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Suicides and Pesticides in Sri Lanka

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Abstract: Sri Lanka has one of the highest rates of suicide in the world (29 per 100,000 population in 1980). Suicides are especially frequent among young adults, both male and female. Compared to the US, the suicide rate for males ages 15 to 24 years in Sri Lanka is nearly four times greater; the female rate nearly 13 times greater. The most common mode of suicide is ingestion of liquid pesticides. (*Am J Public Health* 1988; 78:826-828.)

Introduction

Malnutrition and infectious diseases continue to be major causes of death and morbidity in less industrialized countries (LICs). However, injuries and poisoning are increasingly important.¹⁻³ In Sri Lanka, injuries and poisoning are the leading cause of death from age 10 to 39. Suicides in 1981 accounted for 47 per cent and 41 per cent of such deaths among females and males, respectively. The importance of liquid pesticides as a vehicle for suicide in Sri Lanka emerged when a variety of data sources were analyzed.

Sri Lanka, formerly Ceylon, is an island republic south of the Indian subcontinent. It has a population of 15.3 million (1983 estimate) and covers 25,332 square miles. Rice is the main domestic crop. Major exports are tea, coconuts, rubber, textiles, petroleum products, and gems.⁴ The country's official language is Sinhala; Tamil and English are also spoken. The 1983 per capita gross national product (GNP) was \$301. According to the 1981 Population Census, the literacy rate was 91 per cent for males and 82 per cent for females.⁵

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Methods

Mortality data for Sri Lanka, as reported to the World Health Organization, have been published for 1980, 1977, and 1968.⁶ The most recent computerized vital statistics data (unpublished) are from 1981. Information on causes of injury is recorded by ICDA E-codes ("E" standing for "external causes of injury"). According to the Judicial Medical Officer (JMO) of Sri Lanka's Department of Health (personal communication), death certificates are completed for an estimated 95 per cent of deaths. Some infant deaths in isolated areas of the country are the primary source of unreported deaths.

Hospital discharge data are collected by the Office of the Medical Statistician, Department of Census and Statistics, Ministry of Home Affairs. Only government hospitals (which account for approximately 30 per cent of hospital admissions) report this information; private and military hospitals do not. Only the nature of injury (fracture, burn, contusion, etc.) is listed. E-coding is not performed. The most recent data on hospital discharge diagnoses (also unpublished) is from 1984. The Judicial Medical Officer (JMO) in Sri Lanka's capital, Colombo, made available unpublished data on autopsies performed by his office.

Results

Suicide rates for males and females in Sri Lanka (1980) appear in Table 1. The 4,401 suicides in 1981 represent 4 per cent of all deaths in Sri Lanka. However, for both males and females, suicides account for nearly 40 per cent of deaths in the age group 15-24 years. The 1980 suicide rate for males in this age group in Sri Lanka is 3.5 times the 1980 US rate of 20.2 per 100,000 population; for females, it is nearly 13 times greater than the US rate of 4.3.⁷

Pesticides were implicated in 53 per cent of autopsied suicide victims in the city of Colombo (JMO, 1985, unpublished data); the proportion would be higher in agricultural areas where pesticides are even more widely available.⁸ The

TABLE 1—Suicide Rates* by Age and Sex, Sri Lanka, 1980

Age Group (years)	Total	Males	Females	M:F
All ages	29.0	37.7	19.7	1.9
0-4	0	0	0	—
5-14	3.4	4.2	2.5	1.7
15-24	62.5	70.0	54.9	1.3
25-34	50.4	70.6	29.5	2.4
35-44	26.9	37.7	15.3	2.5
45-54	25.1	38.3	9.8	3.9
55-64	33.0	50.3	11.6	4.3
65-74	39.6	60.4	13.7	4.4
75+	78.0	128.7	23.9	5.4

*Rates per 100,000 population.

TABLE 2—Mode of Suicide among Autopsied Suicides, Colombo, Sri Lanka, 1985

Mode	No.	Per Cent
Pesticides	83	53
Medicines	2	1
Other poisons	11	7
Hanging	19	12
Drowning	3	2
Train	14	9
Burns	16	10
Other	9	6
Total	157	100

great majority of pesticide poisonings in Sri Lanka are the result of suicide attempts. An investigation of 407 pesticide-related deaths in an agricultural area of Sri Lanka revealed that 373 (92 per cent) were suicides and only 29 (7 per cent) were due to occupational exposures.* Similarly, a review over 1,000 medical records of patients with pesticide poisoning admitted to hospitals in 1979 found that 73 per cent were the result of suicide attempts. Occupational and other accidental exposures accounted for 17 per cent and 8 per cent, respectively.⁸

The mortality rate from suicides has increased from 17.2 per 100,000 population in 1968, to 20.0 in 1977, to 29.0 in 1980. The most dramatic increases have been in the 25 to 34 year old age group: the rate for males nearly doubled between 1968 and 1980 (37.0 to 70.6) and, for females, more than tripled (9.4 to 29.5).⁶ The trend is also seen for in-hospital deaths involving pesticide poisonings, which rose from 938 in 1975** to 1,439 in 1984.

Discussion

Sri Lanka has one of the highest suicide rates of any country in the world (29 per 100,000 in 1980). Only Denmark and Hungary reported higher rates in 1980 (31.6 and 44.9, respectively).⁶ The pattern of suicide in Sri Lanka is similar to other East-Asian developing countries.⁹

It is unlikely that Sri Lanka's high suicide rate is merely an artifact of reporting. Despite its economic difficulties, Sri Lanka has an excellent health services system and reporting of death is mandatory. The country's strong religious traditions would lead one to predict that suicides would be under rather than overreported.¹⁰

*Ponnambalam M: Some applied toxicological aspects of pesticides. Unpublished data 1983.

**Fernando G, Perera R, Salgado MSL: The problem of pesticide poisoning in Sri Lanka. Unpublished data 1986.

The widespread availability of liquid pesticides in Sri Lanka makes them an attractive vehicle for suicide attempts. Approximately 700,000 kilograms of pesticides are imported annually. Almost every rural grocery store has shelves full of many brands of pesticides in bottles of various sizes. Over 100 chemicals—including malathion in more than 200 formulations—are sold.¹¹ Liquid preparations of pesticides can be lethal in minute doses. The acute oral LD-50 for a 50-kilogram person ingesting certain pesticides in formulations utilized in Sri Lanka is less than one ounce.¹² Organophosphorus compounds (parathion, malathion) are involved in a majority of poisonings. Mixtures of organophosphorus and organochlorine compounds are the most lethal: the in-hospital case-fatality rate for these ingestions in Sri Lanka is 33 per cent.⁸

There are many psychosocial and economic factors that might contribute to suicide in Sri Lanka: the prolonged and violent civil strife between Sinhalese and Tamils, the clash of Western and traditional values, the recession which has struck agricultural economies particularly hard. Many of these factors will be extraordinarily difficult to alter in the immediate future. However, there is some reason to believe that restricting the availability of the lethal agent (pesticides) would reduce the overall rate of suicide. When carbon monoxide was eliminated from coal gas in Birmingham, England, substitution of other forms of self-destruction occurred to some extent, but the overall suicide rate fell more than 50 per cent: "Many, if not the majority, of homicides and suicides are impulsive acts that will not be repeated. It is the lethality of the means at hand more than the planned intent of the persons involved that results in death."¹³

In 1983, a Registrar of Pesticides was appointed with authority to set regulations and standards for pesticides in Sri Lanka. There are many complicated issues to consider, including the use of less toxic chemicals, and the economic implications—for the country and for individual farmers—of limiting the availability of certain pesticides. The public health implications of the Registrar's decisions are obviously of great import.

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A Survey of Measured Levels and Dietary Sources of Selected Organochlorine Pesticide Residues and Metabolites in Human Sera from a Rural Population

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Abstract: We measured serum levels of 11 pesticide residues and metabolites in 85 rural-dwelling persons. In general, the serum levels increased with age, with males having slightly higher levels than females. Consumption of eggs from home-raised hens contributed substantially to increased serum concentrations of trans-nonachlor, heptachlor epoxide, and oxchlordane; consumption of home-grown root vegetables likewise contributed to increased serum concentrations of trans-nonachlor and oxchlordane. Health risks, if any, that may be attributable to these "background" levels of exposure remain to be fully characterized in this, and all other, affected populations. (*Am J Public Health* 1988; 78:828-830.)

Introduction

Organochlorine pesticides (including accompanying residues and metabolites) are ubiquitous in the environment because of their widespread use; thus, the potential for human exposure and uptake is high. Comprehensive surveys of the general United States population have documented ongoing, low-level exposure to these lipophilic compounds in primarily urban population groups.^{1,2} Rural populations, however, may be at increased risk of exposure because of characteristic occupational activities (i.e., exposure to pesticides and related chemicals used on farms) and from nonpoint sources of environmental contamination (e.g., through the consumption of contaminated drinking water). The purpose of this report is to characterize the distribution of pesticide-related serum levels in an identified rural population, and to identify key pathways of exposure in these rural settings.

Materials and Methods

As part of the investigation of an episode of heptachlor contamination of dairy cattle feed, which led to adulteration of dairy food products in 1986,³ we contacted a representative sample of farm families whose dairy herds had not been fed

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the contaminated feed. A simple random sample of households was drawn from a comprehensive list of 179 family-operated dairy farms, all of which had been tested and were known to be uncontaminated. We obtained 15 ml whole blood specimens from each participant to measure serum levels of 11 pesticide residues. Pesticide residues measured in the sera included the principal heptachlor metabolites (HEPX, OCHD, and TNCH), HCLB, ENDR, DIEL, BBHC, GBHC, p,p'-DDT, p,p'-DDE, and o,p'-DDT.* In addition, we elicited demographic, life-style, and quantitative information about consumption of home-raised animal and vegetable products from participants using a standardized questionnaire.

Results

All of the 85 participants from whom we obtained blood samples were White. This group had a mean age of 36.9 ± 17.3 (standard deviation) years and a male:female ratio of approximately 3:2. The average number of years spent living in rural areas was 33 ± 16 years, and 75 per cent of the participants had spent more than 90 per cent of their lives living on a farm.

The overall distributions of serum concentrations for each of the 11 pesticide residues are summarized in Table 1. All participants showed quantifiable serum levels of both HCLB and p,p'-DDE, and more than half of the participants had quantifiable levels of HEPX, OCHD, and TNCH. In contrast, less than 50 per cent of the study subjects had quantifiable levels of BBHC in their serum; less than 25 per cent had quantifiable levels of DIEL, p,p'-DDT, or o,p'-DDT; less than 5 per cent of the persons tested showed any quantifiable serum concentrations of GBHC; and none of the study participants had a quantifiable concentration of ENDR. Mean quantifiable serum levels for HCLB, HEPX, OCHD,

*Abbreviations Used:

BBHC	beta-benzene hexachloride
DIEL	dieldrin
ENDR	endrin
GBHC	gamma-benzene hexachloride
HCLB	hexachlorobenzene
HEPX	heptachlor epoxide
NHANES II	Second National Health and Nutrition Examination Survey
OCHD	oxchlordane
o,p'-DDT	o,p'-dichlorodiphenyltrichloroethane
ppb	parts per billion
p,p'-DDE	p,p'-dichlorodiphenyldichloroethylene
p,p'-DDT	p,p'-dichlorodiphenyltrichloroethane
TNCH	trans-nonachlor