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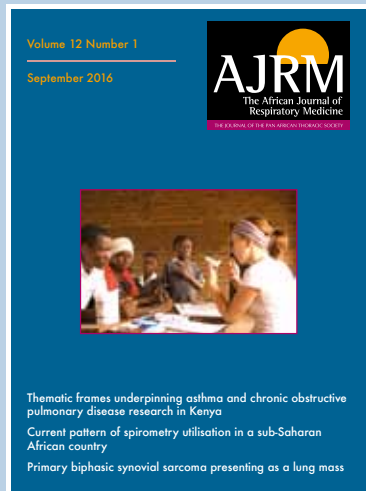
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Thematic frames underpinning asthma and chronic obstructive pulmonary disease research in Kenya

Current pattern of spirometry utilisation in a sub-Saharan African country

Primary biphasic synovial sarcoma presenting as a lung mass



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## First word

In the last six months we have seen a lot of activity in the field of medicine; there is the Zika virus that threatened the Olympic games and crossed over to the USA; and yellow fever raised its ugly head with outbreaks reported in Angola and the Democratic Republic of Congo. The reason for this increase of re-emerging diseases is not clear, but climate change and human migration together with the ongoing evolution of viral and microbial variants, and drug resistance, are the most likely contributing factors in this phenomena. We in Africa should continue to strengthen our surveillance systems so that our capacity to identify and deal with any medical threat is improved.

In this issue we have interesting articles mainly focusing on asthma. The prevalence of asthma in Africa and even the world remains controversial as definition is varied. The Global Asthma Report of 2014 ([www.globalasthmareport.org](http://www.globalasthmareport.org)) puts the number as 300 to 400 million people who are affected globally by asthma, and 250 000 dying, with most of the deaths occurring in the low- and middle-income countries.

There still remains disagreement on the diagnosis of asthma despite some groups having tried to standardise it. Many clinicians and researchers would accept the cause is reversible airway obstruction with eosinophilia, diagnosed if possible, by typical histological findings. Yet there are many patients presenting with reversible airway disease without the other findings. To make it worse the co-morbidity that occurs with asthma not only cause asthma-like symptoms, but can also make the pre-existing condition worse and more difficult to control. Bateman Ed et al<sup>2</sup> estimated that up to 20% of patients did not achieve control despite gold standards of care. In a study carried out by Marchant JM et al on Australian children and published in *Chest* showed that only 5% of children earlier diagnosed with asthma had the condition after thorough investigation. That means a large number of people may unnecessarily be on long-term treatment without the condition.<sup>1</sup>

The three articles within this issue of *AJRM* look at ways to control asthma and how to utilise a spirometer, which is one of tools used to confirm reversibility. These are important areas as the control can be a measure of proper use of medication and other control measures, but can also give an indication if one is not on the right path, and require re-assessment.

The Editorial team would like to thank all readers who continue to patronise this journal and encourage them to continue sending in their manuscripts.

Evans Amukoye, Co-Editor, *AJRM*

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Front cover: Family members in Mulindi village, Kazungula District, Zambia, listen as Dr. Mattea Clarke shows them how to manage their daughter's asthma. © 2012 Malcolm Spence/On Call Africa, Courtesy of Photoshare.

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

E M Nturi, J Kunda, and E W Kamau

## 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.<sup>1</sup> Asthma is a common non-communicable disease (NCD) affecting an estimated 300 million people worldwide.<sup>2</sup> 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.<sup>3</sup> The prevalence of asthma is variable but it is generally accepted that it is increasing.<sup>4,5</sup> An estimated 10% of the Kenyan population or about four million people have asthma.<sup>6</sup> In January 2011, Kenya released its first version of guidelines for asthma management to supersede its 2005 consensus statement.<sup>7</sup> Since then, the country's essential package of medicines has expanded to include inhaled corticosteroids (ICS) which are the backbone of asthma management.<sup>8</sup> 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.<sup>9</sup> 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.<sup>10</sup> 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%).<sup>11,12</sup> 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.<sup>13</sup> A literature review of the burden of COPD in Africa (2009) did not find any studies from Kenya.<sup>14</sup> 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.<sup>15</sup>

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.<sup>2</sup> 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'.<sup>16</sup> An understanding of 'framing effects' is an important step towards improving health outcomes for asthma.<sup>17</sup> For example, in the US the 'pattern of distribution of asthma by race and socio-economic status' may have resulted from inequalities in society.<sup>18</sup>

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
<b>Synonyms</b>	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		
<b>Related terms</b>	Hay fever		
	Allergic rhinitis		
<b>Search terms and strategy</b>	<ol style="list-style-type: none"> <li>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</li> <li>2. Asthma/ (Mesh term exploded)</li> <li>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*</li> <li>4. COPD/ (Mesh, exploded)</li> <li>5. Kenya* OR East Africa* OR Nairobi</li> <li>6. 1 OR 2</li> <li>7. 3 OR 4</li> <li>8. 6 OR 7</li> <li>9. 8 AND 5</li> </ol>		

Table 1: Search strings used in the review.

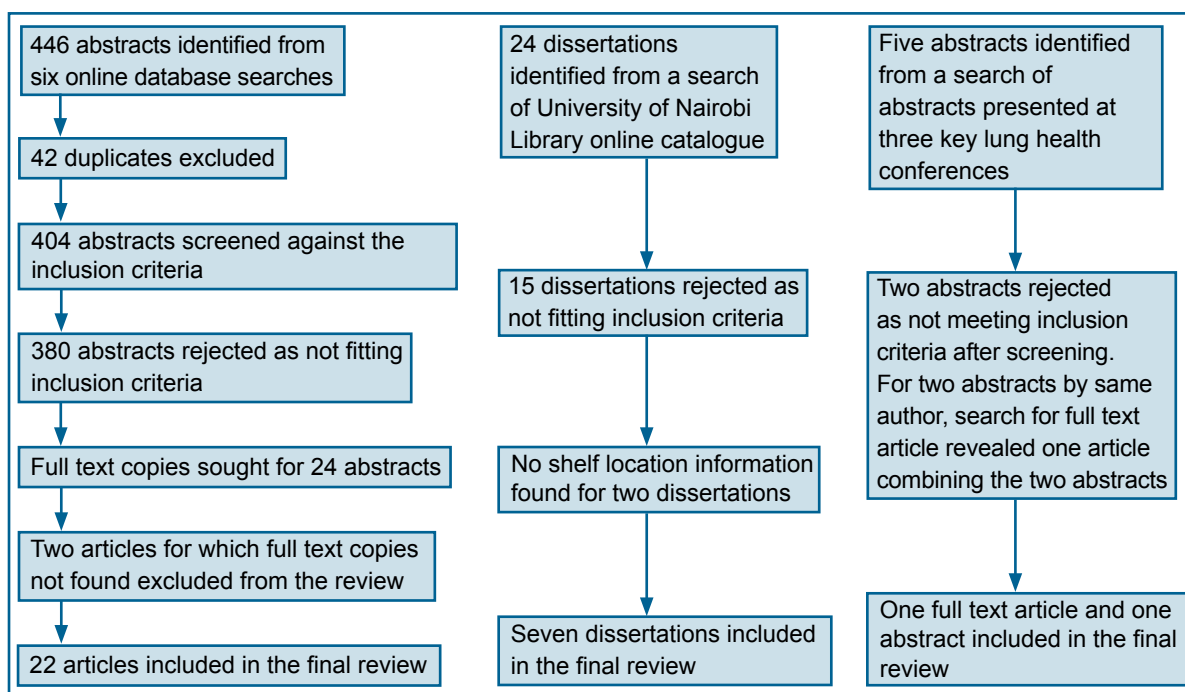


Figure 1: Summary of methods and article selection.

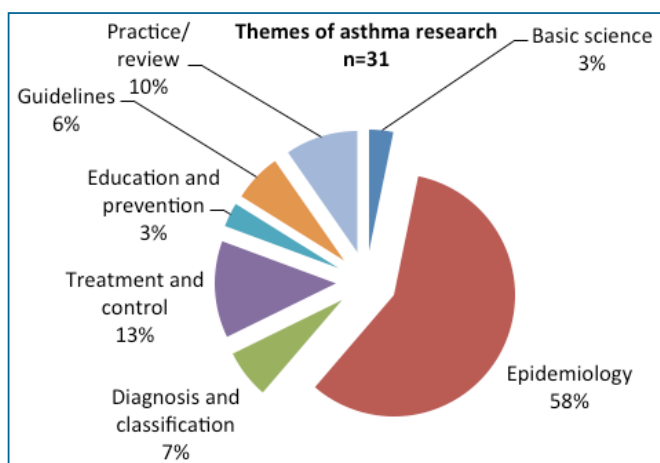


Figure 2: Key thematic areas covered by included papers.

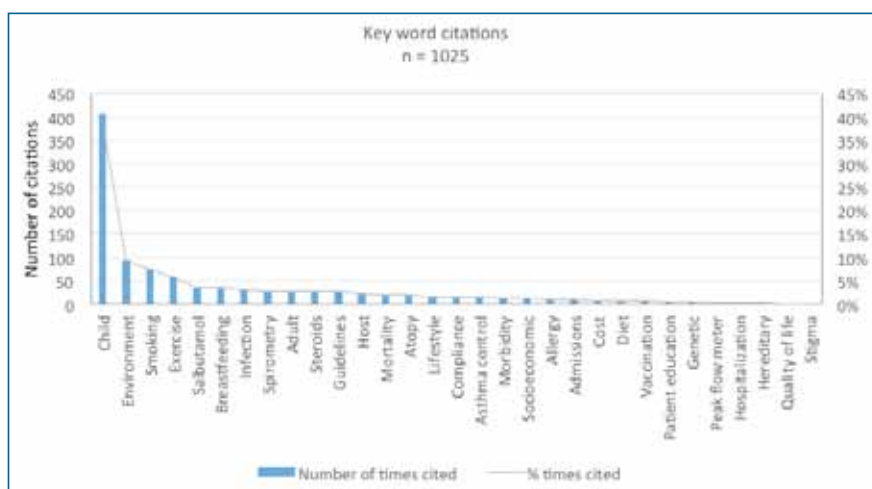


Figure 3 Bar chart of selected key words by number of citations in 25 articles.

review.<sup>19</sup> Counts of selected key words (derived from the GINA report<sup>1</sup>) 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 <sup>20</sup>	PR	1997
Prevalence of exercise induced bronchospasm in Kenyan school children: an urban–rural comparison	Ng'ang'a et al <sup>21</sup>	PR	1997
Urban–rural differences in questionnaire-derived markers of asthma in Kenyan school children	Odhiambo et al <sup>22</sup>	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 <sup>23</sup>	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 <sup>24</sup>	PR	2001
An effective traditional medicine for bronchial asthma : clinical demonstration and preliminary toxicological evaluation	Aluoch et al <sup>25</sup>	PR	1990
Implementation of asthma guidelines in health centres of several developing countries	Ait-Khaled et al <sup>26</sup>	PR	2006
Home environment and asthma in Kenyan schoolchildren: a case-control study	Nashila et al <sup>27</sup>	PR	1995
Atopy, asthma, and antibodies to Ascaris among rural and urban children in Kenya	Perzanowski et al <sup>28</sup>	PR	2002
Some aspects of the etiology of asthma in Nairobi with special reference to parasites and the house dust mite	Rees et al <sup>29</sup>	PR	1974
Bronchial asthma in Kenya.	Mitchell et al <sup>30</sup>	PR	1970
Asthma as seen at the casualty department, Kenyatta National Hospital, Nairobi	Wasunna <sup>31</sup>	PR	1968
Efficacy and safety of inhaled Salmeterol (Serevent) as maintenance therapy for asthma in Nairobi	Nganga et al <sup>32</sup>	PR	1994
Allergic conditions in a general practice in Nairobi: a pilot study	De Souza <sup>33</sup>	PR	1992
Allergies and skin testing: a Nairobi experience	De Souza <sup>34</sup>	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 <sup>35</sup>	PR	1992
Effects of passive smoking and breastfeeding on childhood bronchial asthma	Limbe et al <sup>36</sup>	PR	1999

Prevalence of influenza virus infection in asthmatic children presenting with an acute exacerbation at Kenyatta National Hospital	Hemed <sup>37</sup>	DISS	2004
Prevalence of use of controller medication among asthmatic children in Kenyatta National Hospital	Ngeta <sup>38</sup>	DISS	2006
Ventilatory function of asthmatic children in stable state seen at Kenyatta National Hospital	Gachare <sup>39</sup>	DISS	1986
Acute asthma care in children seen at the Kenyatta National Hospital: a comparison with international standards	Laigong <sup>40</sup>	DISS	1996
An assessment of knowledge and comprehension of asthma therapy among guardians of asthmatic children at KINH paediatric asthma clinic	Simiyu E <sup>41</sup>	DISS	2009
Prevalence of rhinosinusitis in patients on follow up for asthma at Kenyatta National Hospital chest clinic	Okumu <sup>42</sup>	DISS	2009
Selected socio demographic and drug adherence factors associated with uncontrolled asthma at chest clinic, Kenyatta National Hospital.	Andale <sup>43</sup>	DISS	2009
Childhood asthma at Kenyatta National Hospital, Nairobi	Macharia et al <sup>44</sup>	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 <sup>45</sup>	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 <sup>46</sup>	PR	2007
Spirometric evaluation of patients presenting to Moi Teaching and Referral Hospital (MTRH) with dyspnea	Oyeng'o et al <sup>47</sup>	CA	2011
Asthma control in developing economies: a five city survey	Nadeau et al <sup>48</sup>	PR	2012
Current concepts in management of bronchial asthma	Obel A <sup>49</sup>	PR	1981
Relationship between exposure to tobacco smoke and bronchial asthma in children: a review	Esamai F <sup>50</sup>	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
<b>Common key words among top 10 of both list:</b>	<b>Child, Adult, Environment, Exercise, Infection</b>
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
<b>Common key words among bottom 10 of both list:</b>	<b>Vaccination, peak flow meter, hospitalisation, genetic, hereditary, quality of life, stigma</b>

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,<sup>1</sup> 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.

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# Assessment of asthma control in primary care in Maseru, Lesotho

T W Mothae, G Mosweu, K H Thinyane, and T V Mohlabula

## Abstract

In spite of the development of global guidelines for the management of asthma, asthma control remains suboptimal worldwide. The aim of this study was to assess asthma control among adult patients treated in primary care. A cross-sectional study was conducted over a 3-month period. Asthmatic patients aged 16 years and above were recruited from two primary health care clinics in Maseru, Lesotho. Data were collected using questionnaires and medical record reviews. Asthma control was evaluated according to the Global Initiative for Asthma (GINA) guidelines. Of the 50 patients enrolled, 62% were female, 74% were aged 25–64 years, and the mean duration of asthma was 7.9 years. All of the patients were using inhaled short-acting beta agonists; 38% were also taking inhaled corticosteroids and 32% oral short-acting beta agonists; 48% reported night-time symptoms and 52% activity limitations in the past 4 weeks; 42% had at least one asthma exacerbation in the past 6 months. The percentage of patients with controlled, partly controlled, and uncontrolled asthma was 32%, 34%, and 34% respectively. There was no statistically significant difference in asthma control between patients treated with or without inhaled corticosteroids.

The main findings of the study were that less than a third of the patients achieved asthma control, there was low use of long-term control medications and asthma treatment did not adhere to international guidelines. Interventions to improve asthma care and outcomes should focus on revising existing national treatment guidelines to incorporate recommendations from international guidelines for the management of asthma.

setting. A diagnosis of asthma is based on the clinical history of symptoms and pulmonary function tests.<sup>2</sup> In 2006, the Global Initiative for Asthma (GINA) published new recommendations for asthma care based on clinical control; according to these guidelines, patients with good asthma control should experience no/minimal symptoms, no limitations of activities, and reduced frequency of exacerbations.<sup>5</sup> Pharmacological treatment of asthma involves the use of reliever and controller therapies. Relievers are used as-needed for rapid relief of asthma symptoms and these include inhaled short-acting beta-2 agonists (SABAs) and inhaled anticholinergics. Controller medications are taken on a daily basis to prevent asthma symptoms and include anti-inflammatory agents (inhaled corticosteroids (ICS) and leukotriene modifiers) and long-acting bronchodilators (long-acting beta-2 agonists (LABAs)). GINA recommends a stepwise approach to pharmacologic treatment to achieve control of asthma while attempting to minimise adverse effects.<sup>2</sup>

Studies conducted in several countries have shown that many patients fail to achieve optimal asthma control.<sup>6–8</sup> Poorly controlled asthma can place a substantial burden on patients by leading to limitations in daily activities, school and work absenteeism, hospitalisation, and premature death.<sup>4,6</sup> According to the World Health Organization (WHO), an estimated 250 000 people die from asthma every year, mainly in low- and middle-income countries.<sup>9</sup> Barriers to effective asthma management include lack of access to appropriate medical care and poor patient adherence to therapy.<sup>8–12</sup> In Lesotho, asthma control is not routinely assessed using formal tools. The aim of this study was to assess asthma control among adult patients treated in primary care using GINA guidelines.

## Introduction

Asthma is a disease of diffuse airway inflammation caused by a variety of triggering stimuli resulting in partially or completely reversible broncho-constriction.<sup>1</sup> Patients with asthma present with intermittent episodes of wheezing, coughing, and dyspnea.<sup>1,2</sup> Asthma affects more than 300 million people worldwide;<sup>3</sup> although most of these live in industrialised countries, there is evidence that the prevalence of asthma is increasing in low- and middle-income countries.<sup>4</sup>

Asthma is often diagnosed and treated in the primary care

## Methods

A cross-sectional study was carried out at two public primary health care clinics in the Maseru district in Lesotho over a three-month period between March and May 2014. Study participants were adults ( $\geq 16$  years) with physician-diagnosed asthma and a duration of asthma treatment of at least three months. Patients with respiratory conditions other than asthma were excluded from the study. Convenience sampling was used to select study participants.

Prior to data collection, the aim of the study was explained in Sesotho to all eligible patients and patients gave written informed consent. A pre-designed form was used to collect data: patients were interviewed to obtain socio-demographic data and medical history including duration of asthma, current treatment, and type and frequency of asthma symptoms; medical records were reviewed to corroborate information provided by patients. Patients were asked to recall their experiences during

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	Frequency, n (%)
<b>Gender</b>	
Male	19 (38)
Female	31 (62)
<b>Age groups (years)</b>	
16–24	8 (16)
25–44	18 (36)
45–64	19 (38)
≥65	5 (10)
Mean age at diagnosis (±SD) (years)	36.3 (16.3)
Mean duration of asthma (±SD) (years)	7.9 (7.9)
<b>Symptoms in the past 4 weeks</b>	
Nocturnal symptoms ≥1 time/week	24 (48)
Daytime symptoms > 2 times/week	15 (30)
<b>Limitations of activities, past 4 weeks</b>	
Daily activities, n = 50	26 (52)
Work, n = 29	21 (42)
Study, n = 5	14 (48)
Exercise, n = 14	2 (40)
	11 (79)
Exacerbations	21 (42)
Hospitalisation	5 (10)

**Table 1: Demographic characteristics and medical history (N=50).**

Current treatment	Total	Controlled, n (%) <sup>a</sup>	Partly controlled, n (%) <sup>a</sup>	Uncontrolled, n (%) <sup>a</sup>
SABA <sub>inh</sub>	16	7 (44)	6 (38)	3 (19)
SABA <sub>inh</sub> + ICS	15	4 (27)	6 (40)	5 (33)
SABA <sub>inh</sub> + SABA <sub>oral</sub>	11	3 (27)	4 (36)	4 (36)
SABA <sub>inh</sub> + other	8	2 (25)	1 (13)	5 (63)
Total	50	16	17	17

<sup>a</sup>Percentage of controlled/partly controlled/uncontrolled patients in patients treated with the particular drug regimen. ICS, inhaled corticosteroid; inh, inhaler; SABA, short-acting beta agonist.

**Table 2: Asthma control in relation to asthma treatment (N=50).**

the previous four weeks and to respond to questions about: (a) daytime symptoms; (b) nocturnal symptoms; (c) limitations of activities (including household work, exercise, and interference with work/school); and (d) need for reliever treatment. Asthma control was evaluated using the GINA 2012 guidelines;<sup>2</sup> in our setting, lung function testing was not available and patients were categorised as controlled, partly controlled, and uncontrolled on the basis of the responses to the four items above. Asthma

exacerbations were defined as a worsening of symptoms requiring an emergency department visit or an unscheduled visit to the clinic and a short course of oral glucocorticoids.

Data analysis was performed using SPSS version 20.0. The response rate for each variable is presented as a percentage. Fisher's exact test was conducted to examine the relationship between inhaled corticosteroid use and asthma control. A p-value of less than 0.05 was considered statistically significant. Ethical approval to conduct the study was obtained from the Lesotho Ministry of Health Research and Ethics Committee.

## Results

A total of 50 patients from the two study sites participated in the study. Table 1 shows the demographic characteristics and medical history of the study participants: 62% were female and 74% were aged 25–64 years; 58% were employed, 10% were students, and 32% were unemployed. Some 14% of the patients had been diagnosed with asthma before the age of 16 years. The majority of the patients identified cold air or weather (88%), and dust (70%), as triggers for their asthma symptoms; other triggers included strong emotions, exercise/intense physical activity, strong odours and food (around 25% each). Almost half (48%) of the study participants had nocturnal symptoms and 30% had experienced daytime symptoms at least twice a week in the past four weeks; 42% reported interference with normal daily activities and 16 out of 34 employed patients and students (47%) had missed work or school due to asthma. Some 42% of the patients reported one or more emergency department/unscheduled clinic visit for the management of asthma exacerbations in the past six months; 10% had had at least one asthma-related hospitalisation in the past 12 months.

Table 2 shows asthma treatment and levels of asthma control among the study participants. The time interval between

the previous and current clinic visits was around one month for 60% of the patients, two months for 24%, and three months for 16%. All of the patients were using inhaled salbutamol as needed; 38% were also taking inhaled beclomethasone, 32% oral salbutamol and 6% aminophylline. The frequency of inhaled asthma medication prescription refills was high: 80% of all patients

obtained ≥2 refills of inhaled salbutamol and 53% of the patients taking ICS (10/19) had ≥2 refills of inhaled beclomethasone in the previous three months. Almost half (44%) of the patients had run out of their inhaled short-acting beta agonist in the weeks before the current clinic visit. Twelve patients (24%) had been prescribed short courses (5–10 days) of oral glucocorticoids for the management of acute asthma exacerbations at the previous consultation; only one patient was on long-term oral glucocorti-

	Inhaled SABA plus		p value (Fisher's exact test)
	No controller, n/N (%)	Controller therapy, n/N (%)	
Daytime symptoms $\leq 2$ times/week	9/15 (60)	12/19 (63)	1.000
No nocturnal symptoms	7/15 (47)	10/19 (53)	1.000
Controlled asthma	4/15 (27)	5/19 (26)	1.000

**Table 3: Asthma symptoms and control in patients using combination therapy (N = 34).**

coid therapy. Asthma control was as follows: 32% of all patients were categorised as having controlled asthma according to the GINA criteria; 34% had partly controlled asthma; and another 34% were uncontrolled. Of the patients with controlled asthma, 44% (7/16) were using inhaled SABA alone. When comparing control rates between different treatment regimens, asthma control was highest (44%) among patients treated with inhaled SABA alone and less than 30% for patients treated with all other drug combinations.

We evaluated asthma symptoms and control among 34 patients treated with combination therapy (Table 3): 56% (n=19) of these patients were taking a long-term control medication (inhaled beclomethasone, irrespective of dose) and 44% were treated with short-acting bronchodilators only (oral salbutamol and/or short-acting aminophylline). There were no statistically significant differences in the prevalence of daytime and nocturnal symptoms between patients treated with or without controller medications; in addition the use of ICS was not associated with asthma control.

## Discussion

We performed a cross-sectional study of 50 asthma patients treated at two primary health care clinics in Maseru, Lesotho. Asthma was treated with inhaled short-acting beta-2 agonists alone or in combination with inhaled corticosteroids, oral short-acting beta-2 agonists, and/or oral short-acting methylxanthines. Less than a third of the study participants had controlled asthma. This finding is consistent with results from other studies showing low levels of asthma control in clinical practice.<sup>6,13,14</sup>

In this study, asthma control was highest among patients treated with inhaled short-acting beta-2 agonists alone. Inhaled SABAs, taken as needed for relief of symptoms, are usually effective therapy for mild, intermittent asthma (Step 1 of the GINA Classification of Asthma Severity).<sup>2</sup> Patients with persistent asthma symptoms (Steps 2–5 of GINA) require long-term control medications to prevent asthma symptoms. Nearly 50% of the study participants reported nocturnal awakenings due to asthma at least once per week and 30% reported frequent daytime symptoms. The frequency of nocturnal symptoms is used to categorise asthma severity and control; occurrence of nocturnal asthma indicates poor control of asthma and the need for more aggressive controller therapy.<sup>5,15</sup> Inhaled corticosteroids are the most effective medications for long-term control of asthma; regular use of an ICS over the long term reduces nocturnal and daytime symptoms and the need for inhaled bronchodilators.<sup>2,15,16</sup> In our study however, the use of ICS was not associated with asthma

control. Possible reasons for low efficacy of ICS therapy in controlling asthma may include suboptimal dosing of ICS and patient non-adherence to medication.<sup>17–19</sup> Further studies are required to elucidate the reasons for poor asthma control in this setting. In agreement with other studies, we found low use of long-term control medications among the study participants. Studies conducted in various countries consistently show that a significant proportion of patients with persistent asthma symptoms do not

receive ICS therapy as recommended.<sup>6,17</sup> Reasons for underuse of ICS include non-adherence to asthma treatment guidelines by prescribers and high costs/unavailability of the medicines particularly in limited-resource situations.<sup>2,17–20</sup> In Lesotho, asthma medications are provided free of charge to patients in the public sector and inhaled corticosteroids are available for use in primary care. However there has been no recent, formal revision of the national standard treatment guidelines<sup>21</sup> to incorporate recommendations from international guidelines for asthma care. It is therefore possible that the low use of controller medications in this study is partly attributable to the lack of clear national guidelines for the management of asthma in Lesotho. Future research should explore the adaptation of international asthma management guidelines to the local context of healthcare and the dissemination and implementation of the adapted guidelines.

Poor asthma control can place a burden on the physical, social and professional life of patients.<sup>23</sup> In this study, around half of the patients reported activity limitations and 42% had at least one asthma exacerbation in the past six months. Asthma exacerbations are common in patients with severe and/or uncontrolled asthma; mild exacerbations can be treated at home or in the outpatient setting, however more severe exacerbations require hospitalisation or emergency department management.<sup>23,24</sup> Most exacerbations develop over a period of hours or days; early recognition of deterioration in symptoms can enable patients to initiate timely self-management of exacerbations or seek appropriate medical care.<sup>25</sup> Current evidence-based practice guidelines for asthma management emphasise the importance of patient education and use of written self-management plans to improve health outcomes for patients with asthma.<sup>2,25</sup> Patient behaviours such as compliance to treatment, avoidance of trigger factors, and self-monitoring of asthma control can reduce asthma morbidity and requirements for acute medical care.<sup>28</sup> Despite this, studies show that patient adherence to asthma medications and other aspects of self-management such as not smoking is often low.<sup>6,10,14</sup> In the present study, none of the patients were smokers and the majority expressed confidence in their ability to avoid exposure to known asthma triggers; however a significant proportion of the study participants did not take their medication as prescribed. Analysis of refill records for inhaled medications suggested a higher rate of use of inhaled beta agonists and inhaled corticosteroids than reported by patients. Overuse of inhaled reliever medications has been reported by other researchers and is an indication of poor asthma control.<sup>28,29</sup> In contrast to other studies,<sup>17,28</sup> our findings also suggest that

patients took higher doses of inhaled corticosteroids than prescribed. A possible explanation for this may be poor understanding of the effects of inhaled corticosteroids in asthma; nearly a third of the patients using a combination of ICS and inhaled SABA reported using inhaled corticosteroids more frequently when they ran out of reliever medications. There is a need for educational interventions aimed at increasing patients' asthma knowledge and self-management skills.

This study has a number of limitations. Firstly, pulmonary function tests were not done and asthma control was ascertained based only on self-report of symptoms, which may be subject to recall bias or may be under- or over-reported. Secondly, there was insufficient data to determine asthma severity and therefore appropriateness of current pharmacotherapy for the majority of the patients. Finally, the use of convenience sampling and a small sample size limit the extent to which the findings can be generalised to asthmatic patients in Lesotho. The strengths of the study include the prospective study design, a high response rate, and inclusion of more than 80% of the patients who presented for asthma treatment at the two clinics during the study period. The results of the present study provide a useful insight into asthma control and current clinical practice in the management of asthma in typical primary care settings in Lesotho.

In conclusion, less than a third of the study participants achieved asthma control as defined by GINA guidelines. Reasons for poor asthma control in this study may include low use of long-term asthma control medications and patient non-adherence to treatment. Interventions to improve asthma care and outcomes in this setting should include provision of patient education to improve asthma self-management, regular monitoring of asthma symptoms and modification of treatment based on level of control and in accordance with recommendations of international guidelines for the treatment of asthma.

## Author Declaration

Competing interests: none.

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# Current pattern of spirometry utilisation in a sub-Saharan African country

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## Abstract

Spirometry is recommended in the assessment of respiratory diseases. It was however reported to be underutilised in Nigeria. This study assessed current patterns in spirometry utilisation in terms of frequency and sources of referral, the indications for referral and patterns of ventilatory function when compared with a similar study 6 years ago in the same centre. The results will enable us to address gaps in spirometry utilisation. Consecutive subjects underwent spirometry in the University of Nigeria Teaching Hospital (UNTH), Ituku Ozalla, Enugu between January 2013 and June 2015 and were retrospectively studied. Demographic, anthropometric, and spirometric data were obtained from the spirometry register. Data were analysed to determine the mean age, sex distribution, and body mass index (BMI) of the study participants. Data on frequency and sources of referral for spirometry, indications and pattern of ventilatory function were obtained. The number of patients visiting different clinics in the hospital on a monthly basis was recorded. A total of 226 subjects had acceptable spirometry; 120 (53.1%) were males with a male to female ratio of 1.13:1; mean age was  $48.51 \pm 18.13$  years. Of the participants, 180 (79.6%) were referred from the Department of Medicine and 24 (10.6%) from the Department of Surgery, while 12 (5.3%) were referrals from peripheral hospitals. Bronchial asthma was the indication for spirometry in 89 study participants (65.9%) followed by chronic obstructive pulmonary disease (COPD) in 35 (15.5%) and pre-operative spirometry assessment in 33 (14.6%). Normal ventilatory pattern was found in 82 study participants (37.6%), restrictive pattern in 62 (27.4%), obstructive pattern in 57 (25.2%) and a mixed pattern in 22 (9.7%). In conclusion, we found an increase in spirometry utilisation with a comparably wider spread of doctors involved in referring patients from both within and outside the hospital. Bronchial asthma remains a dominant indication for spirometry. The incidence of a restrictive ventilatory pattern appears to be increasing and needs further evaluation.

## Introduction

Worldwide, about 334 million people have asthma and the prevalence is on the increase, especially in middle- and low-income countries.<sup>1</sup> Asthma remains the most common chronic lung condition in children<sup>2</sup> while chronic obstructive pulmonary disease (COPD) affects 300–600 million people with increasing prevalence and mortality.<sup>3</sup> For proper diagnosis, global and national guidelines<sup>4,5</sup> recommend spirometry as the gold standard for accurate and repeatable measurement of lung function; it is the preferred initial test to assess the presence and severity of airflow obstruction in asthma patients,<sup>2,6</sup> and assists in gathering proper epidemiological data of these diseases.

Spirometry as an investigative tool is used for assessing ventilatory function which can be categorised into four types: normal, obstructive, restrictive, and mixed patterns.<sup>7</sup> Obstructive lung diseases such as asthma and COPD constitute the dominant indications for spirometry in Nigeria.<sup>8,9</sup> Although spirometry is a simple, inexpensive, and non-invasive procedure it is underutilised by healthcare practitioners even when indicated.<sup>10–12</sup> This may lead to underdiagnosis, over-diagnosis, or misdiagnosis of asthma or COPD,<sup>13–17</sup> resulting in increased economic costs and medication risks.<sup>18,19</sup> Studies on spirometry utilisation in sub-Saharan Africa are scarce. Desalu et al<sup>8</sup> documented poor spirometry utilisation in Ilorin, Nigeria. A previous study done at the current centre in Enugu, Nigeria, six years ago when spirometry was first introduced in the hospital, showed a low rate of spirometry referrals and there was no referral from peripheral hospitals.<sup>10</sup> We conducted this study as a follow-up to assess for the current pattern of utilisation in terms of frequency and sources of referral for spirometry and the indications for spirometry. This will enable us to understand and subsequently address gaps in spirometry utilisation. This study also aimed to assess the ventilatory pattern prevalent in our centre to better understand the epidemiology of respiratory diseases in our locality.

## Methods

Consecutive subjects who had spirometry at the University of Nigeria Teaching Hospital (UNTH), Ituku Ozalla, Enugu between January 2013 and June 2015 were retrospectively studied. The information gathered for each subject included biodata, anthropometry, source of referral, indication for spirometry, and details of the ventilatory measurements taken. The number of patients, on a monthly basis, attending clinics in the medical out-patient (MOP), surgical out-patient (SOP), childrens' out-patient (CHOP), and general out-patient departments (GOPD) over the study period was also retrieved.

All spirometry tests were done using Spirolab III (Medical International Research, Italy) and were conducted by respiratory

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Age range (years)	Male n (%)	Female n (%)	Total n (%)
<20	4 (3.3)	4 (3.8)	8 (3.5)
20–30	20 (16.7)	20 (18.9)	40 (17.7)
31–40	19 (15.8)	20 (18.9)	39 (17.3)
41–50	14 (11.7)	21 (19.8)	35 (15.5)
51–60	22 (18.3)	16 (15.1)	38 (16.8)
60 and above	41 (34.2)	25 (23.6)	66 (29.2)
Total	120 (100.0)	106 (100.0)	226 (100.0)

$\chi^2=4.214$ ,  $p=0.519$ .

Table 1: Age and sex distribution of patients referred for spirometry in UNTH, Enugu, Nigeria.

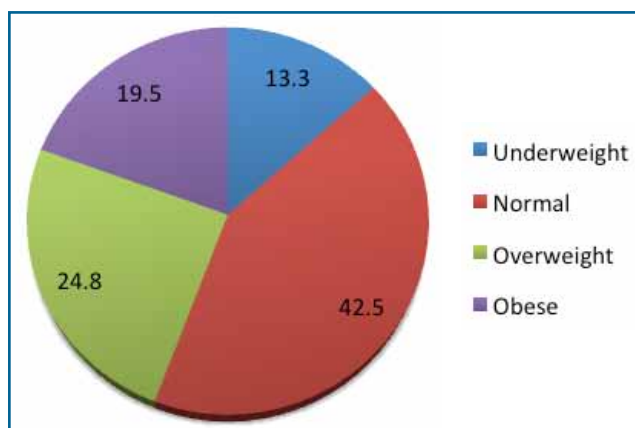


Figure 1: Weight distribution of patients referred for spirometry based on body mass index (BMI).

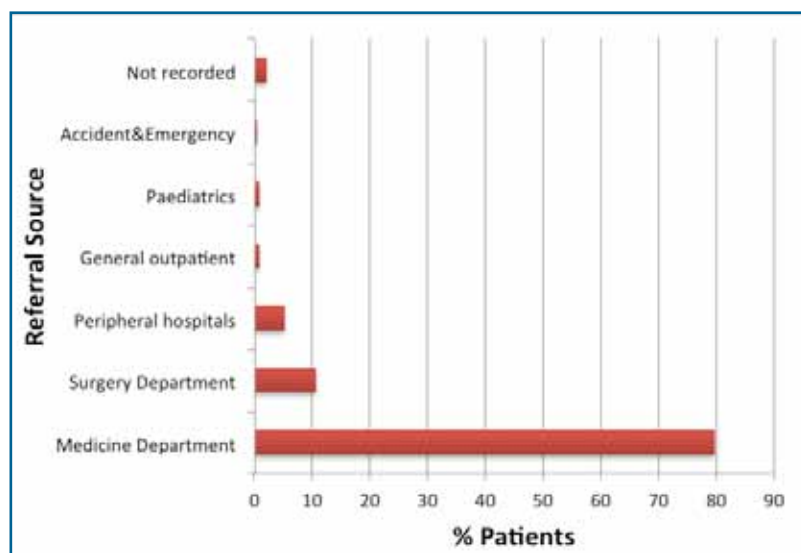


Figure 2: Distribution of referral sources for spirometry at UNTH, Enugu, Nigeria.

physicians and trained residents attached to the respiratory unit. Spirometry was carried out according to the Global Initiative on Chronic Lung Disease (GOLD) and American Thoracic Society and European Respiratory Society (ATS/ERS) guidelines.<sup>20,21</sup>

Ventilatory function was classified as follows. Normal function: FEV<sub>1</sub>/FVC (forced expiratory volume in one second/forced vital capacity) equal to or above 70% with FEV<sub>1</sub> and FVC each equal to or above 80% predicted; obstructive: FEV<sub>1</sub>/FVC below 70%; restrictive: FEV<sub>1</sub>/FVC equal to or above 70% with FEV<sub>1</sub> and FVC below 80% of predicted; mixed: FEV<sub>1</sub>/FVC less than 70% and FVC below 80% of predicted. European Respiratory Society and Knudson reference values were used for adults and paediatrics respectively, with a correction factor of 10%. Patients with unacceptable spirometry were excluded from the final analysis.

Data analysis was done using the Statistical Package for the Social Sciences, version 20 (SPSS Inc., Chicago, IL, USA). Descriptives (frequency and percentages) were used to analyse the age, sex and body mass index (BMI). Chi squared was used as a test of association. The level of significance was set at  $p<0.05$ .

## Results

The records of 243 patients were initially obtained, with 17 excluded due to unacceptable spirometry; 226 subjects had acceptable spirometry and were enrolled into the study. There were 120 (53.1%) males with a male to female ratio of 1.13:1. The age range was from 15 to 87 years with a mean age of  $48.51 \pm 18.13$  (Table 1). BMI was normal ( $18.5\text{--}24.9\text{ kg/m}^2$ ) in 96 (42.5%) of the study participants while 56 (24.8%), 44 (19.5%), and 30 (13.3%) subjects were overweight ( $25.0\text{--}29.9\text{ kg/m}^2$ ), obese ( $\geq 30.0\text{ kg/m}^2$ ), and underweight ( $<18.5\text{ kg/m}^2$ ) respectively (Figure 1).

One hundred and eighty (79.6%) patients were referred from the Department of Medicine in our hospital, 24 (10.6%) from the Department of Surgery, and 12 (5.3%) from peripheral hospitals (Figure 2). In 2013 and 2015, spirometry referral showed a rising

trend compared with out-patients visits to MOP, SOP, CHOP and GOPD clinics (Figure 3(a)) and the same trend was seen when the different clinics were viewed together as hospital out-patients (Figure 3(b)). The most common indication for spirometry referral was for patients with bronchial asthma diagnosis (89 (39.4%) of participants), followed by COPD in 35 (15.5%) and pre-operative spirometry assessment in 33 (14.6%) patients (Table 2).

Assessment of ventilatory function showed that 85 (37.6%) patients had a normal pattern, 62 (27.4%) had a restrictive pattern, 57 (25.2%) had an obstructive pattern, and 22 (9.7%) a mixed ventilatory pattern (Table 3); 44.9% of asthma referrals showed either obstructive (34.8%) or mixed patterns (10.1%). Reversibility testing was documented in only 28 of these patients and was positive in 53% of cases. Only 28.6% and 11.4% of suspected COPD cases (40%) showed obstructive and mixed ventilatory patterns respectively, while 33.3% of interstitial lung disease referrals revealed restrictive ventilatory function.

## Discussion

A total of 226 patients performed acceptable spirometry over the study period of 2.5 years. This was a four-fold rise in spirometry

Indications	n (%)
Asthma	89 (39.4)
COPD	35 (15.5)
Pre-operative assessment	33 (14.6)
Unexplained dyspnoea/chest tightness	13 (5.8)
Chronic cough	12 (5.3)
Interstitial lung disease	9 (4.0)
Connective tissue disease	5 (2.2)
Thoracic cage deformity	3 (1.3)
Lung collapse	2 (0.9)
Hypertensive heart disease	1 (0.4)
Neuromuscular disease	1 (0.4)
Miscellaneous (other lung diseases)	11 (4.8)
Not recorded	12 (5.3)

Table 2: Indications for Spirometry at UNTH, Enugu, Nigeria.

Ventilatory pattern	n (%)
Normal	85 (37.6)
Restrictive	62 (27.4)
Obstructive	57 (25.2)
Mixed	22 (9.7)

Table 3: Ventilatory function patterns of patients at UNTH, Enugu, Nigeria.

referral when compared to an earlier study in the same centre<sup>10</sup> where only 52 referrals were received over a three-year period. Overall, our study showed a rise in spirometry referral over the study period, with a peak in the second or

third quarter of each year, with the exception of 2014 when the spirometer was unusable in the first three months and industrial action by hospital workers in July and August precluded spirometry services. Even so, the greatest number of referrals in a month occurred more recently in 2015. In addition, while the monthly percentage number of patients visiting the hospital out-patient departments remained relatively stable at between 4 and 6%, the monthly percentage referral for spirometry showed a progressive rise, punctuated by two periods of industrial action (July, August and December in 2014 and January in 2015). This rising trend may be related to sensitisation of the hospital community regarding the availability of spirometry at the beginning of 2013.

The majority of referrals for spirometry in our study were from the Department of Medicine. This may be because the commonest indications for spirometry in this study were asthma and COPD, and these were managed by physicians who then referred them. Another plausible explanation may be the fact that the spirometer was domiciled with the Adult Department and was more readily accessible to that department compared with the Paediatrics Department, hence explaining the low number of pediatric patients referred. Kaminsky et al<sup>22</sup> suggested that spirometry is much more relevant to the diagnosis of respiratory disease in medicine compared with the pre-operative evaluation of patients in surgery. Referral from the Surgery Department was mainly from the Cardiothoracic Unit (CTU). As part of hospital protocol, spirometry is recommended as a pre-operative assessment for patients undergoing cardiac, thoracic, and upper abdominal surgeries.<sup>23,24</sup>

In the previous study carried out at our centre, Onyedum

and Chukwuka<sup>10</sup> only reported referrals from the Department of Medicine and three surgery sub-units: CTU, Orthopaedic, and Maxillofacial. The current study in contrast showed more sources of referral from General out-patient, Paediatrics, and Accident and Emergency Departments as well as peripheral hospitals. This may be related to more awareness of the availability and utility of spirometry among doctors that has been obtained from self-education, discussions with colleagues, and scientific conferences conducted within this period.

While the previous studies in the tertiary hospital in Enugu, south-east Nigeria<sup>10</sup> and at a tertiary hospital in Lagos, south-west Nigeria<sup>9</sup> had no referrals from peripheral hospitals, another study carried out at a tertiary hospital in Ilorin, south-west Nigeria<sup>8</sup> reported up to 21% of referrals from peripheral hospitals. Referral from the peripheral hospitals may have occurred in our current study due to sensitisation workshops involving doctors from these hospitals. Workshops and seminars have earlier been shown to improve knowledge and use of spirometers.<sup>22</sup> However an Ontario study reported that if policies regarding evaluation of respiratory symptoms are encouraged and enforced, it will increase the utilisation of spirometry as a procedure.<sup>25</sup>

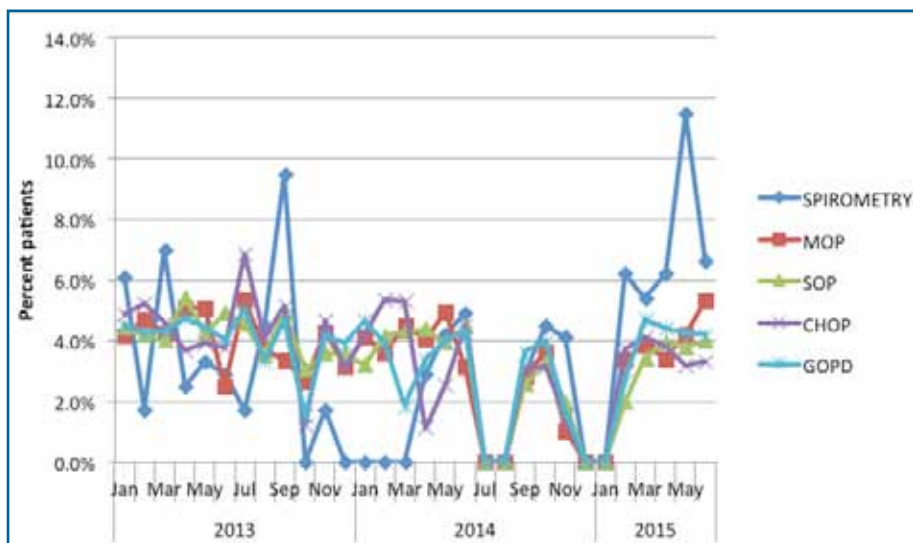
Most respiratory illnesses requiring spirometry evaluation, including asthma and COPD, are known to be managed in the peripheral hospitals by primary care physicians,<sup>10,26</sup> and most of these health facilities in Nigeria do not have spirometers available in their centres,<sup>22</sup> thus primary care physicians would of necessity need to refer patients needing spirometry. The low level of referral from the peripheral hospitals in this study may therefore indicate lack of spirometry utilisation by these primary care physicians. This may be due to lack of awareness of spirometer availability in bigger tertiary centres or lack of knowledge of the utility of spirometers in clinical practice as previously reported.<sup>22</sup> In addition, Enright et al<sup>27</sup> reported that underutilisation of spirometry by primary care physicians may be related to perceptions that spirometers were expensive, that the test process was disturbing to patients, took too much time to complete, and that the reports were too difficult to interpret. Surprising to note also is that in parts of the world where access to a spirometer was very high, spirometry utilisation in the diagnosis of respiratory diseases such as COPD was still low.<sup>28,29</sup>

The most common indication for spirometry in our study was bronchial asthma. This finding was consistent with that of other workers in Africa and Europe,<sup>9,10,30</sup> with the most common indications for spirometry being asthma and COPD. Contrary to our study, the work by Desalu et al<sup>8</sup> showed occupational diseases screening to be the second most-common indication for spirometry following bronchial asthma. They reported that part of their sample included bankers who were involved in a screening exercise during an organised event. This was to help assess for occupation-related lung diseases due to handling dirty and dusty currency notes (pre/intra employment screening). This may have introduced sample bias and thus influenced the outcome of their study.

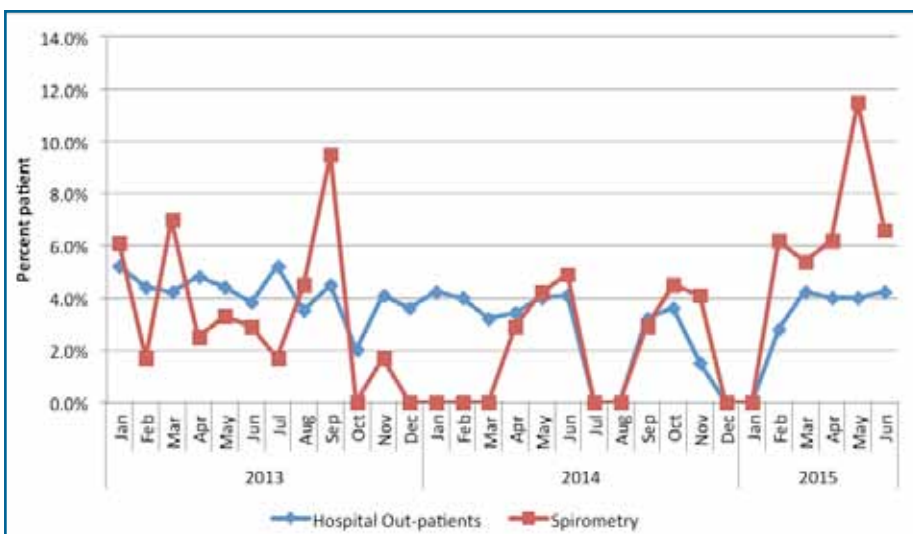
Our study found that the majority of patients had either normal or restrictive ventilatory patterns. Asthma and COPD were the predominant indications for spirometry in our study, and normal or obstructive patterns would be expected as documented by two Nigerian studies done in Ilorin and Lagos.<sup>8,9</sup> However,

both groups of patients can develop air trapping and therefore can present with pseudorestriction, which would partly account for the high frequency of restrictive ventilatory pattern seen in our study.<sup>31,32</sup> Secondly, a reasonable percentage of our population sample were referred for pre-operative assessment. All the patients for pre-operative assessment from CTU in our study were cardiac patients for open heart surgery. The majority of them had restrictive ventilatory patterns due to varying degrees of cardiomegaly and heart failure, in agreement with findings in previous studies.<sup>33,34</sup> Another reason for the difference in ventilatory patterns may be the impact of body mass index (BMI) on ventilatory pattern. A BMI well above normal is known to cause a restrictive ventilatory pattern<sup>35,36</sup> and our study found 19.5% of the subjects to be obese and 24.8% overweight. We used the GOLD criteria which defined air flow obstruction by a fixed ratio of  $FEV_1$  to FVC of less than 70%; this is in contrast to the definition of obstruction as an  $FEV_1/FVC$  less than the lower limit of normal (LLN), as derived from the Global Lung Function Initiative (GLI) equation.<sup>37</sup> This may result in reduced frequency of obstructive ventilatory patterns as shown in a 2015 prevalence study of COPD in a rural district in Uganda.<sup>38</sup> That study found a lower estimate of obstruction when the GOLD criteria was used (12.4%) compared with the GLI equation (16.2%).

Our study showed that 40% of those referred on account of COPD had an irreversible obstructive airway, proving the diagnosis of COPD. The rest had normal or restrictive ventilatory patterns. Without spirometry, all the COPD referrals would have continued to receive treatment for COPD, exposing those in whom COPD was ruled out by spirometry to unnecessary medical costs, unsuitable drugs and their side effects, and delaying the time to reach a definitive diagnosis. Over half of those referred with a presumed diagnosis of asthma in our study had either normal or restrictive ventilatory patterns. Walker et al<sup>39</sup> reported that of 63 patients documented in hospital case notes as having COPD, and of 65 documented as having asthma, who were then referred for primary-care spirometry, only 76% and 52% were diagnosed to have COPD and asthma, respectively, enabling changes in diag-



**Figure 3(a):** Successive percentage number of spirometry tests carried out per month compared with the percentage number of out-patients seen per month at the medical out-patient (MOP), surgical out-patient (SOP), childrens' out-patient (CHOP), and general out-patient departments (GOPD), respectively, at the UNTH. Total number of patients who had spirometry during the study period is 243. Total number of patients over the study at the MOP is 34,226; SOP 33,179; CHOP 20,723; and GOPD 82,613. Percentage is calculated as fraction of the total number in the respective departments over the study period.



**Figure 3(b):** Successive percentage number of spirometry tests carried out per month compared with the percentage number of hospital out-patients seen per month at UNTH (hospital out-patients here comprise MOP, SOP, CHOP, and GOPD combined together). The total number of patients undergoing spirometry during the study period is 243. The total number of hospital out-patients during the study period is 170,741. Percentage is calculated as fraction of the total number undergoing spirometry and the total of hospital out-patients respectively, over the study period. Sensitisation of the hospital community to the use of spirometry occurred in January 2013; a doctors' forum emphasising spirometry occurred in May 2015.

nosis and treatment accordingly. It is established that suspected asthma patients with normal spirometry can have positive results on methacholine or exercise challenge tests indicating airway hyper-responsiveness (AHR) which is a hallmark of bronchial asthma.<sup>40</sup> Conducting methacholine tests would probably have increased the number of asthma referrals to our respiratory

laboratory who could then have been definitively diagnosed to have bronchial asthma. However, as our centre does not have this facility, these types of patients are followed up to monitor future symptoms and seek alternative diagnoses, while some are given empirical treatment with bronchodilators if bronchial asthma is still strongly suspected.

The use of spirometers in our centre is limited by the fact that spirometry services are offered only on a Monday each week; this is due to the lack of adequate numbers of well-trained staff to conduct spirometry. Patients with pulmonary tuberculosis are excluded from spirometry in our centre, because although we use separate disposable mouth pieces for successive patients, they are fitted to a reusable turbine which increases the potential for cross-infection. Employment of a different disposable turbine for each patient would increase the charge for spirometry (US\$11) by 25%. Another limitation is the inability of some patients to perform acceptable spirometry manoeuvres in spite of painstaking coaching.

Our study does have some limitations. Non-African spirometry reference values (ERS for adults and Knudson for paediatrics) were used in the absence of true African reference values and a correction factor of 10% was applied. This may have affected the frequency of normal versus abnormal ventilatory patterns. The presence of a functional cardiothoracic centre within our facility may have also influenced the overall ventilatory pattern seen in our study population.

## Conclusion

Spirometry utilisation is on the increase in our centre with wider spread of referrals. Referral from primary care physicians is still poor. Bronchial asthma, COPD, and pre-operative assessment constitute the predominant indications for spirometry in our centre. A restrictive ventilatory pattern was prominent in our study and this needs further evaluation. Seminars and workshops to educate primary care physicians and other doctors on the usefulness of spirometry are recommended.

## Author Declaration

Competing interests: none.

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**Inflammatory myofibroblastic tumours in the lung and literature**  
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**Recent advances in the management of pre-school wheeze**  
**Childhood pneumonia – looking beyond mortality**  
**An unusual case of an anterior mediastinal mass in a child**

# Primary biphasic synovial sarcoma presenting as a lung mass

A T Tamire, P Kidane, and B Nega

## Abstract

Synovial sarcoma was defined by the World Health Organization (WHO) in 2002 as a type of mesenchymal tissue cell tumour that exhibits epithelial differentiation and represents the third most common soft-tissue sarcoma in adults, accounting for approximately 10% of soft-tissue sarcomas. To date, there are only a few reports of primary pulmonary synovial sarcoma. This report describes a case of a 12 cm primary pulmonary giant synovial sarcoma, diagnosed in a 20-year-old patient admitted in our Department of Surgery with a six-month history of cough productive of bloody sputum.

Serum tumour markers such as alpha-feto protein and human chorionic gonadotropin (hCG) were also determined and they were found to be normal.

A postero-anterior chest X-ray showed a densely radio-opaque shadow on the left upper chest, occupying almost one third of the hemi-thorax. There were no other apparent parenchymal changes (Figure 1(a)). Chest computed tomography (CT) scan revealed a heterogeneously enhancing left upper lobe rounded mass with no areas of calcification, measuring about 12 cm in its

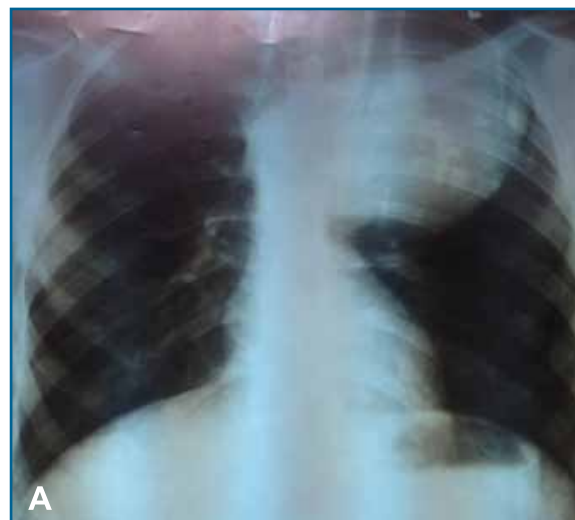


Figure 1: Chest X-ray and CT scan of the chest: (a) a large densely radio-opaque shadow in the left upper lobe area; (b) heterogeneously enhancing mass with central hypodensity which indicates necrosis.

## Introduction

Most lung tumours are malignant and tend to be carcinomas. Primary pleuropulmonary synovial sarcoma is one of the rarest pulmonary soft-tissue malignancies. It presents great diagnostic challenges in areas where there are no well-established pathology and radiology facilities, especially if there are no usual histological patterns. This is a disease that commonly affects the deep soft tissues of the extremities and young adults. Molecular testing for the pathognomonic  $t(x;18)$  chromosomal translocation has enabled diagnostic confirmation in almost all cases. In  $t(x;18)$ -negative cases, diagnosis must rely on histological and immunophenotypic features. We present a case of primary pulmonary synovial sarcoma in a young patient presenting with cough.

## Case summary

Our patient was a 20-year-old man who presented with occasional cough that had been present for one year; the cough was productive of a small amount of blood-tinged sputum. The cough was later accompanied by dull, aching left posterior chest pain. The patient also claimed he had lost weight, but this was unquantified. Otherwise he had no shortness of breath, night sweats, or loss of appetite. He was treated with anti-tuberculosis (TB) drugs, initiated based on chest X-ray and completed six months' treatment to no avail. The patient claimed that he had no contact history with a known TB patient with chronic cough. Physical examination revealed nothing except relatively decreased air entry on the left upper lung field. He was investigated and laboratory investigations (such as complete blood count and blood chemistry) were within the normal limits.

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greatest dimension.

With the radiologic and clinical suspicion of primary lung teratoma, the patient was prepared for surgery. The approach was through a standard posterolateral thoracotomy. There was minimal adhesion between the chest wall and the lung, which was released without much difficulty. The tumour occupied almost the whole of the upper lobe and it had some inflammatory adhesion with the mediastinal pleura. This was released with some difficulty and moderate bleeding. Subsequently the vessels, followed by the upper bronchus, were divided and an upper lobectomy was carried out and a specimen sent for histopathology. The histology showed features consistent with biphasic synovial sarcoma (Figure 2). The patient was counselled regarding subsequent adjuvant treatment but he was lost from follow-up.

## Discussion

Synovial sarcoma was defined by the World Health Organization (WHO) in 2002 as a type of mesenchymal tissue cell tumour that exhibits epithelial differentiation<sup>1</sup> and represents the third most common soft-tissue sarcoma in adults

Synovial sarcoma accounts for 5–10% of all soft-tissue sarcomas, occurring mainly near the big joints of the extremities; however it can occur in many sites in the body, including the lungs and mediastinum, and peritoneal and retroperitoneal areas. Synovial sarcoma of the lung is one of the rarest sarcomas that primarily originates from the lung tissue; as a result of this it is overlooked as a differential diagnosis. It is a highly aggressive tumour with a slight male predilection and is not related to cigarette smoking.<sup>2</sup> It is prevalent in individuals between the ages of 15 and 40 years,<sup>3</sup> commonly presenting with chest pain. The term 'synovial' sarcoma was given because of the synovial differentiation of the tumour that is believed to originate from multipotential mesenchymal cells. The diagnosis of primary pulmonary synovial sarcoma requires clinical, radiological, pathological, and immunohistochemical investigations to exclude alternative primary tumours and metastatic sarcoma.

The tumours are of four types: (a) monophasic fibrous (spindle), composed of homogeneous spindle cells with pale-staining nuclei arranged in fascicles and sheets, embedded in a variable background of myxoid to densely collagenous elements; (b) monophasic epithelial, composed of relatively uniform spindle cells with elongated nuclei, slightly basophilic cytoplasm and indistinct cell borders with tumour cells densely packed and little intervening stroma; (c) biphasic, composed of both spindle and epithelial cells; and (d) the poorly differentiated form, monophasic subtype being the most common.<sup>4</sup> Calcification in these tumours occurring in the periarticular region is said to be relatively common but is seldom found in thoracic lesions.<sup>5</sup> The monophasic type is difficult to diagnose, because it has a uniform spindle cell pattern; thus it may be confused with other malignant spindle cell neoplasms, such as fibrosarcoma, hemangiopericytoma, leiomyosarcoma, and spindle cell carcinoma or carcinosarcoma. Differentiation of these tumours requires immunohistochemistry of different membrane proteins such as cytokeratin, epithelial membrane antigens, CD99, and calponin which are positive in synovial sarcoma. Diagnosis of the bipha-

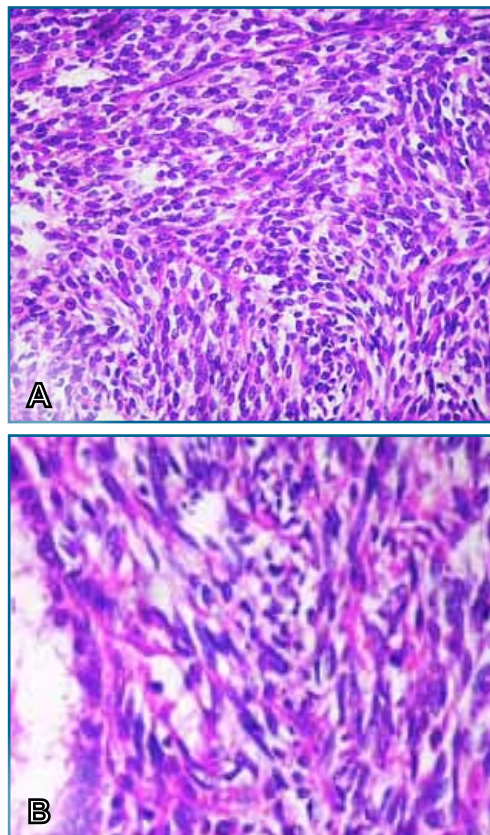
sic type is not difficult because it contains both epithelial and spindle cell components.<sup>2</sup> However, care should be taken not to confuse the epithelial component with entrapped epithelium of alveoli or bronchioles; this was not the case in our patient.

Synovial sarcoma is characterised by translocation t(x: 8)(p11; q110). PCR studies for this translocation can help differentiate between the types of synovial sarcoma in the lung but despite its high sensitivity, molecular testing is not required if the diagnosis of synovial sarcoma is certain or probable on the basis of clinical, histological, and immunohistochemical evaluations.<sup>6,7</sup>

Two-thirds of primary pulmonary synovial sarcomas are centrally located and present with post-obstructive pneumonia, atelectasis, and haemoptysis. Peripheral tumours are less common and usually asymptomatic, but may infiltrate adjacent pleura, thoracic wall, and mediastinum, or metastasize to hilar or mediastinal lymph nodes, adrenal, brain, and spinal cord.<sup>8</sup> Our patient presented with a centrally located tumour with mild haemoptysis and chest pain, and the mediastinal pleura was involved and had to be excised with the tumour. With regard to imaging tools, a chest X-ray is usually the first and least accurate examination performed in all thoracic pathologies; 78% of these tumours have well-delineated circular opacity on posterior-anterior chest X-rays, with no sign of calcification.<sup>9</sup> A CT scan may reveal space-occupying lesions in the thoracic cavity with no specific radiological pattern compared with other mediastinal stromal tumours, including necrotic, haemorrhagic, or cystic components on section with areas of soft tissue density. There is no propensity for sidedness.<sup>10</sup> Pneumothorax may be evident in some patients.

The real site of origin (lung, pleura or mediastinum) is often unclear, but acute or recurrent haemothorax and a rim of ground-glass opacity surrounding the mass has been reported in a case of pulmonary synovial sarcoma.<sup>11</sup>

Owing to its rarity and the paucity of data



**Figure 2: Histologic features of the tumour.** (a) The dominant spindle cell components of the tumour consisted of intervening fascicles of densely packed elongated cells. (b) The smaller epithelial areas show glandular differentiation.

regarding its natural history, there are no guidelines for optimal treatment. Therefore, current treatment includes complete surgical resection (lobectomy or pneumonectomy) followed by adjuvant radiotherapy or chemotherapy.<sup>12</sup> Cure rates are related to how radical the resection was, even then recurrence has been seen.<sup>13</sup> Hence long-term follow up is mandatory. Prognosis is related to the disease stage and is usually poor. In available case series and reports, the five-year survival ranges between 36 and 76%.<sup>8</sup> A full-body scan is part of the management of these patients to rule out the presence of other primary sites. In our patient extensive clinical examination (done after histologic confirmation of the disease) did not reveal any other site of mass or dissemination of the tumour.

In conclusion, primary pulmonary synovial sarcoma is an extremely rare neoplasm. Clinical and imaging investigation is necessary to exclude alternative primary sources, while a definitive diagnosis requires detailed immunohistochemical staining. Surgical excision with clear margins and possibly adjuvant chemo-radiotherapy is the currently accepted treatment. In addition, due to the high risk of recurrences, long-term follow up is needed.

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## Author Declaration

Competing interests: none.

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