

# The role of coping strategies in quality of life of adolescents with asthma

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**Abstract** This study aimed to determine which coping strategies are associated with better quality of life (QOL) in adolescents with asthma. Furthermore, because coping can mediate the effects of health stressors on QOL, this study also examined the indirect effect of asthma severity on QOL via coping. Between January and May 2003, 553 Dutch adolescents with asthma (aged 12–16 years) completed questionnaires assessing coping strategies, symptom severity, overall QOL and positive QOL domain (positive effects of asthma domain). The relations between symptom severity, coping strategies and QOL were tested with structural equation modelling (SEM). Symptom severity affected overall and positive QOL, both directly and indirectly via coping. The coping strategies *restricted lifestyle* and

*worrying about asthma* were associated with poorer overall QOL. The use of the coping strategies *restricted lifestyle*, *positive reappraisal*, and *information seeking* was related to increased scores on the positive QOL domain, whereas *hiding asthma* was related to lower scores on the positive QOL domain. The findings of this study suggest that coping mediates the effect of symptoms of asthma on QOL among adolescents with asthma. Several suggestions for interventions to improve asthma-specific QOL are discussed.

**Keywords** Psychological adaptation · Adolescent · Asthma · Quality of life

## Abbreviations

QOL	Quality of life
ISAAC	International Study of Asthma and Allergies in Childhood
SES	Socio economic status
ACAAI	American College of Allergy, Asthma and Immunology
AAQOL	Adolescent Asthma Quality of Life Questionnaire
SEM	Structural equation modelling
CFI	Comparative fit index
RMSEA	Root mean square error of approximation

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Asthma is the most common chronic disease in childhood and adolescence in Western countries. While adolescence can be a tumultuous period for many youngsters, adolescents with asthma encounter

additional problems due to the need for regular medication and limitation to sporting activities and social events [1]. More significant effects on peer relationships are reported, including stigmatisation [2], especially when hospitalisation is required [3].

Quality of life (QOL) has been defined as a multidimensional concept, including the physical, psychological and social impact a disease has on the daily life of a patient [4]. Several studies demonstrate reduced QOL in children and adolescents with asthma when compared to their healthy peers [5]. In adults, it has been shown that QOL strongly depends on symptom frequency [6]. In children and adolescents, increased asthma severity is also associated with poorer QOL [5, 7, 8].

Although severity has a negative impact on QOL of patients with asthma, adequate coping strategies may mediate these negative effects [9, 10]. In this study, coping is defined as a set of behavioural and cognitive responses designed to manage the stressors of a situation [11]. In adults with asthma, emotional coping (a passive affective reaction to the problem) and avoidant coping (ignoring, denying or avoiding a problem) are associated with poorer QOL [9, 10], whereas active coping (taking an active approach to the problem, whether cognitive or behavioural) is associated with better QOL [9]. To our knowledge, no studies have examined the impact of coping on QOL in adolescents with asthma. Because of the specific issues adolescents encounter in comparison to adults, school absence, the role of parents, and concerns about peer relationships, it may not be possible to generalise the findings for adults to adolescents.

The goal of the present study was to determine which coping strategies are associated with a better QOL among adolescents with asthma. It is hoped that identification of these strategies will provide important directions for designing interventions aimed at improving QOL in adolescents with asthma. Coping strategies were found to mediate the relation between symptom severity and QOL in patients with other chronic conditions [12]. We hypothesised that coping strategies could also mediate the effect of asthma severity on QOL in adolescents with asthma. Therefore, we also aimed to examine the indirect relation between asthma severity and QOL via coping. Because girls report more symptoms of asthma [13] and lower QOL [7] than boys do, but seem better adapted to living with asthma [14], we also examined gender differences in coping, severity, and QOL, as well as the relationships between these concepts.

## Methods

### Sample and sampling procedure

The present study uses data from a national sample of Dutch adolescents with and without asthma [13, 15] that was collected between January and May 2003. This study was approved by the medical ethics committee (CMO Arnhem-Nijmegen). Fifty-five government-funded secondary schools in four regions of the Netherlands were randomly selected and approached for participation; 33 schools agreed to participate in this study. The main reason for refusal was because of participation in other studies. The majority of secondary schools in the Netherlands are privately managed, but over 99 percent of schools are funded by the government.

All students from the first two years of secondary school were asked to fill out written questionnaires during school hours, under the supervision of a teacher. A total of 9008 (89.3%) students aged 12–16 years fully completed the questionnaires. Adolescents with asthma were identified using an extended version of the asthma questionnaire of the International Study of Asthma and Allergies in Childhood (ISAAC) [16], translated into Dutch [17]. The ISAAC questionnaires are designed for population-based research and have proven to be valid instruments for measuring the prevalence of atopic diseases [16, 18, 19]. Furthermore, the results of the asthma questionnaire have been compared with a physician's assessment of asthma and demonstrated both sensitivity and specificity [20]. Respondents were selected based on their positive responses to three items: students who reported lifetime asthma and who either reported they had suffered from asthma in the past 12 months or who had used asthma medication in the past 12 months were categorized as currently having asthma. This resulted in a final sample of 553 adolescents with asthma. The respondents had suffered from asthma for a mean period of 6.74 years (SD 4.23).

The mean age of the respondents was 13.33 years (SD 0.83), of whom 286 (52%) were girls. Most students were of Dutch origin (84.6%) and lived in two-parent families (82.2%). The distribution of the education level of the father implied that all socio-economic status (SES) classes are represented in the sample. However, there is a slight over representation of lower SES classes compared to the general Dutch population, consistent with a higher prevalence of asthma in lower SES classes.

## Measures

### *Symptom severity*

Severity of asthma symptoms was assessed among all adolescents using a Dutch translation of the student questionnaire of the American College of Allergy, Asthma and Immunology (ACAAI) [21]. Respondents were asked to indicate on a 3-point scale (never, sometimes, a lot) how often they suffered from seven symptoms (e.g., “I wake up at night because I have trouble breathing”). Responses were averaged to form a severity score (Cronbachs alpha ( $\alpha$ ) = .72); higher scores indicate more severe asthma.

### *Quality of life*

QOL was only measured among the adolescents with asthma, using a Dutch translation of the Adolescent Asthma Quality of Life Questionnaire (AAQOL) [22], the only asthma-specific QOL instrument designed specifically for this age group, which covers domains of particular relevance for adolescents. This instrument has been validated among Australian and European adolescents [8], and shows good construct validity and high test–retest reliability [22]. The AAQOL questionnaire consists of six dimensions: the *symptoms* domain (six items, e.g., “How bothered have you been by coughing”,  $\alpha$  = .89), the *medication* domain (five items that tap the concerns adolescents have about their medication, e.g., “How bothered did you feel about having to carry your inhaler with you”,  $\alpha$  = .74), the *physical activities* domain (six items, e.g., “How often have you been restricted in sports, hobbies or other recreational activities because of your asthma”,  $\alpha$  = .84), the *emotions* domain (five items, e.g., “How often did you feel frustrated because of your asthma”,  $\alpha$  = .91), the *social interaction* domain (five items measuring the impact asthma has on the social life of adolescents, e.g., “How often have you been annoyed by your asthma when going to a party”,  $\alpha$  = .73), and the *positive effects* domain (five items,  $\alpha$  = .75, e.g., “How often has your asthma brought you closer as a family”). All items were measured on a 7-point Likert scale; mean scores were calculated for each domain. However, because of the possible overlap between the *symptoms* domain and the severity scale, the *symptoms* domain was not included in the analyses. As recommended by the authors, the first domains are added together to create one scale called *overall QOL* ( $\alpha$  = .93). The *positive effects* domain could not be included in the overall score because it cannot be

meaningfully added to the total score [22]. Higher scores represent a better QOL on that domain.

### *Coping strategies*

Coping strategies were assessed in adolescents with asthma, using the Asthma-Specific Coping Scale [23], a modification of the trait form of the Asthma Coping Scale [24]. The psychometric characteristics of this questionnaire have been tested in a validation study among a large general asthma sample of 3,459 adults and in two smaller intervention samples of adults [23]. The results of this validation study supported construct, concurrent and discriminant validity, and Cronbachs alpha’s ranged from .63 to .84. The scale comprises six subscales: *restricted lifestyle* (four items, e.g., “I avoid exertion”,  $\alpha$  = .69), *hiding asthma* (four items, e.g., “I avoid talking about my asthma”,  $\alpha$  = .71), *positive reappraisal* (four items, e.g., “I try to learn something positive about my falling ill and related experiences”,  $\alpha$  = .60), *information seeking* (four items, e.g., “I try to find out more about my asthma”,  $\alpha$  = .72), *ignoring asthma* (four items, e.g., “I avoid thinking about my asthma”,  $\alpha$  = .71) and *worrying about asthma* (three items, e.g., “I am afraid that my asthma will get worse”,  $\alpha$  = .63). All items are measured on a 4-point Likert scale (hardly ever to almost always). Responses were averaged to yield a score for each domain; higher scores indicated more use of that coping strategy.

### *Demographic information*

Gender, age and SES (assessed by the highest education level of the father) were included in the analyses as possible confounders.

### *Data analysis*

The analyses were conducted in four steps. First, gender differences in severity, coping strategies and QOL were examined using *t*-tests. Second, Pearson correlation coefficients between severity, coping and the QOL domains were calculated. Third, the relations between severity, coping and QOL were tested with structural equation modelling (SEM) using the program Amos 5 [25]. SEM makes it possible to combine confirmatory factor analysis with multiple regressions. By using underlying, unobserved (latent) variables with multiple indicators, measurement error can be reduced. Furthermore, it is possible to specify and estimate hypothesized causal pathway models with multiple

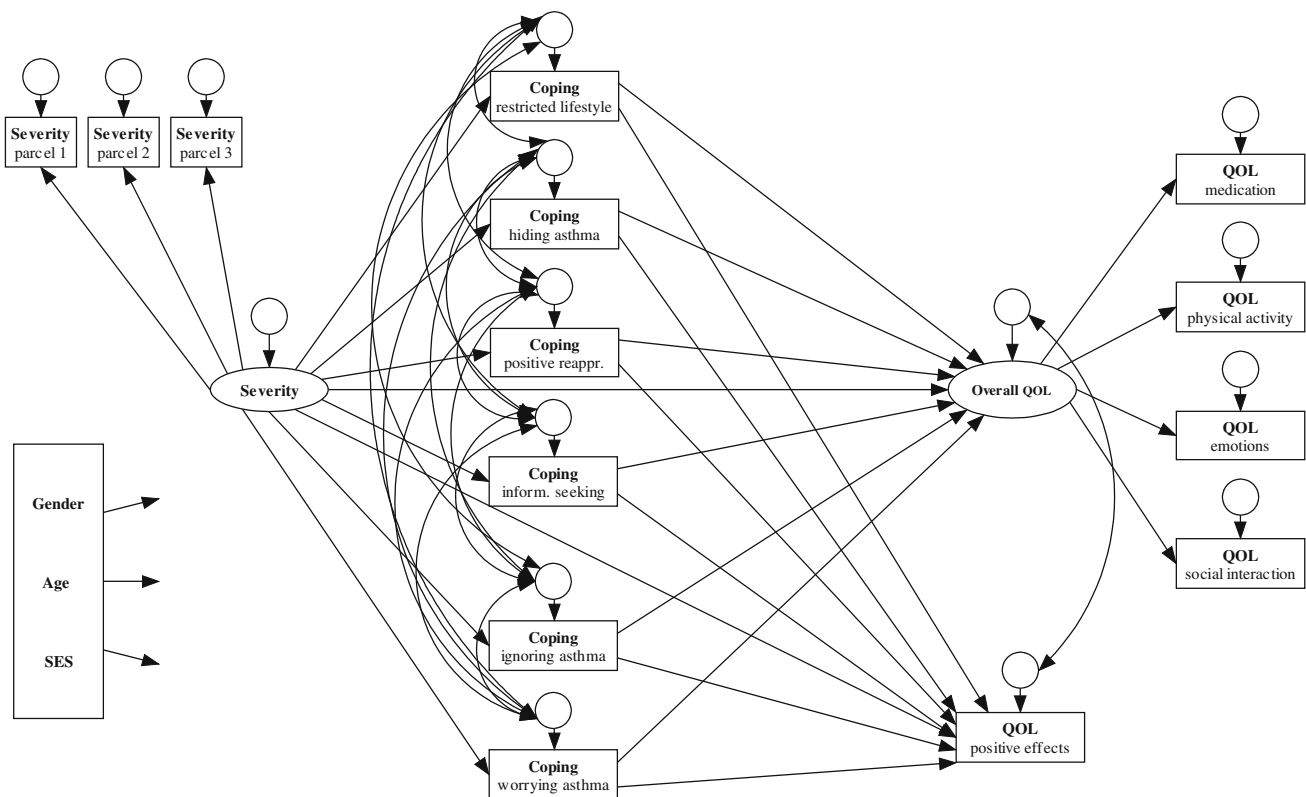
mediating variables and multiple outcome variables. Therefore, the SEM approach is useful in determining the relations between severity, coping with asthma and QOL.

Although the variables in this study have an ordinal character, because of the Likert scales used, they are treated as interval scales. Likert [26] proposed to formulate scales with equal appearing intervals in the format we used for the items in this study. Togerson [27] developed scaling methods to support the idea that Likert scales can be treated as interval scales, at method which is now widely accepted.

Maximum likelihood estimation was used to test the model illustrated in Figure 1. This model has 66 degrees of freedom, and our sample size of 553 is sufficient to achieve power of 0.80 [28]. All variables in the model had a normal distribution with skewness and kurtosis between  $-1$  and  $+1$ , except for the coping subscale *hiding asthma*, which had a skewness of 1.09. The latent variable *overall QOL* was measured by four observed indicators: the scores on the first four subscales of the AAQOL questionnaire. The latent variable *severity* had three parcels as indicators. Parcels are subsets of scale items. Items with corresponding factor loadings were divided over three subsets, leading to three parcels for severity [29]. The other constructs in

the model—the coping strategies and positive QOL—correspond to the observed mean scores for these variables. As shown in Figure 1, all direct paths between severity and coping strategies and between severity and QOL were estimated. Furthermore, we tested indirect paths between severity and QOL via coping. The effects of age, gender and SES were modelled by direct paths of these possible confounders to severity, the six coping strategies, overall QOL and positive QOL. However, for clarity, these paths are not shown in Figure. 1

The goodness of fit of the model was evaluated with several fit indices. The chi-square value with degrees of freedom and the  $P$ -value of the model are calculated. However, the chi-square is extremely sensitive to sample size: in a large sample, it is very likely that the chi-square statistics indicates that the model needs to be rejected, even if it describes the data quite well. Therefore, other fit measures (independent of  $N$ ) were included to evaluate the fit. This study evaluated a chi-square test based index, a comparative-fit index and an absolute-fit index, respectively the chi-square to degrees of freedom ratio ( $\chi^2/df$ ), the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). A model that fits the data well should have good results for many different fit



**Fig. 1** Conceptual model

indices. The  $\chi^2/df$  ratio should be less than three; for CFI, values greater than 0.90 suggest an acceptable fit between the model and the data, values greater than 0.95 indicate a good fit [30]. For RMSEA, values below 0.08 indicate an acceptable fit; values below 0.05 indicate a good fit [30]. In the last step of the analyses, we tested gender differences by multigroup analyses. A nested model with two separate groups (boys and girls) was tested. Differences in structural parameters were tested by chi-square difference testing.

## Results

### Descriptive statistics

Table 1 summarizes descriptive statistics of the main study variables for the total group, as well as comparisons between boys and girls. Gender differences were found for severity, coping and QOL. Girls reported higher asthma symptom severity than boys. The most commonly reported coping strategies in both boys and girls were *hiding asthma* and *positive reappraisal*. Girls had higher scores for three coping strategies: *restricted lifestyle*, *information seeking* and *worrying about asthma*. With regard to QOL, gender differences were found for the first four QOL subscales, where boys reported higher QOL than girls. Boys and girls did not differ in regard to the *positive effects* domain.

Correlations between the variables of the model are outlined in Table 2. All coping scales were positively interrelated except for two combinations (*hiding asthma* with *positive reappraisal*, and *hiding asthma* with *information seeking*). The first four QOL subscales were strongly and positively interrelated and the positive QOL domain showed moderate negative

correlations with all other QOL subscales, supporting the integration of the first four subscales (and not the *positive effects* domain) into one overall QOL score.

### Structural equation model

To facilitate presentation, the standardised factor loadings of the latent variables as well as the interrelations of the coping strategies and the interrelation between positive QOL and overall QOL are presented in Table 3, and not in the graphic representation of the model in Figure 2. The standardised factor loadings for *severity* vary between .60 and .76, thus indicating that the latent variable is very well represented by these indicators. For *overall QOL*, the standardised factor loadings vary between .69 and .91, indicating that a higher-order factor existed, and that the latent variable *overall QOL* is very well represented by the indicators.

Figure 2 shows the significant paths of the model with standardised regression weights. The fit indices showed that the model fitted the data well ( $\chi^2/df$  ratio below 3; CFI was above 0.95, RMSEA was below 0.08). Nineteen percent of the variance in the positive QOL domain and 56% of the variance in overall QOL was explained by the model. In regard to the relationships between the possible confounders and severity, coping and QOL, only the relation between gender and severity was significant, with severity being higher among girls. Gender was not related to coping or QOL in the total model. Furthermore, age and SES did not relate to any of the variables in the model.

### Coping and QOL

The overall QOL score was associated with the coping strategies *restricted lifestyle* and *worrying*: the more

**Table 1** Means, ranges and standard deviations for the total group, and separately for boys and girls

	Total group	Boys	Girls	<i>t</i> -value	<i>P</i>
Symptom severity	1.77 (1.00–3.00; 0.38)	1.69 (1.00–3.00; 0.37)	1.84 (1.00–3.00; 0.39)	–4.79	<0.001
Coping					
Restricted lifestyle	1.80 (1.00–4.00; 0.68)	1.70 (1.00–4.00; 0.67)	1.89 (1.00–4.00; 0.67)	–3.31	<0.001
Hiding asthma	1.91 (1.00–4.00; 0.69)	1.87 (1.00–4.00; 0.65)	1.95 (1.00–4.00; 0.71)	–1.31	ns
Positive reappraisal	2.19 (1.00–4.00; 0.70)	2.15 (1.00–4.00; 0.74)	2.22 (1.00–4.00; 0.67)	–1.03	ns
Information seeking	1.72 (1.00–4.00; 0.66)	1.66 (1.00–4.00; 0.65)	1.78 (1.00–4.00; 0.67)	–2.12	<0.05
Ignoring asthma	1.87 (1.00–4.00; 0.75)	1.84 (1.00–4.00; 0.74)	1.90 (1.00–4.00; 0.77)	–0.92	ns
Worrying asthma	1.64 (1.00–4.00; 0.67)	1.55 (1.00–4.00; 0.63)	1.73 (1.00–4.00; 0.71)	–3.04	<0.01
Quality of Life					
Medication	5.41 (1.60–7.00; 1.18)	5.53 (1.60–7.00; 1.19)	5.31 (2.00–7.00; 1.16)	2.09	<0.05
Physical activities	4.62 (1.00–7.00; 1.43)	4.94 (1.60–7.00; 1.31)	4.32 (1.00–7.00; 1.47)	5.14	<0.001
Emotions	5.31 (1.20–7.00; 1.43)	5.56 (1.40–7.00; 1.33)	5.08 (1.20–7.00; 1.48)	3.99	<0.001
Social interaction	5.51 (1.60–7.00; 1.16)	5.69 (2.60–7.00; 1.03)	5.34 (1.60–7.00; 1.25)	3.58	<0.001
Positive effects	3.54 (1.00–7.00; 1.39)	3.46 (1.00–7.00; 1.41)	3.61 (1.00–6.60; 1.37)	–1.31	ns

Note: Data are expressed in means; values in parentheses represent ranges and standard deviations

**Table 2** Pearson correlations between model variables

	Severity							Coping					QOL				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
1. Severity																	
Coping																	
2. Restricted lifestyle	.32***																
3. Hiding asthma	.12**	.16***															
4. Positive reappraisal	.11**	.36***	-.01														
5. Information seeking	.22***	.42***	.03	.53***													
6. Ignoring asthma	.16***	.25***	.51***	.30***	.17***												
7. Worrying asthma	.31***	.50***	.27***	.33***	.56***	.30***											
Quality of Life																	
8. Medication	-.34***	-.36***	-.22***	-.18***	-.33***	-.25***	-.42***										
9. Physical activities	-.49***	-.47***	-.13**	-.13**	-.31***	-.14**	-.40***	.53***									
10. Emotions	-.44***	-.49***	-.18***	-.20***	-.35***	-.20***	-.53***	.63***	.75***								
11. Social interaction	-.40***	-.47***	-.16***	-.25***	-.37***	-.16***	-.50***	.59***	.60***	.72***							
12. Positive effects	.13**	.26***	-.15***	.34***	.31***	.06	.21***	-.20***	-.27***	-.36***	-.43***						
Mean	1.77	1.80	1.91	2.19	1.72	1.87	1.64	5.41	4.62	5.31	5.51	3.54					
SD	0.38	0.68	0.69	0.70	0.66	0.75	0.67	1.18	1.43	1.43	1.16	1.39					

Note: \*\* $P < 0.01$ ; \*\*\* $P < 0.001$  (2-tailed)

**Table 3** Standardised factor loadings of latent factors *overall QOL* and *Severity* and interrelations of coping strategies and QOL

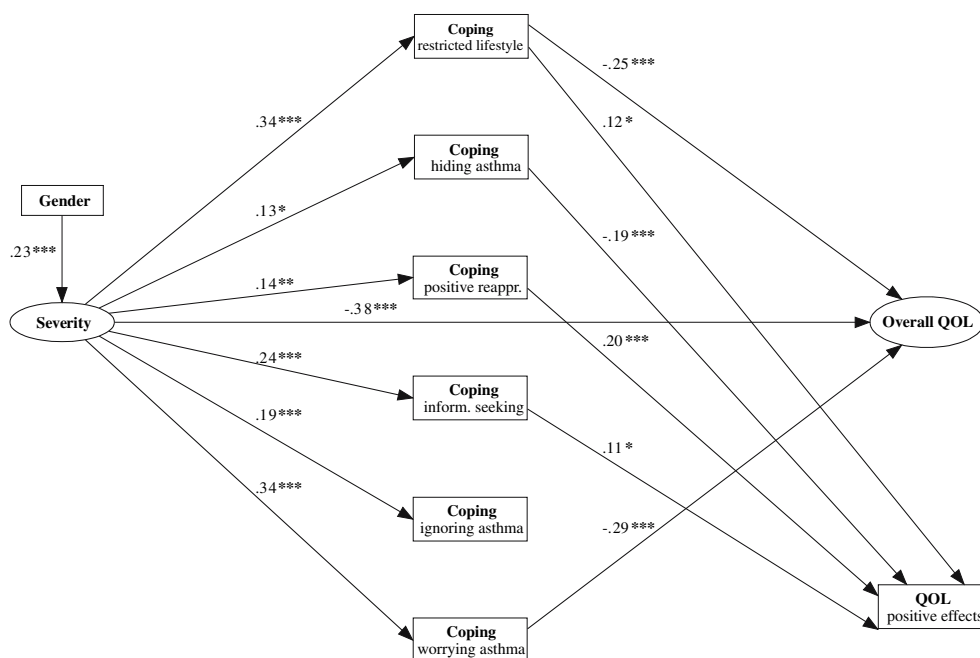
Factor Loadings:		<i>P</i>
Severity → parcel 1	.76	
Severity → parcel 2	.60	
Severity → parcel 3	.72	
Overall QOL → QOL medication	.69	
Overall QOL → QOL physical activities	.80	
Overall QOL → QOL emotions	.91	
Overall QOL → QOL social interaction	.80	
Interrelations		
Coping Restricted lifestyle ↔ Coping Hiding asthma	.12	<0.01
Coping Restricted lifestyle ↔ Coping Positive reappraisal	.34	<0.001
Coping Restricted lifestyle ↔ Coping Information seeking	.36	<0.001
Coping Restricted lifestyle ↔ Coping Ignoring asthma	.20	<0.001
Coping Restricted lifestyle ↔ Coping Worrying about asthma	.42	<0.001
Coping Hiding asthma ↔ Coping Positive reappraisal	-.04	ns
Coping Hiding asthma ↔ Coping Information seeking	.00	ns
Coping Hiding asthma ↔ Coping Ignoring asthma	.50	<0.001
Coping Hiding asthma ↔ Coping Worrying about asthma	.24	<0.001
Coping Positive reappraisal ↔ Coping Information seeking	.52	<0.001
Coping Positive reappraisal ↔ Coping Ignoring asthma	.28	<0.001
Coping Positive reappraisal ↔ Coping Worrying about asthma	.30	<0.001
Coping Information seeking ↔ Coping Ignoring asthma	.13	<0.01
Coping Information seeking ↔ Coping Worrying about asthma	.52	<0.001
Coping Ignoring asthma ↔ Coping Worrying about asthma	.26	<0.001
Overall QOL ↔ QOL positive effects	-.35	<0.001

adolescents led a restricted life and the more they worried, the lower their QOL. The positive QOL domain was mainly associated with the coping strategies *hiding asthma* and *positive reappraisal*; positive QOL was higher for adolescents who tended to hide their asthma less, and for adolescents who reappraised their disease more positively. In contrast with the finding that *restricted lifestyle* was related to poorer overall QOL, this coping strategy was associated with better

positive effects QOL. Additionally, scores on the positive QOL domain were higher for adolescents with increased *information seeking*.

#### *The indirect effect of severity on QOL via coping*

Severity was related to all coping strategies; the more severe the asthma, the more the adolescents used the six coping strategies. Severity was directly—and



**Fig. 2** Structural Equation model with standardised coefficients for the relations between severity, coping and QOL. Only significant paths are given in this figure. Number of distinct sample moments 170; number of distinct parameters to be

estimated 104.  $N = 553$ ,  $\chi^2 [66] = 174.89$ ,  $P = 0.000$ ,  $\chi^2/df = 2.65$ , CFI = 0.963, RMSEA = 0.055;  $R^2$  overall QOL = 0.56;  $R^2$  positive QOL = 0.19. \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$

negatively—related to overall QOL. Severity was also indirectly related to overall QOL via the coping strategies *restricted lifestyle* and *worrying about asthma*. This indirect path was negative as well: higher severity was related to increased use of these previously mentioned coping styles, which were negatively related to overall QOL. Additionally, the model showed no significant direct path from severity to positive QOL; there were only indirect paths via *restricted lifestyle*, *hiding asthma*, *positive reappraisal* and *information seeking*. Three of these indirect paths were positive: higher severity scores were positively related to the use of the coping strategies *restricted lifestyle*, *positive reappraisal* and *information seeking*, which in turn had a positive relation with positive QOL. However, one of the indirect paths was of a negative nature: higher severity was related with increased *hiding asthma*, which in turn had a negative relation with positive QOL.

#### Additional analyses

To exclude the possibility that the proportion of variance explained by the model is caused by the association between symptom severity and QOL, an additional model was tested without severity. This

model still fitted the data well, and explained 45% of the variance of overall QOL and 18% of positive QOL.

To test whether the strengths of the relationships in the model differed between girls and boys, multigroup analyses with chi-square difference testing was applied. No significant differences were found in the factor loadings or regression weights, indicating that the strengths of the paths in the model did not differ between boys and girls.

#### Discussion

This study has found that asthma symptom severity is negatively associated with asthma-specific QOL in adolescents with asthma. The findings provide support for the hypothesis that coping mediates the negative relationship between severity and QOL. Thus, the use of adequate coping strategies to deal with symptoms of asthma appears to prevent adolescents with asthma from experiencing a decline in their QOL.

How do adolescents with asthma cope with their asthma? The most reported coping strategy was *positive reappraisal*, indicating that adolescents with asthma try to actively cope with their asthma. However, the two next most frequently used strategies are passive coping strategies: *hiding asthma* and *ignoring asthma*,

which shows that adolescents also commonly use avoidant coping strategies. *Worrying about asthma* was the least used coping strategy. Similar results have been found in a study on coping in chronically ill adolescents, where avoidance and confrontation were the most frequently used coping styles, and depressive reactions the least used [31]. Although there is similar ordering of coping styles between boys and girls, this study also found gender differences in coping. Girls reported using all coping strategies more often than boys, consistent with a study by Wilson et al. [32] which showed that female adolescents reported to use all studied coping styles (avoidant coping, problem-focused coping, and emotional coping) more often than males.

While symptom severity was only indirectly related to positive effects QOL, symptom severity was both directly and indirectly related to overall QOL. When adolescents experience more symptoms, they have poorer overall QOL. This association has been shown in previous studies, both among adults [6] and adolescents [5, 7, 8]. Due to the cross-sectional nature of this study, we cannot determine the direction of the associations found. Part of this association may be explained by good QOL leading to better self-management of asthma, thereby reducing symptoms of asthma.

Although we have to be careful with interpreting the directionality of the identified relationships, these results suggest that coping mediates the effect of symptom severity on QOL, indicating that interventions based on changing coping strategies may be an approach to improve QOL in adolescents with asthma. A review on the impact of interventions designed to improve coping by de Ridder and Schreurs [33] suggests such approaches offer ‘a promising framework for the development of psychosocial care for chronically ill patients’.

Leading a *restricted lifestyle* was one of the coping strategies found to mediate the relation between severity and *overall QOL*. When adolescents experience more symptoms, they avoid situations and triggers, which in turn is associated with poorer *overall QOL*. This restricted lifestyle may cause adolescents to avoid peer activities, such as parties or extracurricular activities, and thereby decrease their satisfaction with life. Similar results are found in adults with asthma, where avoidant coping was shown to be related to lowered QOL [9, 10].

Another mediating coping strategy was *worrying about asthma*. Increased symptom severity was related to more worrying, which in turn decreased overall QOL. This is consistent with the study of Hesselink

et al. [10], who showed a negative association between emotional coping and QOL among adults with asthma.

To improve QOL in adolescents with asthma, interventions could be aimed at decreasing a *restricted lifestyle* and *worrying about asthma*. This might be done by teaching adolescents to recognize their triggers of asthma and by promoting greater self-management of their illness. This could increase their self-efficacy expectations, such that by feeling more in control of asthma, adolescents may feel less inclined to avoid particular situations such as parties and playing sports. This increased self-efficacy might also reduce worrying about asthma. In addition, interventions could also focus on cognitive restructuring and relaxation to reduce worrying, and thereby enhance QOL among adolescents with asthma.

With regard to the *positive QOL* domain, *hiding asthma* and *positive reappraisal* were the two mediating coping strategies most strongly related to *positive QOL*. Adolescents with worse asthma severity tended to hide their asthma more, which was related to lower *positive QOL*. This may result in fewer people from their social environment being aware of their condition, which may reduce the opportunities for social support, and potentially thus experience fewer positive effects. Interventions that target individuals, such as social skills training or assertiveness training, or interventions that target schools, such as the Asthma Friendly Schools Program [34], might help adolescents feel more able to inform others about their illness. Peer support groups like ChIPS (Chronic Illness Peer Support) [35] and the Triple A program [36] may also help to build resilience and enhance self-confidence and self-acceptance, making it easier for adolescents to be open rather than hide their asthma.

*Positive reappraisal* was the coping strategy most strongly related to *positive QOL*. Adolescents who tried to see positive aspects of their asthma also perceived more positive effects. Part of this association may be due to overlap in constructs. However, studies showed that optimistic persons have greater friendship networks [37], longer friendships [38], and perceive more social support [37]. Therefore we assume that part of the association found in this study is not due to overlap but due to a more positive mindset of the adolescents, making it easier for their social environment to react in a positive way to the adolescent. This is in line with Folkman & Moskowitz [39], who emphasize the role of positive reappraisal in coping with chronic illness. Although positive reappraisal seems to affect *positive QOL* among adolescents with asthma, this coping strategy might be hard to target in interventions because of the effect of personality



factors such as optimism, which have been shown to be related to emphasizing positive aspects of stressful situations [40].

This is the first study to describe the relation between coping strategies and QOL in adolescents with asthma. A strength of this study is the use of a large community sample, which is ruling out the risk of a self-selection bias, and includes adolescents with all levels of asthma severity. This study also used validated instruments specifically designed for adolescents with asthma. The use of sophisticated statistical methods to test relations between severity, coping and QOL allowed testing of both direct and indirect paths, testing group differences in these direct and indirect paths, and decreasing measurement error by using latent factors.

Some of the standardized regression coefficients in the model are weak but significant, which may be partly due to the larger sample size. However, the strengths of these paths are similar to those found in other studies on the relation between coping and QOL [10], and the total model explains 56% of the variance in overall QOL and 19% in positive QOL. When severity was excluded from the model, the model still explained 45% of the variance of overall QOL and 18% of positive QOL, indicating the clinical relevance of coping strategies in QOL among adolescents with asthma. Another limitation of this study is the low reliability of three of the coping subscales, which could have influenced the model. However, coping is a difficult construct to measure, and other coping scales like COPE [41], which are frequently used [37] show Cronbachs alpha's in the same range as those reported in the present study. Furthermore, the alpha's reported in the present study are in line with the validation study ( $\alpha$  ranging from .63 to .84) [23]. A third limitation is that due to the cross-sectional nature of this study, we cannot determine the direction of the associations found. For instance, we assume that severity influences coping, but we cannot rule out the possibility that coping affects symptom severity as well. Thus hiding asthma could lead to a decrease in adherence due to not taking medication in peer settings, which in turn could lead to an increase in symptoms. In regard to the relations between QOL and coping, while worrying about asthma may lead to poorer overall QOL, it is also possible that lower QOL may result in adolescents worrying more about their asthma. Longitudinal designs could provide more insight into the underlying mechanism of the relations found in this study. Further research would also benefit from including personality factors, such as optimism, and other measures of psychosocial well being, such as depression, which may

affect both QOL and coping strategies. Finally, since the responsibility for the management of asthma is transferred from parent to adolescent, further studies that include family factor could also provide fresh insights.

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