

DDT – to Ban or not to Ban?

Malaria discussion group

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Moderation in all things

From early December to late February, one subject dominated this list, almost *ad nauseam*. Though plainly controversial, it was not the subject itself, but tiresome, lengthy, daily exchanges by just a few people, which after the first long month led Lars Hviid (Copenhagen University Hospital, Denmark) to complain, to the relief of many of us. He was immediately supported by contributors from the USA, UK, Israel, India, Saudi Arabia and Australia. The general view was against censorship, but some guidelines were proposed, in the hope that rational discussion could be promoted, and alienation of serious researchers avoided. Suggestions included self-discipline (eg. limiting oneself to one concise message a week and no personal messages) and splitting up the list (eg. into *Plasmodium* spp and vector control). After that, though still lengthy, the discussion became more focused.

1, 1, 1-trichloro-2, 2, bis(p-chlorophenyl) ethane

This was the cause of the argument: e-mail 'subject' headings give an idea of the course it took – 'Control of vector breeding sites in Africa' became 'Feasibility of malaria control through source reduction in rural Africa' and, more simply, 'Avoiding mosquito bites'. In late December, headings became 'DDT for malaria control'. In January, they changed into 'Re: Potential of adverse impact of DDT on human health', 'Re: Illicit use' and then 'DDT: and excito-repellent', which led to 'DDT elimination', 'Persistence of DDT', 'DDT versus pyrethroids', 'DDT or not DDT?' [inevitably]; by late January there followed 'DDT and WWF', 'DDT-response to WWF press release', 'DDT-global mobility', 'DDT/*Culex*' and ultimately, at the end of February, just 'DDT'. (It was discussed here before, though less vehemently: see *Parasitol. Today* 13, 456–458, 1997. Also C.F. Curtis, Should DDT continue to be recommended for malaria vector control? *Med. Vet. Entomol.* 8, 107–112, 1994 and Malaria Unit of WHO, Use of DDT in vector control. *Med. Vet. Entomol.* 8, 113, 1994.)

It was a mega-debate of 91 contributions from 31 contributors from 14 countries: some 30 000 words.

To put a little [spare] flesh on this skeleton: fierce argument took off when Jo Lines (London School of Hygiene & Tropical Medicine, UK), supported by Christian Lengeler (Swiss Tropical Institute, Basel) and Steve Hoffman (Naval Medical Research Institute, MD, USA) wearily contradicted a suggestion that eradication of malaria in rural (clearly as opposed to urban) areas of wet tropical Africa is a simple matter of using manpower intelligently. Peter Singfield from Belize caused the diversion to DDT by saying he himself does not sleep under a bednet and is rarely bitten by mosquitoes while asleep. 'The local Malaria department sprays all the houses once per year with DDT dust ... largely due to DDT that the original, almost total, eradication of malaria was achieved ... this style of DDT application does not adversely effect the environment.' Lutz Breitling from Germany: in Sri Lanka there were 31 cases in 1962, 17 in 1963, 2 500 000 in 1968 after DDT was banned. Don Roberts (Uniformed Services University of the Health Sciences, MD, USA): 'at one time ... only 17 cases recorded for a whole year in Belize (a result of DDT sprayed houses)'. He thought the United Nations Environmental Programme (UNEP) should proscribe DDT for agriculture but allow use for malaria control; concerned scientists should oppose UNEP proposals for global elimination. 'If we think that pyrethroids

should be used in place of DDT ... remember that pyrethroids are just another chemical option ... could be next for elimination. The World Wide Fund [WWF] is already on record with reservations about use of pyrethroids for malaria control.' Ole Skovmand (Intelligent Insect Control, Montpellier, France) objected: DDT use should be eliminated because of its presence in the food chain, in seals in Greenland, its effects on birds. Its only advantage is cost, and prices should be compared per surface area treated, not per litre. 'Pyrethroids are toxic to fish, but not to birds nor mammals, and they do not pass in the food chain.' Roberts: WWF specifically attack DDT for its adverse impact on human health, misrepresenting findings even of cited studies. DDT/DDE in the fat of seals – or of humans – 'after decades of study' has not been linked with any harmful effect on their health, 'be critical of ... all claims ... get copies of referenced literature'. Because WWF want to eliminate DDT to protect wildlife, a scare tactic is needed, ie. breast cancer. However, only one of five studies reporting a lack of association with DDT or DDE is quoted, and one is misquoted, alleging it shows a positive association when its authors concluded 'The data do not support the hypothesis that exposure to DDE and PCBs increases risk of breast cancer' (N. Krieger *et al.*, Breast cancer and serum organochlorines: a prospective study among white, black, and Asian women. *J. Natl. Cancer Inst.* 86, 589–599, 1994). See also S.H. Safe, Is there an association between exposure to environmental estrogens and breast cancer? *Environ. Health Perspect.* 105 (Suppl. 3), 675–678, 1997, to which the answer is 'no'. As to cost: in Belize, spraying one house with deltamethrin costs US \$7.34 compared with US \$2.32 for DDT, and once a year is enough for DDT [D.R. Roberts *et al.*, DDT, Global Strategies, and a Malaria Control Crisis in South America, *Emerg. Infect. Dis.* 3, 295–302, 1997 (<http://www.cdc.gov/ncidod/EID/vol3no3/roberts.htm>); J. Mouchet *et al.* Evolution of malaria in Africa for the past 40 years: impact of climatic and human factors. *J. Am. Mosq. Control Assoc.* 14, 121–130, 1998; Resolving the DDT Dilemma, WWF Canada and WWF US, June 1998 (http://www.wwfcanada.org/hormone-disruptors/ddt_dilemma.htm)]. As to 'illicit use': if used in houses for malaria control only 'the amount available for misuse will be small and environmentally tolerable.' As to *mode of action*: while 'DDT is a repellent, an irritant, and a toxin ... [all] studies have consistently shown that the PRIMARY impact of DDT-sprayed house walls is one of excito-repellency, not toxicity', thus reducing amounts entering the food chain (eg. T. Chareonviriyaphap *et al.*, Pesticide avoidance behavior in *Anopheles albimanus*, a malaria vector in the Americas. *J. Am. Mosq. Control Assoc.* 13, 171–183, 1997). On *persistence*, Lutz Breitling: it is decomposed to CO₂ and HCl in UV light; Don Roberts quoted J.F. Quensen III *et al.*, Reductive dechlorination of DDE to DDMU in marine sediment microcosms. *Science* 280, 722–724, 1999, which provides direct evidence of microbial degradation. As to cost-effective alternatives, he hoped pyrethroids or some other class of chemical will become a realistic, cost-effective replacement, but developing countries should not be forced to stop using DDT while malaria is rapidly increasing and it is still cheaper than pyrethroids. More references: *Net Gain. A New Method for Preventing Malaria Deaths*. C. Lengeler, J. Cattani and Don de Savigny, eds, WHO, 1996 [see *Parasitol. Today* 14, 126, 1998]; Presentation by the Ministry of Health, Mexico. North American regional action plan on DDT, Task force on DDT and chlordane. CEC Report, Appendix A: 15–16, 1996.

Skovmand: Roberts' house calculations are vast underestimations; DDT resistance was one reason for malaria resurgence in many countries, not the ban, which came much later; especially important is type *kdr* crossresistance with pyrethroids, though 'in S America, no-one has to my knowledge probed for the *kdr* gene'. He quoted R.P. Penilla *et al.* Resistance management strategies in malaria vector mosquito control. Baseline data for a large-scale field trial against *Anopheles albimanus* in Mexico. *Med. Vet. Entomol.* 12, 217–233, 1998. In southern Mexico, the use of insecticides for agricultural spraying and DDT for antimalaria house-spraying resulted in high levels of resistance to organochlorines, organophosphates, carbamates and pyrethroids in *Anopheles albimanus* in the late 1970s; resistance has waned with reduction in agricultural use, but resistance to DDT has increased with its continued use for malaria control. DDT use may destroy the protective effect of impregnated bednets for protection against malaria because of crossresistance.

Hans Verhoef (African Medical and Research Foundation, Nairobi, Kenya) thought DDT use specifically for malaria control is justified, provided resistance is absent and it is demonstrably effective. He had attended a meeting on persistent organopesticides, officially meant to be a technical review, which 'got "hijacked" by lobbyists who argued that the demand for a ban was not negotiable ... no such thing as weighing pros and cons ... [they] should simply be banned ... I think a loud Greenpeace voice is highly desirable, but in a policy debate and not in a expert technical review'.

Since Andy Spielman (Harvard School of Public Health, USA) thought 'The outcome of the current debate over the continued availability of DDT may profoundly affect human health' he invited Rich Liroff, a political scientist in the Washington office of WWF responsible for their DDT-related work, to join the argument. ('Resolving the DDT Dilemma: Protecting Biodiversity and Human Health', 1998 can be obtained from Rich.Liroff@wwfus.org.). Briefly, 'we were trying to get away from the simple people vs wildlife dichotomy. The dilemma is that both malaria and the chemicals used to control it pose a threat to human health. The chemicals also threaten biodiversity ... compelling evidence that there are more subtle effects than the direct acute or carcinogenic effects ... essential to determine if breast cancer victims were exposed to such chemicals in the womb or during early childhood. The literature ... fails to mention possible trans-generational consequences of chronic human exposures ... it is especially important to test the synthetic pyrethroids because pregnant women and children ... will be exposed to them inside their homes and under bednets ... [integrated vector management] will use biological methods such as larvivorous fish, environmental management methods ... eliminating breeding areas, and screens ... misleading to assert that if WHO changes its position on DDT, this will be based purely on politics at the expense of science and public health needs. Quite to the contrary, WWF insists that WHO ... should respond to the substantial scientific findings we have gathered.' Don Roberts was riled: 'WWF is actually insisting that WHO respond to highly selective information that supports the singular WWF goal of DDT elimination.' He gave examples of their selection. 'Their own assessment that 'Absence of evidence does not mean absence of effect' attests to their lack of meaningful findings.' They ignore the arguments of the expert Andy Spielman, and reject the findings of the 1993 WHO expert committee, for continued use of DDT for malaria control. Don Mackay (WWF Consultant, Trent University Peterborough, Canada): 'Models of the global transport of chemicals such as DDT from the tropics to polar regions suggest that only a very small

fraction of the DDT applied in the tropics reaches the Poles, but this is enough to cause measurable levels and possibly toxic effects ... the answer is not to return to the days of indiscriminate use of a highly persistent insecticide to which mosquitoes can build up resistance, but ... to seek more subtle control of the vector outdoors.' Kevin Baird (Naval Medical Research Center, MD, USA) objected to the use of the word 'indiscriminate': 'a disservice to the people who toiled for several decades under a deliberate and well-thought out plan to eradicate and control malaria ... their disciplined efforts saved many millions of human lives.' Clive Shiff (Johns Hopkins School of Public Health, Baltimore, MD, USA) said malaria vectors are not all resistant to DDT: 'in Zimbabwe we used DDT sprayed indoors from 1947 until 1984, without detecting any change in the susceptibility of *Anopheles arabiensis* and *An. funestus* ... about 40–100 gm are applied indoors, annually ... It will last about a year or less if the wall is re-plastered ... There is minimum material tracked outside (unless people climb on the walls ... which is what we felt like doing when the banning of this vital malaria control material was contemplated). This makes your note about taking DDT into the external environment a little weak. There is an enormous dilution factor. You should also recall that DDT was sprayed into the environment in kilotonne quantities in Europe and N. America ... not in Africa, or other malaria endemic countries.'

Don Roberts summed up his position: 'First, global environmental levels of DDT have dropped dramatically ... is it not reasonable to conclude that global (but undefined) threat from DDT has also dropped? Second, is it reasonable to eliminate our most cost-effective tool for malaria control at a time of rapidly increasing malaria rates? Third, there is no evidence that the subtle approach to malaria control will impact the global resurgence of malaria. Fourth, there is no evidence that funds are available for support of more expensive and subtle approaches to malaria control.' He described 'a recent gathering of prestigious senior scientists to hear a presentation about trans-generational effects of environmental pollutants. The guest speaker enjoys prominent recognition in the popular press. The audience was openly hostile. The hostility flowed from the speaker making frequent and disjointed EXTRAPOLATIONS from microplate assay findings to tissue, organ, organism, community, ecosystem and global levels ... hostility was also invoked by the persistent inference that while the inferred concerns and associations cannot be proven, humanity should not wait for proof before taking policy and funding actions.'

Kevin Baird: 'If malariologists accept that DDT works well and causes little harm, what explains our silence while others work vigorously to eradicate DDT? This is all the more remarkable in the face of the current 'global' resurgence of malaria. What is driving abdication of one of the most powerful weapons against malaria that remains safe and effective, while we struggle terribly for the slightest gain against these parasites?' [Interestingly, 80% of those who committed themselves opposed a ban] [NB *Parasitology Today* will include an update on the DDT question in a future issue].

The Malaria Project in Washington DC, together with the Malaria Foundation International, are asking public health scientists to oppose a precipitous DDT ban, and to demand that rich countries fund alternative research and control efforts against malaria. Scientists can view and sign an open letter to the DDT treaty diplomats at <http://www.malaria.org>

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