Childhood pesticide poisoning – a clarion call for action on children's vulnerability

The World Health Organization (WHO) estimates that between 1 and 5 million cases of pesticide poisoning occur annually with approximately 20 000 fatalities, representing a significant public health problem.[1,2] Studies have suggested that these figures greatly underestimate the true burden of pesticide-related mortality and morbidity, particularly in developing countries.[3,4] However, within the spectrum of vulnerable populations, children have increasingly been recognised as bearing the brunt of environmental toxins.[5,6] In this issue, Dippenaar and Diedericks[7] highlight the problem of childhood pesticide poisoning by documenting the steady stream of children admitted to hospitals in a rural region of one province of South Africa. The authors identify the main circumstances as accidental ingestion of organophosphates (OPs), either as residues on unwashed fruit or from poorly marked storage containers, or from dermal and respiratory absorption following OP application for pest control in and around homes, and cite a seasonal and geographical clustering of cases that corresponds with temporal and geographical patterns of high use of OPs in agriculture.

These findings are not dissimilar to epidemiological patterns reported in other developing countries[8-11] where high rates of pesticide poisoning in rural populations have included high frequencies of childhood poisonings linked to unsafe use of and uncontrolled access to hazardous chemicals used in agriculture.

What is the basis for children's particular risk for pesticide poisoning? Firstly, there are many reasons related to social context. Children living in low socioeconomic circumstances may experience poor housing conditions associated with pest infestations, which can prompt adults, unaware of the risks, to resort to chemical pest control in ways that are extremely hazardous to children. For example, the practice of spraying children's beds and bedding with pesticide to control fleas or bedbugs is not an uncommon cause of severe childhood poisoning necessitating admission to intensive care facilities.[12] Data from a study of urban residents in South Africa in 2001 suggested that 20% of urban households make regular use of pesticide sprays at home.[13]

Moreover, on farms, the widespread use of chemicals for pest control and the ready availability of agricultural pesticides to household adults make it very easy to use pesticides for the purposes of domestic pest control, particularly where controls over pesticide stores are not enforced by farm owners, or where pesticides are kept in the home, not stored safely under lock and key. In addition, given that the majority of farm workers in South Africa live in close proximity to their working environment,[14] pesticide drift into farm worker homes may be an important route of contamination of the domestic environment, as has been found in Israeli kibbutz residents.[15] Conversely, families lacking recreational spaces or child care may have little choice but to allow children to find their way into fields, orchards or vineyards during or shortly after spray application, resulting in pesticide exposure either directly from spraying or from contact with foliar or soil residues.[8-11,16] Lack of ablution facilities at the worksite for farm employees also means that contaminated overalls can be a source of pesticide exposure for children at home if left lying around or washed with other household clothing or linen. Re-use of pesticide containers to store food, water or other household items may result in very serious poisonings.

Secondly, a range of behavioural factors increase children's risks. Young children at an early stage in their cognitive development are not in a position to take notice of warning signs or labels. Moreover, children's play behaviours frequently bring them into contact with pesticides in ways that do not occur in adults. For example, young children spend large amounts of time on the ground, where pesticide concentrations in dust may be high. Data from Nicaragua[9] on cholinesterase depression in children living near a crop-dusting airport suggested that the mechanism of exposure was children playing barefoot in puddles containing run-off from the pesticide loading site.

Similarly, mouthing of objects, common in infanthood, may provide a route for ingestion of pesticide residues that accumulate on a range of household items. Older children are at risk of ingesting liquid pesticides contained in unmarked containers[17] or inadevertently mixed into food. In 1999, 24 children in a remote Peruvian village died after consuming milk made up from milk powder contaminated with methyl parathion intended for use to poison dogs attacking a villager's chickens.[18]

Thirdly, a set of biological factors increase children's unique vulnerability to a range of chemical toxins, including pesticides. These factors mean that children will suffer physiological and pathological consequences disproportionately greater than an adult with the same exposure. Most pesticides are dermally absorbed, and children's higher surface area to body weight ratios increase the risk posed by skin contact. Children are also predisposed to disproportionately higher exposures to environmental contaminants because they consume greater quantities of food and water for their body weight, increasing the dose of pesticide. Moreover, foods common in children's diet (e.g. fruit) may be more likely to be contaminated with pesticides. Environmentally persistent pollutants, which include a number of pesticides, may accumulate in the food chain and be concentrated in breast-milk, thereby increasing risks to children. Pesticides absorbed

through respiratory routes are also more likely to present a hazard to children, who have breathing rates higher than adults. Moreover, it is well recognised that children's exposure may begin prenatally *in utero*, as a result of which the duration of childhood exposure may be considerably extended. Children's metabolism also differs significantly from that of adults, as a result of which they will exhibit different capacity to metabolise, excrete, activate or deactivate pesticides.[5,17,19,20]

All these factors mean that children are particularly vulnerable to the effects of exposures to pesticides. Given this recognition, what obligations does our society have to prevent these adverse impacts on children's health? While strategies to address safe storage, application and disposal, increased awareness among parents and health care providers, improved surveillance and compliance with national and international laws and conventions[17,19] are important steps, interventions must also trace the roots of poisoning back to those proximal policies that foster inappropriate and unsafe pesticide use.

Two aspects require attention. Firstly, much agricultural production has become increasingly dependent on chemicals for pest control in ways that are neither environmentally sustainable nor safe for human health, and has failed to recognise important international trends. Pesticide reduction policies in other countries have successfully and sustainably encouraged the growth of organic farming and integrated pest management approaches in agriculture as well as reducing pesticide use in urban pest control settings.

Secondly, industry promotion of pesticides as safe and effective has created a 'pesticide culture',[21] in terms of which chemical use for control of pests is established as the norm. This is clearly illustrated in a recent national television advert, in which a mother is shown spraying a cockroach with a domestic pesticide product while bringing food on a tray to her young children. The positive association between children and pesticides, presented as good for their health, is never counterbalanced by information on the very significant potential health hazards of pesticides. It should come as no surprise, therefore, that the public view pesticides as benign and that children continue to be exposed to chemicals harmful to their health as a result of misinformation.

South Africa's constitution guarantees children the right to be protected from 'maltreatment, neglect, abuse or degradation'.[22] Yet, as Dippenaar and Diedericks[7] argue, 'legislation has failed to limit unnecessary exposure' of children to pesticides. Department of Health statistics indicate that children under 10 represent approximately 50% of fatalities in cases of pesticide poisoning.[23] It is therefore not unreasonable to conclude that South Africa's commitments in terms of our ratification of the Convention on the Rights of the Child,[24] which obliges government to 'combat disease . . . within the framework of primary health care, through . . . the provision of adequate nutrition, food and clean drinking water, taking in consideration the dangers and risks of environmental pollution', are not being adequately fulfilled.

Poisoning of children by pesticides is therefore more than a public health problem;[1] it is often a human rights violation[18,25] requiring systemic action. A human rights analysis locates accountability for poisonings in the failure of all parties to ensure an environment that is not harmful to health and that respects human dignity. Cases of childhood pesticide poisoning are almost always eminently preventable and represent a clarion call for action on children's vulnerability.

L London
Occupational and Environmental Health Research Unit
School of Public Health
University of Cape Town

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