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Applicability of the intolerance of uncertainty model to Generalized Anxiety Disorder symptoms in young people

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Abstract

Background: Disorder-specific cognitive-behavioural conceptual models of anxiety disorders have informed psychological interventions with adults, but not with adolescents. This study aims to clarify the applicability of the intolerance of uncertainty model to generalized anxiety disorder symptoms in young people and the moderating influence of gender and age on these relationships.

Methods: Three hundred and twenty-six young people, aged 11 – 15 years, from three high schools in a semi-rural area in West Scotland, completed self-report measures relating to generalized anxiety disorder symptoms and cognitive variables of the intolerance of uncertainty model.

Results: Intolerance of uncertainty and negative problem orientation were found to be predictive of generalized anxiety disorder symptoms; positive beliefs about worry and cognitive avoidance were found to be less important in the prediction of generalized anxiety disorder symptoms. Gender only moderated the relationship between positive beliefs about worry and generalized anxiety disorder symptoms; age did not act as a moderator.

Conclusion: The model of intolerance of uncertainty seems to be helpful in understanding generalized anxiety in young people. Clinical considerations are discussed.

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1. Introduction

Community studies estimate prevalence of worrying in children and adolescents to be approximately 70% (Muris et al., 1998, 2000), with 25% of adolescents reporting excessive and worry (Laugesen et al., 2003). Although common, only a minority develop Generalized Anxiety

Disorder (GAD), in which the main symptoms are excessive and uncontrollable worry. Physical complaints such as muscle tension, restlessness, fatigue and sleep disturbance are associated with worry and anxiety and so also form part of the diagnostic criteria (APA, 2000); physical symptoms of GAD are frequently reported in children and adolescents (Ginsburg et al., 2006). Diagnosis of GAD is associated with significant distress, impairment to functioning and an elevated risk of future mental health problems (Bittner et al., 2004; Campbell et al., 2003; Pine et al., 1998).

The prevalence of anxiety disorders such as GAD, vary significantly over childhood and adolescence depending upon age and gender; for example, Cohen et al. (1993) reported an overall decline in the prevalence of anxiety disorders between the ages of 10 and 20 in the USA, but with notable effects of gender; a higher prevalence of anxiety disorders in boys at age ten declined steeply compared to that of girls over the following nine years; meaning from age 11 onwards girls showed a relatively higher prevalence of anxiety disorders. In contrast, Crocetti et al. (2009) reported 15–19-year-olds scored higher than 11–14-year-olds on a GAD measure, suggesting GAD symptoms increase with age during adolescence. When accounting for effects of gender, however, it was demonstrated that GAD increases steeply with age in females, masking a less pronounced increase for males. This gender-specific pattern in adolescence was also reported by Nelemans et al. (2014).

Furthermore, contextual factors such as parental mental health problems (Beesdo-Baum et al., 2011; Mendes et al., 2013), perceived parental alienation and rejection (Hale et al., 2006), attachment difficulties (van Eijck et al., 2012), early adversity and significant life events (Beesdo-Baum et al., 2011), chronic health conditions (Mendes et al., 2013) and experience of violence (Slopen, et al., 2012) can predispose young people to GAD. Despite the influence of contextual factors, individual cognitive-behavioural therapy (CBT) has been shown to produce positive treatment outcomes with anxious children and adolescents (James et al., 2009). An important aim for research should be to improve the efficacy of treatment for young people whose symptoms are not improved through current treatments, offering reduction in current distress and potential prevention of later adulthood anxiety (Angst et al., 2009).

Despite the potential benefit of treatment of childhood anxiety, research into the development and maintenance of worry and anxiety in childhood lags behind research in adult populations. Disorder-specific cognitive-behavioural conceptual models of anxiety disorders have facilitated the understanding and treatment of anxiety in adults (Salkovskis, 1999; Warwick & Salkovskis, 1990; Wells, 1995). The intolerance of uncertainty model, conceptualized as model-specific to GAD (Dugas et al., 1998), is a cognitive model of excessive worry comprising four components:

intolerance of uncertainty (IU); positive beliefs about worry (PBW); cognitive avoidance (CA); negative problem orientation (NPO). The model is shown in Figure 1.

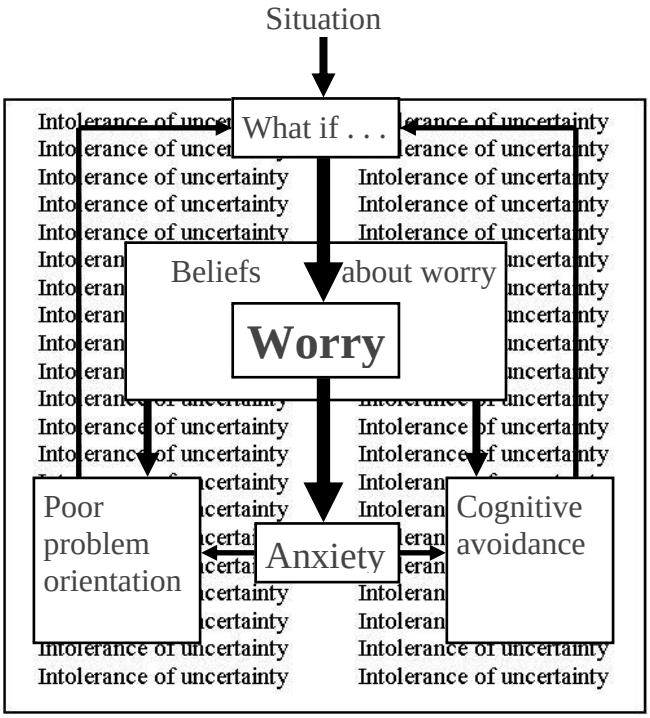

Figure 1. Intolerance of uncertainty model of GAD

IU refers to a propensity to find uncertainty distressing, causing worry in situations where the outcome is uncertain. It is best understood as a cognitive bias that leads individuals to negatively appraise uncertain situations. Numerous studies suggest IU is a cognitive vulnerability factor for worry (e.g. Buhr & Dugas, 2006; Koerner & Dugas, 2008). CBT augmented by the IU model has been shown to be more effective than applied relaxation training in the treatment of GAD in adults (Dugas et al., 2010). A treatment protocol for adults with GAD that targets components of the IU model has been proposed by Robichaud (2013). It would, for example, help clients to recognize and challenge uncertainty beliefs, and incorporate behavioural exposure to uncertainty, re-evaluation of beliefs about worry, cognitive exposure and problem reorientation.

Research has begun to examine whether the IU model is applicable to children and adolescents. Laugeson et al. (2003) reported strong correlations between worry and IU, PBW, and NPO in an analogue sample of adolescents. Similarly, Dugas et al. (2012) found strong correlations between IU and worry over five years in adolescents. Fialko et al. (2012) reported IU and CA significantly correlated with worry and anxiety, but the relationship between PBW and worry was less robust in their sample of 7–19-year-olds. The measures of the IU model components consisted of five items each and were taken from adult scales; 75-86% of the younger children completing the study rated themselves as understanding most or all of the questions, suggesting

these scales may have limited reliability with younger children. Kertz and Woodruff-Borden (2013) reported IU and NPO were significantly correlated with worry, but PBW was not. PBW, however, were measured using subscales of the Metacognitions questionnaire for children (Bacow et al., 2009). The reliability and validity of this measure with 7–8-year-olds has been brought into question by Smith and Hudson (2013), who suggested that children were unable to wholly understand all items on the scales. The suitability of this measure for younger children is therefore questionable.

Age-dependent variation in GAD symptoms and their relationship to the IU model components may affect the applicability of the model to children and adolescents. Fialko et al. (2012), for example, produced two separate path models for 7–12-year-olds and 13–19-year-olds to best fit their data. In the adolescent model, PBW were associated with worry but not anxiety; in the younger age model, PBW were not associated with either. This finding was consistent with previous research, which has found a weak or non-existent relationship between PBW, worry and anxiety in younger child samples (Wilson & Hughes, 2011), and strong positive correlations between PBW and worry in adolescents (Gosselin et al., 2007), suggesting this relationship only develops during adolescence. Data from Fialko et al. (2012) also indicated the relationship between IU and anxiety, and between CA and anxiety, develops with age. Fialko et al. (2012) and Kertz and Woodruff-Borden (2013) demonstrated that age may moderate the relationship between the IU model variables and worry and anxiety; however, the data from these studies may not be generalizable due to reliability issues of some measures used with younger children.

In addition to age effects, gender potentially impacts upon the relationship between the IU model variables and worry and anxiety. With Iranian adolescents, Barahmand (2008) reported that in males NPO and PBW correlated with worry but IU did not; while in females NPO, PBW and IU correlated with worry. Fialko et al. (2012) reported that CA decreased with age during adolescence in girls, but this difference was much less marked in boys, and PBW increased with age in girls but decreased in boys. This suggests there may be a relationship between PBW and worry but gender moderates this relationship. Research into gender differences in the cognitive processes influencing GAD in the adult population demonstrates that women report relatively higher levels NPO and thought suppression, which is a type of CA (Robichaud et al., 2003). They suggest greater endorsement of such cognitive processes in women may explain why women report higher levels of worry than men; although, it is unclear whether this would apply to young people.

Overall, studies indicate that the IU model may be useful within child and adolescent samples. The interaction of age with these variables makes it difficult to understand the applicability of

the model across childhood. Research shows that there are potential gender differences in the reported levels of the IU model variables which warrant further investigation. The current study seeks to investigate the extent to which the IU model variables predict generalized anxiety symptoms in an analogue sample of children and adolescents, aged 11-15. A self-report measure of GAD that is validated for children and adolescents and that covers the full range of clinically relevant symptoms is not currently in existence. In order to ensure that as many symptoms of GAD are measured as possible by self-report, two separate outcome measures will be used; one to measure frequency and intensity of worries (Penn State Worry Questionnaire for Children; Chorpita et al., 1997), and one to measure the physical symptoms associated with excessive worry and anxiety (Worry and Anxiety Questionnaire; Dugas et al., 2001). We hypothesized that IU, CA, NPO and PBW would predict GAD symptoms and that age and gender would moderate the relationship of these variables with GAD symptoms.

2. Method

2.1 Participants

Participants were 326 young people aged 11 – 15 recruited from three high schools across a semi-rural area in West Scotland. The ethnicity of pupils was predominantly White British, with English used as a first language by the majority of pupils. The schools served populations from varied socio-economic backgrounds, identified by the percentage of pupils eligible for free school meals (Education Scotland, 2014). The mean age of participants was 13.2 years (S.D. = 0.98), with the sample comprising 169 (52%) males and 157 (48%) females. Included participants possessed the level of proficiency in English to enable completion of measures. Of the 433 pupils approached, 362 (83.6%) elected to participate. Thirty-six participants were excluded from further analysis due to incomplete data.

2.2 Measures

These questionnaires were combined into a single questionnaire format in the order described here for the purpose of the study. The full questionnaire is shown in Appendix 3.

Worry and Anxiety Questionnaire (WAQ; Dugas et al., 2001). The GAD physical symptom items from the WAQ were used in this study. It contains six items concerning the physical symptoms of worry in relation to the DSM-IV criteria for GAD. These items are rated on an eight-point Likert scale ranging from 'not at all' (0) to 'very severely' (8).

Penn State Worry Questionnaire for Children (PSWQ-C; Chorpita et al., 1997). This is a 14 item self-report measure of worry validated for use with children aged seven upwards. Items are rated on a four-point Likert scale ranging from 'never true' (0) to 'always true' (3). The PSWQ-C has

good internal consistency (α>0.81) and excellent test-retest reliability (r=0.92) over one week. The items in the PSWQ-C relate to some of the diagnostic criteria for GAD from the DSM-IV; in particular the frequency of excessive worry and the frequency that the individual finds it difficult to control the worries.

Short version of the Intolerance of Uncertainty Scale for Children (SV-IUS-C). This measure combines the accessible wording of the Intolerance of Uncertainty Scale for Children (IUS-C) (Comer et al., 2009) with the 12 items from the short version of the Intolerance of Uncertainty Scale (SV-IUS) for adults (Carleton et al., 2007) to produce a 12 items version of the Intolerance of Uncertainty scale for children. Both the IUS-C and the SV-IUS have excellent psychometric properties. Respondents report on their emotional, cognitive and behavioural reactions to ambiguous situations by rating the extent to which they agree with each item; a five-item Likert scale is used, with responses ranging from 'not at all' (1) to 'very much' (5).

Why Worry-III (WW-III; Riley, 2010). This 33 item self-report questionnaire has been adapted for use with children from the adult version (Holowka et al., 2000). A five-point Likert scale is used to measure agreement, with responses ranging from 'agree a lot' (1) to 'disagree a lot' (5). Lower scores indicate a greater belief that worrying is beneficial. Development of the measure was undertaken with 156 English 12–13-year-olds. The measure demonstrates good internal consistency across seven subscales (α = 0.69-0.81) and good convergent validity with the PSWQ-C in five of the seven subscales. Flesch Reading Ease analysis suggested the measure is suitable for children aged eleven upwards.

Negative Problem Orientation Questionnaire – Child version (NPOQ-C; Bowness-Clarke, 2013). This questionnaire contains 12 items rated on a five-point scale, responses ranging from 'not at all like me' (1) to 'entirely like me' (5). This questionnaire has been adapted for use with children from the original adult version developed by Robichaud and Dugas (2005). The language of the scale was checked using Flesch's reading age statistics and was likely to be suitable for children aged eleven upwards. The measure was found to have good reliability (α = 0.90) in an analogue sample of 239 English 11–14-year-olds.

The Revised Cognitive Avoidance Questionnaire (R-CAQ; Heary, 2012). This is a 35 item self-report questionnaire that has been adapted for use with children from the English adult version developed by Sexton and Dugas (2008). A five-point Likert scale is used to measure responses; these range from 'not at all like me' (0) to 'entirely like me' (4). The language of the questionnaire was checked using Flesch Reading Ease analysis, which suggested it was suitable for children aged eleven upwards. Internal consistency was very good (α = 0.95) in an analogue sample of 191 English 12–13-year-olds. Convergent validity with the PSWQ-C was adequate.

2.3 Ethical considerations and procedure

Ethical approval for the study was gained from the lead author's academic institution research ethics committee. Potential participants were recruited via letters distributed by schools, through which both children and parents/guardians were informed about the research opportunity and how to opt-out. Entry into a prize draw to win online shopping vouchers was offered as an incentive. Pupils completed consent forms and questionnaires during lesson time within the school day. Pupils were able to withdraw from the study on the day of data collection if desired.

Power considerations

Green's (1991) calculation for sufficiently powered multiple regression analysis was utilised; with seven predictors a minimum of 106 participants was required to answer our primary hypothesis. Previous research by Fialko et al. (2012) showed a mean difference of 0.34 between age groups for bivariate correlations of variables of interest in this study. In order to calculate required sample size to answer our hypotheses regarding moderators a power analysis was completed using the MMRPOWER (moderated multiple regression) program (Aguinis, 2011). This showed that with 95% reliability of measures, to achieve 80% power would require a sample size of 300 participants.

3. Results

3.1 Preliminary analysis

SPSS version 21 (IBM Corp., 2012) was used for analysis. Inter-item reliability of measures was good (see Table 1). Missing data from the 326 participants included in final analysis were low (<1%). Missing values were imputed using the Expectation-Maximization approach. Data from four measures were positively skewed. Square root, log10 and reciprocal transformations of the data from these variables were conducted. This did not reduce the skew of the data to an acceptable level of normality. It was decided to use the untransformed data in the correlational analyses with bootstrapping to give a 95% confidence interval for r (Lunneborg, 1985). In preliminary checks for multiple regression analysis heteroscedasticity, curvilinearity and multicollinearity were not indicated. Outliers were sought using the outlier labelling rule (N=10; 0.5%) (Hoaglin et al., 1986) and winsorized prior to further analyses (Tukey, 1962).

Pearson's product moment correlation analyses were conducted to examine bivariate relationships between all variables. Two multiple regression analyses were conducted, one with the physical symptoms score of the WAQ as the dependent variable and one with the PSWQ-C score as the dependent variable. Independent variables for both analyses were age, gender, intolerance of uncertainty (IU), positive beliefs about worry (PBW), negative problem

orientation (NPO) and cognitive avoidance (CA). Moderation analyses examining the influence of age and gender on the relationships between the independent and dependent variables were conducted using Hayes (2013) 'PROCESSv213' macro in SPSS.

3.2 Descriptive data

Table 1 gives information regarding each measure, with total scores subdivided according to gender. Independent t-tests revealed that male and female participants significantly differed in their scores on all measures ($p<0.05$); females reported a greater amount of worry and physical symptoms, and higher levels of IU model variables than males.

Table 1. Descriptive data for each measure and gender differences

Variable (measure)	Inter-item reliability (α)	Total mean (SD) (N=315)	Male mean (SD) (N=169)	Female mean (SD) (N=157)	t-test	Sig. (2-tailed)
Physical symptoms of GAD (WAQ)	0.82	18.0 (9.9)	16.4 (9.2)	19.7 (10.5)	-3.0	0.003
Worry (PSWQ-C)	0.93	16.7 (9.2)	13.6 (7.5)	19.9 (9.8)	-6.5*	<0.001
Intolerance of uncertainty (SV-IUS-C)	0.88	24.2 (8.8)	22.4 (8.0)	26.1 (9.2)	-3.9*	<0.001
Positive beliefs about worry (WW-III)	0.94	115.2 (23.3)	118.4 (23.8)	111.9 (22.3)	2.6	0.011
Negative problem orientation (NPOQ-C)	0.95	27.3 (12.0)	23.5 (10.2)	31.3 (12.3)	-6.2*	<0.001
Cognitive avoidance (R-CAQ)	0.96	37.2 (27.3)	30.7 (24.5)	44.5 (28.4)	-4.7	<0.001

*Levene's test showed homogeneity of variance had been violated so t-test results based on equal variances not assumed

3.3 Analysis of potential confounding variables

To examine whether socio-economic demographic of the schools was a potential confound, two schools that fell below the national average for pupils eligible for free school meals were grouped together and compared to the third school, from which the percentage of pupils eligible for free school meals was above the national average. T-tests of difference between means revealed a statistically significant difference between total scores on the physical symptoms of GAD ($t=-0.43$, $p<0.001$), with participants from the school above the national average for free school meals reporting a greater severity of physical symptoms than participants from the two schools below this average. Participants' reporting of worry was not significantly different between the schools.

Table 2. Correlational analysis among variables, showing 95%CI from bootstrapping and p-values

	Worry	IU	PBW	NPO	CA
Physical	0.58 (0.49; 0.66)*	0.52 (0.41; 0.60)*	-0.18 (-0.28; -0.07)*	0.55 (0.45; 0.63)*	0.35 (0.25; 0.45)*
Worry	-	0.66 (0.59; 0.73)*	-0.39 (-0.49; -0.29)*	0.72 (0.65; 0.79)*	0.46 (0.36; 0.54)*
IU		-	-0.38 (-0.47; -0.28)*	0.67 (0.59; 0.74)*	0.46 (0.34; 0.56)*
PBW			-	-0.41 (-0.49; -0.32)*	-0.51 (-0.59; -0.43)*
NPO				-	0.62 (0.55; 0.69)*

* = sig 0.01, two tailed

Correlational and regression analysis

Pearson correlations were calculated between all variables (see Table 2). Hierarchical regression analysis was performed to further examine the relationship between the four cognitive variables, worry and the physical symptoms of GAD. With worry as the dependent variable, gender and age were entered at step one in order to control for the variance accounted for by these factors (Table 3). At this first step gender and age contributed to 12% of the variance in worry scores. Individual t-tests on Beta coefficients showed that only gender contributed to the prediction of worry scores. At step two IU, PBW, NPO and CA were entered. All variables together explained 60% of the variance in worry scores. IU and NPO explained unique variance in worry. PBW was shown as a statistically significant but minimal predictor of variance in worry, whereas CA did not significantly predict variance in levels of worry.

Table 3. Hierarchical Multiple Regression Analysis for variables predicting worry

Variable	R2	adjusted R2	Unstandardised coefficients (ß)	Standardised coefficients (ß)	t	Significance (p)
Step 1	0.12	0.11				
Age			0.40	0.04	0.81	0.419
Gender			6.28	0.34	6.55	0.000
Step 2	0.60	0.59				
IU			0.33	0.31	6.49	0.000
PBW			-0.04	-0.10	-2.28	0.023
NPO			0.36	0.47	8.47	0.000
CA			-0.02	-0.06	-1.3	0.202

The same analysis was run with the physical symptoms of GAD as the dependent variable (Table 4). At the first step gender and age contributed to 8% of variance in physical symptoms. Individual t-tests on beta coefficients showed that gender and age contributed to the prediction of worry scores. All variables together explained 37% of the variance in physical symptoms of GAD. IU and NPO explained unique variance in physical symptoms of GAD. PBW was shown as a statistically significant but minimal predictor of variance in physical symptoms of GAD, whereas CA did not significantly predict variance in levels of physical symptoms of GAD.

Table 4. Hierarchical Multiple Regression Analysis for variables predicting physical symptoms of GAD

Variable	R2	adjusted R2	Unstandardised coefficients (ß)	Standardised coefficients (ß)	t	Significance (p)
Step 1	0.08	0.08				
Age			2.36	0.23	4.36	0.000
Gender			3.26	0.16	3.08	0.002
Step 2	0.37	0.36				
IU			0.32	0.28	4.61	0.000
PBW			0.05	0.11	2.02	0.044
NPO			0.30	0.36	5.23	0.000
CA			0.02	0.04	0.67	0.502

Moderation analysis of the conditional effect of the cognitive variables on physical symptoms of GAD and worry depending on age and gender revealed that gender, but not age, influenced some of these relationships. Gender was shown to moderate the relationship between PBW and the physical symptoms of GAD ($p=0.04$), PBW and worry ($p=0.02$), and CA and the physical symptoms of GAD ($p=0.02$). Inspection of correlation coefficients for these relationships by gender showed that a stronger relationship between PBW and worry occurred in females ($r=-0.43$, $p<0.001$) compared to males ($r=-0.32$, $p<0.001$). The relationship between PBW and the physical symptoms of GAD was shown to be weak-moderate in females ($r=-0.26$, $p<0.001$), while no statistically significant relationship between these variables was shown for males ($r=-0.06$, $p=0.21$). Finally, CA and the physical symptoms of GAD were shown to be moderately correlated in females ($r=0.43$, $p<0.001$), but only weakly correlated in males ($r=0.20$, $p<0.01$).

4. Discussion

This study aimed to investigate the extent to which the IU model variables predicted GAD symptoms and whether age and gender moderated these relationships in an analogue sample of 11–15-year-olds. The results suggest that, although individually the four variables were correlated with worry, only intolerance of uncertainty (IU), negative problem orientation (NPO) and positive beliefs about worry (PBW) explained unique variance in worry. These findings are

consistent with results of Laugeson et al. (2003), but not Kertz and Woodruff-Boden (2013), who found that only IU and NPO were correlated with worry and no components significantly predicted worry scores. Questionable reliability of the measures used and their smaller, younger sample may explain the difference in results. Gosselin et al. (2007) showed cognitive avoidance (CA) predicted worry scores in adolescents; however, as this was the only component from the IU model analysed, it seems likely that significant variance attributable to CA is lost when other key variables are introduced. Taking into consideration the above issues the results of the current study combined with the results reported by Laugeson et al. suggest IU and NPO strongly predict worry in young people, while PBW has minimal predictive power and CA does not predict worry. These results are directly comparable to results from adult populations; Dugas et al. (2007) reported IU and NPO were most strongly related to GAD severity while the importance of PBW and CA in predicting GAD severity only received modest support. Recent research investigating the relationships between meta-cognitive processes and GAD in children and adolescents, however, found significant relationships between PBW and GAD as well as between negative beliefs about worry and GAD (Esbjørn et al., 2015).

In the current study NPO and IU were both strongly correlated with worry, and both variables uniquely predicted worry scores in 12–15-year-olds; whereas in the similar study of adults, Dugas et al. (2007) found IU significantly predicted worry scores above and beyond the other model variables. This relative difference in the contribution of NPO to worry between adolescents and adults may be explained by their differing life experience. Adolescents may experience low problem-solving confidence and low perceived control over problems because in general, they are less autonomous than adults. NPO may therefore be more highly correlated with worry in adolescents than adults, because adults are likely to have experienced some agency over problems in their lives. Additionally, a relatively stronger relationship between worry, IU and NPO was shown in 12–15-year-olds, when compared to these relationships in adults. This suggests that an ability to tolerate uncertainty and a positive impression of one's problem-solving skills may develop with age and experience. Consequently, these components may have a decreased impact on worry severity with age. Differences between measures used in these studies, however, may account for the different results. Dugas et al. (2007) used the five-item negative problem orientation component of the Social Problem-Solving Inventory, Revised Short Form (D'Zurilla et al., 1998), which might not be comparable to the NPOQ-C.

With regard to the moderating effect of gender on the relationship between the IU model components and GAD symptoms, differences in mean scores of the components varied by gender; IU, PBW, NPO and CA were reported at higher levels in females than males. Furthermore, gender moderated the relationship between PBW and worry, and PBW and the

physical symptoms of worry, with this relationship being significantly stronger in females than males. This was partially consistent with the findings of Robichaud et al. (2003), who reported relatively higher levels of CA and NPO in adult females, but that the correlation between PBW and worry was stronger in males than females. The results of the current study may be understood according to the differing socio-cultural experiences of females and males. There may be less variability in the extent that females believe worrying is useful compared to males because worrying is a characteristic that is more consistent with a stereotypical female role (Stavosky & Borkovec, 1988). Worry as a facet of a socially prescribed gender role may be more likely to have associated positive narratives in females than males because it forms part of a 'normal' social identity.

An alternative explanation of gender differences in the relationship between PBW and worry is that they correlate more highly at more severe levels of worry, which females display relative to males. This is inconsistent with the results of Muris et al. (1998), who found children meeting criteria for Overanxious Disorder/Generalized Anxiety Disorder were unable to report positive features of their worry in comparison to 30% of control children, suggesting low worry groups endorse PBW more than high worry groups. Cartwright-Hatton et al. (2004), however, reported no significant differences between clinical and control groups on PBW in adolescents. Given the weight of evidence from previous studies suggesting high worriers do not endorse PBW more than low worriers it seems more likely that the gender differences seen in the present study are as a result of socio-cultural differences between females and males.

Gender was found to not moderate the relationship between IU, NPO, CA, and worry. Similar results were found for the relationships between these components and the physical symptoms of worry. This result conflicts with the results reported by Barahmand (2008), who showed that the relationship between IU and worry varied as a function of gender in Iranian adolescents. Cultural differences between study sites may be implicated. Barahmand suggests social pressure and expectations for males to achieve in Iran are much greater than for females, resulting in higher levels of anxiety in males. This pressure to achieve competence is perhaps more equal for females and males in the context of the current study, which may result in similar relationships between the IU model components and worry. The relationship between IU and worry reported in the current study is consistent with the results reported by Boelen et al. (2010), who found IU and worry correlations did not differ across gender in Dutch adolescents. Gender significantly moderated the relationship between CA and the physical symptoms of GAD, with a relatively stronger relationship in females. However, as CA was found not to significantly predict the physical symptoms of GAD this moderating effect was deemed to be of limited utility.

Age was not found to moderate the relationship between the IU model components and worry and physical symptoms of worry. This is inconsistent with the findings of Fialko et al. (2012); they found the relationship between PBW and worry strengthened with age and the relationship between IU and worry weakened with age. Independent of changes in relationships between variables, Dugas et al. (2012) reported worry and IU demonstrated U-shaped patterns of change over time in Canadian adolescents. Highest levels of worry and IU observed at beginning and end of high school and were suggested to relate to periods of transition. Such changes were not observed in the current study, probably due to the narrow age range recruited, with smaller numbers at its tails. Only seven 11-year-olds and twenty-nine 15-year-olds fully completed all measures, limiting the influence of any differences between participants across ages.

Although the percentage of free school meals registered at each school is only an approximate indicator of the socio-economic status of its pupils, results suggest that pupils from relatively poorer areas experienced a greater amount of physical symptoms of GAD. It is unusual that the same result was not found for worry scores, noting the close association between worry scores and scores on the WAQ. The current finding is inconsistent with previous studies of young people with anxiety disorders (Ginsburg et al., 2006; Hofflich et al., 2006), in which socio-economic status, as measured by family income, was not associated with physical symptoms of anxiety. As the results from the present study are based on generalizing socio-economic status from the school the pupils attend it limits the conclusions we can make about the relationship between socio-economic status and physical symptoms of GAD.

Strengths of this study include the comprehensive use of all components of the IU model, use of self-report measures that have been previously validated with young adolescents, and a well-powered sample size that enabled analysis of gender and age as moderators. The short version of the Intolerance of Uncertainty Scale for children, which combined two previously validated questionnaires, was shown to have good inter-item reliability, and so is potentially useful as a short measure in future studies. Limitations include the cross-sectional design, which does not allow for interpretation of the causal role of IU model components. We acknowledge that the lengthy questionnaires may have impacted on participants' ability to maintain focus during participation. Focusing exclusively on the IU model meant information concerning contextual factors that may also influence anxiety symptoms were not included and so reduces the generalizablity of the model. Furthermore, this was an analogue sample, which may limit whether the model is generalizable to clinical cases.

Although physical symptoms of GAD were significantly correlated with all IU model components, these relationships were weaker than the relationships between the IU model

components and worry. Furthermore, hierarchical regression analysis showed only 37% of variance in physical symptoms of GAD was explained by the IU model components; this compares to 60% of variance in worry explained by the same components.

A possible explanation of this result is the Penn State Worry Questionnaire for Children and the questionnaires for the IU model components measure cognitive constructs and so are conceptually similar, whereas the measurement of physical symptoms is conceptually different to that of the IU model components. Additionally, some of the individual symptoms making up the Worry and Anxiety Questionnaire (e.g. fatigue, sleep disturbance and irritability) are frequently reported within the adolescent population, and may be associated with other potential causal factors. For example, fatigue is frequently reported in adolescent girls, with 30.6 % reporting they feel fatigued in the morning at least once a week (Ghandour et al., 2004); sleep disturbance in adolescents is found to be correlated with electronic media use at night (Lemola et al., 2015); and irritability is associated with family stress (Tarter et al., 1995).

Overall, this suggests that measuring physical symptoms of GAD in isolation may not be the most useful measure of GAD when looking at relationships with cognitive models without taking into consideration multiple potential confounding variables.

5. Implications for research and practice

The results of this study suggest that elements of the IU model are related to GAD symptoms in 11–15-year-olds, as they are in adults; this demonstrates the potential utility of IU and NPO, both as explanatory concepts for the development of GAD in childhood, and as focus areas of psychological interventions targeting the cognitive processes maintaining GAD. Gender differences in the relationship between PBW and worry suggest females who experience higher levels of worry are more likely to endorse positive beliefs about worry than males. This finding requires further research given its novelty and inconsistency with previous research in adults. As negative beliefs about worry have been found to be more closely related to GAD than PBW in children and adolescents (Esbjørn et al., 2015) further investigation of how this meta-cognitive process relates to IU and NPO is warranted.

Regarding IU and NPO, Robichaud (2013) has suggested uncertainty recognition and exposure, and problem reorientation and training, could be useful specific strategies within CBT for GAD. A treatment protocol involving such strategies could be developed and investigated to demonstrate whether reductions in IU and NPO result in subsequent reductions in GAD symptoms in clinical populations of children and adolescents. Furthermore, given the demonstrated efficacy of CBT augmented by the IU model in adults for the treatment of GAD in comparison with applied relaxation training (Dugas et al., 2010), future research involving

GAD-diagnosed children and adolescents should investigate the efficacy of an IU-informed intervention in relation to a comparable cognitive-process informed intervention, such as the meta-cognitive model (Wells, 1995).

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

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