Spirometry in Africa
2017 - 2023
By Lindsay Zurba
Included....

1. What we’ve been doing
2. The numbers
3. Successes
4. Challenges
5. Future directions
Acknowledgements

1. Afripaed
2. PATS
3. PATS Spiro Team
4. Funders / Donors
5. Students
6. All involved
Limitations to spirometry access in Africa

1. Limited access to training
2. Limited access of skilled technicians
3. Limited availability of equipment and technical support
4. Limited consumables
5. Lack of human resources
6. Lack of financial resources
7. Lack of local guidelines
8. Lack of country specific local research
1. Limited access to training and technicians

• Nigeria - 34% of the cohort had the ability to perform basic spirometry

• Few African spirometry-training programs

• Formal courses were only in South Africa

• No spirometry training accreditation or endorsement guidelines in place in South Africa or Africa
3. Limited availability of equipment and technical support

• Little to no access to pulmonary function laboratories

• Uganda - spirometry available in only 13.6% of the private hospitals and 34.8% of public hospitals (Kibirige et al)

• 2013 Nigeria  34% of respondents had access to full spirometry on patients
4. Limited local equipment and consumables suppliers

• Local spirometry equipment service providers are available in only a few African countries = escalated costs due to shipping etc

• Poor access to on-site technical support

• Scarce equipment calibration facilities

• Long delays in access to consumables

• Online low cost purchases and resultant challenges
5. Lack of human resources

**Physicians per 1000 population:**
- 0.019 per 1000 in Malawi
- 0.198 per 1000 in Kenya
- 0.408 per 1000 in Nigeria
- 0.779 per 1000 in South Africa
- High-income countries vary between 2 and 4 per 1000 population

**Paediatricians per 100 000 population:**
- High income countries 11 to 86 (UK) and Germany
- African countries 0.03 and 0.8
- Many African countries no paediatric pulmonologist
- Only 11 paediatric pulmonologists trained over a 10-year period
- Specialists did not use spirometry for diagnosis
6. Lack of financial resources

- Competing interests in healthcare budgets in LMICs
- In the state-funded sector, access to specialized testing and equipment is limited
- Inequity in terms of access to care
- Unstable electricity supply and access to electricity in more rural facilities
7. Lack of local guidelines for spirometry

- Necessary to take into account the local context and disease spectrum in a population
- Only South Africa had published local guidelines for both adults and children
8. Lack of Country specific local research

• Interpretation of spirometry is based on appropriate references for the individuals’ age, gender, height and ethnicity compared to the local population. This requires the collection from large numbers of healthy people form the population.

• With the exception of North Africa, this has not been collected in the majority of African populations = incorrect interpretation
Aims

• PATS - promotion of education and training initiatives
• Address poor access to spirometry in Africa
• International standard, African specific, foundational spirometry training programme
• Funding support from the Lung Health in Africa across the life course (LuLi), the National Institute for Health Research (NIHR) Global Health Research, and the European Respiratory Society (ERS).
• Purpose of increasing knowledge, practice, awareness and access to high quality spirometry in African workplaces and research units
PATS Spirometry Portfolio

Training Courses
1. Adult and Paediatric Foundational Spirometry Certificate of Competence - Short Course
2. Spirometry Data Review and Quality Assurance Workshop
3. Spirometry Refresher Training
4. Spirometry Train-the-trainer
5. FeNO Short Course
6. Peak Flow Workshop

Other
7. Improving educational materials and eLearning platforms
8. Spirometry Equipment Loans
9. Spirometry Support
10. Spiro mentorship
Current PATS Spirometry Training Initiatives in Africa
1. PATS Adult and Paediatric Foundational Spirometry

Certificate of Competence Short Course
1. PATS Certificate of Competence in Adult and Paediatric Foundational Spirometry

- Hybrid

- Focus on our unique African settings and challenges

- The full course takes at least 2 months to complete in 3 stages:
  - Theory online / Prac online / Assessments online
  - Or in person training
  - Portfolio of evidence workbook
Number of courses held 2017 – 2023

- 2017 – 3 (75 / 25)
- 2018 – 11 (146 / 13)
- 2019 – 15 (202 / 13)
- 2020 – 3 (32 / 11)
- 2021 – 11 (66 / 6)
- 2022 – 9 (93 / 10)
- 2023 – 1 (101 / 101)

Average 11 courses / year over 5 years
Percentage students trained in each country

Total Number of Students: 715
Number of students per course

Average number of Students per Course: 13
Percentage of female & male students

Total No of Students: 715

Female 59%
Male 41%
Percentage of students overall who passed theory on first attempt: 56%
Percentage students per country who passed theory re-write

Percentage of students overall who passed theory re-write: 9%
Percentage students per country who passed practical assessment on 1st attempt:

- Cameroon: 0%
- Ethiopia: 51%
- Gambia: 86%
- Ghana: 78%
- Kenya: 93%
- Malawi: 93%
- Mozambique: 56%
- Nigeria: 50%
- South Africa: 44%
- Sudan: 4%
- Tanzania: 8%
- Uganda: 72%
- Zimbabwe: 100%

Percentage students overall who passed practical assessment on 1st attempt: 61%
Percentage students per country who passed practical assessment on 2\textsuperscript{nd} attempt

Percentage students overall who passed prac on 2\textsuperscript{nd} attempt:

2%
Percentage students per country who submitted PoE's

Percentage students overall who submitted PoE’s: 35%
Percentage students per country who passed PoE on 1st attempt

Percentage students overall who passed PoE on 1st attempt: 16%
Percentage students per country who passed PoE on 2\textsuperscript{nd} attempt

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<tr>
<th>Country</th>
<th>% per Country</th>
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<td>Zimbabwe</td>
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Percentage students overall who passed PoE on 2\textsuperscript{nd} attempt: 2%
Percentage students per country who received certificates of competence

Percentage students overall who received certificates of competence: 20%
2. Spirometry Data Review and Quality Assurance Workshop

Certificate of Competence Short Course
2. Spirometry Quality Assurance and Over Reading Workshop

• Intended for African respiratory researchers

• Aims to establish new foundations for standardised, original and innovative quality assurance processes for research sites in Africa

• 1-day workshop augments the foundational spirometry training programme with spirometry data management, quality assurance and over-reading principles
3. Spirometry Refresher Training

Certificate of Attendance 1 Workshop
4. Spirometry Train-the-trainer
3. Train the trainer

- Training opportunities are offered for individuals who would like access to further training to become future PATS spirometry trainers and spirometry champions in host countries.

- Successfully supported spirometry trainers in Malawi, Kenya, Nigeria, Cameroon, Uganda, Nigeria, Tanzania, Cameroon, Ghana with others still in training in Zimbabwe, The Gambia, Mozambique
5. FeNO Short Course

Certificate of Competence Short Course
Fractional Exhaled Nitric Oxide (FeNO)

Children who develop asthma
Allergic asthma
Refractory eosinophilic asthma
Non-atopic severe asthma
Poorly controlled asthma/exacerbations
Asthma exacerbated by aspirin (AERD)
Nasal polyposis
Allergic rhinitis

Non-atopic asthma
Asthma due to smoking
Asthma and obesity
Severe neutrophilic asthma
Neonatal respiratory distress syndrome
Bronchopulmonary dysplasia

>20 ppb

<20 ppb
6. Peak Flow Workshop

Certificate of Competence Short Course
Training feedback

1. “This course is a great opportunity in my professional life. I can say it was the best thing to drive me in my profession in 2021.” (Gambia 2021)
2. “I was highly edified by this skill strengthening. Thank you to Lindsay for her availability and ease of understanding me spirometry. For the next sessions you need a French translation”. (Gambia 2021)
3. “Training has been awesome and efficient and very effective. Good teamwork and effective communication”. (Gambia 2021)
4. “I really enjoy this course a lot, it gave me another level of inspiration on it. The knowledge gained on this course will go a long way”. (Gambia 2021)
5. “Let me take this opportunity to greatly appreciate your invaluable and passionate teaching you gave us. Personally, you armed me with a critical skill that I hope to share will others. I hope to continue learning more from you and the Pan African Thoracic Society. Thank you once again.” (Tafadzwa Nyamukapa – Zimbabwe 2021)
6. “I went into this feeling so negative and unsure of my abilities and came out at the other end full of knowledge and rearing to go. It didn’t come easy and I had to really study but with encouragement from you and your amazing team I survived! You all made me want to push myself and prove to myself that I could do it. Thank you for helping me find myself again during our time spent together and also for the ongoing encouragement you gave to everyone else.” (Jill Hall, South Africa 2021)
7. “The training was well organised and a smooth navigation from the first to the final steps of doing the test. This made it easy for me to grab the knowledge without using a lot of energy” (Julieth Lalashowi, Tanzania 2021)
7. Improving Training Content
Improving Spirometry Educational Content

We need:

• To formalise all processes and courses
• Dedicated PATS controlled eLearning platform
• Human Resources to load and manage
• Admin support
• Digital media and marketing
8. Spirometry Equipment Loans

Certificate of Competence Short Course
4. Spirometry Equipment Loan

- PATS has a limited number of spirometers, donated by the ERS, available for loan to African respiratory researchers.
- Preference is given to PATS MECOR students
- Requests for loan equipment are considered by the PATS spirometry committee on submission of a formal request in writing, submission of the proposal for research and funding statements.
PATS equipment repository (supported by ERS), supports emergent researchers to complete research in respiratory health. In 2022 we supported four investigators with spirometers on the following projects:

- Effects of eight-week exercise-based pulmonary rehabilitation programme on lung function, functional exercise capacity and quality of life of individuals with pulmonary tuberculosis amelioration.; Dr Oyenike Adebajo AYO-OGUNSEYE, University of Ibadan, Ibadan, Nigeria
- Proposal for support to set up spirometry service and conduct research in validating the 2012 GLI equations in Ghanaian children.; Dr Rafiuk Cosmos Yakubu, Ghana
- Multidimensional assessment of asthma phenotypes among patients attending an urban tertiary hospital in Lagos.; Dr Temitope Fapohunda, Lagos State University Teaching Hospital (Lasuth), Ikeja, Lagos, Nigeria
- Asthma and Vitamin D Status in Secondary School Children with and without Obesity in Enugu.; Dr Adaace C. Ayuk, College of Medicine, University of Nigeria Nsukka
9. Spirometry Support

Certificate of Competence Short Course
Spiro Support

✓ Guidance on equipment queries, such as understanding and utilising software correctly, hardware, suppliers, and disposables

✓ Remote assistance while testing

✓ Data management methods

✓ Writing workplace specific spirometry SOPs

✓ Spirometry over reading
10. Spiro mentorship
Successes and Challenges
Successes

- Funding for course development and human resources
- Students access to the updated course material prior to the face-face-training
- Reliable communication between sites and program manager
- Identification of loyal spirometry champions to ensure ongoing local support
- Ongoing post-training support and mentorship.
Challenges

• Funding for trained teaching staff to travel
• Limited language of teaching materials
• Lack of availability of equipment to complete portfolios
• Outdated equipment software to allow appropriate reporting
• Critically short supply of local technical support
Future areas for research and action

- Prevalence and incident data of NCDs and CRDs in African countries
- Reference ranges for spirometry based on population specific healthy data
- Accurate assessment of the type and extent of the challenges to spirometry access: specifically details of equipment used, problems with access to consumables and technical support, and safety, particularly in settings with high infectious disease burden.
- Assessment of efficacy and sustainability of spirometry training programs; and the impact of improved spirometry access.
- Establishing clinical utility of spirometry testing in CRDs in Africa. Notably, the impact of screening and early diagnosis of CRD.
Future areas of focus in training

- Update all courses
- Formalisation of the spirometry data review and quality assurance training programme
- Post course mentorship & support
- Equipment loan to those in need
Conclusion

- We have made progress
- Much work still needed to meet the challenges faced
Conclusion

We need:
- More equipment
- More time
- A dedicated eLearning platform and IT support
- Local, standardised, and context-specific training
- To develop appropriate local reference standards
- Innovative approaches to addressing the challenges of access to equipment, consumables and technical support
- Training and research collaborations that include regional thoracic societies, health system leaders, the Pan African Thoracic Society and international role
References

✓ PATS spirometry training records
✓ Refiloe Masekela,¹,* Lindsay Zurba,² and Diane Gray ³
