

Holden Karnofsky's notes from conversation with Dave Smith, 4-Nov-2011

- The argument for ITNs has always been that ITN coverage is a public good. Some of the good accomplished is not internalized to the person using the net. Some people argue that there's a negative externality as well - unprotected people are getting bitten by the mosquitoes that would have bitten the protected people - but I don't think you can make that argument with ITNs.
- What I do is analysis of data using mathematical models. In general, the leading models say that the more people use the nets, the bigger the positive externalities are. The problem with this is that in some areas the size of the problem is so large: for example you can go to a place with 2 infectious bites per person per year, and in that place before you see any benefits, you're going to have to get it down to 1 bite per person per year, and then you could really see a sharp dropoff in malaria burden, but the problem is that if you don't get enough coverage, you might not get much effect at all.
- The main idea here is that the nets are not going to have the same effect everywhere. But universal coverage should give you overall a much better result than targeted nets. Even people sleeping under nets will get bitten (during the day when not protected by nets); the real benefits are where you get rid of almost all the mosquitoes and almost all the transmission. In most cases you see not only malaria go away, you get bacterial infections going way down. This is a poorly understood phenomenon; there is a big improvement when you get transmission down to nearly zero.
- One of the ways of measuring how intense transmission is is known as R_0 . If you were to introduce an infected mosquito, R_0 is the number of infected mosquitoes that would be infected after a period of time. It's a measure of the reproductive success of malaria. The effects of control interventions can be translated into a reduction in that figure.
- We usually don't know R_0 . We infer it from the proportion of 2-10 year olds carrying malaria (PR). What the paper I've sent shows is the modeled relation between PR and R_0 , and between net coverage and R_0 .
- The places you get the biggest bang for your buck are the ones that start at a middle level of transmission, where control brings transmission down to zero; the ones that are not so good are where controls brings very high transmission down to medium levels. We're starting to get enough data to actually say where you're likely to be in the former case. Almost every place in sub-Saharan Africa is in that category except for a few places with very poor populations and very high transmission.
- The only thing we know for sure is that if you bring malaria transmission down close to zero in a community that you get enormous public health benefits across the board. Pediatric wards are empty, the bacterial infections are down, people are not dying, and you don't have to transfuse nearly as many people. The best benefits come when nets are combined with other control measures to really bring malaria under control. This is what was done in Zanzibar.
- I'll send you a Lancet article listing which countries seem like the best candidates for elimination. From the bibliography of that paper you can see a lot of other

references that you may not have. I'm also going to send you a piece we published in Science which more or less stakes out my position on this, which is that there's not enough money going into malaria right now - forcing us to make suboptimal decisions that are just not pretty. Malaria is something where if we spent enough money, it would go away. Malaria impacts infants and schoolchildren, it leads to malnourishment and short attention span in addition to mortality.

- If you're talking about the marginal dollar for more nets, there's a lot more uncertainty on the cost-effectiveness of that than we'd like. The only data that we have is bad data. Improved surveillance would be helpful. You may wish to check out the work of the group at Imperial College London.
- Nets are one of the really good deals in health; they are underfunded; if we had more money we could get more nets out and more drugs out. Personally, I'd give to a charity like AMF that is working to increase net coverage.