

Thematic frames underpinning asthma and chronic obstructive pulmonary disease research in Kenya

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Introduction

The Global Initiative for Asthma (GINA) defines asthma as a heterogeneous disease characterised by chronic inflammation and defined by a history of respiratory symptoms such as wheeze, shortness of breath, chest tightness, and cough that vary over time and intensity, together with variable expiratory airflow limitation.¹ Asthma is a common non-communicable disease (NCD) affecting an estimated 300 million people worldwide.² Asthma is responsible for about 15 million disability-adjusted life years (DALYs) or 1% of the total global burden of disease. Uncontrolled asthma is responsible for substantial social and economic losses.³ The prevalence of asthma is variable but it is generally accepted that it is increasing.^{4,5} An estimated 10% of the Kenyan population or about four million people have asthma.⁶ In January 2011, Kenya released its first version of guidelines for asthma management to supersede its 2005 consensus statement.⁷ Since then, the country's essential package of medicines has expanded to include inhaled corticosteroids (ICS) which are the backbone of asthma management.⁸ Although asthma control has been brought within reach of patients, owing to the availability of less costly generic drugs, weak health systems present a formidable obstacle to achieving desired goals.

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) defines chronic obstructive pulmonary disease (COPD) as a common preventable and treatable disease characterised by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases and notes that exacerbations and co-morbidities contribute to overall severity in individual patients.⁹ According to the World Health Organization (WHO), COPD was the fifth leading cause of death globally in 2001. By 2020, COPD is projected to be the third leading cause of death worldwide. An ageing population, reduced mortality from ischaemic heart disease and infectious causes, and tobacco smoking are partly responsible for the growing prevalence of the disease.¹⁰ There is marked heterogeneity and variation in the prevalence of COPD globally. The prevalence of COPD among those aged 40 years and above is estimated at

10.0% (95% confidence interval (CI), 8.4–11.8%).^{11,12} In the developed world, COPD is predominantly a male disease but recent data suggest this gap is closing fast and women appear more susceptible to the ill effects of tobacco smoking.¹³ A literature review of the burden of COPD in Africa (2009) did not find any studies from Kenya.¹⁴ A 2009 review showed high prevalence of tobacco smoking among healthcare workers (54%) and undergraduate students (54.7%), and among those aged 13–15 years (13%). Kenya enacted a tobacco control bill in 2004 as part of its obligations under the Framework Convention for Tobacco Control (FCTC). The bill regulates tobacco taxation, advertising, sponsorship, and promotion, and is responsible for restrictions on smoking in public, warnings on cigarette packs, pack content, and age restrictions on sales. However, enforcement of the bill is far from ideal.¹⁵

The fifth objective of the World Health Organization (WHO) 2014–2020 action plan calls for 'support for national capacity for high quality research and development' as a key pillar for the prevention and control of non-communicable diseases.² With reference to asthma in the US, Wright et al call for 'research strategies that embrace the complexity of asthma' through a 'shared conceptual framework' proposing 'trans-disciplinary research' as a means of understanding the biomedical and ecological framing that characterise the 'real world complexity of asthma epidemiology.'¹⁶ An understanding of 'framing effects' is an important step towards improving health outcomes for asthma.¹⁷ For example, in the US the 'pattern of distribution of asthma by race and socio-economic status' may have resulted from inequalities in society.¹⁸

Little is known about the framing of asthma and COPD in the research literature from Kenya. The aim of this review is to explore the coverage of asthma and COPD in the local scientific literature and to identify thematic frames through which the diseases are viewed. Priority areas to guide future research are then proposed.

Methods

Inclusion criteria

1. Published abstracts on asthma and COPD in (and/or on) Kenya identified through an online search of relevant databases.
2. Online abstracts on asthma and COPD in Kenya presented at key scientific conferences; American Thoracic Society (ATS), European Respiratory Society (ERS), and International Union against TB and Lung Diseases (IUATLD).
3. Postgraduate dissertations on asthma and COPD available at two key university libraries.
4. English language articles.

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5. Studies on human subjects.
6. No time limits were applied to the search.

Exclusion criteria

1. Published abstracts for which the original article could not be feasibly retrieved.
2. Policy research.

Search methods

The following databases were searched using variations of

the search string shown in Table 1: Africa-Wide Information (AWI); Embase; Ovid Medline; Global Health; SCOPUS; The Cochrane Library.

Data synthesis

Articles that met the study criteria were classified into key thematic areas: basic science, epidemiology, diagnosis and classification, treatment and control, asthma education and prevention, guidelines, practice, and review. The various themes were generated from the main findings of the articles under

Key word	Asthma	COPD	Kenya
Synonyms	Airway (spasm/hyper-responsiveness/hyper-reactivity/ hyperactivity/obstruction)	Chronic (obstructive pulmonary/lung/airway) disease	Nairobi
	Bronchospasm/bronchospastic	Tobacco/cigarette/biomass (associated or related lung disease)	East Africa
	Bronchial (hyperactivity/spasm/ hyper-responsiveness/hyper-reactivity/obstruction)	Chronic bronchitis	
	Spastic cough	Emphysema	
	Nocturnal cough	Cystic fibrosis	
	Exercise-induced bronchospasm	Bronchiectasis	
	Allergic bronchitis		
	Wheeze		
	Rhonchi		
	Reactive airways disease		
Related terms	Hay fever		
	Allergic rhinitis		
Search terms and strategy	<ol style="list-style-type: none"> 1. Asth* OR Airway spas* OR Airway Hyper* OR Airway React* OR Airway Obst* OR Bronch* spas* OR Bronchial Hyper* OR Bronchial spas* OR Bronchial Obst* OR Spastic cough OR Nocturnal cough OR Night cough OR Exercise ADJ7 Bronchospas* OR Allergic Bronch* OR Wh??z* OR Rhonch* OR Reactive Airway* OR Hay fever OR Rhinitis 2. Asthma/ (Mesh term exploded) 3. CO?D OR Chronic Obstructive Pulmonary* OR Chronic Obstructive Lung* OR Chronic Obstructive Airway* OR Tobacco ADJ 7 lung* OR Tobacco ADJ 10 lung* OR Biomass ADJ 7 lung* OR Biomass ADJ 10 lung* OR Chronic Bronch* OR Emphysema OR Cystic Fibrosis* OR Bronchiect* 4. COPD/ (Mesh, exploded) 5. Kenya* OR East Africa* OR Nairobi 6. 1 OR 2 7. 3 OR 4 8. 6 OR 7 9. 8 AND 5 		

Table 1: Search strings used in the review.

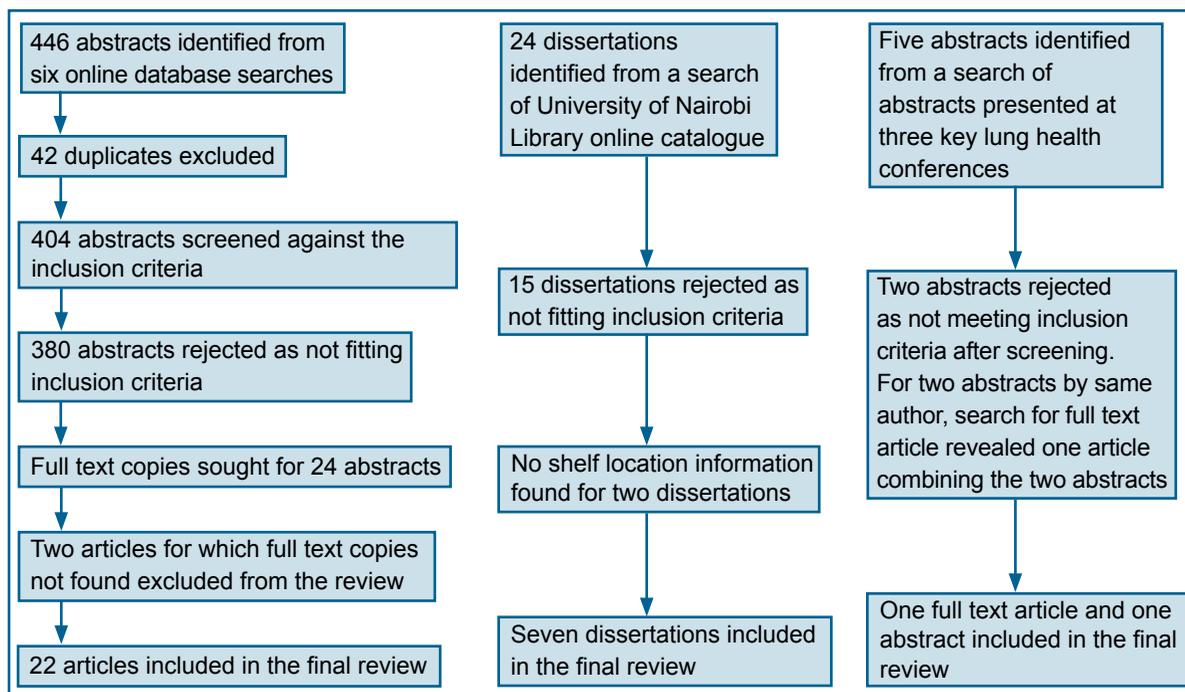


Figure 1: Summary of methods and article selection.

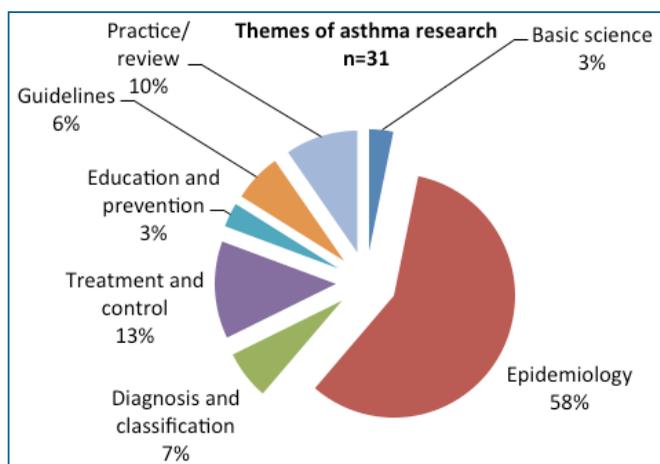


Figure 2: Key thematic areas covered by included papers.

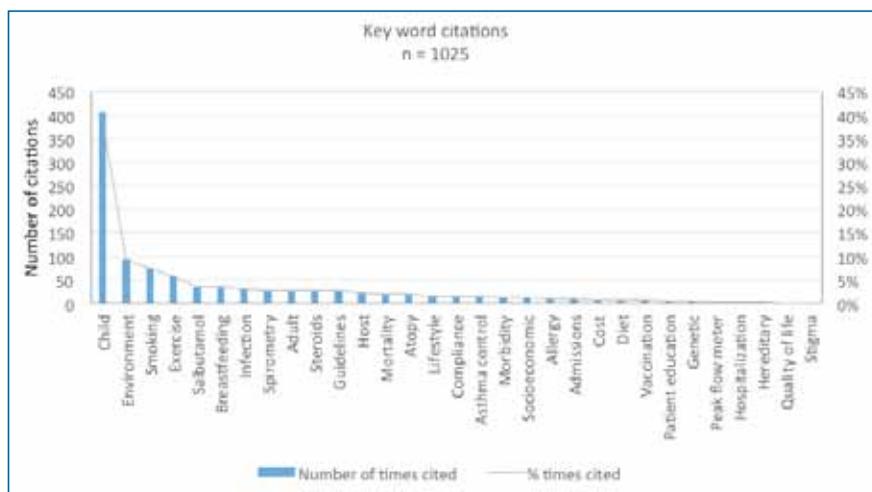


Figure 3 Bar chart of selected key words by number of citations in 25 articles.

review.¹⁹ Counts of selected key words (derived from the GINA report¹) in each article and across the articles were compared and developed into sub-themes. The top ten and bottom ten key words were noted. These refined themes and sub-themes were then presented as the results of the study.

Results

The search for published peer-reviewed articles was carried out on six online databases. A search for postgraduate dissertations was conducted on the electronic library catalogue of the University of Nairobi using variations of the search string. A third search was conducted on electronic and downloaded PDF abstract books from ATS (2011–2015), ERS (2006–2013) and IUATLD (2005–2014) conferences, starting with search for the key words Kenya and Nairobi, then Asthma. Out of a total of 4252 abstracts on asthma and COPD at ATS conferences between 2011 and 2015 identified, three were from Kenya and two included Nairobi as a study site. Out of an estimated 4500 total abstracts presented at the ERS congress annually from 2006 to 2013, none met the inclusion criteria for the study. Likewise no abstracts meeting the inclusion criteria were identified from the IUATLD abstract books. Abstracts listing for the Kenya lung health conference were not available online.

A summary of the articles included in the review is given in Table 2. Full critical appraisals of the articles included are the subject of a separate article yet to be submitted for publication.

Key categories (themes) of research

Article	Authors	Journal	Year
Exercise induced bronchospasm: a pilot survey in Nairobi school children	Odhiambo et al ²⁰	PR	1997
Prevalence of exercise induced bronchospasm in Kenyan school children: an urban-rural comparison	Ng'ang'a et al ²¹	PR	1997
Urban-rural differences in questionnaire-derived markers of asthma in Kenyan school children	Odhiambo et al ²²	PR	1993
Prevalence of asthma, allergic rhinitis and dermatitis in primary school children in Uasin Gishu district, Kenya ISAAC Phase 1 study	Esamai et al ²³	PR	1995
Prevalence of asthma, allergic rhinitis and dermatitis in primary school children in Uasin Gishu district, Kenya ISAAC Phase 3 study	Ayaya et al ²⁴	PR	2001
An effective traditional medicine for bronchial asthma : clinical demonstration and preliminary toxicological evaluation	Aluoch et al ²⁵	PR	1990
Implementation of asthma guidelines in health centres of several developing countries	Ait-Khaled et al ²⁶	PR	2006
Home environment and asthma in Kenyan schoolchildren: a case-control study	Nashila et al ²⁷	PR	1995
Atopy, asthma, and antibodies to Ascaris among rural and urban children in Kenya	Perzanowski et al ²⁸	PR	2002
Some aspects of the etiology of asthma in Nairobi with special reference to parasites and the house dust mite	Rees et al ²⁹	PR	1974
Bronchial asthma in Kenya.	Mitchell et al ³⁰	PR	1970
Asthma as seen at the casualty department, Kenyatta National Hospital, Nairobi	Wasunna ³¹	PR	1968
Efficacy and safety of inhaled Salmeterol (Serevent) as maintenance therapy for asthma in Nairobi	Nganga et al ³²	PR	1994
Allergic conditions in a general practice in Nairobi: a pilot study	De Souza ³³	PR	1992
Allergies and skin testing: a Nairobi experience	De Souza ³⁴	PR	1994
Arterial blood gases and acid-base status of adult patients presenting with acute severe asthma at Kenyatta National Hospital, Nairobi	Odhiambo et al ³⁵	PR	1992
Effects of passive smoking and breastfeeding on childhood bronchial asthma	Limbe et al ³⁶	PR	1999

Prevalence of influenza virus infection in asthmatic children presenting with an acute exacerbation at Kenyatta National Hospital	Hemed ³⁷	DISS	2004
Prevalence of use of controller medication among asthmatic children in Kenyatta National Hospital	Ngeta ³⁸	DISS	2006
Ventilatory function of asthmatic children in stable state seen at Kenyatta National Hospital	Gachare ³⁹	DISS	1986
Acute asthma care in children seen at the Kenyatta National Hospital: a comparison with international standards	Laigong ⁴⁰	DISS	1996
An assessment of knowledge and comprehension of asthma therapy among guardians of asthmatic children at KNH paediatric asthma clinic	Simiyu E ⁴¹	DISS	2009
Prevalence of rhinosinusitis in patients on follow up for asthma at Kenyatta National Hospital chest clinic	Okumu ⁴²	DISS	2009
Selected socio demographic and drug adherence factors associated with uncontrolled asthma at chest clinic, Kenyatta National Hospital.	Andale ⁴³	DISS	2009
Childhood asthma at Kenyatta National Hospital, Nairobi	Macharia et al ⁴⁴	PR	1986-88
The efficacy and safety of a controlled release formulation of salbutamol in the management of patients with asthma in Nairobi, Kenya	Aluoch & Gathua ⁴⁵	PR	1990
Prevalence of symptoms of asthma, rhinitis and eczema in 13- to 14-year-old children in Africa: the International Study of Asthma and Allergies in Childhood Phase III	Khaled et al ⁴⁶	PR	2007
Spirometric evaluation of patients presenting to Moi Teaching and Referral Hospital (MTRH) with dyspnea	Oyieng'o et al ⁴⁷	CA	2011
Asthma control in developing economies: a five city survey	Nadeau et al ⁴⁸	PR	2012
Current concepts in management of bronchial asthma	Obel A ⁴⁹	PR	1981
Relationship between exposure to tobacco smoke and bronchial asthma in children: a review	Esamai F ⁵⁰	PR	1998
Abbreviations: PR = peer reviewed; CA = conference abstract; DISS = dissertation			

Table 2: Studies included in the review.

Top 10 key words by number of citations	Top 10 key words by number of articles citing
Child	Child
Environment	Adult
Smoking	Environment
Exercise	Exercise
Salbutamol	Infection
Breastfeeding	Socioeconomic
Spirometry	Morbidity
Infection	Allergy
Adult	Mortality
Guidelines	Cost
Common key words among top 10 of both list:	Child, Adult, Environment, Exercise, Infection
Bottom 10 key words by number of citations	Bottom 10 key words by number of articles citing
Admissions	Compliance
Diet	Vaccination
Vaccination	Asthma control
Patient education	Admissions
Genetic	Peak flow meter
Peak flow meter	Hospitalisation
Hospitalisation	Genetic
Hereditary	Hereditary
Quality of life	Quality of life
Stigma	Stigma
Common key words among bottom 10 of both list:	Vaccination, peak flow meter, hospitalisation, genetic, hereditary, quality of life, stigma

Table 4: Development of sub-themes from key words.

covered by the studies. No papers on COPD were identified. Almost two thirds of papers were epidemiological with prevalence studies accounting for the majority. Taken together, studies addressing diagnosis of asthma and its classification by severity comprised one fifth of studies reviewed. Three papers were

reviews of current concepts in the field of asthma, two studies compared current asthma care against international standards and one study addressed asthma patient education. Only one study involving efficacy and analysis of chemical constituents of a herbal remedy for asthma was scored as basic science.

Development of sub-themes from key words

Figure 3 shows the number of times selected key words were mentioned in reviewed articles.

Discussion

The main objective of the study was to characterise research on asthma and COPD in Kenya into broad categories (themes). Of the 31 papers included in the review, the majority were epidemiological (18) with most being cross-sectional (prevalence) studies. Papers (5) focusing on asthma management were the second most common and included two controlled trials of inhaled asthma medication, two cross-sectional studies of asthma control, and one on the prevalence of controller medication use. Three papers were reviews of asthma with two discussing current management concepts and one assessing the relationship between breastfeeding and childhood asthma. There were two papers addressing asthma guidelines and standards. In one study, clinics in Kenya were involved as part of a multi-country comparison of actual versus guideline-defined practice. The second study was a postgraduate dissertation. Two papers covered diagnosis and classification of asthma and only one paper assessed asthma knowledge and education among guardians. These broad categories (themes) of asthma research are summarised in Figure 1. Asthma research (the preponderance of cross-sectional studies) appears guided by feasibility (cost, ease of conduct). Most researchers were affiliated to research and academic organisations. No research on COPD was identified. Through an analysis of selected key words extracted from the GINA report,¹ the key words cited most were child, adult, environment, exercise and infection. Those cited the least were vaccination, peak flow meter, hospitalisation, genetic, hereditary, quality of life and stigma. Although this analysis is prone to errors such as author proclivity to repetition of certain key words, the emerging sub-themes of asthma in this population are that it is a disease of childhood, with various environmental factors playing a key role in its development. Crucial in this development is the urban environment which is thought to be a contributing factor to the increasing prevalence of asthma in children. The precipitation of symptoms by exercise is widely used as diagnostic aid in children and the association with infection (notably viral) is strong. As expected, these sub-themes arise most frequently from epidemiological studies which describe the disease in terms of time, place, and person. The least common frames were those of asthma-related stigma, quality of life, morbidity, monitoring using peak flow assessment, vaccination (influenza), genetics, and heredity.

Conclusion

Most research on asthma was epidemiological (58%) followed by studies on asthma treatment and control (13%). Basic science was the least researched area. Asthma in Kenya is portrayed in the research literature as a common disease of childhood that is associated with early childhood experiences such as breastfeeding, passive exposure to smoking, indoor home environment and urbanisation. At the time of the review, no articles on COPD were identified using the search strategy employed by the study.

The authors recommend the development of a country-wide research agenda with specific focus on COPD for which no data

are locally available. A good starting point would be to conduct epidemiological surveys in the most at risk populations including smokers and those exposed to indoor air pollution. Further research is needed on aspects of asthma management such as quality of life, utilisation of resources, stigma, and health education, for which little or no local data exist.

Author Declaration

Competing interests: none.

References

1. Global Initiative for Asthma. Global strategy for Asthma management and prevention 2014. Available from www.ginasthma.org. Last accessed 9th January 2015.
2. World Health Organization. Global action plan for the prevention and control of non-communicable diseases 2013-2020. Available at http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf?ua=1 last accessed 22nd October 2014.
3. The United Nations. Press Release: General Assembly High-Level Meeting on Non-Communicable Diseases Urges National Targets, Global Commitments to Prevent Needless Loss of Life. 10th July 2014. Available at <http://www.un.org/press/en/2014/ga11530.doc.htm>. Last accessed 15th April 2015.
4. Braman SS. The global burden of asthma. *Chest* 2006; 130 (1 Suppl): 4S-12S. PubMed PMID: 16840363. Epub 2006/07/15. eng.
5. Barnes PJ, Jonsson B, Klim JB. The costs of asthma. *Eur Resp J* 1996; 9 (4): 636-42. PubMed PMID: 8726924. Epub 1996/04/01. eng.
6. Marketos SG, Ballas CN. Bronchial asthma in the medical literature of Greek antiquity. *J Asthma* 1982; 19 (4): 263-9. PubMed PMID: 6757243. Epub 1982/01/01. eng.
7. Guidelines for Asthma Management in Kenya. January 2011. Division of Leprosy, Tuberculosis and Lung Disease. Available at <http://www.nltf.co.ke/docs/National%20Asthma%20Guidelines.pdf> last accessed 22nd October 2014.
8. Kenya Essential Medicines List 2010. Ministry of Medical Services, Ministry of Public Health and Sanitation. Available at <http://apps.who.int/medicinedocs/en/d/Js18694en/> last accessed 22nd October 2014.
9. Global Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, management and prevention of chronic obstructive pulmonary disease. Updated 2015. Available at http://www.goldcopd.org/uploads/users/files/GOLD_Report_2015_Apr2.pdf. Last accessed 15th April 2015.
10. Lopez AD, Shibuya K, Rao C, et al. Chronic obstructive pulmonary disease: current burden and future projections. *Eur Respir J* 2006; 27: 397-412.
11. Buist AS, McBurnie MA, Vollmer WM, et al. International variation in the prevalence of COPD (The BOLD Study): a population-based prevalence study. *Lancet* 2007; 370 (9589): 741-50.
12. Halbert RJ, Natoli JL, Gano A, et al. Global burden of COPD: systematic review and meta-analysis. *Eur Respir J* 2006; 28: 523-32.
13. Mannino DM, Homa DM, Akinbami LJ, et al. Chronic obstructive pulmonary disease surveillance—United States, 1971-2000. *MMWR Surveill Summ* 2002; 51: 1-16. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5106a1.htm>. Last accessed April 15th 2015.
14. Mehrotra A, Oluwole AM, Gordon SB. The burden of COPD in Africa: a literature review and prospective survey of the availability of spirometry for COPD diagnosis in Africa. *Trop Med Int Health* 2009; 14 (8): 840-8.
15. Nturibi EM, Kolawole AA, McCurdy SA. Smoking prevalence and tobacco control measures in Kenya, Uganda, the Gambia and Liberia: a review. *Int J Tuberc Lung Dis* 2009; 13 (2): 165-70.
16. Wright RJ, Suglia SF, Levy J, et al. Transdisciplinary research strategies for understanding socially patterned disease: the Asthma Coalition on Community, Environment, and Social Stress (ACCESS) project as a case study. *Cien Saude Colet* 2008; 13 (6): 1729-42. PubMed PMID: PMC2628980.
17. Aronowitz R. Framing disease: an underappreciated mechanism for the social patterning of health. *Soc Sci Med* 2008; 67 (1): 1-9. PubMed PMID: 18378372. Epub 2008/04/02. eng.
18. Williams DR, Sternthal M, Wright RJ. Social determinants: taking the social context of asthma seriously. *Pediatrics* 2009; 123 Suppl

- 3: S174–84. PubMed PMID: 19221161. Pubmed Central PMCID: PMC3489274. Epub 2009/04/16. eng.
19. Green J, Browne J. *Principles of Social Research*. Open University Press; 2005.
 20. Odhiambo JA, Omwega MJ, Gicheha CM, et al. Exercise-induced bronchospasm: a pilot survey in Nairobi school children. *East Afr Med J* 1997; 74 (11): 694–8.
 21. Ng'ang'a LW, Odhiambo JA, Mungai MW, et al. Prevalence of exercise induced bronchospasm in Kenyan school children: an urban-rural comparison. *Thorax* 1998; 53 (11): 919–26.
 22. Odhiambo JA, Ng'ang'a LW, Mungai MW, et al. Urban-rural differences in questionnaire-derived markers of asthma in Kenyan school children. *Eur Resp J* 1998; 12 (5): 1105–12.
 23. Esamai F, Anabwani GM. Prevalence of asthma, allergic rhinitis and dermatitis in primary school children in Uasin Gishu district, Kenya. *East Afr Med J* 1996; 73 (7): 474–8.
 24. Ayaya S, Nyandiko W, Esamai F. Prevalence of asthma, allergic rhinitis and dermatitis in primary school children in Uasin Gishu District, Kenya. *East Afr Med J* 2002; 79 (10): 514–8.
 25. Aluoch JA, Kofi-Tsekpo WM, Were JB, et al. An effective traditional medicine for bronchial asthma: clinical demonstration and preliminary toxicological evaluation. *Anc Sci Life* 1990; 10 (1): 45–51.
 26. Ait-Khaled N, Enarson DA, Bencharif N, et al. Implementation of asthma guidelines in health centres of several developing countries. *Int J Tuberc Lung Dis* 2006; 10 (1): 104–9.
 27. Mohamed N, Ng'ang'a L, Odhiambo J, et al. Home environment and asthma in Kenyan schoolchildren: a case-control study. *Thorax* 1995; 50 (1): 74–8.
 28. Perzanowski MS, Ng'ang'a LW, Carter MC, et al. Atopy, asthma, and antibodies to *Ascaris* among rural and urban children in Kenya. *J Pediatrics* 2002; 140 (5): 582–8.
 29. Rees PH, Gitoho F, Mitchell HS, et al. Some aspects of the aetiology of asthma in Nairobi with special reference to parasites and the house dust mite. *East Afr Med J* 1974; 51 (10): 729–33.
 30. Mitchell HS. Bronchial asthma in Kenya. *East Afr Med J* 1970; 47 (3): 142–5.
 31. Wasunna AE. Asthma as seen at the casualty department, Kenyatta National Hospital, Nairobi. *East Afr Med J* 1968; 45 (11): 701–5.
 32. Nganga LW, Gikonyo BM, Odhiambo JA. Efficacy and safety of inhaled Salmeterol [Serevent] as maintenance therapy for asthma in Nairobi. *East Afr Med J* 1994; 71 (2): 88–92.
 33. De Souza M. Allergic conditions in a general practice in Nairobi: a pilot study. *East Afr Med J* 1992; 69 (12): 700–2.
 34. De Souza M. Allergies and skin testing: a Nairobi experience. *East Afr Med J* 1994; 71 (7): 473–5.
 35. Odhiambo JA, Chwala RD. Arterial blood gases and acid-base status of adult patients presenting with acute severe asthma at Kenyatta National Hospital, Nairobi. *East Afr Med J* 1992; 69 (6): 319–22.
 36. Limbe MS, Onyango FF, Nduati R, et al. Effects of passive smoking and breastfeeding on childhood bronchial asthma. *East Afr Med J* 1999; 76 (11): 606–9.
 37. Hemed T. Prevalence of influenza virus infection in asthmatic children presenting with an acute exacerbation at Kenyatta National Hospital. Postgraduate Dissertation, University of Nairobi, 2004.
 38. Ngeta C. Prevalence of use of controller medication among asthmatic children in Kenyatta National Hospital. Postgraduate Dissertation, University of Nairobi, 2006.
 39. Gachare L. Ventilatory function of asthmatic children in stable state seen at Kenyatta National Hospital. Postgraduate Dissertation, University of Nairobi, 1986.
 40. Laigong P. Acute asthma care in children seen at the Kenyatta National Hospital: A comparison with international standards. Postgraduate Dissertation, University of Nairobi, 1996
 41. Simiyu E. An assessment of knowledge and comprehension of asthma therapy among guardians of asthmatic children at KNH paediatric asthma clinic. Postgraduate Dissertation, University of Nairobi, 2009
 42. Okumu K. Prevalence of rhinosinusitis in patients on follow up for asthma at Kenyatta National Hospital chest clinic. Postgraduate Dissertation, University of Nairobi, 2009
 43. Andale T. Selected socio demographic and drug adherence factors associated with uncontrolled asthma at chest clinic, Kenyatta National Hospital. Postgraduate Dissertation, University of Nairobi, 2009
 44. Macharia WM, Mirza NM, Wafula EM, et al. Childhood asthma at Kenyatta National Hospital, Nairobi. *East Afr Med J* 1990; 67 (12): 837–41.
 45. Aluoch JA, Gathua SN. The efficacy and safety of a controlled release formulation of salbutamol in the management of patients with asthma in Nairobi, Kenya. *East Afr Med J* 1990; 67 (12): 850–5.
 46. Yes N, Odhiambo J, Pearce N, et al. Prevalence of symptoms of asthma, rhinitis and eczema in 13- to 14-year-old children in Africa: the International Study of Asthma and Allergies in Childhood Phase III. *Allergy* 2007; 62 (3): 247–58.
 47. Oyieng'o et al. Spirometric evaluation of patients presenting to Moi Teaching And Referral Hospital (MTRH) with dyspnea. *Am J Respir Crit Care Med* 185; 2012: A3242.
 48. Nadeau et al. Asthma control in developing economies: a five city survey. *Am J Respir Crit Care Med* 185; 2012: A5229.
 49. Obel AO. Practical therapeutics current concepts in management of bronchial asthma. *East Afr Med J* 1981; 58 (5): 311–7.
 50. Esamai FO. Relationship between exposure to tobacco smoke and bronchial asthma in children: a review. *East Afr Med J* 1998; 75(1): 47–50.

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