East African Medical Journal Vol. 95 No. 8 August 2018
ASTHMA CONTROL AND FACTORS ASSOCIATED WITH CONTROL AMONG CHILDREN ATTENDING CLINICS AT A NATIONAL REFERRAL HOSPITAL IN WESTERN KENYA
Justus Maingi Simba MBChB, MMed (Paeds), Department of Child Health and Paediatrics, School of Medicine, Jomo Kenyatta University of Agriculture and Technology. P.O Box 8064-01000 Thika. Irene Marete, MBChB, MMed (Paeds), MPH, PhD, Department of Child Health and Paediatrics, School of Medicine, Moi University. P.O. Box 1998 -30100 Eldoret, Kenya. Rebecca Waihenya, BSc, MSc, PhD, Department of Zoology, School of Biological Sciences, Jomo Kenyatta University of Agriculture and Technology. P.O Box 6200-00200 Nairobi. Yeri Kombe, Kenya Medical Research Institute, Nairobi. P.O Box 20778-00202 Nairobi. Ann Mwangi, BSc, MSc, PhD, Department of Behavioural Sciences, School of Medicine, Moi University. P.O Box 4606-30100 Eldoret. Rosemary Kawira Kithuci, BSc, MSc, School of Nursing, Jomo Kenyatta University of Agriculture and Technology. P.O Box 8064-01000 Thika. Patrick Mburugu MBChB, MMed (Paeds), Department of Child Health and Paediatrics, School of Medicine, Jomo Kenyatta University of Agriculture and Technology. P.O Box 6200-00200 Nairobi. Francis Ogaro, MBChB, MMed (Paeds), Fell (Pulm), Moi Teaching and Referral Hospital, Eldoret. P.O Box 3093-30100. Eldoret.

Corresponding author: Justus Maingi Simba, P.O Box 8064-01000 Thika. Email: maingij@gmail.com

ASTHMA CONTROL AND FACTORS ASSOCIATED WITH CONTROL AMONG CHILDREN ATTENDING CLINICS AT A NATIONAL REFERRAL HOSPITAL IN WESTERN KENYA

J. M. Simba, I. Marete, R. Waihenya, Y. Kombe, A. Mwangi, R. K. Kithuci, P. Mburugu, and F. Ogaro

ABSTRACT

Background: **Asthma control is the extent to which the various manifestations of asthma have been reduced or removed by treatment. In developing countries including Kenya, many children continue to visit hospitals with acute symptoms of asthma, which is a pointer to poor control.**
Objectives: **To determine the level of asthma control and factors associated with the observed control among children at a national referral hospital.**
Design: **Cross-sectional study**
Setting: **Moi Teaching and Referral Hospital, Eldoret, Kenya paediatric clinics.**
Subjects: **A total of 166 asthmatic children aged 6-11 years and their parents/caretakers were enrolled between August 2016 and October 2017.**
Main Outcome: **Level of control using childhood asthma control test (c-ACT)**
Results: **The median age of enrolled children was 8.17 years with males being the majority, 94 (56.6%). Using c-ACT, 92 (55.4%, 95%CI: 47.52, 63.10) had well controlled asthma at baseline. At univariate analysis, having a medical insurance cover (p=0.034), dry season (p=0.036), and parental perception of asthma control (p=0.002) were significantly associated with good control of asthma. Acceptance that a child had asthma was associated with poor control of asthma, p=0.046. On multivariate logistic regression, a perception of a well-controlled child by the parent/caretaker correlated well with good control of asthma.**

Conclusion: **About half of the children in this set up have good control of asthma with the observed status of control being affected by parental/caretaker perception on asthma.**

INTRODUCTION

Asthma control is defined as the extent to which the various manifestations of asthma have been reduced or removed by treatment (1). Further, asthma control is the degree to which therapy goals are met (2). In developing countries including Kenya, many children continue to visit hospitals with acute symptoms of asthma, which is a pointer to poor control. In a recent study in Nairobi and its environs, good control was reported as 42% among asthmatic children aged 1-14year (3).While controversies exist on how best to define asthma control, we utilized childhood asthma control test (c-ACT) which has been widely used and validated in the world (4,5) .

Anecdotal evidence shows that on average 3-4 children are nebulized with bronchodilators every day at Moi Teaching and Referral Hospital (MTRH), Eldoret, Kenya. This study therefore sought to establish the state of asthma control at such a national referral hospital as well as factors associated with the observed control.

MATERIALS AND METHODS

We carried a cross-sectional study among children attending Children's clinics of the Moi Teaching and Referral Hospital (MTRH) in western Kenya between August 2016 and October 2017. Other details of the study site and the study population have been described in a related publication (6).

We screened 6-11-year-old children for asthma using the International Study on Asthma and Allergies in Childhood (ISAAC) screening questionnaire. We excluded very sick children as well as those with other chronic comorbidities such as chronic heart failure. These children were subsequently enrolled to a randomized control trial registration PACTR201702002061736. We estimated the sample size based on the following assumptions:- desired confidence interval at 95%, estimation of asthmatic children with 'good control' at 42% (3),desired level of statistical significance at 5% as well as adjusting for diminishing numbers of asthmatics in subsequent months of recruitment. We analysed the data for the total of 166 study participants recruited.

A questionnaire was used to collect data from children identified as asthmatics from the screening. It collected data on background variables including spirometer values, level of asthma control using a childhood asthma control test as well as factors likely to affect asthma control. The c-ACT is a questionnaire which has been validated for 4-11year olds and used in several countries (4,5) and is part of national guidelines in Kenya (7), it has 7 questions and is answered both by the child and the caretaker/parent. We also assessed for parental knowledge and beliefs concerning asthma treatment, details of which have been published (6). We used a cut off of above 20 as good control having adjusted for possible negative impact of the perceptions on asthma in this community.

We analysed data using STATA version 13, generated descriptive statistics and used Chi-square test to check for associations among categorical variables. Multivariate logistic regression was used to check for factors associated with control at baseline adjusting for confounders. All analysis has been done at 95% level of significance. Ethical clearance to carry out this research was granted by the Moi Teaching and

Referral Hospital/Moi University College of Health Sciences Ethics and Review Committee. Informed written consent was granted by caretakers/parents involved.

RESULTS

We enrolled a total of 166 children together with their caretakers/parents. The median age of the enrolled children was 8.17 years (Interquartile range =7.00-10.00) with the males being the majority, 94 (56.6%). Using the c-ACT, 92 (55.42% 95% CI: 47.52, 63.10) had well controlled asthma.

Factors associated with asthma control:

Social demographics characteristics: Upon testing for associations among the various socio-demographic variables which included residence, level of education and medical insurance cover, only medical insurance cover was associated with good control with a p value of 0.034. This is shown in table 1.

Table 1
Socio-demographic variables

Variable	No control	Control	p-value
Gender of child			
Male	42 (44.7)	52 (55.3)	0.976
Female	32 (44.4)	40 (55.6)	
Caretaker's Relationship to child			
Mother	53 (45.3)	64 (54.7)	0.956
Father	13 (43.3)	17 (56.7)	
Other	8 (42.1)	11 (57.9)	
Residence			
Urban	55 (44.4)	69 (55.6)	0.921
Rural	19 (45.2)	23 (54.8)	
Occupation of Caretaker			
Formal	25 (39.1)	39 (60.9)	0.524
Self employed	19 (48.7)	20 (51.3)	
Unemployed	30 (47.6)	33 (52.4)	
Medical Insurance Cover			
Yes	45 (39.1)	70 (60.9)	0.034
No	29 (56.9)	22 (43.1)	
Highest Education level of caretaker			
None	4 (66.7)	2 (33.3)	0.37
Primary	9 (56.3)	7 (43.8)	
Secondary	20 (51.3)	19 (48.7)	
Tertiary College	23 (41.1)	33 (58.9)	
University	18 (36.7)	31 (63.3)	

Environmental and Clinical factors: The dry season was significantly associated with good control of asthma with a p value of 0.036. Factors like type of fuel, type of the house as well as living near industries were not significant. This is shown in table 2.

Table 2

Environmental and Clinical variables

Variable	No control	Control	p-value
Season Recruited			
Wet	49 (51.6)	46 (48.4)	0.036
Dry	25 (35.2)	46 (64.8)	
Occupation of Caretaker			
Formal	25 (39.1)	39 (60.9)	0.524
Self employed	19 (48.7)	20 (51.3)	
Unemployed	30 (47.6)	33 (52.4)	
Type of residence house			
Permanent	44 (43.1)	58 (56.9)	0.61
Semi-permanent	22 (44)	28 (56)	
Temporary	8 (57.1)	6 (42.9)	
Have carpets at home			
Yes	35 (40.7)	51 (59.3)	0.297
No	39 (48.8)	41 (51.2)	
Good house aeration*			
Yes	68 (44.2)	86 (55.8)	0.695
No	6 (50)	6 (50)	
Ownership of pet			
Yes, and child plays with pet	21 (53.8)	18 (46.2)	0.411
Yes, and child doesn't play with pet	19 (41.3)	27 (58.7)	
No pet	34 (42.0)	47 58.0	
Fuel for cooking			
Kerosene	10 (41.7)	14 (58.3)	0.852
Firewood	37 (46.8)	42 (53.2)	
Gas	27 (42.9)	36 (57.1)	
Person smoke			
Yes	9 (69.2)	4 (30.8)	0.063
No	65 (42.5)	88 (57.5)	
Industries Near Residence			
Yes	17 (54.8)	14 (45.2)	0.202
No	57 (42.2)	78 (57.8)	
Caretaker aware what makes child wheeze			
Yes	46 (47.4)	51 (52.6)	0.382
No	28 (40.6)	41 (59.4)	
Reliever Drugs at home			
Yes	42 (48.8)	44 (51.2)	0.252
No	32 (40)	48 (60)	
Health provider talked about asthma action plan to caretaker			
Yes	21 (47.7)	23 (52.3)	0.624
No	53 (43.4)	69 (56.6)	
Caretakers perception on child's control level			
Well controlled	27 (36.5)	47 (63.5)	0.002
Partially controlled	36 (45)	44 (55)	
Poorly controlled	11 (91.7)	1 (8.3)	

Acceptance that child has asthma			
Yes	31 (55.4)	25 (44.6)	0.046
No	43 (39.1)	67 (60.9)	
Perceived knowledge on asthma			
Knowledgeable	26 (44.1)	33 (55.9)	0.292
Knows a little	29 (39.7)	44 (60.3)	
Not knowledgeable	19 (55.9)	15 (44.1)	
Asthma knowledge			
Not knowledgeable	16 (30.8)	36 (69.2)	0.016
Knowledgeable	58 (50.9)	56 (49.1)	

**Window size at least 10% of floor*

Multivariate logistic regression showed that only caretaker's perception on child's control level and knowledge on childhood asthma were associated with the observed status of asthma control among the study participants adjusting for the other factors. A perception of a well-controlled child by the parent/caretaker correlated well with good control. This is shown in table 3.

Table 3

Multiple logistic regressions on selected factors associated with control

Variable	**Odds Ratio**	**p-value**	**[95% Conf.**	**Interval]**
Male	1.000			
Female	1.124	0.741	0.562	2.250
Wet Season	1.000			
Dry season	1.468	0.275	0.737	2.926
Health insurance	1.000			
No health Insurance	0.625	0.204	0.302	1.292
Person smoke	1.000			
No person smoke	2.607	0.155	0.696	9.758
Industries	1.000			
No industries	1.833	0.163	0.782	4.301
Caretakers perception on child's control level				
Well controlled	1.000			
Partially controlled	0.621	0.183	0.308	1.252
Poorly controlled	0.054	0.009	0.006	0.476
Not knowledgeable	1.000			
Knowledgeable	0.453	0.039	0.213	0.959

DISCUSSION

Using c-ACT, an estimated 55.4% of children in this study had well controlled asthma. This is higher than the control level of Kigathi et.al, 2012, in Nairobi and its environs where only 42% had control (3). In a South African study, c-ACT had shown that 66.2% of children in their area were controlled (5). In Nigeria, 82.1% of children enrolled in a cross-sectional study in 2015 had optimal asthma control based on the Global Initiative for Asthma (GINA) criteria, this largely a very good control in Africa (8). We note one difference that these children were on follow up in an asthma clinic, while as we described earlier at the time of our data collection chest clinic was being set up at our facility (6, 8). We have paucity of studies evaluating asthma control in our set up, especially in children more so on c-ACT. We however used 20 as a cut off as opposed to 19. While Liu et al has previously argued a cut off of 19 has the best sensitivity, it is generally agreed that there exists overlap in the scores between 19 and 22 (4,9,10). In a study among Mexican youth, communities with negative perceptions on asthma, higher cut-offs were likely to give the true level of control, hence we felt this held for our population based on earlier analysis (6, 11).

In univariate analysis, we found that individuals who had accepted that their children were having asthma had poor control. In a related publication on the same cohort, we have demonstrated that those with good knowledge on asthma were those who had accepted asthma as a diagnosis for their children (6). We postulate that in this population with negative perception towards asthma (6), it is possible that those who had severe disease were likely to have accepted asthma status. On the other hand, Kolbe, J., et.al 1996, showed that there exists difference between asthma self-management knowledge and actual behaviour on asthma management (12). Silva D et.al 2013 did not find any association between parental asthma knowledge and childhood asthma control (13). This could be the reason for what appears to be a reverse association. In this cohort therefore, we conclude that a parent/guardian taking care of a child with severe disease is likely to look up for information about asthma notwithstanding the fact that those with severe disease are likely to have poorly controlled asthma. Further, consistently with existing literature (14, 15), children who had a medical insurance cover were well controlled. It is likely our study points to that these children were likely to be brought to the clinics for regular check-ups. It has been shown that, highest levels of asthma control are found in children with adherence to treatment (16). Although there is association of having medical insurance with good control, some studies including Zahran et.al have not found associations (17). Weather seasonality had a significant association with control. Consistently like in other studies, wet weather was associated with poor control. Only knowledge on asthma and perception on child's asthma level of control were independently associated with the observed asthma control status. In our study we found that perception of child's poor state of control was associated with poor c-ACT score (18).

Although low educational attainment, low income, cigarette smoking (8,17), pet ownership (19), and occupation of the parent (20) have also been shown to affect control in asthmatics, we did not find these factors to be significantly associated with control in our cohort. It worth noting that majority of caretakers/parents for our participants had attained tertiary and university education.

We conclude that nearly half of the children in this set up had well controlled asthma and that the observed status of

asthma control among these children is affected by parental/caretaker perceptions on asthma including perceptions on control and on diagnosis of asthma. Enhancing health education among parents/caretakers of children with asthma should be pursued to enhance control levels.

REFERENCES

1. Reddel, H.K., Taylor, D.R., Bateman, E.D., Boulet, L.P., Boushey, H.A., Busse, W.W., et.al. An official American Thoracic Society/European Respiratory Society statement: asthma control and exacerbations: standardizing endpoints for clinical asthma trials and clinical practice. *Am J Respir Crit Care.* 2009;**180**(1): 59-99.
2. Bousquet, J., Mantzouranis, E., Cruz, A. A., Aït-Khaled, N., Baena-Cagnani, C. E., Bleecker, E. R., et.al. Uniform definition of asthma severity, control, and exacerbations: document presented for the World Health Organization Consultation on Severe Asthma. *J Allergy Clin Immunol.* 2010; **126**(5): 926-938.
3. Kigathi, B. Factors affecting levels of Asthma control in patients presenting to Kenyatta National, Thika and Mbagathi Districts Hospital. *[Master's Thesis]. [Nairobi]: University of Nairobi, Kenya.* 2012.
4. Liu, A. H., Zeiger, R., Sorkness, C., Mahr, T., Ostrom, N., Burgess, S., et.al. Development and cross-sectional validation of the Childhood Asthma Control Test. *J Allergy Clin Immunol.* 2007; **119**(4): 817-825.
5. Green, R. J., Klein, M., Becker, P., Halkas, A., Lewis, H., Kitchin, O., et.al. Disagreement among common measures of asthma control in children. *Chest. 2013;* ***143***(1): 117-122.
6. Simba, J., Marete, I., Waihenya, R., Kombe, Y., Mwangi, A., Mburugu, P., et.al. Knowledge and perceptions on childhood asthma among care-takers of children with asthma at a National Referral Hospital in Western Kenya: a descriptive study. *Afr Health Sci.* 2018; ***18***(4): 965-971.
7. Division of Leprosy, Tuberculosis, and Lung Disease. Guidelines for Asthma Management in Kenya. *Ministry of Public Health and Sanitation*. 2011
8. Kuti, B. P., Omole, K. O., & Kuti, D. K. Factors associated with childhood asthma control in a resource-poor center. *J Family Med Prim Care.* 2017; **6**(2): 222-230.
9. Koolen, B., Pijnenburg, M., Brackel, H., Landstra, A., van den Berg, N., Merkus, P., et.al. Comparing global initiative for asthma (GINA) criteria with the childhood asthma control test (C-ACT) and asthma control test (ACT). *Eur. Respir. J.* 2011; **38**(3): 561-566.
10. Voorend-van Bergen, S., Vaessen-Verberne, A., de Jongste, J., & Pijnenburg, M. Asthma control questionnaires in the management of asthma in children: a review. *Pediatr Pulmonol. 2015;* **50**(2): 202-208.
11. Shi, Y., Tatavoosian, A. V., Aledia, A. S., George, S. C., & Galant, S. P. Cut points for Asthma Control Tests in Mexican children in Orange County, California. *Ann Allergy Asthma Immunol.* 2012; **109**(2): 108-113.
12. Kolbe, J., Vamos, M., Fergusson, W., Elkind, G., & Garrett, J. Differential influences on asthma self-management knowledge and self-management behavior in acute severe asthma. *Chest*. 1996; **110**(6): 1463-1468.
13. Silva, C. M., & Barros, L. Asthma knowledge, subjective assessment of severity and symptom perception in parents of children with asthma. *J Asthma*. 2013; **50**(9): 1002-1009.
14. Ferreira-Magalhães, M., Pereira, A. M., Sa-Sousa, A., Morais-Almeida, M., Azevedo, I., Azevedo, L. F., et.al. Asthma control in children is associated with nasal symptoms, obesity, and health insurance: a nationwide survey. *Pediatr Allergy Immunol*. 2015; **26**(5): 466-473.
15. Ghanname, I., Chaker, A., Hassani, A. C., Herrak, L., Ebongue, S. A., Laine, M., et.al. Factors associated with asthma control: MOSAR study (Multicenter Observational Study of Asthma in Rabat-Morocco). *BMC Pulm Med*. 2018; **18**(1): 61.
16. Klok, T., Kaptein, A. A., Duiverman, E. J., & Brand, P. L. It's the adherence, stupid (that determines asthma control in preschool children)! *Eur Respir J.* 2014; **43**(3): 783-791.
17. Zahran, H. S., Bailey, C. M., Qin, X., & Moorman, J. E. Assessing asthma control

and associated risk factors among persons with current asthma–findings from the child and adult Asthma Call-back Survey. *J Asthma.* 2015; **52**(3): 318-326.

18. Sastre, J., Fabbri, L. M., Price, D., Wahn, H. U., Bousquet, J., Fish, J. E., et.al. Insights, attitudes, and perceptions about asthma and its treatment: a multinational survey of patients from Europe and Canada. *World Allergy Organ J.* 2016; **9**(1): 13.
19. Sasaki, M., Yoshida, K., Adachi, Y., Furukawa, M., Itazawa, T., Odajima, H., et.al. Factors associated with asthma control in children: findings from a national Web-based survey. *Pediatr Allergy Immunol.* 2014; **25**(8): 804-809.
20. WHO. (2008). World Health Organization. Asthma fact sheet No. 307. Updated August 2017. *Available from: http://www.who.int/topics/asthma/es*.