Ethical debate

Doctoring malaria, badly: the global campaign to ban DDT

The treaty on persistent organic pollutants—POPs—will be finalised at the United Nations Environment Programme meeting in Johannesburg, 4-9 December. One proposal is to ban DDT, still used by many countries for controlling the mosquitoes that spread malaria. It should not be banned, argue Amir Attaran and Rajendra Maharaj, specialists in malariology and also international development and law—there's no evidence that spraying with DDT harms anyone. The issue is not straightforward, says Richard Liroff, director of the World Wildlife Fund's alternatives to DDT project; the treaty raises a series of equity challenges.

DDT for malaria control should not be banned

Amir Attaran, Rajendra Maharaj

Last year, deaths from malaria in Africa reached an all time high. Next year they will probably do so again, claiming around a million children. Yet in this deadly upward spiral, political pressure is building at the United Nations Environment Programme to pass a treaty by the end of 2000 to internationally ban or restrict one of the world's best anti-malarial tools.

That tool is, of course, DDT—dichlorodiphenyltrichloroethane. The campaign to ban it, joined by 260 environmental groups, reads like a who's who of the environmental movement and includes names such as Greenpeace, Worldwide Fund for Nature (WWF), and (ironically) the Physicians for Social Responsibility. Together, they are "demanding action to eliminate" DDT and its sources.[1]

This view is stunningly naive. DDT residual house spraying is an inexpensive, highly effective, practice against malaria, and it has been approved by the World Health Organization. In it, trained sprayers apply a small quantity of DDT on the interior walls and eaves of homes in endemic regions. The quantities involved are minimal (2 g/m^2) and, unlike agricultural uses which inject tonnes of DDT into the outdoors, indoor house spraying results in little harmful release to the environment. For the amount of DDT used on a cotton field, all the high risk residents of a small country can be protected from malaria.[2]

Few things compare for drama with an effective DDT spraying programme. In its heyday, DDT was successfully used to eradicate malaria from some nations (United States, Europe) and to lower case rates by over 99% in others (Sri Lanka, India).[3 4] In South Africa it was used to eradicate the two most dangerous species of malaria mosquitoes, *Anopheles funestus* and *A gambiae*, from the country. All this saved millions of lives.

So, if DDT can be this successful, why ban it? The latest campaign stems from charges that DDT is an "endocrine disrupter" whose ability to cause harm (like Melville's *Moby Dick* and all excellent monsters since) is both indiscriminate and vast. The World Wildlife Fund and Physicians for Social Responsibility indict DDT chillingly: as a carcinogen, a teratogen, an immunosupressant, and so on.[5 6]

All this would be worrisome if it were true. Conspicuously absent behind the campaigners' claims are any epidemiological studies to demonstrate adverse health effects. Although hundreds of millions (and perhaps billions) of people have been exposed to raised concentrations of DDT through occupational or residential exposure from house spraying, the literature has not even one peer reviewed, independently replicated study linking exposure to DDT with any adverse health outcome. Researchers once thought they had discovered a statistically increased risk of breast cancer and attempted to replicate it, but every later published attempt (eight so far) has failed to confirm it.[7] Even researchers who find DDT in breast milk and claim it leads to early weaning in children quietly confess a "lack of any detectable effect on children's health."[8] Very few other chemicals have been given such extensive scrutiny, and there is still no epidemiological or human toxicological evidence to impugn DDT.[9]

Environmentalists are easily made tetchy about epidemiology. The authors of *Our Stolen Future*, a book and website that "explores the emerging science of endocrine disruption," maintain that it is "impossible" to prove the subtle effects of endocrine disrupting pollutants using epidemiology.[10] Consequently, they and others argue that animal toxicology and animal data must cause us to ban DDT as a precaution.

Such views cannot be taken seriously. Epidemiology has readily shown the risks of other endocrine disrupting pollutants (such as PCBs—polychlorinated biphenyls) even where it finds no risk in DDT.[11] And the very notion of "precaution" is churned to nonsense where potential risks to health, known only through animal studies, supposedly justify banning a chemical with known and large human health benefits in malaria control. Indeed, one could say that precaution takes on a very different complexion in sub-Saharan Africa, where 1 in 20 children die of malaria.

Alternatives to DDT house spraying can substitute in some cases but not all cases. Case detection and treatment can help to lower mortality from malaria but can never stop morbidity that does not present in clinic. Insecticide treated bed nets, although promising, will often have the limitation that they protect one or two people under the net and not the entire household. Integrated vector management, an ecological approach against mosquitoes touted by DDT's opponents,[6] is as yet only an experimental strategy that has never been used in a national malaria control programme (for the 33 years since 1966, Medline, Biological Abstracts and CAB Abstracts list only 19 references

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Alternatives to DDT can be more than twice as expensive

on integrated vector management or control). And while house spraying with alternative insecticides to DDT can work, it is often fraught with insecticide resistance, and costs double or more—a real constraint in African countries, where the health ministry's budget may be less than £3 per person.

South Africa illustrates these limitations in practice. Facing pressure from environmentalists, the national malaria control programme abandoned DDT in favour of more expensive pyrethroid insecticides in 1996. Within three years, pyrethroid resistant *A funestus* mosquitoes invaded KwaZulu-Natal province, where they had not been seen since DDT spraying began in the 1940s. Malaria cases then promptly soared, from just 4117 cases in 1995 to 27 238 cases in 1999 (or possibly 120 000 cases, judging by pharmacy records). Other provinces experienced similar catastrophes, and South Africa was forced to return to DDT spraying this year. It had little alternative: no other insecticide, at any price, was known to be equally effective.

This experience raises a challenging question: if the wealthiest, most scientifically advanced, and least malarious major country of sub-Saharan Africa cannot make do without DDT, how can superendemic and impoverished countries like Tanzania, Congo, or Mozambique do so? Should they be asked to?

We conclude that the public health benefits of DDT amply outweigh its health risks—if, indeed, such risks exist at all. For doctors or their banner groups such as Physicians for Social Responsibility to campaign otherwise is not only wrong but outrageously unethical. Risk-benefit trade-offs are part of public health and medicine, and we would be swift to condemn the malpractice of doctors who would from ideology deny their patients cyclosporin, tamoxifen, chlorambucil, azathioprine, or any other lifesaving drug known to be a human carcinogen.[12] The situation with DDT and malaria is hardly different. The public health malpractice of its avoidance must stop.

An open letter of physicians on the DDT issue is available to read and sign at http://www.malaria.org/DDTpage.html. Over 400 signatures have been collected so far.

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Commentary: Reduction and elimination of DDT should proceed slowly

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DDT (dichlorodiphenyltrichloroethane) is a prominent element in current negotiations of an international treaty to phase out persistent organic pollutants. Malaria specialists have expressed concern that the treaty will prematurely outlaw DDT for malaria control. This will not happen, nor was it ever likely despite exaggerated fears to the contrary. This comment describes the current situation and the rationale for phasing out DDT.

Malaria affects more than 300 million people, and every year it kills more than one million people. An estimated two dozen countries still find DDT effective for malaria control, so DDT's elimination should be done cautiously. A broad consensus exists about how it should be phased out. The treaty language being discussed at the final negotiating session on persistent organic pollutants in South Africa in December 2000 allows for continued use; it calls for expedited development of alternative approaches and promotes periodic evaluation of the status of alternatives and of individual countries' need for DDT.[1]

DDT is a persistent, bioaccumulative, hormone disrupting chemical. It is associated in the public's mind with weakened eggshells and declining bird populations. But the latest push to phase it out is motivated in large measure by concerns about human health arising from research on DDT in wildlife and laboratory animals. The US National Academy of Sciences' 1999 report on endocrine disrupting chemicals cites studies reporting DDT's adverse impact on the immune and reproductive systems of test animals.[2] The "toxicological profile" of DDT and DDE (dichlorodiphenyltrichloroethylene) compiled by the US Agency for Toxic Substances and Disease Registry recites a long list of these chemicals' hormone disrupting impacts in wildlife and laboratory animals. These include impacts on immune, reproduc-

tive, and nervous systems. The agency notes that such studies "raise concerns that exposure to DDT early in life might cause harmful effects that remain or begin long after exposure has stopped."[3] It also observes that "key endocrine processes can be profoundly affected by exposure to extremely small amounts of active chemicals during critical windows of embryonic, fetal, and neonatal development."

DDT or its metabolites have been found in human breast milk and in amniotic fluid.[4] Researchers recently found that raised concentrations of DDE in the serum of human mothers are associated with increased risk of preterm delivery, small for gestational age birth weight, and reduced height of children at age 7.[5] Two studies, one in North Carolina and a replication in Mexico, associate raised concentrations of DDE in human mothers with early weaning.[6–8]

DDT is sprayed inside homes, where it may pose a particular risk to humans. Researchers in Mexico and South Africa found raised concentrations of DDT in people who lived where it was used to control malaria, and they estimated that breastfed children in those areas were being dosed at levels exceeding those recommended by the World Health Organization and the Food and Agricultural Organization.[9 10] These findings contributed to both countries' substituting alternative methods of control.

The draft treaty on persistent organic pollutants is fully consistent with changes in malaria control strategies promoted by the WHO. Over the past 30 years the WHO has backed away from its once enthusiastic support for DDT. The Pan American Health Organization, WHO's affiliate in Latin America, recently expressed strong reservations about the effectiveness of broadscale application of DDT for malaria control.[11] Its recent study illustrates the reason for this concern: it shows that during the late 1980s and early 1990s, malaria rates in Brazil went up even as spraying of houses with DDT increased, but rates dropped after Brazil shifted to alternative control methods.[12]

Many alternatives to DDT have already been successfully used for controlling malaria. Mexico, for example, committed itself to ending use of DDT by 2007, provided that suitable alternatives are available. Relying on a range of effective and affordable chemical and non-chemical strategies, Mexico has been so successful that its DDT manufacturing plant has ceased production owing to lack of demand. The director of Mexico's malaria control programme, Jorge Mendez, has even declared that it is 25% cheaper for Mexico to spray a house with other chemicals—synthetic pyrethroids—than with DDT.[13] Similar success stories of effective programmes not based on DDT can be found around the globe.[14 15]

The cautious approach being adopted in the treaty reflects uncertainty about how many countries that are still using DDT can successfully move from it. South Africa illustrates the dilemma. South Africa stopped spraying DDT out of concern for its hazard to human health. But one of the mosquito vectors of malaria proved resistant to synthetic pyrethroid sprays, so South Africa has resumed using DDT. South Africa made the difficult choice that the developmental risks from spraying with DDT are outweighed by the need to provide protection from malaria.

The treaty on persistent organic pollutants raises a series of equity challenges that must be addressed directly. Firstly, the countries still relying on DDT include some of the poorest in the world. These countries must have financial and technical assistance from the developed world to strengthen their ability to control malaria. The feasibility and cost of shifting from DDT must be assessed and requisite investments made. The WHO's action plan for reducing reliance on DDT calls for such assessments and capacity building activities.

Secondly, the interests of those countries for which alternatives are not available must also be protected. Only two countries still produce DDT—India and China. India's malaria control programme, with support from the World Bank, expects to reduce its use of DDT. Concomitant with increased investments in researching and implementing alternatives to DDT, steps must be taken to assure that DDT remains available at an affordable price to those countries that truly need it. Such supplies would need to be carefully distributed and monitored, to prevent diversion of DDT to illegal agricultural uses.

The executive director of the United Nations Environment Programme, Klaus Toepfer, and the first director of WHO's Roll Back Malaria programme, David Nabarro, have stated that a properly constructed phase out of DDT can produce a "win-win" situation for environmental health.[16 17] Malaria imposes a horrendous social and economic burden totalling billions of dollars. The treaty on persistent organic pollutants can mobilise fresh financial and technical resources to help achieve protection from both malaria and DDT.

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