

## Symptoms of anxiety and depression in school-aged children with active epilepsy: A population-based study



Colin Reilly <sup>a,e,\*</sup>, Patricia Atkinson <sup>b</sup>, Richard F. Chin <sup>c</sup>, Krishna B. Das <sup>a,d,g</sup>, Christopher Gillberg <sup>e</sup>, Sarah E. Aylett <sup>d,g</sup>, Victoria Burch <sup>a</sup>, Rod C. Scott <sup>f,d,g</sup>, Brian G.R. Neville <sup>a,g</sup>

<sup>a</sup> Research Department, Young Epilepsy, Lingfield, Surrey RH7 6PW, UK

<sup>b</sup> Child Development Centre, Crawley Hospital, West Green Drive, Crawley, RH11 7DH West Sussex, UK

<sup>c</sup> Muir Maxwell Epilepsy Centre, Edinburgh Neurosciences, The University of Edinburgh, Edinburgh, UK

<sup>d</sup> Great Ormond Street Hospital for Children NHS Trust, Great Ormond Street, London WC1N 3JH, UK

<sup>e</sup> Gillberg Neuropsychiatry Centre, University of Gothenburg, Kungsgatan 12, Gothenburg, Sweden

<sup>f</sup> College of Medicine, University of Vermont, Burlington, VT 05405, USA

<sup>g</sup> Institute of Child Health University College London, UK

### ARTICLE INFO

#### Article history:

Received 7 April 2015

Revised 1 September 2015

Accepted 3 September 2015

Available online 30 September 2015

#### Keywords:

Epilepsy  
Children  
Anxiety  
Depression

### ABSTRACT

**Methods:** Children (5–15 years) with active epilepsy were screened using the parent-report ( $n = 69$ ) and self-report ( $n = 48$ ) versions of the Spence Children's Anxiety Scale (SCAS) and the self-report version of the Children's Depression Inventory (CDI) ( $n = 48$ ) in a population-based sample.

**Results:** A total of 32.2% of children (self-report) and 15.2% of children (parent-report) scored  $\geq 1$  SD above the mean on the SCAS total score. The subscales where most difficulty were reported on parent-report were Physical Injury and Separation Anxiety. There was less variation on self-report. On the CDI, 20.9% of young people scored  $\geq 1$  SD above the mean. Children reported significantly more symptoms of anxiety on the SCAS total score and three of the subscales ( $p < .05$ ). There was a significant effect on the SCAS total score of respondents by seizure type interaction, suggesting higher scores on SCAS for children with generalized seizures on self- but not parent-report. Higher CDI scores were significantly associated with generalized seizures ( $p > .05$ ).

**Summary:** Symptoms of anxiety were more common based on self-report compared with parent-report. Children with generalized seizures reported more symptoms of depression and anxiety.

© 2015 Elsevier Inc. All rights reserved.

## 1. Introduction

In addition to epileptic seizures, there is a high association with cognitive, psychiatric, motor and academic achievement difficulties in childhood epilepsy [1,2]. Children with epilepsy have higher rates of neurodevelopmental and psychiatric difficulties compared with the general pediatric population and children with other non-neurological chronic conditions based on diagnostic interviews, parent report of diagnoses, and self-report checklists [3–5]. The strongest predictors of decreased quality of life in childhood epilepsy are often psychiatric difficulties [6,7], particularly depression and anxiety [8,9]. Therefore, identification of the extent and nature of symptoms of depression and anxiety would seem crucial with respect to promoting quality of life in childhood epilepsy. However, neurodevelopmental and psychiatric difficulties are often not identified or treated [1,10].

Population-based studies indicate that both depression and anxiety are more common in childhood epilepsy than in the general pediatric

population [3,4] and in children with diabetes [4]. There is a lack of population-based data on profiles of symptoms of anxiety [11] and depression in childhood epilepsy. Knowledge of profiles (i.e., what types of symptoms of anxiety and depression) may be important not only with respect to treatment but also with respect to understanding possible contributors to the symptoms. With respect to the role of epilepsy/seizure variables in symptoms of depression and anxiety, findings have been mixed. Seizure type has not been associated with symptoms of anxiety and depression in most studies [12], but an increased risk has been noted in two studies [13,14]. With regard to seizure frequency or severity, an increased risk of symptoms of anxiety and/or depression has been noted in some [15,16], but not all, studies [17]. It has been suggested that in most studies of adolescents with epilepsy, antiepileptic drug (AED) use and type of AED have not been found to be consistent predictors of depression [18]. However, polytherapy (being on more than one AED) has been associated with increased symptoms of depression [19–21] and anxiety [7,21]. Furthermore, there is a paucity of evidence of the impact of specific AEDs on emotional symptoms. Increased duration of epilepsy has not been associated with symptoms of anxiety or depression [20,22]. With regard to informants, it is important that where possible, children and adolescents are asked about symptoms of

\* Corresponding author at: Research Department, Young Epilepsy, Lingfield, Surrey RH7 6PW, UK. Tel.: +44 1342 832243.

E-mail address: [creilly@youngepilepsy.org.uk](mailto:creilly@youngepilepsy.org.uk) (C. Reilly).

depression and anxiety, as given the internalizing nature of symptoms of the conditions, informants such as parents and teachers may not be aware of depressive and anxiety symptoms the children are experiencing [14,23].

In summary, there is a lack of population-based data on profiles of symptoms of anxiety and depression in childhood epilepsy and the role of epilepsy/seizure variables. Population-based studies are important in epilepsy since studies from specialized centers are likely to be biased in terms of severity and not representative. Many of the previous studies of depression and anxiety in children with epilepsy have focussed on children with refractory epilepsy and/or children attending tertiary epilepsy centers. The Children with Epilepsy in Sussex School (CHESS) study is a population-based study focussed on the learning and behavioral difficulties of school-aged children with active epilepsy (on AEDs and/or had a seizure in the last year). We have previously described this group with respect to DSM-IV-TR diagnoses [1]. We reported that 13% ( $n = 11$ ) met DSM-IV-TR criteria for any anxiety disorder, and 7% ( $n = 6$ ) met DSM-IV-TR criteria for depression. Only one child who met criteria for an anxiety disorder and one who met criteria for depression had previously been diagnosed. On univariable and multivariable analyses, none of the epilepsy factors were significantly associated with diagnoses of depression or anxiety. The aim of the current study was to report on the profile of symptoms on self-reported and parent-reported measures of anxiety and on a self-reported measure of depression. A further aim was to compare child and parent responses on a measure of anxiety. The final aims were to assess the contribution of seizure-related variables to symptoms of anxiety and see if they differed between respondents and to assess the role of seizure-related variables on self-reported symptoms of depression.

## 2. Materials and methods

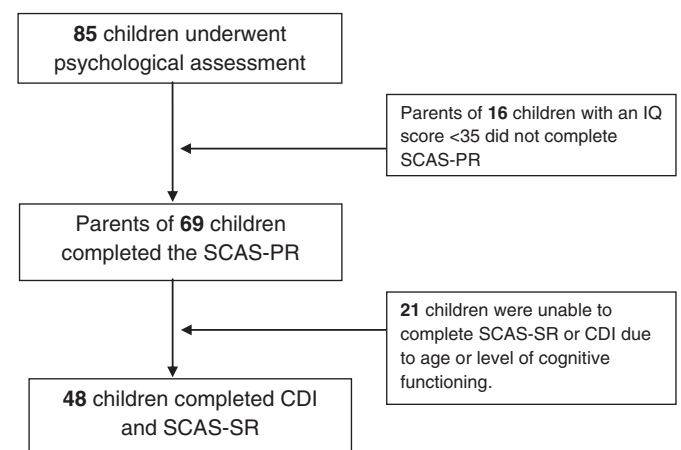
The CHESS study involved the identification of children with epilepsy born between 1995 and 2007 and resident in the RH10 to RH13 postal districts in the south of England between March 31st 2011 and September 30th 2012 (for a detailed description of ascertainment, see Reilly et al. 2014 [9]). The children were identified via a computerized database and liaison with local pediatricians. The prevalence of lifetime (a history of 2 or more unprovoked epileptic seizures) and active epilepsy in the study area was calculated by using the mid-2010 population estimates of 4- to 15-year-olds (32,212) and 5- to 16-year-olds (32,617) provided by the Office of National Statistics (total mid-2010 population 202,919). The prevalence of lifetime epilepsy was 6.1 (95% confidence interval [CI]: 5.2–6.9) per 1000 (1 in 175), and the prevalence of active epilepsy was 3.5 (95% CI: 3.0–4.3) per 1000 (1 in 286).

The parents/guardians of children with active epilepsy were approached by the researchers (sent a letter and/or asked in person) and asked to complete an interest form if they wished to find out about the study. All parents who returned a form were met in the child's school or home by the study psychologist to discuss their child's participation. At this informed consent meeting, the study was described in detail, and parents were asked for written consent for entry of their child into the study. Children, where developmentally appropriate (children 7 years or older who did not have intellectual disability), were also asked to provide assent. Parents and children (where developmentally appropriate) were given information sheets describing the purpose of the study. Parents or participants did not receive payment for participating. Of those who were eligible, 85 (74%) parents consented for their child to participate in the study. The 85 children underwent comprehensive psychological assessment between April 1st 2011 and November 30th 2012. All 85 children completed the study. Assessment included measures of cognition, behavior, emotional functioning, and motor functioning (see Reilly et al. 2014 [9]). Levels of global cognitive functioning and subsequent classification of intellectual disability ( $IQ < 70$ ) were determined by full-scale IQ scores on standardized tests of cognitive functioning.

Diagnostic and Statistical Manual of Mental Disorders – Text Revision diagnoses of depressive and anxiety disorders were made based on consensus diagnosis by study psychologist, pediatrician, and child and adolescent psychiatrist. The consensus diagnostic process involved a review of each child's developmental/medical history based on case/medical notes, results of administered standardized screening measures and cognitive assessments, parent and teacher reports, and school-based observations by the study psychologist. All children regardless of intellectual disability were considered for a diagnosis of depression and anxiety. In relation to depression in children with intellectual disability, parents were asked about symptoms of depression based on DSM-IV-TR criteria. Clinical information on eligible children was extracted using a standardized pro forma. Data obtained from the standardized pro forma included current AEDs, duration of epilepsy, and investigations (MRI and EEG). Seizure frequency was based on parent reports and was categorized as weekly/more often or less frequent/none.

The final sample for the current study contained 69 children (see Fig. 1). In relation to anxiety and depression, parents of the children (5–15 years) who had an  $IQ > 34$  ( $n = 69$ ) completed the parent version of the Spence Anxiety Scale for Children (SCAS) [24]. The SCAS was not completed by parents of children with an  $IQ < 34$  ( $n = 16$ ) as it was not thought to be valid with children functioning in the severe-profound range of ID based on parent feedback. Parents reported that some items were not suitable for children in this range of cognitive functioning, as the items referred to children who were verbal and/or had a higher level of ability compared with the child they were asked to respond about. Children with an  $IQ > 69$  and who were 7 years of age or older completed the self-report version of the SCAS ( $n = 48$ ) [25] and the Children's Depression Inventory (CDI) ( $n = 48$ ) [26]. A psychologist was present with the children when they completed the instruments to provide clarification if needed. Children with an  $IQ$  between 50 and 69 were asked to complete the self-report version of the SCAS and CDI. However, the children had difficulty completing these instruments. The psychologist who was with the children when they completed the instruments did not feel that the children sufficiently understood the questions for them to be a valid measure of the children's emotional symptoms. This view was formed based on the questions asked by the children about the items and the number of uncompleted items which indicated a lack of understanding. As a result, the responses of children with an  $IQ$  score between 50 and 69 were excluded from analysis. An example of an item that was not deemed suitable for children with ID, based on their perceived lack of understanding, was 'I can't seem to get bad or silly thoughts out of my head'.

The Spence Children's Anxiety Scale is one of the most widely used questionnaires to assess perceptions of the frequency with which a



**Fig. 1.** Assessment of anxiety and depression in the CHESS study. SCAS-PR = Spence Children's Anxiety Scale – Parent-Report, SCAS-SR = Spence Children's Anxiety Scale – Self-Report, CDI = Children's Depression Inventory.

child experiences symptoms of anxiety in six areas: generalized anxiety disorder, separation anxiety, social phobia, panic disorder and agoraphobia, obsessive-compulsive disorder, and fears of physical injury. It has good reliability, internal consistency, and validity [27]. The accompanying parent version (SCAS-P [24]) allows for comparisons between child and parent ratings of the same symptoms. Both versions of the SCAS are based on a four-point Likert-type response scale: 'never', 'sometimes', 'often', and 'always'. The parent version contains 38 items, and the child version contains the same 38 items plus six filler items, which are not included in the final scoring. Norms are available for children 8–15 years of age, but norms are not available for children 7 years of age and younger. In this study, we used the norms for 8-year-olds for children 7 years of age and younger as agreed with SCAS authors (Hearn, 2013, personal correspondence).

The CDI [26] is a commonly used self-report measure of depressive symptoms for children 7–17 years of age. The scale comprises 27 items dealing with sadness, self-blame, insomnia, loss of appetite, interpersonal relationships, and school adjustment. Children's Depression Inventory items are rated on a three-point scale (0 = not true, 1 = somewhat true, 2 = very true), reflecting the degree of symptoms of depression over the past 2 weeks. A total CDI score can be calculated by adding the responses of all items. Internal consistency, moderate retest reliability, and convergent validity of the CDI have been demonstrated [28,29].

### 2.1. Statistical analysis

All analyses were done with IBM SPSS version 21.0 (Armonk, NY, USA). Descriptive statistics were used to indicate the distribution of symptoms on the SCAS and CDI. On the CDI and SCAS, scores were categorized into 1 SD, 1–2 SD, and 2 SD above the mean based on comparison with published norms (<http://www.scaswebsite.com> and Kovacs [26]). Paired-sample two-tailed t-tests were used to compare parent-report and self-report total SCAS scores. Results for the paired samples t-tests are reported before and after Bonferroni correction (adjusted alpha  $p < .007$  for t-tests). Reliability analysis for the SCAS and CDI is based on Cronbach's alpha.

Multiple regression applying generalized estimating equation modeling was used to identify epilepsy-related factors associated with child and parent responses on the SCAS total score. The predictors in the model were respondent (child vs. parent), seizure frequency (weekly/more often vs. less frequent/none), predominant seizure type (generalized vs. focal), duration (less than 4 years vs. greater than 4 years), AEDs (monotherapy vs. polytherapy), gender (male vs. female), and age ( $< 11$  or  $\geq 11$  years). In the first instance, all predictors and all possible respondent  $\times$  seizure factor interactions were tested first to see if any were significant at the .05 level. Factors and interactions significant at the  $p < 0.05$  level in initial modeling were subsequently included in model 1, and model 2 shows the regression estimates of the predictors of SCAS scores that were significant at the .05 level in model 1.

Univariable linear regression analyses were done to identify factors associated with the CDI total score. The factors in the model were the same as in the model for the SCAS (i.e., gender, age, seizure frequency, AEDs, duration, and predominant seizure type) with the exception of respondent. Multivariable analysis was carried out via backward regression with all predictors entered into the model to identify factors independently associated with the outcome variable. Residual analyses revealed that assumptions for the linear regression model were met. The alpha level for univariable and multivariable analyses was  $p < 0.05$ .

### 2.2. Ethics

The study was approved by the Brighton and Sussex Research Ethics Committee and was also registered with the collaborating hospital primary care organization — The Sussex Community NHS Trust. Informed consent was obtained from parents of all participating children.

## 3. Results

### 3.1. Child characteristics

Table 1 shows the characteristics of the children who underwent assessment of symptoms of anxiety and depression.

### 3.2. Scores on the Spence Children's Anxiety Scale (SCAS)

Cronbach's alpha values for the SCAS were 0.898 (child report) and 0.907 (parent report). Table 2 shows the categorizations on the SCAS for the total score and the subscale scores (parent-/caregiver-report ( $n = 69$ ) and self-report ( $n = 48$ )) based on normal, between 1–2 SD and 2 SD above the mean.

On the total score, 31% of self-report and 15% of parent scores were 1 SD (84th percentile) or more above the mean. On self-report, the subscales where most children were above 1 SD cutoff were Panic (39.6%) and Physical Injury (39.6%). Social Phobia was the subscale where the least children were  $\geq 1$  SD above the mean. On parent report, Physical Injury (37.9%) and Separation Anxiety (31.8%) were the subscales with most children  $\geq 1$  SD above the mean, whereas the OCD subscale (9.1%) was the area where the fewest children were in the at-risk category. The two items with the highest mean scores on the parent measure were 'my child worries' and 'my child is scared'. On the self-report measure, the two items with the highest mean scores were 'When I have a problem, my heart beats really fast' and 'I have to keep checking that I have done things correct'.

Paired sample t-tests were conducted to compare self-report and parent-report responses on SCAS where both parent and child responses were available for the same child ( $n = 48$ ). The mean scores, standard deviations, p-values, and effect sizes are shown in Supplemental Table 1 (Supplementary material A). Self-report scores were significantly higher (at least  $p < .05$ ) based on paired samples t-test for the

**Table 1**  
Demographics of the children in the CHES study who underwent assessment of symptoms of anxiety and depression ( $n = 69$ )<sup>a</sup>.

	Sample ( $n = 69$ )
Sex: male/female	36/33 (52%/48%)
Ethnicity: white/nonwhite	55/14 (80%/20%)
Primary school/secondary school	39 (57%)/30 (43%)
Duration of epilepsy	
<4 years	29 (42%)
$\geq 4$ years	40 (58%)
Mean age at the time of psychological assessment	10.70 years (5.08–15.75)
Under 11 years of age	37 (54%)
11 years or older	32 (46%)
Seizure frequency <sup>b</sup>	
Weekly or more often	22 (32%)
Less frequent or none	47 (68%)
Monotherapy/polytherapy/none	46 (66%)/19 (28%)/4 (6%)
Types of AEDs	
Sodium valproate	26 (38%)
Lamotrigine	17 (25%)
Levetiracetam	10 (14%)
Topiramate	8 (12%)
Ethosuximide	7 (10%)
Clobazam	6 (9%)
Carbamazepine	4 (6%)
Rufinamide	2 (3%)
Oxcarbazepine	2 (3%)
Zonisamide	2 (3%)
Clonazepam	1 (1%)
Stiripentol	1 (1%)
ILAE 2010 predominant seizure type: generalized/focal <sup>c</sup>	21 (30%)/48 (70%)

ILAE = International League Against Epilepsy.

<sup>a</sup> All data based on a review of medical notes unless otherwise indicated.

<sup>b</sup> Data based on parental reports.

<sup>c</sup> Based on consensus classification by two pediatric neurologists.

**Table 2**  
Self-report (n = 48) and parent categorizations (n = 69) on SCAS in the CHESS study.

Subscale	Normal (1st to 83rd percentile)		1–2 SD (84th to 97.4th percentile)		>2 SD (97.5th percentile to 99th percentile)	
	Self-report	Parent	Self-report	Parent	Self-report	Parent
Total	68.8%	84.8%	22.9%	12.1%	8.3%	3%
OCD	66.7%	90.9%	27.1%	6.1%	6.3%	3%
Social Phobia	70.8%	83.3%	25%	10.6%	4.2%	6.1%
Panic	60.4%	81.8%	31.3%	16.7%	8.3%	1.5%
Separation Anxiety	64.6%	68.2%	20.8%	25.8%	14.6%	6.1%
Physical Injury	60.4%	62.1%	33.3%	28.8%	6.3%	9.1%
Generalized Anxiety	64.6%	87.9%	20.8%	10.6%	14.6%	1.5%

total score and the OCD, Panic, and Generalized Anxiety subscales. After Bonferroni correction (adjusted  $p < .007$ ), differences between parent-report and self-report scores remained significant for the total score and the OCD and Panic subscales.

### 3.3. Scores on Child Depression Inventory (CDI)

Cronbach's alpha for the CDI was 0.896 (child report). Table 3 shows the responses of participants (n = 48) on the CDI.

Twenty-one percent of the children scored in the at-risk category (1 SD or more above the 50th percentile). Ineffectiveness and Anhedonia were the two subscales where most children scored above the 1 SD cutoff, while Interpersonal Problems was the subscale where the least number scored above the cutoff. The items most often endorsed were 'making up my mind' and 'school work effort'. In relation to suicidal ideation, seven children responded that it was 'somewhat true' with respect to the statement that they thought about killing themselves and 2 responded that it was 'very true'.

### 3.4. Regression analyses

The full results of the generalized estimating equations for the SCAS total score are in Table 4.

The interactions involving respondents which were found to be significant at the  $p < .05$  level were respondent  $\times$  seizure type, respondent  $\times$  duration, and respondent  $\times$  gender, and these were included in model 1, along with respondent and age category which were also found to be significant on univariable analysis. The other epilepsy-related factors were not found to be significant predictors of SCAS total scores. Respondent  $\times$  gender interaction was significant in univariable analysis but was not significant in model 1 and, thus, not included in model 2.

In the final model, the factors significantly associated with SCAS scores were respondent (children reported more symptoms compared with parents), age (older children reported more symptoms compared with younger children), respondent  $\times$  duration interaction, and respondent  $\times$  seizure interaction. The significant respondent  $\times$  seizure type interaction suggests that the difference between generalized and

focal seizures is much greater based on child report than on parent report (see graph in Supplementary material B). The significant respondent  $\times$  duration interaction suggests that the difference between short duration and long duration is much greater based on parent report than on child report (see graph in Supplementary material C).

Table 5 shows the factors significantly associated with the CDI total score on univariable and multivariable analyses.

Seizure type was the only factor significantly associated ( $p < 0.05$ ) with the total score on the CDI on univariable and multivariable analyses, with generalized seizures being associated with higher scores on the CDI.

## 4. Discussion

The CHESS study is the first population-based study to report on profiles of symptoms of anxiety and depression on standardized instruments in childhood epilepsy. Previous population-based studies of children with epilepsy have not described profiles in detail and/or have focused on children who meet diagnostic criteria for depression and anxiety. Understanding the profile of symptoms of anxiety and depression may be important with respect to treatment and also possible contributory factors. Symptom checklists can provide information on subclinical symptoms and allow identification of children who are at risk of significant impairment who with support may not develop a clinically significant disorder. Compared with published norms, which come from a large community sample of Australian children (<http://www.scaswebsite.com>), the current study suggests that children with epilepsy experience more symptoms of anxiety than would be expected based on self-report but not on parent-report. Symptoms of depression experienced by the children would not appear to be as common as symptoms of anxiety but are slightly above published norms, which come from a community-based sample of school children in the US [26].

With respect to subscales on a measure of anxiety, variation between subscales in the proportion of children scoring in the abnormal range was more marked on the parent-report scale compared with the self-report scale. On parent-report, 30% of children scored in the abnormal range on the Physical Injury and Separation Anxiety subscales, whereas only 9% of children were in the abnormal range on the OCD subscale. A possible explanation is that parents are more aware of anxieties around physical injury and separation anxiety but less aware of obsessions and compulsions. Elevated symptoms of separation anxiety in childhood epilepsy may result from both parents and children fearing the child being alone in the event of an epileptic seizure. Furthermore, parents and children may fear that if they are not together, other adults may not know how to manage a seizure. In relation to anxiety about physical injury, parents and children may fear that a seizure could result in physical injury and, as a result, are more anxious about this than would be the case for children without epilepsy. A previous study of parent-reported symptoms of anxiety in children with epilepsy noted that the areas where most children scored above at-risk cutoffs were specific phobia, obsessions, and post-traumatic stress disorder [17]. Much fewer children scored in the at-risk range of generalized anxiety disorder, separation anxiety, and social phobia [17]. Jones et al. [30] reported the prevalence rates of several subtypes of DSM-IV anxiety disorders including OCD (11%), specific phobia (8%), social phobia (8%), overanxious disorder (6%), separation disorder (2%), and PTSD (2%). Differences between the current study and previous studies likely reflect the instruments/diagnostic methods used and the populations sampled. These previous studies, although larger with respect to sample size than the current study, were not population-based and, thus, may not be as representative.

Previous population-based research has identified that children with epilepsy are at high risk of symptoms of anxiety, but the findings of the current study show that parents and children can differ significantly with respect to reporting of symptoms. This is important to note, given that it has been recommended that children with epilepsy be

**Table 3**  
Scores on subscales of the CDI in the CHESS study (n = 48).

Subscales	Mean score	Normal	T-score 60–70	T-score 70+
			1–2 SD	>2 SD
Negative Mood	2.67	79.2%	12.5%	8.3%
Interpersonal Problems	0.97	85.4%	12.6%	2.1%
Ineffectiveness	2.37	72.9%	18.7%	8.3%
Anhedonia	4.19	72.9%	22.9%	4.2%
Negative Self-esteem	2.21	83%	6.4%	10.6%
Total	12.40	79.1%	10.5%	10.4%



**Table 4**  
Results of generalized estimating equations for the SCAS total score.

Predictor	Model 1		Model 2	
	B (95% CI)	p	B (95% CI)	p
Respondent	28.34 (16.51 to 40.168)	.000	18.87 (9.81–27.93)	.000
Age category	−9.57 (−18.08 to −1.43)	.022	−10.31 (−19.22 to −1.41)	.023
Respondent by seizure type	−17.77 (−30.87 to −4.48)	.008	−17.93 (−31.18 to −4.678)	.008
Respondent by duration	15.19 (5.41 to 24.98)	.002	14.852 (4.65 to 25.05)	.004
Respondent by gender	6.353 (−2.32 to 15.02)	.151	n/a	n/a

n/a as not in final model.

screened for behavioral and psychiatric difficulties [9,31]. Relying solely on parent-report or self-report will result in a different set of children being identified as at-risk. It would appear particularly important that views of children are accessed, given the internalizing nature of symptoms of depression and anxiety as parents may not be aware of the symptoms the children are experiencing. However, children with intellectual disability are not likely to be able to complete the currently available standardized instruments. There is, thus, a need to develop measures which can allow at least some children with intellectual disability to indicate their views regarding these symptoms, as well as asking parents and other family members about the child's emotional well-being. In the absence of appropriate instruments, clinicians may need to adapt their language for younger children and children with cognitive impairment in order to access reports about symptoms of emotional disorders. In general, it is important that clinicians working with children with epilepsy also ask the child about symptoms of depression and anxiety, as well as using standardized instruments, as this will help with respect to clarifying whether the children understand questions on standardized instruments.

In the current study, age category was significantly associated with scores on the SCAS, with older children being more at risk of symptoms of anxiety than young children as has been noted in previous studies [21,32]. This may reflect a greater awareness of the psychosocial impact of epilepsy with age and other psychosocial and biological factors. The nature of the association between duration and SCAS scores indicates that while parent ratings of their child's anxiety decreases over time, the child's ratings remain more stable. This might reflect increased parental stress and anxiety at the time of diagnosis or better coping, but measures of parental anxiety and coping would be needed to verify this. In relation to the significant respondent x seizure type relationship, generalized seizures contributed more to increased levels of anxiety compared with focal seizures but only on self-report. It is possible that generalized seizures, which are likely to be more visible and involve a loss of consciousness, may impact very significantly on the child's level of anxiety but less so on parents' perceptions of their child's anxiety. The significant impact of seizure type on depression scores may also reflect an increased awareness among children of these types of seizures. Furthermore, we have previously reported that generalized seizures are associated with deficits in working memory in this sample [33], which may contribute to difficulties in school and everyday life resulting in increased symptoms of depression and anxiety. Other

factors such as seizure frequency, AED usage, and gender were not significantly associated with scores on measures of depression and anxiety unlike some previous studies. This may reflect the fact that the current study was population-based and the measures we employed.

There is accumulating evidence that symptoms of both depression [34,35] and anxiety [36] can be successfully treated in children with epilepsy although larger-scale studies are needed. A pilot study suggests that cognitive behavioral therapy (CBT) may be useful in treating children with epilepsy and social anxiety [37], and there is a need for more studies focusing on specific types of depression and anxiety in childhood epilepsy. Psychoeducation programs for children with epilepsy and their parents should highlight the risks of both depression and anxiety in childhood epilepsy. Such programs should also indicate to children and parents that there is an expanding evidence base for CBT in childhood epilepsy. Childhood epilepsy services will benefit from the development of clear pathways for children with epilepsy who screen positive for depression and/or anxiety disorder, including the provision of CBT where appropriate. It has been suggested that all children with epilepsy be screened for symptoms of behavioral and emotional disorders [1]. Instruments focusing on a broad range of behavioral and emotional difficulties may be useful at initial screening to indicate problematic functioning [38], whereas instruments such as the SCAS may be useful as a second stage screener, to identify disorder specific symptoms.

#### 4.1. Limitations

A number of limitations need to be noted in interpreting the study findings. The sample size is relatively small, and there is a need for further studies with larger sample sizes. We used the parent version of the SCAS with children 7 years of age and younger, despite the absence of published norms, and this may have impacted on the proportion of children identified as at-risk. We did not use the parent report version of the CDI to measure depression which would have been informative. We considered a relatively limited range of possible contributory factors to symptoms of depression and anxiety, and other factors such as parental well-being and other behavioral/psychiatric disorders would have been informative. We were not able to assess the contribution of individual AEDs to symptoms of depression and anxiety because of the small sample size, and seizure frequency was based on parent reports.

**Table 5**  
Factors associated with the CDI total score on univariable linear regression and on multivariable linear regression.

Predictor	Univariable		Multivariable	
	B (95% CI)	p	B (95% CI)	p
Gender	3.97 (−1.19 to 9.13)	.128	3.91 (−0.54 to 8.36)	.083
Age category	7.259 (−1.86 to 8.53)	.203	4.252 (−0.37 to 8.87)	.070
AED usage	1.41 (−4.98 to 7.79)	.659	n/a	n/a
Seizure frequency	−1.67 (−7.58 to 4.24)	.572	n/a	n/a
Seizure type	−10.219 (−15.71 to −4.73)	.000	−12.80 (−18.39 to −7.20)	.000
Seizure duration	0.972 (−5.11 to 7.052)	.749	5.05 (−0.39 to 10.49)	.068

n/a as not in final model.

We did not have a control group with which to compare the prevalence and nature of symptoms of anxiety and depression.

Assessing symptoms of anxiety and depression in children with epilepsy and intellectual disability presents significant assessment difficulties [12]. We were not able to assess self-reported symptoms of depression and anxiety in children with intellectual disability or parent-reported symptoms of anxiety in children with an IQ below 35. Despite difficulties in assessment of emotional symptoms in children with intellectual disability, it would have been useful to use measures of emotional functioning suitable for children with this level of cognitive ability.

## 5. Conclusions

In summary, symptoms of self-reported anxiety and depression appear to be elevated in community-based children with epilepsy, highlighting the need for screening in this group. Furthermore, given that the majority of children who reached diagnostic criteria were often not identified, there is a need to investigate possible reasons for this underrecognition. The fact that parents often report fewer symptoms of anxiety and depression highlights the need to garner the views of the children themselves where possible. Symptoms of anxiety were more common than symptoms of depression, and there is a need for further exploration of why this is including an exploration of both environmental and biological contributors.

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.yebeh.2015.09.004>.

## Funding

The CHESSE study was funded by the Esmée Fairbairn Foundation and an anonymous donor to Young Epilepsy. RCS is supported by Great Ormond Street Hospital Children's Charity.

## Acknowledgments

We thank Leanne Menlove for help with data entry and management, Ayesha Memon for help with review of medical notes, and Angela Mensah for administrative support and coordination.

## Conflicts of interest

None of the authors has any conflict of interest to disclose.

## References

- Reilly C, Atkinson P, Das KB, Chin RF, Aylett SA, Burch V, et al. A population-based study of neurobehavioral comorbidities in children with active epilepsy. *Pediatrics* 2014. <http://dx.doi.org/10.1542/peds.2013-3787>.
- Fastenau PS, Shen J, Dunn DW, Austin JK. Academic underachievement among children with epilepsy: proportion exceeding psychometric criteria for learning disability and associated risk factors. *J Learn Disabil* 2008;41:195–207.
- Russ SA, Larson K, Halfon N. A national profile of childhood epilepsy and seizure disorder. *Pediatrics* 2012;129:256–64.
- Davies S, Heyman I, Goodman R. A population survey of mental health problems in children with epilepsy. *Dev Med Child Neurol* 2003;45:292–5.
- Alfstad KÅ, Clench-Aas J, Van Roy B, Mowinckel P, Gjerstad L, Lossius MI. Psychiatric symptoms in Norwegian children with epilepsy aged 8–13 years: effects of age and gender. *Epilepsia* 2011;52:1231–8.
- Ferro MA, Camfield CS, Levin SD, Smith ML, Wiebe S, Zou G, et al. Trajectories of health-related quality of life in children with epilepsy: a cohort study. *Epilepsia* 2006;54:1889–97.
- Williams J, Steel C, Sharp GB, DelosReyes E, Philips T, Bates S, et al. Anxiety in children with epilepsy. *Epilepsy Behav* 2003;4:729–32.
- Baca CB, Vickrey BG, Caplan R, Vassar SD, Berg AT. Psychiatric and medical comorbidity and quality of life outcomes in childhood-onset epilepsy. *Pediatrics* 2011;128:e1532–43.
- Reilly C, Atkinson P, Das KB, Chin RF, Aylett SA, Burch V, et al. Factors associated with quality of life in active childhood epilepsy: a population-based study. *Eur J Paediatr Neurol* 2015. <http://dx.doi.org/10.1016/j.ejpn.2014>.

- Ott D, Siddarth P, Gurbani S, Koh S, Tournay A, Shields WD, et al. Behavioral disorders in pediatric epilepsy: unmet psychiatric need. *Epilepsia* 2003;44:591–7.
- Jones JE. Treating anxiety disorders in children and adolescents with epilepsy: what do we know? *Epilepsy Behav* 2014;39:137–42.
- Reilly C, Agnew R, Neville BGR. Depression and anxiety in childhood epilepsy: a review. *Seizure* 2011;20:589–97.
- Thome-Souza S, Kuczynski E, Assumpcao F, Rzezak P, Fuentes D, Fiore L, et al. Which factors may play a pivotal role on determining the type of psychiatric disorder in children and adolescents with epilepsy? *Epilepsy Behav* 2004;5:988–94.
- Caplan R, Siddarth P, Gurbani S, Hanson R, Sankar R, Shields WD. Depression and anxiety disorders in pediatric epilepsy. *Epilepsia* 2005;46:720–30.
- Turky A, Beavis JM, Thapar AK, Kerr MP. Psychopathology in children and adolescents with epilepsy: an investigation of predictive variables. *Epilepsy Behav* 2008 (12):136–44.
- Alwash RE, Hussein MJ, Matloub FF. Symptoms of anxiety and depression among adolescents with seizures in Irbid, Northern Jordan. *Seizure* 2000;9:412–6.
- Dunn DW, Austin JK, Huster GA. Symptoms of depression in adolescents with epilepsy. *J Am Acad Child Adolesc Psychiatry* 1999;38:1132–8.
- Ekinci O, Titus JB, Rodopman AA, Berkem M, Trevathan E. Depression and anxiety in children and adolescents with epilepsy: prevalence, risk factors, and treatment. *Epilepsy Behav* 2009;14:8–18.
- Adewuya AO, Ola BA. Prevalence of and risk factors for anxiety and depressive disorders in Nigerian adolescents with epilepsy. *Epilepsy Behav* 2005;6:342–7.
- Roeder R, Roeder K, Asano E, Chugani HT. Depression and mental health help-seeking behaviors in a predominantly African American population of children and adolescents with epilepsy. *Epilepsia* 2009;50:1943–52.
- Oğuz A, Kurul S, Dirik E. Relationship of epilepsy-related factors to anxiety and depression scores in epileptic children. *J Child Neurol* 2002;17:37–40.
- Ettinger AB, Weisbrot DM, Nolan EE, Gadow KD, Vitale SA, Andriola MR, et al. Symptoms of depression and anxiety in pediatric epilepsy patients. *Epilepsia* 1998;39:595–9.
- Barry JJ, Ettinger AB, Friel P, Gilliam FG, Harden CL, Hermann B, et al. Consensus statement: the evaluation and treatment of people with epilepsy and affective disorders. *Epilepsy Behav* 2008;13:1–29.
- Nauta MH, Scholing A, Rapee RM, Abbott M, Spence SH, Waters A. A parent-report measure of children's anxiety: psychometric properties and comparison with child-report in a clinic and normal sample. *Behav Res Ther* 2004;42:813–39.
- Spence SH. A measure of anxiety symptoms among children. *Behav Res Ther* 1998;36:545–66.
- Kovacs M. The Children's Depression Inventory (CDI). *Psychopharmacol Bull* 1985;21:995–8.
- Essau CA, Sasagawa S, Anastassiou-Hadjicharalambous X, Guzmán BO, Ollendick TH. Psychometric properties of the Spence Child Anxiety Scale with adolescents from five European countries. *J Anxiety Disord* 2011;25:19–27.
- Ivarsson T, Svalander P, Litere O. The Children's Depression Inventory (CDI) as measure of depression in Swedish adolescents. A normative study. *Nord J Psychiatry* 2006;60:220–6.
- Masip AF, Amador-Campos JA, Gomez-Benito J, Del Barrio Gandara V. Psychometric properties of the Children's Depression inventory in community and clinical sample. *Span J Psychol* 2010;13:990–9.
- Jones JE, Watson R, Sheth R, Caplan R, Koehn M, Seidenberg M, et al. Psychiatric comorbidity in children with new onset epilepsy. *Dev Med Child Neurol* 2007;49:493–7.
- Rai D, Kerr MP, McManus S, Jordanova V, Lewis G, Brugha TS. Epilepsy and psychiatric comorbidity: a nationally representative population-based study. *Epilepsia* 2012;53:1095–103.
- Dunn DW, Austin JK. Differential diagnosis and treatment of psychiatric disorders in children and adolescents with epilepsy. *Epilepsy Behav* 2004(Suppl. 3):S10–7.
- Reilly C, Atkinson P, Das KB, Chin RF, Aylett SA, Burch V, et al. Cognition in school-aged children with "active" epilepsy: a population-based study. *J Clin Exp Neuropsychol* 2015:1–10.
- Guilfoyle SM, Monahan S, Wesolowski C, Modi AC. Depression screening in pediatric epilepsy: evidence for the benefit of a behavioral medicine service in early detection. *Epilepsy Behav* 2015;44:5–10.
- Martinović Z, Simoncović P, Djokić R. Preventing depression in adolescents with epilepsy. *Epilepsy Behav* 2006;9:619–24.
- Blocher JB, Fujikawa M, Sung C, Jackson DC, Jones JE. Computer-assisted cognitive behavioral therapy for children with epilepsy and anxiety: a pilot study. *Epilepsy Behav* 2013;27:70–6.
- Jones JE, Blocher JB, Jackson DC, Sung C, Fujikawa M. Social anxiety and self-concept in children with epilepsy: a pilot intervention study. *Seizure* 2014;23:780–5.
- Reilly C, Atkinson P, Das KB, Chin RF, Aylett SA, Burch V, et al. Screening for mental health disorders in active childhood epilepsy: population-based data. *Epilepsy Res* 2014;108:1917–26.

## Websites

- <http://www.scaswebsite.com>. [accessed June 15th 2015].