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## ACUTE PESTICIDE POISONING: A MAJOR GLOBAL HEALTH PROBLEM

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Pesticides are a group of chemicals used predominantly in agriculture and against vectors in vector-borne diseases such as malaria, filariasis, etc. There are several definitions of a pesticide; the Food and Agriculture Organization of the United Nations (FAO) (1) defines a pesticide as any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs or which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. The term includes substances intended for use as a plant-growth regulator, defoliant, dessicant or fruit-thinning agent or agent for preventing the premature fall of fruit and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

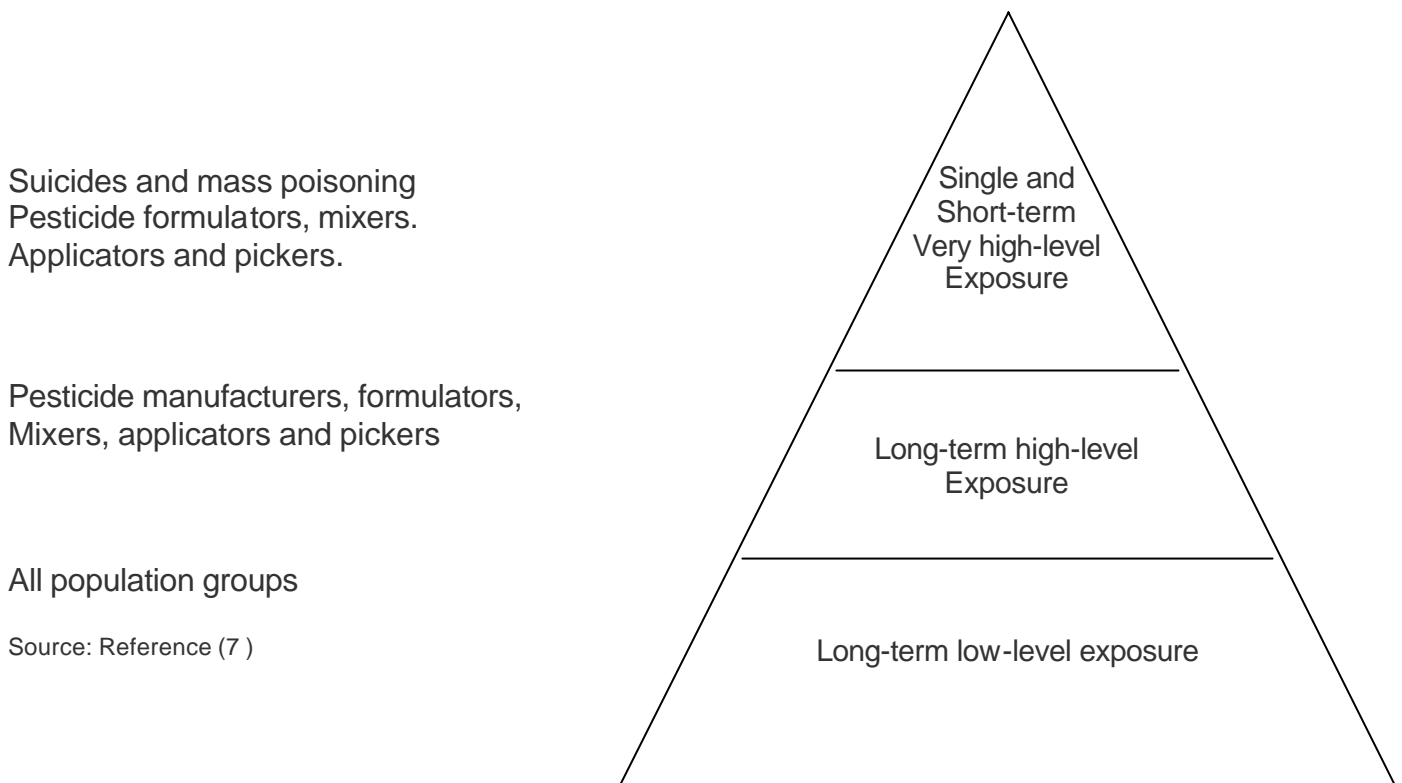
It is evident that a pesticide, so defined, is used for the variety of benefits it provides to mankind. But in so doing there are certain undesirable and unwanted effects of pesticide usage which cannot be ignored. This article focuses attention on the unnecessary acute health effects that arise from the use of pesticides.

Man may be exposed to pesticides in a variety of ways; at different dose levels and for varying periods of time. A schematic representation of the manner of human exposure to pesticides is shown in *Fig. 1*. In most countries all of these modes of pesticide exposure prevail, but what is most important is that each country or region identify the mode of exposure and resultant hazard which is most important to its own circumstances. For instance, in the industrialized world the problem of acute pesticide poisoning has largely been controlled and the main focus of attention is on the possible health effects arising from exposure to low levels of pesticides over a long period of time. Such exposures usually arise from environmental contamination as well as from pesticide residues in food, whereas the situation is quite the reverse in the countries of the developing world. In these countries the main health

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**FIGURE 1: POPULATION GROUPS AT RISK**



problem arising from pesticides is that due to acute poisoning. No doubt the concerns of long-term exposure to low levels of pesticides also obtain in these countries, but they should not be considered a priority health issue as they are in the countries of the industrialized world. The need to set priorities in combating the health problems arising from pesticide usage is illustrated (2) by the fact that only 1-2% of scientific papers published on pesticides and health has addressed the issue of acute pesticide poisoning. This article will mainly focus on acute pesticide poisoning, as it is a major health concern of pesticide usage.

### **Current status of knowledge**

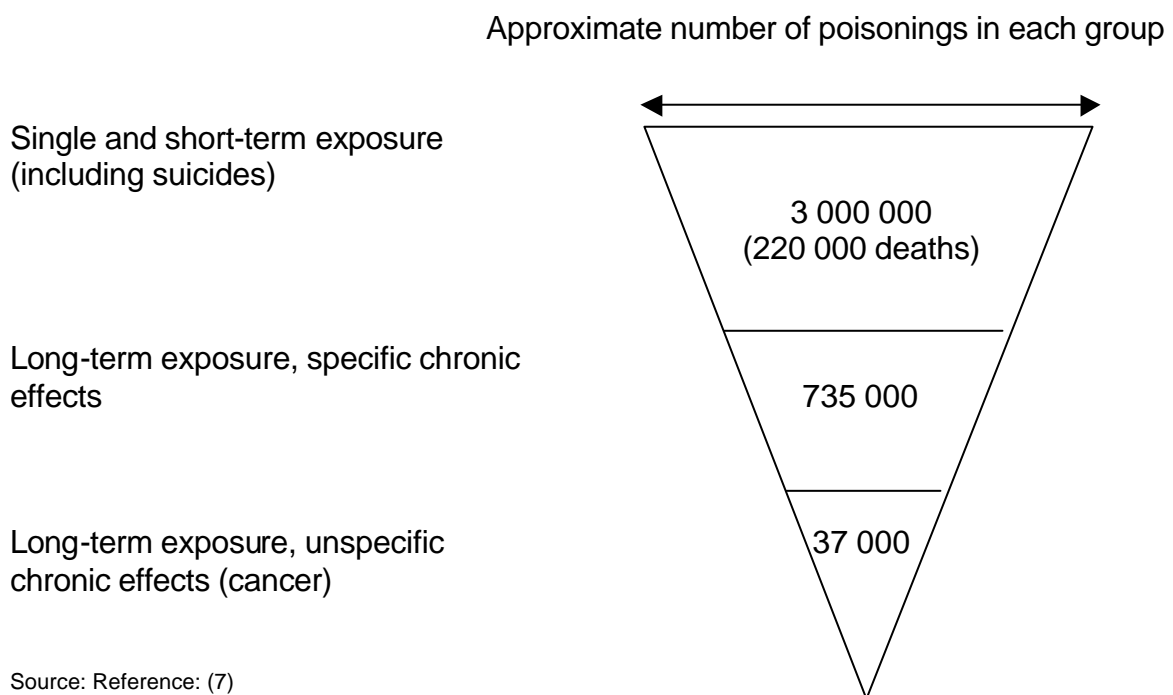
Any figures concerning the extent of acute pesticide poisoning on a global scale are largely based, by necessity, on estimates. The first such estimate was made in 1973 by the World Health Organization (3) which suggested that 500 000 cases of acute serious pesticide poisoning occurred annually. This estimate included only hospitalized cases of unintentional poisoning (excluding suicide attempts). At that time it was considered to be an unacceptably large problem, requiring efforts to substantiate this estimate as well as to control the problem. In 1982 (4) a national study of hospital cases of acute pesticide poisoning demonstrated that Sri Lanka, a country with a population of 12 million, had approximately 10 000 persons admitted to hospitals for acute pesticide poisoning annually, resulting in almost 1000 deaths. The public health importance of this figure was highlighted by the fact that the deaths due to acute pesticide poisoning for that particular year were almost twice the total number of deaths due to malaria, poliomyelitis, whooping cough, diphtheria and tetanus, the traditional public health problems of developing countries. These figures included suicides attempts and suicides, which comprised about two-thirds of the hospitalized poisonings (4-6). The equivalent annual figures at a global level in 1985 (5) were estimated at approximately 3 million cases hospitalized and approximately 220 000 deaths.

Recently, a WHO task group reviewed the available estimates and other pesticide poisoning data and summarized the overall public health impact of pesticides (7), as shown in Fig. 2. WHO states that "the estimated 3 million cases of acute severe poisonings may be matched by a greater number of unreported, but mild, intoxications and acute conditions such as dermatitis" (this figure includes suicide attempts). It should be noted that the data shown in Fig. 2. are the inverse of the pyramid shown in Fig. 1. This is because the associated morbidity is small although a large number of persons are potentially at risk from long-term low-level exposure to pesticides. On the other hand, although the numbers exposed to high levels of pesticides for a short period of time are small, their morbidity and mortality are high. On the basis of this data, WHO states that "there is no segment of the general population that is sheltered from exposure to pesticides and potentially serious health effects, although a disproportionate burden is shouldered by, the developing world and high-risk groups in each country".

Suicides have been incriminated as a major factor in the causation of acute pesticide poisoning. They contribute to approximately two-thirds of all causes of acute pesticide poisoning. The herbicide paraquat is extensively used as an agent for suicides. Paraquat poisoning is a major problem in Malaysia particularly, with 73.4% of such poisonings due to suicides, 13.8% to accidents and only 1.07% to occupational accidents (8).

Suicide in any society is a social problem which requires attention from many disciplines. The reason for the extensive use of pesticides as an agent for suicide in developing countries is the ready availability of extremely toxic pesticides. In the developed countries, pesticides are responsible for only a small percentage of all poisonings, whereas in the developing countries they are a major contributor to poisoning (table 1) (9). The ready availability to the general public of these toxic pesticides should be controlled to limit the current epidemic of acute pesticide poisoning in the countries the developing world.

**FIGURE 2: ESTIMATED OVERALL ANNUAL PUBLIC HEALTH IMPACT**



**TABLE 1: PROPORTION OF ACUTE POISONINGS DUE TO PESTICIDES, SELECTED COUNTRIES, 1980s**

Country	Percentage of total acute poisonings
Indonesia .....	28.0
Brazil .....	16.0
United Kingdom .....	5.0
Australia .....	3.0
Canada.....	2.4
United States of America .....	0.8

Only relatively recently have data on acute pesticide poisoning in Africa become available. Choudhury (10) estimated that 11 million cases of pesticide intoxications occur annually in Africa. This figure includes minor non-hospitalized poisoning cases and is therefore not directly comparable with the figures given above. *Table 2* indicates the extent of the problem in some of the African countries.

In making global estimates, there are a variety of pitfalls which are likely to give rise to inaccurate estimates of the extent of the problem. The main issues which distort the picture are: (i) misdiagnosis of acute pesticide poisoning; (ii) some studies confined to hospital cases, others confined to minor poisoning or mere pesticide exposure; (iii) most studies confined to a limited region and not nationally representative; and (iv) incomplete compilation of data.

In Indonesia, although the officially-collected records do not indicate a problem, local studies estimate that there are 30 000 cases of pesticide poisoning annually, of whom approximately 2 400 require hospitalization<sup>b</sup>. In Thailand (11) the epidemiological surveillance report records 2 094 cases of pesticide poisoning with no deaths for the year 1985, while the data collected by the National Environmental Board record a fatal of 4 046 cases resulting in 289 deaths, indicating the great variation even in official records. The epidemiological surveillance data in Thailand are routinely obtained on the basis that pesticide poisoning is one of the 54 notifiable diseases in that country, whereas the National Environmental Board collects data from a variety of sources.

Given this situation, there is an urgent need to collect accurate data on the different aspects of acute pesticide poisoning, particularly in the countries of the developing world. Such data should not merely be looked upon as data to establish the extent of the problem, but rather as the starting point for programmes for the control of acute pesticide poisoning. Further, such data are necessary to monitor and evaluate the efficacy of different intervention programmes that may be implemented for the control of acute pesticide poisoning.

### **The situation among agricultural workers**

The global estimates of acute pesticide poisoning are largely based on hospital data. Very few, surveys have been undertaken to study the problem of acute pesticide poisoning among agricultural workers. A survey undertaken in Asian countries (6) examined the problem, and the

<sup>b</sup> Suma'mur . P.K. *Current situation of chemicals and accidents/ episodes involving toxic chemicals in Indonesia*. Paper presented at a WHO intercountry workshop on chemical safety in countries of the South-East Asia Region, 29 October-2 November 1989.

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situation in two countries with the most reliable data (Table 3) indicates the extent of pesticide-poisoning episodes as perceived by the workers themselves.

On this basis, if it is taken that maybe on average 3% of agricultural workers in developing countries suffer an episode of pesticide poisoning a year (6), it would mean that for the 830 million agricultural workers in the developing world (12), there are about 25 million cases of occupational pesticide poisoning. The bulk of these episodes of poisoning do not get recorded, as they are considered minor and often self-limiting, and most of the patients do not seek medical attention. A survey of the preferred choice of medical attention for episodes of

**TABLE 2: NUMBER OF POISONINGS IN SOME AFRICAN COUNTRIES, 1980s**

Country – Pays	Population (millions)	Percentage Agricultural labour Force	Annual number Of cases of pesticide Poisoning
Sudan .....	24	80	384 000
United Republic of Tanzania ...	23	85	388 000
Kenya.....	22	80	350 000
Uganda .....	17	80	272 000
Mozambique.....	15	70	240 000
Cameroon .....	11	80	175 000
Zimbabwe.....	10	80	160 000
Malawi.....	8	85	128 000
Senegal .....	7	80	112 000
Maurotius .....	2	75	3 200

From reference (11)

**TABLE 3: PERCENTAGE AGRICULTURAL WORKERS AND PESTICIDE USERS WITH PESTICIDE POISONING, SELECTED COUNTRIES, 1980s**

Country	Agricultural workers Over poisoned	Agricultural workers Poisoned/year	Agricultural workers Over poisoned	Agricultural workers Over poisoned
	(%)	(%)	(%)	(%)
Malaysia .....	13.3	6.7	14.5	7.3
Sri Lanka.....	4.6	2.7	11.9	7.1

Source: Reference (5)

poisoning among agricultural workers indicated variation. In Indonesia 69.9% of patients sought treatment in hospitals, in Malaysia 67.8% and in Sri Lanka 83.5%, but in Thailand only 8.4% of patients chose to seek treatment in hospitals.

### Control of acute poisoning

The essential starting point in any control programme is to establish the extent of the problem. In the case of acute pesticide poisoning it has become abundantly clear over the last few years that the problem on a global scale is immense. It has also become evident that this particular aspect of

pesticide poisoning is almost exclusively a concern of the developing world. The heartening feature in this gloomy picture is that the industrialized countries have been able to successfully control the problem. This must mean that there are valuable lessons to be learnt and it is possible to do likewise in the countries of the developing world. The available data suggest that acute pesticide poisoning is a major health concern in the developing world today. Yet very little has been done. The situation in Sri Lanka is a case in point in 1982, scientists in Sri Lanka published data (4) to indicate that acute pesticide poisoning was an issue of even greater significance than the traditional public health problems of communicable diseases seen in developing countries, yet there has been no significant progress since (Table 4). There is an urgent need to take action.

The problem can be solved if all interested parties collaborate. It is wasteful and unnecessary to embark on activities which purely seek to blame the agrochemical industry. It is recognized that pesticides are primarily used for their beneficial effects, but responsible action must be taken to eliminate or minimize the associated hazards. Thus the people, national governments agrochemical industries, scientists and international agencies all have a role to play in any control programme.

### The role of responsible agents

#### *The role of governments*

The ultimate responsibility to control the use of pesticides so as to minimize health hazards devolves to national governments. They must continue, and whenever necessary strengthen, health education programmes among pesticide users, particularly to ensure safe practices.

Though many countries have enacted legislation, enforcement remains insufficient. As an immediate corrective measure it may be appropriate to consider selective enforcement or selective legislation to control those pesticides considered to be most hazardous. For this purpose the WHO document *Recommended classification of pesticides by hazard and guidelines to classifications*<sup>d</sup> would be most useful-pesticides classified extremely hazardous and highly hazardous should be identified for stricter controls.

Agricultural activities are undertaken in remote rural areas, which often most lack health-care facilities. The primary health care approach can be regarded as most suitable for such situations. Further, such an approach involves the consumer (in this case the worker) in the process of health-care delivery, thereby making it more effective. The primary health care approach also incorporates the multisectoral approach so essential in the control of pesticide poisoning.

**TABLE 4: HOSPITAL ADMISSIONS FOR PESTICIDE POISONING, SRI LANKA, 1984-1988**

Year	Total Number	Deaths
1984.....	16 085	1 459
1985.....	14 423	1 439
1986.....	14 413	1 452
1987.....	12 841	1 435
1988.....	12 997	1 524

Source: Ministry of Health, Sri Lanka

<sup>d</sup> World Health Organization. *Recommended classification of pesticides by hazard and guidelines to classifications 1983-1989* (Document WHO/VBC/88 953, 1988)

### *The role of the agrochemical industry*

The agrochemical industries are often not included in control programmes. This is a great drawback which needs to be rectified, as these organizations can contribute significantly to the control of poisoning, particularly in the following areas:

- research into developing appropriate personal protective equipment for tropical countries;
- prevention of marketing of pesticide mixtures;
- maintenance and repair of spray equipment;
- research to develop hazard-free spray equipment;
- use of safe pesticide containers which are unlikely to be accident prone.

### *The role international agencies*

The international agencies, particularly WHO and the International Labour Organisation (ILO), have contributed a great deal in their attempts to control pesticide poisoning. They should continue their efforts, with particular emphasis on education and training on safety in the use of pesticides (13, 14) and applied research activities, and should play the role of intermediary for the involvement of agrochemical industries in safety activities.

## **SUMMARY**

The global problem of acute pesticide poisoning has been confirmed as extensive by a variety of independent estimates. Further, it is also recognized to be a problem confined to the developing countries. Most estimates concerning the extent of acute pesticide poisoning have been based on data from hospital admissions which would include only the more serious cases. The latest estimate by a WHO task group indicates that there maybe 1 million serious unintentional poisonings each year and in addition 2 million people hospitalized for suicide attempts with pesticides. This necessarily reflects only a fraction of the real problem. On the basis of a survey of self-reported minor poisoning carried out in the Asian region, it is estimated that there could be as many as 25 million agricultural workers in the developing world suffering an episode of poisoning each year. This article emphasizes the need to control the problem on a collaborative basis by all concerned, including national governments, agrochemical industries, international agencies, scientists and victims.

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