The Risk of Indoor Air Pollution in rural Senegal: A Pilot Study

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PATH
A catalyst for global health
Why Senegal?

- PATH conducting a 2 year influenza vaccine effectiveness trial in rural Senegal among children 6 months to 10 years of age (10,000 children)
- Niakhar Demographic Surveillance System (DSS), a sentinel demographic site (pop~40,000)
- Children under active, community-based surveillance for the occurrence of several respiratory infection outcomes
- Estimated 79% Senegalese households are using solid fuels to cook*

*Desai, Mehta, Smith 2004. Assessing the environment burden of disease at national and local levels. *Environmental Burden of Disease Series No. 4*
PATH and IAP in Rural Senegal

• Summer of 2009, PATH funded a 3 month project to evaluate the problem of IAP from burning of biomass fuel and inform future investigations and/or interventions in rural Senegal.

• Objectives included:
  – Conduct literature review
    • IAP exposure
    • Associated health outcomes
    • Appropriate interventions
  – Design data-collection tools to be used in Senegal
  – Conduct pilot study of IAP nested in vaccine trial site area (Niakhar, Senegal)
Pilot Study : September 2009

- Cook interviews (n=15)
  - Duration and frequency of IAP exposure
  - Cooking practices and preferences
- Household observations (n=15)
  - Structural characteristics
  - Ventilation
- Focus Groups (n=2)
  - Perceptions of exposure and risk
  - Stove and fuel acquisition and preferences
- Market Visit (n=2)
  - Stove availability and cost
Household Interviews -- Exposure

- Potential Exposure to IAP through Cooking
  - Cooks exposure (15 women):
    - Cooking time average 5 hours and 20 minutes/day (3-6 hours)
    - 83% within 1 meter of the stove (4 hours and 24 minutes)
Children exposure within 1 meter to stoves during cooking (15 households):

- 14 children ≤5 years average 26 minutes/day
- 16 children 6 to 10 years average of 22 minutes/day
Household Interviews -- Exposure

• **Seasonal Differences**
  
  – Women reported cooking:
  
    • Indoors with wood (twigs and branches) during the rainy season (July-September)
    
    • Outside with dung and crop residue during the dry season (October – February)
Household Interviews -- Exposure

- Alternative IAP Exposure
  - 60% of cooks reported a smoker in the HH
  - Smokers averaged 2 small plastic packets of tobacco/day (1-4 packets)
  - 100% of cooks use incense in the home daily (mostly in bedrooms); these tend to smolder and emit smoke for the entire day
Household Interviews -- Fuel

• Fuel Acquisition
  – 13% of households report buying their fuel the majority of the time
  – 73% collect their fuel
  – 13% both buy and collect fuel

• Fuel Cost
  – For HHs purchasing their fuel, average costs per month are 5583 CFA (3500-9000 CFA), ≈15$
  – For HHs collecting their fuel, an average of 26 hours/week spent collecting fuel
Household Interviews: Fuels
Household Interviews -- Stoves

• Stoves were defined as the primary mechanism by which food was cooked:
  – 27% of stoves were characterized as a 3 stone fire
  – 53% were metal tripods
  – 20% were recycled metal canisters

• One HH reported the use of butane gas as a secondary stove

• Another HH reported a larger version of the traditional metal tea stove using coal
Household Interviews -- Health

• Health

  – 93% of cooks reported difficulty breathing after they cook
  – 47% reported a productive cough every day for last 3 months
  – 87% reported attacks of wheezing or whistling breath
  – 80% reported a history of waking in the morning with a feeling of tightness in her chest and difficulty breathing
Home Observations -- Architecture

- Kitchen location
  - 80% separate structure from the rest of the house
  - 13% same hut used for sleeping
  - 7% cooked outside
Home Observations -- Architecture

- **Kitchen roofs**
  - 67% thatch roofs
  - 17% roofs of thatch and plastic
  - 8% made from couscous stalks and plastic
  - 8% made of plastic alone

- **Walls**
  - 82% were made of mud-bricks
  - 18% of couscous stalks
  - 8% had no walls
Home Observations -- Architecture

- **Eaves/Windows/Chimneys**
  - 100% of kitchens with roofs had eaves approximately 6 inches in height
  - 73% of walled kitchens had at least one window (average size 6”x6”).

- **Kitchen Structure**
  - Average size 10½’ long by 10’ wide and 5’ high
  - Circular, steeped roofs, 12½’ at the apex
  - No chimneys were observed
  - Visible soot was present on ceilings and walls in 11/12 kitchens
    - 50% heavy
    - 42% slight
Home Observations -- Soot

- Visible soot was present on ceilings and walls in 11/12 kitchens
  - 50% heavy
  - 42% slight
Health Post Focus Groups

• Women use metal tripod but prefer butane gas, citing less smoke produced and simple and easy cooking.

• Of biomass fuels (wood, charcoal, crop residue, or dung), women preferred using wood.
Focus Groups Continued

- Women Sx: coughing and teary-eyes common
- Children Sx: particularly causing runny noses and coughing
- Smoke-prevention measures:
  - using a gas stove
  - removing children from kitchen
  - using only very dry wood as fuel
Market Observations

- Butane gas fuel canisters 12,000 CFA (≈30$)
- Refills cost
  - 1300 CFA (≈3$) for ~6 kg
  - 2800 CFA (≈6$) for ~15 kg
- Metal tripods 500-600 CFA (≈1.50$)
Market Observations

- Metal tea stoves using charcoal 500 CFA (∼1$)
- Wood cost
  - Small bunches 100 CFA (∼0.20$)
  - Large bunches 1500 CFA (∼3$)
- Charcoal 150 CFA/kg (∼.35$)
Conclusions

• Women and children exposed to high levels of smoke during periods of cooking
• Smoke likely has an adverse effect on their health.
• Fuel is generally firewood and crop residue, although cooks prefer liquid gas for most cooking
• IAP is perceived to be associated with worse health
• Cost of clean burning fuel is the major barrier to its use
Thank you

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