

Is it really malaria?

Or is it really bad air?

Putting a Priority on Particulate
Pollution for Primary Prevention
of Pediatric Pneumonia

[Trying to get us to 8 P's instead of 4]

Some evidence that reducing IAP* is not a public health priority

- Gates Foundation announced it will give \$10 billion over 10 years to reduce child mortality
- They expect to reduce under 5 mortality overall and from LRI** by more than 20%
- But their plan barely mentions IAP, relying entirely on vaccine coverage and on the improvement of early diagnosis & treatment

* Indoor air pollution

** Lower respiratory infection

Just How Big a Problem is Pneumonia, Anyway

- “...with more than 2 million infant and child deaths each year, pneumonia is the leading cause of childhood mortality in the developing world...
- About 156 million childhood pneumonia cases occur each year, with 97 percent in the developing world. Pneumonia remains ‘the forgotten killer of children’ due to a lack of attention and funding”

Source: Gates Foundation [www.gatesfoundation.org/global-health]

The WHO May Also Be At Fault

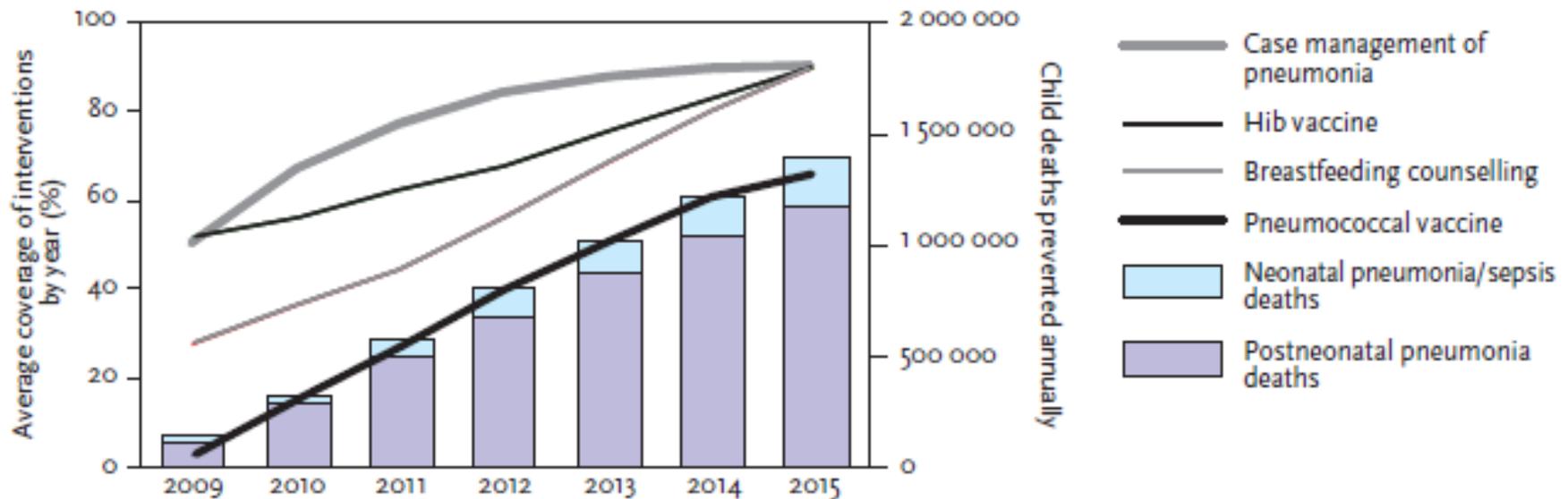
- In more than a decade of efforts at IMCI (Integrated Management of Childhood Illness), there has been little attention to funding ways of fixing IAP
- The Global Action Plan (GAPP) states that “Indoor air pollution increases the risk of pneumonia.” and
- “New technologies can reduce indoor air pollution, and additional research is needed to demonstrate the health benefits of these interventions.”
- But only “Strategies to reduce indoor air pollution”

The GAPP (prevention and control of pneumonia) says it's important

- The Director of the Department of Public Health and the Environment referred to the importance of environmental risk factors contributing to pneumonia in children (2007)
- And “*Preventing disease through healthy environments*”^{*} stated that at least 42% of all LRI can be attributed to indoor and outdoor air pollution in developing countries, compared with 20% in developed countries (WHO 2006)
- **BUT**, at the same meeting on GAPP in 2007, it was acknowledged that: “There has been no large-scale intervention to reduce indoor air pollution, a measure that is perceived as very expensive”

The 2009 WHO vision of what to do

FIG 3. CHILD PNEUMONIA DEATHS THAT COULD BE PREVENTED PER YEAR IN 68 "COUNTDOWN" COUNTRIES^{a,b}



Source: WHO

Note the absence of an IAP reduction plan! WHY?

Maybe because: "There has been no large-scale intervention to reduce indoor air pollution, a measure that is perceived as very expensive."

How Effective is Vaccine?

- The best major trial (in rural Gambia) “found an efficacy of 16% (3–28) against mortality” compared to placebo [just pneumovax] *
- Probably part of the basis for predicting that ½ million lives can be saved per year**
- But, assuming that it can prevent a full 28% of 1.7 million pediatric deaths from pneumonia, more than 2/3 of the deaths won’t be stopped
- This also assumes that poor country health systems manage excellent vaccine coverage

* *Global Alliance for Vaccines and Immunisation

So what about preventing more?

- An assumption may be that better nutrition, other vaccines and better, earlier treatment of sick children can happen over a few years and drop deaths to “first world” levels
- In fact, the most recent WHO publication on IAP contribution to pediatric pneumonia states that it likely only increases risk 1.8x
- If 97 or 98% of pneumonia is in developing countries with high IAP, that seems unlikely

So, has IAP reduction been shown to reduce LRI disease & deaths?

- Unfortunately, at present, not really
- Only one study is ever cited as having truly shown that IAP reduction in a cookstove project reduced the incidence of LRI in kids*
- That study was a chimneyed stove project in highland Guatemala by Kirk Smith's group
- Published only as a meeting abstract; so it may not impact global health leaders and funders much
- 2010 meta-analysis concluded there wasn't evidence, at least as far as invasive pneumococcal or Hib disease **

Why so little evidence?

- In the past, it's been hard to validate LRI diagnoses (the “gold standard” is X-ray)
- Pediatric deaths may be due to many factors and the actual diagnoses can be elusive
- Especially so in areas with no available doctors and even more so in tropical places
- Most systems rely on verbal autopsy or poorly trained CHWs (community health workers), giving poor data on causes of death

An Example from West Africa

- In 2010, I visited Nana Kanieba, Mali, a pretty average village of about 300 families
- It's health center is staffed by a nurse
- I looked at the last year's log of diagnoses
- **NOT A SINGLE CASE OF PNEUMONIA**
- Dozens of cases of malaria recorded
- No tests were done to validate the diagnoses

So here's the connection to malaria

- New technology for malaria diagnosis can help with numbers on LRI, without X-ray
- In fact, we should be able to reduce the overuse of antimalarials and get more kids antibiotic treatment sooner for pneumonia
- And it's already been shown to be possible in rural subsaharan Africa with CHWs

How does this work?

- Infants and young children with any life-threatening illness often look the same
- Elevated blood markers for clinically severe pneumonia are also increased in malaria
- But there are now RDTs (rapid diagnostic tests) for malaria done on fingerstick blood
- A recent African trial showed how effective this can be in getting better diagnoses

Boston U. data from Zambia*

- >3000 kids < 5 y.o. with fever or fast breathing
- Randomized to usual care or guided by RDTs
- In the control group, 99.1% were treated for malaria. With RDTs, that dropped to 27.5%
- > 5x as many kids in the RDT guided group got early & appropriate antibiotic for LRI
- The testing and treatment was done by CHWs; training was the same for both study arms except intervention CHWs trained in RDTs

Malaria tests can aid LRI trials!

- Now, HCWs won't have to assume every fever is malaria; this can conserve medicines
- And many other kids with fever and rapid breathing do have pneumonia (or something else that comes through the respiratory tract)
- It is also evident that tests can make HCWs more open to diagnoses other than malaria
- So better numbers would be possible for comparing # of pneumonia cases between stove program households and 3-stone fires

Some thoughts on why we need additional large scale studies

- We currently have no clear idea how much reducing IAP decreases pediatric pneumonia
- Households where adults smoke have IAP levels that vary markedly but modeling can give typical time-weighted concentrations
- One such model gives a level of 119 mcg/m^3 for low air exchange in a room that is 200m^3 and averaging 2 cigarettes/hr smoked*

Why this is quite relevant

- Compare this to reported stove reductions
 - My Peru study: Baseline $\text{mcg}/\text{m}^3 = 782$; new stove = 192
 - Guatemala* (backpack monitor): Baseline = 264; new stove = 102
- And the likelihood that “The shape of the exposure–response relationship implies much larger public health benefits of reductions at the lower end of the dose spectrum” ** applies to pediatric LRI as well
- This suggests that the intervention group is still as exposed as those living with smokers

How much difference second-hand cigarette smoke makes to LRI

- Community studies of LRI & bronchitis show an increase of 1.54 (1.31- 1.80) [either parent] and of 1.57 (1.33 - 1.86) [mother only]*
- Admission for these plus bronchiolitis (RSV*) were similar: 1.71 (1.21 - 2.40) [either parent] and of 1.53 (1.25 - 1.86) [mother only]*
- Quite similar to that for IAP from use of solid fuel for cooking in the recent WHO report: increase of 1.78 (1.45 – 2.18)

To clear the air, a quote from the GAPP

“Research

The neglect of research in the field of pneumonia over the past decade has left many important clinical and epidemiological questions unanswered. Pneumonia prevention and control efforts are unlikely to be effective unless supported by strong research, both operational and more basic. Therefore, efforts to control pneumonia in children must be underpinned by an expanded research effort

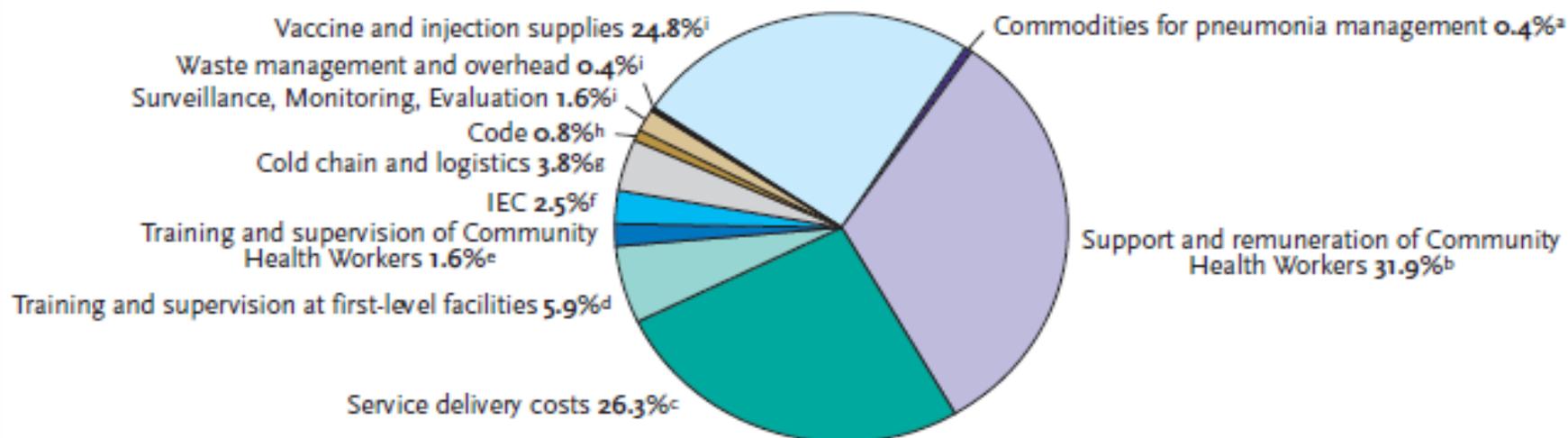
”
...

And right on the GAPP costs page



But then look at the funding below!

FIG 5. 68 COUNTRIES: BREAKDOWN OF TOTAL COSTS 2009–2015



Source: WHO

^a Medicines, injection materials and diagnostics.

^b Includes honorarium of community health workers (CHWs), and staff at national and subnational level to coordinate the CHW programme

^c The costs include human resources plus overhead costs such as capital investments, infrastructure maintenance, electricity and water required for running the facility. The costs reflect the resources used by the provider in providing these services and do not consider who finances these costs, whether this be the government, the patient or another entity.

^d Includes: Vaccine related training and supervision, and IMCI training cost.

^e Includes: Training CHWs, and regular supervision.

^f Includes: Information, education and communication (IEC) for child health; and social mobilization activities for immunizations.

^g Vaccine specific. Cold chain and transport/vehicles.

^h Enactment, monitoring and enforcement of the Code of Marketing of Breast-milk Substitutes (breastfeeding specific).

ⁱ Vaccine specific.

So What # of \$ are going where?

- GAPP calls for 39 billion from 2010 to 2015
- Gates Foundation will cover most vaccines
- The rest is still to be committed
- The Global Alliance for Clean Cookstoves seems less sure what # of \$ need to be raised*
- They do say that the goal is 100 million new “clean and efficient stoves and fuels” by 2020
- But there don't seem to be any research funds

Bottom line in my estimation

- We don't know how far we need to reduce IAP to have as much impact as vaccines
- We're not going to get adequate funding for scale-up of cookstove programs based on saving children's lives without better data
- Boston U. has now shown we can get better data even without better health systems