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Original Article

Knowledge, attitudes, and practice about bronchiectasis among general practitioners in four African cities

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ABSTRACT

Objectives: The survey was to determine Knowledge, attitude, and practices around bronchiectasis, as a starting point for the development of guidelines for care in African Countries.

Materials and Methods: This survey was administered to non-specialist physicians in urban health centers in Burkina Faso, Uganda, South Africa, and Ethiopia. Data were anonymized and analyzed at an individual level by country and health-care setting.

Results: A total of 388 participants were recruited from Ouagadougou (75/388, 19.3%), Kampala (85/388, 21.9%), Johannesburg (74/388, 19.3%), and Addis Ababa (154/388, 39.6%). Median age was 30 years, and 66% were male, with a median of 3-year medical experience. Knowledge about the definition, clinical presentation, and diagnosis of disease was good. However, guidelines for local practice were largely absent. Wide variation was reported in diagnostic and management practices. Physicians recognized the need for guidelines and further training.

Conclusion: This study highlighted the lack of local guidelines for bronchiectasis care in these settings and marked variation in approaches to investigation, diagnosis, and management within and between sites. Context-appropriate guidelines for bronchiectasis care in Sub-Saharan Africa are needed. These must be informed by local epidemiology, should reflect locally available resources and comorbidities including tuberculosis-disease, and should be codeveloped with local practitioners.

Keywords: Bronchiectasis, Tuberculosis, Post-tuberculosis lung disease, Sub-Saharan Africa, General practitioners

INTRODUCTION

Bronchiectasis is a respiratory disease characterized by irreversible dilatation of the airways, associated with chronic cough and sputum production.[1] Data from high-income countries (HICs) suggest a rising burden of bronchiectasis,[2-4] with severe disease associated with adverse patient outcomes including exacerbations, hospitalization, reduced quality of life, and increased mortality.[5-7]

However, very few data are available on the epidemiology of bronchiectasis in low- and middle-income countries (LMICs). This remains the case despite the high prevalence of risk factors including early childhood infections, pulmonary tuberculosis (TB), and HIV infection in these settings.[8-10] Emerging data from a new Indian Bronchiectasis Registry suggest that the epidemiology of disease in LMICs may be markedly different to that seen in HICs, with a higher proportion of younger male patients experiencing disease, frequently as a result of previous TB.[11] Outcomes associated with bronchiectasis in these settings remain unclear.

Guidelines for the diagnosis and management of bronchiectasis in routine clinical settings in LMICs are also limited. Guidelines used in HICs focus on individualized patient care and require specialist respiratory input.[12-14] These approaches are not easily applicable to LMICs where health care is largely decentralized and provided by general practitioners with little access to specialist care. Additional challenges faced in LMICs include the high prevalence of TB disease among those presenting with chronic cough[15] and the high burden of post-tuberculosis lung disease (PTLD) among TB survivors.[16]

Guidelines tailored to the diagnosis and management of bronchiectasis in resource-constrained settings are clearly needed, and a clear understanding of existing practices around bronchiectasis in LMICs will be a crucial starting point in their development. In this paper, we describe findings from a knowledge, attitudes, and practice (KAP) survey about bronchiectasis, completed among non-specialist doctors in four African cities.

MATERIALS AND METHODS

This cross-sectional study was completed in the four African cities of Addis Ababa (Ethiopia), Johannesburg (South Africa), Kampala (Uganda), and Ouagadougou (Burkina Faso) from March 2019 to April 2020.

A list of primary, secondary, and tertiary health facilities was compiled for each city from Ministry of Health and City Authority data. Public facilities were included in South Africa and Ethiopia, and private facilities were also included in Uganda and Burkina Faso. Facilities were convenience sampled from this list, based on ease of access, and were visited on a day convenient to the local investigator. All medical doctors who had completed a first degree, were working with adult medical patients, and were present on that day were eligible for inclusion. A pragmatic minimum sample size of 40 participants was agreed per city, and sampling continued until this number was met.

All participants were asked to complete a study questionnaire, which was developed by the study team based on the British Thoracic Guideline for Bronchiectasis[17] and personal experience of the local study leads. This included questions about bronchiectasis knowledge (definition, clinical presentation, diagnosis, and basic management), attitudes (beliefs about the importance of the condition and standards of training), and current clinical practice (availability of guidelines, access to diagnostic and management tools, and antibiotic use). The questionnaire was developed in English and translated into French for use in Burkina Faso by the local PI (ARO) with review by a professional translation service. Paper questionnaires were administered to participants in English or French and were self-completed by participants, with immediate return to the study team to be checked for missing data. Neither participant nor health facility names were included on the questionnaire, to ensure anonymity. Participants in Uganda received $3 each for participating in the study as required by the local IRB.

Quantitative data were analyzed using Epi Info 7.2 and R-studio. Data were described by country and health-care facility type. Chi-square or Fisher's exact tests were used to compare categorical variables, and ANOVA used to compare continuous parameters between groups. Ethics approval was obtained from the Institutional Review Boards in each country (Burkina Faso: 2019-3-038; Ethiopia: IMR/264/11; Uganda: MHREC 1649; and South Africa: HREC: M190753). Permission was sought from heads of facilities before data were collected. All participants provided a written informed consent.

RESULTS

Participant characteristics

A total of 388 participants were recruited from Burkina Faso (75/388, 19.3%), Uganda (85/388, 21.9%), South Africa (74/388, 19.3%), and Ethiopia (154/388, 39.6%). Median age was 30 years (IQR: 28–33 years), and 66% were male. On average, participants had been working for a median of 3 years (IQR: 2–6). However, marked variation was observed between sites with those in South Africa older, with a longer duration in practice, and more likely to be working in tertiary care facilities. All participants in Ethiopia and South Africa were recruited from the public sector while 72.1% (49/75) and 27.9% (19/85) of participants in Burkina Faso and Uganda were recruited from the private sector, respectively [Table 1].

Knowledge

The majority of participants (333/388, 85.8%) knew that bronchiectasis is defined by chronic irreversible dilatation of the airways. Participants who selected an incorrect definition were marginally older than those who chose the correct definition (32 years [IQR: 29–39.5] vs. 30 years [28–32], $P < 0.001$), but no differences were noted by health facility type [Table 2].

Table 1: Participant characteristics.

Characteristic	All, *n*=388	Burkina Faso, *n*=75	Ethiopia, *n*=154	South Africa, *n*=74	Uganda, *n*=85	*P*-value
Male *n* (%)	256 (66.0)	53 (70.7)	106 (68.8)	42 (56.7)	55 (64.7)	0.278
Age (years) (median, IQR)	30 (28–33)	30 (29–33)	28 (27–30)	33 (31–39)	30 (28–34)	<0.001
Health facility setting (*n*, %)						
Primary	37 (9.5)	6 (8.0)	22 (14.3)	2 (2.7)	7 (8.2)	<0.001
Secondary	173 (4.6)	18 (24.0)	86 (55.8)	28 (37.8%)	41 (48.2)	
Tertiary	110 (28.4)	2 (2.7)	46 (29.9)	44 (59.5)	18 (21.2)	
Private	68 (17.5%)	49 (65.3%)	0 (0.0%)	0 (0.0%)	19 (22.4)	
Years in practice (median, IQR)	3 (2–6)	2 (1–3)	2 (2–4)	8 (6–13)	4 (2–6)	<0.001

Most participants (356/388, 91.7%) also knew that the diagnosis of bronchiectasis is based on imaging, with computerized tomography (CT) identified as the gold standard diagnostic tool by 87.0% (310/356). However, only half (200/388, 51.5%) correctly identified ring and tramlines as the dominant feature of bronchiectasis seen on plain CXR. This proportion was highest in tertiary health facilities (75/111, 67.6%) [Figure 1], and among those practitioners from facilities with CXR capacity, compared to those without (184/345 [53.3%] vs. 10/38 [26.3%], $P = 0.003$).

The most common risk factors identified for bronchiectasis were TB (327/388, 84.3%) and childhood chest infections (212/388, 54.6%). HIV was identified as a common risk factor by less than a third of practitioners in Burkina Faso (23/75, 30.7%) and Ethiopia (42/154, 27.3%), but over half of those in Uganda (43/85, 50.5%) and South Africa (53/74, 71.6%).

Clinical features of both disease and exacerbations were well recognized: Chronic productive cough was widely identified as the most common symptom of disease by 94.1% (365/388), with increased sputum volume and breathlessness correctly identified as common features of exacerbation by 84.8% (329/388) and 73.7% (286/388), respectively. The majority of participants (323/388, 83.2%) recognized that patients with bronchiectasis are at risk of recurrent chest infections.

Knowledge about recommended investigations and management varied widely. When asked which laboratory tests should be completed as part of a standard "workup" for bronchiectasis, sputum mycobacterial culture was selected by 54.1% (20/37), 74.0% (128/173), 82.9% (92/111), and 85.3% (58/68) of respondents from primary, secondary, tertiary, and private care settings, respectively [Table 2].

Among the therapy options presented to participants, daily airway clearance and antibiotics during exacerbations were selected as the most important measures by 55.3% (215/389) and 50.1% (195/389) of participants. Over half (214/388, 55.1%) reported that the recommended antibiotic duration was 10–14 days, while 12.8% (50/359) chose >14 days and 7.5% (29/385) chose 5 days.

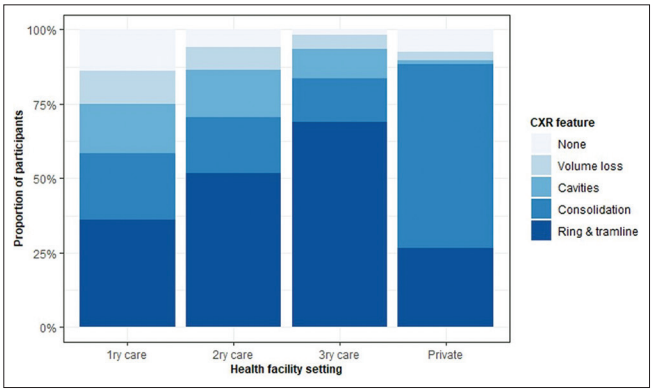

Figure 1: Dominant feature of bronchiectasis on CXR selected by participants, by health facility setting.

Attitudes

Almost two-thirds of participants (243/387, 62.8%) somewhat or strongly agreed that bronchiectasis is a common condition among adults in their setting. However, this proportion varied widely from Burkina Faso (9/75, 12.0%) to South Africa (69/74, 93.3%). The majority of participants in all countries (374/387, 96.9%) felt that general practitioners in their setting need more training on the diagnosis and management of bronchiectasis. Similarly, 82.0% (373/387) strongly agreed that local guidelines for the diagnosis and management of bronchiectasis are needed.

Practice

Overall only 17.3% (67/387) of participants had guidelines or protocols to follow when managing patients with bronchiectasis. Substantial variation was seen between countries: Very few practitioners in Burkina Faso had access to guidelines (1/75, 1.3%), while 29.7% (22/74) in South Africa and 22.9% (35/153) in Ethiopia reported that these were available. The majority of those who had access to guidelines were based in secondary and tertiary centers (53/57, 93.0%). The guidelines referred to included Ugandan and Ethiopian National guidelines or "Standard treatment" guidelines, documents from the World Health Organization

Table 2: Bronchiectasis knowledge.

Variable	All, *n*=388	Burkina Faso, *n*=75	Ethiopia, *n*=154	South Africa, *n*=74	Uganda, *n*=85	*P* value
Definition (*n*, %)						
Chronic irreversible airway dilatation	333 (85.8)	70 (93.3)	142 (92.8)	61 (82.4)	60 (70.6)	<0.001
Reversible airway dilatation	25 (6.4)	4 (5.3)	5 (3.2)	3 (4.1)	13 (15.3)	
Scarring/fibrosis of lung tissue	24 (6.2)	0 (0)	6 (3.9)	10 (13.5)	8 (9.4)	
Consolidation within lung tissue	6 (1.6)	1 (1.3)	1 (0.6)	0 (0)	4 (4.7)	
Gold standard diagnostic test (*n*, %)						
Chest CT scan	310 (79.9)	47 (62.7)	136 (88.3)	61 (82.4)	66 (77.6)	<0.001
CXR	46 (11.9)	21 (28.0)	5 (3.2)	9 (12.1)	11 (12.9)	
Lung function	17 (4.4)	6 (8.0)	4 (2.6)	1 (1.4)	6 (7.1)	
Spirometry	15(3.9)	1 (1.3)	9 (5.8)	3 (4.1)	2 (2.4)	
Main sign on CXR (*n*, %)						
Consolidation	107 (27.6)	49 (65.3)	25 (16.2)	5 (6.8)	28 (33.3)	<0.001
Ring and tramlines	200 (51.5)	23 (30.7)	91 (59.1)	50 (67.6)	36 (42.9)	
Volume loss	24 (6.2)	0 (0)	12 (7.8)	5 (6.8)	7 (8.3)	
Cavities	50 (12.9)	1 (2.3)	26 (16.9)	18 (24.3)	5 (6.0)	
None	22 (5.7)	2 (2.7)	12 (7.8)	0 (0)	8 (9.5)	
Common risk factors (*n*, %)						
Childhood chest infections	212 (54.6)	56 (74.7)	65 (42.2)	49 (66.2)	42 (49.4)	<0.001
TB	327 (84.3)	62 (82.7)	121 (78.6)	70 (94.6)	74 (87.1)	<0.001
HIV	160 (41.2)	23 (30.7)	42 (27.3)	52 (70.3)	43 (50.6)	<0.001
Asthma	147 (37.9)	35 (46.7)	72 (46.7)	11 (14.9)	85 (34.1)	<0.001
Allergic bronchopulmonary aspergillosis	171 (44.1)	37 (49.3)	67 (43.5)	21 (28.3)	46 (54.1)	0.007
Three most important therapies (*n*, %)						
Daily airway clearance	215 (55.4)	41 (54.7)	83 (53.9)	59 (79.7)	32 (37.6)	<0.001
Decreasing amount of activity	57 (14.7)	27 (36.0)	20 (13.0)	1 (1.3)	9 (10.6)	<0.001
Daily antibiotics	110 (28.3)	21 (28.0)	50 (32.5)	2 (2.7)	37 (4.4)	<0.001
Antibiotics during exacerbations	194 (50.0)	40 (53.3)	92 (59.7)	32 (44.2)	30 (35.3)	0.002
Inhaled corticosteroids	126 (32.5)	34 (45.3)	63 (40.9)	2 (2.7)	27 (31.8)	<0.001
Inhaled bronchodilators	89 (22.9)	24 (32.0)	39 (25.3)	4 (5.4)	22 (25.9)	<0.001
Vaccination pneumococcal and influenza	92 (23.7)	16 (21.3)	23 (14.9)	46 (62.7)	7 (8.2)	<0.001
Recurrent TB treatment	15 (3.9)	4 (5.3)	5 (3.2)	1 (1.3)	5 (5.9)	0.406
Recommended duration of antibiotics for exacerbations (*n*, %)						
5 days	29 (7.5)	0 (0)	3 (2.0)	18 (24.3)	8 (9.4)	<0.001
7 days	94 (24.2)	10 (13.0)	41 (26.8)	21 (28.4)	22 (25.9)	
10–14 days	214 (55.1)	45 (60.0)	98 (64.1)	27 (36.5)	43 (50.6)	
>14 days	50 (12.9)	19 (25.3)	11 (7.2)	8 (10.8)	12 (14.1)	
None	1 (0.3)	1 (1.3)	0 (0)	0 (0)	0 (0)	

TB: Tuberculosis

or the British Thoracic Society, and the evidence database "UpToDate" (Wolters Kluwer, Waltham, MA, USA).

The majority of practitioners in all countries had access to blood tests (346/388, 89.2%), oxygen saturation measurement (341/388, 87.9%), and plain chest radiographs (350/388, 90.2%) within their health facilities. Only 19.5% (76/389) and 12.6% (49/389) of participants reported access to spirometry and full lung function testing, respectively. Sputum culture was easier to access in South Africa compared to elsewhere, including both routine (93.3% [70/75] vs. 25.5% [80/314], $P < 0.001$) and TB culture (78.7% [59/75] vs. 32.5% [102/314], $P < 0.001$) [Table 3]. CT imaging was available largely to practitioners from South Africa, and those working in the private sector in Burkina Faso and Uganda, with only 11.8% (29/246) of practitioners in the public sector outside of South Africa able to access this.

A wide range of antibiotics are being used for the treatment of exacerbations [Figure 2]. The most common agent was oral co-amoxiclav, used by 64.8% (252/389). Piperacillin/tazobactam was reported by 10 participants located in Uganda or South Africa, and Meropenem use was reported by 12 practitioners spread across all health facility types in Uganda. Ciprofloxacin use was lower in South Africa, compared to other countries (14.7% [11/75] vs. 45.5% [143/314], $P < 0.001$). Access to chest physiotherapy was reported by 90.5% (67/74) of practitioners in South Africa,

Table 3: Participant practice.

Variable	All, *n*=388	Burkina Faso, *n*=75	Ethiopia, *n*=154	South Africa, *n*=74	Uganda, *n*=85	*P* value
Guidelines/protocol followed for patient management (*n*, %)	*n*=387*		*n*=153*		*n*=85	
Yes	67 (17.3)	1 (1.3)	35 (22.9)	22 (29.7)	9 (10.6)	<0.001
No	232 (60.0)	52 (69.3)	85 (55.5)	36 (48.6)	59 (69.4)	
Not sure	88 (22.7)	22 (29.3)	33 (21.6)	16 (21.6)	17 (20.0)	
Tools available for patient assessment, within health facility (*n*, %)						
Oxygen saturation	341 (87.9)	59 (78.7)	135 (87.7)	67 (90.5)	80 (94.1)	0.022
Spirometry	75 (19.3)	18 (24.0)	8 (5.2)	44 (59.4)	5 (5.9)	<0.001
Full lung function (lung volumes +/− gas transfer)	49 (12.6)	2 (2.7)	5 (3.2)	36 (48.6)	6 (7.1)	<0.001
Blood tests (FBC, renal function, liver function)	346 (89.2)	66 (88.0)	134 (87.0)	70 (94.6)	76 (89.4)	0.544
Sputum culture for respiratory organisms	149 (38.4)	25 (33.3)	24 (15.6)	69 (93.2)	31 (36.5)	<0.001
Sputum culture for *Mycobacterium tuberculosis*	160 (41.2)	23 (30.7)	36 (23.4)	58 (78.4)	43 (50.6)	<0.001
CXR	350 (90.2)	60 (80.0)	140 (90.1)	73 (98.6)	77 (90.6)	<0.001
CT imaging	125 (32.2)	27 (36.0)	18 (11.7)	60 (81.1)	20 (23.5)	<0.001
Access to chest physiotherapy services (*n*, %)	*n*=384*		*n*=152*	*n*=73*	*n*=84*	
Yes	136 (35.4)	18 (24.0)	23 (15.1)	66 (90.5)	29 (34.5)	<0.001
No	199 (51.8)	42 (56.0)	111 (73.0)	4 (5.4)	42 (50.0)	
Not sure	49 (12.8)	15 (20.0)	18 (11.9)	3 (4.1)	13 (15.5)	

*Missing data for this question

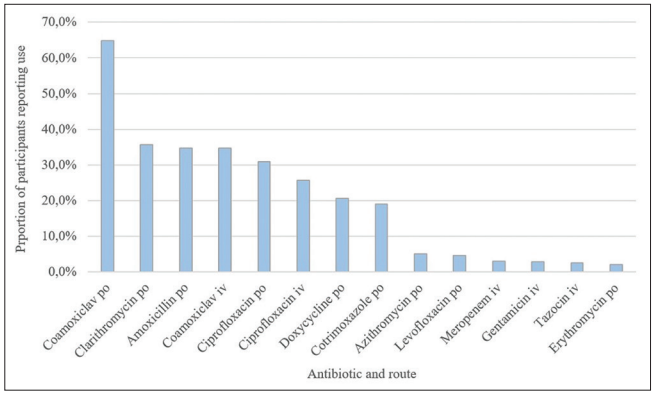

Figure 2: Proportion of participants reporting use of various antibiotics and routes, across all countries.

compared to 22.5% (70/311) of practitioners elsewhere. However, among those with access, only 53.3% (73/137) routinely refer patients for chest physiotherapy treatment.

DISCUSSION

In this paper, we explore KAPs about bronchiectasis among non-specialist doctors in four African cities. Our findings suggest good knowledge about bronchiectasis, its definition, and common risk factors. However, guidelines for local practice were absent, with variation observed in diagnostic and management practices, and reliance on approaches recommended for HICs with little adaptation to local resource capacity.

Participants displayed reasonable knowledge about the diagnosis and definitions of bronchiectasis – the majority were aware of CT imaging as the gold standard for diagnosis, correctly identified symptoms of disease and exacerbations, and knew that recurrent infections may be a consequence of disease.

TB was correctly recognized as an important risk factor by 84% of participants. TB incidence lies between 48 and 500/100,000 in these four countries,[18] and over a third of adult pulmonary TB survivors are thought to have residual bronchiectasis,[16,19,20] such that it is indeed likely that TB is a dominant risk factor for airways disease in these settings. Similarly, chronic HIV infection has been associated with small and large airway pathology,[8] and the recognition of HIV as a risk factor for bronchiectasis increased with the population prevalence: Under a third recognized HIV as a common risk factor in Burkina Faso and Ethiopia (HIV prevalence 0.7% and 1.0%), but 50–70% identified it as a common risk factor in Uganda and South Africa (HIV prevalence 6.5% and 20.4%).[16] However, only half of participants identified childhood infections as a common cause of disease, while ABPA and asthma were identified by approximately 40% of participants. Data from a recently established Indian bronchiectasis registry suggest that almost a quarter of disease in India is post-infectious, while <10% is related to ABPA and 2.5% to asthma and it is likely that patterns may be similar in Africa.[21] If true, the understanding of risk factors among practitioners in this study may reflect the dominance of bronchiectasis literature focused on HICs, where airways disease may be relatively more important.

Variation was observed in approaches to diagnosis and management, and may reflect the lack of established patient pathways and guidelines for bronchiectasis care. Less than a fifth of participants overall had access to any guidelines, and among those that did, many were using documents produced by organizations which are largely focused on care in HICs.

Knowledge of diagnosis and investigations for bronchiectasis appeared correspondingly poorly tailored to the LMIC context. Although CXR was the only imaging modality available to the majority of practitioners, only half knew that ring and tramline changes are the pathognomonic appearance of bronchiectasis on CXR. Despite being in high TB burden settings, only half to three quarters of participants in primary and secondary care selected sputum mycobacterial culture as a relevant investigation to perform in the work-up of patients.

Use of locally appropriate strategies for bronchiectasis management was also limited. Airway clearance exercises are a mainstay of bronchiectasis treatment in international treatment guidelines.[12,13] They are cheap and can be performed independently with minimal equipment, making them a feasible management option in LMICs. However, only half of participants identified regular airway clearance as a management priority, with little access to chest physiotherapy outside of South Africa.

Use of antibiotics for exacerbations was identified as a management priority by only half of participants, and the antibiotic agents and treatment durations used for exacerbations varied widely. The widespread use of ciprofloxacin – a fluoroquinolone with activity against *Mycobacterium tuberculosis* – is worrying in high TB incidence settings, as was the reported use of carbapenems even in primary care settings in Uganda. Access to sputum culture in settings outside of South Africa was limited, and microbiological data are, therefore, needed to guide empirical antibiotic use and prevent emergence of antimicrobial resistance.[22]

Finally, the proportion of participants who felt that bronchiectasis was common in their setting varied from just 12% in Burkina Faso to 93% in South Africa. This may reflect differences in medical training or the true burden of disease in these settings, perhaps as a result of the variation in TB incidence from 48/100,000 to 500/100,000 between these settings.[23] More data on the epidemiology of disease are required to determine this. However, the majority of the study participants in all settings would welcome more training and clear guidelines for management.

This study had several limitations. No standardized tool was available to assess KAP about bronchiectasis. The health facilities included were convenience sampled, based in urban areas, and relatively well resourced, and findings cannot be generalized to rural or less well-resourced settings. Data from practitioners were analyzed at an individual rather than facility level, and so "clustering" of findings by facility cannot be assessed. While participants were asked about their knowledge and practice, routine practice was not observed, and there may have been reporting bias. Finally, in this study, we assessed knowledge and practice of a specific type of pathology – bronchiectasis – but local practitioners may have been more familiar with syndromic descriptions of disease using terms such as "chronic cough" or "PTLD," and questionnaire answers may have been different if these terms had been used.

Strengths of this study include our focus on a hitherto neglected disease in Africa, inclusion of non-specialist practitioners who are responsible for the majority of care in these settings, and large sample size. The survey covered a range of subjects relevant to the development of guidelines and training materials.

Our findings have several implications. First, there is a clear need for context-appropriate guidelines for bronchiectasis care in these settings. We suggest that these guidelines should be informed by data on local epidemiology and codeveloped with local practitioners. They should be suitable for decentralized care, with emphasis on low-cost patient-centered interventions such as chest physiotherapy, and with recommendations for appropriate antibiotic use. Consideration should be given to whether these guidelines are best targeted at syndromes such as "chronic cough" or PTLD, or at bronchiectasis itself, but whatever the approach, care should be taken to prioritize investigation and treatment for active TB disease in all adults presenting with chronic cough in high TB incidence settings. Finally, we call on the international community of bronchiectasis researchers to ensure broader representation of LMICs in bronchiectasis disease registries and research collaborations to ensure that low-resource settings are not left behind as management of this important chronic condition progresses.

CONCLUSION

This study identified the knowledge, attitude and practice gaps in the management of bronchiectasis in Sub-Saharan Africa. These gaps may be related to the lack of data about the epidemiology of the disease in the region and deficit of guidelines for its management. Our findings suggest the need for guidelines for local investigation, diagnosis and management as per the resource availability in the region. Further studies are needed to describe disease epidemiology and current management practices in both urban and rural settings in sub-Saharan Africa.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

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