Headache symptoms consistent with migraine and tension-type headaches in children with anxiety disorders

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A B S T R A C T

Objective: To examine the incidence of headache symptoms consistent with migraine and tension-type headache (TTH) in children with anxiety disorders.

Method: Parents of children with anxiety disorders (n = 27) and children without anxiety disorders (n = 36) completed a headache questionnaire based on the International Classification of Headache Disorders (2nd edition) criteria.

Results: Children with anxiety disorders had a higher incidence of headache symptoms consistent with migraine and TTH compared to children without anxiety disorders. Girls with anxiety disorders and children with separation anxiety disorder had a higher incidence of headaches compared to girls without anxiety disorders and children with other anxiety disorders respectively. Children with anxiety disorders and headaches had higher self-reported anxiety symptom severity compared to children with anxiety disorders without headaches and children without anxiety disorders.

Conclusion: Findings highlight an overlap in anxiety and headaches in children and warrant further research on factors that contribute to the etiology and maintenance of these co-occurring problems.

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1. Introduction

Anxiety disorders are among the most common forms of psychopathology affecting children, with prevalence rates approximating 15–20% (Beesdo, Knappe, & Pine, 2009). Children with anxiety disorders have a heightened risk of developing other forms of psychopathology in later life (Beesdo et al., 2007; Bittner et al., 2007) and also tend to experience poor developmental, social, and educational outcomes (Beesdo-Baum & Knappe, 2012).

There is also a well-established association between anxiety and various somatic and chronic pain complaints among children such as dizziness, nausea, gastrointestinal complaints, musculoskeletal pain and headache (Beidel, Christ, & Long, 1991; Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006; Ginsburg, Riddle, & Davies, 2006; Masi, Favilla, Millepedi, & Mucci, 2000). The co-occurrence of these conditions is linked to greater anxiety severity and impairment (Ginsburg et al., 2006), more cognitive and academic difficulties, and significant social impairment (Dick & Pillai Riddell, 2010; Forgeron et al., 2010; Hughes, Lourea-Waddell, & Kendall, 2008). Although links between anxiety and headache have often been examined in the context of broader associations between anxiety symptomatology and chronic pain, very little research has focused specifically on the incidence of headache among children with anxiety disorders. This is surprising given that headache and anxiety are common problems of childhood (Fuss, Pagé, & Katz, 2011; Rapee, Schniering, & Hudson, 2005), paediatric chronic pain is associated with high risk of anxiety disorders in adolescence and young adulthood (Shelby et al., 2013), and prominent models of paediatric chronic pain conceptualise these conditions in terms of anxiety-related constructs, such as the perception of pain as threatening, catastrophic thinking, pain-related fear, and avoidance behaviour (see Asmundson, Noel, Petter, & Parkerson, 2012; Simons & Kaczynski, 2012). Moreover, several theorists highlight the commonality of mechanisms that underlie anxiety and chronic pain, such as commonality in neurocircuitry and neurophysiology, fear conditioning and stress-induced analgesia (Katz, Pagé, Fashler, Rosenblum, & Asmundson, 2014). Therefore, the aim of the present project was to examine the incidence of headaches among children with anxiety disorders.

The Headache Classification Subcommittee of the International Headache Society (IHS, 2004, p. 150) defines headache as “pain located above the orbitomeatal line”. This pain can often be accompanied by symptoms including sensitivity to light (photophobia) and sound (phonophobia), nausea, vomiting, and light-headedness.

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primary headache disorders constitute a heterogeneous group of neurologic disorders producing recurrent head pain with no identifiable organic cause (Robbins & Lipton, 2010). Primary headache disorders can therefore be considered chronic conditions in that they continue to recur over an extended period (International Association for the Study of Pain, Subcommittee on Taxonomy, 1986).

The International Classification of Headache Disorders (ICHD; IHS, 1988) was developed in order to define and classify headaches in a more standardized and scientifically rigorous manner. The ICHD adopts a symptom-based approach to classifying primary headache disorders and categorises them into four major types: migraine, tension-type headache (TTH), trigeminal autonomic cephalalgias, and other primary headaches. While prevalence rates vary across studies, there is a consensus for higher prevalence rates of TTH (31%) than migraine (7%) (i.e., Stovner et al., 2007), while the remainder of the primary headache disorders are uncommon (0.1–0.9% of the general population) (Lewis, Gozzo, & Avner, 2005).

Population-based studies with adults find that migraine is associated with an increased one-year prevalence rate of anxiety disorders (31.2%) compared to healthy adults (14.1%) (Merikangas, Angst, & Isler, 1990), and a higher rate (7.8%) of anxiety disorders in adults with non-migraine headaches (including TTH) compared to adults who were headache-free (3%) (Zwart et al., 2003). Furthermore, notable associations have been found between primary headache disorders and panic and phobia disorders in adults. Merikangas et al. (1990) reported that adults with primary headache disorders had higher rates of phobias (16.4%) compared to healthy adults (8.8%) and Beghi et al. (2010) reported that the occurrence of panic disorder was greater in headache patients with migraine (12.7%) than in patients with TTH (5.5%). Conversely, two-thirds of adults with panic disorder also met criteria for a primary headache disorder (Marazziti et al., 1999).

Large community studies with children have found strong associations between migraine and TTH and higher internalising symptoms (including anxiety), whereby associations were stronger for migraine than for TTH (Anttila et al., 2004; Arruda & Bigal, 2012; Kroner-Herwig & Gassmann, 2012). Similarly, children with primary headache disorders had significantly higher anxiety symptoms than healthy children; however, in contrast to community studies, significant differences in anxiety symptoms between children with migraine or TTH were not found in these clinical studies (Balottini, Poli, Termine, Molteni, & Galli, 2012; Galli et al., 2007; Just et al., 2003; Margari et al., 2013; Mazzone, Vitiello, Incorpora, & Mazzone, 2005).

Considerably fewer studies have examined the co-occurrence of primary headache disorders and anxiety disorders in children. A study sampling 16 children and adolescents with TTH found that 60% (i.e., 10 children) had co-occurring psychiatric diagnoses, with anxiety and depressive disorders being the most common (Sarioglu et al., 2003). Additionally, Masi et al. (2000) investigated the occurrence of somatic complaints in children referred to a psychiatric clinic and found that of the 132 children with anxiety and/or depression, 74.3% reported somatic complaints of which headache was the most common (56%).

Livingston et al. (1988) Livingston, Taylor, and Crawford (1988) explored the occurrence of somatic complaints (including headache) in children with various anxiety disorders and found that children with panic or separation anxiety disorder had the largest number of unexplained somatic symptoms when compared to children with other anxiety disorders. Additionally, Last (1991) reported that in a sample of children with psychiatric disorders, 100% of children with panic disorder and 78% of children with separation anxiety disorder reported somatic complaints (including headache), whereas only 43% of children with phobic disorders reported somatic complaints. Several studies have found associations between childhood separation anxiety disorder and panic disorder in adulthood (Roberson-Nay, Eaves, Hettema, Kendler, & Sylberg, 2012; Silove, Manicavasagar, Curtis, & Blaszczynski, 1996). This raises the possibility that the co-occurrence of headaches and separation anxiety disorder in childhood may be a developmentally antecedent of co-occurring headaches and panic disorder that emerges during adolescence and adulthood.

Gender differences in headache characteristics and chronic pain prevalence rates have also been reported in the childhood literature, with pain prevalence rates often higher in girls than boys (King et al., 2011; Slater et al., 2009). Anxiety disorders also tend to be more common among girls than boys (Craske, 2003). Yet, there is a paucity of research on the incidence of headaches among boys and girls with and without anxiety disorders.

Taken together, the findings of previous research suggest an association between anxiety and chronic and recurrent pain in children. In contrast to adult work which finds relatively consistent associations between anxiety disorders and migraine and TTH, and that panic and phobia disorders in particular are associated with primary headache disorders, childhood studies are fewer in number and much of the research has explored either anxiety symptoms and/or anxiety disorders in children with either broad somatic complaints or primary headache disorders in relatively small samples of children. Moreover, variations in sample characteristics, nosology, and case definitions limit direct comparisons between studies (Radat & Swensden, 2004).

The aim of the present study was to examine the relationship between anxiety disorders and headache symptoms in children, using migraine and TTH criteria and the anxiety disorders diagnostic criteria specified in Diagnostic and Statistical Manual for Mental Disorders (DSM; American Psychiatric Association, 2013). We hypothesized that children with anxiety disorders would have a higher incidence of headache symptoms consistent with migraine and TTH. We also hypothesized that children with separation anxiety disorder compared to children in the anxious group but without separation anxiety disorder would have a higher incidence of headache symptoms consistent with migraine and TTH. We also examined whether anxiety symptom severity was associated with a higher incidence of headache symptoms consistent with migraine and TTH.

2. Method

2.1. Participants

Sixty-three children (30 girls and 33 boys) with a mean age of 8.26 years (SD = 2.06 years) and their parents participated in this study.

2.1.1. Anxious group

Participants in the anxious group comprised 27 children with anxiety disorders (11 girls and 16 boys) with a mean age of 8.59 years (SD = 1.97 years) whose parents (93% mothers) contacted the Griffith University Child Anxiety Disorders Research Program following advertisements in school newsletters, local newspapers, and general practitioners and other child health professionals. All children were treatment-seeking but none were receiving treatment at the time of assessment. Children were included in this group only if they received an Anxiety Disorders Interview Schedule: Child/Parent Versions (ADIS-IV-C/P) clinical severity rating (CSR) of 4 or higher for a principal (i.e., most severe) anxiety disorder diagnosis. Children with a developmental disorder, principal externalising disorder, or a headache disorder with identified origins (e.g., head injury) were excluded. Children with a comorbid depressive disorder (n = 3) were retained due to the high comor-
Table 1
Distribution of principal and co-occurring anxiety disorder diagnoses.

<table>
<thead>
<tr>
<th>Anxiety Disorder</th>
<th>Principal (n = 27)</th>
<th>Co-occurring (n = 23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalised anxiety disorder</td>
<td>9 (33%)</td>
<td>19 (70%)</td>
</tr>
<tr>
<td>Social phobia</td>
<td>6 (22%)</td>
<td>17 (63%)</td>
</tr>
<tr>
<td>Specific phobia</td>
<td>6 (22%)</td>
<td>17 (63%)</td>
</tr>
<tr>
<td>Separation anxiety disorder</td>
<td>5 (19%)</td>
<td>18 (67%)</td>
</tr>
<tr>
<td>Panic disorder</td>
<td>1 (4%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Obsessive compulsive disorder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttraumatic stress disorder</td>
<td>0</td>
<td>1 (4%)</td>
</tr>
</tbody>
</table>

bidity between anxiety and depression (Kauffman & Charney, 2000).

Table 1 shows the distribution of principal anxiety disorder diagnoses, as well as co-occurring anxiety disorder diagnoses.

2.1.2. Control group

This group comprised children recruited from a local co-educational primary school whose parents (90%) gave written informed consent for their participation. Children were excluded from the control group if they had an anxiety disorder, developmental disorder, or headache disorder of known origin (e.g., head injury). Overall, the control group comprised 36 children (19 girls and 17 boys) with a mean age of 7.92 years (SD = 2.14 years).

2.2. Measures

2.2.1. Anxiety diagnosis

Children and parents completed the Anxiety Disorders Interview Schedule: Child/Parent Versions (Silverman & Albano, 1996), a reliable and well-validated instrument for the assessment of anxiety disorders in children (Lyneham, Abbott, & Rapee, 2007; Silverman, Saavedra, & Pina, 2001; Wood, Piacentini, Bergman, McCracken, & Barrios, 2002). The instrument assesses responses to anxiety-provoking situations (e.g., peer interaction) and respondents rate the severity of symptoms and interference with daily functioning on an eight-point scale from 0 (lowest severity/impairment) to 8 (highest severity/impairment). Ratings from both the parent and child interview schedules are combined to produce a composite CSR which was reviewed during consensus meetings with the research team. Twenty percent of interviews were digitally-recorded and coded by an independent rater blind to children’s diagnostic status. Inter-rater reliability showed excellent agreement for both disorders present and absent (e.g., disorders present: principal diagnosis, 24 = 0.70; second diagnosis, 24 = 0.62; third diagnosis, 24 = 0.68).

2.2.2. Symptom severity

The Spence Children’s Anxiety Scale, Parent and Child Versions (SCAS-P and SCAS-C) were used to measure parent- and child-report anxiety symptom severity. The SCAS-P and SCAS-C each contain six subscales (generalized anxiety, panic and agoraphobia, social phobia, separation anxiety, obsessive compulsive disorder, and physical injury fears) that assess domains of anxiety consistent with the dimensions of the DSM-IV anxiety disorders (Spence, 1998). Both the parent (39 items) and child (44 items) versions require respondents to report how frequently the child experiences a symptom (e.g., “When I have a problem, I feel shaky”) on a four-point response scale from 0 (never) to 3 (always). Both a total score and subscale scores are produced according to the responses. Research supports the reliability and validity of both the child and parent measures (Nauta et al., 2004; Spence, 1998; Spence, Barrett, & Turner, 2003).

2.2.3. Headache symptoms questionnaire

The parent-report of children’s headache symptoms was specifically developed by the research team to assess the ICHD-II criteria for migraine and TTH. Our aim was to focus on headache assessment and classification within the context of a busy paediatric anxiety disorders assessment and treatment program, assessment by a physician and completion of a headache diary (Andrasik & Schwartz, 2006) was beyond the scope of routine care. Thus, we focused on a parent measure of headache symptomatology and presentation (e.g., location, duration, onset, accompanying symptoms, etc.) matched with the ICHD-II criteria for migraine and TTH. As such, we describe the findings in terms of headache symptoms consistent with migraine or TTH in recognition that such symptoms have not been assessed diagnostically by a physician. After an initial screening question (“Has your child had any headaches in the last 3 months?”), the questionnaire is divided into sections assessing the frequency, duration, location, pain characteristics, and symptoms of the child’s headaches. Responses were matched to the ICHD-II criteria for migraine and TTH and the child was deemed to have headache symptoms consistent with these primary headache disorders if the responses satisfied the required criteria. The following sections were utilised for each type of headache:

2.2.3.1. Frequency. Frequency was assessed as follows: “In the last 3 months, how many headaches did your child have in each of those months?” “Did these occur separately on different days throughout the month or more in a cluster of one day or a couple of days?” (Response options: different days/cluster).

2.2.3.2. Duration. Duration was assessed as follows: “What was the usual duration of your child’s headaches in each month (Response options: <1 min, 15–30 min, 30–60 min, 1–2 h, up to 3 h, up to 4 h, up to 5 h, up to 6 h, 6–12 h, up to 1 day, up to 2 days, up to 3 days, up to 4 days, up to 5 days, up to 6 days, up to 7 days, continuous).”

2.2.3.3. Location. Location was assessed as follows: “Where does your child usually feel their headaches?” (Response options: both sides of the head at the same time/one side of the head), and “If on one side of the head, in what region is the headache located?” (Response options: at the front of the head, eye socket region, temple, other).

2.2.3.4. Pain characteristics. Pain was assessed as follows: “What does the pain usually feel like?” (Response options: pressing/tightening, pulsating, other), “What is the usual pain severity of your child’s headaches?” (Response options: mild, moderate, severe), and “Is your child’s headache aggravated by routine physical activity such as walking/coming the stairs?” (Response options: yes/no).

2.2.3.5. Symptoms. The presence (Response options: yes/no), frequency (“How many times in the last three months has your child suffered from these symptoms?”), and duration of associated symptoms (“How long did these symptoms usually last?”) were also assessed. These symptoms included nausea, vomiting, lack of appetite, photophobia and phonophobia, aura symptoms (altered vision, loss of vision, pin and needles, numbness in arms/legs, speech disturbance, motor weakness), and other physical symptoms (inflamed/watery eye, blocked/runny nose, swollen eyelid, forehead/facial sweating, contracted pupil, drooping eyelid, sense of restlessness/ agitation).

Responses were matched to the following ICHD-II criteria for migraine (with and without aura) and TTH, including probable migraine or TTH, defined by the presence of all but one of the ICHD-II criteria (e.g., Arruda & Bigal, 2012; Lanteri-Minet, Valade, Geraud, Chautard, & Lucas, 2005).
2.2.3.6. Migraine without aura. At least five attacks; headache attack lasts 4–72 h; headache has at least two of the following characteristics: unilateral location, pulsating quality, moderate or severe pain intensity, aggravation by routine physical activity; at least one of the following during headache: nausea and/or vomiting, photophobia and phonophobia.

2.2.3.7. Migraine with aura. At least two attacks; aura consisting of at least one of the following: visual symptoms including positive (e.g., spots/lines) and/or negative features (e.g., loss of vision), sensory symptoms including positive (e.g., pins and needles) and/or negative features (e.g., numbness), speech disturbance; at least two of the following: visual symptoms and/or sensory symptoms, aura symptoms develop gradually over ≥5 min, each symptom lasts ≥5 and ≤60 min.

2.2.3.8. TTH. At least ten episodes; headache lasts from 30 min to 7 days; headache has at least two of the following characteristics: bilateral location, pressing/tightening quality, mild or moderate intensity, not aggravated by routine physical activity; both of the following: no nausea or vomiting, no more than one of photophobia or phonophobia.

2.2.4. Demographic information

Sociodemographic variables included the child’s age, gender, country of birth, first language, parents’ marital status, parent occupation and employment status, and other physical health conditions (e.g., asthma).

2.3. Procedure

Families attended the Griffith University Psychology Clinic for anxiety disorders assessment with a trained post-graduate clinical psychologist. Parents completed the headache symptoms questionnaire, the SCAS-P, and the demographic information sheet while children completed the SCAS-C and other assessments within the Griffith University Child Anxiety Disorders Research Program prior to receiving 10 weeks of group-based cognitive-behavioural therapy as part of a larger study. Participants were reimbursed for their time with a $10 gift card. The project was approved by the Griffith University Human Ethics Committee.

2.4. Data analysis

The descriptive statistics of variables were shown as means and standard deviations (SD), frequencies, and percentages. Differences between groups for demographic variables and the incidence of headaches were examined using t-tests and Pearson’s χ² test for independence. Where expected frequencies were below 5, Fisher’s exact test was used. Differences in child- and parent-report anxiety symptom severity between children with and without anxiety disorders and with and without headaches were examined using one-way between subjects ANOVAs and the Welch statistic is reported due to violations in the assumption of homogeneity of variance. These ANOVAs were followed up with post hoc REGWQ tests. All statistical analyses used an alpha level of 0.05 as the cut-off for significance.

3. Results

3.1. Demographic variables

There were no significant differences in any child- or parent-sociodemographic variables between children with and without anxiety disorders (all p > 0.09) (see Table 2).

Table 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Children with anxiety disorders (n = 27)</th>
<th>Children without anxiety disorders (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16 (59.3%)</td>
<td>17 (47.2%)</td>
</tr>
<tr>
<td>Female</td>
<td>11 (40.7%)</td>
<td>19 (52.8%)</td>
</tr>
<tr>
<td>Mean age in years (SD)</td>
<td>8.59 (1.97)</td>
<td>7.92 (2.14)</td>
</tr>
<tr>
<td>Country of birth</td>
<td>26 (96.3%)</td>
<td>33 (91.7%)</td>
</tr>
<tr>
<td>Australia</td>
<td>1 (3.7%)</td>
<td>3 (8.3%)</td>
</tr>
<tr>
<td>First language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>27 (100%)</td>
<td>35 (97.2%)</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>1 (2.8%)</td>
</tr>
<tr>
<td>Other health condition</td>
<td>8 (29.6%)</td>
<td>8 (22.2%)</td>
</tr>
<tr>
<td>Parent marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>20 (74.1%)</td>
<td>31 (86.1%)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (22.2%)</td>
<td>4 (11.2%)</td>
</tr>
<tr>
<td>Mother employed</td>
<td>20 (74.1%)</td>
<td>34 (94.4%)</td>
</tr>
<tr>
<td>Father employed</td>
<td>22 (81.5%)</td>
<td>35 (97.2%)</td>
</tr>
<tr>
<td>Mean parent occupational status (SD)⁶</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>4.13 (0.94)</td>
<td>3.71 (0.86)</td>
</tr>
<tr>
<td>Father</td>
<td>4.17 (1.21)</td>
<td>3.71 (0.90)</td>
</tr>
</tbody>
</table>

⁶ Missing data for children with (n = 1) and without (n = 1) anxiety disorders.
⁷ Parent occupational prestige status: 1 = high to 6 = low (Daniel, 1983).
⁸ Included asthma n = 6; eczema n = 3; constipation n = 1; bed-wetting n = 2; allergies n = 4.

3.2. Incidence of headache symptoms in children with versus without anxiety disorders

Table 3 displays the incidence of headache symptoms consistent with primary headache disorders in children with and without anxiety disorders. Children with anxiety disorders had a significantly higher incidence of headache symptoms consistent with a primary headache disorder than children without anxiety disorders, χ² (1, N = 63) = 6.12, p = 0.01. Moreover, girls with anxiety disorders had a significantly higher incidence of headache symptoms consistent with a primary headache disorder (8/11 girls) than girls without anxiety disorders (4/19 girls), χ² (1, N = 30) = 8.32, p = 0.007; however, boys with and without anxiety disorders did not differ in the incidence of headache symptoms consistent with a primary headache disorder (7/16 anxious boys; 5/17 non-anxious boys), χ² (1, N = 33) = 0.73, p = 0.39. Furthermore, there was a significantly higher incidence of headache symptoms consistent with migraine for children with anxiety disorders compared to children without anxiety disorders, χ² (1, N = 63) = 4.56, p = 0.03. Children with and without anxiety disorders did not differ significantly in the incidence of headache symptoms consistent with TTH, χ² (1, N = 63) = 0.81, p = 0.37.

3.3. Incidence of headache symptoms in separation anxiety disorder versus other anxiety disorders

Children with a diagnosis of separation anxiety disorder (i.e., principal or co-occurring) had a significantly higher incidence of

Table 3

<table>
<thead>
<tr>
<th>Primary headache disorder</th>
<th>Children with anxiety disorders (n = 27)</th>
<th>Children without anxiety disorders (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migraine³</td>
<td>10 (37%)</td>
<td>5 (14%)</td>
</tr>
<tr>
<td>Tension-type headache</td>
<td>7 (26%)</td>
<td>6 (17%)</td>
</tr>
<tr>
<td>Total headache³</td>
<td>15 (56%)⁶</td>
<td>9 (25%)⁶</td>
</tr>
<tr>
<td>Total headache-free</td>
<td>12 (44%)</td>
<td>27 (75%)</td>
</tr>
</tbody>
</table>

³ p < 0.05.
⁶ Co-occurring migraine and TTH in anxious (n = 2) and control (n = 2) groups.
headache symptoms consistent with migraine and TTH than children in the anxious group without a diagnosis of separation anxiety disorder, indicated by Fisher’s exact test, \( p = 0.01 \) (see Fig. 1).

### 3.4. Anxiety symptom severity and headaches in children with versus without anxiety disorders

Table 4 displays the mean SCAS-P and SCAS-C scores for children with anxiety disorders and headaches, children with anxiety disorders only, children with headaches only, and children with neither anxiety disorders nor headaches. There were significant differences between groups for both SCAS-P, \( F(3, 22.86) = 8.94, p < 0.001, \eta^2_p = 0.57 \), and SCAS-C scores, \( F(3, 21.56) = 19.70, p < 0.001, \eta^2_p = 0.46 \).

Post hoc analyses revealed that for child-reports, anxiety symptom severity was significantly higher (\( p < 0.05 \)) in children with both anxiety disorders and headaches compared to children with anxiety disorders only, children with headaches only, and children with neither anxiety disorders nor headaches. Children with anxiety disorders with and without headaches had significantly higher (\( p < 0.05 \)) anxiety symptom severity compared to children without anxiety disorders with or without headaches, according to parents.

### 4. Discussion

To the authors’ knowledge, the present study is the first investigation of the incidence of headaches consistent with primary headache disorders in children with anxiety disorders using a standardised assessment of anxiety disorders and ICHD-II criteria for migraine and TTH. The findings revealed a higher incidence of headaches consistent with these primary headache disorders in children with anxiety disorders compared to children without anxiety disorders. This is consistent with previous research that has documented an association between primary headache disorders and anxiety disorders in adults (Bag et al., 2005; Beghi et al., 2010; Marazziti et al., 1999). This finding also builds upon research that links primary headache disorders and anxiety symptoms in children (Balotin et al., 2012; Galli et al., 2007; Just et al., 2003; Margari et al., 2013; Mazzone et al., 2005).

The finding that children with anxiety disorders had a higher incidence of headaches consistent with migraine but not TTH is consistent with some prior findings for migraine versus TTH in adults and children with high levels of anxiety. The results of this study are similar to previous findings showing stronger associations between migraine, compared to TTH, and anxiety symptoms and panic disorder in adults (Bag et al., 2005; Beghi et al., 2010). Our findings also build on research conducted with children that reported higher internalising symptoms in children with migraine than in children with TTH (Anttila et al., 2004; Arruda & Bigal, 2012; Kroner-Herwig & Gassmann, 2012). One explanation for this finding may be the higher severity of migraine headaches compared to TTH. Although directional effects cannot be determined, a more severe headache may lead to greater distress and more anxiety. Alternatively, consistent with prominent models of paediatric chronic pain that emphasise catastrophic thinking as a key characteristic of headache (see Asmundson et al., 2012), as children with anxiety disorders are also prone to making more catastrophic interpretations of events than children without anxiety disorders (Waters, Wharton, Zimmerman-Gembeck, & Craske, 2008), they may interpret the greater severity of migraine than TTH in more threat-related terms leading to greater distress. Moreover, as headache assessment relied on parent report, greater distress due to migraine than TTH might be more apparent to parents who are already attuned to high levels of emotional distress in their children who have high levels of anxiety.

The finding that children with separation anxiety disorder had a higher incidence of headaches consistent with migraine and TTH than children in the anxiety group without separation anxiety disorder is consistent with previous research in adults. Previous research using adult samples notes a discernible association between primary headache disorders and panic disorder (Jette, Patten, Williams, Becker, & Weibe, 2008; Silberstein, Lipton, & Breslau, 1995; Stewart, Linet, & Celentano, 1989; Swartz, Pratt, Armenian, Lee, & Eaton, 2000; Zwart et al., 2003). Research on the developmental trajectory of anxiety disorders suggests that early separation anxiety disorder is linked to the development of panic disorder in adulthood (Roberson-Nay et al., 2012; Silove et al., 1996). Therefore, co-occurring separation anxiety disorder and primary headache disorders in childhood may be a developmental precursor for co-occurring panic disorder and primary headache disorders in adulthood and warrants further longitudinal research.

Girls with anxiety disorders were also found to have a higher incidence of headache than girls without anxiety disorders whereas there were no significant differences among boys. These findings are interpreted cautiously given the small sample size. However, they are consistent with studies documenting higher chronic pain and anxiety prevalence rates among girls than boys (see Craske, 2003; King et al., 2011) and warrant further investigation in larger studies.

Finally, anxiety symptom severity was higher in children with both anxiety disorders and headaches compared to children with anxiety disorders only, children with headaches only, and children with neither anxiety disorders nor headaches; however, this was found only for child-reported anxiety symptom severity and not when reported by parents. A lack of parent–child agreement on anxiety measures is said to be due in part, to the internalising nature of the disorders; parent–child agreement is often greater in the assessment of externalising disorders where symptoms are more observable (Nauta et al., 2004). Nevertheless, the present findings indicate that children experiencing both high levels of anxiety and headaches concurrently may be at a greater risk of one condition exacerbating the other, which ultimately may lead to greater distress and increased likelihood of psychopathology in adolescence and young adulthood (Shelby et al., 2013). Such risks highlight the importance of treatment for headache and anxiety problems during childhood. Cognitive-behavioural therapy which targets maladaptive, catastrophic thinking and avoidance behaviour has been shown to be effective in treating chronic pain (e.g., Levy et al., 2010) and anxiety disorders in children (e.g., Waters et al., 2008). However, a recent review of psychological therapies for the management of chronic pain in children and adolescents found a small beneficial effect for anxiety at post-treatment, however, this was not maintained at follow-up (see Eccleston et al., 2014). A possible
direction for future research on youth with comorbid conditions is to develop new treatments that more directly target common underlying mechanisms and/or that both conditions become specific intervention targets of CBT pain management interventions (Eccleston et al., 2014).

The present findings are encouraging in that they identify specific links between headache and anxiety disorders in children. However, there were some limitations. Firstly, the study included a small sample, although the findings encourage a larger-scale study. The reliance on parent-report of children’s headache symptoms is another limitation. Pain is a subjective experience and is often internalised, with previous research indicating a tendency for parents to underestimate their child’s pain (Chambers, Reid, Craig, McGrath, & Finley, 1998; Kelly, Powell, & Williams, 2002; Sundblad, Saartok, & Engstrom, 2006). Furthermore, due to the nature of the study, children did not undergo a clinical headache assessment (e.g., headache diary, physician work-up) and we used items that related directly to the ICHD-II criteria. Therefore, the questionnaire used for headache assessment may not have captured the full spectrum of children’s headache experiences. A more thorough assessment and the inclusion of child self-report of headache may have been more sensitive in identifying headache symptoms consistent with primary headache disorders, therefore resulting in an even higher incidence. Also, although pain severity was assessed using 3-point response options (mild, moderate, severe) in order to match them to the listed ICHD-II criteria, a wider scale (e.g., 11-points) would have been optimal for assessing the effects of severity in the analyses.

Finally, the present study does not elucidate the underlying mechanisms common to anxiety and headache. Although a genetic association between migraine and anxiety as well as depression has been found (Lighthart, Nyholt, Penninx, & Boomsma, 2010), a number of cognitive and behavioural factors are also involved, such as catastrophic appraisal biases and behavioural avoidance of triggers and symptoms (see Asmundson et al., 2012; Martin & MacLeod, 2009; Simons & Kaczynski, 2013) and warrant further research in children. Also given the high comorbidity of depression and headaches in adults (Beghi et al., 2010; Jette et al., 2008; Merikangas et al., 1990; Zwart et al., 2003) and that the present sample included three children with comorbid anxiety and depressive disorders (n = 2 with headache diagnoses), it may be important to consider the prevalence of headache as a function of both emotional conditions in youth. Finally, parent factors were not assessed in the present study. As both headache and anxiety tend to run in families, and given that parents play a critical role in the experience of children’s headaches and chronic pain as well as anxiety symptoms via instrumental and vicarious learning processes and operant mechanisms (see Asmundson et al., 2012; Rapee et al., 2009), it would be useful in future research to examine parenting factors that might play a role in the maintenance of co-occurring anxiety and headache symptoms.

This study found an association between anxiety disorders and headaches consistent with primary headache disorders in children, revealing specifically that children with high levels of anxiety, especially anxious girls and those with separation anxiety disorder, are significantly more likely to suffer from symptoms consistent with primary headache disorders than non-anxious children. Previous research has shown that these associations are also present in adulthood. These findings therefore emphasise the importance of early intervention in order to promote more favourable outcomes.

References


Table 4
Mean SCAS-P/C scores for children with and without anxiety disorders and with and without headaches.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Anxiety disorder and headache</th>
<th>Anxiety disorder only (n = 12)</th>
<th>Headacheonly (n = 9)</th>
<th>Neither anxiety disorder nor headache (n = 27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCAS-P score (SD)</td>
<td>30.33 (11.72)</td>
<td>25.58 (9.61)</td>
<td>9.89 (5.78)</td>
<td>10.62* (4.69)</td>
</tr>
<tr>
<td>SCAS-C score (SD)</td>
<td>51.69 (26.30)</td>
<td>27.36* (13.46)</td>
<td>16.67 (10.34)</td>
<td>16.63 (11.02)</td>
</tr>
</tbody>
</table>

* Missing data for n = 1


