WHO News and activities

Use of DDT in vector control[a]

Many countries rely on the use of DDT for the control of both malaria and visceral leishmaniasis. Recently, however, it has been suggested that there is an association between use of DDT and the occurrence of human cancers;[b,c] a report on the presence of DDT in breast milk has appeared;[d] and two general reviews on the use of DDT in vector control have been carried out.[e] The WHO Study Group on Vector Control for Malaria and other Mosquito-borne Diseases, which met in Geneva on 16–24 November 1993, was asked as a specific additional task to review the current situation in the light of these recent developments. For this purpose, two expert toxicologists were invited to participate.[f] Based on the discussions of all the participants at the meeting, the conclusions of the Study Group with regard to the use of DDT for vector control are summarized below.

- The information presented does not provide sufficient and convincing evidence for the adverse effects of DDT exposure as a result of indoor residual spraying as carried out in malaria control activities.
- There is therefore, at this stage, no justification on toxicological or epidemiological grounds for changing current policy towards indoor spraying of DDT for vector-borne disease control.[g]
- DDT may therefore be used for vector control, provided that all the following conditions are met:

— it is used only for indoor spraying;

— it is effective;

— the material is manufactured according to the specifications issued by WHO;[h] and

— the necessary safety precautions are taken in its use and disposal.

- In considering whether to use DDT, governments should take into consideration the following additional factors:

— the costs involved in the use of insecticides (DDT or alternatives);

— the role of insecticides in focal or selective vector control, as specified in the Global Malaria Control Strategy;[i,j]

— the availability of alternative vector control methods, including alternative insecticides (in view of the availability of alternative insecticides for indoor residual spraying, some of which may compete with DDT in terms of their epidemiological impact, public acceptability, logistic suitability and compliance with specifications issued by WHO, DDT no longer merits being considered the only insecticide of choice);

— the implications for insecticide resistance, including possible cross-resistance to some alternative insecticides; and

— the changing public attitude to pesticide use, including public health applications.

- In view of the paucity of data suggesting adverse effects of indoor house-spraying, further epidemiological investigation using rigorous scientific protocols is to be encouraged.
- Further studies should also be carried out on the following:

— examination of the health effects of DDT in breast milk on breast-fed infants, including any resulting behavioural changes;

— thorough investigation of any suspected association between the use of DDT in routine malaria control activities and an increased incidence of cancer(s); and

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[a] Based on: *Vector control for malaria and other mosquito-borne diseases* (Annex 1). Geneva, World Health Organization (WHO Technical Report Series), in press.

[b] **Garabrant DH et al.** DDT and related compounds and risk of pancreatic cancer. *Journal of the National Cancer Institute*, 1992, **84**: 764–771.

[c] **Wolff MS et al.** Blood levels of organochlorine residues and risk of breast cancer. *Journal of the National Cancer Institute*, 1993, **85**: 648–652.

[d] **Bouwman H et al.** Levels of DDT and metabolites in breast milk from Kwa-Zulu mothers after DDT application for malaria control. *Bulletin of the World Health Organization*, 1990, **68**: 761–768.

[e] Prepared by: Dr C. F. Curtis, Department of Medical Parasitology, London School of Hygiene and Tropical Medicine, London, England; and Professor J. Mouchet, Institut français de Recherche Scientifique pour le Développement en Coopération (ORSTOM), Paris, France.

[f] Dr W.N. Aldridge, The Roben's Institute, Kings Worthy, Hants, England; and Professor M. Lotti, Institute of Occupational Medicine, University of Padua, Padua, Italy.

[g] The place of DDT in operations against malaria and other vector-borne diseases. In: Executive Board Forty-seventh Session, Geneva, 19–29 January 1971, Part II. *Report on the proposed programme and budget estimates for 1972*. Geneva, World Health Organization, 1971 (Official Records of the World Health Organization, No. 190): 176–182.

[h] *Specifications for pesticides used in public health — insecticides: DDT*. Unpublished document WHO/CTD/WHOPES/93, 1993 (Specifications WHO/SIT/1.R7 and WHO/SIF/1.R7).

[i] *A global strategy for malaria control*. Geneva, World Health Organization, 1993.

[j] *Implementation of the Global Malaria Control Strategy. Report of a WHO Study Group on the Implementation of the Global Plan of Action for Malaria Control 1993–2000*. Geneva, World Health Organization, 1993 (WHO Technical Report Series, No. 839).

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— clarification of the significance of the reduction in muscarinic receptor density caused by DDT.

Control of epidemic meningococcal disease

Meningococcal disease occurs in two clinical forms: meningococcal meningitis and meningococcal septicaemia. Of these, the former is commoner, but responds well to treatment. In contrast, meningococcal septicaemia, although less common, is fatal, even when actively treated. Meningococcal meningitis is the only form that causes epidemics. These can occur anywhere in the world; however, the largest occur mainly in the semi-arid areas of sub-Saharan Africa (African meningitis belt). Apart from epidemics, meningococcal meningitis occurs sporadically throughout the world, with seasonal variations, and accounts for a variable proportion of endemic bacterial meningitis.

A 71-page booklet containing practical guidelines on the control of meningococcal disease for health personnel and health authorities, at any level, has recently been prepared by a WHO Working Group.[k] The five chapters cover a range of topics, the most important of which are outlined below.

- *The magnitude of the problem:* review of epidemics of meningococcal disease since 1970 (periodicity and seasonality of the epidemics, epidemic patterns); conditions favouring epidemics (serogroups and serotypes, immunity, and demographic factors); and meningococcal meningitis as part of bacterial meningitis (endemic meningococcal disease, other causes of bacterial meningitis).
- *The disease:* how to recognize and confirm meningococcal disease (signs and symptoms, physical examination, lumbar puncture and cerebrospinal fluid (CSF) examination, differential diagnosis); how to manage patients with meningococcal disease (antimicrobial therapy, supportive therapy, simplified management under difficult conditions); how to prevent meningococcal disease (vaccination, chemoprophylaxis).
- *How to detect and confirm an outbreak or epidemic of meningococcal disease:* epidemic versus endemic disease; planning and implementing an early warning system (collecting and reporting information, regular data review, deciding when an epidemic is occurring); rapid assessment of a suspected epidemic of meningococcal disease (investigation of suspected cases).
- *How to plan for and respond to an epidemic:* national/provincial crisis committee; informing the public; planning an appropriate emergency response (vaccination, chemoprophylaxis, general measures); sustaining the control programme and ensuring follow-up; and documenting the epidemic.
- *Interepidemic prophylaxis:* containment around a patient with meningococcal disease in non-epidemic conditions; routine vaccination; and regulations for travellers.

A list of 84 references to the original literature is included, together with 10 annexes that provide information on the following:

— Gram and methylene blue staining;
— latex agglutination tests;
— injecting oily chloramphenicol;
— vaccines;
— public domain software for epidemiological investigations;
— materials for field investigations;
— materials for diagnosing *Neisseria meningitidis*;
— preparing trans-isolate medium;
— sources of kits for mass vaccination campaigns; and
— organizing a vaccination campaign.

Single copies of this booklet can be obtained from the Programme on Bacterial, Viral Diseases and Immunology, Division of Communicable Diseases, World Health Organization, 1211 Geneva 27, Switzerland.

Yellow fever in 1992 and 1993[l]

The total numbers of cases of yellow fever in 1992 and 1993 were relatively low, but noteworthy in that the first outbreak recorded in Kenya since 1943 was documented. A total of 295 cases were reported to WHO for 1992, with 102 deaths (case-fatality rate (CFR), 35%). These included 176 cases and 21 deaths (CFR, 12%) from Africa, and 119 cases and 81 deaths (CFR, 68%) from South America. In 1993, a total of 218 cases and 38 deaths (CFR, 17%) were reported from Africa, and 175 cases with 79 deaths (CFR, 45%) were documented from South America, for a grand total of 393 cases and 117 deaths (CFR, 30%). A summary of the number of yellow fever cases and deaths reported to WHO by Member States for the period 1989–93 is shown in Table 1.

[k] *Control of epidemic meningococcal disease: WHO practical guidelines.* Lyon, Edition Foundation Marcel Mérieux, 1995.

[l] Based on: Yellow fever in 1992 and 1993. *Weekly epidemiological record,* 1995, **70**(10): 65–70.

Table 1: **Yellow fever: number of cases and deaths (case-fatality rate) notified to WHO, 1989–93**

Country/area	1989		1990		1991		1992		1993	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Africa										
Cameroon	—	—	173	118	—	—	—	—		
Ghana	—	—	—	—	—	—	—	—	39	15
Kenya	—	—	—	—	—	—	27	13	27	15
Nigeria	3 270	618	4 075	223	2 561	661	149	8	152	8
Total	3 270	618 (19)[a]	4 248	341 (8)	2 561	661 (26)	176	21 (12)	218	38 (17)
South America[b]										
Bolivia	107	87	50	38	91	54	22	18	18	14
Brazil	9	3	2	1	15	8	12	8	66	17
Colombia	1	1	7	7	4	4	2	2	1	1
Ecuador	—	—	12	6	14	9	16	13	1	—
Peru	120	100	17	17	27	15	67	40	89	47
Total	237	191 (81)	88	69 (78)	151	90 (60)	119	81 (68)	175	79 (45)
Grand total	3 507	809 (23)	4 336	410 (9)	2 712	751 (28)	295	102 (35)	393	117 (30)

[a] Figures in parentheses are percentages.
[b] The case previously reported in French Guiana in 1990 has been deleted.

Africa

In a dramatic decrease in the number of cases reported compared with previous years, only Kenya and Nigeria reported yellow fever in 1992, while Ghana experienced a limited outbreak in 1993 that continued into 1994.

Ghana. In 1993, an outbreak of yellow fever occurred in the Upper West Region, with 39 cases and 15 deaths (CFR, 38%).[m] The outbreak began in October 1993 and cases were still being reported in December. Transmission appeared to be limited to the Jiripa District. Yellow fever was confirmed serologically. Of 37 cases where age and sex were reported, 15 (40%) were under 15 years of age, and 9 (24%) were females. An immunization campaign was begun in December 1993 and continued into 1994; it appears to have controlled the outbreak.

Kenya. The first yellow fever outbreak reported from Kenya since 1943 began in September 1992 and continued through March 1993. The outbreak was limited to the Baringo and Elgeyo Marakwet Districts in the Kerio Valley, north-west of Nairobi. A total of 54 cases and 28 deaths (CFR, 52%) were recorded. Eighteen of the cases (33%) were among people aged ≤19 years and 19 cases (35%) were females. Epidemiological investigations indicated that the outbreak was consistent with jungle yellow fever. The virus was isolated from clinical specimens of ill and fatal cases, and from captured mosquitos. Molecular characterization of the isolated viruses indicated that they were similar in genetic composition to those previously isolated from humans and mosquitos during past outbreaks of yellow fever in East Africa, and genetically distinct from isolates from specimens collected in West Africa or South America. The outbreak was halted following a mass immunization campaign, during which nearly 1 million doses of yellow fever vaccine were administered to residents of the areas at risk.

Nigeria. Only 149 cases and 8 deaths (CFR, 5%) were reported from Nigeria in 1992, unlike the situation in recent years when several thousand cases were documented. In 1993, 152 cases were reported, with eight deaths (CFR, 5%). No information was provided on the specific dates of onset, locations, age or sex of the reported cases for either year.

EPI: yellow fever vaccine in Africa. Since 1989, WHO/EPI has recommended that yellow fever vaccine be included in the childhood immunization programmes of the 33 countries in Africa at risk for the disease. Today, 17 of the 33 countries have a national policy to this effect. Up to August 1994, yellow fever immunization coverage data had been reported to WHO by 15 of the 17 countries. Burkina Faso, the Gambia, and Mauritania have achieved coverage above 50% for children by their first birthday. However, for all 33 African countries at risk for yellow fever, vaccine coverage levels only reached 7% in 1993, compared with 11% in 1992.

[m] Yellow fever, Ghana. *Weekly epidemiological record*, 1994, **69**(6): 44; and 1994, **69**(10): 76.

The African countries at risk are among the most impoverished countries in the world. Although yellow fever vaccine is available to developing countries at less than US$ 0.25 per dose, this price is still a barrier to many countries at risk. Donors are encouraged to provide assistance to help the African countries at risk prevent the deadly disease through routine immunization.

South America

In 1992, a total of 119 cases and 81 deaths (CFR, 68%) were officially reported from South America: 22 cases and 18 deaths (CFR, 82%) were reported from Bolivia; 12 cases and 8 deaths (CFR, 67%) from Brazil; 2 cases and 2 deaths (CFR, 100%) from Colombia; 16 cases and 13 deaths (CFR, 81%) from Ecuador and 67 cases and 40 deaths (CFR, 60%) from Peru.

In 1993, 18 cases and 14 deaths (CFR, 78%) were reported from Bolivia, 66 cases and 17 deaths (CFR, 26%) from Brazil; one fatal case from Colombia; one non-fatal case from Ecuador; and 89 cases with 47 deaths (CFR, 53%) from Peru. Thus, a total of 175 cases were reported, with 79 deaths (CFR, 45%).

Bolivia. All 22 cases that occurred during 1992 were among adult males aged 16–70 years. A total of 16 cases were reported from La Paz Department, 1 case from Cochabamba, and 5 cases from Santa Cruz. Eighteen of the 22 cases were fatal, including all those from La Paz, the case in Cochabamba, and one of the cases in Santa Cruz. Cases occurred throughout the year. Of the 18 cases reported in 1993, 14 were from La Paz and 4 from Santa Cruz: 13 of the 14 patients from La Paz and 1 of the cases from Santa Cruz died. Three cases involved females aged 6 months, 30 years, and 70 years. The youngest and the oldest were among the fatal cases. The 15 male cases were aged 7–57 years; 12 died.

Brazil. Of 12 cases reported in 1992, all were among young adult males except one, a 21-year-old woman who died on 1 January 1992 in Sidrolandia, Mato Grosso do Sul State. The male cases were aged 18–39 years (1 was aged <20 years; 4 were aged 20–29 years; 6 were aged 30–39 years). A total of eight cases were reported from Mato Grosso do Sul State, two from Mato Grosso, and one each from Amazonas and Roraima. Six cases occurred in January, one in February, three in March and two in November.

In 1993, an outbreak of yellow fever occurred between March and May around the Municipality of Mirador in the State of Maranhão. Of the 66 cases reported, 44 were from this location, and an additional 11 were from Barra do Corda in the same state. A total of 17 deaths were reported (CFR, 26%), but only three were from Mirador and four from Barra do Corda.

Colombia. In 1992, two fatal cases of yellow fever involving young men were reported in Florencia, Caqueta Province, and Puerto Asis, Putumayo Province. No additional epidemiological information was reported for these cases. In 1993 one fatal case was reported in Zaragoza, Antioquia Province.

Ecuador. Epidemiological information was available for 11 of the 16 cases reported in 1992. All were among young men, with seven aged less than 20 years, two aged 20–29 years, and two aged 40–49 years. The dates of onset were May (3 cases) and June (8 cases), and the localities affected were Pastaza Province (4 cases), Napo (3 cases), and Sucumbios (3 cases); no information was provided for one case. In 1993 one case was reported but no epidemiological information was given.

Peru. Peru accounted for the largest number of cases notified in the American Region in 1992 and 1993. In 1992, 67 cases were reported, of which 40 were fatal (CFR, 60%) and in 1993, 89 cases and 47 deaths (CFR, 53%). Throughout 1992, a total of 1–12 cases were notified monthly. A total of 35 cases were from seven provinces in the Department of San Martín. The remaining 32 cases were reported in 13 provinces in seven departments. A total of 56 of the 67 cases were in patients over 15 years of age, and 43 were aged 20–40 years.

Of the 89 cases notified in Peru in 1993, a total of 80 were from the Departments of San Martín (32), Junín (28) and Ayacucho (20). The highest number of cases in San Martín Department were reported from Huallaga Province (17 cases), in Junín Department from Chanchamayo Province (21 cases), and in Ayacucho Department from Lucanas Province (12 cases). Six other provinces in San Martín, two in Junín and 12 in Ayacucho reported cases, and the remaining nine cases were scattered over six provinces in five departments. Seventeen of the 89 cases were in females, 15 cases were 15 years of age, and three were >60 years of age.

Conclusion

The risk of yellow fever in many tropical and subtropical areas of Africa and South America continues to be significant. The disease remains enzootic in these areas in a jungle cycle, with transmission occurring primarily among non-human primates, with forest-dwelling mosquitos serving as vectors. Humans are infected when they enter into areas of active transmission and are fed upon by infectious

mosquitos. A greater risk for human epidemic transmission occurs when viraemic persons enter urban centres where they may be fed upon by competent domestic mosquito vectors, especially *Aedes aegypti*. The re-infestation of many tropical and subtropical cities by this mosquito species is of grave concern in the light of historical urban yellow fever outbreaks, and the realization that both human and vector mosquito population densities are now much greater than when urban yellow fever was last commonplace.

Nutritional value of Antarctic krill[n]

A healthy diet requires a proper balance of carbohydrates, proteins, fats (and oils), fibre and minerals, as well as other nutrients. Nutritionally, Antarctic krill (*Euphausia superba*) appears to be a food appropriate for inclusion in a healthy diet; it contains equal proportions of polyunsaturated, monounsaturated, and saturated fatty acids, with the last-mentioned accounting for less than 6% of the total energy content; and it has a high protein content (63.7% of dry weight of the meat).

Of the more than 70 species of euphausiid crustaceans that are present in the ecosystem of the south-western Atlantic Ocean, the largest is Antarctic krill, which can reach up 5–6 cm in length. Antarctic krill occurs throughout the circumpolar zone, but is especially abundant in the waters surrounding the South Shetland Isles. The total estimated reserves of the crustacean are enormous (500–2500 million tonnes) and an annual catch of only 10% of this biomass would be equivalent to the world's total yearly fish catch. Work on its use as a foodstuff for human consumption has been carried out in several countries, e.g., Russian Federation, Poland, Japan, Chile, and Uruguay.

The cholesterol level of Antarctic krill is low (ca. 30 mg per 100 g), while the level of polyunsaturated fatty acids of the n–3 series (principally octadecatetraeonic acid, eicosapentaenoic acid, and docosahexaenoic acid) is high (1.47 g per 100 g). The total level of polyunsaturated fatty acids is similar to that of tuna, salmon, anchovy, and herring.

Noteworthy is the high selenium content of Antarctic krill (3.41 µg/g), a trace element that is a cofactor for glutathione peroxidase. Other trace elements present include zinc (43.7 µg/g) and copper (4.77 µg/g), both of which play a role in the action of superoxide dismutase.

Studies on rabbits indicated that replacement of 10% of their basal diet with krill produced a reduction ($P<0.05$) in formation of atheromatous plaque; also, the levels of aortic and pulmonary plaque caused by a hypercholesterolaemic diet were reduced in rabbits that were fed krill.

Controlled studies on humans suggest that consumption of 25 g per day of Antarctic krill meat for 7 days could significantly reduce platelet aggregation and increase plasma levels of eicosapentaenoic acid and docosahexaenoic acid. Furthermore, a krill diet may have a pronounced anti-atherogenic effect, as indicated by the marked reduction or elimination of the atherogenic potential it produces on the blood plasma of patients with cardiac insufficiency, inducing an *in-vitro* reduction in the incorporation of cholesterol into the subendothelial cells of the aorta. The organoleptic properties appear to be retained in krill meal stored for up to 6 months at temperatures below 20 °C and for over 8 months at temperatures of 4–8 °C. The authors report that Antarctic krill meat has no hepatotoxic effects and that it may have beneficial effects on chronic diseases such as atherosclerosis. Other products that can be derived from Antarctic krill, e.g., chitosans from the shell, astaxanthins, proteolytic and lipolytic enzymes, together with exploitation of its high fluorine content, represent novel areas for research.

[n] Summary of an article submitted by B.A. Grillo, W. Alallon, and P. Louisot. Copies of the full article can be obtained upon request from Dr Grillo, Bvar. Espana 2575/402, Montevideo 11300, Uruguay.

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