

Predictors of Health-Related Quality of Life Affecting Asthmatic Children and Their Caregivers in Usmanu Danfodiyo University Teaching Hospital (Uduth), Sokoto, Nigeria.

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Background: Asthma is the most common chronic respiratory disease among children which impairs various bio-psychosocial domains of health. Hence, a wholistic approach in management should be key; consisting of the convectional clinical indices assessment as well as improvement in the quality of life (QoL) through assessment of predictors that influences health-related quality of life (HRQOL) among the asthmatic children and their caregivers.

Aim: To determine the predictors of HRQoL affecting asthmatic children and their caregivers.

Materials and methods: This was a cross-sectional, hospital- based study conducted among 80 asthmatic children (aged 7-15 years) and their caregivers during a period of 4 months. The diagnosis was made based on Global Initiative for asthma (GINA) criteria. Biodata, socio-demographic and anthropometrics information were collected using a predesigned questionnaire; standardized paediatric asthma QoL (PAQoLQ) and caregiver QoL (PACQoLQ) questionnaire were used to assess QoL, asthma control and severity was assessed based on GINA classification. Spirometry was done using a portable spirometer. Data was analysed with SPSS version 22.

Results: The mean age of the asthmatic children was 11.4±2.6 years, mothers comprise 95% of the caregivers. Older Age, higher educational level and good caregiver's QoL grade were the positive predictors of HRQoL among asthmatic children. Presence of a caregiver with smoking habit, obesity, and overweight were the negative predictors of HRQoL among asthmatic children. Good lung function tests (higher FEV₁/FVC) and good QoL among the asthmatic children were positive predictors of HRQoL among the caregivers.

Conclusion: Assessment of Predictors of HRQoL in the evaluation of asthmatic children will help in strategizing a management plan for a better asthma care outcome. This is because it is the quality of care that produces wellness, which is assessed by QoL.

Keywords: Predictors, asthma, health, quality of life, children

Background: Health related quality of life refers to overall QoL as determined primarily by a person's health status.¹ It is an individual's or a group's perceived physical and mental health over time and their correlates including health risks and conditions, functional status, social support, and socioeconomic status.¹ Asthma is the most common chronic respiratory disease among children which impairs various bio-psychosocial domains of health leading to a reduction in QoL, as its symptoms result to reduction in physical, social and psychological health domains.^{2,3} However, asthma does not only have an impact on patients but also affects the QoL of people living with them. In childhood asthma, the family particularly the primary caregiver faces a considerable health burden.^{4,5} Health-related quality of life (HRQoL) in many subjects can be affected by socio-clinical factors such as age, gender, educational level, socioeconomic status, body mass index, asthma control and severity.^{4, 6,7} Hence, assessment of factors affecting HRQoL in asthmatic children and their caregivers is important because it helps to identify impaired items or domains which are vital to the daily lives so that strategic plans to improve quality of life can be recommended.^{8,9} Predictors of HRQoL also have a role in describing health outcomes, the burden of disease, guiding and assessing management and predicting health outcomes.⁹ Thus, assessment of predictors of HRQoL is an imperative goal of therapeutic intervention in asthma.^{4,5}

Objective: To determine the predictors of HRQoL affecting asthmatic children and their caregivers.

Study site

The study was conducted in Paediatric Pulmonology and Allergy clinic, UDUTH, Sokoto which holds weekly on Fridays with patients' attendance of about 12-15 patients per week. It is the major tertiary facility in the state which provides care to children and serves as a referral centre for hospitals within Sokoto and neighboring states including Kebbi, Zamfara, Niger, Katsina states as well as the neighboring countries of Niger Republic and Benin.

STUDY DESIGN

The study was cross - sectional over a period of 4 months (December 2019 - April 2020).

STUDY POPULATION

The study population comprised of children aged 7 years (lower cut- off age for administering the PAQLQ as provided by the producer of PAQLQ) to 15 years (age of paediatric age limit for the department of Paediatrics, UDUTH, Sokoto) attending the Paediatric Pulmonology and Allergy clinic of UDUTH Sokoto within the study period who had a diagnosis of childhood asthma according GINA diagnosis¹⁰ and met the inclusion criteria.

Inclusion criteria

- 1) Aged between 7 and 15 years who understands English language.
- 2) Children whose parents or legal guardians give signed, written informed consent or children > 7 years that assent to the study.¹¹

Exclusion Criteria

- 1) Presence of other chronic illness affecting major organ systems such as cardiac, haematological, renal, etc.-this

served to limit chronic co-morbidities like chronic kidney disease, dilated cardiomyopathy as tools are designed to measure HRQoL in patients that suffer from asthma.

- 2) Inability to understand and respond to the questions when not deaf and dumb.

SAMPLE SIZE DETERMINATION

The sample size was calculated using the formula as follows: -

$$n = \frac{z^2 pq}{d^2} \quad ^{11}$$

Where

n = minimum sample size.

z = standard normal deviate corresponding to a 95% confidence interval obtained from a Normal distribution table = 1.96.

p = prevalence of asthma (6%).¹²

q = complementary probability to p i.e. (1-p) = (1-0.06) = 0.94

d = desired precision = 0.05 or 5%.

$$n = \frac{(1.96)^2 \times (0.06) \times (0.94)}{(0.05)^2}$$

$$n = \frac{3.84 \times 0.06 \times 0.94}{0.0025}$$

$$n = 87$$

Average population of asthmatic children seen in Pulmonology clinic weekly was 14 children.

For sample size adjustment for a finite population less than 10,000:

$$nf = \frac{n}{1 + \frac{n}{N}} \quad ^{12}$$

Where:

nf = adjusted sample size when study population was less than 10,000

n = sample size: 87

N = estimate of the finite population = (14 asthmatic patients' X 52 weeks = 728 patients yearly)

N = Children aged 7-15 years makes up the $\frac{3}{4}$ of the average population seen in the pulmonology clinic = 546

$$nf = \frac{87}{1 + \frac{87}{546}} = 75$$

In order to account for attrition, 10% contingency was added to the minimum sample size and rounded up to 80 children.

Sampling technique

Patients with childhood asthma diagnosed based on GINA guideline¹⁰ and their caregivers were recruited by systematic random method of sampling technique. To achieve that, sample interval was generated as follows:

Sample interval was calculated as = $\frac{\text{Sample size}}{\text{Sample frame}}$

Sample frame

Sample size n = 80, Average target population = 14 asthmatics children per clinic weekly

Sample frame = average target population per clinic x duration of time for data collection (4 month) = 14 x 4 weeks in a month = 56/month = 56 x 4 months = 224 participants

Therefore, sample interval = $\frac{224}{80} = 2.8 \sim 3$

Asthmatic children were enrolled at every 3rd subject as seen in the clinic.

Using balloting technique, the first study subject was randomly chosen between one and the value of the sampling interval which was three and the subsequent study subjects enrolled by adding the value of the sampling interval of 3 to the serial number of the previously enrolled study subject till the required sample units were enrolled. Since the duration of the study

was 16 weeks (4 months), $80/16 = 5$. Therefore, 5 patients were enrolled per each clinic day for the duration of 4 months and 1 week.

Biodata (child's age, gender, domicile e.t.c.), history, examination, anthropometric measurements (weight measured using seca digital weighing machine to the nearest 0.1kg, height measured using seca stadiometer to the nearest 0.1cm, body mass index BMI = $\text{weight(kg)}/\text{height(m}^2\text{)}$) were recorded in a study questionnaire, and BMI percentile calculated and plotted on the growth chart accordingly)¹⁴ as follows:

- Underweight BMI percentile < 5th percentile
- Normal weight BMI percentile >5th - <85th percentile
- Overweight BMI percentile >85th - <95th percentile
- Obese BMI percentile >95th percentile

Asthma control and severity was assessed and classified accordingly using GINA classification.¹⁰

I. Asthma Control assessment was administered and response given as follows: In the past 4 weeks, has the patient had:

- a. Daytime asthma symptoms more than twice/week? Yes () No ()
- b. Any night waking due to asthma? Yes () No ()
- c. Reliever needed for symptoms more than twice/week Yes () No ()
- d. Any activity limitation due to asthma? Yes () No ()

Based on above symptoms, asthma controlled was classified and categorised as either:

- i. Well controlled asthma
- None of these symptoms

- ii. Partly controlled asthma 1 – 2 of these symptoms
- iii. Poorly controlled asthma 3 – 4 of these symptoms

II. GINA Asthma severity assessment was administered and categorized as either:

- i. Mild Asthma: Well controlled with as – needed reliever medication alone or with low- intensity controller medication treatment such as low-dose inhaled corticosteroids (ICSs), leukotriene receptor antagonists
- ii. Moderate asthma: Well controlled with low dose ICS/long acting beta2-agonists (LABA)
- iii. Severe asthma: Requires high-dose ICS/LABA to prevent it from becoming uncontrolled, or asthma that remains uncontrolled despite this treatment.

III. Socio – economic class was also classified based on Oyedele social class scheme:¹⁵

Social class 1	High
Social class 2 and 3	Middle
Social class 4 and 5	Low

IV. Detailed spirometry was performed by the researcher to assess their lung function test (LFT) according to American Thoracic Society guideline using BTL- 08 Spiro Pro portable spirometer under aseptic procedure.¹⁶ The spirometer was calibrated daily and procedure done under ambient temperature, pressure and humidity. The procedure was explained and demonstrated to all the subjects. An incentive spirometer was used to encourage the participants while

the subjects' seated on a chair and instructions were given. The subjects were allowed 2-3 practice trial blow and three test blows for 4-6 seconds and the personal best (forced expiratory volume in one second FEV₁, forced volume capacity FVC, FEV₁/ FVC, peak expiratory flow rate PEFr) were recorded.

- V. The English version of the interviewer administered pediatric asthma quality of life questionnaire (PAQLQ) was used. It measures the functional (physical, emotional, occupational, and social) problems that are most troublesome to child. PAQLQ has 23 questions in three domains (symptoms, activity limitation, and emotional function). The PAQLQ has a time specification of 1 week. The patient response to each question on a seven-point scale (7 = no impairment to 1 = severe impairment) was recorded.

7	No impairment	Good QoL
5 - 6.99	Mild impairment	Good QoL
3- 4.99	Moderate impairment	Poor QoL
1-2.99	Severe impairment	Poor QoL

The overall PAQLQ score was the mean of the responses to each of the 23 questions. The resultant overall and each domain result was scored accordingly, each indicating grades of QOL. The English version of the pediatric asthma caregiver's quality of life questionnaire (PACQLQ) was used to measure QOL of caregivers. It consists of 13 items (4 assess the activity limitations and 9 assess emotional functions). Responses to each item of the PACQLQ are given on a 7-point scale, ranging from 1 to 7, with the higher scores indicating less impairment. The result was

expressed as a mean score per item for each of the domains, as well as for the overall QOL.

Data were analyzed using Statistical Package for social sciences version 22.0 (Chicago Illinois). Data was found to be normally distributed after being tested for normality distribution using Shapiro- Wilk test.

Mean and standard deviation were used for quantitative variables, differences between continuous data were analyzed using the t-test, and the Chi-square test was used to assess categorical variables.

Multiple regression model was done to determine for independent variables (age group, gender, duration of illness, type of settlement, caregiver's smoking habit, BMI, socio- economic class, asthma severity, asthma control) of HRQOL. β coefficient score was used to determine the strongest predictor factors for QoL. A p value ≤ 0.05 was considered significant.

The study was approved by the Research Ethics committee of UDUTH (UDUTH/HREC/2020/995/V1). All patients' parents/caregivers were required to sign a written informed consent form; parents/caregivers who cannot sign had thumb print on the consent form. Assent was obtained from children aged 7 years and above.

Results

Socio- demographic characteristics of the study population

A total of eighty (80) asthmatic children aged 7 years to 15 years and their caregivers were enrolled for the study.

Nearly half (48.8%) of the subjects were adolescents, with males comprising more than half (57.5%) of the asthmatic children, Male: female = 1:1.35. Majority (95%) of the caregivers enrolled were the subjects' mothers. Mean age of study children and caregivers was 11.4 ± 2.6 years and 33.2 ± 5.9 years respectively. A large proportion (93.8%) of the subjects came from urban area while sixty-five (81.3%) of the asthmatic children had family history of asthma. Average duration of illness was 41.40 ± 31.76 months.

Majority (91.2%) of the subjects had no family history of parental smoking habit and almost half (46.2%) of the subjects belong to low socio - economic status as shown in Table I.

Table Ia. Socio- clinical characteristics of the asthmatic children

Variables	N (80)	Percentage (%)
Age (years)		
7 - < 10	41	51.2
10 - 15	39	48.8
Gender		
Male	46	57.5
Female	34	42.5
Domicile		
Urban	75	93.8
Rural	5	6.2
Family history of asthma		
Yes	65	81.2
No	15	18.8
Child's educational level		
Primary	55	68.8
Secondary	25	31.2
On Asthma medications		
Yes	73	91.3
No	7	8.7

Table 1b. Socio- demographic characteristics of the caregivers

Variables	N(80)	Percentage (%)
Age		
<30 years	19	23.7
30 - 39 years	55	68.8
>40 years	6	7.5
Gender		
Male	4	5.0
Female	76	95.0
Socio-economic status		
Lower	37	46.2
Middle	36	45.0
Higher	7	8.8
Parental smoking habit		
Yes	7	8.8
No	73	91.2

Anthropometric measurement of the asthmatic children

Mean ($\pm$ SD) weight of the subject was 27.91 ($\pm$ 10.56) and more than half (56.2%) of the subjects had normal BMI percentile as depicted below in Table II:

Table II: Anthropometric measurement of the asthmatic children

Variable	Frequency	Percentage
BMI percentile		
Underweight	30	37.5
Normal	45	56.2
Overweight	1	1.3
Obesity	4	5.0
Weight (kg)	27.91	
Mean ($\pm$SD)	($\pm$10.56)	
Height (cm)	133.10	
Mean ($\pm$SD)	($\pm$17.26)	

BMI = body mass index, SD = Standard deviation

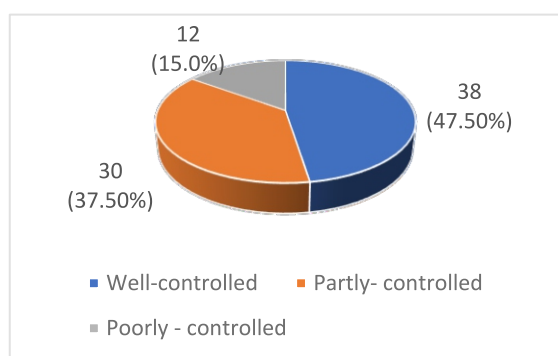


Figure1. Proportion of Asthmatic children level of asthma control

Nearly half (47.5%) of the asthmatic children had well-controlled asthma while less than one-fifth (15.0%) of them had poorly controlled asthma.

Factors that influenced (predictors of) PAQL scores

Age ($\beta=0.128$, $p=0.021$), child's educational level ($\beta=0.268$, $p=0.048$), and PACQL score ($\beta=0.730$, $p=0.001$) had a positive significant influence (predictors) on PAQL score. as shown in Table III below.

Table III: Multilinear regression model of factors that influenced (predictors of) PAQL scores

Variables	B	T	P
Age	0.128	2.047	0.021
Gender	0.286	2.087	0.644
Domicile	0.112	1.117	0.268
child's educational level	0.268	2.048	0.048
Family history of asthma	-0.060	0.600	0.550
Duration of Illness	-0.082	-0.788	0.433
Social class	-0.116	-1.163	0.249
Asthma control	0.303	-1.955	0.571
Asthma severity	0.161	1.214	0.264
PACQL grade	0.730	5.112	0.001

Factors that influenced (predictors of) PACQL scores

BMI percentile ($\beta= -0.258$, $p= 0.021$) and caregiver smoking habit ($\beta= -0.293$,

$P=0.008$) negatively influenced PACQL scores while PAQL grade ($\beta=0.507$, $P=0.001$) and FEV₁/FVC ($\beta=0.279$, $p=0.003$) positively influenced PACQL score as depicted in Table IV below:

Table IV: Multilinear regression model of factors that influenced (predictors of) PACQL scores

Variables	B	t	P
BMI Percentile	-0.258	-2.359	0.021
PAQL grade	0.507	5.112	0.001
Caregiver smoking habit	-0.290	2.757	0.008
FEV ₁ /FVC	0.279	3.117	0.003

Discussion

Socio-demographic factors such as age, and child's educational level were found to be predictors of HRQoL among asthmatic children in this study. Also, caregiver's QoL was found to influence the QoL of their asthmatic children.

The older the patient, the better the QoL among asthmatic children. This is because adolescents are able to handle the burden of the disease better than younger children due to their cognitive and emotional development variations in grasping the content measured.¹⁷ Older children may have better understanding and meaning of chronic disease in the context of asthma and their symptoms, avoid trigger factors and opt for treatment when needed. This is in consonance with other studies.^{18, 19} However, El- Gendi *et al*⁶ reported that older subjects had lower QoL scores while younger ones had better QoL scores. The disparity found could be due to the high number (95%) of younger subjects (preparatory school age less than 5 and primary pupils) that were enrolled in their study, with only 5% being secondary school subjects as compared to 68.8% of

subjects being primary school pupils (age ≥ 7 years) and 31.3% being secondary school students in this study. Therefore, there is tendency for the QoL scores among their subjects to be in favour of the majority of the age group (young age) enrolled due to the lack of adequate heterogeneity and poor representation in their study.

The level of subjects' education in this study influenced HRQoL among asthmatic children. The QoL scores were better among secondary school subjects than those in the primary school. Subjects with higher educational level had good QoL. Thus, subjects with higher educational grade have more knowledge and capability of understanding asthma as a chronic disease; and are more likely to be aware and avoid the trigger factors that could worsen their asthma condition.²⁰

Caregiver's QoL (PACQL) grade was shown to have influenced HRQoL positively among asthmatic children in this study. Good QoL among asthmatic caregivers translates to good QoL amongst asthmatic children.²⁰ This is because parent proxy measured on PACQLQ provide, at best, an informed idea of how a parent expects their child to feel in many contexts (including emotionally and physically) and hence serves as a guide to opt for medical intervention for the child. The more impaired QoL in parent as a result of their child's asthma, the more it affects all aspects of family life and increase a total cost of asthma management.²¹ More so, parent's perception of their children's HRQoL is one of the determinants of the utilization of healthcare services.²²⁻²³ Hence, measuring QoL in parents could be

a useful tool in monitoring asthma in children.²¹

Caregiver smoking habit and child's BMI percentile were found to be among the factors that influenced HRQoL among caregivers. Additional factors like child's QoL grade, FEV₁/FVC were found to influenced caregiver's QoL. Caregiver smoking habit influenced HRQoL negatively in this study. This indicates that second hand smoking in the homes of children with asthma predicts significantly worse asthma-related QoL among caretakers, independent of the child's symptom severity.²⁴ This suggests the negative influence of smoke exposure on asthmatic patient as a trigger factor which directly impairs the caretakers' health, thus making them less able to cope with child's symptoms, heightening their difficulties in providing home care to the asthmatic children.²⁴ Furthermore, the presence of smokers in asthmatic home may be a marker for other stressors or reflect a lack of support in a family, which impacts negatively on the caretaker's QoL.²⁴⁻²⁵ Halterman *et al*²⁴ had made similar observation as this study, whereas El- Gewely *et al*²⁶ found no significant association between parental smoking habit and HRQoL.

Obese and overweight asthmatic children had severe impairment in HRQoL compare to subjects with normal BMI percentile. High BMI percentile was a negative predictor of HRQoL in this study, which is consistent with an earlier study by Blandon *et al*²⁷. Thus, HRQoL becomes poorer in overweight and obese asthmatic children. This is due to the fact that increased BMI leads to limited surface area in the lungs, and this is associated with

easy collapsibility of the airway.²⁷ This further leads to increased workload and ventilation, which culminate to create exacerbation of asthma with antecedent poor QoL. Abdel – Hady *et al*²⁸ reported a contrary finding that BMI had no influence on HRQoL.

Results from this study showed that lung function test (FEV₁/FVC) influenced caregiver's HRQoL. The higher the value of FEV₁/FVC among the asthmatic children, the better the QoL among their caregivers. Previous observations by studies²⁹⁻³⁰ were in consonant with this study but differ from report by Ricci *et al*³¹ which showed that QoL does not affect lung function test (LFT). This may be because neither the PACQLQ nor PAQLQ seems to be unable to discriminate HRQoL among asthmatic children with good LFT.³¹ Moreover; single clinical measurement of LFT may not be enough to make an objective conclusion of the LF.³²

Child's QoL grade influenced caregiver's QoL in this study, hence, the higher the PAQLQ scores the better the QoL of the caregiver. The asthmatic children's QoL is positively related to caregiver's QoL.^{21,33} Thus, the relationship between parent's QoL and asthmatic children's QoL could be bidirectional.²⁰ This is because of the transactional nature of the parent – child

relationship, in that both family members influence each other over time which is seen in chronic health conditions like asthma. Moreover, asthmatic children depend more on their parents than healthy children especially on matters related to health care and symptom monitoring.²⁰ Additional worries by the asthmatic children's caregivers about impact of the disease on their children's lives compared to parents of healthy children could contribute to this finding.²⁰

Conclusion and recommendation: Socio-clinical factors such as age, child's educational level, BMI, caregiver's smoking habit, PAQL, FEV₁/FVC among asthmatic children and their caregivers can affect their QoL, hence assessment of predictors of HRQOL should be included as part of the wholistic evaluation of asthmatic patients. This will help in strategizing management plan among asthmatic children for a better asthma care outcome. This is because it is the quality of care that produces wellness, which is assessed by QoL.

Limitation of the study

Recall bias of symptoms by both asthmatic children and their caregivers is a limitation to the study (1 week recall for PAQLQ and PACQLQ).

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