Chapter 4: Patient-reported Health Instruments used for people with Asthma

Asthma is a chronic inflammatory disorder of the airways associated with variable airflow limitation. Obstruction of the airways can be reversible either spontaneously or with treatment. Diagnosis is often clinical with observed changes in lung function during periods of exacerbation. Whilst symptoms include wheeze, shortness of breath, chest tightness and cough these are not specific to asthma. However, symptoms tend to be intermittent and provoked by triggers such as pollens, dust, exercise, chemicals, smoke and infections. Other associated atopic disorders include eczema and allergic rhinitis (SIGN 2005).

The impact of asthma will be dependant on the severity of the disease and triggers specific to individuals. Exercise and activity limitations particularly during the pollen season can result in social isolation which may also limit employment opportunities. The physical burden of the disease can result in fatigue and sleep disturbance. Understanding the specific impact on a patient's life can contribute to successful management of the condition.

The following review provides current information available of the patient-reported health questionnaires used to measure health-related quality of life with patients with asthma.

Search terms and results: identification of articles
At the time of the review, the PHI database contained 12,000+ records (up to June 2005). The primary search strategy, using the terms 'asthma' and 'respiratory' keyword searching generated 468.records, as shown in Table 4.1. All abstracts were reviewed. When assessed against the review inclusion criteria, 220 articles were retrieved and reviewed in full. Of these, 50 articles were included in the review.

Table 4.1 Number of articles identified by the literature review

Source	***Results of search***	***No. of articles considered eligible***	***Number of articles included in review***
PHI database: original search (up to June 2005) **Total number= 12,562**	468	220	44
Supplementary search	-	-	6
TOTAL	-	-	**50**

Supplementary searches which included hand searching of titles from 2004 to 2006 of the following key journals:
-Chest
-Health and Quality of Life Outcomes
-Medical Care
-Quality of Life Research
-Respiratory Medicine
-Thorax

Further searches were conducted within the bibliography and using Pub Med per instrument up to September 2006.

Identification of patient-reported health instruments

Five generic and 10 asthma-specific instruments were included in the review. The developmental and evaluative studies relating to the generic instruments reviewed are listed in Tables 4.2 and 4.3. Those relating to asthma-specific instruments are shown in Tables 4.4 to 4.10.

RESULTS: GENERIC PATIENT-REPORTED HEALTH INSTRUMENTS

Seven generic instruments were identified which were evaluated with patients with COPD. For full details of the development, domains and scoring methods are detailed in Chapter 3.

The following instruments measurement properties are reported:

a) SF-36
b) SF-12
c) EQ-5D
d) Sickness Impact Profile
e) Health Utilities Index

a) SF-36

Twelve studies describe the evaluation of the SF-36 following completion by patients with diagnosed asthma, as shown in Table 4.2. Two studies evaluated the SF-36 as the principal instrument with patients with asthma (Keller et al., 1997; Caro et al., 2001). Nine studies describe the concurrent evaluation of the SF-36 alongside other asthma-specific instruments (Blumenschien et al., 1998; Juniper et al., 2000, 2001; Lee et al., 2003; Mancuso et al., 2001; Mancuso and Peterson 2004; McColl et al., 1995, 2003; Ware et al., 1998). One publication describes an expert consensus conference in which recommendations are made for clinically important differences for the SF-36 (Wywrich et al., 2003).

Keller et al., (1997) evaluated both standard and acute forms of the SF-36, the acute form with a one week recall period and the standard version of 4 week recall. Different order of administration of patient-reported health instruments was evaluated in McColl et al., (2003) with version 1 containing asthma-specific instruments first and in version 2 generic instruments presented first to examine order effects.

Studies were carried out in a primary care or out-patient setting. Two studies describe evaluation of the SF-36 following clinical trials of the effectiveness of different medications. One study was conducted in the UK (McColl et al., 1995). The average age of the patients was forty years. One study used a postal survey as the method of administration and the other study used interviews.

Reliability
Four studies reported evidence of reliability (Keller et al., 1997; Ware et al., 1998; Juniper et al., 2001, McColl et al., 2003).

Test-retest reliability was reported in a concurrent evaluation of the SF-36, Asthma Quality of Life Questionnaire (AQLQ)-Juniper, Standard Gamble (SG) and Rating Scale (RS) (Juniper et al., 2001). Moderate levels of reliability were reported for the SF-36 Physical and Mental component scores (ICC 0.65 PCS; 0.68 MCS); reliability levels were greater for the comparator instruments (>0.70), with the exception of the SG.

With the exception of the domains RE (St. 0.79; Ac 0.59) and MH (Ac 0.64), similar moderate to high levels of internal consistency reliability have been reported for both standard and acute forms of the SF-36 across all domains (all greater than 0.70); the authors attribute the low levels of reliability for the RE domain to low variability in group scores (Keller et al., 1997). Lower levels of internal reliability were also reported for the RP, RE, SF and PI domains (range 0.63 to 0.65) (Ware et al., 1998).

Different order of administration of patient-reported health instruments was evaluated in McColl et al., (2003) with version 1 containing asthma-specific instruments first and in version 2 generic instruments presented first. Internal consistencies were in excess of 0.80 for the SF-36 with PF and BP greater than 0.90 for version 1 and PF, RP and BP for version 2. Generally, alphas were slightly higher for version 2 where the SF-36 was presented first.

Item level analysis
Low levels of item-total correlation (less than 0.40) have been reported for the RE and MH domains (Keller et al., 1997).

High scaling success rates across all domains, where the percentage of scaling successes (positive correlations with hypothesised domains) is reported relative to the total number of scaling tests with other domains, was reported for both standard and acute forms (Keller et al., 1997). Response consistency (proposed by the SF-36 developers as an internal consistency check on 15 item pairs) for the standard form was comparable to US population norms (91.2% and 90.3%); the acute form was lower (86.5%), with the greatest inconsistencies for the MH and GH domains.

High levels of item-discriminant validity (the percentage of times that items correlate higher in the hypothesised domain than other domains) were reported (greater than 0.4) (Keller at al., 1997).

Validity
Seven studies reported evidence of internal and/or construct validity (Blumenschien 1998; Juniper et al., 2000, 2001; Keller et al., 1997; Mancuso et al., 2001; McColl et al., 1995, 2003).

Internal validity
Principal components analysis supported the two factor high-order solution of MCS and PCS, and the eight-domain structure proposed by the instrument developers (Keller et al., 1997).

Health status

Viramontes and O'Brien (1994) evaluated the discriminative validity of the SF-36 with patients with chronic lung diseases including asthma, emphysema and chronic bronchitis and reported significantly different domain scores between disease severity subgroups based on the UK Medical Research Council symptoms classification. Lower SF-36 scores were associated with higher dyspnoea scores as expected and moderate to large correlation was reported for activity threshold and SF-36 PF, GHP and EG. There was no relationship between disease severity and SF-36 ER, SF, BP and MH.

The SF-36 discriminated between asthma and angina patients in McColl et al., (2003) with higher scores for all domains with the exception of MCS and MH domain indicating less impairment for the asthma patients which was in accordance with hypotheses. Version effect was observed for six domains with the exception of PF, BP and MCS with higher scores than predicted for version 2 (SF-36 presented first) (McColl et al., 2003).

Asthma-specific measures of health-related quality of life

Moderate levels of correlation have been were reported between SF-36 domains and several asthma-specific measures of health status (Blumenschien and Johannesson 1998; Juniper et al., 2000, 2001; Mancuso et al., 2001; McColl et al., 1995; Ware et al., 1998).

Correlation between the SF-36 and the Asthma TyPE ranged from -0.32 to -0.58. Most correlations were in the hypothesised direction; the association between the SF-36 PCS, MCS and the Allergy Index component of the Asthma TyPE did not have hypothesised correlations (Blumenschien and Johannesson 1998).

Correlations between the MCS and PCS scores of the SF-36 and the Asthma Control Questionnaire and Asthma Control Diary were as follows: MCS: 0.19 ACQ; 0.31 ACD: PCS 0.53 ACQ; 0.55 ACD (Juniper et al., 2000)) which indicates greater strength of correlation between the ACQ and ACD and the PCS of the SF-36.

Small to moderate levels of correlation respectively were reported between the SF-36 MCS and the PCS with the AQLQ-Juniper (Mancuso et al., 2001; Lee et al., 2003); levels of correlation with the MCS were smaller than hypothesised (Mancuso et al., 2001). Further hypothesises correlations (greater or less than 0.60) were reported for related domains in a study by McColl et al., (2003). This study examined order effects with either asthma-specific measures presented first in the questionnaire package or generic. There was with a slight trend for stronger correlations between the SF-36 and the AQLQ when specific measures were administered first (McColl et al., 2003).

Correlations between related physical function domains on the SF-36 (PF, RP) and the LWAQ (PF) were 0.70 to 0.80. Moderate correlations between related instrument domains assessing elements of emotional health were reported (0.45 to 0.54). Similar results were reported for the social functioning domains (0.54 to 0.64) (McColl et al., 1995).

Moderate levels of correlation were reported between several SF-36 domains (PF, RP, E, SF) and Asthma symptom frequency (range 0.22 MH to 0.59 PF (McColl et al., 1995).

Health utilities
The relationship between a range of methods for obtaining health utilities (Heath State Utilities (Rating Scale (RS), Time Trade Off (TTO), Standard Gamble (SG)), Willingness to Pay (Bid Game; Dichotomous Choice (DC)) and the SF-36 have been explored (Blumenschien and Johannesson 1998). SF-36 domains have small to moderate levels of correlation with the RS (ranging from SF-36 RF 0.28 to SF-36 PF 0.63); these are generally greater levels of correlation than with the TTO (SF-36 range 0.01 to 0.34) and SG (SF-36 range -0.01 to 0.30).

Small levels of correlation between the SF-36, the SG (PCS 0.19; MCS 0.38) and the RS (PCS 0.36; MCS 0.52 were reported in Juniper et al., (2001).

The SF-36 (PF, BP, GHP, VT and SF) had hypothesised correlations (greater than 0.60) for the EQ-5D score (McColl et al., 2003).

The SF-36 has been applied in other studies with patients with asthma where the principal instrument undergoing evaluation is an asthma-specific questionnaire and hypotheses stated about those instruments validity and relationship with the SF-36 (Adams et al., 2000; Juniper et al., 1999a, b, c; Leidy 1998b; Katz et al., 2002 and Reid et al., 1999).

Respiratory function
Small levels of correlation were reported between the SF-36 and respiratory function and medication use (Juniper et al., 2001).

Responsiveness
Responsiveness was reported in six concurrent evaluations (Juniper et al., 2001; Keller et al., 1997; Lee et al., 2003; Mancuso 2001; Mancuso and Peterson 2004; Ware et al., 1998); although responsive to change, the SF-36 was less responsive than asthma-specific instruments in these evaluations.

Following completion by asthmatics taking part in trial of asthma medication, the PCS was able to detect change in physical health both within and between groups of patients; the MCS did not detect change (responsiveness index -0.06) Juniper et al., (2001).

Receiver Operating Characteristics (ROC) curves were used to assess the sensitivity and specificity of the SF-36 and AQLQ-Juniper to patient perceived change in current disease activity (external criteria classified as cases or non-cases (active or non active disease (Mancuso et al., 2001). The SF-36 PCS discriminated between patient's perceptions of disease activity; however ROC curves ranked lower than the AQLQ-Juniper. These results were confirmed in a later study (Mancuso and Peterson 2004); although different analyses of longitudinal data were utilised, all results were in the same direction with lower ROC curves for SF-36 MCS and PCS.

Keller et al., (1997) used patient self-report of change in health (improved, stayed the same, declined) as external criteria for the assessment of instrument responsiveness; the SF-36 acute form was more responsive to change in clinical status over the past week than the standard form.

Ware et al., (2001) also adopted patient-reported, and clinician-reported, assessment of change in health as external criteria. Small to moderate significant relative validity coefficients were observed for all domains (range 0.11 to 0.52) for patient perceived change. Moderate correlation was reported for the RF domain and clinician-assessed change (Treatment Impact; Cough and Wheeze) and RP for Treatment Impact and Cough. All other domains had small correlations with the external criteria. The SF-36 did not perform as well as the MAQLQ with lower relative validity coefficients.

Correlations were reported between changes in SF-36 domain scores and AQLQ score changes with a range of 0.20 for RE to PF 0.62 (Lee 2003). Furthermore, the SF-36 was not as responsive as the AQLQ with ES per domain lower than for the AQLQ (Domains: Large ES: RP, PF; Medium ES GH, VT, SF and small BP, MH and RE Lee 2003). SRM's for the SF-36 domains were lower than for the AQLQ (0.92 to 0.29 vs. 1.17).

Interpretation

Expert consensus

Wyrwich et al., (2003) report on an expert consensus process with the aim to generate recommendations for clinically important differences for the SF-36 and AQLQ.
A modified RAND method was adopted to inform a consensus agreement:

- systematic review of the literature;
- recruitment of healthcare professional experts and researchers for consultation;
- Delphi consensus technique and a subsequent meeting to achieve consensus and formulate recommendations.

Both the SF 36 and AQLQ-Juniper were assessed by the expert group. Recommendations for the interpretation of clinically important differences for SF-36 domains were made: small change in score equates 10 to 16 points; moderate change in score equates 20 to 33 points; large change in score equates 30 to 37 points.

Precision

Three studies reported evidence of precision (Keller et al., 1997; Mancuso et al., 2001; Ware et al., 1998).

Mean scores on the RE scale for the Acute form were significantly higher than scores on the Standard form (Keller et al., 1997); RP and SF Acute form scores were also higher (non-significant). Ceiling effects have been reported for RP, SF and RE (Standard form) and RP, BP, SF and RE (Acute form) (50 to 77%). Further ceiling effects were reported for the SF 36 (Mancuso et al., 2001; Ware et al., 1998).

The Acute and Standard forms had no floor effects (Keller et al., 1997).

Acceptability
Three studies report different aspects of patient acceptability (Caro et al., 2001; Keller et al., 1997; Ware et al., 1998).

Four (6%) of patients indicated that they had no preference for different versions of the instrument in the evaluative study by Caro et al., (2001), 49 (77%) expressed a preference for the electronic version and found it easy to use (this includes preferences for AQLQ combined). A total of 43 spoiled responses were recorded for the paper version of the SF-36 (the electronic version does not permit multiple responses).

The concordance of responses on electronic versus paper versions was also compared (Caro et al., 2001). Patients completed instruments two hours apart; the order of presentation was alternated. A high degree of concordance for patient's scores across either completion format was reported (range 0.83 to 0.96).

Patients preferred the Acute form to the Standard form in Keller et al., (1997) (15/18).

Ware et al., (1998) reported that 94% of responses were logically consistent. McColl (2003) hypothesised that responses would be higher and quicker when asthma-specific instruments (AQLQ, NASQ) were presented before generic instruments (EQ-5D, SF-36). No order effect was found for versions for response rates or response speed.

Feasibility
Completion times for paper or electronic versions of the SF-36 instrument were compared (Caro et al., 2001). A statistically significant difference was reported: 11.21 minutes (electronic) vs. 9.47 minutes (paper).

b) SF-12

The SF-12 has been evaluated in three studies (Franic et al., 2005; Garratt et al., 2000; Magid et al., 2004), one of which was in the UK (Garratt et al., 2000). Two studies used a postal survey as the method of administration. The average age of the patients was forty years.

Reliability
No evidence reported.

Validity
Healthcare utilisation
The SF-12 PCS was predictive of asthma related Emergency department utilisation (Magid et al., 2004). A 10 point (1 SD) decrement was found to be associated with a 72% increased risk of hospital admission / ED admission (OR 1.72; 95% CI 1.46 to 2.02). The SF-12 MCS was not predictive of ED utilisation (OR 1.17; 95% CI 0.96 to 1.44). Scores for patients with asthma were significantly lower than the US norms for the PCS but not for the MCS (Franic et al., 2005).

Asthma-specific patient-reported health instruments
Hypothesised correlations were moderate between the SF-12 Physical component and NASQ (PCS 0.58; MCS 0.36), AQLQ(S) Juniper (PCS 0.58; MCS 0.34). Further similar results were observed for the SF-12 and ACQ with correlations -0.76 for PCS and 0.03 MCS with corresponding correlations for similar domains (Franic et al., 2005)**.**

Generic patient-reported health instruments
Moderate levels of correlation were reported between the SF-12 and EQ-5D (MCS 0.37, PCS 0.49) (Garratt et al., 2000).

Responsiveness
One study evaluated responsiveness of the SF-12 in a concurrent evaluation (Garratt et al., 2000) and reported moderate levels of responsiveness for the PCS (SRM 0.35) which was higher than the EQ-5D. The smallest SRM was reported for the MCS (0.03) suggesting little or no responsiveness.

Precision
No evidence identified.

Acceptability
High levels of completion rates were reported for the SF-12 (94%) in a study by Garratt et al., (2000).

Feasibility
No evidence identified.

a) SF-36 and b) SF12

Table 4.2: Evaluative studies relating to the SF-36 and SF-12 when completed by patients with asthma

Study/ Country	**Population (N) Age (years) Method of administration Setting**	**Measurement and Practical properties**					
SF-36		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Blumenschien and Johannesson (1998) USA	Asthma (69) Age: mean 40 Interview administered Out-patients		Construct ✓				
Caro et al., 2001 Canada	Asthma (68) Age: range 16-75 Interview but patient completed Out-patients					✓	
Juniper et al., 2000 Canada	Asthma (50) Age: mean 37 Self completed Out-patients	Test re-test ✓	Construct ✓	✓			
Juniper et al., 2001 Canada	Symptomatic asthma (40) Age: mean 38 Interview administered Out-patients	Test re-test ✓	Construct ✓	✓			
Keller et al., 1997 USA	Participants in a RCT of asthma medication (142) Age: mean 39 Self report Out patients	Internal consistency ✓	Construct ✓ Internal validity ✓				
Lee et al., 2003 USA	Participants in a RCT of asthma medication (241) Age: mean 38 Self report-hand held electronic device recording patients responses to the instruments) Out patients		Construct ✓	✓			

Study/ Country	Population (N) Age (years) Method of administration Setting	Measurement and Practical properties					
SF-36		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Mancuso and Peterson (2004) USA	Asthmatics identified for healthcare plan (185) Age: mean 41 Postal			✓			
Mancuso et al., 2001 USA	Moderate asthma (requiring medications daily) (230) Age: mean 41 Interview Primary care		Construct ✓	✓	✓		
McColl et al., 1995 UK	Asthma (650) Age: over 18 Self-report and postal response Primary care		Construct ✓ Internal ✓				
McColl et al., 2003 UK	Asthma (4751) Age: mean 48 Postal Primary care	Internal consistency ✓	Construct ✓			✓	
Viramontes and O'Brien (1994) Canada	Patients with asthma, chronic bronchitis and emphysema (102) Age: mean 62 Self-reported but interview administered in patient's own homes		Construct ✓				
Ware et al., 1998 USA	Participants in RCT of asthma medication (142) Age: mean 39 Self report Out patients	Test re-test ✓	Construct ✓	✓	✓	✓	
SF-12		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Franic et al., 2005 USA	Asthma (46) Age: mean 46 Self-report Primary care (pharmacies)		Construct ✓	✓			
Garratt et al., 2000 UK	Patients with asthma (394) Age: adults Postal Primary care	Internal consistency ✓	Construct ✓	✓	✓	✓	
Magid et al., 2004 USA	Patients with asthma (1406) Age: mean 35.9 Postal		✓				

c) EuroQol-EQ-5D

One evaluation was identified where the EQ-5D was the principal instrument (Hazell et al., 2003) and three concurrent evaluations (Franic et al., 2005; Garratt et al., 2000; McColl et al., 2003).

Reliability
No evidence reported.

Validity
Age
The EQ-5D index and VAS scores decreased significantly with age with moderate correlations (-0.41; -0.34) (Hazell et al., 2003).

Health status
Hazell et al., (2003) reported a study of the ability of the EQ-5D to discriminate patients with respiratory disease. A postal survey including the ED-5D and a respiratory questionnaire identifying patient with symptoms associated with obstructive airways disease. The survey was posted to all patents identified from a primary care practice in the UK (10,471) and those with self-reported respiratory symptoms were included in the analysis (6828, with 5944 questionnaire computable). The EQ-5D index and VAS scores were significantly lower for those with respiratory symptoms compared to those without.

Patient–reported health instruments
The validity of the EuroQol has been evaluated in a concurrent evaluation with the Newcastle Asthma Symptoms Questionnaire, AQLQ and SF-12 (Garratt et al., 2000). Correlations between the EuroQol and NASQ, SF-12 and AQLQ were moderate and according to hypotheses. The EQ-5D and SF-12 correlations were of similar magnitude to the other instruments in this evaluation. The EQ-5D correlated strongly with the ACQ index -0.72, VAS -0.56 (Franic et al., 2005).

Generic health status
The EQ-5D score had hypothesised correlations (greater than 0.60) for the SF-36 PF, BP, GHP, VT and SF domains (McColl et al., 2003).

Responsiveness
Responsiveness was examined using a patient-reported health transition question and results expressed with SRM's in Garratt et al., (2000). The EQ-5D was responsive with a small SRM but other instruments (AQLQ, NASQ and SF-12 PCS had larger SRM's in this evaluation.

Acceptability
Garratt et al., (2000) compared the number of missing data for different instruments and reported the EQ-5D to have 96% of the scale score computable. 87% of responses for the EQ-5D were computable in a postal survey (6828) with the highest proportion of missing values for the self-care domain (5.7%); anxiety/depression (4.4%); usual activities (4.3%); pain (4.1%); mobility (3.9%). The VAS though had a greater proportion of missing responses (6.3%) (Hazell et al., 2003).

McColl et al., (2003) hypothesised that responses would be higher and quicker when asthma- specific instruments (AQLQ, NASQ) were presented before generic instruments (EQ-5D, SF-36). No order effect was found for versions for response rates or response speed.

Feasibility
No evidence reported.

Table 4.3: Evaluative studies relating to the EQ-5D when completed by patients with asthma

Study/ County	Population	Measurement properties					
EQ-5D		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Franic et al., 2005 USA	Asthma (46) Age: mean 46 Self-report Primary care (pharmacies)		Construct ✓	✓			
Garratt et al., 2000 UK	Patients with asthma (394) Age: adults Postal Primary care		Construct ✓	✓	✓	✓	
Hazell et al., 2003 UK	Asthma related symptoms (5944) Age: mean 48 Postal survey Primary care practice		Construct ✓			✓	
McColl et al., 2003 UK	Asthma (4751) Age: mean 48 Postal Primary care		Construct ✓			✓	

d) Health Utilities Index (HUI)

Validity
Three studies include the HUI in evaluations that focused on the performance of the AQLQ and ACQ (Juniper) following completion by patients with asthma (Franic et al., 2005; Leidy and Coughlin 1998a; Leidy 1998b). As hypothesised, moderate correlations were reported between the AQLQ and the HUI (range 0.40 AQLQ Emotional to 0.60 AQLQ Activities). The item content of the HUI emphasises functional aspects of quality of life, and stronger correlations with the AQLQ Activity limitations domain were as expected (Leidy and Coughlin1998; Leidy 1999b).

Correlations between the ACQ and HUI total was -0.50, with correlations greater than 0.60 for Ambulation, Pain; small correlations for Speech, Dexterity and Cognition and

no correlation for Emotion, Hearing and Vision as would be expected (Franic et al., 2005)

e) Sickness Impact Profile (SIP)

Validity

Three studies include the SIP in evaluations that focus on the performance of the AQLQ-Juniper (Juniper et al., 1993; Rowe and Oxman 1993) or the MAQLQ (Marks et al., 1993) following completion by patients with asthma. This evidence is therefore detailed in chapter 4.2: Asthma-specific instruments.

In summary, the MAQLQ had small correlations with the SIP Total (0.18) and no correlation with the SIP Psychosocial component (-0.01) (Marks et al., 1993). The AQLQ had lower than predicted correlations with the SIP Psychosocial (Rowe 1993) and AQLQ and the SIP correlations were lower than the RAND (Juniper et al., 1993).

RESULTS: ASTHMA-SPECIFIC PATIENT REPORTED HEALTH INSTRUMENTS:

Nine asthma-specific instruments were included in the review. Full details of the development, domains and scoring methods are detailed in Tables 4.4 and 4.5.

The following instruments measurement properties are reported:

a) Asthma Quality of Life Questionnaire (AQLQ)
b) MiniAQLQ
c) AQLQ(S)
d) Acute AQLQ
e) Asthma Control Questionnaire
f) Asthma Control Diary
g) Marks Asthma Quality of Life Questionnaire (MAQLQ)
h) Living With Asthma Questionnaire
i) St. Georges Respiratory Questionnaire

Asthma Quality of Life Questionnaire(s) (Juniper)

The conceptual underpinning of the Asthma Quality of Life Questionnaire(s) developed by Juniper et al., (1993) adopts a functional impairment approach to measurement.

a) Asthma Quality of Life Questionnaire (AQLQ)

The Asthma Quality of Life Questionnaire (AQLQ) was developed in Canada for evaluating health-related impairment of quality of life in adults with asthma in clinical trials (Juniper et al., 1992). The instrument addresses symptoms, emotional function, activity limitations and environmental stimuli.

Instrument content was derived from existing generic instruments; literature review; experiences of patients with chronic airflow limitation; expert consensus; and unstructured interviews with six patients with asthma. From this, 152 items were considered important and an item reduction questionnaire was developed and interview administered to 150 patients (18-70 years) with asthma. Patients were asked which of the 152 items were they affected by in the past year and indicate the importance on a five point Likert scale from ‘not very important’ to ‘extremely important’. The items chosen most frequently and labelled most important were included in the questionnaire. A total of 32 items were included within four domains of symptoms (12 items), emotional function (5 items), exposure to environmental stimuli (4 items) and activity limitations (11 items) were included. For the activity domain, there was a wide range of activities reported by patients during the item reduction phase and the final version thus included five individualised questions relating to activities which patients identified as being problematic (activities offered to aid recall) and a further 6 questions relating to non-specific activities. The time to recall was suggested as two weeks. A seven point Likert scale (1 indicating maximal impairment and 7 no impairment) was developed for responses and scoring is conducted using the mean score per item and domain and an aggregated overall quality of life score.

The instrument underwent further pre-testing to examine face and content validity and acceptability to patients. Thirty patients were interviewed and time to administer was recorded as well as patient feedback about wording and what they understood each question to be asking. The questionnaire was then modified for self-report and then administered to five other patients and no further modifications were considered necessary. Both the interview administered and self-report format took a maximum of 15 minutes to complete.

b) MiniAQLQ

A shorter version of the AQLQ was developed for greater efficiency (Juniper et al., 1999a). Item-total correlations were examined in previously collected data and correlations greater than 0.70 were considered evidence of similar items and combined resulting in 26 items from the original 32. Further analysis of the original AQLQ item reduction questionnaire (Juniper et al., 1992) resulted in exclusion of those items which had the lowest impact for frequency and importance. The final questionnaire was reduced to 15 items, Symptoms (5 items), Emotions (3 items), Environment (3 items) and for Activities (4 items). Generic items were included for the Activity domain thus removing the individualized questions. Nine patients were involved in the pre-testing of the questionnaire and minor wording and modifications were made. The final version included the seven point Likert scale, 2 week recall and took 7-10 minutes to complete by self-report at baseline and 3-5 minutes at follow-up.

c) Standardised Asthma Quality of Life Questionnaire (AQLQ(S))

A standardised version of the original AQLQ was developed (Juniper et al., 1999b) in which five generic activities replaced the individualised approach used in the AQLQ. The items were selected based on the impact and frequency of reporting activities in the item reduction questionnaire (Juniper et al., 1992) and classified as 'strenuous', 'moderate', 'social', 'work related' and 'sleeping'. The wording of the revised, standardised instrument was pre-tested in ten patients with asthma. Scoring and recall period remained the same as the AQLQ.

The questionnaire was administered to forty patients and the classifications of 'activities' were examined in relation to patients self reported activities (as per original instrument). The classifications of activities were considered to represent the patient-specific activities chosen by the patients.

d) Acute Asthma Quality of Life Questionnaire (Acute AQLQ)

The Acute AQLQ is a modification of the AQLQ with the intention of being specific to patients experiencing an acute severe asthma attack (Juniper et al., 2004). The 32 items from the AQLQ were examined and those considered not relevant or unlikely to change to patients during an acute exacerbation were excluded. The final instrument contains two domains: Symptoms (6 items) and Emotions (5 items) and scoring the same as other AQLQ instruments using a seven point scale. The format was tested with ten patients.

e) Asthma Control Questionnaire (ACQ)

Item generation for this patient-reported symptom focused questionnaire was informed by treatment goals from clinical guidelines, reviewing other asthma questionnaires and a postal survey of asthma clinicians to rank symptoms presented for content. The final instrument includes seven items relating to awakening at night by symptoms; waking in the morning with symptoms; limitations in activities; dyspnoea; wheeze and β_2-agonist use. One item, FEV_1 is clinician assessed (Juniper 1999c). Patient's responses are on a 7 point Likert scale and evaluation for the last 7 days. Scoring of the ACQ is computed as the mean of the 7 items with 0= well controlled and 6= poorly controlled.

f) Asthma Control Diary (ACD)

The Asthma Control Diary is modified form the Asthma Control Questionnaire for daily completion using PEF instead of FEV_1.

g) Asthma Quality of Life Questionnaire (Marks) (MAQLQ)

The initial items for the instrument were derived from analysis of results from a focus group with eight patients with a wide range of asthma severity; from patients participating in an asthma education programme and clinical experience of the developers (Marks et al., 1992). Initial testing was with 283 patients using principal components analysis. Further evaluation of measurement properties was conducted with seventy-seven patients with stable asthma and another sample of patients with unstable asthma (n=42).

The instrument measures the effect of the disease with negative statements (not at all; mildly; moderately; severely; very severely). Conceptually, the AQLQ is underpinned by a limitation and negative approach of the impact of asthma on the individual.

Content validity was examined empirically using principle components analysis. Items were excluded is they had highly skewed distribution; missing values; or low loadings. Principal components analysis gave a six component solution and items most strongly correlated with each component were labelled Breathlessness, Concerns, Mood, Social, Cough and Control. Item-total correlation ranged from 0.13 to 0.72 with correlations less than 0.5 for Cough and Control. These items were deleted based on weak correlation and being considered unrelated to quality of life. The final instrument contained four domains (Breathlessness, Concerns, Mood and Social) and a total of 20 items. Each item contributes to the total scale and domain scores are calculable.

g.i) Modified Marks Asthma Quality of Life Questionnaire

In the original instrument developed by Marks there were two items related to activities which were combined to a single item. Adams et al., (2000) extended the number of items to 22 in the instrument to allow for different responses for this 'activity' question. In addition, a seven point Likert scale was used with the intention of increasing reliability.

h) Living With Asthma Questionnaire (LWAQ)

The Living With Asthma Questionnaire was developed by Hyland (1991, UK) using a comprehensive methodology. Six focus groups were conducted, four with patients and two with the general population (under-graduates). Eleven themes (classified as domains) were identified from content analysis and further items and domains were developed following analysis. The questionnaire was further tested and refined in three phases with a total of 656 patients from primary care. Psychometric testing and item reduction included principal factor analysis, item variability analysis and patient comment. The final questionnaire contained eleven domains and 68 items with a 3 point response format to statements: 'untrue of me', 'slightly true of me', 'very true of me' with an additional option of 'not applicable'. Hyland (1991) attempted to compensate for acquiescence bias by ensuring there were both negative and positive statements. Both negative and positive statements were included in the questionnaire with a third of statements negative. Factor analysis indicated a unifactorial solution.

The final instrument has five constructs: Avoidance, Distress, Preoccupation, Colds and Activities with eleven domains and 68 items. Mean scale scores are obtained with 2 indicating poor quality of life and 0 best.

h.i) ms-LWAQ

Modifications were made to the LWAQ by Reid et al., (1999) for use with Americans. The instrument has twenty-seven items and five subscales: Consequences (10 items); Affect (6 items); Leisure (4 items); Seriousness (5 items) and Drugs (2 items). Scoring is the same as the LWAQ but with different wording of responses.

i) St. George's Respiratory Questionnaire (SGRQ)

The SGRQ was developed in the UK to measure the impact of asthma and chronic obstructive pulmonary disease (COPD) from a patient perspective. There are two parts of the instrument. Part 1 is concerned with symptoms focusing on the severity, frequency and effect of respiratory symptoms over the last year and responses are obtained with a 5 point Likert scale. Part 2 includes two domains: Activity limitations and social and psychological impact and focuses on the patient's current state with True or False responses. Three components scores are calculated and a total score. All items have empirically derived weights and normative data are available. Scoring algorithms and calculators are available from the developers. Scores are expressed as the percentage of overall impairment with 100 equaling to worst possible health and zero the best.

Items were initially derived from studies with adult patients with asthma examining distress ratings relating to symptoms and the impacts of asthma (Quirk and Jones 1990) and the influence of demographic and disease factors with the degree of distress (Quirk et al., 1991). Empirical weights were obtained from one hundred and forty patients with asthma (Quirk 1991). Further analysis of previously derived weights were compared with patients with COPD with thirty-six patients (mean age 66) (Jones et al., 1991) and no significant differences between the item weights from the asthma patients (Quirk et al., 1991) and COPD patients.

ASTHMA-SPECIFIC INSTRUMENTS:

Table 4.4: Asthma-specific patient-reported health instruments

Instrument	*Domains (no. items)*	*Response options*	*Score*	*Administration/ Completion (time)*
Asthma Control Questionnaire (ACQ) (Junipers)	*7 Symptoms (1 clinician assessed):* Sleep related (2); breathlessness; wheeze; activity limitations; use of bronchodilators *(FEV_1 % of predicted clinician assessed)*	7 point Likert	Mean score of all items 0=well controlled, 6=extremely poorly controlled	Self- report and clinician assessed (one item)
Asthma Control Diary (ACD) (Junipers') ***Modified ACQ***	*7 Symptoms:* Sleep related (2); breathlessness; wheeze; activity limitations; use of bronchodilators; morning peak expiratory flow rate (PEFR)	7 point Likert	Mean score of all items 0=well controlled, 6=extremely poorly controlled	Self- report
Asthma Quality of Life Questionnaire (AQLQ) (Junipers')	*4 domains/32 items* 1. Symptoms (12) 2. Emotions (5) 3. Environment (4) 4. Activities (11 including 5 individualised questions)	7 point Likert	Summation and domain score Mean score of all items Index: 1 = maximal impairment , 7 = no impairment	Interviewer- and self-administered format 10 minutes to complete at the first visit and 5 minutes at follow-up.
Standardised Asthma Quality of Life Questionnaire (AQLQ(S)) (Junipers')	*4 domains/32 items* 1. Symptoms (12) 2. Emotions (5) 3. Environment (4) 4. Activities (11 including 5 standardised activity classifications)	7 point Likert	Summation and domain score Mean score of all items Index: 1 = maximal impairment , 7 = no impairment	Interviewer- and self-administered format 10 minutes to complete at the first visit and 5 minutes at follow-up.
Mini Asthma Quality of Life Questionnaire (MiniAQLQ) (Junipers')	*4 domains/15 items* 1. Symptoms (5) 2. Emotions (3) 3. Environment (3) 4. Activities (4 all generic)	7 point Likert	Summation and domain score Mean score of all items Index: 1 = maximal impairment , 7 = no impairment	Self administered 7-10 minutes to complete at baseline and 3-5 minutes at follow-up
Acute Asthma Quality of Life Questionnaire (Acute AQLQ) Junipers	*2 domains/11 items* 1. Symptoms (6) 2. Emotions (5)	7 point Likert	Summation and domain score	

Instrument	*Domains (no. items)*	*Response options*	*Score*	*Administration/ Completion (time)*
Marks Asthma Quality of Life Questionnaire (MAQLQ)	*4 domains (20 items)* Breathlessness Concerns Mood Social	5 point Likert Modified: 7 point Likert	Total and domain score	
Living with Asthma Questionnaire (LWAQ)	*5 constructs/ 11 domains/68 items* *Constructs:* Avoidance, Distress, Preoccupation, Colds, Activities *Domains:* 1. Social/leisure (6) 2. Sports (3) 3. Holidays (3) 4. Sleep (4) 5. Work and other activities (6) 6. Colds (5) 7. Mobility (6) 8. Effects on others (5) 9. Medication usage (6) 10.Sex (1) 11.Dysphoric states and attitudes (23)	3 point scale with additional option of n/a	Construct and domain scores	Self-administered 10 to 20 minutes completion
St. George's Respiratory Questionnaire (SGRQ)	*Two parts; Domains (3)/17 items* Part 1: Symptom scores (8) Part 2: Activity and Impact (9)	Part 1: 5 point Likert Part 2: True or False	Weighted scoring Total and domain scores Percentage of overall impairment 0=best possible health and 100 worse	Self- report but recommended interview administered 8- 15 minutes to complete

Table 4.5: Summary of asthma-specific instruments: health status domains ***(after Fitzpatrick et al., 1998)***

Instrument	***Instrument domains***								
	Physical function	**Symptoms**	**Global judgement**	**Psychol. well-being**	**Social well-being**	**Cognitive functioning**	**Role activities**	**Personal construct**	**Treatment satisfaction**
AQLQ		x		x			x		
MiniAQLQ		x		x			x		
AQLQ(S)		x		x			x		
Acute AQLQ		x		x					
ACQ)		x							
ACD		x							
MAQLQ		x		x	x			x	
LWAQ		x		x	x			x	
SGRQ	x	x		x	x		x		x

RESULTS: AQLQ Junipers

a) Asthma Quality of Life Questionnaire (AQLQ-Juniper)

Seventeen studies were identified which evaluated the AQLQ, five were in concurrent evaluations (Caro et al., 2001; Cook et al., 1993; Juniper et al., 1992, 1993, 1994, 1999a,b, 2000, 2001; Leidy and Coughlin 1998a, Leidy et al., 1998b; Mancuso et al., 2001; Mancuso and Peterson 2004; Orr et al., 2003; Ware et al., 2002; Wywrich et al., 2002). Typically studies included patient samples with an average age around forty years. One study evaluated the instrument with patients participating in a RCT of asthma treatment regimes (Cook 1993) and the others with patients with a diagnosis of asthma. Two studies used a postal survey and the other studies interview administered the self-reported instruments. Two studies were conducted in the UK (McColl et al., 2003; Orr et al., 2003).

Reliability
High levels of test re-test reliability have been reported for the AQLQ with values exceeding 0.90 in five studies for the Summary score and greater than 0.80 for component scores (Juniper et al., 1993, 1999a, 1999b; Rowe et al., 1993; Leidy and Coughlin 1998a). Higher levels of test-retest reliability were reported for the AQLQ in comparison to several generic measures (SF-36, SG, and RS) completed during a comparative evaluation of measurement performance (Juniper et al., 2001).

ICC values greater than 0.70 have been reported across all domains of the AQLQ with the exception of the Environment domain (ICC 0.67) (Leidy and Coughlin 1998a)). Different order of administration of patient-reported health instruments was evaluated in McColl et al., (2003) with version 1 containing asthma-specific instruments first and in version 2 generic instruments presented first. Internal consistencies were in excess of 0.90 for the AQLQ domains with the exception of the Environment domain (0.80) for version 1 and Emotional (0.89) and Environment (0.79) for version 2.

High levels of internal consistency reliability have been reported (Juniper et al., 1999a; Leidy and Coughlin1998a, b; Wyrwich et al., 2002): alpha values greater than 0.90 have been reported for the Summary score.

Interscale correlation coefficients among AQLQ sub-scales and between each sub-scale and the Summary scores were greater than 0.50 (Leidy et al., 1998b). Lower correlations were reported between the Environmental and Emotional domains, but Summary score, Symptoms and Activity were higher.

Validity
Evidence of validity was reported in eight studies (Leidy and Coughlin 1998a, Leidy et al., 1998b; Juniper et al., 1993, 1999a, b, 2000, 2001; Rowe et al., 1993).

Socio-demographic variables
There was no relationship between age, overall score and sub-scales reported in Leidy and Coughlin (1998a). They did however report statistically significant worse HRQoL in women for Overall score, Activity and Environmental domains. Further evidence of the instruments ability to discriminate was reported in Leidy et al., (1998b) with men reporting better HRQoL in the activity and symptom domains. Furthermore, effects

for race were statistically significant for all domains and overall score with African Americans reporting poorer HRQoL (Leidy et al., 1998b). Education effects were statistically significant for Summary score and all domains. (Leidy and Coughlin 1998a)

Health status
Overall and domain scores on the AQLQ (with the exception of the Activity domain) were lower when the AQLQ was presented first (version 1 McColl et al., 2003) but less than 0.5.

Asthma-specific patient-reported health instruments
The Summary score discriminated between asthma severity groups using Physician Severity Rating scheme and Asthma Disease Severity Scale (ADSS) as a reference criterion (Leidy and Coughlin 1998a). The Summary score, Activity and Symptom domains differentiated patients with different disease severity in Rowe (1993). Stronger correlations between AQLQ and patient reported Symptom score and Global Assessment were reported seven to 10 days following treatment in an ED. All correlations were in accordance with hypotheses at baseline and follow-up (Rowe et al., 1993).

Moderate levels of correlation were reported between the AQLQ Summary and the ACQ (0.76) and ACD (0.75) (Juniper et al., 2000). Correlations between the NASQ and the AQLQ were greater than 0.60 for all domains (McColl et al., 2003). The AQLQ was moderately correlated with the ACQ with the lowest coefficient for the Environment domain (0.55) (Franic et al., 2005).

Generic patient-reported heath instruments
Several studies have reported moderate levels of correlation between the AQLQ domain scores and the SF-36 PCS (Juniper et al., 1999a,b; Juniper 2000, 2001; Lee et al., 2003; Mancuso et al., 2001); smaller correlations have been reported between the AQLQ Activity domain and the SF-36 MCS (Juniper et al., 1999a,b) and AQLQ and SF-36 RE (Lee et al., 2003). Further hypothesises correlations (greater or less than 0.60) were reported for similar and different traits with a slight trend for stronger correlations between instruments when specific measures were administered first (McColl et al., 2003) between the AQLQ and SF-36.

Correlations between the AQLQ and RAND physical and emotional domains that had hypothesised associations were moderate For the SIP although statistically significant hypothesised relationships were found; these were lower than for the RAND (Juniper et al., 1993). Correlations between the AQLQ and the SIP domains that had hypothesised associations were moderate but lower correlations were found for the AQLQ domains and SIP-psych (Rowe and Oxman1993).

Moderate to large correlations were reported in accordance with hypotheses with the HUI and instrument domains (Leidy 1998a). Correlations between Summary score and domains and HUI, SF-36 Physical and Mental components and Cantril's Ladder (a global QoL measure) with a population of low income African Americans and Caucasians although in the expected direction, were small to moderate (Leidy et al., 1998b).

Juniper et al., (2001) reported in a concurrent evaluation of the AQLQ, SG, RS and SF-36, higher correlations for the AQLQ and RS with moderate correlation with SF-36 and SG (0.48 to 0.53).

Respiratory Function
Several authors have reported small to moderate levels of correlation between the AQLQ and a range of measures of lung function (Leidy et al., 1998b; Juniper et al., 1999[a, b]; Juniper et al., 2000).

Responsiveness
Eight studies reported evidence of responsiveness (Juniper et al., 1993, 1994, 2001; Mancuso et al., 2001; Mancuso and Peterson 2004; Orr et al., 2003; Rowe and Oxman 1993; Wyrwich et al., 2002).

Following completion in a clinical trial of asthma medications the AQLQ detected within-subject change and group change (responsiveness index 0.64) (Juniper et al., 1993). Moderate to strong levels of correlation between change scores were reported for change in AQLQ score and change in clinical asthma based on changes in respiratory function and frequency of symptoms; change in generic quality of life score (SIP) and Asthma global ratings of change (Juniper et al., 1993).

Orr et al., (2003) evaluated changes in patients quality of life using the AQLQ related to changes in respiratory function during a four week treatment programme. Laboratory measures included FEV_1, Bronchial hyper-responsiveness (BHR) using Methacholine bronchial challenge (Methacholine $PD_{20)}$ and patient administered Peak expiratory flow measurement (PEF). Self-reported measures included AQLQ and a total daily symptom score. Clinically important differences in AQLQ scores (defined a priori by authors as 0.5) were reported post intervention for summary and domains scores, with the exception of the Activity domain (change in score for this domain reached statistical significance only).

All domains were responsive to change in terms of agreement with patient-reported change in condition in patients presenting for assessment and treatment in an Emergency department (0.68 to 0.78) with the exception of the Environmental domain (0.44) (Rowe and Oxman (1993).

Several authors have reported greater levels of responsiveness for the AQLQ when directly compared to the responsiveness of generic instruments in concurrent evaluations (Juniper et al., 2000, 2001; Lee et al., 2003; Mancuso 2001; Mancuso and Peterson 2004).

Mancuso et al., (2001) evaluated the discriminative ability of the AQLQ and SF-36 using ROC curve analysis with the patient's perception of disease activity as the external criterion and report higher ranked curves for AQLQ than the SF-36. In a further study by Mancuso and Peterson (2004), similar results were reported with the AQLQ ranking higher than the SF-36. Juniper et al., (2001) reported the AQLQ had the highest responsiveness index (1.35) in comparison to the SG, RS and SF-36. Further evidence of the AQLQ being more responsive than the SF-36 is reported in Lee et al., (2003) with a larger effect size and SRM (1.26; 1.17) than for all SF-36

domains. Moderate correlation was reported between changes in the AQLQ scores and SF-36 with a range of 0.20 for RE to PF 0.62 (Lee et al., 2003).

Moderate levels of correlation between change scores for the AQLQ, ACQ and ACD were reported at 9 weeks; only small levels of correlation between change scores for the AQLQ and respiratory function, peak expiratory flow and medication usage were reported (Juniper et al., 2002).

Furthermore, the SF-36 was not as responsive as the AQLQ with ES per domain lower than for the AQLQ (Domains: Large ES: RP, PF; Medium ES GH, VT, SF and small BP, MH and RE Lee 2003). SRM's for the SF-36 domains were lower than for the AQLQ (0.92 to 0.29 vs. 1.17).

Interpretation

Several studies have contributed to furthering interpretation of change in score for the AQLQ, and in determining a minimal important difference (improvement or deterioration) in scores (Juniper et al., 1994; Rowe and Oxman 1993; Wyrwich et al., 2002, 2003).

A small study was carried out that identified minimally important change scores on the AQLQ by use of a patient rating scale of change (Juniper et al.,1994). A change in score of 0.5 on the seven point AQLQ indicated minimal important difference and a change of 1.0 suggestive of a moderate change. The authors acknowledge the small sample size and number of patients experiencing a large change to be able to be confident of the change in score for this group.

Rowe and Oxman (1993) using a patient-reported change scale (0=no change; 1-3=minimal change [MID]; 4-5 moderate change; 6-7= substantial change) to determine AQLQ change scores in a group of patients visiting an emergency department for treatment and at a 2 week follow-up., MID for the AQLQ was reported as 0.51 which is consistent with other reports.

Wyrwich et al., (2002) explored the relationship between the MID (AQLQ) and the standard error of measurement (SEM) and reported evidence to support the use of one SEM to identify important individual change in HRQoL measures supported by weighted kappa values (0.88-0.93). Values of one SEM were computed using the baseline SD and reliability estimates with Activity=4.43; Symptoms= 4.18; Emotional= 3.04; Environmental 2.89. Further computation for SEM per item values: Activity= 0.40; Symptoms=0.35; Emotional=0.6

Expert consensus

Wywrich et al., (2003) provide a report of an expert consensus process utilising a modified RAND method. The following procedure was carried out:
-systematic review of the literature;
-recruitment of healthcare professional experts and researchers for consultation;
-Delphi consensus technique and a subsequent meeting to achieve consensus and formulate recommendations.

The panel defined a clinically important change (CID) as '*what the physician found important in the treatment of an individual patient even if the CID did not necessarily*

lead to a change in the patients therapy'. A Small change was recommended between 5 and 12; Moderate change 8 to 24 and Large change as 12 to 33 (overlap accounts for different domain CIDs).

Wyrwich et al., (2003) attributed the differences found between Juniper (1994) study of determining the MID as a result of the approaches used to define MID and CID. Minimal important difference as defined by Juniper refers to patients perceptions of change as opposed to clinically importance changed defined by experts.

Precision

Four studies examined precision (Garratt et al., 2000; Mancuso et al., 2001; McColl et al., 2003; Wyrwich et al., 2002) and reported normal response distributions with no evidence of floor or ceiling effects.

Acceptability and Feasibility

Three studies assessed different aspects of acceptability of the AQLQ (Caro et al., 2001; Cook et al., 1993; Garratt et al., 2000).

The concordance of responses on electronic versus paper versions was also compared in Caro et al., (2001). Patients completed instruments two hours apart; the order of presentation was alternated. A high degree of concordance for patients' scores for overall score (0.99) and domain scores (range 0.97 to 0.98) was reported.

Concordance of responses was examined for interview vs. self-administration of the AQLQ where patients were randomized to receive self-administered questionnaire followed by interview-administered two weeks later (Cook et al., 1993). The self-administered approach produced a higher percentage of item endorsement and impact than the interview method. The ICCs for endorsement 0.84 and for total impact 0.93 indicating that both instrument administrations were similar.

McColl et al., (2003) hypothesised that responses would be higher and quicker when asthma- specific instruments (AQLQ, NASQ) were presented before generic instruments (EQ-5D, SF-36). No order effect was found for versions for response rates or response speed.

In a concurrent evaluation including AQLQ and AQLQ(S) Garratt et al., (2000) reported more missing data for the AQLQ individualized Activity questions.

Feasibility

Completion times for paper and electronic versions of the AQLQ were compared (Caro et al., 2001). Similar administration/completion times were reported: 12 (electronic) vs. 11 minutes (paper). Four (6%) of patients indicated that they had no preference for different versions. 49 (77%) expressed a preference for the electronic version and found it easy to use (this includes preferences for SF-36 combined).

b) MiniAQLQ (Juniper)

Four studies were identified which evaluated the MiniAQLQ (Baghi et al., 2004; Juniper et al., 1999a; Magid et al., 2004; Pinnock et al., 2004). Two studies used postal surveys; one used an online method of administration and one interview administered. One study was conducted with UK participants (Pinnock et al., 2004).

Reliability

Test re-test reliability was reported in two studies (Baghi 2004; Juniper 1999a) with the ICCs for the MiniAQLQ reported as consistently lower than the AQLQ in Juniper et al., (1999a). Levels greater than 0.90 for individual comparison were reported in Baghi et al., (2004).

Two studies (Juniper et al., 1999a; Baghi et al., 2004) reported evidence of internal consistency with alpha levels greater than 0.70 with the exception of the Environment domain (pre-test) with an alpha of 0.65 (Baghi et al., 2004).

Validity

Evidence of internal and construct validity of the MiniAQLQ is supported by four studies (Baghi et al., 2004; Franic et al., 2005; Juniper et al., 1999a: Magid et al., 2004).

Health service utilisation

In a prospective study (Magid et al., 2004), patients with a low baseline score (MiniAQLQ) were more likely to have an ED visit and subsequent asthma related healthcare utilization. Multivariate analysis adjusted for sociodemographic and clinical factors, the MiniAQLQ was predictive of ED visit (OR 1.34; 95% CI 1.18 to 1.52).

Internal validity

Baghi et al., (2004) investigated internal validity using principal components analysis pre and post-test of the effectiveness of a web-based intervention for self management. The analysis of the fifteen items extracted 4 factors which accounted for 69% of the variance for pre-test and 76% for post-test providing further empirical evidence that the 15 items are measuring the 4 conceptual constructs within the instrument.

Asthma-specific patient-reported health instruments

The MiniAQLQ scores were similar for the AQLQ for Symptoms and Emotional function but slightly lower for the Environmental and Activity domains. Overall correlation between the two instruments and Symptoms, Environment and Emotional domains were high (0.80) as hypothesised. There was moderate correlation between the Activity domains of both instruments which reflects the differing methods of identifying important activities (Juniper et al., 1999a).

The MiniAQLQ Environment was moderately correlated with the ACQ (-0.55) and Symptoms -0.83 (Franic et al., 2005).

Responsiveness

Two studies evaluated responsiveness (Baghi et al., 2004; Juniper et al., 1999a).

The MiniAQLQ did not correlate as well as the AQLQ with changes overtime with the ACQ and SF-36 physical domain suggesting that the MiniAQLQ may not be as responsive as the AQLQ (Juniper et al., 1999a).

Baghi et al., (2004) reported statistically significant change in scores pre and post testing of the MiniAQLQ following evaluation of a web-based intervention for asthma self management.

Precision

No evidence reported.

Acceptability

Completion errors and response rates of postal MiniAQLQ were compared to interview administered in patients recruited from a primary care practice in the UK (Pinnock et al., 2004). Instruction sheets were provided for guidance. Ninety-eight percent response-rates for the postal questionnaire were reported and of these 10% contained one or more missing responses. Question 15 (work related activities) was the most common error where non-workers considered this question not applicable to them. There were no completion errors for the interview administered method.

Feasibility

No evidence reported.

c) Standardised Asthma Quality of Life Questionnaire (AQLQ(S)) (Junipers')

Two studies were identified which evaluated the AQLQ(S) (Garratt et al., 2000; Juniper et al., 1999b). Garratt et al., (2000) evaluated the AQLQ(S) and other instruments (SF-12; NASQ; EQ-5D) with participants of a RCT of the effectiveness of evidenced based guidelines by means of a postal survey; Juniper et al., (1999b) administered the questionnaire in an out-patient setting.

Reliability

High levels of internal consistency were reported in one study (Garratt et al., 2000) with alphas ranging from 0.81 for Environment to 0.96 for Symptoms.

High levels of test re-test reliability are reported for the Summary score and Activities and are similar to the AQLQ (Juniper et al., 1999b).

Validity

Two studies provide evidence of validity (Garratt et al., 2000; Juniper et al., 1999b).

Health status
The AQLQ(S) discriminated between smokers and non-smokers with the exception of Activities and Environment domains in Garratt et al., (2000).

Asthma-specific patient-reported health instruments

The overall correlation between the AQLQ(S) and AQLQ was high as hypothesised but the Activity domain, correlation was weaker than hypothesised. The mean difference in the Activity domain for the AQLQ(S) was higher than for the AQLQ and the overall score slightly higher for the AQLQ(S). These results are indicative of the difference between the instruments in the items within the activity domain. The AQLQ(S) has standardized activities and the AQLQ adopts an individualised approach (Juniper et al., 1999b).

In a concurrent evaluation, Garratt et al., (2000) reported large correlation with the NASQ and AQLQ(S) as hypothesised.

Generic patient- heath instruments
Moderate correlation was reported for the AQLQ(S) and SF-12 PCS and only weak correlation with the MCS (range 0.27 to 0.36). Moderate correlation was reported for AQLQ(S) and EQ-5D (Garratt et al., 2000).

Respiratory function
The AQLQ(S) correlated moderately with clinical indicators of respiratory function.

Responsiveness
Responsiveness was evaluated in a concurrent evaluation reporting SRMs ranging from 0.32 for Environmental exposure to 0.77 for Symptoms which ranked higher in magnitude than for other instruments in this study (NASQ, SF-12, and EQ-5 D) (Garratt et al., 2000).

Precision
No evidence reported

Acceptability
Garratt et al., (2000) reported less missing data with the AQLQ(S) than the AQLQ.

Feasibility
No evidence reported.

d)Acute Asthma Quality of Life Questionnaire (Acute AQLQ)

One study was identified which evaluated the Acute AQLQ (Juniper et al., 2004) in an emergency department setting with patients with acute broncho-constriction.

Reliability

High levels of internal consistency were reported with alphas 0.82 to 0.90 (Juniper et al., 2004).

Validity

There was no correlation with respiratory function (FEV_1, % predicted) and the AQLQ reported in Juniper et al., (2004); moderate correlation was reported with Asthma Symptom Severity (patient-reported).

Responsiveness

The responsiveness of the Acute AQLQ was evaluated in a Randomised Controlled Trial (RCT) of asthma medications and reported a responsiveness index of 2.5 (Juniper et al., 2004). The instrument was able to detect improvement seventy-five minutes after treatment.

Moderate correlation was reported in Juniper et al., (2004) in longitudinal correlation between respiratory function changes (FEV_1, % predicted) and patient-reported Asthma Symptom Severity.

Precision
No evidence reported

Acceptability
No evidence reported

Feasibility
No evidence reported

e) Asthma Control Questionnaire (ACQ)
Two studies were identified which evaluated the ACQ as the principal instrument under study (Juniper et al., 1999c, 2005) and Juniper et al., (2000) used the ACQ in a concurrent evaluation with the ACD.

Reliability
High level of test re-test reliability was reported in Juniper et al., (1999c) (ICC $\geq$0.90).

The ACQ was internally consistent in (Juniper et al., 2005) with levels greater than 0.90.

Concordance of responses between the ACQ and ACD was high with ICC= 0.87 (Juniper 2000) and in the same study higher levels of test-retest reliability (0.90) was reported for the ACQ than the ACD (Juniper et al., 2000).

Validity
Three studies reported evidence of validity (Franic et al., 2005; Juniper et al., 1999c, Juniper et al., 2000).

Asthma severity and medication use
The Global Initiative for Asthma (GINA) guidelines uses four variable to classify asthma severity based on frequency of symptoms, lung function and medication regime. Correlations between the ACQ with a patient-reported version of item 7

relating to peak flow recordings and the GINA guidelines were moderate (0.57) and accorded with hypotheses. The ACQ discriminated between patients with increased usage of quick-relief medication with less asthma control (correlation 0.84) (Franic et al., 2005).

Asthma-specific patient-reported health instruments
The ACQ had hypothesised correlations with AQLQ total score and sub-domains and there was also moderate correlation as predicted with other patient-reported asthma symptoms (Juniper et al., 1999c; 2000).

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As hypothesised, there was strong association between the scores for the ACQ and ACD but only moderate correlation between the ACQ and respiratory function in Juniper 2000). The ACQ was moderately correlated with the AQLQ with the lowest coefficient for the Environment domain (0.55) with similar results for the MiniAQLQ: range -0.55 for Environment to -0.83 Symptoms (Franic et al., 2005).

Generic patient-reported health instruments
Moderate correlations as hypothesised were reported for the ACQ with SF-36 Physical (0.55), and weak for SF-36 Mental component (0.19) (Juniper et al., 1999c; 2000). Further similar results were observed for the ACQ and SF-12 with correlations -0.76 for PCS and 0.03 MCS with corresponding correlations for similar domains (Franic 2005)**.** Correlations between the ACQ and HUI total was -0.50, with correlations greater than 0.60 for Ambulation, Pain; small correlations for Speech, Dexterity and Cognition and no correlation for Emotion, Hearing and Vision as would be expected. The ACQ correlated strongly with the EQ-5D index -0.72, Vas -0.56 (Franic et al., 2005).

Responsiveness
The ACQ detected change reporting a responsiveness index of 1.35 and moderate correlations between changes in the ACQ and other instruments (AQLQ; ACD) as hypothesised (Juniper et al., 1999c).

Precision
No evidence reported.

Acceptability
No evidence reported.

Feasibility
No evidence reported.

e.i) Shortened version of the ACQ

Reliability
High levels of internal consistency and test-re-test reliability are reported for all shortened versions of the ACQ (Juniper et al., 2005). A high level of concordance was reported for all shortened versions with data from the original ACQ.

Validity
Evidence of construct validity is reported with hypothesised correlations between shortened versions and the MiniAQLQ.

Responsiveness
All versions of the ACQ had hypothesised correlations with the MiniAQLQ in longitudinal analysis of change and all versions detected similar change scores between baseline and 26 weeks (Juniper et al., 2005).

Interpretation
The change in ACQ that was equivalent to a change in MiniAQLQ score of 0.5 was calculated by regressing model (Juniper et al., 2005). The MID for all versions was close to 0.5. Furthermore, changes in all versions were associated with changes in lung function and β_2-agonist use

Precision
No evidence reported.

Acceptability and Feasibility
No evidence reported

f) Asthma Control Diary (ACD)
One study was identified which evaluated the ACD in a concurrent evaluation with the ACQ (Juniper et al., 2000).

Reliability
Concordance of responses between the ACD and ACD was high (ICC=0.87). Reliability was high for test re-test within a four week period and although an acceptable level of ICC (0.86) was achieved it was not as reliable as the ACQ for individual assessment (0.90).

Validity
The ACD had similar correlations with the AQLQ as the ACQ (range 0.52 (Environment) to 0.75 for other AQLQ domains).

Weak to moderate correlation was reported for the ACD and SF-36 components with the Mental component having a weaker correlation (0.31).

Responsiveness
Juniper et al., (2000) compared the responsiveness of the ACD and ACQ and reported responsiveness indexes of similar value but the ACD was less in magnitude than the ACQ.

Table 4.6: Developmental and evaluation studies relating to the AQLQ (Junipers) instruments:

Study/ Country	**Population (N) Age Method of administration Setting**	**Measurement properties**					
AQLQ		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Caro et al., 2001 Canada	Asthma (68) Age:16-75 Interview but patient completed Out-patients					✓	
Cook et al., 1993 Canada	Asthma participating in a RCT of different methods of administration (Interview administered vs. self-administered (150) Age: mean 39					✓	
Juniper et al., 1992 Canada	Developmental study		Content ✓				
Juniper et al., 1993 Canada	Further development study Patients who were symptomatic or required treatment at least once a week (150) Age: 39-77 Interview Out-patients		Content ✓				
Juniper et al., 1993, 1994 Canada	Patients who reported asthma symptoms at least once per week and hyperesponsiveness to methacholine[o] (39). Age: 16-60 Interview-self reported Out-patients	Test re-test ✓	Construct ✓	✓			

Study/ Country	Population (N) Age Method of administration Setting	Measurement properties					
AQLQ		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Juniper et al., 1999a Canada	Development/ adaptation study Patients with symptomatic asthma (40) Age: 18-65 Interview Out-patients	Internal consistency ✓ Test re-test ✓	Construct ✓	✓			
Juniper et al., 1999b Canada	Patients with current symptoms of asthma (40) Age: 18-65 Self-report Out-patients	Test re-test ✓	Construct ✓	✓			
Juniper et al., 2000 Canada	ACQ score>0.5 (50) Age: Mean 37 Self-report Completion during one week before follow-up appointment	Internal consistency ✓ Test re-test ✓	Construct ✓	✓			
Juniper et al., 2001 Canada	Patients with symptomatic asthma (40) Age: mean 38 Interview administered Out-patients	Test re-test ✓	Construct ✓	✓			
Lee et al., 2003 USA	Participants in a RCT of asthma medication (241) Age: mean 38 Self report-hand held electronic device recording patients responses to the instruments) Out patients		Construct ✓	✓			

Study/ Country	Population (N) Age Method of administration Setting	Measurement properties					
AQLQ		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Leidy and Coughlin 1998a USA	Patients attending asthma clinic (161) Age: mean 34.7 (data derived from a study testing the ASUI) Interview-self reported Out-patients	Internal consistency ✓ Test re-test ✓	Construct ✓				
Leidy et al., 1998b USA	Patients with self reported diagnosis of asthma; asthma symptoms; low income (112: n=46 African American/AA, n=66 Caucasian/C) Age: mean 33.4 Interview-self reported Out-patients	Internal consistency ✓ Test re-test ✓	Construct ✓				
Mancuso et al., 2001 USA	Patients with moderate asthma (requiring medications daily) (230) Age: mean 41 Interview Primary care		Construct ✓	✓	✓		
Mancuso and Peterson 2004 USA	Asthmatics identified for healthcare plan (185) Age: 41 Postal			✓			
McColl et al., 2003 UK	Asthma (4751) Age: mean 48 Postal Primary care	Internal consistency ✓	Construct ✓			✓	
Orr et al., 2003 UK	Uncontrolled asthma patients participating in treatment programme Age: mean 44 Out patients Self report		Construct ✓				

Study/ Country	Population (N) Age Method of administration Setting	Measurement properties					
AQLQ		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Rowe and Oxman (1993) Canada	Patients who met the American Thoracic Society diagnosis (52) Age: 18-64 Interview administered Emergency department	Test re-test ✓	Construct ✓	✓			
Ware et al., 1998 USA *Only activities questions*	Patients participating in a RCT of asthma medications (142) Age: mean 39 Self reported Out patients	Test re-test ✓	Construct ✓	✓			
Wyrwich et al., 2002 USA	Diagnosis of asthma and/or prescription for asthma medication in the last 2 years (198) Age: mean 37 Interview Out-patients	Internal consistency ✓	Construct	✓			
Mini Asthma Quality of Life Questionnaire (MiniAQLQ) (Junipers')							
Baghi et al., 2004 USA	Patients participating in web based management tools (307) Age: mean 36 Self-report Online	Internal consistency ✓ Test re-test ✓	Construct ✓				
Franic et al., 2005 USA	Asthma (46) Age: mean 46 Self-report Primary care (pharmacies)		Construct ✓	✓			

Study/ Country	Population (N) Age Method of administration Setting	Measurement properties					
MiniAQLQ		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Juniper et al., 1999a Canada	Development/ adaptation study Patients with symptomatic asthma (40) Age: 18-65 Interview Out-patients	Internal consistency ✓ Test re-test ✓	Construct ✓	✓			
Magid et al., 2004 USA	Asthmatics identified from health plan (1406) Age: mean 35.9 Postal		Construct ✓				
Pinnock et al., 2004 UK	Asthma (96) Age: mean 58.5 Postal vs. Interview administered Primary care		Construct ✓			✓	
Standardised Asthma Quality of Life Questionnaire (AQLQ(S)) (Junipers')							
Garratt et al., 2000 UK	Patients participating in a randomised trial assessing the affects of evidence based guidelines (235) Age: 18-60 Postal Primary care	Internal consistency ✓	Construct ✓	✓	✓		
Juniper et al., 1999b Canada	Patients with current symptoms of asthma (40) Age: 18-65 Self-report Out-patients	Test re-test ✓	Construct ✓	✓			

Study/ Country	Population (N) Age Method of administration Setting	Measurement properties					
Acute Asthma Quality of Life Questionnaire (Acute AQLQ)		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Juniper et al., 2004 Canada	Patients with acute broncho-constriction (88) Age: 18-70 (RCT) Interview Emergency department	Internal consistency ✓	Construct ✓				
Asthma Control Questionnaire (ACQ) (Junipers')							
Franic et al., 2005 USA	Asthma (46) Age: mean 46 Self-report Primary care (pharmacies)		Construct ✓	✓			
Juniper et al., 1999c Canada	Developmental study ACQ score>0.5 (50) Age: Mean 37 Self-report (one item clinician assessed) Out-patients	Test re-test ✓	Construct ✓	✓			
Juniper et al., 2000 Canada	ACQ score>0.5 (50) Age: Mean 37 Self-report Completion during one week before follow-up appointment	Internal consistency ✓ Test re-test ✓	Construct ✓	✓			
Juniper et al., 2005 Canada	Patients requiring inhaled steroids participating in a RCT comparing different treatments (552) Age: mean 44.7 Out-patients	Internal consistency ✓ Test re-test ✓	Construct ✓	✓			
Asthma Control Diary							
Juniper et al., 2000 Canada	ACQ score>0.5 (50) Age: Mean 37 Self-report Completion one week before follow-up	Internal consistency ✓ Test re-test ✓	Construct ✓	✓			

g) Marks AQLQ (MAQLQ)

Four studies provide evidence of the measurement performance of the MAQLQ (Gupchup et al., 1997; Katz et al., 1999; Marks et al., 1992, 1993; Ware et al., 1998). Patients with a range of asthma severities were included in these studies and one study evaluated the performance with patients recruited in a RCT of asthma medications (Ware et al., 1998). The average age of the participants was forty years. Two studies used a telephone survey (Gupchup et al., 1997; Katz et al., 1999) and others obtained responses from patients during an out-patient appointment.

Reliability

Five studies reported reliability evidence (Hyland et al., 1992; Gupchup et al., 1997; Katz et al., 1999; Marks et al., 1992, Ware et al., 1998).

High levels of internal consistency (greater than 0.90) were reported for stable and unstable patients in Marks et al., (1992) developmental study. Similarly positive internal consistency was observed for the Total score; Total and domain in Gupchup et al., (1997); Total in Katz et al., (1999). Ware et al., (1998) reported alphas greater than 0.80 for Breathlessness, Social, Concerns and Overall with 0.71 for Moods.

Test re-test reliability results exceeded the recommended 0.70 for group comparison with exception of the Breathlessness domain (ICC 0.61).

Item level analysis

Item-total correlations were greater than 0.40 for each domain (Marks et al., 1992; Gupchup et al., 1997; Katz et al., 1999).

Validity

Four studies reported evidence of validity (Gupchup et al., 1997; Katz et al., 1999; Marks et al., 1992; 1993).

Internal validity

The conceptual framework of the MAQLQ with a four domain structure was empirically supported in factor analysis (Katz et al., 1999) although the overlapping items of two domains were eliminated in these analyses.

Asthma-specific patient-reported health instruments

No evidence was found comparing the MAQLQ with other asthma-specific measures.

Generic patient-reported health instruments

Moderate, hypothesised correlation were reported between the MAQLQ scales and the SF-36 PCS range 0.43 (Emotional impact) to 0.66 (Total); MCS range 0.22 (Physical) to 0.60 (Emotional) (Katz et al., 1999).

Lung function

Moderate correlations were reported for number of medications and MAQLQ total and domain scores (Marks 1992) in patients with unstable asthma. Weak correlations were found for MAQLQ scores and baseline FEV_1 and degree of bronchial hyperesponsiveness. The authors attribute the weak correlation with the physiological measures due to the variability of airflow obstruction over a period of time. Gupchup et al., (1997) also reported significant but weak to moderate correlation between

number of medications and MAQLQ Total and domain scores. Weak correlations were reported for the MAQLQ total and domain scores with FEV_1 (Range 0.06 to -0.17).

Responsiveness
Evidence of responsiveness of the MAQLQ is supported by three studies (Katz et al., 1999; Marks et al., 1993; Ware et al., 1998).

Marks et al., (1993) evaluated the longitudinal validity of the MAQLQ hypothesising moderate correlation with changes in the SIP, patient-reported symptoms, peak flow variability and degree of bronchial hyperesponsiveness at baseline and at follow-up (3/4 months). There were moderate correlations as hypothesised between the MAQLQ total score and Symptoms and degree of bronchial hyperesponsiveness (BR), but weak (non-significant) correlation for SIP and Peak flow variability. Significant moderate correlation was found for MAQLQ Social domain and Symptoms, Peak flow variability and BR. There was no to weak correlation with MAQLQ and SIP (Psychosocial). The MAQLQ was able to detect change in improved patients and identify those who had remained stable and the magnitude of the responsiveness index greater than for other measures.

Responsiveness was evaluated by comparing changes in MAQLQ to external criteria of changed defined for the SF-36 components and Asthma Severity scale by calculating the better and worse group as one standard deviation above or below the mean for the entire group (Katz et al., 1999). All differences were statistically significant demonstrating responsiveness to change in this group of patients.

Ware et al., (1998) evaluated the responsiveness of the MAQLQ compared with the SF-36 expressing results as relative validity (RV) coefficients. The best measure with RV estimates of 1.0 were reported for MAQLQ Breathlessness and Clinician assessed pulmonary function, Chest tightness, Wheeze, Shortness of breath and Overall condition. In this concurrent evaluation, the MAQLQ was more responsive than the SF-36.

Precision
No ceiling or floor effects were reported in Ware et al., (1998).

Acceptability
Gupchup et al., (1997) assessed acceptability of the MAQLQ during a telephone survey by offering a ‘don’t know’ option for each item. No participants chose this option. Ware (1998) reported that 99% of all items were completed by patients.

Feasibility
No evidence reported.

g.i) Modified Asthma Quality of Life Questionnaire-Marks (MAQLQ-M)

One study was identified which modified the MAQLQ and evaluated its performance (Adams et al., 2000).

Reliability

Internal consistency reliability values for the MAQLQ-M for the Total scale exceeded 0.90 (Adams et al., 2000). High levels of Test-retest reliability were found in a two week re-test period in the same study population.

Validity

Internal validity

Factor analysis of the structure of the modified instrument refuted the results from a previous study of the original instrument by Katz et al., (1999) in Adams et al., (2000). A three component solution was reported for Breathlessness, Mood but loadings on one factor only for the Social/ Concerns domain. The authors suggest that the alteration of the response scale from a 5-point Likert to 7 may have accounted for these results.

Healthcare utilisation

Patients who did not have repeated hospital admissions or visits to the ER reported better quality of life as hypothesized.

Generic patient-reported health instruments

Moderate to large correlations with the MAQLQ-M and SF-36 PCS were reported (0.71) and MCS (0.62) (Adams et al., 2000).

Lung function

Several disease reference measures were employed to assess the correlation of MAQLQ-M scores. Stronger associations were reported between patient-reported symptoms (range 0.35 to 0.56) than lung function (range -0.29 to 0.30).

Responsiveness

Small to moderate correlations with changes in MAQLQ-M scores and respiratory function but with stronger correlations with self-reported measures of symptoms were reported in (Adams et al., 2000).

Precision

Adams et al., (2000) reported no floor or ceiling effects of the MAQLQ-M and the distribution of scores was normal.

Acceptability

No evidence reported.

Feasibility

No evidence reported.

Table 4.7: Developmental and evaluation studies relating to the MAQLQ instruments:

Study/ Country	**Population (N) Age Method of administration Setting**	**Measurement properties**					
MAQLQ		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Marks et al., 1992 Australia Developmental study	Focus group Patients with a wide range of asthma severity (8) Patients with asthma (283) Age: mean 39 Out-patients		Internal ✓				
	Patients with stable asthma (77) Out-patients	Internal consistency ✓ Test re-test ✓	Construct ✓				
	Patients identified from population survey with unstable asthma (87) Population survey	Internal consistency ✓	Construct ✓				
Marks et al., 1993 Australia	Patients attending asthma clinic (44) Age: mean 33 Out-patients			✓			
Gupchup et al., 1997 USA	Patients taking medications for asthma (106) Age: range 18 and over Community-telephone survey	Internal consistency ✓	Construct ✓			✓	
Ware et al., 1998 USA	Patients enrolled in a RCT of asthma medication (142) Age: mean 39.5 Out patients	Internal consistency ✓	Construct ✓	✓	✓	✓	
Katz et al., 1999 USA	Patients selected from physician records (539) Age: mean 39.4 Community-telephone survey	Internal consistency ✓	Construct ✓ Internal ✓	✓			
Modified Marks Asthma Quality of Life Questionnaire (MAQLQ-M)							
Adams et al., 2000 Australia	Patients selected with physiological evidence of asthma (293) Age: mean 42 Out-patients and postal survey	Internal consistency ✓ Test re-test ✓	Construct ✓ Internal ✓	✓			

h) Living With Asthma Questionnaire (LWAQ)

Three studies were identified which evaluated the LWAQ (Hyland 1991; 96; McColl et al., 1995).

Reliability

High ICC levels for test re-test reliability were reported in Hyland (1991) (≥ 0.90).

Validity

Internal validity

Hyland et al., (1996) conducted exploratory factor analysis and two cognitive factors (activities and avoidance) and two emotional (distress and pre-occupational) with a general factor of disease severity were reported.

Generic patient-reported health instruments

The LWAQ and the SF-36 were evaluated concurrently with patients with asthma (McColl et al., 1995) and reported hypothesised correlations with related domains for example Physical functioning (0.70 to 0.80). The Emotional and Mental domains for both instruments were only moderately correlated (0.45 to 0.54). Similar results were reported for the Social functioning domains (0.54 to 0.64)

Responsiveness

No evidence reported.

Precision

No evidence reported.

Acceptability

No evidence reported.

Feasiblity

No evidence reported.

-ms-LWAQ

Reliability

Adequate levels of internal consistency with the exception of 'Drugs construct' with an alpha of 0.40 reported in Reid et al., (1999).

Validity

Healthcare utilisation

All of the sub-scales of the ms-LWAQ were associated with the level of healthcare utilisation as measured by visiting physicians; emergency room visit and hospital in-patient (Reid et al., 1999).

Correlations with SF-36 domains were moderate as hypothesised in Reid et al., (1999) although small correlation was reported for Seriousness and Role Emotional and Pain; and Affect and Pain

Responsiveness

No evidence reported.

Precision
No evidence reported.

Acceptability
No evidence reported.

Feasiblity
No evidence reported.

Table 4.8: Developmental and evaluation studies relating to the Living With Asthma Questionnaire instruments:

Study/ County	**Population (N) Age Method of administration Setting**	**Measurement properties**					
LWAQ		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Hyland (1991) UK. Developmental study	Patients with a wide range of asthma severity and general population sample Six focus groups		Content ✓				
	Asthma 101, 150, 405, 282 Primary care		Internal ✓				
	Asthma (81) Aged over 18 years Primary care	Test re-test ✓	Construct Internal ✓				
Hyland et al., 1996 UK	Asthma (810) Primary care		Internal ✓				
	Participants of a RCT of two different asthma medications (149) Primary care			✓			
McColl et al., 1995 UK	Asthma (650) Age: over 18 Primary care Self-report and postal response		Construct ✓ Internal ✓				
Ms-LWAQ							
Reid et al., 1999 USA	Asthma (250) Age: 19-83 Primary care	Internal consistency ✓	Construct ✓				

i) St. George's Respiratory Questionnaire

Reliability
Reproducibility was examined with asthmatic patients (40) and patients with COPD (20) with a two week recall period with high levels of test-retest reliability (Jones et al., 1992) (0.91).

Validity
Health status
The SGRQ Symptoms domain discriminated between patients with respiratory symptoms and those without but was weakly correlated with physiological measures, dyspnoea grade, mood state and SIP scores (Jones et al., 1991). Moderate correlations were reported as hypothesised for the Activity and Impact domains and MRC dyspnoea grade, physical function test, psychological functioning and general health. Stronger correlations were reported for the Impact domain and anxiety and depression (Jones et al., 1991).

Generic patient-reported health instruments
For the Total score the highest but moderate correlation was reported for SIP total and dyspnoea, followed by anxiety and depression.

Responsiveness
Smaller than hypothesised but significant correlation was reported in longitudinal analysis (one year) of changes in SGRQ scores and other measures: (SIP; Respiratory function) (Jones et al., 1991).

Precision
No evidence reported.

Acceptability
No evidence reported.

Feasiblity
No evidence reported

Table 4.9: Developmental and evaluation studies relating to the St Georges Respiratory Questionnaire evaluations in asthma

Study/ Country	**Population (N) Age Method of administration Setting**	**Measurement properties**					
SGRQ		**Reliability**	**Validity**	**Responsiveness**	**Precision**	**Acceptability**	**Feasibility**
Quirk and Jones (1990) UK	Asthma (40) Age:16-75 Interview but patient completed Out-patients Development study		Content ✓				
Quirk et al., 1991 UK	Asthma (140) Age: mean 44 Interview but patient completed Out-patients Development study: empirical weights		Content ✓				
Jones et al., 1991 UK	Asthma (40); COPD (20) Age: mean 45; 66 Self-completed	Test re-test ✓	Construct ✓	✓			

Other asthma-specific instruments identified from the review.

The following table provides an overview of other records of asthma-specific instruments identified of either newly developed instruments or single study reporting of measurement properties and/or evaluation.

Table 4.10

Instrument/ reference	Population (N) Age Method of administration Setting	Reliability	Validity	Responsiveness	Precision	Acceptability	Feasibility	Comments No other records identified unless stated
AQ30 and AQ20 Barley et al., 1998 UK	Patients with asthma (90) Age: mean 46 Self report Out-patients		✓	✓	✓		✓	No advantage over the AQ30 over the AQ20. Correlations reported with respiratory function, SGRQ and AQLQ Junipers. AQ30 and AQ20 evaluated in patients with COPD (Quirk 1994)
AQ18 Barley and Jones, 2006 UK	Asthma (144) Self report UK	✓			✓			Rasch analysis of the AQ20. Highlights the usefulness of multiple repeat assessments over time allowing for testing of differential item functioning (DIF)
Asthma Therapy Assessment Questionnaire Vollmer et al., 2002 USA	Asthma		✓					Problems based questionnaire to generate an index of asthma control and relationship with healthcare utilisation
Asthma TYPE Blumenschien and Johannesson (1998) USA	Patients with Asthma (69) Age: mean 40 Out-patients Interview administered		✓					Concurrent evaluation with SF-36 (have put this in concurrent evaluation table and SF-36 table) Moderate correlation for all domains except Allergy index

Instrument/ reference	Population (N) Age Method of administration Setting	Reliability	Validity	Responsiveness	Precision	Acceptability	Feasibility	Comments No other records identified unless stated
Integrated Therapeutics Group Asthma Short Form (ITG-ASF Bayliss et al., 2000 USA	Development study: Three groups of patients (Total: 584) Age: Over 14 years	Internal consistency ✓	✓	✓	✓		✓	High level of internal consistency Acceptable ceiling and floor effects Moderate correlation with MAQLQ Correlation with changes in asthma severity and lung function
Life Activities Questionnaire for Adult Asthma Creer et al., 1992 USA	Developmental study including different groups of patients with asthma	Internal consistency ✓ Test re-test✓	✓					High levels of internal consistency and test re-test reliability. Content validity established by patients judgement
Life Quality (LQ) Test Winder et al., 2000 USA	Patients with asthma (239) out-patients, and people without asthma (46) from a dental practice		✓					Higher scores indicate worse asthma specific quality of life. Patients diagnosed with asthma had statistically significantly higher scores than those without asthma.
Perceived Control of Asthma Questionnaire (PCAQ) Katz et al., 2002 USA	Patients with asthma (374) Age: over 18 years Telephone survey	Internal consistency ✓	✓	✓	✓			High level of internal consistency Small to moderate correlation with clinical variables and perceived asthma severity scores; SF-36 and MAQLQ both cross sectional and longitudinal analysis One other record identified: Chinese

Instrument/ reference	Population (N) Age Method of administration Setting	Reliability	Validity	Responsiveness	Precision	Acceptability	Feasibility	Comments No other records identified unless stated
Quality of Life Diary Hyland et al., 1995 UK	Patients participating in a RCT (426) Age: 16 years and over		✓	✓	✓	✓		Correlation with respiratory function and LWAQ 75% compliance with diary for 20 days Moderate correlation with LWAQ and respiratory function cross sectional and longitudinal
University of Alabama at Birmingham (UAB) Functional Impairment Scale Player et al., 1994 USA	Total of 382 patients with asthma Self-report Out-patients	Internal consistency ✓	✓		✓			High level of internal consistency No floor or ceiling effects Moderate correlation with other asthma measures: Bother scale, symptom survey and asthma opinion survey

SUMMARY - GENERIC INSTRUMENTS

A total of twenty-one articles were included in the review which reported results from evaluation studies of generic instruments evaluated with patients with asthma.

Six generic instruments were identified in the review which had been evaluated with people with asthma. Only two though, the SF-36 and SF-12 were the principal instrument undergoing evaluation. The others included the EuroQol which was evaluated concurrently with other asthma-specific instruments (Garratt 2000); HUI, RAND and SIP as a reference instrument (Leidy and Coughlin1998a, Leidy et al., b; Juniper et al., 1993; Rowe and Oxman 1993; Marks et al., 1993).

The included instruments were evaluated with a wide range of patients with different asthma severities and classifications defined as patient-reported symptom prevalence and severity, use of medications and physiological lung function. The overall age of participants was forty years and study sizes ranged from 40 to 1406.

Only two studies were conducted in the UK (Garratt et al., 2000; McColl et al., (1995) using the SF-12 and SF-36. Other studies were from Canada and USA.

Details of the instruments domains, items and scoring procedures are detailed in Chapter 3, Tables 1 and 2. All instruments are multi-dimensional with an average of six domains similar in construct. The SIP though does not include a Global judgement question but has a Cognitive functioning domain. Item content ranges from five (EQ-5D) to 136 for the SIP. All instruments have a scoring algorithm and the SF-36, SF-12 and SIP have domain scoring and component scores (Physical and Mental). The SIP items are weighted. All are self-administered or interview. One study evaluated and compared results of two versions of the SF-36 (Standard vs. Acute form) (Keller et al., 1997). Completion times range from five (EQ-5D) to twenty minutes (SIP).
.
The most frequently reported instrument evaluated was the SF-36 with evidence provided for most measurement selection criteria. The overall evidence supports the use of the SF-36 as a generic instrument for the assessment of health-related quality of life in people with asthma. The studies included in the review report acceptable internal consistency and reproducibility for group comparison. The validity of the SF-36 has been comprehensively examined in concurrent evaluation with asthma-specific instruments and also the HUI and provides evidence of a relationship of measuring similar constructs. Empirical evidence supports the internal structure and proposed health domains of the SF-36. The SF-36 has evidence of responsiveness but does not perform as well as asthma-specific instruments. The evidence available suggests that it is acceptable to patients in the studies included. The SF-12 has also been evaluated with patients with asthma in two UK studies and evidence although limited, supports the hypothetical construct underpinning the instrument and that it is responsive to change.

Limited evidence is reported for other instruments identified in the review (EQ-5D, HUI, RAND and SIP). The EQ-5D performed equally as well as the SF-12 in a concurrent evaluation but was less responsive than asthma-specific instruments. The HUI, RAND and SIP have not been the principal instrument under study nor evaluated concurrently. Evidence of performance therefore can only be extrapolated

from studies which have used these instruments as a reference measure of construct validity. Results from these studies suggest that there is moderate correlation between specific and generic instruments.

Overall, the SF-36 is the most rigorously evaluated generic instrument and provides evidence to support its application with patients with asthma. The SF-12 has some evidence to support application but further evaluations are needed to be confident in recommending it. There is limited evidence available to support or refute the use of other generic instruments included in this review.

Limited evidence is available for the comparative performance of generic instruments. The lack of this evidence is limiting as this would give a clear indication of which instrument performs the best with patients with asthma. Concurrent evaluations and principal instrument evaluations are necessary for other available generic instruments to provide evidence of the measurement and practical properties before recommendations can be made.

Table 4.11: Summary of generic instruments: measurement properties

Instrument	**Measurement properties**	**Availability**: Royalty; Scoring methods and interpretation guide	**Acceptability/Feasibility**: Patient acceptability Staff acceptability
SF-36	Two UK evaluations Several studies evaluating most measurement criteria. Good evidence of reliability, validity and responsiveness supporting application	Permission and licensing should be obtained from the authors Scoring algorithms and manual are available from the developers	Self- report 10 to 15 minutes to complete Some difficulties experiences with completion
SF-12	One UK evaluation	Permission and licensing should be obtained from the authors Scoring algorithms and manual are available from the developers	Self-report 5 minutes completion Acceptable to patients
SIP	Limited evaluations and evidence of measurement properties. It has only been used as a reference measure.		
HUI	Limited evaluations and evidence of measurement properties. It has only been used as a reference measure.		
EuroQol	Three /four evaluations in the UK Some evidence of measurement properties	Permission and licensing should be obtained from the authors Scoring algorithms and manual are available from the developers	Self-report 5 minutes completion VAS higher proportion of missing responses

SUMMARY - ASTHMA-SPECIFIC INSTRUMENTS

Thirty-five studies provided some evidence of measurement and/or practical properties for the asthma-specific measures included in the review.

Nine instruments were reviewed: ACQ, ACD, AQLQ, AQLQ(S), MiniAQLQ, Acute AQLQ MAQLQ, and LWAQ. The SGRQ, a general respiratory specific instrument, was also included. A further eight instruments were identified which had undergone one evaluation and are illustrated in Table 4.10.

The number of participants included in studies ranged from 40 to 1406 and average age was 40 years. Four of the 35 studies were conducted in the UK. Most studies were conducted in an out-patient primary care setting. Two studies were conducted in emergency departments. Several studies administered questionnaires via interviews; six studies adopted postal surveys, and two telephone surveys. One study used an online version of the AQLQ (Baghi et al., 2004). Four studies evaluated instrument measurement properties following clinical trials of medication effectiveness (Cook et al., 1993, Garratt et al., 2000, Ware et al., 1998, Juniper et al., 2005).

All instruments included the assessment of symptoms, with the exception of the ACQ and ACD. Psychological well-being was the next most frequently assessed domain. Several instruments assessed role activities (AQLQ, MiniAQLQ, AQLQ(S), and SGRQ). Social well-being was assessed in two instruments (MAQLQ; SGRQ). One instrument assessed personal construct (MAQLQ) and one assessed treatment satisfaction (SGRQ). The number of assessed domains ranged from three to six; total number of items ranged was from seven (ACD/ACQ) to 68 (LWAQ). The SGRQ has a total and domain weighted scoring system. All are available as self completion although interview methods are recommended by the developers for the SGRQ. The ACQ has self report responses and one clinician assessed item.

The most comprehensively evaluated instruments were the Juniper Asthma Quality of Life Questionnaires (AQLQ, AQLQ(S), MiniAQLQ and AcAQLQ). An extensive and thorough synthesis of evidence in support of a wide range of measurement and practical properties provides favourable support for the collection of instruments developed by Juniper et al. Modest and promising evidence of both measurement and practical properties are presented for the LWAQ, SGRQ and MAQLQ.

All instruments have been developed in collaboration with patients with asthma and have undergone evaluation of face and content validity.

All instruments included in the review have evidence of reliability supporting application in studies involving groups of patients; two instruments have higher levels of reliability supporting application in individual analysis (AQLQ, MAQLQ).

Empirical evidence supports the proposed domain structure for the MiniAQLQ, MAQLQ and LWAQ.

Most instruments were assessed for validity through comparison with other instruments. All instruments have evidence for validity through comparison with

instruments that measure similar or related constructs. This is most extensive for the Juniper instruments.

Evidence of responsiveness was reported for all instruments except the LWAQ. In concurrent evaluations, the instruments included in the review performed better than generic comparator instruments.

Instrument patient acceptability is reported for the AQLQ and MAQLQ; some patients experience difficulty completing the individualised questions included in the AQLQ. The AQLQ(S) does not include the individualised section, but has good evidence of measurement and practical properties.

There is good evidence of the measurement and practical properties for the AQLQ, AQLQ(S), and MiniAQLQ and the MAQLQ. Limited evidence for the LWAQ and SGRQ was reviewed; further evaluations are required.

Some instruments have been identified in this review which report only one evaluation. There is insufficient evidence therefore to make firm recommendations about these at present.

Concurrent evaluations of asthma-specific and generic instruments provide further good evidence of performance. As expected, results indicate that asthma-specific instrument generally perform better that generic instrument particularly with reference to responsiveness. This may reflect the specific domain structure of the instruments and greater relevance to health concerns of patients with asthma.

There is limited evidence available for the comparative performance of asthma-specific instruments with the exception of comparative performance of different versions of instruments. The lack of this evidence is limiting as this would give a clear indication of which instrument performs the best with patients with asthma.

Table 4.12: Summary of asthma-specific instruments: measurement properties

Instrument	**Measurement properties**	**Availability**: Royalty; Scoring methods and interpretation guide	**Acceptability/Feasibility**: Patient acceptability Staff acceptability
Asthma-specific			
ACQ) ACD AQLQ MiniAQLQ AQLQ(S) Acute AQLQ	Several studies evaluating most measurement criteria. Good evidence of reliability, validity and responsiveness supporting application (AQLQ, AQLQ(S), MiniAQLQ) 4/33 evaluations in the UK. Others in Canada and USA	All questionnaires and the translations are copyrighted. They must not be altered in any way, sold, translated or adapted for another medium (*e.g.,* computer) without the written permission of Professor Elizabeth Juniper. Scoring methods illustrated	Acceptable to patients particularly the AQLQ(S) and the MiniAQLQ. Patients experienced some difficulty with the individualised Activity domain of the AQLQ. Questionnaires suitable for self-completion and interview administration Maximum of 10 minutes completion No details of cost
MAQLQ	Developed and evaluated in Australia Six evaluations with comprehensive testing of measurement properties Good evidence of reliability, validity and responsiveness supporting application No UK evaluations	No details of licensing or permission for use. Contact details provided.	Acceptable to patients Questionnaires suitable for self-completion and interview administration No details of cost, completion time

Instrument	**Measurement properties**	**Availability**: Royalty; Scoring methods and interpretation guide	**Acceptability/Feasibility**: Patient acceptability Staff acceptability
LWAQ	Developed in the UK Some evidence of reliability and validity	Permission required and contact details provided	Suitable for self-completion but 68 items 10 to 20 minutes completion No details of patient acceptability or feasibility
SGRQ	Developed in the UK Three evaluations with people with Asthma. Has been used with patients with COPD Some evidence of reliability and validity	Contribution to the St. George's Research Fund is requested from commercial organizations using the instrument. Permission should be obtained from the authors Scoring algorithms and calculators are available from the developers	Self- report but recommended interview administered 8- 15 minutes to complete No details of patient acceptability

DISCUSSION AND RECOMMENDATIONS

Many evaluations have been identified in this review of both generic and asthma-specific instruments with patients with different disease severities. The evaluations were conducted mainly in an out-patient setting and although all instruments were completed by the patients, some were administered during interviews. There are limited UK evaluations. Most have been applied in the USA or Canada.

The SF-36 is the most widely evaluated generic instrument and the Juniper collections of instruments have extensive evidence of measurement properties. There is also promising evidence for several additional asthma-specific instruments - MAQLQ, LWAQ, SGRQ.

The generic instruments chiefly the SF-36, included in the review adopt a multi-dimensional perspective to the measurement of patient-reported health.

All reviewed asthma-specific instruments address multi-dimensional aspects of health-related quality of life. All include the assessment of symptoms and most also include psychosocial well-being. Other frequently assessed dimensions include the impact of asthma on role activities and personal constructs.

The lack of studies evaluating the performance of different generic instruments is disappointing. The SF-12 and EQ-5D performed equally well in one concurrent evaluation where moderate levels of correlation were reported between the SF-36 and HUI.

Concurrent evaluations of asthma-specific instruments were dominated by evaluations of modifications of the AQLQ (Juniper): modifications of the AQLQ performed as well as the original version in most populations and settings.

However, several studies report the concurrent evaluation of generic and asthma-specific instruments. Good evidence supports the reliability and validity of both generic (SF-36) and asthma-specific (AQLQ collection) measures, supporting their combined use in people with asthma. However, and as expected, consistently higher levels of responsiveness were reported for the asthma-specific instruments.

Recommendations

Synthesising the available primary evidence reported in this review and extrapolating evidence from concurrent evaluations supports the use of both generic and asthma-specific patient-reported health instruments for people with asthma. The SF-36 is recommended as a generic instrument for the broad evaluation of health-related quality of life for people with asthma. Further evaluations are required, particularly concurrent evaluations of different generic instruments to inform further recommendations and for the UK population.

Asthma-specific instruments particularly the AQLQ Juniper collection and the MAQLQ are recommended and different versions of the AQLQ instruments selected for particular purposes. For example, although the AQLQ original version of the

instrument has been widely evaluated and demonstrates good performance, some patients experience some difficulty when completing the individualised activity questions. The AQLQ(S), which does not include the individualised questions, may therefore be preferable. Furthermore, the MiniAQLQ may be more acceptable to patients and administrators. It may not be as responsive to changes in health as the other, more comprehensive versions (AQLQ and AQLQ(S)). Further evaluations are needed to support the use of these instruments specifically in the UK and further evaluations are required for the SGRQ and LWAQ. The SGRQ has though been evaluated extensively with patients with COPD (Chapter 5).

REFERENCES

Adams RJ, Ruffin RE, Smith BJ. Validity of a modified version of the Marks Asthma Quality of Life Questionnaire. *Journal of Asthma* 2000; **37**:131-43.

Baghi, H., & Atherton, M. Construct Validity and Reliability of Scores on Scales to Measure the Impairment of Health-Related Quality of Life in Persons with Asthma. *Journal of Nursing Measurement* 2004; **12**(1), 21-31.

Barley EA, Quirk FH, Jones PW. Asthma health status measurement in clinical practice: validity of a new short and simple instrument. *Respiratory Medicine* 1998; **92:**1207-14.

Barley EA, Jones PW. Repeatability of a Rasch model of the AQ20 over five assessments. *Quality of Life Research* 2006; **15**: 801-809

Bayliss MS, Espindle DM, Buchner DA, Blaiss MS, Ware JEJ. A new tool for monitoring asthma outcomes: the ITG Asthma Short Form. *Quality of Life Research* 2000; **9**:451-66.

Blumenschein K, .Johannesson M. Relationship between quality of life instruments, health state utilities, and Willingness To Pay in patients with asthma. *Annals of Allergy, Asthma and Immunology* 1998; **80**:189-94.

Caro JJ, Caro I, Caro J, Wouters F, Juniper EF. Does electronic implementation of questionnaires used in asthma alter responses compared to paper implementation? *Quality of Life Research* 2001; **10**:683-91.

Cook DJ, Guyatt GH, Juniper EF, Griffith LE, McIlroy W, Willan AR *et al*. Interviewer versus self-administered questionnaires in developing a disease-specific, health-related quality of life instrument for asthma. *Journal of Clinical Epidemiology* 1993; **46**:529-34.

Creer TL, Wigal JK, Kotses H, McConnaughy K, Winder JA. A life activities questionnaire for adult asthma. *Journal of Asthma* 1992; **29**:393-9.

Franic, Duska M; Aull, Larry; Grauer, Dennis; Oyelowo, Olatoye. Adherence, asthma control, generic and disease-specific quality-of-life instruments in asthma. *Expert Review of Pharmacoeconomics and Outcomes Research* 2005; 5, 4: 411-421(11)

Garratt AM, Hutchinson A, Russell IT. Patient-assessed measures of health outcome in asthma: a comparison of four approaches. *Respiratory Medicine* 2000; **94**:597-606.

Gupchup GV, Wolfgang AP, Thomas JI. Reliability and validity of the Asthma Quality of Life Questionnaire-Marks in a sample of adult asthmatic patients in the United States. *Clinical Therapeutics* 1997; **19**:1116-25.

Hazell M, Frank T, Frank P. Health related quality of life in individuals with asthma related symptoms. Respir Med. 2003;97(**11**):1211-8.

Hyland ME, Finnis S, Irvine SH. A scale for assessing quality of life in adult asthma sufferers. *Journal of Psychosomatic Research* 1991; **35**:99-110.

Hyland ME. The living with asthma questionnaire. *Respiratory Medicine* 1991; **85**:13-6.

Hyland ME. Measuring quality of life of adult asthmatics: a patient-centred approach. In Christie MJ, French DJ, eds. *Assessment of quality of life in childhood asthma. 189 pp*, pp 147-55. Langhorne, PA, USA: Harwood Academic Publishers/Gordon and Breach Science Publishers, 1994.

Hyland ME, .Crocker GR. Validation of an asthma quality of life diary in a clinical trial. *Thorax* 1995; **50**:724-30.

Hyland ME, Bellesis M, Thompson PJ, Kenyon CAP. The constructs of asthma quality of life: psychometric, experimental, and correlational evidence. *Psychology and Health* 1996; **12**:101-21.

Jones PW, Quirk FH, Baveystock CM. The St George's Respiratory Questionnaire. *Respiratory Medicine* 1991; **85**:25-31.

Jones PW. Testing health status (quality of life) questionnaires for asthma and COPD. *European Respiratory Journal* 1998; **11**:5-6.

Juniper EF, Guyatt GH, Epstein RS, Ferrie PJ, Jaeschke R, Hillers TK. Evaluation of impairment of health related quality of life in asthma: development of a questionnaire for use in clinical trials. *Thorax* 1992; **47**:76-83.

Juniper EF, Guyatt GH, Ferrie PJ, Griffith LE. Measuring quality of life in asthma. *American Review of Respiratory Disease* 1993; **147**:832-8.

Juniper EF, Guyatt GH, Willan AR, Griffith LE. Determining a minimal important change in a disease-specific quality of life questionnaire. *Journal of Clinical Epidemiology* 1994; **47**:81-7.

Juniper EF. Assessing health-related quality of life in asthma. *Canadian Respiratory Journal* 1997; **4**:145-51.

Juniper EF, Buist AS, Cox FM, Ferrie PJ, King DR. Validation of a standardized version of the Asthma Quality of Life Questionnaire. *Chest: the Cardiopulmonary Journal* 1999; **115**:1265-70.

Juniper EF, Guyatt GH, Cox FM, Ferrie PJ, King DR. Development and validation of the Mini-Asthma Quality of Life Questionnaire. *European Respiratory Journal* 1999; **14**:32-8.

Juniper EF, O'Byrne PM, Guyatt GH, Ferrie PJ, King DR. Development and validation of a questionnaire to measure asthma control. *European Respiratory Journal* 1999; **14**:902-7.

Juniper EF, O'Byrne PM, Ferrie PJ, King DR, Roberts JN. Measuring asthma control: clinic questionnaire or daily diary? *American Journal of Respiratory and Critical Care Medicine* 2000; **162**:1330-4.

Juniper EF, Norman GR, Cox FM, Roberts JN. Comparison of the Standard Gamble, Rating Scale, AQLQ, and SF-36 for measuring quality of life in asthma. *European Respiratory Journal* 2001; **18**:38-44.

Juniper EF, Svensson K, Mork AC, Stahl E. Measuring health-related quality of life in adults during an acute asthma exacerbation. *Chest* 2004; **125**:93-7.

Juniper EF, Svensson K, Mork AC, Stahl E. Measurement properties and interpretation of three shortened versions of the asthma control questionnaire. *Respir.Med.* 2005;**99**:553-8.

Katz PP, Eisner MD, Henke J, Shiboski S, Yelin EH, Blanc PD. The Marks Asthma Quality of Life Questionnaire: further validation and examination of responsiveness to change. *Journal of Clinical Epidemiology* 1999; **52**:667-75.

Katz PP, Yelin EH, Eisner MD, Blanc PD. Perceived control of asthma and quality of life among adults with asthma. *Annals of Allergy, Asthma and Immunology* 2002; **89**:251-8.

Keller SD, Bayliss MS, Ware JEJ, Hsu MA, Damiano AM, Goss TF. Comparison of responses to SF-36 health survey questions with one-week and four-week recall periods. *Health Services Research* 1997; **32**:367-84.

Lee TA, Hollingworth W, Sullivan SD. Comparison of directly elicited preferences to preferences derived from the SF-36 in adults with asthma. *Medical Decision-Making* 2003; **23**:323-34.

Leidy NK, .Coughlin C. Psychometric performance of the Asthma Quality of Life Questionnaire in a US sample. *Quality of Life Research* 1998a; **7**:127-34.

Leidy NK, Chan KS, Coughlin C. Is the Asthma Quality of Life Questionnaire a useful measure for low-income asthmatics? *American Journal of Respiratory and Critical Care Medicine* 1998b; **158**:1082-90.

Magid DJ, Houry D, Ellis J, Lyons E, Rumsfield JS. Health-related quality of life predicts emergency department utilization for patients with asthma. *Annals of Emergency Medicine* 2004; **43**:551-7.

Maille AR, Koning CJM, Zwinderman AH, Willems LNA, Dijkman JH, Kaptein AA. The development of the Quality of Life for Respiratory Illness Questionnaire/QOL-RIQ: a disease-specific quality of life questionnaire for patients with mild to moderate chronic non-specific lung disease. *Respiratory Medicine* 1997; **91**:297-309.

Mancuso CA, Peterson MGE, Charlson ME. Comparing discriminative validity between a disease-specific and a general health scale in patients with moderate asthma. *Journal of Clinical Epidemiology* 2001; **54**:263-74.

Mancuso CA, .Peterson MGE. Different methods to assess quality of life from multiple follow-ups in a longitudinal asthma study. *Journal of Clinical Epidemiology* 2004; **57**:45-54.

Marks GB, Dunn SM, Woolcock AJ. A scale for the measurement of quality of life in adults with asthma. *Journal of Clinical Epidemiology* 1992;**45**:461-72.

Marks GB, Dunn SM, Woolcock AJ. An evaluation of an asthma quality of life questionnaire as a measure of change in adults with asthma. *Journal of Clinical Epidemiology* 1993;**46**:1103-11

McColl E, Steen N, Meadows KA, Hutchinson A, Eccles MP, Hewison J *et al*. Developing outcome measures for ambulatory care: an application to asthma and diabetes. *Social Science and Medicine* 1995; **41**:1339-48.

McColl E, Eccles MP, Rousseau NS, Steen IN, Parkin DW, Grimshaw JM. From the generic to the condition-specific?: Instrument order effects in Quality of Life Assessment. *Med Care.* 2003;**417**:777-90.

Orr LC, Fowler SJ, Lipworth BJ. Relationship between changes in quality of life and measures of lung function and bronchial hyper-responsiveness during high-dose inhaled corticosteroid treatment in uncontrolled asthma. *American Journal of Respiratory Medicine* 2003; **2**:433-8.

Pinnock H, Sheikh A, Juniper EF. Evaluation of an intervention to improve successful completion of the Mini-AQLQ: Comparison of postal and supervised completion. *Primary-Care-Respiratory-Journal* 2004; **13**:36-41.

Player R, Richards JMJ, Kohler CL, Woodby LL, Brooks CM, Bailey WC. Scale for assessing functional impairment in adults with asthma. *Journal of Asthma* 1994; **31**:437-44.

Quirk FH, Jones PW. Patients' perception of distress due to symptoms and effects of asthma on daily living and an investigation of possible influential factors. *Clin Sci* 1990; **79**: 17-21.

Quirk FH, Baveystock CM, Wilson RC, Jones PW. Influence of demographic and disease related factors on the degree of distress associated with symptoms and restrictions on daily living due to asthma in six countries. *Eur Respir J* 1991; **4**: 167-71.

Quirk FH, .Jones PW. Back to basics: how many items can adequately represent health-related quality of life in airways disease? *European Respiratory Review* 1997; **7**:50-2.

Ried LD, Nau DP, Grainger-Rousseau TJ: Evaluation of patient's Health-Related Quality of Life using a modified and shortened version of the Living With Asthma Questionnaire (ms-LWAQ) and the medical outcomes study, Short-Form 36 (SF-36). *Quality of Life Research* 1999;**8[6**]:491-9.

Rowe BH, .Oxman AD. Performance of an asthma quality of life questionnaire in an outpatient setting. *American Review of Respiratory Disease* 1993; **148**:675-81.

SIGN British Guideline on the management of Asthma 2005: Scottish Intercollegiate Guideline Network

Viramontes JL, .O'Brien BJ. Relationship between symptoms and health-related quality of life in chronic lung disease. *Journal of General Internal Medicine* 1994; **9**:46-8.

Vollmer M, Markson L E, O'Conner E, Sanocki L L, Fitterman L, Berger M, and Buist S. Association of Asthma Control with Health Care Utilization and Quality of Life 1999. *Am. J. Respir. Crit. Care Med*. 160, **5**,:1647-1652

Ware JEJ, Kemp JP, Buchner DA, Singer AE, Nolop KB, Goss TF. The responsiveness of disease-specific and generic health measures to changes in the severity of asthma among adults. *Quality of Life Research* 1998; **7**:235-44.

Winder JA, Nash K, Brunn JW. Validation of a life quality (LQ) test for asthma. *Annals of Allergy, Asthma and Immunology* 2000; **85**:467-72.

Wyrwich KW, Tierney WM, Wolinsky FD. Using the standard error of measurement to identify important changes on the Asthma Quality of Life Questionnaire. *Quality of Life Research* 2002; **11**:1-7.

Wyrwich KW, Nelson HS, Tierney WM, Babu AN, Kroenke K, Wolinsky FD. Clinically important differences in health-related quality of life for patients with asthma: an expert consensus panel report. *Annals of Allergy, Asthma and Immunology* 2003; **91**:148-53.