Psychological Flexibility in Parents of Children with Asthma: Analysis Using a Structural Equation Model

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Abstract

Psychological flexibility (PF) refers to an individual's capacity to deal with the present moment non-judgmentally and to commit to value-based actions. This study evaluated how parental PF, psychological adjustment to a child's illness, and psychological symptoms including anxiety, depression, and stress in parents are associated with asthma morbidity in children. Three-hundred and twenty-four parents of children aged 3–12 years with asthma completed a self-administered questionnaire to measure their PF, psychological adjustment, and symptoms of anxiety, depression, and stress, their children's asthma symptoms and their use of bronchodilators. Structural equation modeling was used to explore the relationships among these constructs. The results showed that poor PF was significantly associated with poor psychological adjustment to the child's illness and increased psychological symptoms in parents. Parental PF was found to be the only latent construct possessing a significant association with the child's asthma morbidity ($\beta = 0.27$, 95% CI [0.09, 0.42], $p = .002$). These results suggest that by fostering their PF parents may improve their own psychological well-being as well as their child's asthma condition.

Keywords

Psychological flexibility
Psychological adjustment
Parents
Children
Asthma

Introduction

Asthma is the most common chronic disease in children, affecting one-tenth of all children worldwide (Anandan et al. 2010). A multi-country survey has revealed that among children diagnosed with asthma, 92% experienced asthma-related coughing and 59% would wake up during the night because of asthma symptoms (Wildhaber et al. 2012). Asthma also has an impact on children's enjoyment of physical and social activities (Wildhaber et al. 2012). Every year

over half (51.7%) of Asian children with asthma access urgent healthcare services due to an asthma attack (Wong et al. 2013). The involvement of parents in caring for a child with asthma has been proven to enhance treatment adherence (Fiese et al. 2005), the child's psychological functioning (Minuchin et al. 1975), and the child's quality of life (Sales et al. 2008). However, parents, as the crucial caregivers, face many critical challenges in caring for a child with asthma, including fear and uncertainty that the child may die due to recurrent asthma attacks (Horner 1997; MacDonald 1996; Trollvik and Severinsson 2004). In addition, parents show an array of psychological difficulties if they perceive routine asthma care to be a burden (Fiese et al. 2008). A recent meta-analysis identified 25 studies and compared symptoms of anxiety and depression in 4300 parents of children with asthma with those in 25,064 parents of healthy children. The review suggested that parents of children with asthma exhibit more symptoms of anxiety ($d = 0.50$) and depression ($d = 0.44$) when compared with the parents of healthy children (Easter et al. 2015).

It has been suggested that the psychological distress of parents is not only the consequence but also the potential cause of poor asthma symptom control in young children. Results from longitudinal studies indicate that children whose parents have a significant level of psychological distress such as anxiety, depression, and stress when compared with their counterparts suffer from more asthma symptoms in both daytime and nighttime (Otsuki et al. 2010); make more recurrent use of oral corticosteroids (Lange et al. 2011); visit to emergency care services more frequently; and eventually have a greater need to be admitted to hospitals due to an asthma attack (Bartlett et al. 2001; Weil et al. 1999). Furthermore, parents who are unable to psychologically adjust well are those who are unable to maintain a healthy emotional balance between the demands of caring for a child with asthma and the available personal resources (such as self-efficacy) (Wallander and Varni 1998). Eventually, such parents could experience psychological problems, which could affect their asthma management behaviors (Celano 2006; Kaugars et al. 2003).

It has recently been suggested that addressing the psychological difficulties of parents in managing their child's asthma is a viable treatment strategy. Psychological interventions for parents, however, such as cognitive behavioral therapies (Eccleston et al. 2015), and family therapies (Yorke and Shuldham 2005), have not been conclusively shown to improve the asthma symptoms of children. In order to develop an effective intervention, it is important for researchers to explore what other potential psychological factors from parents might have an effect on their child's health.

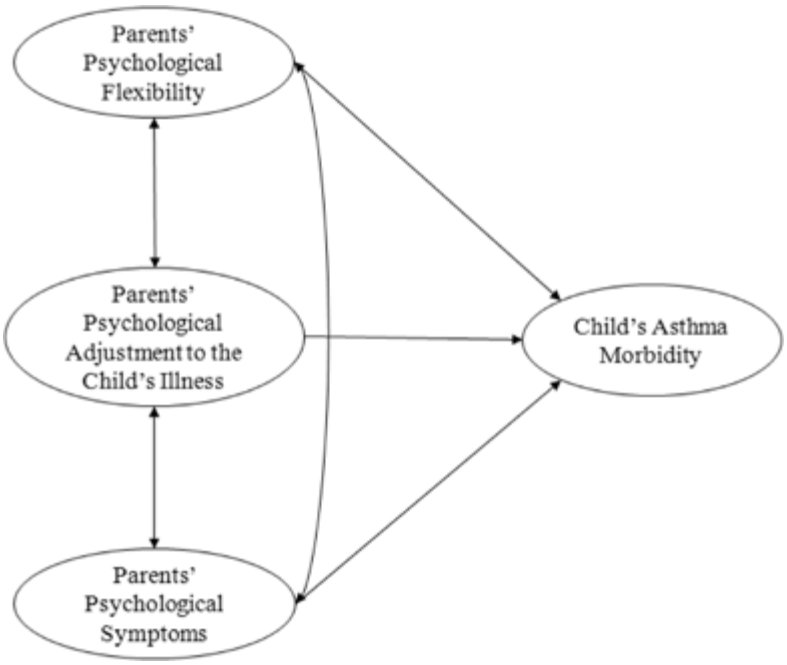
A number of studies have supported the view that parents may not respond appropriately when caring for their child with asthma. For example, parents may over-utilize healthcare facilities and keep their child away from school and from engaging in physical activities based on their perceptions of their child's heightened vulnerability due to the illness, rather than on the actual severity of the asthma symptoms (Spurrier et al. 2000). Inhaled corticosteroid (ICS) is considered a first-line therapy to control asthma (van Aalderen and Sprikkelman 2011). However, 30 to 70% of patients do not adhere to the prescribed ICS (Rand and Wise 2012). Even when parents are aware of the necessity of using ICS as a long-term asthma treatment, they worry about its side-effects, such as growth impairment in children (Klok et al. 2015).
Psychological flexibility (PF) describes an individual's capacity to adopt an intentionally open, flexible, and non-judgmental posture to moment-to-moment experiences when interacting with the contextual environment, and to engage in behaviors that are consistent with valued goals, even when the present moment includes aversive experiences, such as difficult thoughts, feelings, or body sensations (Hayes et al. 2006). In the other words, individuals with poor PF will entangle themselves in a psychological process called ~~experience~~experiential avoidance by avoiding experiences or struggling for control even when psychological or behavioral harm occurs (Hayes et al. 2006). For example, individuals with poor PF will tend to manage their social fears by concealing their ongoing feelings through behavioral avoidance strategies (e.g., avoiding the crowd). Paradoxically, this could intensify their symptoms of anxiety and result in social anxiety disorders (Kashdan and Rottenberg 2010). Another example relates to parenting practices. When her child misbehaves, a mother with poor PF might engage in a negative self-evaluation of her competence as a parent and engage in punitive parenting to control the child's behavior, which might further exacerbate the mother's stress but also intensify the child's behavioral problem (Shea and Coyne 2011).
Putting the concept of PF into the context of parental involvement in managing the child's asthma, when negative emotions arise when taking care of a child with asthma, such as fear of the recurrence of asthma attacks, parents who are less psychologically flexible may attempt to alleviate their perceived difficulties by responding with avoidance and engaging in ineffective asthma management behaviors. This could have a negative impact on their child's asthma morbidity. To our knowledge, however, no studies have been conducted to assess the association between the PF of parents of a child with asthma and their child's asthma morbidity.

A major challenge in studying how the psychological status of parents might affect their children is that many psychological factors, such as psychological adjustment to the child's illness and psychological symptoms, are multi-dimensional and are correlated with each other. Previous studies using regression analyses may have overlooked the actual contributions of a variety of potential parental psychological predictors to the child's asthma (Bartlett et al. 2001; Klinnert et al. 2008; Silver et al. 2005). Structural Equation Modeling (SEM) is an extension of regression analysis. SEM allows researchers to simultaneously instead of separately examine the interrelationships of multiple factors in a model (Nachtigall et al. 2003). Latent factors in SEM refer to the hypothetical constructs that cannot be measured directly, but are inferred from a class of indicators that belong to the same dimension (Bollen 2002). In the other words, latent factors such as parents' psychological adjustment (Bonner et al. 2006) and psychological symptoms (Henry and Crawford 2005) can be constructed directly by indicators (observed variables); and hence the relationships of these latent factors can be assessed by SEM.

In the present study, our aim was to examine the ways in which the PF of parents, their psychological adjustment to their child's illness and their psychological symptoms including anxiety, depression, and stress, related to their child's asthma morbidity (see Fig. 1). We hypothesized that poor PF would be associated with poor psychological adjustment to the child's illness and to increased psychological symptoms in the parents, and that consequently, their child would be more likely to suffer from poor asthma morbidity.

Fig. 1

The conceptual model



Method

Participants

Participants were recruited between January to June 2016 in two pediatric respiratory outpatient clinics (the Ambulatory Care Centre and a nurse-led asthma clinic) in one of the public hospitals in Hong Kong. This hospital serves two of the 18 districts in Hong Kong. In 2016, these two districts had a total population of 130,200 children (15.7% of the total population aged under 14 years in Hong Kong) (Census and Statistics Department 2016a). Parents were recruited if they had a child aged 3–12 years with a physician's diagnosis of asthma (International Classification Diseases—10 codes J45, J46), were Hong Kong permanent residents aged 18 years or above, living together with the child, and able to communicate in Cantonese. Parents were excluded if their child had been diagnosed with asthma but (a) was under care due to autism, epilepsy, or Attention Deficit Hyperactivity Disorders; and/or (b) under another form of pediatric specialty care due to a congenital problem, oxygen-dependent conditions, or the presence of tracheotomy.

The present study involved 324 Hong Kong parents of children with asthma. The characteristics of the parents and their children are presented in Table 1. The mean age of the parents (88.3% mothers, 56.8% home-makers) was 40.7 years ($SD = 8.7$, range 25–72 years) and that of their children (63.6% boys) was 7.0 years ($SD = 2.5$, range 3–12 years). The majority of the parents had an educational attainment at secondary school level (70.1%). Nearly half (43.8%) of the parents had a monthly household income ranging from $25,001 to

$50,000 (in Hong Kong Dollars, USD $1.00 = HKD $7.80), which was above the median monthly household income ($25,000) of households with an average of three family members (Census and Statistics Department 2016b). Children were diagnosed with asthma at a young age ($M = 3.5$, $SD = 1.8$). Almost 30% of the children had suffered from at least one asthma attack and had been brought to the emergency department for acute treatment in the past 6 months.

Table 1

Descriptive summary of parents' characteristics and child's characteristics

	n	**%**
Parents' characteristics		
Relationship with the child		
Father[a]	38	11.7
Mother[b]	286	88.3
Age, *M* (SD)	40.7 (8.7)	
Educational attainment		
Primary education or below	39	12.0
Secondary education	227	70.1
Tertiary education or above	58	17.9
Monthly household income (HKD)[c]		
<$ 10,000	51	15.7
$10,000 to $25,000	115	35.5
$25,001 to $50,000	142	43.8
>$50,000	16	4.9
Employment status		
Full-time employed	132	40.7
Part-time employed	8	2.5
Home-makers or unemployed	184	56.8
Marital status		
Single/ separated/ divorced/ widowed	41	12.7
Married	283	87.3
Smoking status		
Both parents are non-smokers	198	61.1
At least one parent is a current smoker	126	38.9
History of asthma diagnosis		
Neither parents has a history of asthma	227	70.0

Table 1

Descriptive summary of parents' characteristics and child's characteristics

	n	%
At least one parent has a history of asthma	97	30.0
Child's characteristics		
Gender		
Male	206	63.6
Female	118	36.4
Child's age, *M* (SD)	7.0 (2.5)	
Child's age of diagnosis of asthma	3.5 (1.8)	
Current use of inhaled corticosteroid		
Yes	156	48.1
No	168	51.9
Diagnosed with allergic rhinitis		
Yes	121	37.3
No	203	62.7
Diagnosed with eczema		
Yes	32	9.9
No	292	90.1
Total number of unplanned physician's office visit(s) due to an asthma attack in the past 6 months, *M* (SD)[d]	1.41 (2.38)	
0 times	163	50.3
1 to 2 times	95	29.3
3 to 4 times	42	13.0
5 to 6 times	16	4.9
7 times or above	8	2.5
Total number of emergency care visit(s) due to an asthma attack in the past 6 months, *M* (SD)	0.48 (0.90)	
0 times	229	70.7
1 to 2 times	90	27.8
3 to 4 times	3	0.9
5 times or above	2	0.6
Total number of hospital admission(s) due to an asthma attack in the past 6 months, *M* (SD)	0.24 (0.59)	
0 times	266	82.1
1 to 2 times	54	16.7

Table 1

Descriptive summary of parents' characteristics and child's characteristics

	n	%
3 to 4 times	4	1.2

Note: *N* = 324, *M* mean, *SD* standard deviation, *HKD* Hong Kong Dollars (USD $1.00 = HKD $7.80)

[a] 3 out of 38 (7.9%) participants were grandfathers

[b] 22 out of 286 (7.8%) participants were grandmothers

[c] According to data from the Quarterly Report on the General Household Survey data conducted in Hong Kong on January–March 2016, the median monthly household income of the households with in an average size of 2.9 people was approximately $25,000 Hong Kong Dollars (Census and Statistics Department 2016b)

[d] Unplanned physician's office visit(s) refers to the sum of unplanned service attendances due to children's asthma attacks in the General Outpatient Clinics and in the private practitioners' clinics

Procedure

This was a cross-sectional study using the baseline assessment findings on parents who had participated in a randomized controlled trial (RCT). The aim of this RCT was to examine the effects of a group-based Acceptance and Commitment Therapy for parents in managing their child's asthma. Approvals were obtained from the university and the hospital's institutional review board before the commencement of the study. Parents were consecutively recruited during their visits to the clinics. Eligibility screening was carried out in two stages. First, the research investigator retrieved the child's information from the electronic medical records and screened out all of those who had scheduled appointments in the clinics for pediatric respiratory problems. Second, when an identified child attended the clinic with an accompanied parent, further screening for eligibility was conducted via individual interviews. Eligible parents were then invited by the nursing staff of the clinics to complete a set of self-administered questionnaires while awaiting service in the clinics. The research investigator was available in the clinics to answer any questions raised by the parents. Participation in this study was voluntary and written consent was obtained from all parents.

Measures

This study employed a self-administered questionnaire to obtain information on the parents and their children using the following measures:

Parents' psychological flexibility

The Acceptance and Action Questionnaire-II (AAQ-II) was used to assess the psychological flexibility (PF) of parents (Bond et al. 2011). Parents rated seven statements on a 7-point Likert scale ranging from 1 (*never true*) to 7 (*always true*); for example: "My painful experiences and memories make it difficult for me to live a life that I would value." A higher total score indicates poor PF. The AAQ-II possessed good internal consistencies (mean $\alpha = .84$, range $\alpha = .86$ to .88) and test-retest reliabilities over a 3-month interval ($r = .81$) and 12-month interval ($r = .79$), respectively (Bond et al. 2011). The alpha of the AAQ-II in this study was .91.

Parents' psychological adjustment to their child's illness

The Parent Experience of Child Illness (PECI) was used to capture the psychological adjustment of parents in taking care of a child with asthma (Bonner et al. 2006, 2008). The PECI contains 25 statements with three subscales for assessing the illness-specific psychological distress experienced by parents who have a chronically ill child, including Guilt and Worry (e.g., "I feel guilty because my child became ill while I remained healthy"), Unresolved Sorrow and Anger (e.g., "I am jealous of parents who have healthy children"), and Long-term Uncertainty (e.g., "I worry about whether my child will be able to live independently as an adult"), together with one subscale on perceived Emotional Resources (e.g., "I feel ready to face challenges related to my child's wellbeing in the future"). Parents rated the degree to which each statement applied to them over the past month on a 5-point Likert scale from 0 (*never*) to 4 (*always*). The PECI had adequate internal consistencies (α in each subscale = .72 to .89) (Bonner et al. 2006) and test-retest reliabilities over a two-week interval (r in each subscale = .83 to .86) (Bonner et al. 2008). The alphas of the PECI subscales in this study ranged from .76 to .83.

Parents' psychological symptoms

The Depression Anxiety Stress Scale 21 (DASS-21) (a short form of the original DASS-42 scale) with 21 statements was used to evaluate the states of depression (e.g., "I felt that I had nothing to look forward to"), anxiety (e.g., "I felt I was close to panic") and stress in adults (e.g., "I found myself getting agitated") (Henry and Crawford 2005). Parents rated the degree to which each statement applied to them in the past week on a 4-point Likert scale from 0 (*does not apply to me at all*) to 3 (*applies to me very much, or most of the time*). A higher score on each subscale indicates more severe symptoms of depression, anxiety, or stress. The reliabilities for the depression, anxiety, and stress subscales in DASS-21 were .82, .88, and .90, respectively (Henry and Crawford

2005). The alphas of the depression, anxiety and stress subscales in DASS-21 in this study were .81, .84, and .85, respectively.

Child's asthma morbidity

Three indicators of the severity of a child's asthma symptoms were chosen (Global Initiative of Asthma 2015). Parents reported their child's health condition in the past 1 month with regard to: (a) the average number of days per week that the child presented with asthma symptoms, including chronic coughing, wheezing, or shortness of breath, during the daytime (day symptoms); (b) the average number of nights per week that the child awakened or coughed due to asthma (night symptoms); (c) the average number of days per week that the child was required to use a short-acting bronchodilator to relieve his/her asthma symptoms (reliever use). The alpha of the child's asthma symptoms in this study was .83.

Characteristics of the parents and the children

The socio-demographic characteristics of the parents of children with asthma were assessed. These included age, gender, level of education, monthly household income, employment status, and marital status. The characteristics of the children were collected, including age, gender, the age of diagnosis of asthma, current use of ~~ICS~~Inhaled corticosteriod (ICS), diagnosis of allergic rhinitis (yes/no), diagnosis of eczema (yes/no), and the total number of healthcare service visits (physician clinics, emergency care units, hospital admissions) due to an asthma attack in the past 6 months.

Instrument validation

Although the above-mentioned measures have demonstrated good psychometric properties in Western populations, they have not been tested cross-culturally. Hence, to further enhance the robustness of the assessment specifically in Hong Kong Chinese parents of children with asthma, the psychometric properties of the measures in the Chinese version were examined before the study was conducted. The internal consistency of the questionnaire was ($n = 49$) and the test-retest reliability was ($n = 20$) in a sample of parents of children with asthma in the study hospital and in a community setting, respectively. This sample was not included in the primary analyses of the present study. The internal consistency of each measure ranged from moderate to high, indicating the homogeneity of its construct ($\alpha = .88$ for the AAQ-II; .74 to .86 for the PECI subscales; .82 to .84 for the DASS-21 subscales; .81 for the child's asthma morbidity indicators). The intra-class correlation (ICC) of each measure also showed satisfactory stability over 2 weeks (ICC = .94 for the AAQ-II; .76

to .85 for the PECI subscales; .78 to .88 for the DASS-21 subscales; .87 for the child's asthma morbidity indicators).

Data Analysis

The Statistical Package for the Social Sciences (SPSS) software version 23.0 was used for descriptive statistics and correlational analyses. The SPSS Analysis of Moments Structure (AMOS) software version 23.0, based on a maximum likelihood model estimation, was used for SEM. Analyses were conducted in four stages. First, the data were screened for missing values, univariate normality was checked by examining the values of skewness and kurtosis, and multivariate outliers were detected by checking the Mahalanobis distance at $p = .001$ (Osborne and Overbay 2004). Second, descriptive statistics and Pearson's correlation coefficients (r) were obtained to explore the zero-order correlations among all of the observed variables to be included in the model. Effects sizes for absolute r were interpreted as follows: >.10, small; >.30, medium; >.50, large (Cohen 1988). Third, a confirmatory factor analysis (CFA) was conducted to examine whether the constructs were measured by the indicators with significant loadings. Finally, a structural model was tested to examine the correlations and the regressive relationships among the latent variables and whether the model had acceptable indices. The criteria for a good model fit were: comparative fit index (CFI) $\geq .95$; Tucker-Lewis Index (TLI) $\geq .95$; standardized root means square residual (SRMR) $\leq .08$; and root mean square error approximation (RMSEA) $\leq .06$ (Hu and Bentler 1999). Attempts to improve the goodness of fit of the model were carried out by adding covariance path(s), if a significant modification index (MI) coincided with a large expected parameter change (EPC) value (Saris et al. 1987). The above adjustments were made only under conceptual justification (Byrne 2010). Previous research suggests that the parents' relationship with the child (Kaugars et al. 2003), the parents' history of asthma diagnosis (Burke et al. 2003), and the child's age may affect the interrelationships between the parental psychological factors and the children's asthma outcomes (Global Initiative of Asthma 2015). Hence, they were included as control variables and analyzed as correlated with all latent constructs in the model.

In this study, 331 parents completed the questionnaire. Seven parents (2%) were excluded from the analysis. They were outliers, departing from multivariate normality as shown by their Mahalanobis distance values that were significant at the $p < .001$ level. Our sample did not have missing data in each of the observed variables. Observed variables representing the child's asthma morbidity had a moderate degree of non-normality (skewness range: 1.54 to

1.91). Positive skewness was noted in the reported symptoms of depression (value = 1.75) and anxiety (value = 1.66). The joint multivariate kurtosis value was 28.70 with a critical ratio of 14.75. In order to address the issue of non-normality to further confirm the model fit, we conducted a Bollen-Stine bootstrap test with 2000 bootstrapped samples to produce a corrected chi-square *p*-value for the goodness of fit of the null model (a non-significant result indicates a good fit) (Bollen and Stine 1992). This was followed by a comparison of whether the parameter estimates calculated by the bootstrap method differed from those of the original maximum-likelihood based model as shown by the bias values (Nevitt and Hancock 2001).

Results

The means, standard deviations, actual ranges, possible ranges, and zero-order correlations of the observed variables are presented in Table 2 ($N = 324$). The mean scores for the DASS-21 depression ($M = 4.24$, $SD = 5.71$, range: 0–28), anxiety ($M = 4.91$, $SD = 5.83$, range 0–32), and stress ($M = 9.19$, $SD = 8.17$; range 0–42) were lower than the DASS-21 clinical cut-off values indicating psychological problems (score = 9 for depression; 7 for anxiety; 14 for stress). In addition, the mean scores for the PECI Guilt and Worry ($M = 1.50$, $SD = 0.68$), the PECI Unresolved Sorrow and Anger ($M = 1.15$, $SD = 0.63$), and the PECI Long-term Uncertainty ($M = 1.11$, $SD = 0.76$) revealed that, on average, the parents rated themselves as having “rarely” or “sometimes” experienced emotional distress in caring for their child with asthma. Correlations between the observed variables among two latent variables, including the DASS-21 subscales ($r = .70$ to $.85$, all ps $< .001$) and the child’s asthma morbidity ($r = .55$ to $.69$, all ps $< .001$) were significant with large effect sizes. Notably, regarding a latent variable concerning the psychological adjustment of parents to their child’s illness, three PECI subscales, namely Guilt and Worry, Unresolved Sorrow and Anger and Long-term Uncertainty were significantly correlated ($r = .79$ to $.85$, all ps $< .001$), while their correlations with the PECI Emotional Resources were relatively weak ($r = -.06$ to $.15$).

Table 2

Means, standard deviations, actual ranges, possible ranges and zero-order correlations of observed variables

Variables	Parents								Children		
	AAQ-II	PECI-G	PECI-U	PECI-L	PECI-E	DASS21-D	DASS21-A	DASS21-S	Day sym	Night sym	Reliever use
Parents											
AAQ-II	–										
PECI-G	.62***	–									
PECI-U	.62**	.85***	–								
PECI-L	.60***	.79***	.81***	–							
PECI-E	−.24**	−.06	−.15**	.01	–						
DASS21-D	.51***	.52***	.56***	.51***	−.20**	–					
DASS21-A	.47***	.55***	.58***	.51***	−.12*	.85***	–				
DASS21-S	.60***	.60***	.55***	.50***	−.13*	.70***	.71***	–			
Children											
Day sym	.25***	.22***	.20***	.20***	−.02	.09	.05	.12*	–		
Night sym	.24***	.17**	.13*	.15**	−.02	.12*	.07	.09	.62***	–	
Reliever use	.24***	.23***	.19**	.18**	.04	.10	.07	.14*	.69***	.55***	–
M	18.91	1.50	1.15	1.11	2.27	4.24	4.91	9.19	1.18	0.95	1.29
SD	8.46	0.68	0.63	0.76	0.89	5.71	5.83	8.17	1.75	1.52	1.88
Actual range	7.0–49.0	0.1–3.8	0.0–3.3	0.0–3.6	0.0–4.0	0.0–28.0	0.0–32.0	0.0–42.0	0.0–7.0	0.0–7.0	0.0–7.0
Possible range	7–49	0–4	0–4	0–4	0–4	0–42	0–42	0–42	0–7	0–7	0–7

Note: $N = 324$. *M* mean, *SD* standard deviation, *AAQ-II* Acceptance and Action Questionnaire-II, *PECI-G* Parent Experience of Chronic Illness-Guilt and Worry, *PECI-U* Parent Experience of Chronic Illness-Unresolved Sorrow and Anger, *PECI-L* Parent Experience of Chronic Illness-Long-term Uncertainty, *PECI-E* Parent Experience of Chronic Illness-Emotional Resources, *DASS21-D* Depression Anxiety Stress Scales 21-Depression, *DASS21-A* Depression

Table 2

Means, standard deviations, actual ranges, possible ranges and zero-order correlations of observed variables

Variables	Parents								Children		
	AAQ-II	PECI-G	PECI-U	PECI-L	PECI-E	DASS21-D	DASS21-A	DASS21-S	Day sym	Night sym	Reliever use

Anxiety Stress Scales 21-Anxiety, *DASS21-S* Depression Anxiety Stress Scales 21-Stress, *Day sym* day symptoms, *Night sym* night symptoms

*$p < .05$, **$p < .01$, ***$p < .001$

The progression of model modifications and model fit indices are shown in Table 3. The results of the CFA indicated an acceptable model for the proposed latent variables and the indicators, with the exception of RMSEA (see Model 1 in Table 3). The modification indices suggested that the model fit could be further improved by adding the following two covariance paths between: (a) the parents' PF and the DASS-21-Stress (MI = 26.30, EPC = 9.28); (b) the PECI-Guilt and Worry and the DASS-21-Stress (MI = 17.48, EPC = 0.41), respectively. We determined that the above relationships were justified. Theoretically speaking, parents of children with asthma who are psychologically less flexible may regard their caregiving roles as a huge burden of responsibility. Guilt and worry about their child's future, together with stress, are common psychological experiences that can occur concurrently among parents of children with chronic illnesses (Semple and McCance 2010; Senger et al. 2016; Trollvik and Severinsson 2004). After the inclusion of the covariance paths, the final structural model (see Model 3 in Table 3) was tested and demonstrated a very good fit with the data ($\chi^2 = 69.43$, $df = 53$; CFI = .993; TLI = .988; SRMR = .028; RMSEA = .031).

Table 3

Progression of the model modifications and model fit indices

Model	Model details and modifications	χ^2 (*df*)	CFI	TLI	SRMR	RMSEA (90% CI)
1	4 latent constructs: (a) AAQ-II for parents' psychological flexibility; (b) PECI subscales for parents' psychological adjustment to the child's illness; (c) DASS21 subscales for parents' psychological symptoms; (d) day symptoms, night symptoms and reliever use for the child's asthma morbidity, and 3 control variables: (a) parents' relationship with the	123.20 (55)	.971	.952	.034	.061 [.047, .077]

Table 3

Progression of the model modifications and model fit indices

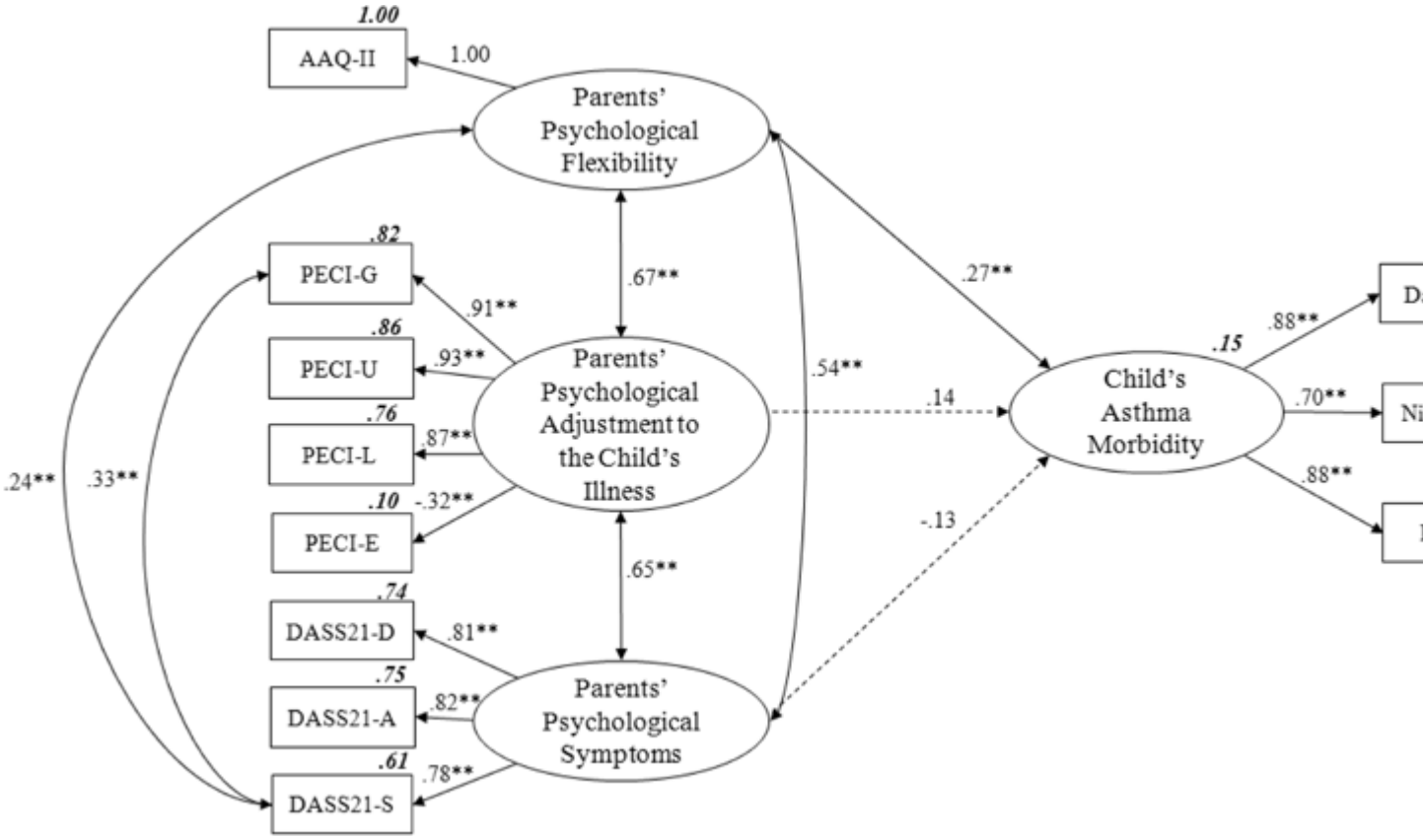
Model	Model details and modifications	χ^2 (*df*)	CFI	TLI	SRMR	RMSEA (90% CI)
	child; (b) parents' history of asthma and (c) the child's age					
2	Covariance between parents' psychological flexibility and DASS21-S allowed	95.13 (54)	.982	.970	.030	.049 [.032, .064]
3	Covariance between PECI-G and DASS21-S allowed	69.43 (53)	.993	.988	.028	.031 [.000, .050]

χ^2 Chi-square, *df* degree of freedom, *CFI* comparative fit index, *TLI* Tucker Lewis Index, *SRMR* standardized root means square residuals, *RMSEA* root mean square error approximation, *CI* confidence interval, *AAQ-II* Acceptance and Action Questionnaire-II, *PECI*, Parent Experience of Chronic Illness, *DASS21* Depression Anxiety Stress Scales 21, *DASS21-S* Depression Anxiety Stress Scales 21-Stress, *PECI-G* Parent Experience of Chronic Illness-Guilt and Worry.

Figure 2 illustrates the standardized path coefficients and correlations of the final structural equation model, controlling for the parents' relationship with the child, the parents' history of asthma, and the child's age. The Bollen-Stine bootstrap test showed a non-significant result ($p = .134$). There was no substantial discrepancy between the results of the bootstrap analysis and the original maximum likelihood analysis, as shown by the bias values of each parameter estimate ranging from 0.001 to 0.006. These findings offer support for the stability of the model with non-normal data. As hypothesized, poor PF was significantly associated with poor psychological adjustment to the child's illness in parents ($r = .67$, 95% CI [.61, .73], $p = .001$). Similarly, the significant associations were found between poor PF and increased psychological symptoms ($r = .54$, 95% CI [.45, .63], $p = .001$); and between poor psychological adjustment to the child's illness and increased psychological symptoms in parents ($r = .65$, 95% CI [.58, .72], $p = .001$). Overall, three parental psychological constructs (PF, PECI, and DASS-21) explained 15% of the variation in the child's asthma morbidity. Parents' PF was found to be the only latent construct possessing a significant association with the child's asthma morbidity ($\beta = 0.27$, 95% CI [0.09, 0.42], $p = .002$). No significant associations were found in the case of psychological adjustment to the child's illness ($\beta = 0.14$, 95% CIs [−0.04, 0.32], $p = .120$) or in psychological symptoms ($\beta = -0.13$, 95% CI [−0.27, 0.04], $p = .126$), respectively.

Fig. 2

The final structural equation model. Latent variables are represented by *ellipses* and observed variables by *squares*. *Solid lines* indicate significant paths, while *dashed lines* indicate non-significant paths. The *bold*, *italicized* values on the top right-hand corner denote the *squared* multiple correlations. For simplicity, control variables including parents' relationship with the child, parents' history of asthma diagnosis and the child's age are not displayed. The error covariance paths between (1) PECI-G and PECI-E; (2) PECI-U and PECI-E; (3) PECI-L and PECI-E within the latent variable are also not displayed. All coefficients are standardized. *AAQ-II* Acceptance and Action Questionnaire-II, *PECI-G* Parent Experience of Chronic Illness-Guilt and Worry, *PECI-G* Parent Experience of Chronic Illness-Guilt and Worry, *PECI-U* Parent Experience of Chronic Illness-Unresolved Sorrow and Anger, *PECI-L* Parent Experience of Chronic Illness-Long-term Uncertainty, *PECI-E* Parent Experience of Chronic Illness-Emotional Resources, *DASS21-D* Depression Anxiety Stress Scales 21-Depression, *DASS21-A* Depression Anxiety Stress Scales 21-Anxiety, *DASS21-S* Depression Anxiety Stress Scales 21-Stress. *$p < .05$, **$p < .01$, ***$p < .001$



Discussion

Previous research has shown support for an association between the psychological characteristics of parents and the prognosis of their child's asthma. However, other factors beyond mental health problems alone have rarely been postulated. This current study tested a model examining the psychological difficulties of parents in taking care of their child with asthma in a broader context of the parents' psychological distress, and includes an exploration of the relationship between the PF of the parents and the asthma morbidity of their children.

Parents who have poor PF may encounter difficulties in the adjusting to caring for their child with asthma and may exhibit psychological symptoms such as anxiety, depression, and stress. We found support for this relationship in our model. The results of our study showed that the correlation coefficient between PF and psychological symptoms in our sample is close to the weighted correlation as found in a previous meta-analysis (Ruiz 2010). Furthermore, the co-occurrence of poor psychological adjustment to the child's illness and increased psychological symptoms as shown in our sample is congruent with prior research on parents of children with other serious chronic illnesses, such as brain tumors (Hutchinson et al. 2009), multiple food allergies (Williams et al. 2009), and obsessive-compulsive disorder (Storch et al. 2009). In other words, individuals with better PF would have a better ability to regulate strong emotions when engaging in difficult activities that are in line with their values (Kashdan and Rottenberg 2010). When the individuals become more willing to make room for both positive and negative emotional experiences, they would be better able to adjust to situational changes and their psychological symptoms would improve.

The association between poor PF in parents and poor asthma morbidity in children was found in our model. This finding is consistent with the recent research showing that within the family context, parental PF affects not just the parent but his/her child. Among parents with healthy children, parental PF is positively related to adaptive parenting practices and inversely related to youth internalizing and externalizing behaviors (Brassell et al. 2016). Parental PF also accounts for a significant degree of variability in a child's symptoms of anxiety among children with anxiety disorders (Cheron et al. 2009); in pain-related anxiety and depression (McCracken and Gauntlett-Gilbert 2011); and in pain-related functional ability to engage in physical activities (Smith et al. 2015) among children who suffer from chronic pain. The mechanism by which parental PF could play an influential role on a child's asthma morbidity may operate in different ways. Flexible parents, who possess the ability to be aware

of and to accept their own internal experience in caring for a child who suffers from asthma, would be more willing to open up and to notice opportunities for strengthening their asthma management behaviors, rather than avoiding the problem. When parents are struggling less with their child's asthma condition, a modeling effect may occur whereby the child becomes more psychologically flexible in response to the difficulties of his/her own health condition, eventually engaging actively with his/her parents to manage the asthma symptoms. To summarize, our finding adds further to the growing amount of evidence of the significant role played by parental PF.

It is worth noting that our model shows that, when three parental psychological constructs (PF, psychological adjustment to the child's illness, and psychological symptoms) were assessed simultaneously for associations with the child's asthma morbidity, only the association between the parents' PF and their child's asthma morbidity remained significant. The result regarding parental psychological adjustment to the child's illness and psychological symptoms did not add explanatory power to the model. This result deserves attention because this is inconsistent with previous studies (Tibosch et al. 2011; Yamamoto and Nagano 2015). One plausible reason for the lack of such a relationship lies with the characteristics of our study sample. In general, as reported above, our sample (Hong Kong parents of children diagnosed with asthma recruited in outpatient clinics) did not exhibit clinically significant mental health problems when compared with the samples from previous studies, in which a significant relationship was found between the psychological symptoms of parents (e.g., anxiety and depression) and the asthma outcome of children (Bartlett et al. 2001; Otsuki et al. 2010; Shalowitz et al. 2001; Weil et al. 1999). Therefore, in our sample, the variations in the scores concerning the psychological adjustment of the parents to their child's illness and the psychological symptoms in parents might not have adequate power to reflect the variability in the asthma symptoms of the children.

In contrast, parental PF may be a more valuable psychological factor in a child's asthma condition, especially in the case of parents who suffer from psychological difficulties during the trajectory of their child's illness, but whose difficulties have not reached the clinical cutoff indicating significant anxiety or depressive disorders. Future studies shall be conducted among the parents of children hospitalized due to asthma or after seeking care for asthma in an emergency department. Given that parents with such children are expected to be more distressed than those whose children have not been hospitalized for asthma, this will help to clarify whether psychological

adjustment to a child's illness and psychological symptoms experienced by parents can still play a significant role in the child's asthma, together with PF.

Strengths, Limitations and Future Directions

The present study provides an important preliminary investigation of the role of parental PF together with other psychological constructs and their child's asthma morbidity. This study possesses several strengths. Our sample was recruited by consecutive sampling and there was a full response to the request to complete the questionnaire, which minimized the risk of data manipulation. Our sample may represent parents of children with asthma living in Asian urban cities, given that the clinical characteristics of the children in our study are comparable to those of a representative Asian pediatric sample recruited in a cross-country survey, including in the following areas: child's age, age of diagnosis, urgent healthcare use and hospital admissions due to asthma attacks per year (Wong et al. 2013). Moreover, SEM with the Bollen-Stine bootstrap test was applied, making it possible to examine the relationships among the multiple latent psychological factors of the parents and to accurately handle the non-normality of the data.

This study has a number of limitations, and the findings should be interpreted with caution. The cross-sectional nature of the data limited our ability to draw inferences about directionality and causality. There was a possibility of child-directed or bi-directional effects. Future research using longitudinal designs with a cross-lagged model may shed light on the directionality of parent-child influences. Furthermore, most of the survey respondents (primary caregivers) were mothers, which could influence the generalizability of the study's findings. Our model requires verification through a multi-group analysis to determine whether it is still valid for both parents.

Another limitation of this study is that our data relied on a self-report by parents on the health outcomes of their child. Prior studies showed that there could be discordance between the parent's and the child's reports of symptoms, due to differences in their psychological experiences of the illness (Davis et al. 2011; Dell et al. 2007). Given that our study focused on young children, with 44% of the participating parents reporting that their child was a preschooler, the report of parents may help to overcome the limitations that come with a study involving young children, whose general cognitive competencies are still developing and whose ability to recall their past asthma-related activities might therefore be limited (Bevans et al. 2010). Although there may be concerns regarding the use of objective measures (e.g., hospital admissions due to asthma attacks) as a better option to assess a child's asthma morbidity, asthma

symptoms and the use of rescue medications are measures that could more closely reflect the actual disease status of a child at the time of data collection (Brand et al. 2015). For patients who cannot respond for themselves about their observable symptoms, such as young children with asthma who are wheezing and coughing, relying on proxy reports by the primary caregivers is an approach that is well-supported by experts (Barrett et al. 2013). Hence, it is entirely appropriate to make use of a parent's report to capture a young children's asthma condition.

It is also of potential concern that in our SEM model the construct validity of the psychological adjustment of parents to their child's illness as the latent factor was limited due to the weak factor loading of PECI Emotional Resources (see Fig. 2). This suggests that the remaining three PECI subscales are likely to represent a distinct latent construct. The use of distress and perceived emotional resources in our model to indicate the psychological adjustment of parents to their child's illness shall be further explored in future studies. In addition, the percentage of the explained variance in the child's asthma morbidity contributed by the three parental psychological constructs was only 15%. The data analyses were conducted by controlling for three major potential covariates, namely, the parents' relationship with the child, the parents' history of asthma, and the child's age, owing to the concern about the small sample size and the degrees of freedom, which may have increased the instability of the parameter estimates. Further research shall be conducted to test the model by including other major known risk factors or covariates of asthma morbidity in children, such as types of inhaled corticosteroids (Global Initiative of Asthma 2015), the child's history of lower respiratory infections, and whether the child is living in a damp or humid home (Strina et al. 2014).

Finally, the generalizability of the conclusion is limited as the data were collected from one study site, a public hospital in Hong Kong. Nevertheless, the findings of the study would be particularly valuable to healthcare professionals from other countries undergoing rapid economic development and Westernization, in that asthma is becoming a health priority in pediatric care. Future research shall test whether the model as shown in this study operates similarly in other populations or settings, such as rural areas with better air quality, so as to broaden our understanding of the role played by parental PF in children's asthma care across various contexts.

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Author Contributions

Y.Y.C. and Y.W.M. conceived and designed the study. Y.Y.C. carried out data collection, analyzed and drafted the manuscript. Y.Y.C. and Y.W.M. interpreted the data. Y.W.M. and A.Y.L. critically revised it. All authors approved the final draft of the paper.

Compliance with Ethical Standards

Conflict of Interest

The authors declare that they have no competing interests.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants who were included in this study.

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