presence of additional comorbid anxiety disorder diagnoses. Interested individuals called the Anxiety Disorders Research Center and scheduled an in-person interview for eligibility screening, during which the ADIS-IV-L was completed. Following the interview, the interviewer met with a team of licensed clinicians to derive a consensus on each diagnosis and the CSR score for each diagnosis.

In order to meet criteria for a panic attack within either disorder, at least four of the thirteen panic attack symptoms had to have a severity rating of 1 or higher. Panic attacks were categorized by disorder (PD-PAs or SAD-PAs) based on the relevant ADIS-IV-L module in which the panic attack symptoms were rated. In cases where participants reported both PD-PAs and SAD-PAs, a principal panic type was determined based on the principal diagnosis. For participants who endorsed both PD-PAs and SAD-PAs, the panic attacks occurring outside their principal diagnosis were labeled 'secondary panic attacks'. As described below, some analyses were conducted with panic attacks occurring within the principal diagnosis (e.g., Prin-PD-PA, Prin-SAD-PA) while some were conducted using the combined principal and secondary panic attacks (e.g., PD-PA, SAD-PA) based on the research question. Of the 404 participants included in this sample, 200 (49.5%) had only PD-PA, 114 (28.2%) had only SAD-PA, and 90 (22.3%) had both PD-PA and SAD-PA.

2.4. Data analysis

All analyses were conducted using Stata version 13 (StataCorp, 2013). To test the first hypothesis that Prin-PD-PA were characterized by more symptoms than Prin-SAD-PA, a series of χ^2 analyses compared the prevalence of symptoms across attack type using a Bonferroni corrected $\alpha=0.0036$. Next, a multivariate analysis of variance (MANOVA) was conducted with principal panic attack (Prin-PD-PA or Prin-SAD-PA) as the independent variable and panic attack symptom severity for each of the 14 symptoms as the dependent variables. A significant omnibus MANOVA was then followed by post-hoc individual analyses of variance (ANOVAs) in order to examine which individual panic symptoms were driving the effect. In the event of a significant omnibus test, a conservative Bonferroni post-hoc analysis explored how the types of panic attacks differed in their symptoms (Abdi, 2007).

To test our second hypothesis, a linear discriminant function analysis was employed to elucidate whether the panic attack symptoms could be classified along a dimension. Discriminant function analysis allows for the classification of participants into groups, or categories of panic attacks in this study, based on a series of independent variables, or individual panic attack symptoms (Morrison, 1969). Discriminant function analysis analyzes whether the dimension significantly differs based on primary panic type. This type of analysis is ideal when the independent variables (i.e., panic attack symptoms) are continuous in nature, and when a goal is to maximize the differences between the dependent variables (i.e., primary panic type) (Silva Ramos et al., 2012). The maximum number of dimensions that can be assigned in this analysis are the number of levels of the dependent variable, minus one. Therefore, in the current study, the maximum number of dimensions is one.

Third, a multinomial logistic regression was used to predict principal panic attack (Prin-PD-PA or Prin-SAD-PA) from panic symptom severity. This analysis does not assume multivariate normality, and provides a useful method for validating the results of the linear discriminant function analysis. These are similar analyses but provide slightly different interpretations, thus both are reported. Omnibus tests of the PA symptoms as a differential predictor of principal panic attack followed. In the event of a significant omnibus test, a family-wise Bonferroni corrected alpha of 0.0035 (for 14 tests) was used to correct for multiple comparisons.

A series of logistic or linear regressions examined the clinical correlates (e.g., relationship status, suicidality) of PA severity within the context of each disorder. This analysis included principal and secondary attacks (i.e., PD-PA or SAD-PA) as well as the dimensions retrieved from the discriminant function analysis to evaluate whether PA severity in the context of each disorder predicted clinical outcomes of interest. Due to the multiple comparisons within each disorder, a family-wise Bonferroni corrected alpha value of 0.0035 was again employed. In the case of SAD-PA, SAD CSR was covaried, such that the effect of the panic symptom severity is uniquely measured above and beyond other factors that

go into the determination of overall disorder severity (i.e., resultant distress and impairment of those symptoms). Given that PA severity highly influences the CSR in PD-PA, severity of agoraphobia (where 0=none/mild and 1=moderate/severe) was covaried to account for other factors that go into the determination of overall disorder severity.

Finally, to determine whether the presence of PA in the context of SAD confers greater severity, a univariate ANOVA compared CSR between participants with SAD-PA ($n=125$) and those with SAD (CSR of 3 or greater) and no panic attacks (SAD-No PA; $n=48$). A series of chi-square analyses (for dichotomous outcomes) and linear regressions (for continuous outcomes) examined the clinical correlates listed above with PA status (SAD-PA vs SAD-No PA) as a predictor.

3. Results

3.1. Clinical severity of PD and SAD

Average CSR ratings per disorder were as follows: PD=5.75 ($SD=0.94$; range 3–8) and SAD=5.55 ($SD=1.03$, range 3–8). CSRs did not differ between groups ($F(1,401)=3.51$, $p=0.062$).

3.2. Rate of panic attacks in PD and SAD

As required by the diagnostic criteria, 100% of 279 participants with at least probable clinical severity of PD (indicated by a CSR score of 3 or greater) had unexpected panic attacks (i.e., 4 or more symptoms rated as 1 or higher). Of the 207 participants who had at least probable clinical severity of SAD, 161 (77.8%) had expected panic attacks.

3.3. Principal panic attacks

Principal panic attacks were distributed as follows: Prin-PD-PA, $n=279$, and Prin-SAD-PA, $n=125$. Bivariate correlations between CSR and panic attack severity were significant for PD ($r=0.38$, $p<0.001$), but not for SAD ($r=0.16$, $p=0.07$). When covariates of gender and ethnicity were added to a regression model for SAD, panic attack severity became predictive of CSR ($\beta=0.695$, $t=18.14$, $p<0.001$).

3.4. Comparison of principal panic attacks across disorders

Fig. 1 depicts the percentage of panic symptom endorsement by principal panic type. Prin-PD-PA endorsed dizziness, numbness, fear of dying, fear of going crazy, and fear of losing control more frequently than Prin-SAD-PA (see Table 1). Prin-SAD-PA endorsed chills/hot flushes/blushing more frequently than Prin-PD-PA (though the blushing component is not included in the ADIS-IV-L section for PD). No other differences emerged in the frequency of endorsement of the symptoms based on principal panic type. After gender and ethnicity were covaried in logistic regression analyses, chills/hot flushes/blushing was no longer significantly associated with primary panic type, though all other differences remained.

Panic attack symptom severity differed significantly across Prin-PD-PA and Prin-SAD-PA in an omnibus MANOVA ($F(14, 353)=16.59$, $p<0.0001$, Wilkes Lambda $=0.576$). Results of follow-up univariate ANOVA are shown in Table 2 and Fig. 2. Prin-PD-PA symptoms were significantly more severe than Prin-SAD-PA symptoms for: shortness of breath, chest pain/discomfort, dizziness, unreality, numbing/tingling, fear of dying, fear of going crazy, and fear of doing something uncontrolled. When gender and ethnicity were covaried all of these associations remained, but

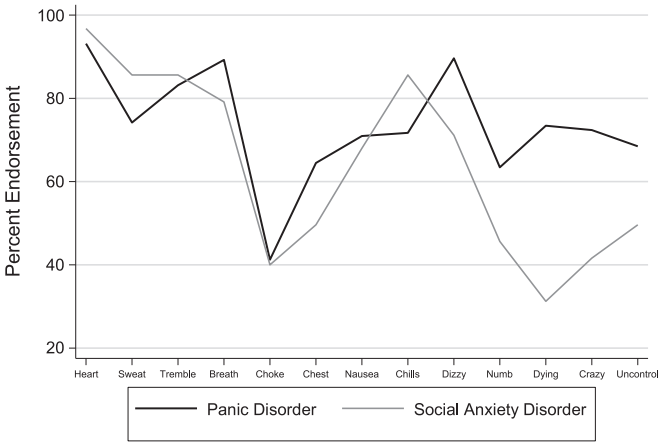

Fig. 1. Frequency of Panic Attack Symptoms by Primary Panic Type. Note: Fig. 1 includes the frequency, in terms of percentage of participant endorsement, of individual panic attack symptoms by primary panic type.

Table 1
Predicting panic attack symptom frequency from type of panic attack.

Symptom	Omnibus test χ^2, p value (Panic versus Social)
Heart palpitations	2.095
Sweating	6.487
Trembling/Shaking	0.383
Shortness of breath	7.298
Choking	0.053
Chest pain/discomfort	7.996
Nausea/stomach distress	0.362
Chills/hot flushes/blushing	9.162* (SAD)
Dizziness	21.662* (PD)
Unreality	4.423
Numbing/tingling	11.274* (PD)
Fear of dying	64.504* (PD)
Fear of going crazy	35.084* (PD)
Fear of doing something uncontrolled	13.117* (PD)

Note: Table 1 reports on chi-square values using a 1 df test.

* indicates $p<0.0036$, the classification in parentheses indicates the type of panic attack with the higher frequency of symptom endorsement.

· When gender and ethnicity were covaried in a logistic regression, Chills/Hot flushes/Blushing was no longer predicted by primary panic type (OR=2.24, $z=2.62$, $p=0.009$).

Table 2
Predicting panic attack severity from type of panic attack.

Symptom	ANOVA result
Heart palpitations	$F(1, 399)=0.40$, $p=0.529$
Sweating	$F(1, 397)=8.31$, $p=0.0042$
Trembling/Shaking	$F(1, 398)=0.84$, $p=0.361$
Shortness of breath	$\mathbf{F(1, 394)=13.88, p<0.0003}$
Choking	$F(1, 382)=2.48$, $p=0.1162$
Chest pain/discomfort	$\mathbf{F(1, 386)=18.30, p<0.0001}$
Nausea/stomach distress	$F(1, 396)=1.18$, $p=0.2789$
Chills/hot flushes/blushing	$F(1, 398)=6.21$, $p=0.0131$
Dizziness	$\mathbf{F(1, 393)=46.06, p<0.0001}$
Unreality	$\mathbf{F(1, 395)=21.79, p<0.0001}$
Numbing/tingling	$\mathbf{F(1, 385)=16.77, p<0.0003}$
Fear of dying	$\mathbf{F(1, 384)=125.67, p<0.0001}$
Fear of going crazy	$\mathbf{F(1, 381)=58.64, p<0.0001}$
Fear of doing something uncontrolled	$\mathbf{F(1, 385)=25.25, p<0.0001}$

Table 2 Note: The above analyses include the results of the ANOVA analyses. All significant findings are bolded and are more severe in PD than SAD.

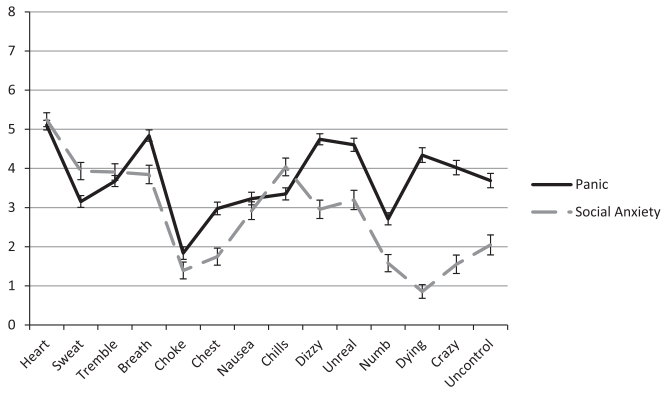

Fig. 2. Panic Attack Symptoms Severity by Primary Panic Type. Note: Fig. 2 depicts the mean severity rating for each panic attack symptom by primary panic type. The maximum score on each item is 8.

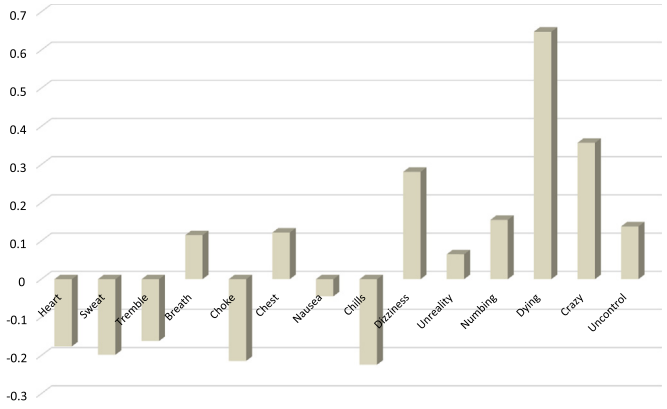

Fig. 3. Symptom Loading on Panic Attack Dimension.

there were also differences in sweating ($F(1,341)=5.14$, $p<0.05$, with the SAD group higher), fears of choking ($F(1,329)=4.76$, $p<0.05$, with the PD group higher), and chills ($F(1,342)=5.77$, $p<0.05$, with the SAD group higher). Fig. 3

3.5. Discriminant function analysis

The discriminant function analysis revealed that the dimension most accurately classifying participants into PD-PAs vs. SAD-PAs represents cognitive symptoms at the positive end and autonomic dysregulation at the negative end. This dimension properly classified 80% of participants into their respective type of panic attacks. See Fig. 1 for a graphical depiction of the dimension. The positive side of the dimension, conceptualized as cognitive in nature, includes the following symptoms in order from most to least extreme: fear of dying, fear of going crazy, dizziness, numbness, and fear of doing something uncontrolled. The negative side of the dimension, conceptualized as primarily autonomic dysregulation, has the following symptoms in order from most to least extreme: chills/hot flushes/blushing, choking, sweating, heart palpitations, and trembling. Chest pain, difficulty breathing, feelings of unreality, nausea were represented in the middle of the dimension.

An omnibus test revealed that this dimensional variable is a significant classifier of PA type (PD-PAs vs. SAD-PAs; $F(14,353)=16.6$, $p<0.0001$, canonical correlation=0.63). Post-hoc Tukey tests revealed that PD-PAs (mean score=0.53, $SD=1.05$) were significantly more positive than SAD-PAs (mean score=−1.24, $SD=0.89$, $p<0.0001$).[1]

Table 3
Multinomial logistic regression omnibus tests.

Symptom	Omnibus $\chi 2$ by PA, SAD, and SP Panic Attacks
Heart	2.93
Sweat	2.33
Tremble	1.61
Breath	3.21
Choke	5.81
Chest	1.25
Nausea	0.74
Chills/hot flushes/blushing	5.98
Dizzy	5.44
Unreal	0.72
Numbing/tingling	0.94
Fear of dying	36.59**
	*PD-PA vs SAD-PA: RRR=0.645***
Fear of going crazy	8.35
Fear of doing something uncontrolled	2.42

Table 3 Note: Chi-square tests were calculated using 1 degree of freedom.
** indicates $p<0.001$.

3.6. Classification of principal panic attack by panic attack symptoms

Omnibus tests indicated that only fear of dying differentially predicted type of principal panic attacks (Prin-PD-PA vs Prin-SAD-PA) after a family-wise Bonferroni alpha-correction ($\chi^2=36.59$, $p<0.0001$; see Table 3). Compared to Prin-PD-PA, a one-unit increase in fear of dying is associated with a 35.5% decrease in the relative risk ratio of Prin-SAD-PA ($RRR=0.645$, $p<0.001$).

3.7. Clinical correlates

After controlling for the presence of agoraphobia, greater severity of PD-PAs (combining panic attacks in PD regardless of whether principal or secondary) was associated with a higher likelihood of history of trauma, lifetime inpatient treatment, and benzodiazepine use (see Table 4). It was also associated with greater likelihood of being in a current relationship. After controlling for CSR of SAD, PD-SAD (combining panic attacks in SAD regardless of whether principal or secondary) was associated with a reduced likelihood of physical health concerns.

More positive scores on the classification dimension retrieved through linear discriminant function analysis, characterized as greater cognitive disturbances during panic attacks, was associated with higher likelihood of physical health concerns, history of trauma, lifetime outpatient treatment, and benzodiazepine use. After controlling for gender and ethnicity, there was no longer an association between the classification dimension and physical health concerns or outpatient treatment, and after controlling for ethnicity, the dimension became a significant predictor of gender. Specifically, more positive dimensional scores were associated with a greater likelihood of being female.

[1] The 14 PA symptoms violated the assumption of multivariate normality, and the procedure was repeated again following Box–Cox transformation to the predictors, resulting in improved multivariate normality. There were no important differences in the results following this transformation, providing enhanced confidence in them. However, the multinomial logistic regression analysis, which is not affected by violations of multivariate normality (Sakia, 1992), is included below to corroborate the findings of the discriminant function analysis.

Table 4
Clinical correlates predicted by panic attack severity.

	PD (OR)	SAD (OR)	Dimension (OR)	SAD-PA vs SAD-No PA ($\chi 2$)
Physical Health Problems	1.012	0.942*	1.699*,^	1.018
History of trauma	1.015*	0.995	1.423*	0.959
Lifetime outpatient	1.014	0.998	1.428**	2.03
Lifetime inpatient	1.022*	1.004	1.388	1.231
Benzo use	1.022**	0.974	1.520**	1.377
Gender	0.988	1.008	0.898	0.809
Family history of psychiatric disorder	1.01	0.994	1.207	0.14
Education	1.004	0.971	0.554	0.402
Smoker	1.011	1.006	1.318	0.234
Marital Status	1.015*	0.982	1.223	0.708
Suicide (continuous)	β=0.002	β=0.013	β=0.168	β=0.052

Table 4 Note: This table reports the association between clinical variables and panic attack severity within each panic type. All of the clinical variables were dichotomous except for suicidality, which was continuous. In the PD analyses, severity of agoraphobia was covaried, and in the SAD analysis, SAD CSR was covaried.

* indicates $p < 0.0045$.

** indicates $p < 0.001$.

^ After controlling for gender and ethnicity, there was no longer an association between the classification dimension and Physical Health Problems (OR=1.669, p=0.007) or Lifetime outpatient (OR=1.32, p=0.009).

3.8. Severity and risk of SAD-PA

CSR did not significantly differ based on the presence or absence of panic attacks in the context of SAD ($F(1,171)=3.16$, $p=0.08$). Similarly, the presence of panic attacks did not confer greater risk for any of the clinical correlates (see Table 4).

4. Discussion

Little is known about the differences between panic attacks based on whether they are expected or unexpected in nature. In this study, we found that the majority of participants who met criteria for SAD experienced expected panic attacks in social situations, but that these attacks differed from unexpected panic attacks in the context of principal PD. While the panic attack groups differed in terms of gender and ethnicity, the findings remained robust after accounting for these demographic variables. Severity of attacks in the context of PD significantly correlated with overall distress and impairment from the disorder (as measured by CSR), but severity of attacks in SAD did not. However, when gender and ethnicity were covaried, severity of SAD attacks was associated with CSR. Also, unexpected panic attacks in PD were significantly more severe than expected panic attacks in SAD in terms of seven of the list of 14 symptoms (i.e., chest pain/discomfort, dizziness, unreality, numbing/tingling, fear of dying, fear of going crazy, and fear of doing something uncontrolled).

The patterns of results suggest that panic attacks occurring in principal PD are, by and large, characterized by more symptoms and greater severity of symptoms than panic attacks occurring in SAD. The findings replicated prior research showing greater severity of dizziness, fear of going crazy, fear of losing control, and dysregulated breathing in PD compared to SAD panic attacks (Barlow et al., 1985; Rapee et al., 1992) and remained after accounting for ethnicity and gender. They are also consistent with prior research demonstrating that unexpected attacks are more severe (Rapee et al., 1992) or are characterized by more symptoms than expected attacks (Barlow et al., 1985). One exception was that chills/hot flushes/blushing was endorsed more frequently in participants with principal SAD panic attacks, consistent with prior research demonstrating that blushing is a unique physiological response to social threat (Gerlach et al., 2001; Mulkens et al., 2001). However, after gender and ethnicity were covaried, frequency of chills/hot flushes/blushing was no longer significantly predicted by type of panic attack, but severity of sweating and chills were higher in the SAD group. Barring this exception, this pattern of results suggests that there are important differences between panic attacks that occur in PD and those that occur in SAD, with those occurring in the context of PD being fundamentally more severe than those occurring in SAD. Given that the relationship between aversive unexpected events and increased anxiety is well-replicated in the experimental literature (Barlow, 1988; Craske, 1991; Craske et al., 1995), it seems plausible that this difference may be driven by the fact that panic attacks in the context of PD are much more likely to be unexpected than panic attacks that occur in the context of SAD.

Furthermore, when specific panic attack symptoms were used to classify attacks according to whether they were unexpected and expected in nature, cognitive and autonomic dysregulation symptoms were expressed on opposing ends of a dimension that promotes this classification. PD panic attacks were associated with scores on the cognitive end of this dimension, whereas SAD panic attacks were associated with scores on the autonomic dysregulation end of this dimension. In separate analyses, fear of dying was the only symptom that differentially predicted expected an unexpected principal attacks, and therefore, it is likely that this symptom drove the higher loading of PD panic attacks on the cognitive end of the dimension. Similarly, in the analyses of panic symptom frequency, chills/hot flushes occurred significantly more frequently (or were more severe, based on covariates included) in SAD, potentially driving the higher loading of social anxiety panic attacks on the autonomic dysregulation end of the dimension. The low frequency and severity of cognitive symptoms in SAD panic attacks likely also drives the more negative loading. Interestingly, numbness and dizziness were both positive and therefore further toward the cognitive end of the dimension than the physical end of the dimension. Numbness traditionally refers to either a physical or an emotional state, and the use of both definitions might lead to confusion in responding to this item on the ADIS-IV-L. Dizziness is more difficult to conceptualize as a cognitive symptom, though perhaps the resulting cognitive confusion or feelings of reduced control cause it to load with the cognitive symptoms. Future research should replicate this finding before strong interpretations are made.

Higher severity of PD panic attacks were associated with a variety of poor clinical characteristics, including an increased risk of having previously experienced a traumatic event, greater likelihood of past inpatient psychiatric treatment, and greater use of benzodiazepines. The findings for PD are consistent with prior research demonstrating that panic attacks in PD are associated with a variety of negative health outcomes (Batelaan et al., 2012; Klerman et al., 1991). It is conceivable that the unexpected nature of panic attacks in PD drive their associations with other indices of negative clinical status, especially given experimental evidence for more negative consequences from unexpected compared to expected aversive events (Barlow, 1988; Craske, 1991; Craske et al., 1995). It is also possible that the unexpected nature of panic attacks in PD is associated with greater cognitive dysregulation than expected panic attacks in social anxiety. In support, more positive scores on the cognitive dimension of panic attack symptoms were associated with more physical health problems, history of traumatization, outpatient treatment, and benzodiazepine use. There were some differences in these findings after accounting for gender and ethnicity. Specifically, there was no longer an association between the classification dimension and physical health concerns or outpatient treatment. Gender was a significant predictor of the

classification dimension, with higher cognitive loadings for females relative to males. In contrast to some research, more severe principal PD panic attacks were not related to an increase in suicidality (Brown et al., 2010; Von Korff et al., 1985). However, the National Comorbidity Survey ($n=5,877$) similarly found that PD with and without agoraphobia was not significantly associated with increased risk for suicidal ideation or suicide attempts (Sareen et al., 2005). In the current study, participants were only assessed for suicidality if they screened into the major depression section of the ADIS-IV-L ($n=183$) and of those participants, only 29 participants reported clinically significant suicidal ideation (i.e., a 4 or greater on a 0–8 scale assessing suicidality), suggesting that perhaps there was not enough variability in the sample to address this question.

In contrast, higher severity of SAD panic attacks were only associated with a decreased likelihood of physical health concerns. Therefore, while these attacks were more associated with somatic symptoms in the linear discriminant analysis, this does not translate into concerns about physical illnesses. When SAD was parsed into those with and without panic attacks, there was no difference in severity of disorder. Furthermore, the presence of SAD-PA did not confer risk of more severe clinical characteristics. These findings collectively suggest that individuals who experience SAD and expected panic attacks do not differ in terms of clinical severity than individuals with SAD who do not experience expected panic attacks. This is somewhat inconsistent with findings suggesting that panic attacks confer greater severity of SAD (Jack et al., 1999), though this study did not include a PD alone comparison condition or an exploration of clinical correlates of panic attacks. It is also somewhat inconsistent with findings that panic attacks are associated with greater risk to the development of or current comorbidity with serious mental disorders (e.g., anxiety, mood, substance, and somatoform disorders; Goodwin and Hamilton, 2001; Goodwin et al., 2004c), although this research examined only incidence and not severity of the disorders. Therefore, perhaps the presence of panic attacks predicts greater incidence of other disorders but not greater severity of those disorders. It is also possible that the increased severity previously detected in the presence of panic attacks is attributable to the presence of a comorbid diagnosis and not panic attacks *per se*. One study found that expected SAD panic attacks were associated with greater SAD severity after controlling for the presence of comorbid PD (Jack et al., 1999), but more research is needed in this area. Future research should explore whether the presence of panic attacks confers risk of greater severity above and beyond the presence of comorbid diagnoses including but not limited to PD.

In the current study, the association between panic attacks in the context of PD and several clinical characteristics was found above and beyond that accounted for by other disorder severity variables, such as agoraphobia severity. This suggests that there is unique association between panic attack severity in the context of PD, but not in SAD. These findings justify a call for additional research to more clearly distinguish unexpected and expected panic attacks, as well as the clinical correlates of each type of attack.

Several limitations of this research are worth noting. First, the sample gathered in the current study was recruited for a variety of treatment outcome studies, and therefore the results may not generalize to non-treatment seeking patients with panic attacks. Future research should compare panic attacks in non-treatment seeking samples to determine whether these differences hold. Second, there was significant comorbidity in this sample (i.e., individuals who experienced panic attacks both in the context of PD and SAD). It is possible that individuals with only one type of panic attack (i.e., PD-PA alone vs. SAD-PA alone) meaningfully differed from those with both types of panic attacks. Thus, further research should replicate these analyses in “pure” panic attack samples. Third, this study does not take into consideration panic attacks that occur outside of PD or SAD. It is possible that panic attacks in the context of other disorders, such as specific phobias, major depression, posttraumatic stress disorder, and substance use, are characterized by a different symptom profile and clinical characteristics than those occurring in PD. Finally, this study was predominantly Caucasian, and there were differences in gender and ethnicity based on primary panic attacks. Future research will have to demonstrate whether these differences are artifacts of the current study sample, or whether demographic differences characterize principal panic attack type.

DSM-5 allows for the specification of panic attacks across various disorders, even those outside of anxiety disorders, which is an important step toward more accurately reflecting psychopathology. However, more research is needed to determine the heterogeneity of panic attacks outside of PD. This study demonstrates some key differences between panic attacks that occur in the context of PD versus SAD. Overall, panic attacks in PD are more severe and are associated with a variety of negative clinical correlates.

Patients commonly report to primary care and emergency departments seeking treatment for panic attacks (Roy-Byrne et al., 1999) sometimes occurring in the context of other disorders, like SAD or PTSD. Currently, there are no standardized treatment guidelines for this population, particularly because it is not clear that this presentation warrants special considerations. This may lead treating physicians unsure of the appropriate level of concern for different types of panic attacks, and further, unclear of how to make further treatment recommendations. It may also help streamline diagnostic decision making, as fewer provisions of inappropriate PD diagnoses may occur if providers are aware of common differences in types of panic attacks that occur in SAD. The results of this paper demonstrate that the context in which the attacks occur is an important indicator of attack severity. If these attacks are unexpected in nature, such as those in PD, this may represent a more severe type of panic attack that may necessitate more immediate treatment, particularly due to the association with a variety of negative health outcomes (e.g., inpatient treatment, benzodiazepine use, history of traumatization). In contrast, panic attacks circumscribed to social situations are not as severe in nature, nor are they associated with the negative health concerns measured in this study. Therefore, their presence may not warrant additional interventions beyond standard evidence-based practice for SAD.

Acknowledgements

This work was supported by the following National Institute of Mental Health grants: 5R21MH081299-02 and R01MH049713-05

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