

THE APPLICABILITY OF CLARK'S COGNITIVE MODEL OF PANIC DISORDER IN  
CHILDREN AND YOUNG PEOPLE

by

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A THESIS SUBMITTED TO THE UNIVERSITY OF BIRMINGHAM FOR THE DEGREE  
OF DOCTOR OF CLINICAL PSYCHOLOGY

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## **Thesis Overview**

This thesis includes two volumes. Volume I is the research project and Volume II contains the clinical practice reports based on work completed during clinical placements.

Volume 1 is comprised of two papers: a systematic literature review and an empirical study. A press release pertaining to the two papers is also included. The aim of both papers was to address gaps within the literature and to develop a better understanding of panic disorder in younger populations. Specifically, the thesis aimed to investigate the applicability of the Clark (1986) cognitive model of panic disorder for understanding the condition in children and young people.

The systematic review found that the Clark (1986) cognitive model of panic may be applicable for understanding the condition in children and young people. There was evidence for an association between panic symptoms and anxiety sensitivity in children and adolescents, and interpretation of bodily sensations in children. There were notably less studies examining behavioural factors. There was preliminary evidence for the role of avoidance in the treatment of panic disorder in adolescents, however, no studies relating to the association between the use of safety seeking behaviours and panic symptoms were identified. Methodological issues with the studies, particularly the sensitivity and specificity of questionnaires, mean that findings should be interpreted with caution.

The empirical study used a cross-sectional questionnaire method and found that Clark's (1986) cognitive model, particularly fear and catastrophic misinterpretations of bodily sensations, may be applicable for understanding the condition in adolescents. Due to issues concerning the validity of participant responses, avoidance was not included in any inferential analyses. Panic symptoms were significantly correlated with cognitive (fear and catastrophic misinterpretations of bodily sensations) and behavioural (safety seeking behaviours) variables, however only cognitive factors significantly predicted panic symptoms when the variables were entered into a regression model.

Volume II is comprised of five clinical practice reports (CPR). CPR1 presents a cognitive-behavioural and psychodynamic formulation of a 35-year-old male referred for psychological assessment following admission to a medium secure forensic unit. CPR2 is a service evaluation exploring staff views of Risk Assessment Using Structured Professional Judgement Frameworks training transfer. CPR3 is a case study of a 15-year-old male referred for psychological assessment following admission to a hospital for adolescents with intellectual

disabilities and autism after an increase in behaviours that challenge. CPR4 presents a single case experimental study assessing the effectiveness of an exposure-based intervention for a 16-year-old female presenting with obsessions and compulsions. CPR5 presents an abstract for a comprehensive neuropsychological report of a 73-year-old male referred to a community dementia service following a stepwise change in personality and functioning.



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Volume One

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## Table of Contents: Volume One

<b>i) Literature Review: Cognitive and Behavioural Factors Associated with the Clark Cognitive Model of Panic in Children and Adolescents: A Systematic Review .....</b>	<b>1</b>
<b>1. Introduction .....</b>	<b>2</b>
<b>1.1 Treatment of Panic Disorder in Children and Young People .....</b>	<b>2</b>
<b>1.2 The Cognitive Model of Panic in Adults .....</b>	<b>3</b>
<b>1.3 Treatment of Panic Disorder in Adults .....</b>	<b>6</b>
<b>1.4 Psychological Processes in Child and Adolescent Panic .....</b>	<b>6</b>
<b>1.5 Summary and Aim of Review .....</b>	<b>7</b>
<b>2. Method .....</b>	<b>8</b>
<b>2.1 Search Strategy .....</b>	<b>8</b>
<b>2.2 Inclusion Criteria .....</b>	<b>8</b>
<b>2.3 Study Selection .....</b>	<b>9</b>
<b>2.4 Data Extraction .....</b>	<b>10</b>
<b>2.5 Measure of Panic Severity / Symptoms .....</b>	<b>11</b>
<b>2.6 Data Synthesis .....</b>	<b>11</b>
<b>2.7 Study Quality Ratings .....</b>	<b>12</b>
<b>3. Results .....</b>	<b>12</b>
<b>3.1 Description of Included Studies .....</b>	<b>12</b>
<b>3.2 Quality Ratings .....</b>	<b>26</b>
<b>3.3 Synthesis of Findings .....</b>	<b>26</b>
<b>3.3.1 Anxiety Sensitivity .....</b>	<b>26</b>
<b>3.3.2 Interpretation of Bodily Sensations .....</b>	<b>33</b>
<b>3.3.3 Avoidance .....</b>	<b>35</b>
<b>4. Discussion .....</b>	<b>37</b>
<b>4.1 Cognitive Factors .....</b>	<b>37</b>
<b>4.2 Behavioural Factors .....</b>	<b>38</b>
<b>4.3 Strengths &amp; Limitations .....</b>	<b>39</b>
<b>4.4 Clinical Implications .....</b>	<b>40</b>
<b>4.5 Conclusion and Future Research Directions .....</b>	<b>41</b>
<b>5. References .....</b>	<b>42</b>
<b>ii) Empirical Research Paper: How applicable is Clark's Cognitive Model of Panic for Adolescents? .....</b>	<b>53</b>
<b>1. Introduction .....</b>	<b>54</b>

1.1	Panic Disorder in Adolescents.....	54
1.2	Treatment of Panic Disorder in Adolescents .....	54
1.3	The Cognitive Model of Panic in Adults .....	55
1.4	Treatment of Panic Disorder in Adults .....	57
1.5	The Cognitive Model of Panic for Young People .....	57
1.6	Aim, Research Question and Hypothesis .....	58
2.	Method.....	59
2.1	Design .....	59
2.2	Participants .....	59
2.3	Recruitment .....	59
2.4	Measures .....	60
2.5	Procedure .....	64
2.6	Power Analysis.....	65
2.7	Statistical Analysis.....	65
3.	Results.....	67
3.1	Descriptive Statistics .....	67
3.2	Psychometric Properties of Panic Questionnaires .....	68
3.3	Correlations .....	68
3.4	Regression Analysis.....	68
4.	Discussion .....	70
4.1	Strengths and Limitations .....	72
4.2	Future Research Directions.....	74
4.3	Clinical Implications .....	75
4.4	Conclusion.....	75
5.	References.....	76
iii)	Press Release.....	86
iv)	Appendices.....	90
	Literature Review .....	90
	Appendix 1. Search Strategies.....	90
	Appendix 2. Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies – Adapted.....	91
	Empirical Paper .....	98
	Appendix 1: Pilot Study Questionnaire.....	98
	Appendix 2: Pilot Study Feedback .....	99
	Appendix 3: Ethical Approval Email: Original Submission.....	100

<b>Appendix 4: Information Sheet for Adolescents .....</b>	<b>101</b>
<b>Appendix 5: Information Sheet for Parents of Adolescents aged 13-15 .....</b>	<b>103</b>
<b>Appendix 6: Assent form for Adolescents aged 13-15 .....</b>	<b>105</b>
<b>Appendix 7: Consent Form for Adolescents aged 16-18.....</b>	<b>106</b>
<b>Appendix 8: Parent Consent Form for Adolescents aged 13-15 .....</b>	<b>107</b>
<b>Appendix 9: Demographic and Questionnaire Measures.....</b>	<b>108</b>
<b>Appendix 10: Study Debrief.....</b>	<b>121</b>
<b>Appendix 11: Qualtrics Survey .....</b>	<b>122</b>
<b>Appendix 12: SPSS Output .....</b>	<b>126</b>

## Table of Contents: Volume Two

<b>Clinical Practice Report 1: The Assessment and Formulation of a Client from a Cognitive-Behavioural and Psychodynamic Perspective .....</b>	<b>1</b>
1. Presenting Difficulties .....	2
2. Assessment Method .....	2
3. Assessment of the Presenting Difficulties .....	5
4. Therapeutic Relationship .....	7
5. Cognitive Behavioural Formulation .....	8
6. Psychodynamic Formulation .....	14
7. Reflections .....	19
<b>Clinical Practice Report 2: Follow-up evaluation of Risk Assessment using Structured Professional Judgement Frameworks training within Secure Care and Offender Health services .....</b>	<b>25</b>
1. Introduction .....	26
2. Method .....	28
3. Results .....	31
4. Discussion .....	45
5. Recommendations .....	48
6. References .....	50
<b>Clinical Practice Report 3: Case Report of a 15-Year Old Male with Challenging Behaviour: A Behavioural Formulation and Intervention .....</b>	<b>52</b>
2. Background information .....	53
3. Assessment .....	53
4. Behavioural Formulation .....	61
5. Intervention .....	68
6. Evaluation .....	74
7. Reflections .....	76
8. References .....	78
<b>Clinical Practice Report 4: Single Case Experimental Study of a 16-year Old Female with Obsessions and Compulsions .....</b>	<b>82</b>
1. Case Summary .....	83
4. Intervention .....	95
5. Method .....	98
6. Results .....	99
7. Discussion .....	107
9. References .....	110

<b>Clinical Practice Report 5: A Comprehensive Neuropsychology Assessment of 73-year-old White-British male referred to a community Dementia Service.....</b>	<b>118</b>
<b>APPENDICES.....</b>	<b>119</b>
<b>CLINICAL PRACTICE REPORT 2 .....</b>	<b>119</b>
<b>Appendix A: NRES Guidance: Differentiating audit, service evaluation and research .....</b>	<b>119</b>
<b>Appendix B: Information Sheet.....</b>	<b>121</b>
<b>Appendix C: Staff Survey (exported from Qualtrics).....</b>	<b>122</b>
<b>Appendix D: Proposal Acceptance .....</b>	<b>138</b>
<b>.....</b>	<b>138</b>
<b>CLINICAL PRACTICE REPORT 4 .....</b>	<b>139</b>

## **List of Illustrations**

### **Literature Review**

<b>Figure 1.</b> The Cognitive Model of Panic Attacks (Clark, 1986).....	<b>3</b>
<b>Figure 2.</b> The Revised Cognitive Model of Panic including Safety Seeking Behaviours as a Maintenance Process (Clark, 1996).....	<b>6</b>
<b>Figure 3.</b> Study selection.....	<b>10</b>

### **Empirical Paper**

<b>Figure 1.</b> The Cognitive Model of Panic (Clark, 1986).....	<b>55</b>
<b>Figure 2.</b> The Revised Cognitive Model of Panic including Safety Seeking Behaviours as a Maintenance Process (Clark, 1996).....	<b>56</b>



## List of Tables

### Literature Review

<b>Table 1.</b> Reviewed Studies; Study Characteristics.....	<b>13</b>
<b>Table 2.</b> Associations between panic symptoms/severity and factors associated with the Cognitive Model of Panic (Clark, 1986).....	<b>20</b>
<b>Table 3.</b> Study Quality Ratings.....	<b>27</b>

### Empirical Paper

<b>Table 1.</b> Reviewed Studies; Study Characteristics.....	<b>13</b>
<b>Table 2.</b> Associations between panic symptoms/severity and factors associated with the Cognitive Model of Panic (Clark, 1986).....	<b>20</b>
<b>Table 3.</b> Study Quality Ratings.....	<b>27</b>

i) **Literature Review: Cognitive and Behavioural Factors Associated with the Clark Cognitive Model of Panic in Children and Adolescents: A Systematic Review**

**Abstract**

**Introduction:** Panic disorder is a disabling condition for both young people and adults. Clark's (1986) cognitive model of panic disorder has led to the development of a highly effective treatment for the condition in adults (Clark, 2004), however, the degree to which the cognitive model is applicable in understanding the development and maintenance of the condition in children and adolescents is unclear.

**Method:** This systematic review evaluated the current evidence for an association between panic symptoms and cognitive and behavioural processes associated with Clark's cognitive model of panic in adults, in children and adolescents aged 5 to 19 years. We searched Psych-Info and Medline databases using a systematic search strategy and identified 38 articles.

**Results:** This systematic review found evidence for an association between panic symptoms and anxiety sensitivity in children and adolescents, and interpretation of bodily sensations in children. There was preliminary evidence for the role of avoidance in the treatment of panic disorder in adolescents, however, there were notably less studies examining behavioural factors. No studies relating to the association between the use of safety seeking behaviours and panic symptoms were identified.

**Conclusion:** There is evidence that factors associated with the cognitive model are important for understanding panic in children and adolescents. However, methodological issues mean that these findings should be interpreted with caution.

**Future Research:** Studies of clinical populations (with panic disorder), using longitudinal and experimental methods, and clinically sensitive measures, are needed to establish the applicability of the cognitive model of panic with young people.

**Keywords**

Child, adolescent, youth, panic, cognitive theory, cognitive model

## **1. Introduction**

Panic disorder is a common and impairing mental health problem experienced by approximately 1% of adolescents (Sadler et al., 2018) with onset typically occurring during adolescence and early adulthood (Beesdo, Knappe, & Pine, 2009; Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012; Ramsawh, Weisberg, Dyck, Stout, & Keller, 2011). Individuals with panic disorder experience recurrent, unexpected panic attacks characterised by distressing physical and cognitive symptoms such as heart palpitations, nausea, difficulty breathing, dizziness, derealisation, fears of dying and/or losing control (American Psychiatric Association, 2013; World Health Organization, 2020). For a diagnosis of panic disorder, symptoms must be accompanied by persistent fears about future panic attacks and changes in behaviour such as avoiding crowds, elevators, or exercise, to prevent the occurrence of further panic attacks (American Psychiatric Association, 2013). Between 16 and 63% of adolescents have experienced at least one panic attack during their lifetime (Asselmann, Wittchen, Lieb, & Beesdo-Baum, 2016), and there is some evidence that pre-adolescent children also experience panic attacks (Ollendick, Mattis, & King, 1994).

In adults, panic attacks are associated with many negative outcomes such as poorer physical and interpersonal functioning (Marshall, Zvolensky, Sachs-Ericsson, Schmidt, & Bernstein, 2008). While there has been scarce recent examination of outcomes associated with panic disorder in young people, earlier research indicates that panic disorder is associated with significant impairment in social functioning, high levels of psychiatric comorbidity, school refusal and educational underachievement (Bradley & Hood, 1993; Hayward et al., 1997, 1995; Kearney, Albano, Eisen, Allan, & Barlow, 1997). Furthermore, individuals with early panic onset (< 20 years) are more likely to have poorer treatment outcomes compared to those with later onset (Chen & Tsai, 2016).

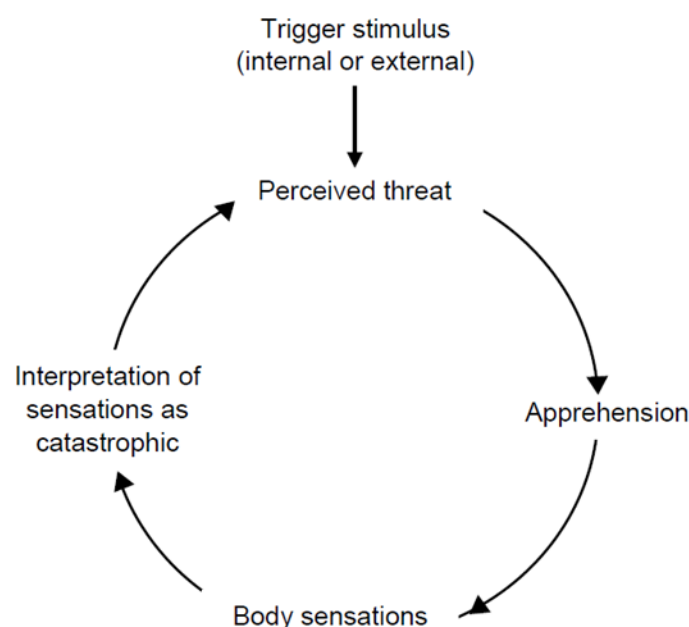
### **1.1 Treatment of Panic Disorder in Children and Young People**

The identification and effective treatment of panic disorder in young people is critical (Hayward, Killen, Kraemer, & Taylor, 2000), however, the levels of identification of panic disorder in young people are low in Child and Adolescent Mental Health Service (CAMHS) clinicians (Baker & Waite, 2020). The U. K. National Institute for Health and Care Excellence (NICE; 2011) make no recommendations for assessing or treating children or young people with panic disorder, and the evidence base for psychological treatment is limited. Cognitive behavioural therapy (CBT) appears to be the chosen treatment approach in CAMHS services

(Baker & Waite, 2020) however, most CBT treatment trials exclude young people with panic disorder (e.g., Walkup et al., 2008) and where they are included, specific outcomes for young people with panic disorder are largely unknown.

## 1.2 The Cognitive Model of Panic in Adults

A theoretical understanding of the key mechanisms that underpin the maintenance of psychological disorders has led to the development of effective treatment approaches in adults (e.g., (Clark, 1995; Ehlers & Clark, 2000)). When it comes to panic disorder, Clark's (1986) cognitive model suggests that the condition is maintained by catastrophic misinterpretation of bodily sensations mainly involved in normal anxiety responses (e.g., palpitations, breathlessness, dizziness etc). Panic attacks can be triggered by a range of internal (e.g., increased heart rate) or external (e.g., a supermarket where an individual has previously experienced a panic attack) stimuli. The model suggests that when stimuli are perceived in a threatening way, the individual experiences apprehension, increased bodily sensations (anxiety-produced) and catastrophic interpretation followed by further apprehension, resulting in a vicious cycle, culminating in a panic attack (see Figure 1).



**Figure 1.** The Cognitive Model of Panic Attacks (Clark, 1986)

### *1.2.1 Cognitive Factors*

Cognitive factors associated with the development and maintenance of panic disorder have been established in research with adults. Anxiety sensitivity is defined as a dispositional cognitive style that predisposes individuals to respond fearfully to anxiety sensations (Steven Reiss, Peterson, Gursky, & McNally, 1986) due to concerns about negative social (e.g., “It embarrasses me when my stomach growls”), physical (e.g., “It scares me when my heart beats fast”) or psychological (e.g., “When I am afraid, I worry that I might be crazy”) consequences. Anxiety sensitivity is significantly associated with the onset and maintenance of panic disorder (Schmidt, Lerew, & Jackson, 1997, 1999), and adults with panic disorder report significantly greater anxiety sensitivity compared to those without the condition (Olatunji & Wolitzky-Taylor, 2009). Self-report studies often measure anxiety sensitivity using the Anxiety and Sensitivity Index (ASI; Reiss et al., 1986); with subscales specifying different concerns about anxiety (i.e., physical, cognitive and social concerns). Cross-sectional studies have found elevated ASI scores in adults with panic disorder (Taylor, Koch, & McNally, 1992) and prospective naturalistic studies indicate that adults with elevated levels of anxiety sensitivity are more likely to develop panic attacks (Schmidt et al., 1997). Moreover, fear of bodily sensations (e.g., rapid heartbeat, dizziness and feeling short of breath) best discriminate panic disorder from other anxiety disorders (Apfeldorf, Shear, Leon, & Portera, 1994; Clark et al., 1988; Hazen, Walker, & Stein, 1994).

Catastrophic misinterpretations involve the interpretation of bodily sensations as a sign of physical or psychological danger (Clark, 1986; Clark et al., 1997). For example, drinking a coffee and interpreting consequent heart palpitations (a normal response to caffeine consumption) as an indication of a heart attack, or exercising and interpreting breathlessness (a normal response to exercise) as an indication of suffocation. Similarly, there is evidence from research with adults, that individuals with panic disorder are more likely to experience catastrophic misinterpretations of bodily sensations compared to non-anxious individuals (Clark et al., 1997), and greater reductions in catastrophic misinterpretations during panic disorder treatment, predicts a greater overall reduction in panic severity/symptoms (e.g., panic attack frequency, distress, apprehension and avoidance) (Teachman, Marker, & Clerkin, 2010).

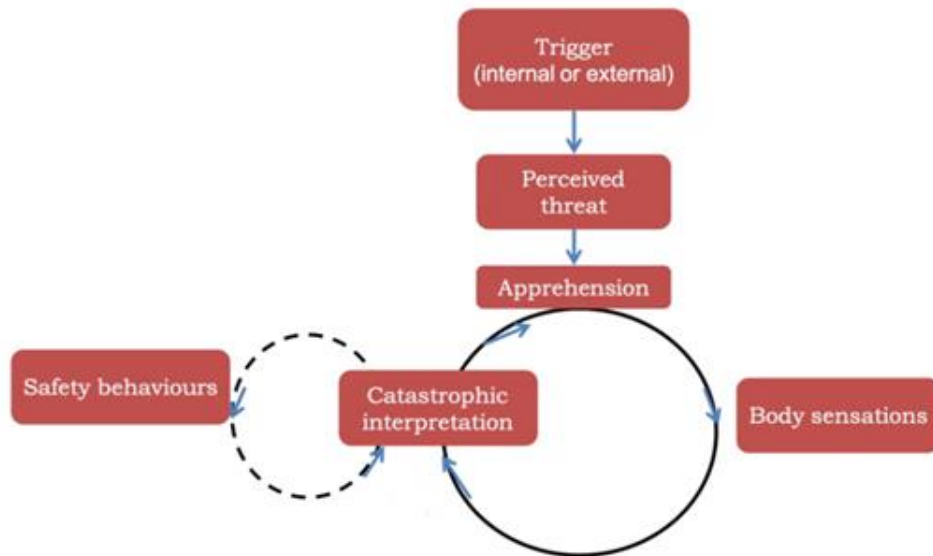
Anxiety sensitivity and catastrophic misinterpretations of bodily symptoms are closely related; however, the precise nature of the relationship is unclear. Previous research has equated the two constructs as overlapping, whereby anxiety sensitivity may predispose individuals to catastrophic misinterpretation of benign bodily cues (Clark, 1986). There is also suggestion that anxiety sensitivity is a dispositional construct, whereas misinterpretations of bodily

sensations have been conceptualised as an episodic concept (i.e., a state-trait distinction; McNally, 1994). However, longitudinal research with adults has indicated that improvements in panic disorder symptoms are mediated by reductions in anxiety sensitivity (Smits, Berry, Tart, & Powers, 2008), thus challenging the conceptualisation of anxiety sensitivity as a trait variable. Furthermore, McNally (2002) proposed that individuals with high anxiety sensitivity may dread bodily sensations as purely signalling another panic or fear of panic, not necessarily in a catastrophic way, and there is evidence that anxiety sensitivity and catastrophic misinterpretations are in fact, differential constructs which may have separate effects on panic disorder (Sandin, Sánchez-Arribas, Chorot, & Valiente, 2015).

### *1.2.2 Behavioural Factors*

Behavioural factors associated with the development and maintenance of panic disorder (Salkovskis, 1991) have now been incorporated within an adapted version of Clark's cognitive model of panic (Clark, 1996; see Figure 2). Safety-seeking behaviours are defined as behaviours carried out (either overtly or covertly) in anxiety provoking situations in an attempt to prevent a feared outcome from occurring (Salkovskis, 1991). Examples of panic relevant safety behaviours include moving slowly, sitting down and keeping still (to prevent heart attack), holding onto/leaning against a ledge/person (to prevent fainting) (Salkovskis, Clark, Hackmann, Wells, & Gelder, 1999) and avoidance of situations associated with the occurrence of panic attacks (e.g., supermarkets, restaurants, crowded areas) (Clark & Ehlers, 1993). While safety behaviours may alleviate distress in the short-term, long-term, they prevent the disconfirmation of catastrophic beliefs (i.e., learning that the catastrophe associated with bodily sensations does not happen), and thus, maintain anxiety (Salkovskis, 1991).

There is empirical support from cross sectional studies for behavioural processes embedded in Clark's (1986; 1996) cognitive model of panic disorder, including significant associations between panic-related cognitions and behaviours (Salkovskis, Clark, & Gelder, 1996; Salkovskis et al., 1999). Furthermore, experimental research in adults with panic disorder and agoraphobia found that dropping safety seeking behaviour during a brief period of panic-related exposure led to a significantly greater decrease in catastrophic beliefs and anxiety compared to those who maintained safety seeking behaviour (Salkovskis et al., 1999).



**Figure 2.** The Revised Cognitive Model of Panic including Safety Seeking Behaviours as a Maintenance Process (Clark, 1996)

### 1.3 Treatment of Panic Disorder in Adults

The Clark (1986; 1996) cognitive model of panic disorder has led to the development of Cognitive Therapy for Panic Disorder (Clark, 2004); a highly effective, disorder specific treatment for adults (Clark, 2004; Clark et al., 1999). Cognitive therapy is comprised of a mixture of cognitive techniques and behavioural experiments intended to modify misinterpretations of bodily sensations and the processes that maintain them. Opportunities to learn that bodily sensations are not dangerous are provided through cognitive restructuring and behavioural exercises (e.g., interoceptive exposure, aerobic exercise), and safety behaviours are discouraged to allow for greater learning (Craske et al., 2008).

### 1.4 Psychological Processes in Child and Adolescent Panic

Unlike adults (Clark 1986; 1996), while there is good evidence for the presence of panic disorder in adolescents, and preliminary evidence for the occurrence of panic attacks and panic disorder in pre-adolescent children ( $\geq 5$  years) (Ollendick et al., 1994; Vitiello, Behar, Wolfson, & McLeer, 1990), there is no established theoretical understanding of the key mechanisms that underpin panic in either age group. Furthermore, there has been debate as to whether younger people, particularly children, have the cognitive capacities necessary to catastrophically interpret bodily sensations (Kearney & Silverman, 1992; Nelles & Barlow, 1988). However, anxiety sensitivity emerges in middle childhood (Reiss, Silverman, & Weems, 2001) and consistent with a cognitive model of panic, there is preliminary evidence

that some children and young people who report panic attacks experience physiological symptoms and catastrophic cognitions (Ollendick et al., 1994) and avoid school (Vitiello et al., 1990) subsequent to the onset of panic disorder. However, different factors may underpin panic difficulties across different developmental stages, and a greater understanding of cognitive processes during panic attacks/disorder in children is needed (Ollendick et al., 1994).

### **1.5 Summary and Aim of Review**

Given the preliminary evidence for the presence of catastrophic cognitions in some children and young people reporting panic attacks, it is plausible that the Clark (1986; 1996) cognitive model may be suitable for understanding panic disorder in children and young people. Cognitive therapy based on the cognitive model of panic (Clark, 1986; 1996) may therefore be appropriate for children and adolescents, however, cognitive and behavioural processes underpinning panic disorder across development remains unclear. The aim of this review, therefore, is to examine the evidence for a relationship between panic symptoms/severity and cognitive and behavioural factors associated with the cognitive model of panic (Clark, 1986; 1996) in children and adolescents. The inclusion of a broad age range will allow, where possible, exploration of any differences relating to child age.



## 2. Method

The review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis of Individual Participant Data (Moher et al., 2009).

### 2.1 Search Strategy

A systematic review of the literature was conducted during July 2020 using two databases *Psych-INFO* and *Medline (Pub-Med)*. The start time was selected based on the earliest material published in the databases. The search used terms covering three key areas including panic: *panic*, terms to identify studies which involved children and adolescents: *child*, *children*, *childhood*, *adolescen\**, *youth* and *teen\**, and cognitive and behavioural factors associated with panic: "*catastroph\* misinterpret\**", "*selective attention*", "*interpret\* bias*" *somati\** "*body sensation\**", "*heart beat perception*", *hypervigilan\**, "*anxiety sensitivity*", "*safety behavio?r*", *avoidance*, *cogniti\**, *think\** and *image\**. The terms were derived from words used in the description of the Cognitive Model of Panic (Clark, 1986), such as 'catastrophic misinterpretations', 'selective attention' and 'safety behaviour'. To capture studies examining cognitions about bodily sensations in younger children, terms derived from studies examining panic symptoms in children (e.g., Eley, Gregory, Clark, & Ehlers, 2007; Eley, Stirling, Ehlers, Gregory, & Clark, 2004), such as 'heartbeat perception', 'body sensation' and 'cognition', were also included. Full details of the search strategy used in the two databases are available (Appendix A). The search results were collated in Endnote where duplicates between databases were removed.

### 2.2 Inclusion Criteria

To be included in the review, studies had to meet the following criteria via a hierarchical coding system:

1. Written in English;
2. Peer-reviewed empirical study (case studies not included);
3. Involved human participants aged between 3 and 21 years, with a mean age of  $\geq 5$  and  $\leq 19$  years;
4. Focused on typically developing children / adolescents (i.e., the study was not intentionally set up to investigate non-typically developing children / adolescents);
5. Used a validated measure of panic symptoms *or* participants had received a diagnosis of panic disorder using a validated measure;

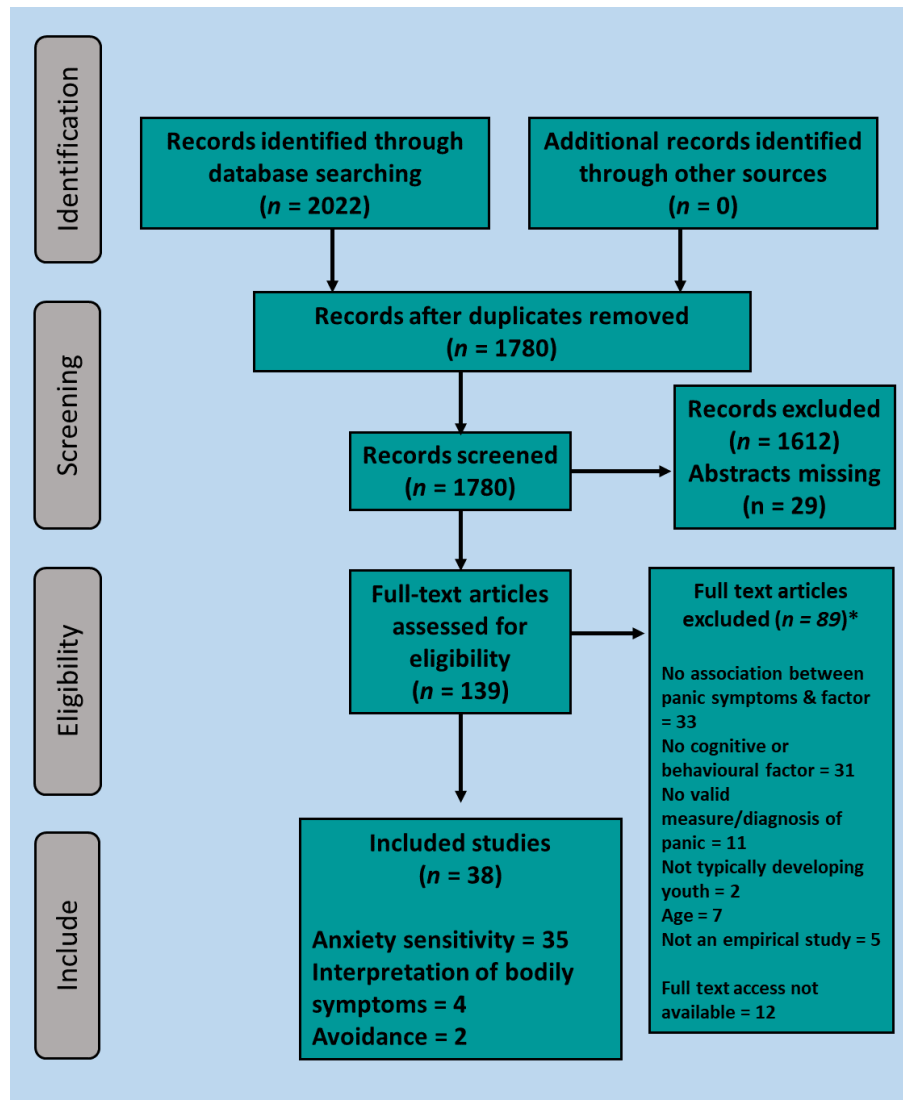
6. A cognitive or behavioural factor associated with the cognitive model of panic disorder (such as catastrophic misinterpretations, avoidance or anxiety sensitivity) was studied;
7. The association between a cognitive or behavioural factor and panic symptoms/severity was tested statistically.

Studies were excluded if:

1. Participants were recruited due to a comorbid medical condition such as asthma;
2. They were review or theoretical articles;
3. They were not published in a peer-reviewed journal (including unpublished dissertations);
4. They were not written in English (due to time and financial constraints precluding translation).

### **2.3 Study Selection**

Following a search of electronic databases, the selection process was piloted using a small sample of papers ( $n = 50$ ). Abstracts were screened for inclusion by two raters (author and a psychology graduate) using the hierarchical coding system. A sample (20%) of the papers were double rated with a high level of reliability ( $k = 0.82$ ). The remaining papers (80%) were split and screened for inclusion between the two raters. Full-text articles were screened by the author. Reference lists of the primary studies identified were reviewed to identify further potential studies of interest, and abstracts were retrieved, and full texts screened for inclusion, if appropriate. All queries regarding study eligibility were discussed and resolved between the author and research supervisors. The study selection process and the number of studies remaining at each stage is shown in Figure 3. Risk of bias within individual studies was controlled as far as possible through the development and implementation of eligibility criteria to ensure that papers would be of sufficient quality regarding their design, and the measures used to assess panic symptoms and cognitive and behavioural factors associated with the Clark's (1986) cognitive model of panic disorder. All accepted papers were assessed for quality against a checklist derived from (Study Quality Assessment Tool, 2021) (see Study Quality Ratings for further details).



**Figure 3.** Study selection<sup>1</sup>

## 2.4 Data Extraction

For each study, the following information was extracted: a) sample size; b) age range, mean and standard deviation; c) gender (% female); d) ethnicity; e) whether the participants had been diagnosed with panic disorder; f) study design; g) factor of interest; h) location; i) how panic symptoms/severity were measured; j) how the factor of interest was measured; k) effect sizes; l) any ethical issues or sources of bias. The data was extracted by the author. Where there was missing data or additional data needed, authors of the studies were contacted.

<sup>1</sup> Other sources; hand searching and reference lists of included papers, full text access not available; attempts to obtain copies of the full text from authors were unsuccessful, included studies; 3 studies reported associations across multiple cognitive/behavioural domains.

## 2.5 Measure of Panic Severity / Symptoms

A hierarchy of preferred measures was applied (1 = highest rank, 4 = lowest rank):

1. Clinician severity ratings (CSR) – i.e., independent evaluators used a structured diagnostic interview such as the Anxiety Disorders Interview Schedule for Children – Child and Parent Versions (Anxiety Disorders Interview Schedule for Diagnostic and Statistical Manual of Mental Disorders Fourth Edition Child/Parent Version; ADIS-IV-C/P) (Silverman & Albano, 1996) and assigned a CSR using a 0-8 scale (no interference/impairment to extreme interference/impairment) based on child/parent interviews;
2. Validated self-report measures of symptom severity/fear – i.e., child / parent questionnaires (e.g., the Revised Child Anxiety and Depression Scale-Panic Scale; RCADS-PD);
3. Self-rating of anxiety during a task that elicits panic symptoms (e.g., voluntary hyperventilation challenge) – i.e., Subjective Units of Distress Scales (SUDS);
4. Physiological measure of anxiety during a task that elicits panic-like experiences (e.g., voluntary hyperventilation challenge) – i.e., heartrate or skin conductance response (SCR).

For each study, if multiple outcomes were reported the measure with the highest rank was selected for inclusion. If a study included multiple measures from one category, the most frequently used measure across all studies in the review was selected. If a study included a self-report measure *and* self-rating of anxiety and/or a physiological measure of anxiety, all measures were reported. Where child and parent measures were provided separately, both informants' reports were included.

## 2.6 Data Synthesis

Due to the heterogeneity of studies included within the review (e.g., participants and measures used) and the broad factors of interest, the findings were evaluated through a narrative systematic approach, rather than a meta-analysis. Where possible, effect sizes were extracted or calculated, and examined, for each individual study. Most studies reported effect sizes in terms of Pearson's product-moment correlation coefficient ( $r$ ). Where studies reported only standardised multiple regression coefficients, rather than correlation coefficients, Peterson & Brown's (2005) imputation approach was used to convert B coefficients to corresponding coefficients ( $r$ ). Where no effect size is reported it is because sufficient data was unavailable.

Once effect sizes were all converted into  $r$ , they were then interpreted using Cohen's (1988) definition of an effect size of at least .10 as 'small', .30 as 'medium' and .50 as 'large', and adapted by (Ellis, 2015) to also include any effect size  $\geq .70$  as 'very large'.

## **2.7 Study Quality Ratings**

All included papers were assessed for quality (the extent to which the study design and analysis was appropriate to answer the research question) against an adapted checklist derived from Study Quality Assessment Tool (2021) (see Appendix 2). This checklist was adapted by (Pearcey et al., 2020) to include a quantitative assessment. For the current review, a checklist including assessment of the following areas was included: transparency of aims, clear specification of population (demographics, location, and time period), representativeness (participant rate at least 50% of those identified as eligible and invited to participate), participant selection procedures (valid / reliable), sample size justification, sufficient timeframe, clear definitions of the reliability and validity of relevant measures, follow-up rate, and adjustments made for confounding variables (see Appendix 2 for full details on quality coding criteria). Included studies were rated between two raters; the author and a psychology graduate following detailed training. Inter-rater reliability for study quality ratings (a subset of 30%) was substantial ( $k = .73$ ) for total quality scores between raters. All discrepancies and queries regarding study ratings were discussed and resolved between the author and research supervisors.

## **3. Results**

### **3.1 Description of Included Studies**

Thirty-eight studies were identified, published between 1996 and 2020, details of which can be found in Tables 1 and 2. Thirty-seven (97%) of the studies used a within-subject design and 1 (3%) used a between-subject design. Thirty-one (81%) of the studies were cross-sectional, 6 (16%) were longitudinal, and 1 (3%) was a treatment outcome study. Three (8%) included participants with a broad age range (e.g., 7-17 years), 5 (13%) included only children (e.g., 3-11 years) and 32 (84%) included only adolescents (e.g., aged 12-17 years)<sup>2</sup>.

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<sup>2</sup> Two studies (Francis et al., 2019; Weems et al., 1998) included separate child and adolescent samples.

**Table 1.** Reviewed Studies (n=38); Study Characteristics

<b>Study Authors</b>	<b><i>N</i></b>	<b>Age range (mean, SD)</b>	<b>Gender (% female)</b>	<b>Ethnicity</b>	<b>Panic Disorder</b>	<b>Location</b>
Babson, Feldner, Connolly, Trainor, & Leen-Feldner (2010)	88	10-17 (14.00, 2.37)	35.2	83% Caucasian, 9.1% Asian, 1.1% American Indian, 6.8% “Other” or did not specify.	No	USA
Badour et al (2012)	63	10-17 (14.8, 2.10)	58.7	4.8% Hispanic/Latino, 85.7% Caucasian, 3.2% Asian, 1.6% Native American, 9.5% Other or did not respond.	No	USA
Blumenthal, Leen-Feldner, Knapp, Bunaciu, & Zamboanga (2012)	111	12-17 (15.76, 1.56)	45.1	17.4% Hispanic/Latino, 80.2% Caucasian, 11.7% African American, 2.7% Native American, 0.9% Asian, 4.5% “Other” or did not respond,	No	USA
Buckner, Leen-Feldner, Zvolensky, & Schmidt (2009)	153	11-17 (14.95, 1.49)	46.4	90.8% Caucasian, 2.0% African American, 0.7% Native Hawaiian, 0.7% Asian, 0.7% American Indian, 2.0% 'Other', 3.3% not specified	No	USA
Bunaciu et al (2014)	50	10-14, (11.58, 1.21)	56.0	86% White, 4% Asian, 4% Biracial, 2% African America, 2% American Indian	No	USA

<b>Study Authors</b>	<b><i>N</i></b>	<b>Age range (mean, SD)</b>	<b>Gender (% female)</b>	<b>Ethnicity</b>	<b>Panic Disorder</b>	<b>Location</b>
Calamari et al (2001)	114	11-18 (13.98, 2.30)	49.6	100% Caucasian	No	USA
Chorpita & Daleiden (2000)	228	7-17 (12.75, 2.75)	51.3	97% Caucasian, 2% African American, 1% Hispanic American	No	USA
Deacon, Valentiner, Gutierrez, & Blacker (2002)	308	12-18 (16.2, 1.4)	52.8	63.2% Caucasian, 15.6% African American, 8.1% Asian American, 7.1% Hispanic, 4.5% Biracial, 1.0% Native American, 0.3% Other	No	USA
Eley, Gregory, Clark, & Ehlers (2007)	576	8-8 (- , -)	NR	87% White 13% Not reported	No	UK
Eley, Stirling, Ehlers, Gregory, & Clark (2004)	79	8-11 (9.67, 0.89)	60	70% White, 30% not reported	No	UK
Elkins, Gallo, Pincus, & Comer (2016)	54	11-17 (15.29, 1.68)	61	86.8% Caucasian/Non- Hispanic, 13.2% not reported	Yes	USA
Elkins, Pincus, & Comer (2014)	60	11-17 (15.17, 1.71)	58.0	85% Caucasian, 15% Not reported	Yes	USA
Francis (2014)	56	7-18 (13.34, 2.91)	39.3	91.1% White, 3.6% Aboriginal Descent, 1.9% “Other”, 3.6% Not reported	No	CV
Francis, Manley, & Doyle (2019)	117	8-14 (11.0, 1.78)	59.0	48.7% White, 21.4% Mixed, 17.1% African	No	ES

Study Authors	<i>N</i>	Age range (mean, SD)	Gender (% female)	Ethnicity	Panic Disorder	Location
				American, 2.6% Asian, 7.7% “Other”		
Ginsburg & Drake (2002)	107	14-17 (15.60, -)	50.5	100% African American	No	USA
Ginsburg, Lambert, & Drake (2004)	109	14-19 (15.75, -)	52.3	100% African American	No	USA
Hawks, Blumenthal, Feldner, Leen-Feldner, & Jones (2011)	127	10-17 (14.63, 2.24)		82% Caucasian, 4.7% Hispanic/Latino, 6.3% Asian, 0.8% Native American, 4.7% “Other” or did not respond	No	USA
Hensley-Maloney & Varela (2009)	T1: 302	10-15 (12.41, 0.94)	61.0	37% White, 46% African American, 8% Hispanic, 6% Asian/Pacific Islander, 3% did not respond	No	USA
	T2: 110	11-15 (13.05, 0.72)	67.0	45% White, 40% African Americans, 8% Hispanic, 5% Asian/Pacific Islander, 2% Other		
Joiner (2002)	47	9-17 (14.23, 1.89)	61.7	81% Caucasian, 13% African American, 6% Hispanic	No	USA
Knapp, Frala, Blumenthal, Badour, & Leen-Feldner (2013)	153	10-17 (14.66, 2.18)	49.7	4.4% Hispanic/Latino, 85.0% White/Caucasian, 5.9% Asian,	No	USA



Study Authors	<i>N</i>	Age range (mean, SD)	Gender (% female)	Ethnicity	Panic Disorder	Location
				0.7% Black/African American, 0.7% American Indian, 3.3% Other		
Lau, Calamari, & Waraczynski (1996)	77	14-18 (16.74, -)	55.8	100% Caucasian	No	USA
Leen-Feldner et al (2008)	249	12-17 (14.89, -)	53.0	86.7% Caucasian, 3.2% African America, 0.4% Native Hawaiian, 0.8% Asian, 1.2% American Indian, 2.8% “Other” and 4.8% did not specify race	No	USA
Leen-Feldner, Feldner, Tull, Roemer, & Zvolensky (2006)	160	12-17 (14.92, 1.49)	44.4	87.5% Caucasian, 3.1% African American, 6% Native Hawaiian, 6% Asian, 1.9% American Indian, 1.9% “Other” and 5.6% did not specify.	No	USA
Leen-Feldner, Reardon, et al (2006)	124	12-17 (15.04, 1.49)	50.0	90.3% Caucasian, 3.2% African American, 0.8% American Indian, 0.8% “Other”, 3.2% did not specify race	No	USA
Leen-Feldner, Feldner, Bernstein, McCormick, & Zvolensky (2005)	151	12-17 (14.93, 1.50)	43.7	89.4% Caucasian, 3.3% African American, 0.7% Native Hawaiian, 0.7% Asian, 0.7% American Indian,	No	USA

Study Authors	<i>N</i>	Age range (mean, SD)	Gender (% female)	Ethnicity	Panic Disorder	Location
				0.7% 'Other', 4.6% not specified		
Leen-Feldner et al (2007)	206	12-17 (14.88, 1.49)	52.4	89.32% Caucasian, 2.91% African American, 0.4% Native Hawaiian, 0.9% Asian, 0.9% American Indian, 1.94% 'Other', 3.39% Not Specified	No	USA
Leventhal et al (2016)	3310	- (14.08, 0.42)	53.4	0.9% American Indian/Alaska Native, 16.2% Asian, 4.9% Black/African American, 46.9% Hispanic//Latino, 3.4% Native Hawaiian/Pacific Islander, 15.6% White, 5.6% Other, 6.0% Multi-ethnic/Multi-racial	No	USA
Mattis & Ollendick (1997)	118	Gr3: NR, (8.59, 0.63)  Gr6: NR (11.17, 0.38)  Gr7: NR (14.34, 0.73)	53.2	Not reported	No	USA

Study Authors	<i>N</i>	Age range (mean, SD)	Gender (% female)	Ethnicity	Panic Disorder	Location
Micco, Hirshfeld-Becker, Henin, & Ehrenreich-May (2013)	80	Clinical: 7-14 (10.65, 2.20)  Non-clinical: 8-14 (11.40, 2.04)	Clinical: 55  Non-clinical: 52.5	Clinical: 97.7% Caucasian, 2.3% note reported  Non-clinical: 75% Caucasian, 12.5% African American, 5% Asian American	No	USA
Muris (2002)	518	12-18 (14.9, 1.9)	53.9	Not reported	No	NL
Muris, Schmidt, Merckelbach, & Schouten (2001)	819	13-16 (14.2, 1.0)	48.0	Not reported	No	NL
Waszczuk, Zavos, & Eley (2013)	T1: 289  T2: 248	T1: 8.19-8.92 (8.50, -)  T2 2: 9.58-10.83 (10.08, -)	T1: 47  T2: 46	T1: 85% White, 15% Non- white  T2: 86% White, 14% Non- white	No	UK
Wauthia et al (2019)	200	8-12 (11.04, 1.21)	52	100% Caucasian	No	BE
Weems, Hayward, Killen, & Taylor (2002)	2356	NR (15.4, 0.9)	Not reported	42% White, 24% Asian, 16% Hispanic, 18% Other, 7% American Indian, 4% African American, 7% Multi-ethnic race or not specified	No	USA

Study Authors	N	Age range (mean, SD)	Gender (% female)	Ethnicity	Panic Disorder	Location
Weems, Hammond-Laurence, Silverman, & Ginsburg (1998)	280	6-17	42.5	55% Caucasian, 40% Hispanic, 2% African American, 3% Not reported/other	No	USA
Wilson & Hayward (2006)	2246	NR <sup>a</sup>	49.5	23% White, 23% Asian, 15% Latino, 6% American Indian, 6% Multi-ethnic, 4% African American	No	USA
Wolitzky-Taylor et al (2015)	534	14-15 (14.5, 0.54)	49	23.2% Caucasian, 2.1% African America, 5.8% Asian American, 50.15% Hispanic, 2.5% Native Hawaiian/Pacific Islander, 0.7% American Indian/Native American, 15.7% Other or mixed race/ethnicity	No	USA
Wolitzky-Taylor et al (2016)	3002	NR (14.1, 0.41)	54.1	47.7% Hispanic, 16.6% Asian, 16.1% Caucasian, 6.7% Multiracial, 4.9% African American, 4.1% Native Hawaiian or Pacific Islander, 1% American Indian or Alaska Native	No	USA

**Note.** AU = Australia, BE = Belgium, DE = Germany, CV = Canada, ES = Spain, NL = Netherlands, UK = United Kingdom, USA = United States of America, NR = Not reported, <sup>a</sup> = High school students, in grades 9, 10 and 11

**Table 2.** Associations between panic symptoms/severity and factors associated with the Cognitive Model of Panic (Clark, 1986)

Study	Panic Symptom/Severity Measure	Factor Measure	<i>r</i>	Size of effect
<b>Anxiety Sensitivity</b>				
<b>Cross Sectional Studies</b>				
Babson, Feldner, Connolly, Trainor, & Leen-Feldner (2010)	API-post <sup>VH</sup> SUDS-post <sup>VH</sup> HR	CASI-DC	.05 -.06 -.07	No Effect No Effect No Effect
Badour et al (2012)	SUDS-pre <sup>VH</sup> SUDS-post <sup>VH</sup>	CASI	.15 .02	Small No Effect
Blumenthal, Leen-Feldner, Knapp, Bunaciu, & Zamboanga (2012)	RCADS-P API-post <sup>VH</sup>	CASI	.59** .29**	Large Small
Buckner, Leen-Feldner, Zvolensky, & Schmidt (2009)	API-physical API-cognitive	CASI	<i>Males:</i> .26* .12	Small Small
			<i>Females:</i> .30* .50**	Medium Large
	API-physical API-cognitive			
Bunaciu et al (2014)	RCADS-C-P SUDS-pre <sup>VH</sup>	CASI	.72** .23	Very large Small
Calamari et al (2001)	RCMAS-SOM	CASI	.50*	Large

Study	Panic Symptom/Severity Measure	Factor Measure	<i>r</i>	Size of effect
Chorpita & Daleiden (2000)	Panic Disorder-CSR	CASI	.24*	Small
Deacon, Valentiner, Gutierrez, & Blacker (2002)	SCAS-P/A	ASIC	.54*	Large
Eley, Gregory, Clark, & Ehlers (2007)	SCARED-P	CASI	.55***	Large
Eley, Stirling, Ehlers, Gregory, & Clark (2004)	SCARED-P	CASI	.62*	Large
Elkins, Pincus, & Comer (2014)	PDSS-C	CASI	.40**	Medium
Francis (2014)	RCADS-C-P RCADS-P-P	CASI	.76** .35**	Very large Medium
Francis, Manley, & Doyle (2019)	RCADS-C-P	CASI <i>Older (≥ 12 years)</i> CASI <i>Younger (≤ 11 years)</i> CASI	.53**  .53**  .55**	Large  Large  Large
Hawks, Blumenthal, Feldner, Leen-Feldner, & Jones (2011)	API RCADS-P SUDS-pre <sup>VH</sup> SUDS-post <sup>VH</sup>	CASI CASI	.46** .67** .17 .09	Medium Large Small No Effect
Joiner (2002)	RCMAS-SOM	ASI	.43*	Medium
Knapp, Frala, Blumenthal, Badour, & Leen-Feldner (2013)	RCADS-P	CASI	.64**	Large

Study	Panic Symptom/Severity Measure	Factor Measure	<i>r</i>	Size of effect
Lau, Calamari, & Waraczynski (1996)	PAQ-R total	CASI	.42**	Medium
Leen-Feldner et al (2008)	SCARED-P	CASI	.76**	Very Large
Leen-Feldner, Feldner, Tull, Roemer, & Zvolensky (2006)	API-post <sup>VH</sup>	CASI	.35**	Medium
	SUDS-post <sup>VH</sup>		.23**	Small
Leen-Feldner, Reardon, et al (2006)	SUDS-pre <sup>VH</sup>	CASI	.17	Small
	SUDS-post <sup>VH</sup>		.25**	Small
Leen-Feldner, Feldner, Bernstein, McCormick, & Zvolensky (2005)	API	CASI	.37**	Medium
	SUDS-baseline <sup>VH</sup>		.20*	Small
	SUDS-post <sup>VH</sup>		.25**	Small
	HR		-0.2	No effect
	SCR		-0.4	No effect
Leen-Feldner et al (2007)	SCARED-P	CASI	.72**	Very Large
Leventhal et al (2016)	RCADS-P	CASI	.54***	Large
Mattis & Ollendick (1997)	COIQ	CASI	-.05	No Effect
Muris (2002)	SCAS-P/A	CASI-R	.76***	Very large
Muris, Schmidt, Merckelbach, & Schouten (2001)	SCAS-P/A	CASI	.45***	Medium
Wauthia et al (2019)	RCADS-P	CASI	<i>Model 1: .49***</i>	Medium
			<i>Model 2: .34***</i>	Medium

Study	Panic Symptom/Severity Measure	Factor Measure	<i>r</i>	Size of effect
Weems, Hammond-Laurence, Silverman, & Ginsburg (1998)	RCMAS-SOM	CASI	<i>Total: .55**</i> <i>6-11: .51**</i> <i>12-17: .64**</i>	Large Large Large
Wolitzky-Taylor et al (2015)	RCADS-P	CASI	.53***	Medium
Wolitzky-Taylor et al (2016)	RCADS-P	CASI	.42***	Medium
<b>Longitudinal Studies</b>				
Ginsburg & Drake (2002)	T1: SCARED-P	CASI	TI: .55**	Large
	T2: SCARED-P		T2: .36** T1: .27* T2: .61**	Medium Small Large
Ginsburg, Lambert, & Drake (2004)	T1: SCARED-P	CASI	TI: .55***	Large
	T2: SCARED-P		T2: .55*** T1: .30* T2: .57***	Large Medium Large
Hensley-Maloney & Varela (2009)	T1: SCAS-P/A	CASI	T1: .76**	Very large
	T2: SCAS-P/A		T2: .41**	Medium
	T1: SCAS-P/A		T1: .40**	Medium
	T2: SCAS-P/A		T2: .72** T1: $\square\Diamond$ ** T1: .47 $\Diamond$ **	Very large - Medium



Study	Panic Symptom/Severity Measure	Factor Measure	<i>r</i>	Size of effect
Waszczuk, Zavos, & Eley (2013)	T1: SCARED-P T2: SCARED-P	CASI	T2: .05 T1: .17***	No Effect Small
Weems, Hayward, Killen, & Taylor (2002)	Wave 3: SCID-NP-PD	Wave 4: ASI	.11♦*	Small
<b>Bodily Sensations</b>				
<b>Cross Sectional Studies</b>				
Eley et al (2007)	SCARED-P	HBP	-.13**	Small
Eley et al (2004)	SCARED-P	HBP	□*	-
Joiner (2002)	RCMAS-SOM	ASI-Fear	.38*	Medium
Mattis & Ollendick (1997)	COIQ	PAC- I/C	-.08	No Effect
Micco, Hirshfeld-Becker, Henin, & Ehrenreich-May (2013)	RCADS-P	CARBQ-P-CO	<i>Clinical:</i> .47**	Medium
		CARBQ-P-C	.42**	Medium
		CARBQ-P-CO	<i>Non-clinical:</i> -.01	No Effect
		CARBQ-P-C	-.05	No Effect

Study	Panic Symptom/Severity Measure	Factor Measure	<i>r</i>	Size of effect
<b>Avoidance</b>				
<b>Longitudinal Study</b>				
Wilson & Hayward (2006)	SCID-PM	FQ	.04♦	No Effect
<b>Treatment Study</b>				
Elkins, Gallo, Pincus, & Comer, 2016)	PDSS-C <sup>PT</sup>	Avoidance Checklist (from ADIS-IV-C/P)	<i>FS</i> : -.13 <i>CBT</i> : .32	Small Medium

**Note.** API = Acute Panic Inventory, ASIC = Anxiety Sensitivity Index for Children, CARBQ-P-C = Cognitive and Avoidant Response Bias Questionnaire child rated, CARBQ-P-CO = Cognitive and Avoidant Response Bias Questionnaire coder rated, CASI = Childhood Anxiety Sensitivity Index, CASI-DC = CASI disease concerns, CASI-R = CASI revised, COIQ = Conceptions of Illness Questionnaire (responses to questions about panic attacks), FQ = Fear Questionnaire agoraphobia subscale, HBP = Heartbeat Perception, HR = Difference between average baseline heart rate and average hyperventilation challenge heart rate, NR = Not reported, RCADS-C-P = Revised Child Anxiety and Depression Scale-Panic/Agoraphobia Scale, RCADS-P-P = Revised Child Anxiety and Depression Scale-Parent Version-Panic/Agoraphobia Scale, RCMAS-SOM = Revised Children's Manifest Anxiety Scale somatic anxiety subscale, PAQ-R = Panic Attack Questionnaire Revised, Panic Disorder CSR = Clinical severity rating for panic disorder (ADIS-C/P), PDSS-C = Panic Disorder Severity Scale for Children, SCAS-P/A = Spence Child Anxiety Scales panic/agoraphobia, SCARED-P = Screen for Child Anxiety Related Emotional Disorders-Panic Subscale, SCID-PM = Structured Clinical Interview for DSM-III-R, panic attack section, SCID-NP-PD = SCID, Structured Clinical Interview for DSM-III-R, Non-patient Version, panic disorder section, SUDS = Subjective Units of Distress, T1 = Time 1, T2 = Time 2, <sup>PT</sup> = Post treatment, <sup>VH</sup> = Voluntary Hyperventilation Task, YSR-SC = Youth Self-Report of Somatic Complaints, ■ = significance level not reported, \* =  $p < .05$  (two tailed), \*\* =  $p < .01$  (two-tailed), \*\*\* =  $p < .001$ , ♦ =  $r$  imputed from  $\beta$  coefficients using Peterson and Brown's (2005) imputation approach, □ = Not possible to calculate  $r$  using Peterson and Brown's (2005) imputation approach (e.g.,  $\beta$  coefficient resides outside .50), *CBT* = Sample received Cognitive behavioural therapy treatment, *FS* = Full sample.

### **3.2 Quality Ratings**

As shown in Table 3, quality ratings ranged widely from 20% to 80%. Particular areas of strength in the studies related to transparency of aims, clear specification of population demographics (e.g., age, gender, ethnicity, socioeconomic status) and clear definitions of the reliability and validity of relevant measures. Weakness in study quality related to a lack of information about study location, time period, participation rate and sample size justification. For longitudinal studies, there was mostly a sufficient timeframe ( $\geq 1$  year), however, there was commonly a lack of acceptable follow-up rates ( $\geq 80\%$ ).

### **3.3 Synthesis of Findings**

The results will be presented looking at each factor in turn, split between cross-sectional, longitudinal and treatment studies, and panic severity/symptom measure including questionnaire (e.g., Panic Disorder Severity Scale for Children; PDSS-C; Pincus, Spiegel, & Mattis, 2004), interview (e.g., Anxiety Disorder Interview Schedule for the DSM-IV-R; Silverman & Albano, 1996) and panic-relevant task (e.g., voluntary hyperventilation) studies.

#### **3.3.1 Anxiety Sensitivity**

Thirty-five studies reported the association between panic disorder symptoms/severity and anxiety sensitivity.

#### **Cross Sectional Findings**

##### **3.3.1.1.1 Questionnaire Studies**

Twenty-two studies reported cross-sectional associations between symptoms of panic, measured using a self-report questionnaire, and anxiety sensitivity (Blumenthal, Leen-Feldner, Knapp, Bunaciu, & Zamboanga, 2012; Bunaciu et al., 2014a; Calamari et al., 2001; Deacon, Valentiner, Gutierrez, & Blacker, 2002; Eley et al., 2007, 2004; Elkins, Pincus, & Comer, 2014; Francis, 2014; Francis, Manley, & Doyle, 2019; Hawks, Blumenthal, Feldner, Leen-Feldner, & Jones, 2011; Joiner, 2002; Knapp, Frala, Blumenthal, Badour, & Leen-Feldner, 2013; Lau, Calamari, & Waraczynski, 1996; Leen-Feldner et al., 2008, 2007; Leventhal et al., 2016; Muris, 2002; Muris, Merckelbach, Schmidt, Gadet, & Bogie, 2001; Wauthia et al., 2019; Weems, Hammond-Laurence, Silverman, & Ginsburg, 1998; Wolitzky-Taylor et al., 2015, 2016).

**Table 3.** Study Quality Ratings

<b>Study first author<sup>a</sup></b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>Total %</b>
<b>Anxiety Sensitivity</b>													
<b>Cross Sectional Studies</b>													
Babson	Y	Y	Y	N	N	Y	N	n/a	Y	Y	n/a	Y	70
Badour	Y	Y	N	N	N	Y	N	n/a	Y	Y	n/a	Y	60
Blumenthal	Y	Y	N	N	N	Y	N	n/a	Y	Y	n/a	Y	60
Buckner	Y	Y	N	N	N	Y	N	n/a	Y	Y	n/a	Y	60
Bunaciu	Y	Y	Y	N	N	Y	N	n/a	Y	Y	n/a	N	60
Calamari <sup>b</sup>	Y	Y	N	N	N	N	N	n/a	Y	Y	n/a	Y	50
Calamari <sup>c</sup>	Y	Y	N	N	N	N	N	n/a	Y	Y	n/a	Y	50
Chorpita	Y	Y	Y	N	N	Y	N	n/a	Y	Y	n/a	Y	70
Deacon	Y	Y	N	N	N	N	N	n/a	Y	N	n/a	Y	40
Eley (2007)	Y	N	N	N	N	Y	N	n/a	Y	Y	n/a	N	40
Eley (2004)	N	N	Y	N	Y	N	N	n/a	Y	Y	n/a	N	40
Elkins (2014)	Y	Y	Y	N	N	Y	N	n/a	Y	Y	n/a	Y	70
Francis (2014)	Y	Y	N	N	N	N	N	n/a	Y	Y	n/a	Y	50
Francis (2019)	Y	Y	N	N	N	N	N	n/a	Y	Y	n/a	N	40
Hawks	Y	Y	N	N	N	Y	N	n/a	Y	Y	n/a	Y	60
Joiner	Y	Y	N	N	N	N	N	n/a	Y	N	n/a	Y	40
Knapp	Y	Y	Y	N	N	Y	N	n/a	Y	Y	n/a	Y	70
Lau	Y	Y	Y	N	N	N	N	n/a	N	Y	n/a	N	40
Leen-Feldner (2008)	Y	Y	N	N	N	N	N	n/a	Y	Y	n/a	Y	50

<b>Study first author<sup>a</sup></b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>Total %</b>
Leen-Feldner (2006)	Y	Y	N	N	N	Y	N	n/a	Y	Y	n/a	Y	60
Leen-Feldner & Reardon (2006)	Y	Y	N	N	Y	Y	N	n/a	Y	Y	n/a	Y	70
Leen-Feldner (2005)	Y	Y	Y	N	N	Y	N	n/a	Y	Y	n/a	Y	70
Leen-Feldner (2007)	Y	Y	N	N	N	N	N	n/a	Y	Y	n/a	Y	50
Leventhal	N	Y	Y	Y	Y	Y	N	n/a	Y	Y	n/a	Y	80
Mattis	Y	Y	N	N	N	N	N	n/a	Y	Y	n/a	Y	50
Muris (2002)	Y	N	N	N	N	N	N	n/a	Y	Y	n/a	N	30
Muris (2001)	Y	N	N	N	N	N	N	n/a	N	N	n/a	Y	20
Wauthia	Y	Y	Y	N	N	N	N	n/a	Y	Y	n/a	Y	60
Weems (1998)	Y	Y	N	Y	N	Y	N	n/a	Y	Y	n/a	Y	70
Wolitzky-Taylor (2015)	Y	Y	Y	N	Y	Y	N	n/a	Y	Y	n/a	Y	80
Wolitzky-Taylor (2016)	Y	Y	Y	Y	N	N	N	n/a	Y	Y	n/a	Y	70
<b>Longitudinal Studies</b>													
Ginsburg (2002)	Y	Y	N	N	N	N	N	N	Y	Y	N	Y	41
Ginsburg (2004)	Y	Y	N	N	N	N	N	N	Y	Y	N	Y	41
Hensley-Maloney	Y	Y	Y	Y	N	N	N	Y	Y	Y	N	Y	67
Waszczuk	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	75
Weems (2002)	Y	Y	Y	N	Y	N	N	Y	N	N	Y	Y	58

Study first author <sup>a</sup>	1	2	3	4	5	6	7	8	9	10	11	12	Total %
<b>Bodily Sensations</b>													
<b>Cross Sectional Studies</b>													
Eley (2007)	Y	N	N	N	N	Y	N	n/a	Y	Y	n/a	N	40
Eley (2004)	N	N	Y	N	Y	N	N	n/a	Y	Y	n/a	N	40
Joiner	Y	Y	N	N	N	N	N	n/a	Y	N	n/a	Y	40
Mattis	Y	Y	N	N	N	N	N	n/a	Y	Y	n/a	Y	50
Micco	Y	Y	N	N	N	Y	Y	n/a	Y	N	n/a	Y	60
<b>Avoidance</b>													
<b>Longitudinal Study</b>													
Wilson	Y	Y	Y	N	N	N	N	Y	N	N	Y	Y	50
<b>Treatment Study</b>													
Elkins (2016)	Y	Y	Y	N	N	Y	N	n/a	Y	Y	n/a	Y	70

**Note.** <sup>a</sup> = Study first author name (where more than one paper has the same first author, year/second author is added to differentiate), <sup>a</sup> = Calamari paper Study 1, <sup>b</sup> = Calamari paper Study 2, 1 = research question/objective clearly defined, 2 = demographics, 3 = location, 4 = time period, 5 = participation rate at least 50%, 6 = Participant selection valid/reliable, 7 = sample size justification, 8 = sufficient timeframe, 9 = panic measure clearly defined, valid and reliable, 10 = factor[s] associated with cognitive model clearly defined, valid and reliable, 11 = follow-up rate, 12 = confounding variables measured and adjusted for statistically, Y = meets criteria, N = does not meet criteria/not reported or unable to determine.

Twenty studies found a significant association between panic disorder symptoms and anxiety sensitivity (Blumenthal et al., 2012; Bunaciu et al., 2014a; Calamari et al., 2001; Eley et al., 2007; Elkins et al., 2014; Francis, 2014; Francis et al., 2019; Hawks et al., 2011; Joiner, 2002; Knapp et al., 2013; Lau et al., 1996; Leen-Feldner et al., 2008, 2007; Leventhal et al., 2016; Muris, 2002; Muris, Merckelbach, et al., 2001; Wauthia et al., 2019; Weems et al., 1998; Wolitzky-Taylor et al., 2015, 2016), with effect sizes ranging from medium to very large. Two studies did not report significance (Deacon et al., 2002; Eley et al., 2004), however, effect sizes were large and medium, respectively.

Five studies examined the relationship between panic symptoms and anxiety sensitivity in child only (< 11 years) samples (Eley et al., 2007, 2004; Francis et al., 2019; Wauthia et al., 2019; Weems et al., 1998). Four studies (Eley et al., 2007; Francis et al., 2019; Wauthia et al., 2019; Weems et al., 1998) reported a significant association, one study found a medium effect (Wauthia et al., 2019) and four studies found a large effect (Eley et al., 2007, 2004; Francis et al., 2019; Weems et al., 1998).

Eighteen studies examined the relationship between panic symptoms (measured using the RCADS-PD in 50% of studies) and anxiety sensitivity (measured using the CASI in 94% of studies) in adolescent only samples (Blumenthal et al., 2012; Bunaciu et al., 2014a; Calamari et al., 2001; Deacon et al., 2002; Elkins et al., 2014; Francis, 2014; Francis et al., 2019; Hawks et al., 2011; Knapp et al., 2013; Lau et al., 1996; Leen-Feldner et al., 2008, 2007; Leventhal et al., 2016; Muris, 2002; Muris, Merckelbach, et al., 2001; Weems et al., 1998; Wolitzky-Taylor et al., 2015, 2016) and all the studies found a significant association. Effect sizes were medium (Elkins et al., 2014; Lau et al., 1996; Muris, Schmidt, et al., 2001; Wolitzky-Taylor et al., 2015, 2016), large (Blumenthal et al., 2012; Calamari et al., 2001; Deacon et al., 2002; Francis et al., 2019; Hawks et al., 2011; Knapp et al., 2013; Leventhal et al., 2016; Weems et al., 1998), and very large (Bunaciu et al., 2014a; Leen-Feldner et al., 2008, 2007; Muris, 2002). Only one study (Francis, 2014) included a parent measure of panic symptoms (RCADS-P-PD) and found a significant association with anxiety sensitivity, with a medium effect.

Two studies included a broad age range of child and adolescent participants (Joiner, 2002; Weems et al., 1998) to examine the relationship between panic symptoms (measured using the somatic anxiety subscale of the Revised Children's Manifest Anxiety Scale; RCMAS-SOM) and anxiety sensitivity. Both studies found a significant association with a large and medium effect size, respectively, and age did not moderate the outcomes.

#### 3.3.1.1.2 Interview Studies

Two studies (Chorpita & Daleiden, 2000; Mattis & Ollendick, 2002), used an interview format to measure panic severity. Chorpita & Daleiden (2000) included an adolescent only sample, and measured anxiety sensitivity using the CASI, and classified items into autonomic (e.g., physical concerns such as "It scares me when my heart beats fast" and "When my stomach hurts I worry that I might be really sick") and non-autonomic (e.g., mental incapacitation, social concerns and control such as "I don't want other people to know when I feel afraid" and "When I cannot keep my mind on my schoolwork, I worry that I might be going crazy") groups as determined by independent raters. The study found that only autonomic items were

significantly associated with panic disorder severity, with a medium effect, whereas non-autonomic items did not meet threshold for even a small effect. Mattis & Ollendick (1997) included both children and adolescents and examined the association between panic symptoms measured using the panic attack items from The Conceptions of Illness Questionnaire (administered in an interview format) and anxiety sensitivity. The association was not significant and did not meet the threshold for even a small effect.

#### 3.3.1.1.3 Panic Task Studies

Nine studies included adolescent only samples and measured panic symptoms in response to a voluntary hyperventilation (VH) challenge (Babson et al., 2010; Badour et al., 2012; Blumenthal et al., 2012; Buckner et al., 2009; Bunaciu et al., 2014b; Hawks et al., 2011; Leen-Feldner et al., 2005; Leen-Feldner, Feldner, et al., 2006; Leen-Feldner, Reardon, et al., 2006). The voluntary hyperventilation challenge involved a 3-minute hyperventilation with a breathing rate of 30 respiratory cycles/min.

Seven studies (Babson et al., 2010; Badour et al., 2012; Bunaciu et al., 2014b; Hawks et al., 2011; Leen-Feldner et al., 2005; Leen-Feldner, Feldner, et al., 2006; Leen-Feldner, Reardon, et al., 2006) measured panic symptoms using subjective units of distress (SUDS) in response to the VH challenge. In five of the studies (Badour et al., 2012; Bunaciu et al., 2014b; Hawks et al., 2011; Leen-Feldner et al., 2005; Leen-Feldner, Reardon, et al., 2006), participants reported SUDS ratings *before* completing the VH task. All five studies found a small effect for the association between SUDS *pre*-VH challenge and anxiety sensitivity (Badour et al., 2012; Bunaciu et al., 2014b; Hawks et al., 2011; Leen-Feldner et al., 2005; Leen-Feldner, Reardon, et al., 2006), however the association was only found to be significant in the study by Leen-Feldner et al (2005). This study had a similar methodology to the other studies, but a larger sample (n=151), therefore may have been the only study sufficiently powered to detect a significant association.

In six of the studies (Babson et al., 2010; Badour et al., 2012; Hawks et al., 2011; Leen-Feldner et al., 2005; Leen-Feldner, Feldner, et al., 2006; Leen-Feldner, Reardon, et al., 2006) participants reported SUDS ratings *immediately after* completing the VH task, with mixed results. Specifically, three studies (Leen-Feldner et al., 2005; Leen-Feldner, Feldner, et al., 2006; Leen-Feldner, Reardon, et al., 2006) found a significant association between panic symptoms and anxiety sensitivity, with small effect sizes, whereas three studies (Babson et al., 2010; Badour et al., 2012; Hawks et al., 2011) did not find a significant relationship, and effect sizes did not meet threshold for a small effect. The difference in findings may reflect sample



characteristics, as participants in Leen-Feldner et al (2005), Leen-Feldner, Feldner, et al (2006) and Leen-Feldner, Reardon, et al (2006) used a shorter age range (12-17 years vs 10-17 years) and reported less subjective anxiety on average *post*-VH challenge, compared to participants in Babson et al (2010), Badour et al (2012) and Hawks et al (2011).

Six studies (Babson et al., 2010; Blumenthal et al., 2012; Buckner et al., 2009; Hawks et al., 2011; Leen-Feldner et al., 2005; Leen-Feldner, Feldner, et al., 2006) used the Acute Panic Inventory (API) to assess panic symptoms *following* the VH challenge. Of these studies, five (Blumenthal et al., 2012; Buckner et al., 2009; Hawks et al., 2011; Leen-Feldner et al., 2005; Leen-Feldner, Feldner, et al., 2006) found a significant association between panic symptoms and anxiety sensitivity, all with a medium effect, apart from *male* adolescents in Buckner et al (2009), as the effect in this subgroup of participants was only small, and Blumenthal et al (2012) did not meet threshold for a medium effect, although this was marginal ( $r = .29$ ). In contrast, in the study by Babson et al (2010), the relationship between panic symptoms and anxiety sensitivity was not significant, and the finding did not meet the threshold for even a small effect. While all five studies used the CASI as a measure of anxiety sensitivity, notably, Babson et al (2010) only included the “disease concerns” subscale, which may account for the conflicting findings.

Two studies (Babson et al., 2010; Leen-Feldner et al., 2005) examined the relationship between physiological responses (e.g., heart rate, skin conductance response) to the VH challenge and anxiety sensitivity. Neither study found a significant association, nor did the findings meet the threshold for even a small effect.

### **3.3.1.2 Longitudinal Findings**

#### **3.3.1.2.1 Questionnaire Studies**

Four longitudinal studies reported the association between symptoms of panic, measured using a self-report questionnaire, and anxiety sensitivity (Ginsburg & Drake, 2002; Ginsburg et al., 2004; Hensley-Maloney & Varela, 2009; Waszczuk et al., 2013). All four studies found a significant association between anxiety sensitivity (Time 1) and panic symptoms (Time 2), with effect sizes ranging from small to very large.

One study over approximately 2-years (Waszczuk et al., 2013) examined partial correlations (controlling for other anxiety variables at Time 1), and found a significant association between anxiety sensitivity at Time 1 and panic symptoms at Time 2, with a small effect, but not between panic symptoms at Time 1 and anxiety sensitivity at Time 2 (did not meet threshold for a small effect).

Three studies included adolescent only samples (Ginsburg & Drake, 2002; Ginsburg et al., 2004; Hensley-Maloney & Varela, 2009), and found effect sizes ranging between small and very large for associations between panic symptoms and anxiety sensitivity. Differences in study methodology and sample characteristics may account for the wide variation in effect sizes. For example, the study by Hensley-Maloney & Varela (2009) involved self-report measures collected from adolescents at two time points; between 5 and 8 months following Hurricane Katrina (Time 1), and between 17 and 18 months post-hurricane (Time 2). The study found that anxiety sensitivity at Time 1 was significantly associated with panic symptoms at Time 1 and Time 2, with a very large and medium effect sizes, respectively. Hierarchical regression analysis including gender (step 1) and hurricane exposure (step 2) found that anxiety sensitivity at Time 1 significantly predicted panic symptoms at Time 1 and Time 2, with a medium effect size at Time 2. Ginsburg et al. (2004) and Ginsburg & Drake (2002) however, measured panic symptoms (using the SCARED-P) and anxiety sensitivity on two occasions, 6 months apart, in a sample of low-income, urban adolescents, and both studies found significant associations at both time points, with small to large effect sizes.

#### **3.3.1.2.2 Interview Studies**

One study (Weems, Hayward, Killen, & Taylor, 2002) examined the longitudinal association between panic severity and anxiety sensitivity in a large sample of students (mean age at study entry = 15.4) assessed annually over 4 years. Panic symptoms were measured using the panic disorder section of the Structured Clinical Interview for DSM-III-R. A significant association was found between panic symptoms at Year 3, and anxiety sensitivity (measured using the Anxiety Sensitivity Index; ASI) at Year 4 when controlling for anxiety sensitivity as Year 3. Notably, this was only for participants reporting their first panic attack onset at Year 3. No other significant associations between assessment timepoints were observed, and the study did not report the size of effects.

### **3.3.2 Interpretation of Bodily Sensations**

Four studies reported the association between panic disorder symptoms/severity and interpretation of bodily sensations.

#### **3.3.2.1 Cross Sectional Findings**

Four studies examined cross-sectional relationships between panic symptoms and interpretation of bodily sensations (Eley et al., 2007, 2004; Mattis & Ollendick, 1997; Micco et al., 2013). Of these studies, three found a significant association (Eley et al., 2007, 2004; Micco et al., 2013), with effect sizes ranging from no effect to medium.

#### 3.3.2.1.1 Questionnaire & Interview Studies

No studies were identified that met inclusion criteria and reported the association between panic symptoms measured using a self-report questionnaire or interview and interpretation of bodily sensations.

#### 3.3.2.1.2 Panic Task Studies

Two studies (Eley et al., 2007, 2004) included similar aged child only samples and found a significant association between panic symptoms (measured using the panic subscale of the Screen for Child Anxiety Related Emotional Disorders; SCARED) and interpretation of bodily sensations, with a small effect size in the study by (Eley et al., 2007). The studies conceptualised interpretation of bodily sensations as “good heart-beat perception” whereby participants are instructed to count the heart beats felt during three signalled intervals (Schandry, 1981). Micco et al. (2013) involved slightly older children (mean age = 10.65) and young adolescents (mean age = 11.40), to examine the relationship between panic symptoms and interpretations of bodily sensations (measured as threat perception of somatic concern items such as “feeling your heart beating fast” in the Cognitive and Avoidant Response Bias Questionnaire), with mixed findings. Specifically, when participants imagined themselves in anxiety provoking scenarios, there was a significant association between panic symptoms and interpretation of bodily sensations (both coder and child report), with medium effect sizes, for clinically anxious participants, but not for non-clinical participants (neither coder nor child report), and effect sizes did not meet threshold for even a small effect.

One study examined the relationship between panic symptoms and cognitive interpretations of somatic symptoms using a guided imagery task (Mattis & Ollendick, 1997). The guided imagery task required children and adolescents to imagine that they were sitting at home, reading a book, then to imagine experiencing the somatic symptoms of panic (e.g., shortness of breath, dizziness). After the task, participants were asked to indicate the extent to which items from The Panic Attributional Checklist characterised his/her own thoughts using

a “*none*”, “*some*” or “*a lot*” scale<sup>3</sup>. The study found no significant association between panic symptoms and internal/catastrophic interpretations of somatic symptoms, and the effect size did not meet threshold for a small effect.

### **3.3.2.2 Longitudinal Findings**

No studies were identified that met inclusion criteria and reported the association between panic symptoms / severity and interpretation of bodily sensations over time.

### **3.3.3 Avoidance**

Two studies reported the association between panic disorder symptoms/severity and avoidance.

#### **3.3.3.1 Cross Sectional Findings**

##### **3.3.3.1.1 Questionnaire, Interview and Panic Task Studies**

No cross-sectional studies were identified that met inclusion criteria and reported the association between panic symptoms measured using a self-report questionnaire, interview or as part of a panic task, and avoidance.

#### **3.3.3.2 Longitudinal Findings**

##### **3.3.3.2.1 Questionnaire Studies**

No longitudinal studies were identified that met inclusion criteria and reported the association between panic symptoms measured using a self-report questionnaire and avoidance.

##### **3.3.3.2.2 Interview Studies**

One study met inclusion criteria and reported the association between panic symptoms / severity and avoidance over time. Wilson & Hayward (2006) recruited a very large sample of adolescents from high schools across Northern California (n = 2246) to examine the relationship between the presence of panic attacks (measured using The Panic Attack Module of the Structured Clinical Interview for DSM-III-R), and avoidance (measured using the Fear

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<sup>3</sup> Items on the checklist were divided into four categories representing different types of cognitive attributions: external/non-catastrophic, external/catastrophic, internal/non-catastrophic and internal/catastrophic. For this review, only the findings from the internal/catastrophic (e.g., “I’d think I must be dying”, “I’d think I must be losing control” and “I’d think I must be going crazy”) category are reported.

Questionnaire), from 14 to 18 years old. Participants completed a structured clinical interview and self-report measures each Spring for 4 years. A hierarchical linear regression predicting phobic avoidance at 15-16 and 16-17 years (with gender, trait anxiety, panic and avoidance at 14-15 years, entered as covariates), found no significant association between the presence of panic attacks and avoidance, and did not meet threshold for even a small effect. Notably, the study included a community sample and avoidance was assessed using a general measure asking participants to indicate how much they would avoid each of 17 situations such as travelling alone, large open spaces, talking to people in authority, speaking to an audience, and hospitals, rather than panic specific situations, which may account for the lack of significance and effect.

### **3.3.3.3 Treatment Study**

One study examined the moderating role of baseline avoidance in intensive cognitive behavioural therapy (CBT) for adolescent panic disorder and agoraphobia (Elkins et al., 2016). Participants were randomised to either an intensive cognitive behavioural therapy, or to a 6-week waitlist condition. Posttreatment panic disorder severity was assessed using the Panic Disorder Severity Scale for Children (PDSS-C) and baseline avoidance was measured using the Panic Disorder Module-Avoidance Checklist in the child version of the ADIS-IV-C/P. The study found no significant associations between posttreatment/post-waitlist panic severity and baseline avoidance for the full sample (treatment condition plus waitlist condition), nor for youth receiving CBT, with small, and medium, effect sizes, respectively. However, hierarchical regression analysis indicated that the extent of baseline avoidance significantly moderated the effect of intensive CBT on panic severity (the interaction of Treatment Condition x Avoidance) after accounting for main effects of treatment condition and baseline avoidance ( $F_{\text{change}}(1, 36) = 5.51, p = .03$ ).

## **4. Discussion**

The aim of this review was to examine the evidence for a relationship between panic symptoms/severity and cognitive and behavioural factors associated with Clark's (1986; 1996) cognitive model of panic disorder in children and adolescents. The review synthesised findings from 38 studies and revealed the existing literature to largely involve adolescents from community samples, cross-sectional designs, self-report questionnaires to measure panic symptoms, and in most cases, anxiety sensitivity. Notably, no studies were found examining the association between panic and safety-seeking behaviours.

### **4.1 Cognitive Factors**

The pattern of results from the review is somewhat consistent with the Clark (1986; 1996) cognitive model of panic and suggest that cognitive factors (i.e., anxiety sensitivity and interpretation of bodily sensations) are important for understanding panic in children and young people.

#### Anxiety Sensitivity

There is evidence that anxiety sensitivity is an important factor for panic disorder in children and young people. In line with adult research (Olatunji & Wolitzky-Taylor, 2009), most of the cross-sectional studies that measured panic using a self-report questionnaire found a significant association between child and adolescent panic symptoms and anxiety sensitivity, with effect sizes in the medium to very large range. There was some evidence from prospective longitudinal studies supporting a causal role of anxiety sensitivity for onset of panic symptoms in children (Waszczuk et al., 2013) and adolescents (Ginsburg & Drake, 2002; Ginsburg et al., 2004; Hensley-Maloney & Varela, 2009; Weems et al., 2002) although effect sizes were somewhat smaller (small to medium) and may reflect quality issues (e.g., insufficient timeframes ( $\leq 1$  year) in the studies by Ginsburg & Drake (2002) and Ginsburg et (2004)).

When panic was measured using an interview format, there was preliminary evidence from one study (Chorpita & Daleiden, 2000) for a significant relationship between panic severity in adolescents and physical concerns (e.g., "It scares me when my heart beats really fast"), with a medium effect. Notably, findings from cross-sectional studies measuring the relationship between panic symptoms as self-rated anxiety (in response to a voluntary hyperventilation task) were mixed, and effect sizes were smaller (no effect to small range)

which may reflect quality issues and raises questions about the sensitivity and generalisability of panic-related tasks, particularly in non-clinical samples.

### Interpretation of Bodily Sensations

There was evidence from three cross-sectional studies (Eley et al., 2007, 2004; Micco et al., 2013) for a significant association between panic symptoms in children and interpretation of bodily sensations, with effect sizes in the small to medium range. Notably, the study by Micco et al (2013) found that panic symptoms were significantly associated with interpretation of bodily sensations in clinically anxious children, with a medium effect size, but not in non-clinically anxious children (effect size did not meet threshold for even a small effect). The findings may indicate that interpreting bodily sensations as dangerous may be unique to children who meet clinical threshold for an anxiety disorder. However, it should be noted that all three studies involved a panic task with samples that were not selected due to the presence of panic disorder, therefore the extent to which the findings map onto the misinterpretation of bodily sensations in Clark's (1986) cognitive model is unclear. No adolescent or prospective longitudinal studies were identified, therefore causal relationship cannot be established.

## **4.2 Behavioural Factors**

The findings provide very preliminary support for avoidance as an important factor in the treatment of panic disorder in young people. Notably, only two studies were identified, and no studies included younger children.

### Avoidance

Contrary to research with adults (Clark & Ehlers, 1993), there was no evidence for a significant cross-sectional association between avoidance behaviour and panic symptoms in adolescents. However, after accounting for main effects of treatment condition and baseline avoidance, Elkins et al., (2016) found that avoidance significantly moderated the effect of intensive CBT on panic severity for adolescents. Notably, only two studies were identified and included in this review (Elkins et al., 2016; Wilson & Hayward, 2006), and methodological issues may account for the lack of significant findings. For example, Elkins et al. (2016), examined the association between pre-treatment avoidance and *post-treatment* panic severity. As panic severity reduced over the course of treatment, this may have washed out potential effects and account for the lack of significant findings. Wilson & Hayward (2005) failed to

find support for a causal role of avoidance in panic symptoms in high school students, however, the sample were not recruited based on the presence of panic disorder, and avoidance was assessed using a general measure of avoidance, rather than panic specific situations, highlighting the need for further research using a panic disorder specific avoidance measures (e.g., The Mobility Inventory (MI); Chambless, Caputo, Jasin, Gracely, & Williams, 1985).

### **4.3 Strengths & Limitations**

A particular strength of this review is its broad focus on a common, and problematic condition that typically manifests during childhood, which meant that all available child and adolescent studies were included. Where possible, effect sizes and quality ratings were considered in the interpretation of the findings, particularly when findings were mixed.

There are notable limitations that should be taken into consideration. The majority of studies included adolescent only samples and were cross sectional which limits directional interpretation of the findings. Of the 38 included studies, only one was a treatment study (Elkins et al., 2016) and six were longitudinal (Ginsburg & Drake, 2002; Ginsburg et al., 2004; Hensley-Maloney & Varela, 2009; Waszczuk et al., 2013; Weems et al., 2002; Wilson & Hayward, 2006). Most of the studies relied on self-report (e.g., questionnaire) measures of panic symptoms and cognitive/behavioural factors, and the measures were mostly completed by the same reporter (e.g., young person), with only one study (Francis, 2014) including a parent report.

Only two studies (Elkins et al., 2016, 2014) specifically included participants with a diagnosis of panic disorder, therefore, the generalisability of findings from this review to a treatment seeking population is unclear. Where community samples were used and data was available, panic symptoms were well below clinical cut-off<sup>4</sup> (e.g., RCADS-PD mean = 0.29 – 2.82; Hawks et al., 2011; Knapp et al., 2013; Wolitzky-Taylor et al., 2015, 2016). This is not surprising given that most studies were not set up with panic disorder in mind. Therefore, it may be that participants were reporting on physiological arousal for some items (e.g., RCADS-PD; “When I have a problem my heart beats really fast”, SCARED-P-PD; “When I get frightened my heart beats really fast”, RCMAS-SOM; “Often I have trouble catching my breath”), rather than panic symptoms. Further, many of the self-report panic scales (e.g., RCADS-PD; ‘how often?’) may fail to capture the frequency of panic specific symptoms and the findings may reflect that for children and young people without demonstratable panic

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<sup>4</sup> Clinical cut-off scores obtained from (Chorpita, Moffitt, & Gray, 2005)



disorder/symptoms, a measure of physiological arousal correlates with a cognitive/behavioural measure. An alternative questionnaire, such as the PDSS-C, may be a more sensitive measure of panic symptoms, although its use in non-clinical populations has yet to be established.

While an overall strength of most studies was the inclusion of validated measures, it may be that some of the panic symptom/severity and cognitive/behavioural measures captured the same or overlapping constructs. The CASI was used in 94% of studies examining anxiety sensitivity, however, there is suggestion that the CASI contains items that are not related to the anxiety sensitivity construct. For example, factor analysis in a sample of young people found that some items in the CASI may measure trait anxiety more broadly (Chorpita & Daleiden, 2000). Furthermore, anxiety sensitivity significantly correlated with other anxiety subscales (e.g., separation anxiety, generalised anxiety disorder and social phobia) in a number of studies (e.g., Blumenthal et al., 2012; Bunaciu et al., 2014b; Wolitzky-Taylor et al., 2016) which raises questions regarding the specificity of the findings.

Finally, there was wide variation in the quality of studies included, with lower quality studies failing to report on information about study location, time period, participation rate and sample size justification. Quality assessments also indicated there was commonly a lack of acceptable follow-up rates ( $\geq 80\%$ ) in longitudinal papers and while most longitudinal studies included a sufficient timeframe ( $\geq 1$  year), 33% included a timeframe of  $\leq 6$  months.

#### **4.4 Clinical Implications**

Recommendations are *very* tentative at this stage. The findings may suggest that cognitive techniques which focus on interpretations of bodily sensations in the treatment of young people with panic disorder may be appropriate. However, Clark's protocol for treating panic disorder in adult populations outlines strategies for overcoming cognitive *and* behavioural maintenance factors. Therefore, it will be important for future research to determine whether behavioural factors play an important role in panic for children and young people, and to test the validity of this model in a treatment seeking population with a formal diagnosis of panic disorder.

The findings also highlighted potential methodological issues concerning self-report measures (e.g., RCADS-PD, CASI). Therefore, clinically sensitive symptom measures (e.g., PDSS-C) and measures that specifically target cognitive and behavioural aspects of panic (e.g., Agoraphobic Cognitions Questionnaire (ASI); Chambless, Caputo, Jasin, Gracely, & Williams,

1985) may be more appropriate for developing formulations of individual cognitions and behaviours to guide panic treatment for children and young people.

#### **4.5 Conclusion and Future Research Directions**

The results of this systematic review provide evidence for the role of cognitive factors, and some very preliminary evidence for avoidance, in understanding panic disorder in young people. However, it remains unclear whether Clark's (1986; 1996) cognitive model of panic more broadly is applicable to children and adolescents as key aspects of model, such as the use of safety seeking behaviours, have yet to be explored. Further, methodological issues in the studies mean that the results should be interpreted with caution.

The studies in this review predominantly included non-clinical samples. Therefore, an important first step will be to examine young people with high levels of panic symptoms or panic disorder. It will also be important for future research to establish the applicability of factors that have yet to be explored in child and adolescent samples such as safety-seeking behaviours, and interpretation of bodily sensations in adolescents. Most of the research is cross sectional therefore more longitudinal studies are warranted. Given that there is preliminary evidence for a significant relationship between panic symptoms and cognitive factors in children, as well as adolescents, the potential moderating influence of age should also be addressed. There is a lack of preclinical experimental research, therefore future studies should consider analogue samples and experimental methods (e.g., Dixon, Sy, Kemp, & Deacon, 2013) to establish causal roles, and relationships between, cognitive and behavioural factors for panic disorder in young people. Finally, studies examining the potential overlap between anxiety sensitivity, panic symptoms and other cognitive/behavioural variables are also required.

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ii) **Empirical Research Paper: How applicable is Clark's Cognitive Model of Panic for Adolescents?**

**Abstract**

**Background:** Panic disorder is a prevalent, disabling condition that often manifests during adolescence. Clark's (1986; 1996) cognitive model of panic disorder has led to an effective treatment for the condition in adults (Clark et al., 2003). The current study examines the applicability of Clark's cognitive model for understanding panic symptoms in adolescents.

**Method:** One-hundred and thirty-one adolescents (aged 13-18 years) recruited from the community completed a set of questionnaires measuring symptoms of panic and variables hypothesised to maintain panic disorder in Clark's (1986; 1996) cognitive model: fear and catastrophic misinterpretations of bodily sensations, safety behaviours and avoidance. Due to the COVID-19 pandemic/restrictions, and issues concerning the validity of participant responses, avoidance was not included in any inferential analyses.

**Results:** Panic symptoms were significantly correlated with cognitive and behavioural variables. Linear regression analysis found that cognitive factors (i.e., fear of body sensations and catastrophic misinterpretations of bodily sensations) significantly accounted for 53% of the variance in panic symptoms. Notably, safety seeking behaviours were not a significant predictor.

**Conclusion:** The findings suggest that Clark's (1986; 1996) model of panic disorder, particularly fear and catastrophic misinterpretations of bodily sensations, may be applicable to understanding the condition in younger people. While safety seeking behaviours were not found to be a significant predictor, they were significantly correlated with panic symptoms, and may still be an important factor. Future research should seek to replicate the study in a clinical population and determine the role of safety seeking behaviours and avoidance for understanding adolescent panic disorder.

**Key Words**

Adolescents, Cognitive Model, Panic Disorder, Questionnaire

## **1. Introduction**

### **1.1 Panic Disorder in Adolescents**

Panic disorder is characterised by repeated, unexpected panic attacks, which involve an abrupt onset of intense fear or discomfort that reaches a peak within minutes and includes symptoms such as increased heart rate, feeling lightheaded and shaking (American Psychiatric Association (APA), 2013). Around 1% of adolescents meet or have previously met diagnostic criteria for panic disorder (Essau, Conradt, & Petermann, 2000; Sadler et al., 2018), increasing to around 3% among older adolescents (Merikangas et al., 2010; Sadler et al., 2018). Panic disorder is a disabling condition that typically does not go away without treatment, has a lasting, negative impact on normal adolescent development and, unsurprisingly, is associated with high rates of school non-attendance, depression, substance abuse and suicidal behaviour (Beesdo, Knappe, & Pine, 2009; Kearney, Albano, Eisen, Allan, & Barlow, 1997). Individuals seeking help for panic disorder typically do so in their late twenties (Macaulay & Kleinknecht, 1989) despite often reporting that their panic attacks first began during adolescence (Barlow, 2002; Grant et al., 2006; Von Korff, Eaton, & Keyl, 1985). An onset in adolescence may be associated with more severe symptoms and a worse outcome than in adulthood (Ramsawh, Weisberg, Dyck, Stout, & Keller, 2011). The levels of identification of panic disorder in young people are low in Child and Adolescent Mental Health Service (CAMHS) clinicians (Baker & Waite, 2020), and left untreated, panic disorder typically continues into adulthood (Moreau & Weissman, 1992) and is associated with reduced quality of life (Comer et al., 2010). Taken together, enhancements in the identification and effective treatment of panic disorder during adolescence is crucial (Hayward, Killen, Kraemer, & Taylor, 2000).

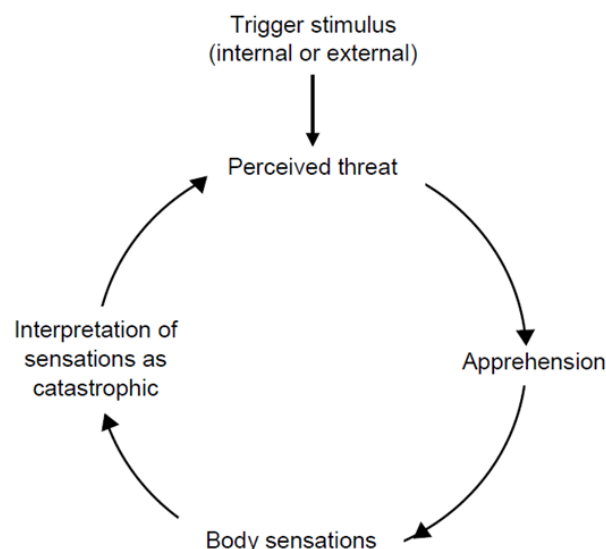
### **1.2 Treatment of Panic Disorder in Adolescents**

The U. K. National Institute for Health and Care Excellence (NICE; 2011) make no recommendations for assessing or treating young people with panic disorder. Notably, a recent survey study found that while less than half of clinicians (48.6%) identified panic disorder or panic symptoms as the main presenting problem from a vignette describing an adolescent with panic disorder, the majority suggested that cognitive behavioural therapy (CBT) would be their treatment approach (Baker & Waite, 2020). Although there are a large number of studies (e.g., Warwick et al., 2017) evaluating generic cognitive behavioural therapy (e.g., the 'C.A.T. Project'; Kendall & Hedtke, 2006, 'Cool Kids'; Hudson et al., 2009) for young people with a range of anxiety disorders, most treatment trials exclude young people with panic disorder (e.g., Walkup et al., 2008) and specific outcomes for adolescents with panic disorder are largely

unknown. Furthermore, although CBT is an effective treatment, approximately half of young people retain their primary anxiety disorder post-treatment, and only a small number of studies look at outcomes  $\geq 6$  months post treatment completion (James, Reardon, Soler, James, & Creswell, 2020).

### 1.3 The Cognitive Model of Panic in Adults

Effective treatment approaches require a theoretical understanding of the key mechanisms that underpin the development and maintenance of psychological disorders. According to cognitive-behavioural theory (e.g., Beck, 1979; Salkovskis, 1996; Salkovskis & Warwick, 1985; Wells & Leahy, 1998), anxiety disorders arise when situations are perceived as more dangerous than they really are. When it comes to panic disorder, the cognitive model (Clark, 1986; Clark et al., 1997) suggests that bodily sensations are misinterpreted as being dangerous (e.g., drinking a coffee and interpreting consequent heart palpitations as an indication of a heart attack, or exercising and interpreting breathlessness as an indication of suffocation) creating a vicious circle which culminates in a panic attack (see Figure 1) .



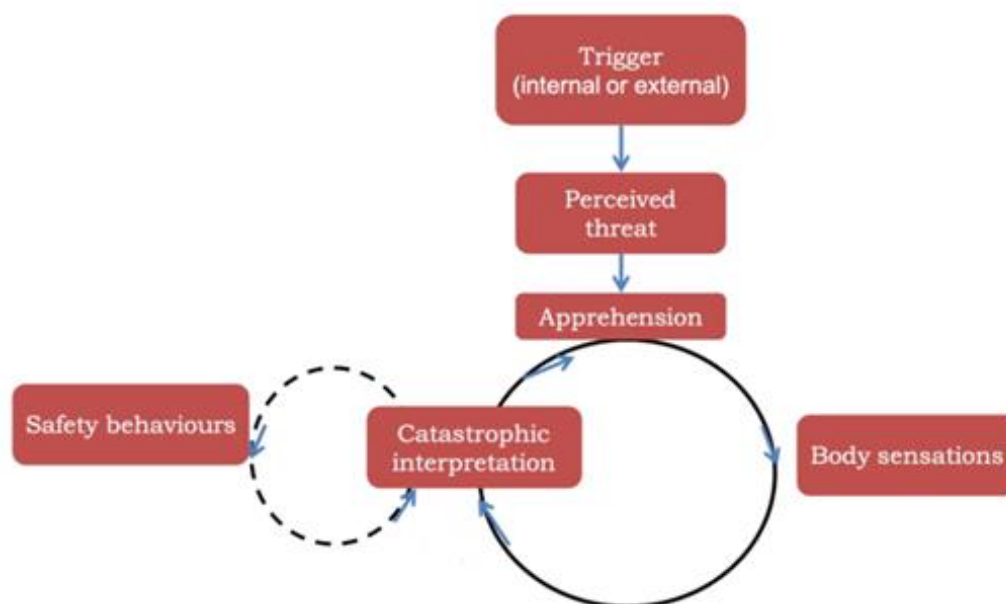
**Figure 1.** The Cognitive Model of Panic (Clark, 1986)

Catastrophic misinterpretations of bodily sensations in panic disorder are well established in research with adults. For example, individuals with panic disorder are more likely to experience catastrophic misinterpretations of bodily sensations compared to non-anxious individuals (Clark et al., 1997). Furthermore, catastrophic misinterpretations and



related cognitions reduce following CBT for panic (Schmidt, Trakowski, & Staab, 1997), individuals who have residual tendency to misinterpret bodily sensations at the end of treatment have worse outcomes at follow-up (Clark et al., 1994; Clark et al., 1999), and greater reductions in catastrophic misinterpretations during treatment predicts a greater overall reduction in panic severity/symptoms (Teachman, Marker, & Clerkin, 2010).

The cognitive model of panic (Clark, 1986; see Figure 1) has been adapted to include behavioural maintenance processes (Clark, 1996; see Figure 2). Safety-seeking behaviours are defined as behaviours carried out (either overtly or covertly) in anxiety provoking situations in an attempt to prevent a feared outcome from occurring (Salkovskis, 1991). Although safety behaviours may alleviate distress in the short-term, long-term, they prevent the formation of new, disconfirmatory information (e.g., learning that the catastrophe associated with bodily sensations does not happen) (Clark & Ehlers, 1993) and maintain anxiety (Salkovskis, 1991). When it comes to panic, three main types of safety behaviours have been identified; i) avoidance of activities or situations which the individual expects will provoke panic (e.g., exercise, travelling on public transport or being in a classroom environment), ii) escape from a situation at the time of a panic attack, and iii) subtle avoidance behaviours carried out during panic believed to prevent the feared catastrophe while remaining in the feared situation (e.g., trying to keep control of their mind or body, changing their breathing or looking for escape routes) (Salkovskis, Clark, & Gelder, 1996).



**Figure 2.** The Revised Cognitive Model of Panic including Safety Seeking Behaviours as a Maintenance Process (Clark, 1996)

Safety seeking behaviours as a key feature of panic disorder has been established in research with adults. For example, significant associations between panic-related cognitions and panic-related behaviours (e.g., *fainting* with seeking support by holding on to objects and people, having a *heart attack* with sitting down and keeping still, having a *tumour* with focussing attention on one's body) (Salkovskis et al., 1996; Salkovskis, Clark, Hackmann, Wells, & Gelder, 1999) have been identified. Furthermore, experimental research of adults with panic disorder and agoraphobia found that dropping safety seeking behaviour during a brief period of panic-related exposure (e.g., going into the street in front of their home, going to a department store in the centre of town) led to a significantly greater decrease in catastrophic beliefs and anxiety compared to those who maintained safety seeking behaviour (Salkovskis et al., 1999).

#### **1.4 Treatment of Panic Disorder in Adults**

Cognitive therapy for panic disorder (based on the cognitive model of panic; Clark, 1986; 1996) has been shown to be highly effective in adults (Clark et al., 1994; Clark et al., 1999), treatment gains are maintained at follow up (Arntz & Van Den Hout, 1996), and outcomes are superior compared to habituation (exposure) based treatment (Salkovskis, Hackmann, Wells, Gelder, & Clark, 2007). Cognitive therapy is comprised of a mixture of cognitive techniques and behavioural experiments intended to modify misinterpretations of bodily sensations and the processes that maintain them. During treatment, individuals are supported to practice cognitive restructuring and behavioural exercises (e.g., interoceptive exposure, aerobic exercise) which provide opportunity to learn that bodily sensations are not dangerous, but safe (i.e., processing of disconfirmatory evidence), and are encouraged to refrain from using safety behaviours, to allow for greater learning (e.g., "I do not need to use safety behaviours to be safe") (Craske et al., 2008).

#### **1.5 The Cognitive Model of Panic for Young People**

Cognitive models developed for adults have been successfully applied to young people, and the treatments developed from them are effective. For example, key processes in Ehlers and Clark's (2000) cognitive model of PTSD (i.e., trauma severity, sequelae appraisal, behavioural avoidance and cognitive strategies) have been found in traumatised young people (Stallard, 2003), and therapy developed from Ehlers and Clark's model is an effective treatment for traumatised young people (Smith et al., 2004).

Cognitive therapy based on Clark's cognitive model of panic disorder might also be suitable for young people. For example, there is a wealth of research with young people supporting a significant association between anxiety sensitivity (a fearful response to anxiety sensations; Reiss, Peterson, Gursky, & McNally, 1986) and panic symptoms (e.g., Buckner, Leen-Feldner, Zvolensky, & Schmidt, 2009; Elkins, Pincus, & Comer, 2014; Ginsburg & Drake, 2002; Leen-Feldner et al., 2006). Furthermore, there is evidence for children with panic symptoms being more likely to interpret physical sensations associated with anxiety in a threatening way and that avoidance of panic related situations may be an important moderator of treatment outcomes for adolescents. Specifically, three studies with children (Eley, Gregory, Clark, & Ehlers, 2007; Eley, Stirling, Ehlers, Gregory, & Clark, 2004; Micco, Hirshfeld-Becker, Henin, & Ehrenreich-May, 2013) have found a significant relationship between interpretation of bodily sensations and panic symptoms, and a study by Elkins, Gallo, Pincus, & Comer (2016) found that greater avoidance of situations commonly avoided by young people with panic disorder (e.g., classrooms, public transport, and elevators) at baseline significantly moderated treatment effects for intensive CBT in adolescents with panic disorder. To the best of our knowledge, no studies have directly examined the relationship between panic-related safety behaviours and panic symptoms/severity in young people. Taken together, while there is good reason to think that cognitive therapy based on Clark's cognitive model of panic might also be suitable for young people, as well as adults, a necessary first step is to establish whether the cognitive model more broadly is applicable for adolescents.

### **1.6 Aim, Research Question and Hypothesis**

An enhanced theoretical understanding of the central processes involved in adolescent panic may lead to better identification and treatment outcomes. The aim of this study therefore was to evaluate the role of key aspects of Clark's cognitive model of panic in a community sample of adolescents. Specifically, the extent to which cognitive (i.e., fear and catastrophic interpretation of bodily sensations) and behavioural (i.e., avoidance and safety seeking behaviours) processes associated with the cognitive model predict panic symptoms in a community sample of adolescents will be explored. The research question addresses the applicability of the cognitive model (Clark; 1986; 1996) for understanding panic in adolescents by examining the extent to which theoretically relevant cognitive and behavioural processes correlate with, and predict, panic symptoms in adolescents. Based on findings from adult literature, it was hypothesised that each of the cognitive and behavioural variables in Clark's cognitive model of panic (Clark, 1996) would individually predict adolescent panic symptoms.

## **2. Method**

### **2.1 Design**

The study used a cross-sectional, self-report questionnaire design with four independent variables and one dependent variable.

### **2.2 Participants**

One-hundred and thirty-one participants (73.3% female) aged 13-18 years ( $M = 15.79$ ,  $SD = 1.19$ ) were recruited through the general community. Demographic characteristics are presented in Table 1. Inclusion criteria for the study were that participants were able to understand English, aged between 13-18 years and a resident of the United Kingdom. Young people aged 13-15 also required consent from a parent/guardian who was able to understand English.

### **2.3 Recruitment**

Recruitment was conducted across two phases: between November 2018 and January 2019 (Phase 1) and between November 2020 and February 2021 (Phase 2). Both phases recruited from schools (known to the researchers) across five counties in England. The sample collected during Phase 1 ( $n = 78$ ) was initially part of an undergraduate study at the University of Reading. Recruitment during Phase 1 was conducted across two secondary schools and extra-curricular groups. Participants recruited through secondary schools received a brief presentation about the study and a study information sheet (see Appendix 4) and researcher contact details. An email about the study was also circulated by each school. Participants recruited through extra-curricular groups were given a newsletter, an information sheet and researcher contact details (if interested in the study). The sample collected during Phase 2 ( $n = 53$ ) was combined with the Phase 1 sample, for a doctoral study at the University of Birmingham. Recruitment during Phase 2 was conducted across two secondary schools known to the researcher and through advertising online (i.e., through social media including Instagram, Facebook, and Twitter; 67% recruited through social media). Due to the COVID-19 pandemic, recruitment during Phase 2 was entirely remote. Study information sheets (see Appendix 4 and 5) and researcher contact details were distributed via email by the schools. Social media posts with key information about the study, electronic copies of the information sheets (e.g., as images/pdf documents) and researcher contact details were shared. Adolescents/their parents were instructed to contact the researcher if they were interested in taking part in study. The study used an online survey (Qualtrics; a web-based survey platform) compatible with several electronic devices (e.g., PC, laptop, mobile phone) and all participants completed the study at

home. Once adolescents/their parents expressed an interest in the study, had opportunity to ask questions, and confirmed the adolescent's age, they were provided with brief study information and a one-time-use link to the survey.

## **2.4 Measures**

A battery of standardised self-report measures assessing different cognitive and behavioural features of the cognitive model of panic, panic symptoms, and anxiety and depression symptoms was administered to each participant. The questionnaires were piloted in consultation with a small sample ( $n = 7$ ) of young people (aged 13-18 years) with and without panic disorder from an active Patient and Public Involvement (PPI) group. The feedback was reviewed, and adaptations were made (see 'Measures of the Cognitive Model of Panic' for the adaptations made to each measure) by a Clinical Psychologist with extensive experience working with adolescents to ensure their suitability for an adolescent sample, and in agreement with Professor David Clark. Descriptive statistics (i.e., mean, standard deviation, range and Cronbach's alpha) for the study sample questionnaires (independent and dependent measures) are presented in Table 1.

### **2.4.1 Panic Symptoms**

#### *2.4.1.1 Panic Disorder Severity Scale for Children (PDSS-C; Pincus, Spiegel, & Mattis, 2004)*

The PDSS-C was used to measure panic disorder symptoms. The measure was adapted from the adult self-report Panic Disorder Severity Scale (PDSS-SR; Houck et al., 2002; Shear et al., 2001). Seven experiences relating to panic attacks over the previous week are rated (panic frequency, distress associated with panic attacks, severity of anticipatory anxiety, agoraphobia and avoidance, fear associated with the physical symptoms that accompany panic attacks, and work and social impairments related to the disorder), on a five-point scale, ranging from 0 (none) to 4 (extreme). The sum of the seven items yields an overall severity score between 0 and 28. While there are no clinical cut-offs for the measure, a mean score of 13.44 ( $SD = 5.36$ ) was found in a clinical sample (Elkins et al., 2014). The PDSS-C (Pincus et al., 2004) for use with young people aged 11-17 years is a valid and reliable measure of panic disorder symptoms and their severity demonstrating acceptable internal consistency, adequate one-day test-retest reliability, and convergent and discriminant validity (Elkins et al., 2014).

## **2.4.2 Measures of the Cognitive Model of Panic**

### *2.4.2.1 Agoraphobic Cognitions Questionnaire (ACQ; Chambless, Caputo, Jasin, Gracely, & Williams, 1985, modified by Clark et al., 1994) adapted for adolescents*

The ACQ, an 18-item questionnaire, was used to measure the dysfunctional cognitions individuals experience when the bodily sensations that are linked to panic attacks occur (e.g., ‘I am going to have a heart attack’, and ‘I am going to pass out’). Two subscale scores are obtained: a mean thought frequency, ranging from 1 (thought never occurs) to 5 (thought always occurs); and a mean belief rating ranging from 0 (I do not believe this thought) to 100 (I am completely convinced this thought is true). In line with adolescent and adult studies (Hodson, McManus, Clark, & Doll, 2008; McManus, Sacadura, & Clark, 2008), only the frequency subscale score was included in analysis for the current study. In adults, the ACQ has demonstrated high reliability (Cronbach’s alpha of 0.8), validity (Chambless, Caputo, Bright, & Gallagher, 1984) and has good construct validity as demonstrated by a significant relationship between anxiety provoking physical sensations and agoraphobic cognitions (Chambless, Beck, Gracely, & Grisham, 2000). The psychometric properties of the ACQ have not been established in young people. For the current study, the following items were adapted in line with adolescent feedback; ‘throw up’ to ‘be sick’ and ‘acting foolish’ to ‘looking silly’.

### *2.4.2.2 Body Sensations Questionnaire (BSQ; Chambless, Caputo, Bright, & Gallagher, 1984) adapted for adolescents*

The BSQ, a 17-item questionnaire, was used to determine the degree to which participants experience panic sensations in response to bodily symptoms (e.g., ‘feeling short of breath’ and ‘blurred or distorted vision’). A mean score is obtained by rating the level of fear individuals feel when experiencing different bodily sensations, on a five-point scale, ranging from 1 (not frightened) to 5 (extremely frightened or worried). In adults, the BSQ has demonstrated high internal consistency (Cronbach’s alpha of .87), stability over time good test-retest reliability ( $r = .67$ ) (Chambless et al., 1984). The psychometric properties of the BSQ have not been established in young people. For the current study, the BSQ has been modified in several ways, in line with adolescent feedback. The five-point scale was changed from ‘not at all’, ‘somewhat’, ‘moderately’, ‘very’ and ‘extremely’ to ‘never’, ‘slightly’, ‘moderately’, ‘very’ and ‘extremely’. The word ‘palpitations’ has been changed to ‘beating fast or skipping a beat’. The possession of the questions from ‘your’ to ‘my’ and the word ‘jelly’ to ‘rubber’ have also been adapted. The section where participants are asked to ‘select the three sensations which they find most difficult in life’ was removed as this is mainly useful in clinical situations.

#### *2.4.2.3 Safety Behaviours Questionnaire (SBQ; Clark & Salkovskis, 2009)*

The SBQ, a 15-item questionnaire, was administered to measure how often participants use a range of panic related safety-seeking behaviours (e.g., ‘hold on to or lean on to something’, ‘avoid doing physical exercise’ and ‘focus on what is going on in my body’). A mean score is obtained by rating the frequency with which each behaviour is used in response to a panic related situation (e.g., in response to a feared catastrophe) on a 4-point scale, ranging from 0 (‘never’) to 3 (‘always’). To the best of our knowledge, the psychometric properties of the SBQ have not been established in adults or young people. For the current study, the SBQ has been adapted in several ways. The possession was changed from ‘your’ to ‘my’. The words ‘fluids’ and ‘making yourself do more exercise’ were changed to ‘tablets/liquids/scents’ ‘doing more exercise’, respectively. The item ‘carry or drink water’ was also added, bringing the SBQ item total to 16.

#### *2.4.2.4 The Mobility Inventory (MI; Chambless et al., 1985)*

The MI, a 27-item questionnaire, was used to measure avoidance of situations with and without another person in response to a feared catastrophe/panic attack (e.g., ‘supermarkets’, ‘classrooms’ and ‘restaurants’). Two mean subscale scores rate how often a situation is avoided; a mean ‘accompanied’ rating, and a mean ‘alone’ rating, both ranging from 1 (never) to 5 (always) are obtained. In adults, the MI has good internal consistency, reliability, validity, sensitivity to symptom change and temporal validity (Rodriguez, Pagano, & Keller, 2007). The psychometric properties of the MI have not been established in young people. For the current study, the MI was adapted in several ways: a ‘not applicable’ option was included, and the words ‘theatres’, ‘department stores’, ‘auditoriums’ and ‘gatherings’ were changed to ‘cinemas’, ‘shops’, ‘arenas/stadiums’ and ‘events’, respectively. Two further situations were also added including ‘doing PE’ and ‘going swimming’, bringing the MI item total to 29.

### **2.4.3 Anxiety and Depression Symptoms**

#### *2.4.3.1 Revised Child Anxiety and Depression Scale (RCADS; Chorpita, Moffitt, & Gray, 2005; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000)*

Symptoms of anxiety and depression were measured using the RCADS. The RCADS (Chorpita et al., 2000), is a 47-item measure of anxiety and depression symptoms which assesses symptoms of Separation Anxiety Disorder, Social Anxiety Disorder, Generalised Anxiety Disorder, Panic Disorder, Obsessive Compulsive Disorder and Major Depressive Disorder. Responders rate how often each item applies on a scale of 0 (‘never’) to 3 (‘always’). For this study, the total (anxiety and depression) scale and panic subscale were used. This scale

has shown good psychometric properties in young people aged 7-18 years, within both non referred (Chorpita et al., 2000) and clinical populations (Chorpita et al., 2005).

**Table 1.** Sample demographics and panic questionnaire measures

<b>Total Sample (n = 131)</b>			
	<b>Mean (SD)</b>	<b>Range</b>	
<b>Age</b>	15.79 (1.19)	13-18	
	<b>Total (%)</b>		
<b>Gender</b>			
Male	35 (26.7)		
Female	96 (73.3)		
Other	0 (0)		
<b>SES (professional)</b>			
High	100 (76)		
Medium	26 (20)		
Low	5 (4)		
<b>Ethnicity</b>			
White (British, Irish & Other)	119 (90.8)		
White Asian	2 (1.5)		
Asian British-Pakistani	1 (0.8)		
Indian	2 (1.5)		
Black British-African	2 (1.5)		
Mixed White & Black Caribbean	2 (1.5)		
Mixed White & Asian	1 (0.8)		
Other Mixed	1 (0.8)		
Not Stated	1 (0.8)		
	<b>Mean (SD)</b>	<b>Range</b>	<b><math>\alpha</math></b>
<b>RCADS-C</b>			
Total	48.37 (27.57)	0 – 118	.96
Panic	8.21 (6.44)	0 – 27	.90
<b>Panic Measures</b>			
<b>PDSS-C</b>	6.02 (5.44)	0 – 23	.90
<b>ACQ</b>	1.92 (.61)	1 – 3.78	.88
<b>BSQ</b>	2.41 (.76)	1 – 4.47	.92



<b>SBQ</b>	1.21 (.48)	0 – 2.19	.79
<b>MI</b>			
Total <sup>a</sup>	2.04 (.68)	1 – 3.73	.96
Accompanied <sup>a</sup>	1.99 (.86)	1 – 4.36	.95
Alone <sup>a</sup>	2.10 (.78)	1 – 4.55	.95

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**Note:** SES = socioeconomic status, RCADS = Revised Child Anxiety and Depression Scale, PDSS-C = Panic Disorder Severity Scale - Child, BSQ = Body Sensations Questionnaire, ACQ = Agoraphobia Cognitions Questionnaire - frequency, SBQ = Safety Behaviour Questionnaire, MI = Mobility Inventory, <sup>a</sup> = Multiple imputation used to replace missing data

## 2.5 Procedure

The study was reviewed by the School of Psychology Ethics Committee at the University of Birmingham (ref. ERN\_19-1747) and permission for it to proceed was granted (including the amalgamation with data collected during Phase 1).

Participants accessed the study via a one-time-use link. A one-time-use link was used to enhance study control (e.g., to ensure that each participant only completed the questionnaires once, to reduce the risk of adolescents under the age of 16 accessing the survey without prior parent consent). Participants were advised that the study would take approximately 20 minutes to complete. For ease of use, it was recommended that participants accessed the study using a PC or laptop, where possible. Electronic consent/assent was obtained through two different methods depending on the age of the participant. For participants aged between 13 and 15 years, the one-time-use link was sent by email to their parent/guardian that directed the parent/guardian to a parent consent form (see Appendix 8). Once the parent consent form was complete, and if the adolescent was still interested in taking part, the participant was directed to a young person assent form (see Appendix 6). For participants aged between 16 and 18 years, parent consent was not required, therefore, the one-time-use link was sent by email directly to the participant to complete a young person consent form (see Appendix 7).

Once the consent/assent forms were complete, detailed study instructions were provided. Participants were instructed to complete all questionnaires in one sitting and reminded that the responses would be uploaded anonymously. The instructions also reiterated that taking part in the study was completely voluntary and that participants were able to withdraw data from the study up to 2 weeks after completing the questionnaires. Participants were also informed that they would be given two unique participant ID numbers that they

would need to quote if they decided to withdraw their data. Next, participants were asked to provide basic demographic information including date of birth, gender identity and ethnicity, parent occupation (to ascertain socio-economic status; see Appendix 9) and given the first unique ID number. Participants were then instructed to complete the relevant questionnaires. Once the questionnaires were complete, participants were provided with a debrief (see Appendix 10) outlining the study, details of support if distress was caused, the second unique ID number, and information on a prize draw. Finally, participants were given a link to enter a prize draw to win a £50 Amazon voucher, drawn randomly at the end of the study. Participants were instructed to provide their name and a preferred email address and told that a member of the research team would contact them by email if they were the winner. To create a further level of data protection and anonymity, the consent/assent, demographic, and questionnaire surveys were formatted separately into distinct databases.

## **2.6 Power Analysis**

A previous study examining the cognitive model for social anxiety (rather than panic) symptoms in an adolescent population (Smetham, 2016) reported a statistically significant model, with a large effect ( $r^2 = 0.61$ ). For the current study, and based on findings from Smetham (2016), G\*Power analysis indicated that a sample of 49 participants would provide 80% power to detect a large effect ( $r^2 = 0.6$ ) using a two-sided ( $p < .05$ ), multiple linear regression analysis with 5 predictor variables.

## **2.7 Statistical Analysis**

SPSS 26.0 for Windows (UK) was used for statistical analysis. Statistical significance was taken at the 5% level ( $p < .05$ ). Cronbach's alpha coefficients were calculated to determine the internal consistency of the questionnaires for the sample. Multiple imputation was used to replace missing values (Enders, 2017) (see Table 1). Descriptive statistics for sample demographic (age, gender, ethnicity, SES) and questionnaire measures (ACQ, BSQ, SBQ, MI, PDSS-C and RCADS-C) were computed. The data was screened for violation of assumptions (see Appendix 12) including normality (plus residuals), linearity, outliers (by distance and influence), multicollinearity and homoscedasticity.

Most of the data was not normally distributed, therefore a Mann Whitney-U test was conducted to examine whether study variables differed between the data-collection phases (Phase 1 and Phase 2). For MI-total, there was a significant difference between data-collection phase ( $U = 1470$ ,  $z = -2.80$ ,  $p < .01$ ), reflecting that MI-total scores in the sample collected

during Phase 2 were significantly higher (Mean Rank = 77.25) than during Phase 1 (Mean Rank = 58.35) (see Appendix 12). The elevated MI scores during Phase 2 raise questions concerning the validity of the measure administered during this time and may reflect situations that have been avoided due to nervousness/anxiety associated with COVID-19 and/or due to accessibility/restriction issues (rather than panic). Indeed, Phase 2 was conducted during the COVID-19 pandemic when many restrictions were in place (e.g., closure of schools, restaurants and cinemas, travel bans and social distancing) and most items on the MI include situations/places (e.g., parties/social events, swimming, cinema, museum) impacted by the pandemic in some way. The MI-total was therefore excluded from further analysis. No other statistically significant differences between questionnaire measures (ACQ, BSQ and SBQ) and assessment phase were found (all  $ps \geq .05$ ) (see Appendix 12).

Zero-order correlation analyses were conducted to examine the relationship between age and study variables (see Table 2). As most of the continuous data were negatively skewed, non-parametric tests (Spearman's correlation) were used.

To examine which variables predict panic symptoms (measured using the PDSS-C), multiple linear regression analysis was conducted with each of the variables identified by Clark's (1986) cognitive model and panic symptoms. Any independent variable that significantly correlated with the dependent variable (PDSS-C) was included in the regression model. The forced entry method (including all independent variables in the model) was used because there are currently no known predictors (Field, 2013).

### **3. Results**

#### **3.1 Descriptive Statistics**

##### **3.1.1 Sample Characteristics**

Demographic information is presented in Table 1. The majority of participants were White (90%), from a high (76%) socio-economic background, and scored below the clinical cut off<sup>5</sup> for symptoms of overall anxiety and depression ( $M = 48.37$ ) and panic ( $M = 8.21$ ).

##### **3.1.2 Panic Symptoms**

The overall score for panic symptoms (measured using the PDSS-C) in the current sample was 6.02. Thirteen percent of participants scored  $> 13$  on the PDSS-C.

##### **3.1.3 Cognitive and Behavioural Factors**

For catastrophic misinterpretations of bodily sensations (ACQ), fear of bodily sensations (BSQ), safety seeking behaviours (SBQ), and avoidance (MI-total), the overall mean scores were 1.92, 2.41, 1.21 and 2.04, respectively. On the BSQ, the most feared sensations were 'Feeling short of breath' ( $M = 2.89$ ), 'Feeling sick or nauseous' ( $M = 2.88$ ) and 'Dizziness' ( $M = 2.71$ ). The least feared bodily sensations were 'Tingling in my fingertips' ( $M = 1.78$ ), 'A dry throat' ( $M = 1.95$ ) and 'Numbness in another part of my body' ( $M = 2.04$ ). On the ACQ, the most frequently reported cognitions were 'I will look silly' ( $M = 3.57$ ), 'I am going to babble or talk funny' ( $M = 2.45$ ) and 'I will not be able to control myself' ( $M = 2.44$ ). The least frequent catastrophic cognitions were 'I am going to have a stroke' ( $M = 1.21$ ), 'I must have a brain tumour' ( $M = 1.21$ ) and 'I will choke to death' ( $M = 1.25$ ). On the SBQ, the most used were 'Sit down' ( $M = 1.76$ ), 'Try to keep control of my mind' ( $M = 1.73$ ) and 'Try to think about other things' ( $M = 1.72$ ). The least used safety behaviours were 'Use tablets/liquids/scents to reduce physical sensations' ( $M = 0.42$ ), 'Ask people for help' ( $M = 0.68$ ) and 'Hold on or lean on to something' ( $M = 0.80$ ). On the MI-total, the most avoided places were 'cinema - alone' ( $M = 2.90$ ), 'Going in (or driving) a car at any time - accompanied' and 'Enclosed spaces (e.g., tunnels) – accompanied' ( $M = 2.69$ ). The least avoided places were 'staying at home alone' ( $M = 1.56$ ), 'crossing bridges – accompanied' ( $M = 1.58$ ) and 'crossing bridges – alone' ( $M = 1.60$ ).

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<sup>5</sup> Clinical cut-off scores obtained from (Chorpita et al., 2005)

### 3.2 Psychometric Properties of Panic Questionnaires

For internal consistency in this sample, the PDSS-C ( $\alpha = .90$ ), BSQ ( $\alpha = .92$ ) and MI-total ( $\alpha = .96$ ) were excellent, the ACQ ( $\alpha = .88$ ) was good, and the SBQ ( $\alpha = .79$ ) was acceptable. Cronbach's alpha were interpreted using Cronbach's (1951) criteria of  $\alpha \geq 0.9$  'excellent',  $0.8 \leq \alpha < .09$  'good',  $0.7 \leq \alpha < .08$  'acceptable',  $0.6 \leq \alpha < .07$  'questionable',  $0.5 \leq \alpha < .6$  'poor' and  $\alpha < .05$  'unacceptable'.

### 3.3 Correlations

Correlational analysis (see Table 2) revealed that age was not correlated with the dependent variable (PDSS-C) ( $r = -.01$ ,  $p = .95$ ). The ACQ, BSQ and SBQ were significantly and positively correlated with the dependent variable (value of  $r$ s ranged between .58 - .74, all  $p$ s  $< .001$ ), with large to very large effect sizes.

**Table 2.** Spearman's correlations between participant age and study variables

	Measure	1	2	3	4	5
1	Age	-	-.01	.09	.19*	.13
2	PDSS-C	-	-	.74**	.67**	.58**
3	ACQ	-	-	-	.74**	.62**
4	BSQ	-	-	-	-	.59**
5	SBQ	-	-	-	-	-

**Note.** \* = correlation is significant at the .05 level (2-tailed), \*\* = correlation is significant at the .01 level (2-tailed)

### Hypothesis Testing

#### 3.4 Regression Analysis

Three predictor variables including the ACQ, BSQ and SBQ were included in the regression model (see Table 3).

**Table 3.** Multiple Regression Analysis using Cognitive and Behavioural Factors Associated with Clark's Cognitive Model of Panic to Predict Panic Symptoms<sup>ab</sup>

	<i>B</i>	<b>Bias</b>	<b>SE B</b>	<i>p</i>	<b>95% Confidence Intervals (CI)</b>	
					<b>Lower CI</b>	<b>Upper CI</b>
Constant	-7.97	-.01	1.06	-	-	-
ACQ	4.81	-.03	.87	.001	3.10	6.58
BSQ	1.89	.04	.78	.02	.47	3.50
SBQ	.16	-.01	.92	.87	-1.78	1.92

**Note.**  $R^2 = .53$ , <sup>a</sup> = 8 outliers by influence identified and removed before analysis, <sup>b</sup> = Regression analysis conducted with bootstrapping of 1000 samples

The model was statistically significant, ( $F(3,119) = 47.65, p < .001$ ) indicating that the results were unlikely to have arisen by chance. The adjusted  $R^2$  indicated that 53% of the variance in panic symptoms can be explained by variances in the three predictor variables. The individual regression analyses suggested that when considered in isolation, two of the three variables were significantly predictive of panic symptoms. Specifically, the analysis suggested that ACQ ( $B = 4.81, SE = 1.06, p = .001$ ) was the most influential predictor in the model, followed by the BSQ ( $B = 1.89, SE = .78, p = .02$ ). The SBQ ( $B = .16, SE .92, p = .87$ ), was not significant, and was the least influential predictor.

#### 4. Discussion

This study examined the applicability of the Clark (1986; 1996) cognitive model of panic disorder in adolescents. The results of the study provide preliminary support for cognitive factors being applicable to younger people. However, in contrast with hypothesis, while correlational analysis indicated that cognitive and behavioural variables were significantly correlated with panic symptoms, when the variables were collectively entered into a linear regression model, only cognitive factors individually predicted panic symptoms in adolescents. Together, the findings indicate that in adolescents, increased fear and misinterpretations of bodily sensations predict greater panic symptoms, however the role of behavioural factors is not clear.

Consistent with child studies (Eley et al., 2007, 2004; Micco et al., 2013), catastrophic interpretation of bodily sensations significantly predicted panic symptoms in adolescents. Notably, the two most frequently reported catastrophic interpretations were related to social fears (i.e., ‘I will look silly’ and ‘I am going to babble or talk funny’), rather than fears related to physical harm (e.g., ‘I am seriously ill’, ‘I am about to die’ and ‘I will have a heart attack’) which may suggest that socially related fears are a particularly important cognitive factor for panic disorder in young people.

Fear of bodily sensations was also a significant predictor of panic in young people. While this may be the first study to explicitly examine panic and interpretation of bodily sensations in adolescents, the role of anxiety sensitivity (a cognitive factor that involves the fear of anxiety and anxiety-related bodily sensations) has been established in a wealth of studies investigating panic in this age group (e.g., Blumenthal, Leen-Feldner, Knapp, Bunaciu, & Zamboanga, 2012; Bunaciu et al., 2014; Elkins et al., 2014; Francis, 2014; Francis, Manley, & Doyle, 2019; Hawks, Blumenthal, Feldner, Leen-Feldner, & Jones, 2011; Knapp, Frala, Blumenthal, Badour, & Leen-Feldner, 2013; Leen-Feldner et al., 2008; Leventhal et al., 2016; Wolitzky-Taylor et al., 2016, 2015). Notably, anxiety sensitivity and catastrophic interpretation of bodily symptoms are closely related, however, the precise nature of this relationship is unclear, and the two constructs may overlap. Furthermore, anxiety sensitivity in adolescents is often measured using the Children’s Anxiety Sensitivity Index (CASI) (e.g., Elkins et al., 2014) and there are notable similarities between items on the CASI and BSQ (e.g., ‘Scares me when my heart beats fast’ (CASI) and ‘mark down how worried or afraid you are... heart beating fast or skipping a beat’ (BSQ)). As such, the discriminant validity between the measures is not clear, and to an extent, the questionnaires may be capturing similar constructs. It is also worth

noting that while the validity of the CASI has been supported through many studies (e.g., Weems, Hammond-Laurence, Silverman, & Ginsburg, 1998) the cognitive measures used in the current study (i.e., the ACQ and the BSQ) were developed with adults and the psychometric properties for their use with adolescents is unclear (although in the current sample, the ACQ and BSQ showed good and acceptable internal consistency, respectively). Nevertheless, while the current findings support a cognitive component of panic in young people, further work is needed to understand cognitive processes, and develop reliable and valid measures for use with young people.

The finding that safety seeking behaviours did not significantly predict panic symptoms may suggest that unlike adults (Salkovskis et al., 1996, 1999) safety behaviours are not a key feature, or maintenance process, for panic disorder in young people. However, given that correlational analysis revealed a significant, positive, association between safety seeking behaviour and panic symptoms, with a large effect, the findings may in fact reflect that in the regression model, the cognitive predictors washed-out the contribution of safety seeking behaviours. Furthermore, safety seeking behaviours are defined as behaviours carried out to prevent a feared catastrophe from occurring (Salkovskis, 1991) and therefore, are likely to be a precursor to behavioural processes (Wilson & Hayward, 2006). As such, the findings may also reveal that safety behaviours do not come “on-line” until feared catastrophes/panic symptoms have reached a clinical threshold. Indeed, the sample in the current study were recruited from the community, and overall use safety behaviours was low ( $M = 1.21$ ), whereas participants from earlier research with adults (e.g., Salkovskis et al., 1996, 1999) had a diagnosis of panic disorder, with moderate to severe symptoms. Together, the findings may suggest that behavioural processes only predict panic in adolescents with more severe symptoms/catastrophic cognitions. It should also be noted that the COVID-19 restrictions may have influenced how participants recruited during Phase 2 responded to some items on the SBQ questionnaire (e.g., ‘look for an escape route’ and ‘ask people around to help’). Although no significant differences were observed between the two data-collection phases, the potential impact of the COVID-19 pandemic restrictions cannot be completely ruled out. Indeed, the results of the present study may reflect limited opportunities to engage in usual safety behaviours (e.g., ‘talk more’ or ‘hold on or lean on to someone’), or that alternative/novel safety behaviours (e.g., ‘turn video off during remote teaching’ and ‘text others asking for help’) were not captured in the SBQ.



The finding that avoidance differed between assessment timepoints suggests that the COVID-19 restrictions are likely to have significantly influenced participants' responses on this measure. This result is not surprising given that many situations often avoided by individuals with panic (e.g., cinemas, restaurants, arenas/stadiums) were not accessible during the COVID-19 pandemic. Furthermore, the MI instructs responders to 'indicate the degree to which you avoid the following places or situations because of discomfort or anxiety', rather than because of panic related thoughts/fears. As such, the measure may lack specificity and capture other constructs (e.g., anxiety/discomfort more broadly). Given that there is preliminary evidence for avoidance of situations (e.g., classrooms, public transport, and elevators) significantly moderating treatment effects for intensive CBT in adolescents with panic disorder (Elkins et al., 2016), it will be important for future studies to examine the potential role of avoidance in panic disorder using measures that have established psychometric properties for use with young people.

#### **4.1 Strengths and Limitations**

This is the first study to examine theoretically relevant cognitive and behavioural processes associated with Clark's cognitive model of panic in a community sample of adolescents. Strengths include a large sample recruited from a range of sources including schools, extra-curricular groups, and social media. It should also be noted that most of the previous studies with young people (e.g., Bunaciu et al., 2014; Knapp, Frala, Blumenthal, Badour, & Leen-Feldner, 2013; Wolitzky-Taylor et al., 2015) included heterogenous samples and measured panic symptoms using subscales from self-report measures of anxiety and depression (e.g., Revised Children's Anxiety and Depression Scale; RCADS, and The Screen for Child Anxiety Related Disorders; SCARED) which may have captured physiological symptoms of anxiety more broadly (e.g., RCADS; 'I suddenly feel as if I can't breathe when there is no reason for this' and 'When I have a problem my heart beats really fast'). The current study however, assessed panic symptoms using a validated, clinically sensitive measure (PDSS-C; Elkins et al., 2014), and adaptations were made to several of the questionnaires to ensure they were developmentally appropriate for an adolescent sample. Furthermore, the PDSS-C in this sample had excellent internal consistency which may suggest that the measure is suitable for use with adolescents in the community, as well as adolescents receiving CBT/meeting clinical threshold for panic disorder (e.g., Elkins et al., 2014).

Nevertheless, the study had several limitations which may have reduced the generalisability of findings. The study was cross-sectional and relied on self-report measures,

which may have inflated/biased reporting. This potential bias may be particularly relevant given that more conservative prevalence rates for panic disorder in young people have been found in studies that have used structured clinical interviews (Hayward, Killen, & Taylor, 1989). Given that there are currently no established measures concerning cognitive and behavioural factors in Clark's (1986; 1996) cognitive model of panic in young people, most of the included measures do not have established psychometric properties for use with young people and/or community samples. While internal consistency for all measures in the current sample was fair to excellent, research with adults has found inconsistencies with several items on the ACQ and BSQ highlighting the need for a possible revision of these scales more generally (Khawaja, 2003). While the PDSS-C is a validated measure of panic symptoms in young people, its validity has not been explored in a community sample and there is suggestion that its language may be too advanced for younger participants (e.g., < 14 years) (Elkins et al., 2014). It should also be noted that the PDSS-C measures several panic domains (e.g., frequency of panic attacks/associated distress, worry/apprehension...) including two avoidance items ('places/situations' and 'activities'). As with the elevated scores on the MI, this raises questions concerning the validity of the PDSS-C in this sample as some participant responses may have reflected places/activities avoided due to nervousness/anxiety associated with COVID-19 and/or due to accessibility/restriction issues (rather than panic).

The participants recruited for this study were an analogue sample, not a clinical population, and scored below the clinical cut off for symptoms of overall anxiety and panic. Therefore, the results may not generalise to individuals who have been diagnosed with panic disorder. However, compared to previous analogue studies (e.g., Bunaciu et al., 2014; Knapp et al., 2013; Wolitzky-Taylor et al., 2015), scores on measures of overall anxiety and panic were elevated and 45% of participants scored above the clinical cut-off ( $\geq 8$ ) recommended to indicate the presence of panic disorder. Therefore, some participants with clinical levels of panic may have been included in the sample. Nonetheless, it will be important to replicate the findings in a treatment-seeking clinical population to determine whether the Clark (1986; 1996) cognitive model of panic is applicable to a clinical group of adolescents with a formal diagnosis of panic disorder.

Similar to previous studies examining the applicability of cognitive models in adolescents (Hodson et al., 2008), only 53% of the variance of panic symptoms was explained by the model, leaving 47% unaccounted for. Further, the extent to which avoidance (a key factor in the cognitive model of panic) predicts adolescent panic symptoms is not clear, as

issues concerning the validity of the data meant that it was excluded from the regression analysis. Therefore, it will be important for future research to determine the extent to which avoidance, and other potentially relevant factors, such as anxiety sensitivity, parent anxiety, family enhancement of avoidance responding/accommodation, and peer influence, predict panic symptoms in young people.

A large proportion (40%) of the data used in this study was collected during the COVID-19 pandemic while many restrictions were in place, therefore, the results of the study may not be translatable beyond this time. As discussed, concerns regarding the validity of the MI led to this measure being excluded from analysis and is also possible that the pandemic, and subsequent restrictions/loss of opportunities to engage in many activities/behaviours, also impacted participant responses on other measures. Finally, the sample included within the study was primarily Caucasian, from relatively high socio-economic backgrounds, and non-English-speaking participants were not eligible to participate (as all assessments were delivered in English), therefore, the results may not be generalisable to young people from more diverse ethnic and socio-economic backgrounds.

#### **4.2 Future Research Directions**

An important first step will be for future research to address whether avoidance is a maintenance process for panic in young people when the study is replicated at time when COVID-19 pandemic restrictions are no longer in place. It will also be important to establish the psychometric properties of the cognitive and behavioural measures used in the current study for use with community and clinical samples of young people. Furthermore, the sample in the current study was predominantly older, therefore the cognitive model may be less applicable for younger adolescents and children. As such, while Clark's (1986; 1996) model does not concern the aetiology of panic disorder, it may be beneficial for prospective longitudinal studies to examine the maintenance of panic disorder across development.

Unlike adult studies (e.g., Salkovskis et al., 1999), there has been no experimental research with young people in the field of understanding the maintenance of panic disorder, and CBT treatment for anxiety disorders in young people (e.g., Kendall, Choudhury, Hudson, & Webb, 2002) has mostly been conducted using data from clinical trials that exclude young people with panic disorder (e.g., Walkup et al., 2008). Therefore, and in line with adult studies (Abramowitz et al., 2014; Ehring, 2013), future research may benefit from expanding the field firstly by examining theoretically driven maintenance factors in preclinical, experimental

studies, and use the findings to guide and prioritise the development of clinical research. It will also be important for future research to replicate the current study in a treatment-seeking population to determine whether Clark's (1986; 1996) cognitive model is applicable in a clinical sample with a diagnosis of panic disorder. Further research may then trial a developmentally adapted cognitive treatment for panic disorder in adolescents, beginning with case series (e.g., Leigh & Clark, 2015).

### **4.3 Clinical Implications**

The findings support a role for fear and catastrophic misinterpretations of bodily sensations in the maintenance of panic in adolescents. As such, the findings provide some very preliminary evidence that adolescents with panic may benefit from treatment that utilises cognitive techniques designed to support the identification and modification of misinterpretations of bodily sensations (e.g., Clark et al., 2004). While safety behaviours were not found to be a significant predictor of panic symptoms, safety seeking behaviours were significantly, and strongly, correlated with panic symptoms, and suggest that during treatment, it may be beneficial for clinicians to also focus on the reduction of safety behaviours. However, more research is needed to develop a better understanding of the applicability of Clark's (1986; 1996) cognitive model of panic disorder before firm conclusions can be made about how to target treatment.

### **4.4 Conclusion**

To conclude, the current study examined the applicability of the Clark (1986; 1996) cognitive model of panic disorder for understanding panic in adolescents. Although significant correlations were found between cognitive and behavioural factors and panic symptoms, only fear and catastrophic misinterpretations of bodily sensations were found to be significant predictors of panic symptoms. This study supports the role of cognitive factors in panic in an adolescent community sample, however, the generalisability of findings is limited by COVID-19 restrictions and validity issues. Further research should replicate the findings to establish the applicability of safety behaviours (including avoidance) in understanding adolescent panic disorder.

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### iii) Press Release

Press Release

UNIVERSITY OF  
BIRMINGHAM

For immediate release

**Children and adolescents may experience panic disorder in a similar way to adults.  
How the condition is understood and treated in young people may be improved using a  
cognitive therapy developed with adults.**

#### **Literature Review**

The findings from this systematic literature review show that a model for understanding panic disorder in adults might also be useful for understanding panic disorder in children and young people.

Panic disorder is a common and challenging mental health problem experienced by roughly 1% of adolescents, and often develops during adolescence and young adulthood. Children can also experience panic attacks, although there is less available evidence. People with panic disorder experience frequent, unexpected panic attacks which involve distressing thoughts (like believing they are going to lose control or die) and feelings in their body (such as a racing heart and difficulty breathing). Research with adults suggests that the key parts of panic disorder, and what keeps it going, are misinterpreting body sensations as dangerous, being on the lookout for body sensations, avoidance and safety seeking behaviours. This has led to the development of the Cognitive Model of Panic Disorder (Clark, 1986; 1996), for understanding and treating panic disorder in adults. This model has been used in the development of a highly effective treatment; Cognitive Therapy for panic disorder (Clark, 2004). The model and treatment may also be helpful for children and young people, but the evidence is not clear.

The systematic review searched for studies that looked at the relationship between panic symptoms and elements of the cognitive model of panic, in children and young people. The search found 38 studies. Most were questionnaire studies of teenagers reporting on the

relationship between panic symptoms and fear of bodily sensations (known as anxiety sensitivity).

- There was evidence for a strong relationship between panic symptoms and anxiety sensitivity in children and adolescents, and some evidence for a relationship between panic symptoms and interpretation of bodily sensations in children. This suggests that like adults, how children and young people interpret physiological feelings of anxiety appears to be an important part of the panic process.
- There were less studies looking at behavioural factors. One study found that avoidance was important in the treatment of panic disorder in adolescents and may suggest that how young people behave in anticipation, or during feelings of, panic may also be important for understanding and treating the condition.
- No studies looking at the role of safety seeking behaviours were found.

Together, the findings highlight that the cognitive model of panic may be helpful for understanding and treating the condition in children and young people.

However, study limitations and issues with measures mean that the findings should be considered with caution. For example:

- Anxiety sensitivity was mostly measured using a questionnaire looking at fear of anxious feelings (e.g., heart racing, sweating, shaking) however, there is some evidence that this measure also captures other factors, and therefore, is not specific to anxiety sensitivity.
- Interpretation of bodily sensations was measured using a heart-beat perception task, and the extent to which this method truly captures catastrophic interpretations is not clear.
- Panic symptoms were mostly measured using questionnaire subscales. It is possible that these scales capture physiological responses to anxiety more generally (rather than panic specific symptoms) and raises questions about the specificity of the findings.
- Only 2 studies included individuals with a diagnosis of panic disorder.

Studies that are set up with panic disorder in mind (e.g., include treatment seeking individuals with panic disorder), using longitudinal and experimental methods, and clinically sensitive measures, are needed.



## Empirical Research Paper

The findings from the study support that the cognitive model of panic disorder, particularly fear and catastrophic misinterpretations of bodily sensations, may be applicable to understanding the condition in younger people.

Models for understanding and treating anxiety disorders in adults have been successfully applied to young people. This has led to the development of highly effective treatments such as cognitive therapy for PTSD in young people. There is reason to think that therapy based on Clark's cognitive model of panic might also be suitable for young people. For example, there is evidence for a strong relationship between fearing physiological responses to anxiety and panic symptoms. There is also evidence for children with greater panic symptoms being more likely to interpret physical sensations associated with anxiety in a threatening way and that avoidance is an important factor in the treatment of panic disorder in adolescents. However, no studies have directly examined the relationship between interpretations of bodily sensations and safety behaviours and panic symptoms in young people.

This study recruited 131 teenagers (aged 13-18 years) from schools, extracurricular groups and social media, to complete a set of questionnaires measuring symptoms of panic and key factors in Clark's cognitive model: fear and catastrophic misinterpretations of bodily sensations (cognitive variables), safety behaviours and avoidance (behavioural variables). Due to the COVID-19 pandemic/restrictions, and issues concerning participant responses, avoidance was not included in any inferential analyses.


- Panic symptoms were significantly correlated with cognitive *and* behavioural variables.
- Linear regression analysis found that cognitive factors significantly predicted panic symptoms.
- Safety seeking behaviours were not a significant predictor of panic symptoms.

Cognitive factors (fear and catastrophic interpretation of bodily sensations) appear to be an important factor in adolescent panic. Although safety seeking behaviours were not found to be a significant predictor, they were significantly correlated with panic symptoms, and may still be an important factor.

The findings from the current study need to be repeated in a clinical population (adolescents seeking treatment for panic disorder). The role of safety seeking behaviours and avoidance for understanding adolescent panic disorder should also be explored.

**Hannah Plaisted, Clinical Psychologist in Training, lead-author,** said,

“The findings highlight how a model for understanding panic disorder in adults may also be relevant for understanding the condition in children and young people. This is important as an improved understanding of the development and maintenance of panic disorder in young people is needed to enhance identification and treatment. It is crucial that future research replicates these findings, particularly in individuals with panic disorder, and determines the extent to which behavioural factors also play a role in the onset and maintenance of the condition”.

- ❖ The research was funded by Birmingham and Solihull Mental Health Foundation Trust as part of Hannah Plaisted’s Doctorate in Clinical Psychology training.
- ❖ For further information, contact **Hannah Plaisted**, Clinical Psychologist in Training, at 

#### iv) Appendices

### Literature Review

#### Appendix 1. Search Strategies

##### Psych-Info

- |   |           |   |
|---|-----------|---|
| 1 | PsychINFO | (panic).ti,ab   |
| 2 | PsychINFO | (adolescen* OR teen* OR child* OR young OR youth OR juvenile OR p?ediatric OR student* OR school).ti,ab   |
| 3 | PsychINFO | ("catastroph* misinterpret*" OR "selective attention" OR "interpret* bias" OR somati* OR "body sensation*" OR "heart beat perception" OR hypervigilan* OR "anxiety sensitivity" OR "safety behavio?r" OR avoidance OR cogniti* OR think* OR image*).ti,ab |
| 4 | PsychINFO | (1 AND 2 AND 3) [Languages English]   |

##### Medline

- |   |        |   |
|---|--------|---|
| 5 | PubMed | (panic).ti,ab   |
| 6 | PubMed | (adolescen* OR teen* OR child* OR young OR youth OR juvenile OR p?ediatric OR student* OR school).ti,ab   |
| 7 | PubMed | ("catastroph* misinterpret*" OR "selective attention" OR "interpret* bias" OR somati* OR "body sensation*" OR "heart beat perception" OR hypervigilan* OR "anxiety sensitivity" OR "safety behavio?r" OR avoidance OR cogniti* OR think* OR image*).ti,ab |
| 8 | PubMed | (6 AND 7 AND 8) [Languages English]   |

## Appendix 2. Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies

– Adapted

Criteria	1 = Yes 0 = No	Other (CD, NR, NA)*
1. Research question clearly stated?		
2. Demographics		
3. Location		
4. Time period		
5. Was the participation rate of eligible persons at least 50%?		
6. Participant selection		
7. Sample size justification		
8. Timeframe		
9. Panic measures		
10. Cognitive behavioural measures		
11. Follow-up rate		

11. Potential confounding variables		
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\*CD, cannot determine; NA, not applicable; NR, not reported

## **Guidance for Assessing the Quality of Observational Cohort and Cross-Sectional Studies**

The guidance document below is organized by question number from the tool for quality assessment of observational cohort and cross-sectional studies.

### **Question 1. Research question**

Did the authors describe their goal in conducting this research? Is it easy to understand what they were looking to find? This issue is important for any scientific paper of any type. Higher quality scientific research explicitly defines a research question.

### **Questions 2. Study population (demographics, location, time period)**

Did the authors describe the group of people from which the study participants were selected or recruited, using demographics, location, and time period? If you were to conduct this study again, would you know who to recruit, from where, and from what time period? Is the cohort population free of the outcomes of interest at the time they were recruited?

An example would be men over 40 years old with type 2 diabetes who began seeking medical care at Phoenix Good Samaritan Hospital between January 1, 1990 and December 31, 1994. In this example, the population is clearly described as: (1) who (men over 40 years old with type 2 diabetes); (2) where (Phoenix Good Samaritan Hospital); and (3) when (between January 1, 1990 and December 31, 1994). Another example is women ages 34 to 59 years of age in 1980 who were in the nursing profession and had no known coronary disease, stroke, cancer, hypercholesterolemia, or diabetes, and were recruited from the 11 most populous States, with contact information obtained from State nursing boards.

### **Question 3: Participant rate at least 50%**

If fewer than 50% of eligible persons participated in the study, then there is concern that the study population does not adequately represent the target population. This increases the risk of bias.

#### **Question 4. Subjects recruited from the same population and uniform eligibility criteria**

Were the inclusion and exclusion criteria developed prior to recruitment or selection of the study population? Were the same underlying criteria used for all of the subjects involved? This issue is related to the description of the study population, above, and you may find the information for both of these questions in the same section of the paper.

#### **Question 4. Sample size justification**

Did the authors present their reasons for selecting or recruiting the number of people included or analysed? Do they note or discuss the statistical power of the study? This question is about whether or not the study had enough participants to detect an association if one truly existed.

A paragraph in the methods section of the article may explain the sample size needed to detect a hypothesized difference in outcomes. You may also find a discussion of power in the discussion section (such as the study had 85 percent power to detect a 20 percent increase in the rate of an outcome of interest, with a 2-sided alpha of 0.05). Sometimes estimates of variance and/or estimates of effect size are given, instead of sample size calculations. In any of these cases, the answer would be "yes."

However, observational cohort studies often do not report anything about power or sample sizes because the analyses are exploratory in nature. In this case, the answer would be "no." This is not a "fatal flaw." It just may indicate that attention was not paid to whether the study was sufficiently sized to answer a prespecified question—i.e., it may have been an exploratory, hypothesis-generating study.

#### **Question 5. Sufficient timeframe to see an effect**

Did the study allow enough time for a sufficient number of outcomes to occur or be observed, or enough time for an exposure to have a biological effect on an outcome? In the examples given above, if clinical depression has a biological effect on increasing risk for CVD, such an effect may take years. In the other example, if higher dietary sodium increases BP, a short timeframe may be sufficient to assess its association with BP, but a longer timeframe would be needed to examine its association with heart attacks.

The issue of timeframe is important to enable meaningful analysis of the relationships between exposures and outcomes to be conducted. This often requires at least several years, especially when looking at health outcomes, but it depends on the research question and outcomes being examined.

Cross-sectional analyses allow no time to see an effect, since the exposures and outcomes are assessed at the same time, so those would get a "no" response.

### **Question 6. Panic symptoms/severity measure[s]**

Were the panic measures defined in detail? Were the tools or methods used to measure panic accurate and reliable—for example, have they been validated for use with children/young people or are they objective? This issue is important as it influences confidence in the reported exposures. When exposures are measured with less accuracy or validity, it is harder to see an association between exposure and outcome even if one exists.

For example, retrospective self-report of dietary salt intake is not as valid and reliable as prospectively using a standardized dietary log plus testing participants' urine for sodium content. Another example is measurement of BP, where there may be quite a difference between usual care, where clinicians measure BP however it is done in their practice setting (which can vary considerably), and use of trained BP assessors using standardized equipment (e.g., the same BP device which has been tested and calibrated) and a standardized protocol (e.g., patient is seated for 5 minutes with feet flat on the floor, BP is taken twice in each arm, and all four measurements are averaged). In each of these cases, the former would get a "no" and the latter a "yes."

Here is a final example that illustrates the point about why it is important to assess exposures consistently across all groups: If people with higher BP (exposed cohort) are seen by their providers more frequently than those without elevated BP (nonexposed group), it also increases the chances of detecting and documenting changes in health outcomes, including CVD-related events. Therefore, it may lead to the conclusion that higher BP leads to more CVD events. This may be true, but it could also be due to the fact that the subjects with higher BP were seen more often; thus, more CVD-related events were detected and documented simply because they had more encounters with the health care system. Thus, it could bias the results and lead to an erroneous conclusion.

### **Question 7. Cognitive / behavioural measure[s] (e.g., Childhood Anxiety Sensitivity Index; CASI)**

Were the cognitive / behavioural measures defined in detail? Were the tools or methods for measuring outcomes accurate and reliable—for example, have they been validated for use with children/young people or are they objective? This issue is important because it influences confidence in the validity of study results.

An example of an outcome measure that is objective, accurate, and reliable is death—the outcome measured with more accuracy than any other. But even with a measure as objective as death, there can be differences in the accuracy and reliability of how death was assessed by the investigators. Did they base it on an autopsy report, death certificate, death registry, or report from a family member? Another example is a study of whether dietary fat intake is related to blood cholesterol level (cholesterol level being the outcome), and the cholesterol level is measured from fasting blood samples that are all sent to the same laboratory. These

examples would get a "yes." An example of a "no" would be self-report by subjects that they had a heart attack, or self-report of how much they weigh (if body weight is the outcome of interest).

### **Question 8. Sufficient timeframe to see an effect**

Did the study allow enough time ( $\geq 1$  year) for a sufficient number of outcomes to occur or be observed, or enough time for an exposure to have a biological effect on an outcome? In the examples given above, if clinical depression has a biological effect on increasing risk for CVD, such an effect may take years. In the other example, if higher dietary sodium increases BP, a short timeframe may be sufficient to assess its association with BP, but a longer timeframe would be needed to examine its association with heart attacks.

The issue of timeframe is important to enable meaningful analysis of the relationships between exposures and outcomes to be conducted. This often requires at least several years, especially when looking at health outcomes, but it depends on the research question and outcomes being examined.

Cross-sectional analyses allow no time to see an effect, since the exposures and outcomes are assessed at the same time, so those would get a "no" response.

### **Question 9. Follow-up rate**

Higher overall follow-up rates are always better than lower follow-up rates, even though higher rates are expected in shorter studies, whereas lower overall follow-up rates are often seen in studies of longer duration. Usually, an acceptable overall follow-up rate is considered 80 percent or more of participants whose exposures were measured at baseline. However, this is just a general guideline. For example, a 6-month cohort study examining the relationship between dietary sodium intake and BP level may have over 90 percent follow-up, but a 20-year cohort study examining effects of sodium intake on stroke may have only a 65 percent follow-up rate.

### **Question 10. Statistical analyses**

Were key potential confounding variables measured and adjusted for, such as by statistical adjustment for baseline differences? Logistic regression or other regression methods are often used to account for the influence of variables not of interest.

This is a key issue in cohort studies, because statistical analyses need to control for potential confounders, in contrast to an RCT, where the randomization process controls for potential confounders. All key factors that may be associated both with the exposure of interest and the outcome—that are not of interest to the research question—should be controlled for in the analyses.



For example, in a study of the relationship between cardiorespiratory fitness and CVD events (heart attacks and strokes), the study should control for age, BP, blood cholesterol, and body weight, because all of these factors are associated both with low fitness and with CVD events. Well-done cohort studies control for multiple potential confounders.

### **Some general guidance for determining the overall quality rating of observational cohort and cross-sectional studies**

The questions on the form are designed to help you focus on the key concepts for evaluating the internal validity of a study. They are not intended to create a list that you simply tally up to arrive at a summary judgment of quality.

Internal validity for cohort studies is the extent to which the results reported in the study can truly be attributed to the exposure being evaluated and not to flaws in the design or conduct of the study—in other words, the ability of the study to draw associative conclusions about the effects of the exposures being studied on outcomes. Any such flaws can increase the risk of bias.

Critical appraisal involves considering the risk of potential for selection bias, information bias, measurement bias, or confounding (the mixture of exposures that one cannot tease out from each other). Examples of confounding include co-interventions, differences at baseline in patient characteristics, and other issues throughout the questions above. High risk of bias translates to a rating of poor quality. Low risk of bias translates to a rating of good quality. (Thus, the greater the risk of bias, the lower the quality rating of the study.)

In addition, the more attention in the study design to issues that can help determine whether there is a causal relationship between the exposure and outcome, the higher quality the study. These include exposures occurring prior to outcomes, evaluation of a dose-response gradient, accuracy of measurement of both exposure and outcome, sufficient timeframe to see an effect, and appropriate control for confounding—all concepts reflected in the tool.

Generally, when you evaluate a study, you will not see a "fatal flaw," but you will find some risk of bias. By focusing on the concepts underlying the questions in the quality assessment tool, you should ask yourself about the potential for bias in the study you are critically appraising. For any box where you check "no" you should ask, "What is the potential risk of bias resulting from this flaw in study design or execution?" That is, does this factor cause you to doubt the results that are reported in the study or doubt the ability of the study to accurately assess an association between exposure and outcome?

The best approach is to think about the questions in the tool and how each one tells you something about the potential for bias in a study. The more you familiarize yourself with the key concepts, the more comfortable you will be with critical

appraisal. Examples of studies rated good, fair, and poor are useful, but each study must be assessed on its own based on the details that are reported and consideration of the concepts for minimizing bias.

## Empirical Paper

### Appendix 1: Pilot Study Questionnaire



Thank you for agreeing to help us. We would be grateful if you could look at the following five questionnaires so that we can make sure that they are appropriate for young people aged 13-17 years.

- Body Sensations Questionnaire
- Agoraphobia Cognitions Questionnaire
- Safety Seeking Behaviours Questionnaire
- Avoidance Questionnaire
- The Mobility Inventory (MI)

Please can you:

- 1. Highlight anything that doesn't make sense**
- 2. Highlight any wording that you think is not appropriate or understandable (and suggest more appropriate wording if possible)**
- 3. Suggest other items that you think would be relevant for a young person who experiences panic attacks and worries about having further panic attacks**



## Appendix 2: Pilot Study Feedback

### SUGGESTED AMENDMENTS

Suggested amendments are made on the basis of feedback from 7 young people (5 others expressed an interest but did not provide feedback, one young person returned questionnaires but completed them instead of providing feedback).

Number	Age	Gender	Panic disorder	Panic attacks	Anxiety	Depression
1	16	Female	Y	Y	Y	Y
2	16	Female	Y	Y	Y	Y
3	18	Female	Y	Y	Y	Y
4	18	Female	N	Y	Y	Y
5	19	Female	N	Y	N	Y
6	13	Male	N	N	Y	N
7	15	Male	N	N	N	N

- Feedback was around format, as well as text
  - The need for the format to be consistent across the questionnaires
  - Switching the order of the anchors (as they had found that mixing up whether start with 'never' or 'always' made it difficult to answer easily)
  - Make it easier to complete by circling (or clicking if online) rather than writing numbers
- Text changes involve simplifying language and adding other relevant items
- Text changes also included suggested changes to title of measures
- All suggested amendments are shown as tracked changes in the questionnaires

## Appendix 3: Ethical Approval Email: Original Submission

Application for Ethical Review ERN\_19-1747



Samantha Waldron (Research Support Services)

Reply all

Inbox



Action Items



Dear Dr Waite

**Re: "How applicable is the adult cognitive model of panic disorder for adolescents?"**  
**Application for Ethical Review ERN\_19-1747**

Thank you for your application for ethical review for the above project, which was reviewed by the Science, Technology, Engineering and Mathematics Ethical Review Committee.

On behalf of the Committee, I confirm that this study now has full ethical approval.

I would like to remind you that any substantive changes to the nature of the study as described in the Application for Ethical Review, and/or any adverse events occurring during the study should be promptly brought to the Committee's attention by the Principal Investigator and may necessitate further ethical review.

Please also ensure that the relevant requirements within the University's Code of Practice for Research and the information and guidance provided on the University's ethics webpages (available at <https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Links-and-Resources.aspx>) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (<https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx>) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.

Please be aware that whilst Health and Safety (H&S) issues may be considered during the ethical review process, you are still required to follow the University's guidance on H&S and to ensure that H&S risk assessments have been carried out as appropriate. For further information about this, please contact your School H&S representative or the University's H&S Unit at [healthandsafety@contacts.bham.ac.uk](mailto:healthandsafety@contacts.bham.ac.uk).

Kind regards,

**Ms Sam Waldron**  
Research Ethics Officer  
Research Support Group  
C Block Dome (room 137)  
Aston Webb Building  
University of Birmingham  
Edgbaston B15 2TT

back to you)

Please remember to submit a new [Self-Assessment Form](#) for each new project. Click [Ethical Review Process](#) for further details regarding the University's Ethical Review process.

Click [Research Governance](#) for further details regarding the University's Research Governance and Clinical Trials Insurance processes, or email [researchgovernance@contacts.bham.ac.uk](mailto:researchgovernance@contacts.bham.ac.uk) with any queries



*Notice of Confidentiality:*

*The contents of this email may be privileged and are confidential. It may not be disclosed to or used by anyone other than the addressee, nor copied in any way. If received in error please notify the sender and then delete it from your system. Should you communicate with me by email, you consent to the University of Birmingham monitoring and reading any such correspondence.*

## Appendix 4: Information Sheet for Adolescents



**Around 1 in 10 young people experience a mental health disorder, over half of which starts by the age of 14.**

*By doing this research you will be helping us to understand more about teenage anxiety, allowing us to refine treatments so teenagers with panic disorder can get effective treatment.*



**Principal Investigator:**  
Polly Waite  
p.l.waite@reading.ac.uk  
0118 378 5534



**Researcher:**  
Hannah Plaisted  
Trainee Clinical Psychologist

*The results of this study will form part of Hannah's clinical psychology doctorate*

School of Psychology  
Birmingham University  
Hills Building  
Edgbaston Park Road  
Birmingham  
B15 2TT

The questionnaires will ask you about your fears, worries, mood and behaviour. If this raises any concerns, there are people you can talk to for advice and support:

- Your GP
- The Principal Investigator (Dr Polly Waite) can provide appropriate contacts
- National organisations such as Young Minds (<http://www.youngminds.org.uk>); Parent helpline: 0808 802 5544)

You can also find information and resources on the following website:  
(<https://andyresearchclinic.com/parents/>)

The University of Birmingham  
Research Ethics Committee has  
reviewed this study

**What happens to teenagers when they experience panic?**



**Understanding how teenagers think and what they do when they feel panicky**

**Information for Young People**



**UNIVERSITY OF BIRMINGHAM**



## Who can take part?

We are inviting **teenagers aged 13-18** to help us understand what young people feel when they experience **panicky** symptoms, by **filling in some questionnaires**

We are looking for a range of teenagers to take part – including those who do not experience panicky feelings

Your participation in this study is **completely voluntary**. If you change your mind about taking part, you are **free to withdraw at any time**. If you have already completed the questionnaires, you can still **withdraw** your data up to **two weeks after completing the study**.

All investigators on this project have had criminal records checks and have been approved by the School to work with children.

## What will you be asked to do?



1. Answer a set of **6 multiple-choice questionnaires** which will take around **20 minutes**. Questionnaires ask about different fears and worries, how you feel and what you may think or do if/when you feel scared or worried.
2. Provide some **background information** such as your date of birth and gender.

## Who will see what you do?

All of your personal data will be **kept confidential** and will **only be seen by the researchers**.



All questionnaire and background data will be **completely anonymised**.

Data collected will be **stored securely** at the University (unless you or your parent chooses to withdraw your data, if this happens, your data will be removed and destroyed).

Everyone's results will be grouped together, included in publications of scientific journals and be presented to other interested academics and clinicians.

## What next?

### If you are aged 15 or younger:

- We require your parent or guardian's approval before taking part.
- Please **ask your parent or guardian** to email Hannah on –  or phone 
- Once we have your parent's approval, we will provide you with details to give your agreement to take part.

### If you are aged 16 or older:

- Please email or phone Hannah (using the above contact details). Hannah will answer any questions and send you a link for you to give consent and complete the questionnaires.

**On completion everyone who takes part will be able to enter a prize draw to win a £50 Amazon voucher**

Your responses will be anonymised and may subsequently be made available to other authenticated researchers if they agree to hold the data securely.

## Appendix 5: Information Sheet for Parents of Adolescents aged 13-15



The aim of our research is to explore the relationship between anxious, panicky feelings and how adolescents think and what they do.

We hope that our research will help us understand more about adolescents' experience of panicky feelings, to then help us develop and improve treatments for panic disorder in this age group.



**Principal Investigator:**  
Polly Waite  
p.l.waite@reading.ac.uk  
0118 378 5534



**Researcher:**  
Hannah Plaisted  
Trainee Clinical Psychologist

*The results of this study will form part of Hannah's clinical psychology doctorate*

School of Psychology  
Birmingham University  
Hills Building  
Edgbaston Park Road  
Birmingham  
B15 2TT

The questionnaires will ask your child about fears, worries, mood and behaviour. If this raises any concerns, there are people you/they can talk to for advice and support:

- Your GP
- The Principal Investigator (Dr Polly Waite) can provide appropriate contacts
- National organisations such as Young Minds (<http://www.youngminds.org.uk>); Parent helpline: 0808 802 5544)

You can also find information and resources on the following website:  
(<https://andyresearchclinic.com/parents/>)

The University of Birmingham  
Research Ethics Committee has reviewed this study

**What happens to adolescents when they experience panic?**



*Understanding how adolescents think and what they do when they feel panicky*

**Information for Parents & Guardians**



UNIVERSITY OF BIRMINGHAM



## Who can take part?

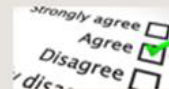
We are inviting **adolescents aged 13-18** to help us understand what young people feel when they experience **panicky** symptoms, by **filling in some questionnaires**

We are looking for a range of young people to take part – including those who do not experience panicky feelings

Their participation in this study is **entirely voluntary**. If they change their mind about taking part, they are **free to withdraw at any time**. If your child has already completed the questionnaires, they can still **withdraw** their data up to **two weeks after completing the study**.

All investigators on this project have had criminal records checks and have been approved by the School to work with children.

## What will your child be asked to do?



1. Answer a set of **6 multiple-choice questionnaires** which will take around **20 minutes**. Questionnaires ask about different fears and worries, how they feel and what they may think or do if/when they feel scared or worried.
2. Provide some **background information** such as their date of birth and gender.

## Who will see their responses?

All personal data will be **kept confidential** and will only be seen by the researchers..

All questionnaire and background data will be **completely anonymised**.

Data collected will be **stored securely** at the University (unless you or your child chooses to withdraw the data. If this happens, your child's data will be removed and destroyed).

Everyone's results will be grouped together, included in publications of scientific journals and be presented to other interested academics and clinicians.

## What next?

- As your child is aged 15 or younger, we **require your consent** before they can take part.
- Please **email** the researcher Hannah on [redacted] or phone [redacted]
- Hannah will answer any questions you have and then, if you are happy for your child to take part, you will be sent a link to give your consent online.
- Once we have received this, we will send a link for your son/daughter to provide their agreement to take part and to complete the questionnaires online.

**On completion everyone who takes part will be able to enter a prize draw to win a £50 Amazon voucher**

Your son/daughter's responses will be anonymised and may subsequently be made available to other authenticated researchers if they agree to hold the data securely.

## Appendix 6: Assent form for Adolescents aged 13-15



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### ASSENT FORM FOR YOUNG PERSON (AGED 15 OR UNDER)

Project Title: What happens to teenagers when they experience panic?

	Please <b>initial</b> each box to show agreement.
1. I confirm that I have read and understand the information leaflet for the above study. I have had the opportunity to consider the information, ask questions and (if applicable) have had these answered satisfactorily.	
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason.	
3. I understand that the project has been reviewed by the University of Birmingham Research Ethics Committees and has been given a favourable ethical opinion for conduct.	
4. I understand that my responses will be anonymised and may subsequently be made available to other authenticated researchers if they agree to hold the data securely.	
5. I understand that if I indicate that I am, or anyone else is, at serious risk of harm that the research team will need to pass this information on to keep me/other people safe (e.g. school, parent, local safeguarding team).	
6. I agree to take part in this study.	
7. I confirm that I live in the United Kingdom.	

My name \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

## Appendix 7: Consent Form for Adolescents aged 16-18



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BIRMINGHAM

### CONSENT FORM FOR YOUNG PERSON (AGED 16 OR OVER)

**Project Title: What happens to teenagers when they experience panic?**

	Please <b>initial</b> each box to show agreement.
1. I confirm that I have read and understand the information leaflet for the above study. I have had the opportunity to consider the information, ask questions and (if applicable) have had these answered satisfactorily.	
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason.	
3. I understand that the project has been reviewed by the University of Birmingham Research Ethics Committees and has been given a favourable ethical opinion for conduct.	
4. I understand that my responses will be anonymised and may subsequently be made available to other authenticated researchers if they agree to hold the data securely.	
5. I understand that if I indicate that I am, or anyone else is, at serious risk of harm that the research team will need to pass this information on to keep me/other people safe (e.g. school, parent, local safeguarding team).	
6. I agree to take part in this study.	
7. I confirm that I live in the United Kingdom.	

**My name** \_\_\_\_\_

**Signature** \_\_\_\_\_

**Date** \_\_\_\_\_

## Appendix 8: Parent Consent Form for Adolescents aged 13-15



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### PARENTAL CONSENT FORM

**Project Title: What happens to teenagers when they experience panic?**

	Please <b>initial</b> each box to show agreement.
1. I confirm that I have read and understand the information leaflet for the above study. I have had the opportunity to consider the information, ask questions and (if applicable) have had these answered satisfactorily.	
2. I understand that my child's participation is voluntary and that he/she is free to withdraw at any time, without giving a reason.	
3. I understand that the project has been reviewed by the University of Birmingham Research Ethics Committees and has been given a favourable ethical opinion for conduct.	
4. I understand that my child's responses will be anonymised and may subsequently be made available to other authenticated researchers if they agree to hold the data securely.	
5. I understand that if my child indicates that he/she or anyone else is, at serious risk of harm that the research team will need to pass this information on to keep my child/other people safe (e.g. to me, my child's school, the local safeguarding team).	
6. I agree for my child to take part in this study.	
7. I agree for my child to be entered into a prize draw to win a £50 Amazon voucher.	
8. I confirm that my child lives in the United Kingdom.	

**My Child's Name** \_\_\_\_\_

**My Name** \_\_\_\_\_

**Signature** \_\_\_\_\_

**Date** \_\_\_\_\_



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### STUDY INFORMATION

Thank you for agreeing to take part in our study “What happens to teenagers when they experience panic?”.

By now, you should have had a chance to read the information leaflet given to you and to discuss the study further with a member of the research team if required.

Before you begin the questionnaires, please take some time to carefully read through the following information:

- To take part in the study, you should have already completed online consent (if you are aged between 16-18 years) OR assent (if you are aged between 13-15 years). Please contact a member of the research team if you are not sure whether you have already provided online consent/assent.
- If you are under 16, your parent should have provided online consent for you to take part in this study. Please contact a member of the research team if you are not sure whether your parent has provided online consent.
- If you are aged 16 or older, you do not need parent consent to take part.

You will be given a selection of questionnaires which will take approximately 20 minutes to complete. You will be required to complete all of the questionnaires in one sitting.

As you progress through the questionnaire your responses will be uploaded anonymously. This means that no-one (not even the researcher) will know that the data belongs to you.

Once we have finished collecting enough data we will combine your responses with the other teenagers who have taken part. All data will be combined and analysed by Hannah Plaisted (Trainee Clinical Psychologist).

Taking part in this study is your choice and completely voluntary. You may choose not to take part, or you may change your mind at any time. You can also withdraw your data from the study up to 2 weeks after completing the questionnaires. You will be given two unique participant ID numbers as you progress through the questionnaires. Please make a note of these numbers. If you would like to withdraw your data, please email Hannah on [REDACTED] and quote both participant ID numbers. If you have any further questions, please contact Hannah.

## QUESTIONNAIRES

We'd like to begin by asking you some background questions. This is so that we can describe the group of people who take part in the study.

1. What is your date of birth?      \_\_\_\_/\_\_\_\_/\_\_\_\_
2. What is your gender identify?      Male (boy) / Female (girl) / Other (please circle)
3. What is your ethnic background (please circle below)

White	Code	Black or Black British	Code
British	A	African	M
Irish	B	Caribbean	N
Any other White Background	C	Any other Black background	P
<b>Mixed</b>		<b>Other Ethnic groups</b>	
White and Black Caribbean	D	Chinese	R
White and Black African	E	Any other Ethnic group	S
White and Asian	F	<b>Not Stated</b>	
Any other mixed background	G	I do not wish to state my ethnicity	Z
<b>Asian or Asian British</b>			
Indian	H		
Pakistani	J		
Bangladeshi	K		
Any other Asian background	L		

4. Can you tell us about what your parent(s) or guardian(s) do for a living?

Please tell us about each person on a separate line. Who is this about?  (e.g. Mum/Dad/Guardian)	Works (yes/no)	If they work, what is their job?

### **PANIC QUESTIONNAIRES**

Now we'd like to ask you lots of questions about what you think and what you do. Please answer all the questions even if they don't seem relevant to you. Please do not spend too much time on each question – there are no right or wrong answers.

## Panic Disorder Severity Scale

**Instructions:** Several of the following questions refer to panic attacks and limited symptom attacks. For this questionnaire, a panic attack is defined as a sudden rush of fear or discomfort accompanied by at least four of the symptoms listed below. To qualify as a sudden rush, the symptoms must peak within 10 minutes. Episodes like panic attacks, but having fewer than four of the listed symptoms, are called limited-symptom attacks. Here are the symptoms to count:

- Rapid or pounding heartbeat
- Sweating
- Trembling or shaking
- Breathlessness
- Feeling of choking
- Chest pain or discomfort
- Nausea
- Dizziness or faintness
- Feelings of unreality
- Numbness or tingling
- Chills or hot flushes
- Fear of losing control or going crazy
- Fear of dying

For each of the following questions, circle the number of the answer that best describes your experience during the past week:

1. How many panic and limited-symptoms attacks did you have during the past week?
  - 0- No panic or limited-symptoms episodes
  - 1- Mild: No full panic attacks and no more than one limited-symptoms attack/day
  - 2- Moderate: One or two full panic attacks and/or multiple limited-symptom attacks/day
  - 3- Severe: More than two full attacks but not more than one per day on average
  - 4- Extreme: Full panic attacks occurred more than once a day, more days than not
2. If you had any panic attacks during the past week, how distressing (uncomfortable, frightening) were they while they were happening? (If you had more than one, give an average rating. If you didn't have any panic attacks but did have limited-symptoms attacks, answer for the limited-symptom attacks)
  - 0- Not at all distressing, or no panic or limited-symptom attacks during the past week
  - 1- Mildly distressing (not too intense)
  - 2- Moderately distressing (intense, but still manageable)
  - 3- Severely distressing (very intense)
  - 4- Extremely distressing (extreme distress during all attacks)
3. During the past week, how much have you worried or felt anxious about when your next panic attack would occur, or other fears related to the attacks (for example, that they could mean you have physical or mental health problems or could cause you social embarrassment)?
  - 0- Not at all
  - 1- Occasionally or only mildly
  - 2- Frequently or moderately
  - 3- Very often or to a very disturbing degree
  - 4- Nearly constantly and to a disabling extent
4. During the past week, were there any places or situations (e.g. public transportation, movie theaters, crowds, bridges, tunnels, shopping malls, being alone) you avoided, or felt afraid of (uncomfortable in, wanted to avoid or leave), because of fear of having a panic attack? Are there any other situations that you would have avoided or been afraid of if they had come up during the week, for the same reason? If yes to either question, please rate your level of fear and avoidance this past week.



- 0- *None: No fear or avoidance*
  - 1- *Mild: Occasional fear and/or avoidance, but I could usually confront or endure the situation. There was little or no modification of my lifestyle due to this.*
  - 2- *Moderate: Noticeable fear and/or avoidance, but still manageable. I avoided some situations but I could confront them with a companion. There was some modification of my lifestyle because of this, but my overall functioning was not impaired*
  - 3- *Severe: Extensive avoidance. Substantial modification of my lifestyle was required to accommodate the avoidance, making it difficult to manage usual activities*
  - 4- *Extensive: Pervasive disabling fear and/or avoidance. Extensive modification in my lifestyle was required, such that important tasks were not performed*
5. During the past week, were there any activities (e.g. physical exertion, taking a hot shower or bath, drinking coffee, watching an exciting or scary movie) that you avoided, or felt afraid of (uncomfortable doing, wanted to avoid or stop), because they cause physical sensations like those you feel during panic attacks or that you were afraid might trigger a panic attack? Are there any other activities that you would have avoided or been afraid of if they had come during the week, for that reason? If yes to either question, please rate your level of fear and avoidance of those activities this past week
- 0- *No fear or avoidance of situations or activities because of distressing physical sensations*
  - 1- *Mild: Occasional fear and/or avoidance, but usually I could confront or endure with little distress activities that cause physical sensations. There was little modification of my lifestyle due to this*
  - 2- *Moderate: Noticeable avoidance, but still manageable. There was definite, but limited, modification of my lifestyle, such that my overall functioning was not impaired*
  - 3- *Severe: Extensive avoidance. There was substantial modification of my lifestyle or interference in my functioning*
  - 4- *Extensive: Pervasive and disabling avoidance. There was extensive modification in my lifestyle due to this, such that important tasks or activities were not performed*
6. During the past week, how much did the above symptoms altogether (panic and limited-symptom attacks, worry about attacks and fear of situations and activities because of attacks) interfere with your ability to work, go to school, or carry out your responsibilities at home? (If your work or home responsibilities were less than usual this past week, answer how you think you would have done if the responsibilities had been usual)
- 0- *No interference with work or home responsibilities*
  - 1- *Slight interference with work or home responsibilities, but I could do nearly everything I could do if I didn't have these problems*
  - 2- *Significant interference with work or home responsibilities, but I still could manage to do the things I needed to do*
  - 3- *Substantial impairment in work or home responsibilities; there were many important things I couldn't do because of these problems*
  - 4- *Extreme, incapacitating impairment, such that I was essentially unable to manage any work or home responsibilities*
7. During the past week, how much did panic and limited-symptoms attacks, worry about attacks, and fear of situations and activities because of attacks, interfere with your social life? (If you didn't have any opportunities to socialise this past week, answer how you think you would have done if you did have opportunities)
- 0- *No interference*
  - 1- *Slight interference with social activities, but I could do nearly everything I could do if I didn't have these problems*
  - 2- *Significant interference with social activities, but I could manage to do more things if I made the effort*
  - 3- *Substantial impairment in social activities; there are many social things I couldn't do because of these problems*
  - 4- *Extreme, incapacitating, impairment, such that there was hardly anything social I could do*

## BODY SENSATIONS Questionnaire – ADAPTED

Below is a list of specific body sensations that may occur when you are nervous or in a feared situation. **Please mark down how worried or afraid you are of these feelings.**

1. Heart beating fast or skipping a beat	Not at all	Slightly	Moderately	Very	Extremely
2. Pressure or a heavy feeling in my chest	Not at all	Slightly	Moderately	Very	Extremely
3. Numbness in my arms or legs	Not at all	Slightly	Moderately	Very	Extremely
4. Tingling in my fingertips	Not at all	Slightly	Moderately	Very	Extremely
5. Numbness in another part of my body	Not at all	Slightly	Moderately	Very	Extremely
6. Feeling short of breath	Not at all	Slightly	Moderately	Very	Extremely
7. Dizziness	Not at all	Slightly	Moderately	Very	Extremely
8. Blurred or distorted vision	Not at all	Slightly	Moderately	Very	Extremely
9. Feeling sick or nauseous	Not at all	Slightly	Moderately	Very	Extremely
10. Having 'butterflies' in my stomach	Not at all	Slightly	Moderately	Very	Extremely
11. Feeling a knot in my stomach	Not at all	Slightly	Moderately	Very	Extremely
12. Having a lump in my throat	Not at all	Slightly	Moderately	Very	Extremely
13. Wobbly or jelly legs	Not at all	Slightly	Moderately	Very	Extremely
14. Sweating	Not at all	Slightly	Moderately	Very	Extremely
15. A dry throat	Not at all	Slightly	Moderately	Very	Extremely
16. Feeling disoriented and confused	Not at all	Slightly	Moderately	Very	Extremely
17. Feeling disconnected from my body	Not at all	Slightly	Moderately	Very	Extremely
Other (please describe)					
	Not at all	Slightly	Moderately	Very	Extremely
	Not at all	Slightly	Moderately	Very	Extremely
	Not at all	Slightly	Moderately	Very	Extremely

## ACQ - ADAPTED

This questionnaire has two parts. Below are some thoughts or ideas that may go through your mind when you are nervous or frightened.

- a. Indicate how often each thought occurs when you are nervous; rate each thought from 1-5 using the scale below; put your rating on the **LEFT** hand side of each item.
1. Thought never occurs
  2. Thought rarely occurs
  3. Thought occurs during half of the times when I am nervous
  4. Thought usually occurs
  5. Thought always occurs when I am nervous
- b. When you have the symptoms of panic, how much would you believe each of these thoughts to be true? Rate each thought by choosing a number from 0-100% (see the scale below), and put the number which applies on the line on the **RIGHT** hand side of the form.

0	10	20	30	40	50	60	70	80	90	100
I do not believe this thought at all										I am completely convinced this thought is true

	<b>a. How often do you have this thought? (Rate from 1- 5)</b>		<b>b. How much do you believe this thought? (Rate from 0-100%)</b>
1)	___	I am going to be sick	___ %
2)	___	I am going to pass out	___ %
3)	___	I must have a brain tumour	___ %
4)	___	I will have a heart attack	___ %
5)	___	I will choke to death	___ %
6)	___	I will look silly	___ %
7)	___	I am going blind	___ %
8)	___	I will not be able to control myself	___ %
9)	___	I will lose control of my bladder or bowels	___ %
10)	___	I will hurt someone	___ %
11)	___	I am going to have a stroke	___ %
12)	___	I am going to go crazy	___ %
13)	___	I am going to scream	___ %
14)	___	I am going to babble or talk funny	___ %
15)	___	I will be paralysed with fear	___ %
16)	___	I am about to die	___ %
17)	___	I am seriously ill	___ %
18)	___	I am going to suffocate	___ %
		Other ideas not listed (please describe and rate):	

_____	_____	_____ %
_____	_____	_____ %
_____	_____	_____ %

## Safety Behaviours Questionnaire - ADAPTED

When you are at your most anxious or panicky, how often do you do the following things:

1. Try to think about other things	Never	Sometimes	Often	Always
2. Hold on to or lean on to something	Never	Sometimes	Often	Always
3. Hold on or lean on to someone	Never	Sometimes	Often	Always
4. Sit down	Never	Sometimes	Often	Always
5. Keep still	Never	Sometimes	Often	Always
6. Move very slowly	Never	Sometimes	Often	Always
7. Look for an escape route	Never	Sometimes	Often	Always
8. Avoid doing physical exercise	Never	Sometimes	Often	Always
9. Focus on what is going on in my body	Never	Sometimes	Often	Always
10. Try to keep control of my mind	Never	Sometimes	Often	Always
11. Try to keep tight control over my behaviour	Never	Sometimes	Often	Always
12. Talk more	Never	Sometimes	Often	Always
13. Use tablets/liquids/scents to reduce my physical sensations	Never	Sometimes	Often	Always
14. Ask people around for help	Never	Sometimes	Often	Always
15. Change my breathing	Never	Sometimes	Often	Always
16. Carry or drink water	Never	Sometimes	Often	Always
<b>Please list other things you do when anxious/panicky</b>				
17.	Never	Sometimes	Often	Always
18.	Never	Sometimes	Often	Always
19.	Never	Sometimes	Often	Always

## THE MOBILITY INVENTORY - AMENDED

Please indicate the degree to which you avoid the following places or situations because of discomfort or anxiety. Rate your amount of avoidance when you are with someone you trust (e.g., parent or friend) and when you are alone. If situations do not apply to you please select 'not applicable'.

Cinemas	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Supermarkets	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Classrooms	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
School	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Shops	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Restaurants	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Museums	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Lifts	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Arenas/stadiums	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Car parks	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
High places	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Enclosed spaces (e.g. tunnels)	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Open spaces outside (e.g. fields, wide streets)	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Open spaces inside (e.g. large rooms, lobbies)	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Going on buses	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Going on trains	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable

	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Going on underground/tubes	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Going on aeroplanes	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Going on boats	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Going in (or driving) a car at any time	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Going in (or driving) a car on motorways	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Standing in lines	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Crossing bridges	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Parties or social events	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Walking along a street	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Staying at home alone		Never	Rarely	Sometimes	Mostly	Always	Not applicable
Being far away from home	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Doing P.E.	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Going swimming	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
Other (specify)							
	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	a. Accompanied	Never	Rarely	Sometimes	Mostly	Always	Not applicable
	b. Alone	Never	Rarely	Sometimes	Mostly	Always	Not applicable

## REVISED CHILDREN'S ANXIETY AND DEPRESSION SCALE (RCADS)

**Please select the word that shows how often each of these things happen to you. There are no right or wrong answers.**

1. I worry about things	Never	Sometimes	Often	Always
2. I feel sad or empty	Never	Sometimes	Often	Always
3. When I have a problem, I get a funny feeling in my stomach	Never	Sometimes	Often	Always
4. I worry when I think I have done poorly at something	Never	Sometimes	Often	Always
5. I would feel afraid of being on my own at home	Never	Sometimes	Often	Always
6. Nothing is much fun anymore	Never	Sometimes	Often	Always
7. I feel scared when I have to take a test	Never	Sometimes	Often	Always
8. I feel worried when I think someone is angry with me	Never	Sometimes	Often	Always
9. I worry about being away from my parents	Never	Sometimes	Often	Always
10. I get bothered by bad or silly thoughts or pictures in my mind	Never	Sometimes	Often	Always
11. I have trouble sleeping	Never	Sometimes	Often	Always
12. I worry that I will do badly at my school work	Never	Sometimes	Often	Always
13. I worry that something awful will happen to someone in my family	Never	Sometimes	Often	Always
14. I suddenly feel as if I can't breathe when there is no reason for this	Never	Sometimes	Often	Always
15. I have problems with my appetite	Never	Sometimes	Often	Always
16. I have to keep checking that I have done things right (like the switch is off, or the door is locked)	Never	Sometimes	Often	Always
17. I feel scared if I have to sleep on my own	Never	Sometimes	Often	Always
18. I have trouble going to school in the mornings because I feel nervous or afraid	Never	Sometimes	Often	Always
19. I have no energy for things	Never	Sometimes	Often	Always
20. I worry I might look foolish	Never	Sometimes	Often	Always
21. I am tired a lot	Never	Sometimes	Often	Always
22. I worry that bad things will happen to me	Never	Sometimes	Often	Always
23. I can't seem to get bad or silly thoughts out of my head	Never	Sometimes	Often	Always
24. When I have a problem, my heart beats really fast	Never	Sometimes	Often	Always
25. I cannot think clearly	Never	Sometimes	Often	Always



26. I suddenly start to tremble or shake when there is no reason for this	Never	Sometimes	Often	Always
27. I worry that something bad will happen to me	Never	Sometimes	Often	Always
28. When I have a problem, I feel shaky	Never	Sometimes	Often	Always
29. I feel worthless	Never	Sometimes	Often	Always
30. I worry about making mistakes	Never	Sometimes	Often	Always
31. I have to think of special thoughts (like numbers or words) to stop bad things from happening	Never	Sometimes	Often	Always
32. I worry what other people think of me	Never	Sometimes	Often	Always
33. I am afraid of being in crowded places (like shopping centres, the cinema, buses, busy playgrounds)	Never	Sometimes	Often	Always
34. All of a sudden I feel really scared for no reason at all	Never	Sometimes	Often	Always
35. I worry about what is going to happen	Never	Sometimes	Often	Always
36. I suddenly become dizzy or faint when there is no reason for this	Never	Sometimes	Often	Always
37. I think about death	Never	Sometimes	Often	Always
38. I feel afraid if I have to talk in front of my class	Never	Sometimes	Often	Always
39. My heart suddenly starts to beat too quickly for no reason	Never	Sometimes	Often	Always
40. I feel like I don't want to move	Never	Sometimes	Often	Always
41. I worry that I will suddenly get a scared feeling when there is nothing to be afraid of	Never	Sometimes	Often	Always
42. I have to do some things over and over again (like washing my hands, cleaning or putting things in a certain order)	Never	Sometimes	Often	Always
43. I feel afraid that I will make a fool of myself in front of people	Never	Sometimes	Often	Always
44. I have to do some things in just the right way to stop bad things from happening	Never	Sometimes	Often	Always
45. I worry when I go to bed at night	Never	Sometimes	Often	Always
46. I would feel scared if I had to stay away from home overnight	Never	Sometimes	Often	Always
47. I feel restless	Never	Sometimes	Often	Always

## Appendix 10: Study Debrief

### DEBRIEF

You have now completed all the questions.

Please **carefully read** the following information (**and don't forget to click SUBMIT at the bottom of the page!**):

Your second participant ID number is **INSERT ID NUMBER**. Please make a note of it.

This study was interested in looking at how teenagers experience panic. By taking part in this study you are helping us to better understand what happens to teenagers when they experience panic. The findings will be used to help to improve treatment for teenagers who experience difficulties with panic in the future.

If answering the questions has caused you any concern please do not hesitate to contact us.

Please telephone or email Polly Waite, the Principal Researcher on -

If you feel you need to seek support around your mental health -

The National Institute for Health and Care Excellence (NICE) Guidelines state that Cognitive Behavioural Therapy (CBT) is the most effective treatment for anxiety disorders in young people (and adults) and therefore recommends it as the first line treatment.

You can seek support via your GP or school nurse and they will be able to refer you to the appropriate local services for further help. There are also many websites where you might find useful information, for instance:

<https://research.reading.ac.uk/andy/>

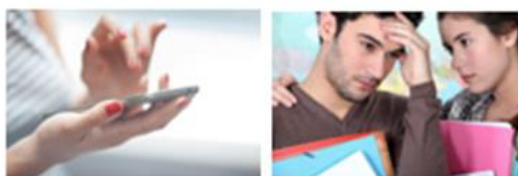
<https://youngminds.org.uk>

<https://www.mind.org.uk>

<https://www.nopanic.org.uk>

<https://www.childline.org.uk>

<http://www.themix.org.uk>



**For taking part, you can now enter a prize draw for a chance to win a £50 Amazon voucher. If you are under 16, your parent should have provided online consent for you to enter the prize draw. To enter, please use the link below and provide your name and preferred email address. A member of the research team will contact you by email if you are the winner.**

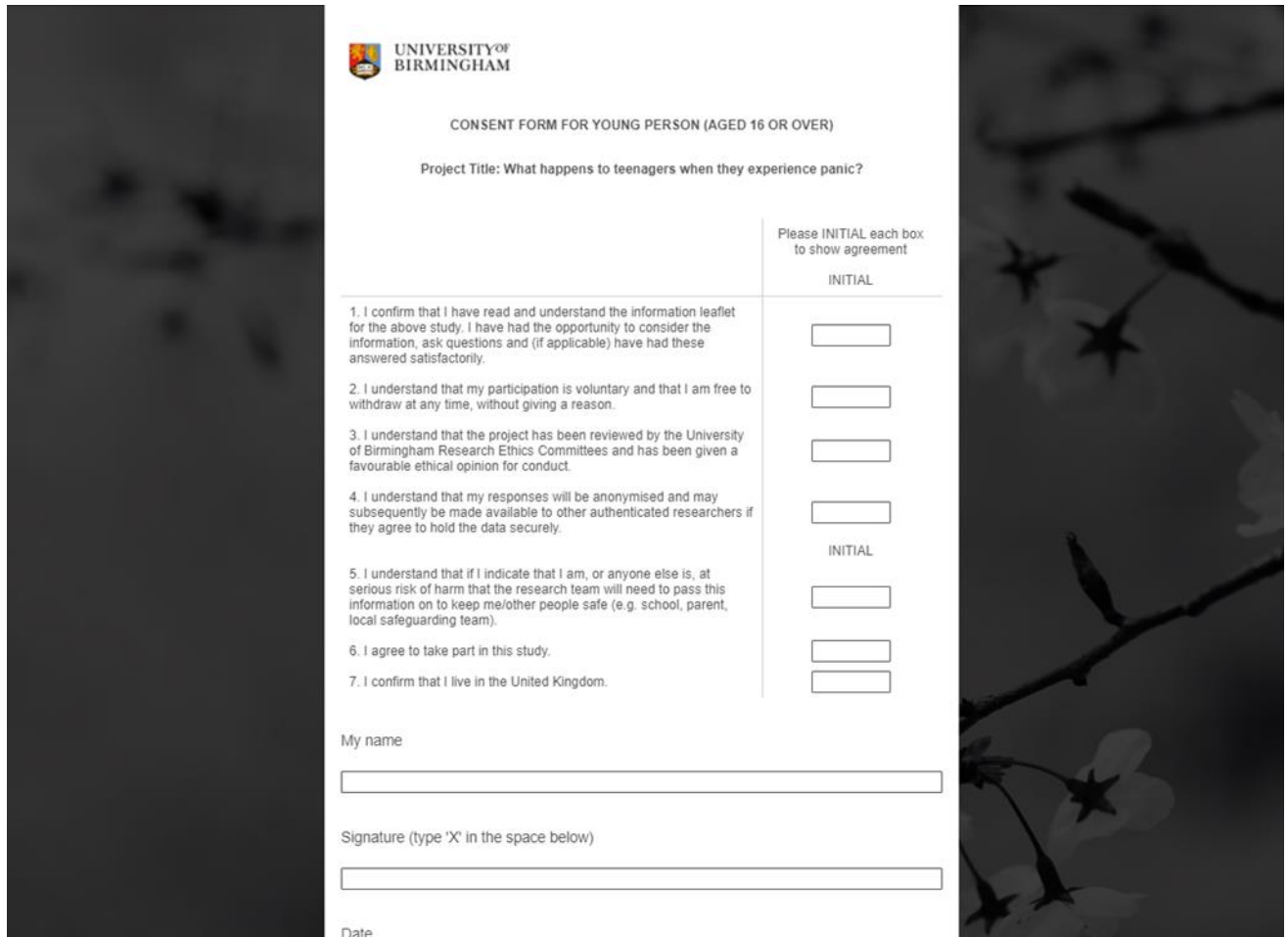
**Good luck!**


**[LINK TO PRIZE DRAW PAGE].**

**Thank you for taking part in this study. CLICK SUBMIT WHEN YOU ARE READY.**

## Appendix 11: Qualtrics Survey

Screenshot of Consent Form for Young Person:



 UNIVERSITY OF BIRMINGHAM

CONSENT FORM FOR YOUNG PERSON (AGED 16 OR OVER)

Project Title: What happens to teenagers when they experience panic?

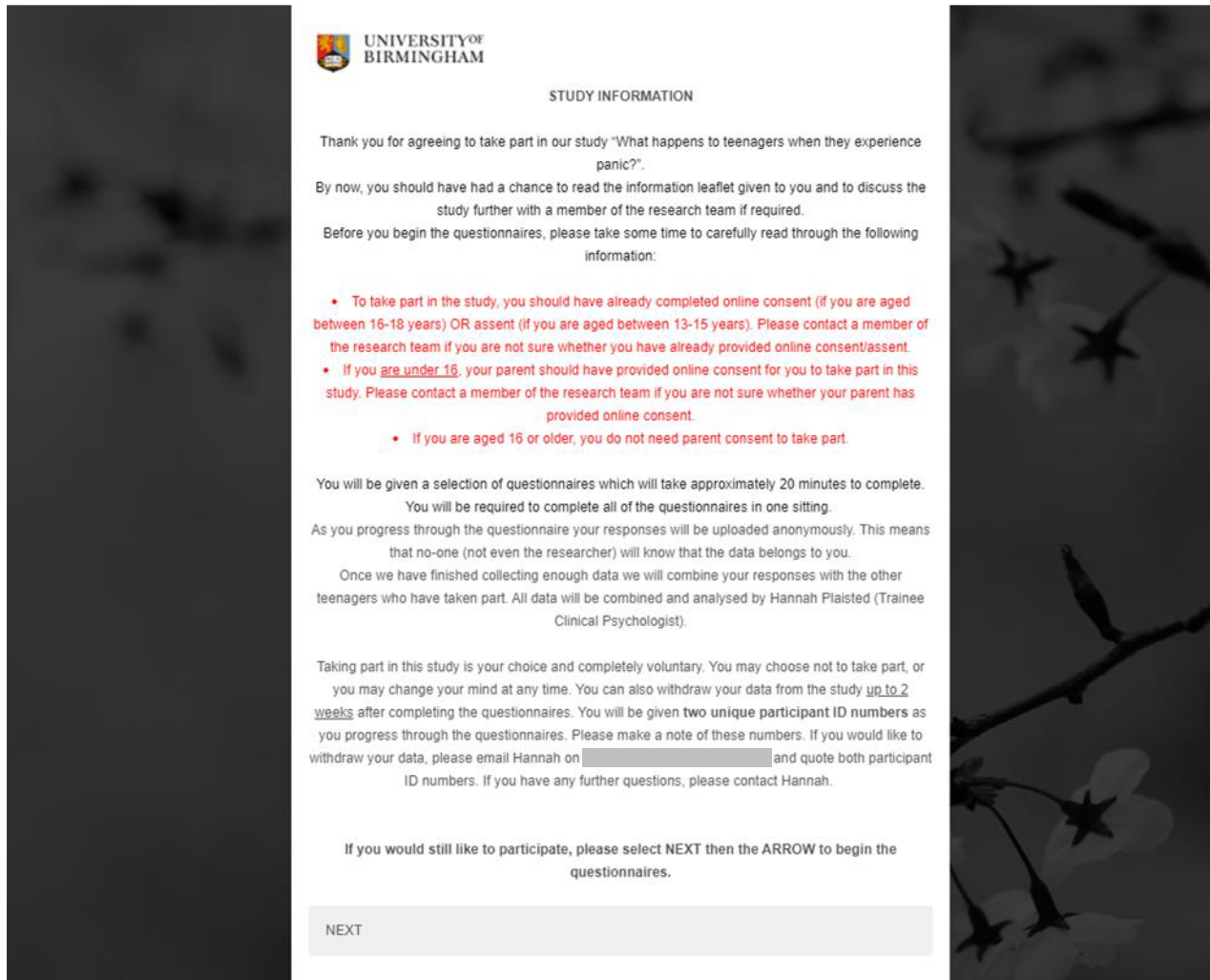
	Please INITIAL each box to show agreement
	INITIAL
1. I confirm that I have read and understand the information leaflet for the above study. I have had the opportunity to consider the information, ask questions and (if applicable) have had these answered satisfactorily.	<input type="text"/>
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason.	<input type="text"/>
3. I understand that the project has been reviewed by the University of Birmingham Research Ethics Committees and has been given a favourable ethical opinion for conduct.	<input type="text"/>
4. I understand that my responses will be anonymised and may subsequently be made available to other authenticated researchers if they agree to hold the data securely.	<input type="text"/>
	INITIAL
5. I understand that if I indicate that I am, or anyone else is, at serious risk of harm that the research team will need to pass this information on to keep me/other people safe (e.g. school, parent, local safeguarding team).	<input type="text"/>
6. I agree to take part in this study.	<input type="text"/>
7. I confirm that I live in the United Kingdom.	<input type="text"/>


My name

Signature (type 'X' in the space below)

Date

## Screenshot of Study Information:



 UNIVERSITY OF BIRMINGHAM

STUDY INFORMATION

Thank you for agreeing to take part in our study "What happens to teenagers when they experience panic?".

By now, you should have had a chance to read the information leaflet given to you and to discuss the study further with a member of the research team if required.

Before you begin the questionnaires, please take some time to carefully read through the following information:

- To take part in the study, you should have already completed online consent (if you are aged between 16-18 years) OR assent (if you are aged between 13-15 years). Please contact a member of the research team if you are not sure whether you have already provided online consent/assent.
- If you are under 16, your parent should have provided online consent for you to take part in this study. Please contact a member of the research team if you are not sure whether your parent has provided online consent.
- If you are aged 16 or older, you do not need parent consent to take part.

You will be given a selection of questionnaires which will take approximately 20 minutes to complete. You will be required to complete all of the questionnaires in one sitting.

As you progress through the questionnaire your responses will be uploaded anonymously. This means that no-one (not even the researcher) will know that the data belongs to you.

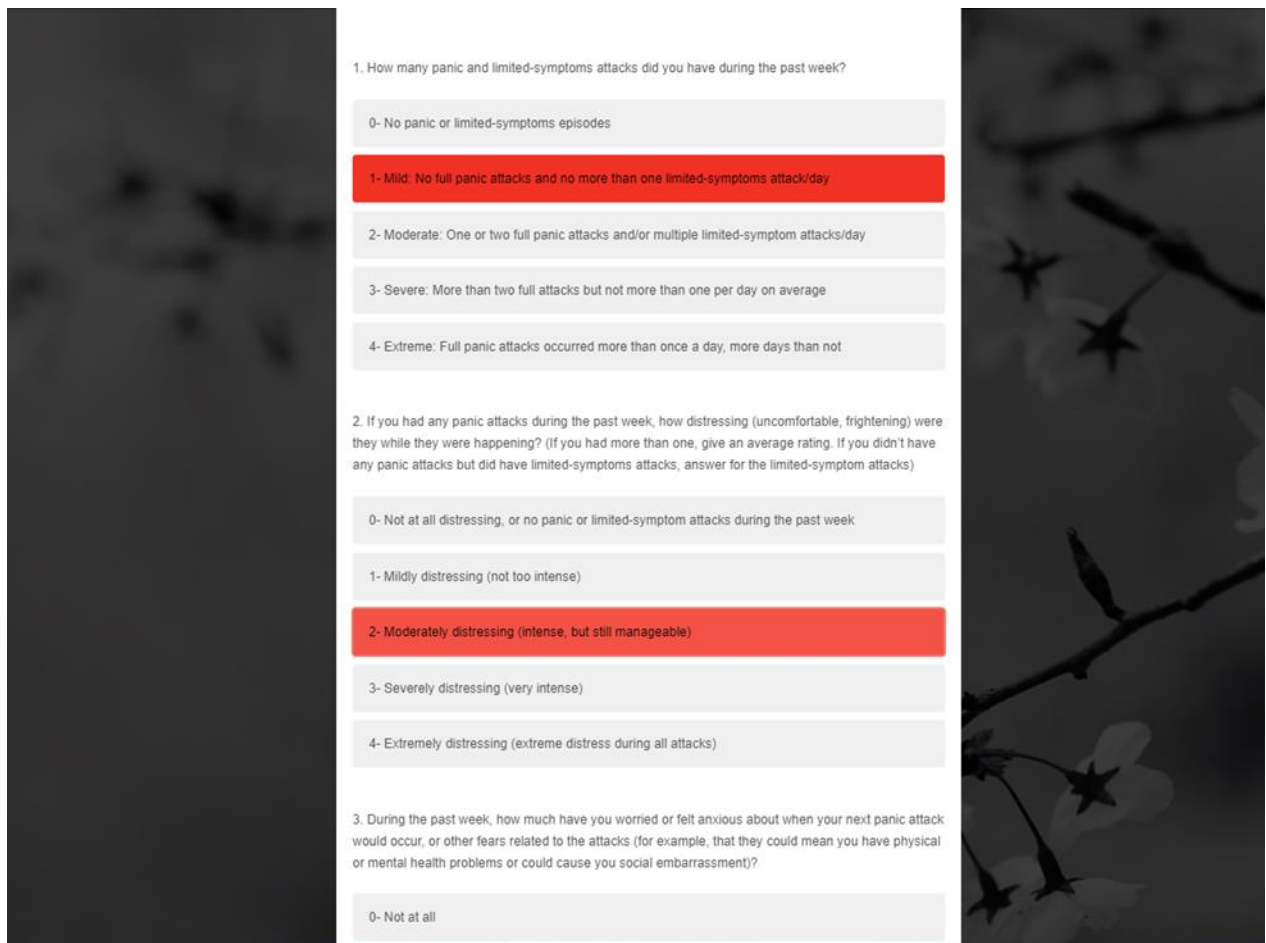
Once we have finished collecting enough data we will combine your responses with the other teenagers who have taken part. All data will be combined and analysed by Hannah Plaisted (Trainee Clinical Psychologist).

Taking part in this study is your choice and completely voluntary. You may choose not to take part, or you may change your mind at any time. You can also withdraw your data from the study up to 2 weeks after completing the questionnaires. You will be given **two unique participant ID numbers** as you progress through the questionnaires. Please make a note of these numbers. If you would like to withdraw your data, please email Hannah on [redacted] and quote both participant ID numbers. If you have any further questions, please contact Hannah.

If you would still like to participate, please select NEXT then the ARROW to begin the questionnaires.

NEXT

## Screenshot of PDSS-C Questionnaire:



1. How many panic and limited-symptoms attacks did you have during the past week?

- 0- No panic or limited-symptoms episodes
- 1- Mild: No full panic attacks and no more than one limited-symptoms attack/day**
- 2- Moderate: One or two full panic attacks and/or multiple limited-symptom attacks/day
- 3- Severe: More than two full attacks but not more than one per day on average
- 4- Extreme: Full panic attacks occurred more than once a day, more days than not

2. If you had any panic attacks during the past week, how distressing (uncomfortable, frightening) were they while they were happening? (If you had more than one, give an average rating. If you didn't have any panic attacks but did have limited-symptoms attacks, answer for the limited-symptom attacks)

- 0- Not at all distressing, or no panic or limited-symptom attacks during the past week
- 1- Mildly distressing (not too intense)
- 2- Moderately distressing (intense, but still manageable)**
- 3- Severely distressing (very intense)
- 4- Extremely distressing (extreme distress during all attacks)

3. During the past week, how much have you worried or felt anxious about when your next panic attack would occur, or other fears related to the attacks (for example, that they could mean you have physical or mental health problems or could cause you social embarrassment)?

- 0- Not at all

## Screenshot of BSQ:

Questionnaire 2 of 6

**BODY SENSATIONS Questionnaire – ADAPTED**

Below is a list of specific body sensations that may occur when you are nervous or in a feared situation.

**Please mark down how worried or afraid you are of these feelings.**

	How worried or afraid you are of these feelings				
	Not at all	Slightly	Moderately	Very	Extremely
Heart beating fast or skipping a beat	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pressure or a heavy feeling in my chest	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Numbness in my arms or legs	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tingling in my fingertips	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Numbness in another part of my body	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling short of breath	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Dizziness	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Blurred or distorted vision	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling sick or nauseous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Having 'butterflies' in my stomach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling a knot in my stomach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having a lump in my throat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wobbly or jelly legs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A dry throat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling disoriented and confused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling disconnected from my body	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please describe)					

## Appendix 12: SPSS Output

### Descriptives:

Descriptive Statistics										
	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness		Kurtosis	
Age	131	5.00	13.00	18.00	15.7863	1.19620	-.892	.212	.225	.420
Total_anx_depression	131	160.00	5.00	165.00	66.7481	34.14614	.241	.212	-.689	.420
PDSS	131	23.00	.00	23.00	6.0229	5.43842	.759	.212	-.303	.420
ACQ	131	2.78	1.00	3.78	1.9211	.60842	.747	.212	.050	.420
BSQ	131	3.47	1.00	4.47	2.4055	.76154	.067	.212	-.616	.420
SBQ	131	2.19	.00	2.19	1.2123	.48336	-.360	.212	.004	.420
MI_total	131	2.73	1.00	3.73	2.0416	.68034	.529	.212	-.409	.420
Valid N (listwise)	131									

### Normality:

Tests of Normality						
	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Age	.327	131	.000	.837	131	.000
Total_anx_depression	.088	131	.015	.975	131	.016
PDSS	.139	131	.000	.904	131	.000
ACQ	.094	131	.007	.946	131	.000
BSQ	.078	131	.047	.983	131	.093
SBQ	.062	131	.200 <sup>*</sup>	.981	131	.071
MI_total	.107	131	.001	.960	131	.001

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Non-parametric questionnaire descriptives between assessment phase:

Ranks				
	Phase	N	Mean Rank	Sum of Ranks
ACQ	Phase 1	78	62.37	4864.50
	Phase 2	53	71.35	3781.50
	Total	131		
BSQ	Phase 1	78	62.91	4907.00
	Phase 2	53	70.55	3739.00
	Total	131		
SBQ	Phase 1	78	61.58	4803.00
	Phase 2	53	72.51	3843.00
	Total	131		
MI_total	Phase 1	78	58.35	4551.50
	Phase 2	53	77.25	4094.50
	Total	131		

Mann-Whitney U comparing questionnaire scores by assessment phase:

Test Statistics <sup>a</sup>				
	ACQ	BSQ	SBQ	MI_total
Mann-Whitney U	1783.500	1826.000	1722.000	1470.500
Wilcoxon W	4864.500	4907.000	4803.000	4551.500
Z	-1.330	-1.131	-1.619	-2.797
Asymp. Sig. (2-tailed)	.183	.258	.105	.005

a. Grouping Variable: Phase



## Correlations:

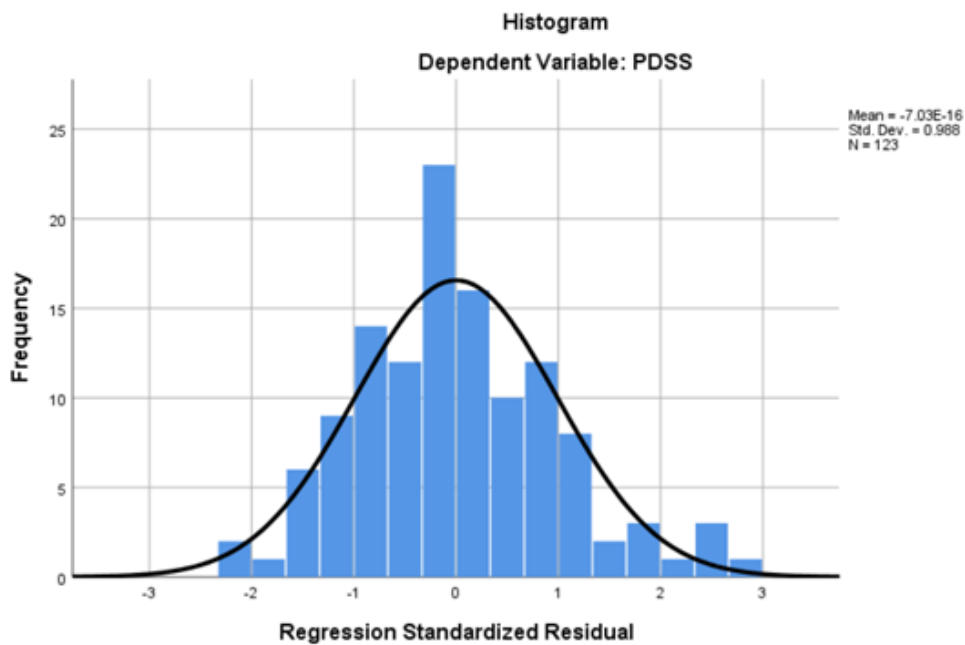
Correlations			Age	PDSS	ACQ	BSQ	SBQ
Spearman's rho	Age	Correlation Coefficient	1.000	-.005	.092	.192*	.129
		Sig. (2-tailed)	.	.955	.295	.028	.141
		N	131	131	131	131	131
	PDSS	Correlation Coefficient	-.005	1.000	.739**	.672**	.547**
		Sig. (2-tailed)	.955	.	.000	.000	.000
		N	131	131	131	131	131
	ACQ	Correlation Coefficient	.092	.739**	1.000	.741**	.621**
		Sig. (2-tailed)	.295	.000	.	.000	.000
		N	131	131	131	131	131
	BSQ	Correlation Coefficient	.192*	.672**	.741**	1.000	.589**
		Sig. (2-tailed)	.028	.000	.000	.	.000
		N	131	131	131	131	131
	SBQ	Correlation Coefficient	.129	.547**	.621**	.589**	1.000
		Sig. (2-tailed)	.141	.000	.000	.000	.
		N	131	131	131	131	131

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

## Regression Assumptions<sup>6</sup>

### Normally Distributed Residuals:



### Outliers by Distance:

Residuals Statistics <sup>a</sup>					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-1.2646	15.5277	5.8943	4.00365	123
Std. Predicted Value	-1.788	2.406	.000	1.000	123
Standard Error of Predicted Value	.350	1.045	.645	.172	123
Adjusted Predicted Value	-1.3445	15.8335	5.8942	4.01477	123
Residual	-8.09332	10.42442	.00000	3.65305	123
Std. Residual	-2.188	2.818	.000	.988	123
Stud. Residual	-2.244	2.852	.000	1.003	123
Deleted Residual	-8.51600	10.67540	.00014	3.76837	123
Stud. Deleted Residual	-2.284	2.942	.002	1.013	123
Mahal. Distance	.099	8.740	2.976	2.088	123
Cook's Distance	.000	.081	.008	.013	123
Centered Leverage Value	.001	.072	.024	.017	123

a. Dependent Variable: PDSS

<sup>6</sup> 8 outliers by distance removed.

### Collinearity:

Coefficients <sup>a</sup>								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-7.971	1.215		-6.559	.000		
	ACQ	4.814	.953	.514	5.050	.000	.368	2.719
	BSQ	1.893	.815	.252	2.324	.022	.325	3.080
	SBQ	.159	1.003	.014	.159	.874	.484	2.068

a. Dependent Variable: PDSS

### Homoscedasticity:

Breusch-Pagan test for Heteroscedasticity (CHI-SQUARE df=P)  
17.584

Significance level of Chi-square df=P (H0:homoscedasticity)  
.0015

Koenker test for Heteroscedasticity (CHI-SQUARE df=P)  
16.177

Significance level of Chi-square df=P (H0:homoscedasticity)  
.0028

## Multiple Linear Regression:

### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.739 <sup>a</sup>	.546	.534	3.69881

a. Predictors: (Constant), SBQ, ACQ, BSQ

b. Dependent Variable: PDSS

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1955.565	3	651.855	47.646	.000 <sup>b</sup>
	Residual	1628.061	119	13.681		
	Total	3583.626	122			

a. Dependent Variable: PDSS

b. Predictors: (Constant), SBQ, ACQ, BSQ

### Bootstrap for Coefficients

Model		B	Bias	Std. Error	Sig. (2-tailed)	Bootstrap <sup>a</sup> 95% Confidence Interval	
						Lower	Upper
1	(Constant)	-7.971	-.013	1.064	.001	-10.297	-5.939
	ACQ	4.814	-.034	.873	.001	3.104	6.582
	BSQ	1.893	.039	.775	.019	.470	3.495
	SBQ	.159	-.010	.919	.865	-1.779	1.918

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples