Cookstoves and Pneumonia Study (CAPS) in Malawi
BREATHE Partnership
Current projects

- CAPS trial [www.capstudy.org](http://www.capstudy.org)
- BREATHE Partnership grant
- Burden of Adult Lung Disease study in Malawi GSK
- Two WT Fellowships (one complete on lung mechanisms and one ongoing on pneumonia)
- MRC grant Adult Lung Health Survey
Talk overview

Introduction
  • Recognition of a problem
  • Macrophage carbon load and exposure
  • Symptoms, lung function
  • Air quality data

Approach to control and lessons learned
  • Cookstove trial design
  • Intervention & Implementation
  • Air sampling & Monitoring
  • Endpoint measurement

Collaboration to make a regional difference
  • PCIA and then GACC
  • BREATHE
  • PATS MECOR

Summary
Recognition of a problem – lung macrophages

Macrophages and exposure

Fullerton et al. Trop Med Int Health 2009
Recognition of problem: symptoms

- Difficult to determine low exposure group
- Compared 160 adults cooking on charcoal with 174 cooking on wood
- 61% of group were women

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<thead>
<tr>
<th></th>
<th>Charcoal</th>
<th>Wood</th>
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<tbody>
<tr>
<td>Cough</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Phlegm</td>
<td>9</td>
<td>6</td>
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<tr>
<td>Breathlessness</td>
<td>15</td>
<td>11</td>
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<tr>
<td>Asthma</td>
<td>10</td>
<td>7</td>
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<tr>
<td>Respiratory infection</td>
<td>13</td>
<td>9</td>
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<td>Previous TB</td>
<td>13</td>
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Clear symptom excess in wood burning households

Prevalence of chronic lung disease

330 Malawian adults lung function -11% reduced FEV1

- Age p<0.0001
- Gender p<0.0001
- Height p<0.0001
- Cooking fuel – WOOD p<0.0001
- Smoking p=0.112
- NOT location (rural/urban)

Biomass use and the scale of toxic exposure

- **Air sampling**
  - Domestic
  - Personal

- **Gravimetric methods**
  - Gold standard
  - Collect a physical sample of PM
  - Total inhalable or respirable

- **Direct reading instruments**
  - Photometry
  - Sidepak- respirable dust
  - HOBO for CO concentration
  - UCB-PM
Levels of inhaled particulates are high

High 24hr average (rural>urban) and toxic while cooking.

Fullerton DG et al. *OEM* 2009;63:288
PCIA Uganda 2009

- Cleaner fuels
- Cleaner stoves
- Change behaviour
- Improve ventilation

Approach to control and lessons learned

The “chitetso” stove is homemade with clay and is (almost) financially accessible in rural villages. It cannot be anticipated to have a health benefit resulting from decreased smoke exposure.

Malawi Cookstove and Pneumonia Study (CAPS)

- **Advanced cook stove intervention to prevent pneumonia in children under 5 years old in Malawi: a cluster randomised controlled trial**

- High death rate among infants and under 5s (69 and 110 per 1000 live births).

- Pneumonia is the most common cause of death.

- **Population:** 10,000 Malawian children under the age of 5yrs

- **Intervention:** High impact stove to reduce smoke exposure

- **Control:** Traditional open fires

- **Outcome:** Pneumonia (defined using the WHO IMCI and consistent with PERCH)

- **Time:** Observation for 24 months
Cooking and Pneumonia Study
Africa Clean Energy - Lesotho
Top of the range, with health benefits
CAPS study introducing stoves

- Village level consent
- Training
- 2 stoves per house
- Solar panel charging
- Support and maintenance
- Contract for non-sale
CAPS study measuring exposure

- Particulates
  - Static
  - Personal
- CO
  - Child
- HbCO
  - Child

- SUMs
  - Stove
Personal monitoring
Total CAPS population: 10,000 children from 8000 HH

Personal CO monitoring (48 hr every 6 mo) and non-invasive carboxyHb measurements in children 2000 children from 2000 HH (70 Lascar monitors available; 3 Rad 57s available) [KM leading – MRC NIRG]

SUM on 1 of their stoves 400 HH from intervention arm (400 SUMs available) [DH or KC leading – CAPS]

Aprovecho monitors

CO, PM2.5 and BC assessments on women and households +/- induced sputum [J Grigg leading - CAPS] N=?

Sub samples all obtained by random probabilistic sampling from each cluster
CAPS study: how smoky is it?
CAPS study measuring endpoints

Child pneumonia
CAPS study measuring endpoints

Child pneumonia – fast, difficult breathing
CAPS study project team
Clean Indoor Air in Africa: cook stoves, partnerships and capacity building

Introduction - biomass smoke
  • Definition and distribution
Recognition of a problem
  • Macrophage carbon load and exposure
  • Symptoms, lung function
  • Air quality data
Approach to control and lessons learned
  • Cookstove trial design
  • Intervention & Implementation
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Collaboration to make a regional difference
  • PCIA and GACC
  • BREATHE
  • PATS MECOR
Summary
Global Alliance for Clean Cookstoves

Exposure to cookstove smoke doubles a child’s risk of contracting pneumonia.

photo by: Michael Benanav

LEARN MORE

Find Out More
Clean cookstoves save lives, improve livelihoods, empower women, and combat climate change.
Learn More »

Support the Alliance
Support life-saving clean cookstoves for the nearly 3 billion people who lack healthy and efficient cooking solutions.
Get Involved »

DONATE

Make a Donation
Click the link below to make a financial contribution to support the Alliance.
Donate Now »

LEARN MORE

Award-Winning Chef José Andrés...
Andrés brings culinary and development experience to raise awareness of the Alliance.
Read More »

Cookstoves and Non-Communicable Diseases
Read the new fact sheet on cookstoves and non-communicable diseases.
Read More »

FICCI Joins the Global...
FICCI will support the Alliance and work as a Champion to support the initiative.
Read More »

Clinton Takes “Clean Cookstove”...
In India, Clinton pushed one of her transformative diplomatic priorities:
Read More »

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GACC Health Working Group research needs

- Current evidence of health impacts of HAP
  - Inventory of existing studies, centres and infrastructure
  - Ongoing public health, basic science, animal studies, and technology advances of stoves, monitors and fuels

- Evaluation of implementation programs
  - Short to medium-term (5-10y) studies to answer key scientific questions
  - Long-term (>10y) cohort studies to study impacts on development and adult disease

- HAP solutions integrated with strategies to reduce other poverty-related health risks

- Documentation of improved human health and quality of life

Observe interventions
Plan RCTs
Long term cohorts
• **Exposure** & Biomarkers

• **Interventions**
  • Which intervention for which community?

• **Health Effects**
  • Long term cohorts +/- interventions for chronic disease

• **Mechanisms**
  • How clean does the air need to get for health benefits to be seen?
  • Early life origin of disease
Workshop, booklet, grant not funded (twice)
PATS origins

The Pan African Thoracic Society
Promoting lung health in Africa

Introduction

Africa is the continent most afflicted by morbidity and death from respiratory disease. As well as the burden of pneumonia and HIV-related respiratory illness including TB, there is an increasing problem with asthma and tobacco-related disease. biomass fuel use is ubiquitous and likely to be a major contributor to the prevalence of both pulmonary infection and COPD. Children under 15 years make up almost 50% of the population in African countries; childhood respiratory illness is the major cause of pediatric morbidity, healthcare utilization and mortality in Africa.

Aims

Overall Aim
To promote lung health in Africa

Specific Aims
Promote education, training, research, advocacy, prevention of disease, optimal care and development of capacity nationally to promote lung health

Activities

• To further develop and maintain the website
• To establish a database of respiratory health-related issues
• Promote collaboration between organizations and individuals whose aims are to promote lung health
• Encourage and expand membership of PATS
• Advocate and make representation for African respiratory health in global forums
• To develop capacity for research in respiratory health by training in the PATS-MECOR programme
• Encourage best practices for the prevention and management of respiratory diseases

Please get involved!

Please visit the website, register yourself and send in details of your work and research interests. We will post photos and text, along with information about funding and collaboration opportunities.

www.africanthoracic.org
Overall Aim
To promote lung health in Africa

Specific Aims
Promote education, training, research, advocacy, prevention of disease, optimal care and development of capacity nationally to promote lung health

www.africanthoracic.org
Biomass Reduction and Environmental Air Towards Health Effects in Africa – (BREATHE Africa) partnership will:

• **Establish a partnership** to bring together African researchers, both leaders and trainees, together with experts in all key aspects of household air pollution (HAP) research

• **Maximise the opportunities presented by ongoing HAP trials**, both for measured health impact in all ages, capacity development in health related research and policy change in most affected countries

• **Hold Annual Scientific Meetings (ASM)** and interim Theme Programmes including mentored trainee projects and trial site collaborations
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<th>Theme</th>
<th>Lead</th>
<th>Immediate Goals</th>
<th>Collaboration Opportunities</th>
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<tbody>
<tr>
<td>Biomarkers and Exposure</td>
<td>Sean Semple</td>
<td>• PhD on diverse smoke toxicity</td>
<td>• Sharing of samples</td>
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<td></td>
<td></td>
<td>• Smoke exposure training</td>
<td>• Equipment testing at field sites</td>
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<td>Health Effects</td>
<td>Kevin Mortimer</td>
<td>• CAPS study (see overleaf)</td>
<td>• Design CAPS follow-up</td>
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<tr>
<td></td>
<td></td>
<td>• PhD on exposure and pneumonia relationships</td>
<td>• Adult lung health studies</td>
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<td>Mechanisms</td>
<td>Jon Grigg</td>
<td>• PhD on macrophage inflammation</td>
<td>• Expanded pathogenesis studies linked to HAP</td>
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<td></td>
<td><a href="mailto:j.grigg@qmul.ac.uk">j.grigg@qmul.ac.uk</a></td>
<td>• Linking infection and smoke</td>
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<td>Interventions, Advocacy and Policy</td>
<td>Nigel Bruce</td>
<td>• PhD on challenges to stove adoption</td>
<td>• Stove and LPG comparisons</td>
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<td><a href="mailto:ngb@liv.ac.uk">ngb@liv.ac.uk</a></td>
<td>• Advocacy and linkage with WHO Standards Committee</td>
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<td>Research Training</td>
<td>Stephen Gordon</td>
<td>• PATS MECOR 2015 and 2016</td>
<td>• Further courses</td>
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<td><a href="mailto:stephen.gordon@lstmed.ac.uk">stephen.gordon@lstmed.ac.uk</a></td>
<td></td>
<td>• Train the Trainer</td>
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<td>• Collaborative multi-site publications</td>
<td>• Spirometry training</td>
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<td>• Air sampling</td>
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Summary

Cooking and Pneumonia Study
  • Fully recruited >9000 kids
  • 2 Phillips stoves; IMCI pneumonia
  • Video production to engage communities
  • Completes 2017

BREATHE Partnership
  • Welcomes collaboration on
    – Exposure and biomarkers
    – Health Effects
    – Mechanisms
    – Interventions and Advocacy
    – Research Capacity Development
  • Theme Leads, PhD students and new applications
THANK YOU

CAPS
Kevin Mortimer, Deborah Havens, Chikhwawa and Karonga field teams

BREATHE grant
Jane Ardrey, Bill Martin, Darby Jack, Pat Kinney, Alison Lee, Jim Tielsch, Sumi Mehta, Kirk Smith, Christa Rothe

FELLOWS
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LUNG FUNCTION
Aryo Suseno, Sandy Jack, Peter Calverley

BREATHE leads
Nigel Bruce