

The Impact of Chronic Physical Illness, Maternal Depressive Symptoms, Family Functioning, and Self-esteem on Symptoms of Anxiety and Depression in Children

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Abstract The present study extends earlier research identifying an increased risk of anxiety among children with chronic physical illness (CwCPI) by examining a more complete model that explains how physical illness leads to increased symptoms of anxiety and depression. We tested a stress-generation model linking chronic physical illness to symptoms of anxiety and depression in a population-based sample of children aged 10 to 15 years. We hypothesized that having a chronic physical illness would be associated with more symptoms of anxiety and depression, increased levels of maternal depressive symptoms, more family dysfunction, and lower self-esteem; and, that maternal depressive symptoms, family dysfunction, and child self-esteem would mediate the influence of chronic physical illness on symptoms of anxiety and

depression. Data came from the National Longitudinal Survey of Children and Youth ($N=10,646$). Mediating processes were analyzed using latent growth curve modeling. Childhood chronic physical illness was associated with increases in symptoms of anxiety and depression, $\beta=0.20$, $p<0.001$. Mediating effects were also observed such that chronic physical illness resulted in increases in symptoms of maternal depression and family dysfunction, leading to declines in child self-esteem, and in turn, increases in symptoms of anxiety and depression. CwCPI are at-risk for symptoms of anxiety and depression. Some of this elevated risk appears to work through family processes and child self-esteem. This study supports the use of family-centered care approaches among CwCPI to minimize burden on families and promote healthy psychological development for children.

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Nearly 20 % of children have a chronic physical illness (e.g., asthma, diabetes, epilepsy; van der Lee et al. 2007) that exerts an adverse impact on them, their families, and society. Chronic physical illness is defined as having a biological basis, being present for at least one year, and resulting in one or more of the following sequelae: functional limitations, dependencies to compensate for limitations in function (e.g., medication, assistive devices), and the need for health care above the usual level of care for youth of that age (Stein et al. 1993). The five leading causes of mortality in childhood are chronic physical illnesses (Hoyert et al. 2006), and 42 % of health costs in children are attributable to such conditions (Newacheck and Kim 2005). Recent U.S. data show that chronic physical illness results in substantial functional disability and school activity limitations (Msall et al. 2003). Moreover, having a

child with special health needs is associated with increased marital stress, divorce, and financial hardship (Reichman et al. 2004).

Children with chronic physical illness (CwCPI) face considerable challenges to their psychological well-being (Zashikhina and Hagglof 2007), reporting significantly higher levels of psychiatric disorder compared to healthy children (Pinquart and Shen 2011b). Cross-sectional studies suggest that CwCPI have almost a three-fold increase in the risk of developing emotional-behavioral problems compared to their healthy counterparts (Blackman et al. 2011). Furthermore, the differential risk for emotional-behavioral problems across chronic physical illness groups is generally negligible. For example, recent meta-analyses showed that effect sizes for symptoms of anxiety and depression were slightly larger among children with neurological illnesses versus other chronic physical illnesses (Pinquart and Shen 2011a); and that associations between child self-esteem and chronic physical illnesses were relatively homogenous across illness types (Ferro and Boyle 2013c). Elements of family functioning such as emotional expression, communication patterns, and conflict resolution also seem to exhibit few differences across illness types (Holmes and Deb 2003; McClellan and Cohen 2007).

Investigators have called for population-based research into family processes and child factors that mediate the health effects of having a chronic physical illness in childhood (Witt and DeLeire 2009; Zimmer and Minkovitz 2003) with a “plea for more developmentally appropriate, family-focused and child-led models of anxiety in young populations” (Cartwright-Hatton 2006, p. 813). Few studies have taken a causal modeling approach to examining the pathways through which exposure to chronic physical illness might increase risk for adverse childhood emotional-behavioral outcomes, particularly symptoms of anxiety. When chronic physical illness is present in children, parents report increased levels of depression (Singer 2006); families, more dysfunction (Wallander and Varni 1998); and, the children themselves, lower self-esteem (Ferro and Boyle 2013b, c). Unfortunately, the mechanisms linking these processes have not been modeled in CwCPI. Clarifying these mechanisms will lead to a better understanding of how we might mute these mechanisms, informing the development of prevention strategies, and refining treatment approaches for children with anxiety and depression.

There are good reasons to untangle the developmental mechanisms linking childhood chronic physical illness and symptoms of anxiety and depression in the context of the family environment. The diagnosis of a chronic physical illness in childhood is associated with elevated risk for maternal depression (Brehaut et al. 2009; Ferro and Speechley 2009; Whittemore et al. 2012). There is also evidence that family functioning mediates the impact of maternal depressive symptoms on behaviour and quality of life in CwCPI (Ferro

et al. 2011; Lim et al. 2011) and that child self-esteem mediates the impact of maternal depressive symptoms and family functioning on anxiety disorders in children (Roustit et al. 2010; Yen et al. 2013). At least one meta-analysis supports the argument that the family environment is an important context for the development and treatment of symptoms of anxiety and depression in children (McLeod et al. 2007).

The notion that CwCPI may be at elevated risk for anxiety and depression is consistent with current theories linking physical and mental health. According to cognitive-behavioural theories, anxiety can arise from negatively-biased thought patterns that exaggerate the risk and adverse effects of illness episodes, and undermine confidence in handling potentially threatening situations (Beck et al. 1985). For example, the experience of unpredictable asthma attacks or seizures can lead to a state of learned helplessness that can lead to symptoms of anxiety (Chaney et al. 1999; Hoppe and Elger 2011).

Furthermore, stress models suggest that CwCPI are exposed to higher allostatic load, which results in adverse effects on mental health (Bahreinian et al. 2013; McEwen 1998). The increased allostatic load in CwCPI may be the result of shared biological pathways or psychosocial and clinical factors which can have a negative impact on the stress levels of these children (Datta et al. 2005; McCaffery et al. 2012; Mullick et al. 2005). However, little is known empirically about additional stressors and how they mediate the adverse effects of chronic physical illness on mental health. Stress-generation theory (Hammen 1991) hypothesizes that some individuals, based on trait (e.g., having a chronic physical illness) or state (e.g., experiencing a current exacerbation of the illness) characteristics generate circumstances (i.e., dependent stressors/stress mediators) for themselves and intimate others, which can lead to further declines in physical and mental health of the individual in a potentially devastating cycle. As illustrated in Fig. 1, stressors such as the diagnosis of a chronic physical illness in childhood can increase the risk for symptoms of anxiety and depression directly, or its effect can be mediated, or transmitted by, symptoms of maternal depression, family dysfunction, and child self-esteem. In other words, having a potentially debilitating health condition may place CwCPI at increased risk for symptoms of anxiety and depression as a result of increasing maternal depressive symptoms, worsening family dysfunction, and declines in self-esteem. This model has been used previously to examine mediational pathways leading to symptoms of depression in adolescents (Auerbach et al. 2011; Kercher and Rapee 2009).

Symptoms of anxiety and depression are hypothesized to be the converging consequence of all components in the stress-generation model. The examination of symptoms of anxiety and depression during childhood/late adolescence is particularly important because of the academic, social, economic, and public health implications resulting from elevated

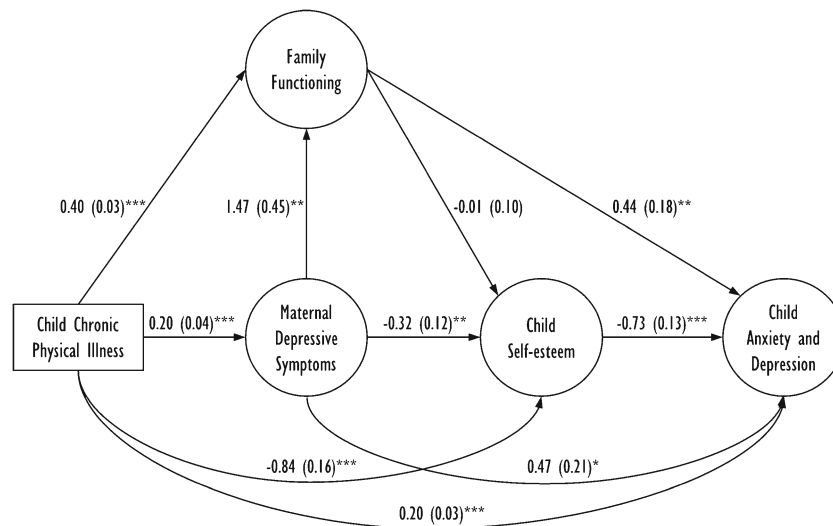


Fig. 1 A Stress-Generation Model for Symptoms of Anxiety and Depression in Children. The model illustrates the hypothesized relationships linking chronic physical illness and symptoms of anxiety and depression in childhood. While there is some evidence for bidirectional associations within the model, the one-way arrows depict the direction of effect that was tested in the current study. Although not shown for simplicity, each construct (circles) was modeled using latent intercepts and slopes

representing their respective initial status and growth rate. Each variable was measured at all three waves (ages 10–11, 12–13, and 14–15) to examine concurrent changes over time. Because the mediational model used to analyze the data focuses on how components of the model change over time, parameter estimates (β) and their associated standard errors for the slope of each construct are shown. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

symptoms (Costello et al. 2005; Ginsburg et al. 1998; Greenberg et al. 1999; Ialongo et al. 1996). Anxiety disorder is the most common mental health problem among children, with an estimated prevalence as high as 24 % and typically increasing from childhood to adolescence (Costello et al. 2005; Merikangas et al. 2009). The developmental processes that may explain this rise in prevalence include puberty-related hormonal changes, increased capacity for self-reflection and rumination associated with cognitive maturation, increased psychological stress resulting from normative developmental transitions, and changing relationships with parents and peers (Ge et al. 2001; Hankin et al. 2007). Given the evidence that many children experience subclinical symptoms of anxiety and depression and that anxiety disorder in childhood is a major risk factor for mental disorder in adulthood (Kim-Cohen et al. 2003), childhood is a critical period for identification, prevention, and intervention.

It is important to acknowledge that most CwCPI do not experience elevated symptoms of anxiety and depression suggesting that resilience in these children may be a prominent factor contributing to psychological well-being. There is a growing body of evidence that points to the family as the major determinant of resilience in CwCPI (Patterson and Blum 1996). Despite the difficulties associated with having a CwCPI, the ability of a family to maintain healthy functioning, adapt to stressors, and refocus priorities reflect their resilience, which in turn can foster healthy psychological development of children (Gannoni and Shute 2010; Rolland and Walsh 2006).

The objective of this study was to test a stress-generation model of putative mechanisms that may link chronic physical illness to symptoms of anxiety and depression in a population-based sample of children aged 10–15 years. Compared to healthy controls, we hypothesized that mothers of CwCPI would report more symptoms of depression, their families experience greater levels of dysfunction, and CwCPI report lower self-esteem and more symptoms of anxiety and depression. In addition, symptoms of maternal depression, family dysfunction, and child self-esteem would form a web of interconnected relationships mediating the negative impact of chronic physical illness on symptoms of child anxiety and depression: Chronic physical illness in childhood would lead to higher levels of maternal depressive symptoms leading to more family dysfunction, resulting in declines in child self-esteem, and in turn, leading to increases in symptoms of child anxiety and depression.

Methods

Data Source and Participants

Data came from the National Longitudinal Survey of Children and Youth (NLSCY) (Statistics Canada 2007). The NLSCY was a study of Canadian children from birth to early adulthood on factors influencing children’s social and behavioral development. The study methods are summarized here, with details available elsewhere (Statistics Canada 2007). Using a

stratified, multistage, probability design based on Statistics Canada's Labour Force Survey, the NLSCY enlisted a representative sample of newborns to 11 year-old children ($N=22,831$). Institutionalized children and those living on Aboriginal reserves were excluded. At each 2-year interval, children and their corresponding person most knowledgeable (PMK) caregiver completed a survey battery assessing sociodemographic and health-related constructs, including medical, psychological, and behavioral variables.

Waves 1–8 of the NLSCY were merged and restricted to 10–15 year-old children. This identified 15,389 children with self-assessments on at least one of three assessment occasions when they were 10–11, 12–13, and 14–15 years old. All data were measured at each of these three waves. The sample was then restricted to children where the PMK was the mother, $N=12,740$ (83 %) as mothers typically perform the role of primary caregiver to children (Marshall 2006). Children whose mothers reported inconsistent health status (e.g., asthma at 10–11 years, but no asthma at 12–13 years) were excluded, $N=10,714$ (70 %). A total of 68 children were also excluded due to missing household identifiers, resulting in a final sample size of $N=10,646$ (69 %). There were no significant sociodemographic differences between children included ($N=10,646$) and excluded in the analysis ($N=4,743$), with the exception that excluded participants reported more family dysfunction (8.3 vs. 7.9, $p=0.014$). Children were included if they completed at least one assessment. Among participants, 8,091 (76 %) completed the three assessments. Comparing respondents who completed all three assessments versus those who did not, missing data was associated ($p<0.001$) with mothers who were younger (age in years 38.6 vs. 39.2), not married (20 % vs. 14 %), lower education (post-secondary graduate: 37 % vs. 43 %), and lower household income (income \geq \$80,000: 18 % vs. 25 %). Participation in the NLSCY was voluntary and ethical approval was obtained from McMaster University.

Measures

Symptoms of anxiety and depression were measured using seven items adapted from the Ontario Child Health Study Checklist when adolescents were 10–11 years of age (Boyle et al. 1993). The items were assessed using a 3-point scale (0 = *never or not true*; 1 = *sometimes or somewhat true*; 2 = *often or very true*) such that higher scores indicated more symptoms. Sample questions included, “I am unhappy or sad”; “I worry a lot”; and “I have trouble enjoying myself”. The scale demonstrated good reliability ($\alpha=0.76$). Composite scores spanned 0–14 with higher scores indicating more symptoms of anxiety and depression.

Child self-esteem was measured using four items from the General Self-image subscale of the Self-Description Questionnaire (Marsh 1992). The four items were: “In general, I like the way I am”; “Overall, I have a lot to be proud of”; “A lot of things about me are good”; and “When I do something, I do it well” (Statistics Canada 2007). The items were rated using a 5-point Likert scale (0–4). Composite scores spanned 0–16 with higher scores indicating better self-esteem. The scale demonstrated good reliability ($\alpha=0.84$).

Maternal depressive symptoms were measured using a reduced version of the Center for Epidemiological Studies Depression Scale (CES-D; Radloff 1977), a 12-item questionnaire designed to assess depressive symptoms over the past week (Poulin et al. 2005). A 4-point Likert scale (0–3) was used to rate the frequency of symptoms experienced (e.g., “I felt depressed”; “I felt lonely”). Composite scores spanned 0–36 with higher scores indicating greater impairment. The scale demonstrated good reliability ($\alpha=0.86$).

Mother-reported family dysfunction was measured using the 12-item General Functioning subscale of the McMaster Family Assessment Device (FAD), providing an overall measure of the health/pathology of the family (Byles et al. 1988). Each item is rated on a 4-point Likert scale (0–3; e.g., “We confide in each other”; “We don't get along well together”). Composite scores spanned 0–36 with higher scores indicating more family dysfunction. The scale demonstrated excellent reliability ($\alpha=0.91$).

Child chronic physical illness was measured by asking mothers, “Has a health professional diagnosed any of the following long-term conditions for this child...? (asthma; cerebral palsy; epilepsy; heart condition; kidney condition; any other long-term condition). As required by Statistics Canada, the categories were aggregated and coded as binary (1=present; 0=absent) due to low case counts for some conditions. This resulted in 1,932 children classified as having a chronic physical illness and 8,714 healthy controls.

Children reported on their age in years, sex, and immigrant status (born in/out of Canada). Parents reported their sex, age in years, immigrant status (born in/out of Canada), education attainment (elementary school, secondary school graduate, some post-secondary, postsecondary graduate), employment status (working full- or part-time/unemployed), marital status (yes [includes common-law relationships]/no), and annual household income (categorized by \$20,000 intervals, from $<$ \$20,000 to \geq \$80,000).

Statistical Analysis

Baseline comparisons between children with and without chronic physical illness were conducted with χ^2 and t -tests using SAS 9.2. Effect sizes (d) were calculated using Hedges's g to account for unequal sample sizes (Hedges and Olkin

1984) and interpreted according to published guidelines (Cohen 1988). The method of variance estimates recovery was used to calculate the 95 % confidence interval for differences in the magnitude of mediating effect estimates (Zou and Donner 2008). Concurrent mediating processes within the model were examined using latent growth curve modeling in Mplus 7.11 (MacKinnon 2008). Due to the complex, hierarchical structure of the NLSCY, the model was estimated using maximum likelihood estimation with robust standard errors (Muthén and Muthén 2010). In the multistep method described by MacKinnon (2008), modeling of each individual variable over time (i.e., maternal depressive symptoms, family dysfunction, child self-esteem, child anxiety and depression) was conducted first for each subgroup (i.e., CwCPI and controls). Next, each of these individual growth processes was combined in a single model to assess potential mediational relationships among the variables in the stress-generation model. Finally, estimates of mediated effects ($\alpha\beta$) and the associated standard errors and 95 % confidence intervals were calculated to determine the significance of the mediated effects (MacKinnon 2008). Mediated effects were not bootstrapped on account of the following: (1) the sample size was large; (2) the distribution of $\alpha\beta$ typically does not deviate substantially from normality; and, (3) bootstrapping is not available in Mplus when the hierarchical structure of the data is accounted for using TYPE = COMPLEX.

Model fit was assessed using χ^2 goodness-of-fit, Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) with 90 % confidence interval. Adequate model fit was defined using the following thresholds: $\chi^2 p > 0.05$, CFI > 0.95 , and RMSEA < 0.06 (Singh 2009). If ≥ 2 indices met the threshold, fit was deemed adequate. Analyses conducted in this study implemented sampling weights based

on the probabilities of selection and participation, developed by Statistics Canada to ensure comparability between the NLSCY and Canadian population. Each child’s final survey weight was adjusted for the survey design and non-response, and post-stratified by province, age, and sex to match known population totals (Statistics Canada 2007). Full information maximum likelihood was used to account for data assumed to be missing at random (Graham 2009).

Results

Children were aged 10.5 (*SD* 0.5) years and 52 % were male at the time of study entry. Eighteen percent had a chronic physical illness (asthma=715; cerebral palsy=41; diabetes=47; epilepsy=69; heart condition=89; kidney condition=35; other=937) and these children were more likely to be male. Mothers were mostly married (83 %), 39 % had post-secondary education, and 16 % had household incomes of \geq \$80,000 per year. As shown in Table 1, CwCPI had lower self-esteem and more symptoms of anxiety and depression compared to healthy controls, $d=0.13$ and 0.25 , respectively. Mothers of CwCPI reported more symptoms of depression compared to mothers of healthy controls, $d=0.21$.

In the first step to test the stress-generation model, separate latent growth curve models for each variable were specified to examine change over time and to ensure adequate fit for each specific element of the stress-generation model in both groups of children. As shown by the slope estimates for CwCPI in Table 2, symptoms of maternal depression and family dysfunction increased significantly over time, $\beta=0.50$ and $\beta=0.21$, $p < 0.001$ for both. A significant decline in child-reported self-esteem was also observed, $\beta=-0.46$, $p < 0.001$. Symptoms

Table 1 Sociodemographic characteristics at study entry

	Chronic physical Illness (<i>n</i> =1,932)	Healthy (<i>n</i> =8,782)	<i>t</i> / χ^2	<i>p</i> -value
Children				
Age, years	10.5 (0.5)	10.5 (0.5)	0.57	0.567
Male, %	61.3	49.7	34.40	< 0.001
Immigrant, %	3.7	3.5	0.01	0.927
Self-esteem	13.3 (2.7)	13.6 (2.3)	4.82	< 0.001
Symptoms of anxiety and depression	7.0 (3.9)	6.1 (3.7)	9.27	< 0.001
Mother				
Age, years	38.8 (5.2)	38.9 (5.3)	0.73	0.464
Immigrant, %	14.9	18.1	2.79	0.099
Married, %	83.2	82.7	0.13	0.721
Post-secondary graduate, %	38.7	38.9	1.74	0.629
Household Income \geq \$80,000, %	15.5	16.6	6.14	0.189
Depressive symptoms	5.1 (6.0)	4.0 (5.1)	9.69	< 0.001
Family dysfunction	8.4 (4.9)	8.2 (4.7)	0.85	0.393

Variables are reported as mean (standard deviation) unless noted

Table 2 Latent growth curve models for children with chronic physical illness

	Maternal depressive Symptoms	Family dysfunction	Self-esteem	Symptoms of anxiety and depression
Growth factor				
Intercept (mean)	4.63 (0.12)***	8.33 (0.11)***	13.02 (0.02)***	6.86 (0.04)***
Intercept (variance)	23.64 (6.35)***	10.98 (0.16)***	3.70 (0.26)***	12.07 (0.45)***
Slope (mean)	0.50 (0.02)***	0.21 (0.01)***	-0.46 (0.01)***	1.02 (0.01)***
Slope (variance)	3.67 (2.17)	0.81 (0.57)	1.19 (0.06)***	3.48 (0.29)***
Covariance	3.87 (2.06)	-0.64 (0.35)	-0.77 (0.17)***	3.88 (0.21)***
Residuals variances				
Time 1	8.65 (4.02)***	13.49 (0.17)***	2.51 (0.25)***	2.74 (0.44)***
Time 2	19.73 (3.85)***	13.20 (0.81)***	4.34 (0.06)***	6.94 (0.13)***
Time 3	9.76 (3.10)***	13.32 (0.77)***	2.05 (0.13)***	2.71 (0.31)***
Fit indices				
$\chi^2(1)$	0.61	9.52	7.33	0.51
CFI	0.999	0.985	0.996	0.999
RMSEA [90 % CI]	0.001 [0.000, 0.055]	0.066 [0.033, 0.108]	0.058 [0.025, 0.101]	0.001 [0.000, 0.053]

Values are reported as unstandardized β estimate (standard error)

*** $p < 0.001$

of anxiety and depression increased significantly over time, $\beta = 1.02$, $p < 0.001$. Similar results were obtained for healthy controls (Table 3): family dysfunction increased, $\beta = 0.18$, $p = 0.007$, self-esteem decreased, $\beta = -0.47$, $p < 0.001$, and symptoms of anxiety and depression increased, $\beta = 1.00$, $p < 0.001$. The one exception was that for healthy controls, symptoms of maternal depression decreased significantly over time, $\beta = -0.14$, $p = 0.038$. The non-significant variance in the slopes of maternal depressive symptoms (CwCPI and healthy) and family dysfunction (CwCPI) suggested that there was little inter-individual deviation from the average change in

these constructs over time. Fit indices for each model were excellent.

Given the specification of the growth models and their adequate fit to the data, there was sufficient justification to combine each of the growth models and examine the potential mediational relationships within the full stress-generation model (Fig. 1). Because there was a significantly higher proportion of male CwCPI, the mediation model controlled for the potential confounding effects of child sex. Two of the three fit indices for the model were good: $\chi^2(51) = 527.11$, $p < 0.001$, CFI = 0.958, and RMSEA = 0.030, 90 % CI [0.027,

Table 3 Latent growth curve models for healthy controls

	Maternal depressive symptoms	Family dysfunction	Self-esteem	Symptoms of anxiety and depression
Growth factor				
Intercept (mean)	4.37 (0.18)***	8.02 (0.02)***	13.49 (0.00)***	6.73 (0.02)***
Intercept (variance)	14.13 (0.55)***	10.80 (0.03)***	3.36 (0.09)***	12.26 (0.34)***
Slope (mean)	-0.14 (0.07)*	0.18 (0.07)**	-0.47 (0.03)***	1.00 (0.02)***
Slope (variance)	0.21 (0.35)	1.70 (0.39)***	1.23 (0.14)***	3.51 (0.20)***
Covariance	-0.06 (0.15)	-1.50 (0.41)***	-0.72 (0.04)***	3.78 (0.26)***
Residuals variances				
Time 1	17.38 (1.97)***	13.49 (0.41)***	2.88 (0.09)***	2.45 (0.77)***
Time 2	14.35 (0.96)***	14.50 (0.17)***	3.85 (0.10)***	6.96 (0.01)***
Time 3	14.48 (0.94)***	13.07 (0.28)***	2.15 (0.29)***	2.36 (0.10)***
Fit indices				
$\chi^2(1)$	9.43	0.17	1.31	4.17
CFI	0.996	0.999	0.999	0.998
RMSEA [90 % CI]	0.031 [0.015, 0.051]	0.0001 [0.000, 0.021]	0.006 [0.000, 0.031]	0.019 [0.003, 0.039]

Values are reported as unstandardized β estimate (standard error)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

0.032]. Examination of the direct effects demonstrated that chronic physical illness in childhood was significantly associated with increases in symptoms of maternal depression, increases in family dysfunction, declines in child self-esteem, and increases in symptoms of anxiety and depression in children over time. Statistically significant associations between increases in symptoms of maternal depression, $\beta=0.47$, $p=0.025$ and family dysfunction, $\beta=0.44$, $p=0.015$ and increases in symptoms of anxiety and depression in children were also found. Likewise, declines in child self-esteem were associated with increases in symptoms of anxiety and depression, $\beta=-0.73$, $p<0.001$. All other pathways in the model were statistically significant and in the anticipated direction, with the exception of the association between changes in family dysfunction and child self-esteem, $\beta=-0.01$, $p=0.949$.

Mediated effects assessed in the model are shown in Table 4. In the single-mediator pathways, changes in symptoms of maternal depression, family dysfunction, and child self-esteem all independently mediated the impact of chronic physical illness in childhood on symptoms of anxiety and depression. Although there was no difference in the magnitude of the mediating effect between symptoms of maternal depression and family dysfunction, the mediating effect of child self-esteem was found to be significantly larger than both symptoms of maternal depression, $\Delta\alpha\beta=0.52$ [0.20, 0.85], and family dysfunction, $\Delta\alpha\beta=0.43$ [0.09, 0.78]. In the two-mediator pathways, chronic physical illness in childhood was found to increase symptoms of maternal depression, resulting in increases in family dysfunction, and in turn, leading to increases in symptoms of anxiety and depression. Similarly, increases in maternal depressive symptoms leading to declines in child self-esteem were also found to mediate the impact of chronic physical illness on child symptoms of anxiety and depression. There was no significant difference in the magnitude of the mediating effect for these two pathways, $\Delta\alpha\beta=-0.08$ [-0.19, 0.03].

Table 4 Mediated effects on symptoms of anxiety and depression in children

	$\alpha\beta$ (SE)	95 % CI
CPI→MDS→SAD	0.09 (0.05)	0.00, 0.18
CPI→FD→SAD	0.18 (0.06)	0.03, 0.32
CPI→SE→SAD	0.61 (0.16)	0.30, 0.93
CPI→MDS→FD→SAD	0.13 (0.05)	0.03, 0.23
CPI→MDS→SE→SAD	0.05 (0.02)	0.01, 0.09

CPI, chronic physical illness; FD, family dysfunction; MDS, maternal depressive symptoms; SAD, symptoms of anxiety and depression; SE, self-esteem

Discussion

Data from this population study suggest that children aged 10–15 years with chronic physical illness compared to their healthy counterparts are at-risk for more symptoms of anxiety and depression. This finding is consistent with a recent meta-analysis of children with a chronic illness compared to healthy controls and population norms (Pinquart and Shen 2011a). This study also demonstrated support for the stress-generation model linking chronic physical illness, symptoms of maternal depression, family dysfunction, and child self-esteem with symptoms of anxiety and depression in children. Whereas previous research has typically only examined two or three constructs at a time, this study tested five constructs simultaneously which allowed for the examination of multiple mediating pathways.

Our results are generally consistent with research on specific stress-generation model components, particularly among CwCPI. For example, in a sample of children with asthma, family functioning was found to mediate the effect of maternal depressive symptoms on child internalizing problems (Lim et al. 2011). Among children with epilepsy, family processes mediated the effect of maternal depressive symptoms on child health-related quality of life (Ferro et al. 2011). In the general population, there is also evidence that family functioning mediates the relationship between maternal depressive symptoms and child anxiety (Hughes et al. 2008) and that child self-esteem mediates the relationship between maternal depressive symptoms and symptoms of anxiety in children (Roustit et al. 2010). Because all of the pathways included in our model are taken into account (i.e., controlled), the mediating effect of child self-esteem on the relationship between family dysfunction on symptoms of child anxiety and depression may have been muted.

The role of child self-esteem in our study is an important finding. Researchers have developed a competency-based model of depression in children (Cole et al. 1997) which argues that children internalize competency-related feedback from others to form self-perceptions related to several domains, including academic competence, social acceptance, and physical appearance. Whereas positive self-esteem is linked to various developmental outcomes and is fundamental to coping with adversity, negative self-esteem places children at risk for anxiety and depression (Ginsburg et al. 1998; Pelkonen et al. 2008). Self-perceptions are inherent to self-esteem (Harter 1982) and recent studies have provided evidence supporting this mediational process (Class et al. 2012; Jacquez et al. 2004). In addition to documented evidence, the consistency and strength of effects observed in our study argues that the mediating role of self-esteem may be a causal effect.

Combined with previous research, this study provides some insight into the potential linkages among chronic

physical illness, maternal depressive symptoms, family dysfunction, and child self-esteem on symptoms of anxiety and depression in children. The diagnosis of chronic physical illnesses in childhood can have a variety of adverse consequences for mothers (Brehaut et al. 2009), including added care requirements and costs for treatment (Burton and Phipps 2009), experiences of grief or stigma (Hobdell et al. 2007), and increases in the manifestation of symptoms of depression (Brehaut et al. 2011; Ferro and Speechley 2012; Gray et al. 2011). These symptoms of maternal depression can lead to declines in family functioning (Celano et al. 2008; Ferro et al. 2011), attributable in part to strains in parent-child relationships, marital discord, and financial stress (Reichman et al. 2004). Mothers with elevated symptoms of depression typically direct more negative expressed emotion at their children. In addition to being an indicator of family dysfunction, exposure to negative expressed emotion can result in declines in self-esteem and poorer psychological functioning in CwCPI (Hodes et al. 1999). The relationship between maternal depression and lower child self-competence may be attributable to shared genetic and environmental liability (Class et al. 2012).

Using a developmental approach, this study provided some evidence to suggest that changes in self-esteem preceded changes in symptoms of anxiety and depression in children. Because of its large effect and central developmental role, self-esteem may be considered a priority target for intervention to prevent the onset or reduce the severity of symptoms of anxiety and depression among CwCPI. In children and adolescents, with and without chronic physical illness, there is strong evidence that self-esteem can be markedly improved using a variety of interventions within home, school, community, or clinical settings (O'Mara et al. 2006). Interventions specifically focused on improving child self-esteem have had stronger positive effects on behavioral and academic functioning compared to interventions that took aim at other aspects of function such as social skills (Haney and Durlak 1998).

This research contributes to the growing literature of family influences on the mental health of CwCPI and support the implementation of family-centered care strategies, which have shown to be associated with improved outcomes for parents and CwCPI, including satisfaction with care and fewer child developmental problems (Law et al. 2003). In providing individualized care, clinicians should be attuned to the family climate and proceed with recommendations (e.g., screening, referral, treatment) on a case-by-case basis. Clinicians should openly discuss how maternal mood can affect child outcomes by impacting the family climate. Such actions may exert their effects upstream in the stress-generation model to reduce the impact of childhood chronic physical illness on mothers' mental health and family functioning. At a more active level, clinicians might use the Psychosocial Assessment Tool to assess parent and family functioning in families (Pai et al.

2008). Routine screening and the provision of supportive resources may also help families adapt more positively to the hardships associated with childhood chronic physical illness potentially warding off child emotional-behavioral problems.

There is strong evidence to suggest that symptoms of anxiety and depression can be treated using a variety of interventions in children with (Beebe et al. 2010) and without chronic physical illness (Settipani and Kendall 2013; Sportel et al. 2013). Among CwCPI, modalities that aim to increase capacity and improve self-management capabilities can reduce symptoms of anxiety (Chiang et al. 2009; Vazquez and Buceta 1993). Additionally, there has been a call for family-focused interventions that will enable families to draw on supportive resources to help them adapt to having a CwCPI (Svavarsdottir and Rayens 2005). Preliminary evidence suggests that structured behavioral group training to reduce parental stress and improve parenting skills is associated with an improvement in symptoms of anxiety among children with diabetes (Sassmann et al. 2012).

This study has several limitations. First, the sample represents a narrow age range and the differential attrition among participants may limit the generalizability of the findings. Second, the study relied on brief measures of self-esteem and anxiety and depression; however, our measure of self-esteem is reliable and invariant in children aged 10–19 years (Ferro and Boyle 2013a; Ferro and Boyle 2013b) and the measure of symptoms of child anxiety and depression is psychometrically sound (Boyle et al. 1993). Third, while evidence suggests the direction of effects stem from mother and family to child (Elgar et al. 2003; Lim et al. 2011), alternate models depicting reciprocal effects between child behavior and family processes are possible (Gartstein and Sheeber 2004; Trautwein et al. 2006) and warrant investigation. Sensitivity analyses assessing various alternate models with the current dataset demonstrated considerably worse model fit compared to the model presented (data not shown). Fourth, the association between child self-esteem and symptoms of anxiety and depression may have been enhanced by overlapping method variance. Fifth, pooling chronic physical illnesses may have tempered effect sizes. While Stein and Silver have shown that a non-categorical approach to studying childhood chronic physical illness is valid (Stein and Silver 1999), low counts for some conditions prevented formal tests of between-group differences. For example, effects may be larger for children with epilepsy because it is a neurological illness manifested physically through unpredictable seizures (Hoare and Mann 1994). However, recent meta-analyses have shown relatively little heterogeneity in problem behavior across conditions (Ferro and Boyle 2013c; Piquart and Shen 2011b). Finally, the measure of chronic physical illness is non-specific for the relatively large proportion of adolescents in the “any other long-term condition” category.

Conclusion

Children with chronic physical illness are at-risk for elevated symptoms of anxiety and depression. The effects of childhood chronic physical illness on symptoms of anxiety and depression were mediated by symptoms of maternal depression, family dysfunction, and child self-esteem. Consistent with the stress-generation model, this study supports the use of family-centered care approaches for CwCPI, with particular emphasis on child self-esteem as antecedent to more serious psychopathology. Future research is needed to examine these mediational pathways in high-risk clinical populations, as well as investigate protective factors and their mechanisms leading to child resilience against symptoms of anxiety and depression. Further research is also needed to determine the extent to which symptoms of anxiety are normative or even adaptive for CwCPI. An important contribution to child and adolescent psychology would be intervention studies that target child self-esteem and family processes to determine whether the negative influences of chronic physical illness, low self-esteem, maternal depressive symptoms, and family dysfunction on symptoms of anxiety and depression in children can be minimized.

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