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Deliberate self-harm and suicide by pesticide ingestion in the Sundarban region, India

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Summary

OBJECTIVE To examine the clinical epidemiology, including case fatality and determinants of self-harm in six island blocks of the Sundarban region of West Bengal, India.
METHODS We examined the clinical records of 1277 patients admitted for deliberate self-harm (DSH) to the six island hospitals from 1999 to 2001.
RESULTS 77.7% of the patients survived their attempt, 11.9% died and for 10.4% the outcome was not recorded. Women accounted for 65.2% of the DSH admissions and 67.1% of the deaths. Pesticides were the most commonly used means (88.7%). The case fatality of self-harm reported in these hospitals ranged from 6.0% to 50.0% (mean 13.3%; CI, 11.3–15.3). The age group 55–64 years was at highest risk of death, the age group 15–24 years at lowest risk. Higher lethality of pesticide ingestion compared to other methods was suggestive but not significant. Case fatality within the region varied but was high compared to industrialized nations. Case records and management of DSH were poor.
CONCLUSION Effective DSH prevention in the Sundarban region would require better surveillance at clinical facilities and an intersectoral approach, linking the agricultural interests of pesticide safety and mental health interests for preventing DSH.

keywords deliberate self-harm, suicide, pesticide, mental health, Sundarban

Introduction

Non-fatal deliberate self-harm (DSH) and suicides particularly with pesticides are serious global health problems in many low- and middle-income countries (Gunnell & Eddleston 2003; Eddleston & Phillips 2004; Gunnell *et al.* 2007), including India (Bose *et al.* 1999; Gautami *et al.* 2001; Mohanty *et al.* 2004; Srinivas *et al.* 2005; Fleischmann *et al.* 2005). Pesticides contribute substantially to public health by limiting the spread of certain vector-borne diseases (van der Hoek *et al.* 1998) and by aiding agricultural development, but they also have deleterious effects on health and environment (Pimentel 1996). Serious hazards of pesticide use and misuse are accidental, occupational and deliberate poisoning.

An estimated 3 million people are hospitalized for pesticide poisoning each year throughout the world, resulting in 7.3% mortality (Jeyaratnam 1990). Most of this morbidity and mortality is due to intentional self-poisoning. Due to lack of a uniform global surveillance system, however, there are no precise data for occupational, accidental or deliberate self-poisoning (Konradsen *et al.* 2005). Although more than 85.0% of the 815 000 global suicides in 2000 occurred in low-and middle-income countries (Peden *et al.* 2002), reports and documentation of the epidemiology of DSH and suicide from more remote rural communities, such as those of the Sundarban region in West Bengal, India, are for the most part unavailable.

Straddling Bangladesh and India, the Indian Sundarban region, covering an area 9630 km^2 is located at the southernmost tip of the state of West Bengal (Naskar 1998). It is an underdeveloped region comprising both island and mainland community development blocks, which are the lowest-level administrative unit of a district in this rural region. These blocks have a population of 150 000–200 000. Geographical remoteness, low agricultural yield due to high soil salinity, ecological vulnerability from unpredictable weather conditions, dearth of industry and limited health facilities make this area one of the most disadvantaged regions of the state of West Bengal (Chowdhury *et al.* 2001). Nearly half of the families in the region (41.3%) live below the poverty line (i.e. a family earning less than Rs 1000, or US$21.70 per month). Agriculture is

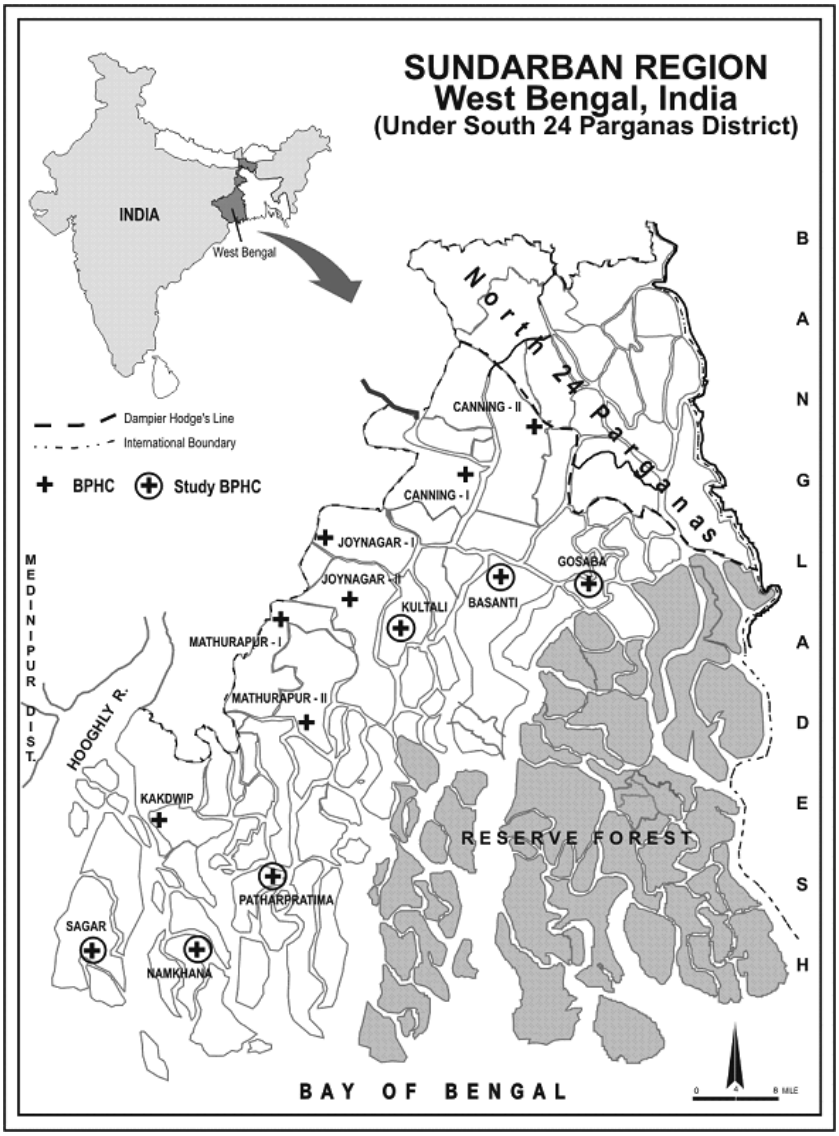

Figure 1 Sundarban region of West Bengal, India.

the primary occupation for 85.0% of the population (Ganguly 2005) and pesticides are extensively used for cultivation (Chowdhury *et al.* 1999).

Community mental health research in the Sundarban region previously identified widespread concerns about pesticide-ingested DSH and suicide and the lack of effective treatment to prevent avoidable mortality (Chowdhury *et al.* 2003, 2004). To document the burden of DSH and suicide, we researched the clinical epidemiology in six island blocks: Gosaba, Basanti, Kultali, Patharpratima, Namkhana and Sagar (Figure 1).

Methods

Study sites

Research took place in six island blocks of the Sundarban region. The total population in these six islands is about 1.14 million (Census 2001). A Block Public Health Centre (BPHC) is the main clinical facility in each, typically with 15–30 inpatient beds, providing both outpatient and inpatient services. Each BPHC has one block medical officer (BMOH), one to three medical officers (MO) and

five to eight nurses. Staff also includes 20–50 health assistants and 5–10 community health guides who work in the community. BPHCs are stretched beyond their capabilities, and usually lack adequate machinery such as ICU ventilators and expertise, such as that required to manage cases of poisoning. They have insufficient supplies of atropine and pyridine aldoxime methiodide, the antidote for treating most cases of pesticide poisoning.

Data collection

Information about DSH and suicide from 1 January 1999 to 31 December 2001 was compiled by manually reviewing admission and emergency registers of the six BPHCs. The purpose of the study was communicated to the block medical officers in advance, and data were collected in two phases. During the first phase, each BPHC was visited for a 2-week period to identify DSH cases in patient registers, extracted from the general clinic register. The hospitals did not maintain separate registers to record self-harm. Gosaba, Kultali and Patharpratima, however, maintained additional registers for emergencies and poisoning, which were also examined. A second visit was made after the data had been tabulated and studied. Clarifications were sought for missing data in the registers, consulting the case history sheets for selected records.

Cases of DSH were identified and analysed for the 3-year period. The demographic characteristics, the method for DSH, and resulting morbidity and mortality of patients older than 10 years were studied. For children below 10 years of age, we were assumed that pesticide poisoning was accidental rather than DSH.

Statistical analysis

Data were analysed with STATA (Intercooled Standard version 8.0). DSH was the outcome variable, with two levels: non-fatal deliberate self-harm and suicide. Patients with missing outcomes were excluded from analysis. Bivariate logistic regression was carried out to assess the relationship between fatal outcome and individual variables sex, age groups, marital status, religion and method of self-harm. The model considered random effect at the hospital level to take into account possible correlation between study sites. A multivariate logistic regression model with backward stepwise selection was applied to identify the most significant risk factors for suicide. The removal level of covariates was taken to be at $P = 0.1$, based on the likelihood ratio test.

A model was fitted for each hospital separately, and results were compared between hospitals. Case fatality (CF) was also calculated for each of the six hospitals. The percentage of DSH clinic visits was calculated after deducting the estimated child (0–9 years) visits from the total BPHC admissions, based on an estimate of sampling every fifth page of the case registers (1999–2001) for the Namkhana BPHC. The distribution of age groups and sex was calculated for the same ($n = 354$). The findings were then extrapolated to calculate the percentage of 0- to 9-year-old children in the other five hospitals. It was assumed that all BPHCs have a similar structure of patients with regard to age and sex classes and thus, the same proportion of children (0–9) years was deducted from total patient numbers.

Results

A total of 1277 DSH patients (405 in 1999, 433 in 2000 and 439 in 2001) were admitted to the six BPHCs, of whom 77.7% (992) survived their attempt and 11.9% (152) died. The fate of the remaining 10.4% (133) cases was not recorded, and coded missing. The median age of the DSH patients was 24 years (range 10–95 years ±SD 11.9). In all the BPHCs, men were consistently older than women. The median age of women was 22, the median age of men was 26. Most (72.5%) of the patients were young adults aged 15–34 years. 72.2% were married; 27.2% were single. 90.9% were Hindus, the rest were Muslims and other religions.

The percentage of clinic visits for DSH among patients over 10 years of age varied among the different BPHCs; it was highest at Patharpratima (14.8%) and lowest at Gosaba (3.2%) (Table 1).

More women than men were admitted to all six BPHCs for DSH (Table 2). The distribution of admissions for women and men were similar in all the BPHCs except Kultali, where female admissions were highest (75.2%). The difference between women and men DSH admissions in the six hospitals was not significant (Fisher's exact test). Of the DSH patients, 65.2% were women and among the subset of

Table 1 Percentage of clinical consultations for DSH among patients 10 years-of-age or older in the six Block Primary Health Centres (BPHCs) during 1999–2001

BPHCs	Admissions ≥ 10 years	DSH	%
Basanti	846	48	5.7
Gosaba	2889	91	3.2
Kultali	1484	161	10.8
Namkhana	5650	322	5.7
Patharpratima	1950	289	14.8
Sagar	6584	366	5.6
Total	19 403	1277	6.6

Table 2 DSH admissions and mortality in the six Block Primary Health Centres (BPHCs) during 1999–2001

	All self-harm			Non-fatal DSH				Suicide				Uncertain			
BPHCs	T	F %	M %	T	%*	F %	M %	T	%*	F %	M %	T	%*	F %	M %
Basanti	48	64.6	35.4	24	50.0	62.5	37.5	24	50.0	66.7	33.3	0	0.0	0.0	0.0
Gosaba	91	61.5	38.5	74	81.3	60.8	39.2	9	9.9	55.6	44.4	8	8.8	75.0	25.0
Kultali	161	75.2	24.8	130	80.7	75.4	24.6	8	5.0	87.5	12.5	23	14.3	69.6	30.4
Namkhana	322	61.5	38.5	251	78.0	63.7	36.3	40	12.4	60.0	40.0	31	9.6	45.2	54.8
Patharpratima	289	64.4	35.6	249	86.2	64.7	35.3	24	8.3	83.3	16.7	16	5.5	31.3	68.7
Sagar	366	62.6	37.4	264	72.1	63.6	36.4	47	12.8	63.8	36.2	55	15.0	56.4	43.6
Total	1277	64.3	35.7	992	77.7	65.2	34.8	152	11.9	67.1	32.9	133	10.4	54.1	45.9

*Percentage of admissions for non-fatal DSH and suicide, and DSH with uncertain outcome.

Table 3 Case fatality (CF) for DSH in the six Block Primary Health Centres (BPHCs) during 1999–2001

BPHCs	Cases	Suicides	CF (%)
Basanti	48	24	50.0
Gosaba	83	9	10.8
Kultali	138	8	5.8
Namkhana	291	40	13.7
Patharpratima	273	24	8.8
Sagar	311	47	15.1
All sites	1144	152	13.3

Table 4 Methods used by patients to attempt self-harm

Methods	Total	%	DSH	%	Suicide	%	CF
Pesticides	1015	88.7	877	88.4	138	90.8	13.6
Indigenous poisons	33	2.9	30	3.0	3	2.0	9.1
Other	38	3.3	34	3.4	4	2.6	10.5
Unknown poison	58	5.1	51	5.1	7	4.6	12.1
All methods	1144*	100.0	992	100.0	152	100.0	13.3†

*Patients with uncertain outcome (n = 133) was excluded from the calculation.
†Crude mean CF of all methods.

suicides, 67.1% were women. Collectively, the CF rate (CI) was 13.3% (11.4–15.4) (Table 3). The highest CF was found in Basanti (50.0%) and the lowest in Kultali (5.8%).

Pesticides were the most common method for self-harm, both for DSH and suicide (Table 4). Indigenous poisons including yellow oleander (*Thevetia peruviana*) and dhatura (*Datura stramonium*) were the next most frequently used for self-harm. For 5.1% patients, the type of poison was unknown. The combined CF of all methods of DSH was 11.3%. The CF was the highest for pesticide ingestion and the lowest for indigenous poison intake.

Table 5 shows that the age group 55–64 years was at highest risk of death from DSH, and the 15–24 year age group at lowest risk. The higher lethality of DSH from pesticide ingestion compared with other methods was suggestive, but not significant.

Discussion

This study clarified the clinical epidemiology of DSH and suicide with pesticides in six islands of the Sundarban region, India. Findings are notable with respect to four important issues: variable but substantial clinical burden of DSH, high frequency of pesticides as the means of DSH, high and variable CFs and poor quality of DSH and suicide data in the BPHCs.

Deliberate self-harm was responsible for more than 5.0% of clinic consultations in these six centres. Considerable differences in clinical rates of DSH at the BPHCs were also noted, particularly as a result of the pattern of help-seeking behaviour. People travel from coastal areas to urban towns where they hope to receive better treatment. In Patharpratima, the patients on the island are compelled to seek help from the designated health facility on this island, as transportation off the island is limited and difficult. This is also true for Kultali.

On Sagar Island, the BPHC is easily accessible to most people because of its central location. However, many patients, especially in the northern part of the island, where the ferry is located, preferred to attend a mainland district-level hospital. Basanti, Gosaba and Namkhana islands are divided by rivers into two major segments (north and south), and the BPHCs are located in the southern sector. Residents of the northern sector of these islands less frequently use services of the local BPHCs, as they have easier access to sub-divisional or district hospitals. Consequently, the magnitude of the identified clinical burden of DSH identified in our study should be regarded as a conservative assessment of the problem in the community.

Table 5 Determinants of mortality from deliberate self-harm. (n = 1144)

	Bivariate analysis			Multivariate analysis		
Variables (n)	OR	95% CI	P-value*	OR	95% CI	P-value*
Age, years			0.0003			0.007
15–24 (525)	**1.0**	–		**1.0**	–	
10–14 (82)	0.17	0.40–0.71		0.2	0.03–0.78	
25–34 (313)	1.21	0.76–1.91		1.3	0.82–2.19	
35–44 (118)	0.86	0.45–1.66		0.9	0.48–1.95	
45–54 (54)	2.22	0.99–4.97		2.6	1.20–5.44	
55–64 (26)	2.78	1.04–7.39		2.7	0.96–7.46	
>65 (26)	1.72	0.61–4.81		2.0	0.67–5.93	
Sex			0.155			0.17
Female (749)	**1.0**	–		**1.0**	–	
Male (395)	0.87	0.60–1.26		0.8	0.49–1.13	
Marital status			0.006			0.73
Married (838)	**1.0**	–		**1.0**	–	
Single (299)	0.55	0.35–0.87		0.9	0.53–1.68	
Others (7)	3.04	0.63–14.50		2.0	0.34–11.80	
Religion			0.105			0.14
Hindu (1041)	**1.0**	–		**1.0**	–	
Islam (101)	0.68	0.35–1.34		0.7	0.37–1.48	
Others (2)	6.94	0.40–119.69		20.37	1.01–409.33	
Method			0.056			0.09
Pesticide (1015)	**1.0**	–		**1.0**	–	
Non-pesticide (129)	1.60	0.87–2.91		1.66	0.89–3.06	

*P-value calculated for the grouped variable.

Rates of both DSH and suicide were higher for women at all six sites. The gender aspect of suicidal behaviour requires more attention in the region.

Pesticide poisoning was the method of self-harm for most hospital DSH admissions. Previous research in the region (Chowdhury *et al.* 2004, 2007) and other studies in low- and middle-income countries emphasize the role of pesticides as the method of choice for DSH and suicide (Phillips *et al.* 2002; Moghadamnia & Abdollahi 2002; Kalkan *et al.* 2003; Nesime *et al.* 2004; Thanh *et al.* 2005). Because pesticides are responsible for accidental and occupational exposures, questions about access and storage bridge the interests of accident prevention, occupational health and mental health.

Development of alternatives to agricultural pesticides, advocating limited use of pesticides, improving storage facilities, reducing toxicity, adding emetic agents to all pesticide products, restricting the sale of very toxic pesticides and promoting awareness about limiting access to pesticides are cornerstones of self-harm prevention strategies(Gunnell & Frankel 1994; Roberts *et al.* 2003). A study conducted in Samoa (formerly Western Samoa) showed that Paraquat-related suicide rates declined after its partial restriction (Bowles 1995).

Intersectoral strategies that combine regulatory activities to minimize impulsive access to hazardous pesticides and to acknowledge the role of mental health problems, awareness about psychosocial contexts and stressors that lead to DSH and suicide should guide health policy and community actions (Chowdhury & Weiss 2004).

The CF of DSH in the study BPHCs was higher than in most industrialized countries, which are typically <1.0% (Gunnell *et al.* 2004). The CF for poisoning in low-income countries, on the other hand, is typically far higher than 10.0% (Eddleston 2000; Hettiarachchi & Kodithuwakku 1989a,b; Gunnell & Eddleston 2003). It is not only the quality of clinical care but also the particular agents used for self-harm that account for differences in mortality. The substances consumed in overdose in high-income settings are typically prescribed or non-prescription drugs that are less toxic than lethal pesticides. Other factors, such as proximity to the health centre, availability of medical supplies and antidotes (Eddleston *et al.* 1998), and absence of uniform management guidelines to treat self-harm patients also contribute to the higher CFs.

Case fatalities indicate the need to improve case management in the BPHCs, particularly in Basanti, where rates were highest. Field experiences indicate that pesticides

available in Basanti are similar to those in the entire region which may not have influenced the high CFs. The BPHC at Basanti lacked infrastructure to handle cases of DSH. Kultali and Patharpratima, which were better equipped, had lower fatality rates. Both clinical training and resources to make use of clinical skills are needed. Site-specific monitoring of CF is also required to identify problems, support efforts to acquire needed resources and to track the impact of improved services. Establishing guidelines to manage self-harm patients, training medical personnel, and ensuring the availability of cheap antidotes in households and BPHCs are appropriate measures that will reduce pesticide mortality.

In this study, the outcome for 10.0% of the DSH patients was not recorded. This represents another aspect of health system problems and neglect of mental health priorities contributing to the poor quality of DSH and suicide mortality data (Bertolote & Fleischmann 2002). Improved surveillance for DSH and pesticide poisoning would contribute to the quality of care and mental health services. This requires developing standards for documenting DSH and suicide and training medical staff to maintain records. Because there was no such system, a DSH register was developed for this study. These registers were distributed in all Sundarban BPHCs to establish a uniform DSH surveillance system in the region. Our training of BPHC personnel for this study is also intended to facilitate sustained surveillance from improved clinical data in the region.

This study is the only source of information about the clinical epidemiology of DSH and suicide in the six islands of the Sundarban region, but it has limitations: Because many DSH patients do not reach medical facilities and only the serious cases seek help from the BPHC, clinic-based DSH data provide conservative estimates of the community burden. As it was not possible to make a crude estimate of the number of people seeking help outside their designated health centres, our study did not estimate a crude incidence of self-harm based on hospital admissions as this would raise questions about the validity of the data presented. Further research on the other types of healthcare services used by self-harm patients, community surveys of DSH and suicide and development of a regular surveillance system in all blocks of the region are required for a comprehensive account of the problem. The nature of data recording made it impossible to include certain explanatory variables (e.g. types of pesticide ingested) in the analysis which acted as confounders.

We documented the nature and significance of DSH in a rural Indian agricultural community, showing that it is typically neglected but a substantial clinical and public health problem. We suggest to improve the CF of pesticide poisoning by better supplies, training of health staff, community awareness and access to services. The agricultural department should be involved in campaigns promoting safe pesticide practices throughout the region. This study also indicates the need for intersectoral programmes linking health and agricultural departments to ameliorate the problem of DSH with pesticides and to reduce mortality from all types of pesticide poisoning, both accidental and intentional. Intersectoral systems-oriented approaches to DSH and suicide are needed for effective prevention strategies in India and settings elsewhere where pesticide-related DSH and suicide are important public health problems.

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References

Bertolote JM & Fleischmann A (2002) A global perspective in the epidemiology of suicide. *Suicidologi* **2**, 6–8.

Bose TK, Basu RK, Biswas B *et al.* (1999) Cardiovascular effects of yellow oleander ingestion. *Journal of the Indian Medical Association* **97**, 407–410.

Bowles JR (1995) Suicide in Western Samoa. An example of a suicide prevention program in a developing country. In: *Preventative Strategies on Suicide* (ed. RFW Diekstra) EJ Brill, Leiden, pp. 173–206.

Census (2001) *A Census View*. Office of the Director of Census Operations, Kolkata.

Chowdhury AN & Weiss MG (2004) Ecostress and mental health in Sundarban Delta, India. In: *The Dying Earth: People's Action and Nature's Reaction* (eds M Desai & MK Raha) ACB Publications with Netaji Institute for Asian Studies, Kolkata, pp. 108–119.

Chowdhury AN, Chowdhury S & Chakraborty A (1999) Ecostress, quality of life and mental health in Sundarban delta of India. *International Medical Journal (Japan)* **6**, 59–63.

Chowdhury AN, Chakraborty AK & Weiss MG (2001) Community mental health and concepts of mental illness in the

Sundarban Delta of West Bengal, India. *Anthropology & Medicine* **8**, 109–129.

Chowdhury AN, Sanyal D, Dutta SK *et al.* (2003) Deliberate self-harm by ingestion of poisons on Sagar Island in the Sundarban Delta, India. *International Medical Journal (Japan)* **10**, 85–91.

Chowdhury AN, Shasmal R, Dutta SK *et al.* (2004) Ethnographic survey of deliberate self-harm in some villages of Sundarban Delta, West Bengal. *Journal of Indian Anthropological Society* **39**, 173–182.

Chowdhury AN, Banerjee S, Brahma A *et al.* (2007) Pesticide poisoning in non-fatal deliberate self-harm: a public health issue. *Indian Journal of Psychiatry* **49**, 117–120.

Eddleston M (2000) Patterns and problems of deliberate self-poisoning in the developing world. *Quarterly Journal of Medicine* **93**, 715–731.

Eddleston M & Phillips MR (2004) Self poisoning with pesticides. *British Medical Journal* **328**, 42–44.

Eddleston M, Sheriff MH & Hawton K (1998) Deliberate self harm in Sri Lanka: an overlooked tragedy in the developing world. *British Medical Journal* **317**, 133–135.

Fleischmann A, Bertolote JM, De Leo D *et al.* (2005) Characteristics of attempted suicides seen in emergency-care settings of general hospitals in eight low-and middle-income countries. *Psychological Medicine* **35**, 1467–1474.

Ganguly K (2005) Beauties of Sundarban. In: *Sreekhanda Sundarban* (ed. B Jana) Abc printers, Kolkata, pp. 3–6.

Gautami S, Sudershan RV, Bhat RV *et al.* (2001) Chemical poisoning in three Telengana districts of Andhra Pradesh. *Forensic Science International* **122**, 167–171.

Gunnell D & Eddleston M (2003) Suicide by intentional ingestion of pesticides: a continuing tragedy in developing countries. *International Journal of Epidemiology* **32**, 902–909.

Gunnell D & Frankel S (1994) Prevention of suicide: aspirations and evidence. *British Medical Journal* **308**, 1227–1233.

Gunnell D, Ho D & Murray V (2004) Medical management of deliberate drug overdose: a neglected area for suicide prevention? *Emergency Medicine Journal* **21**, 35–38.

Gunnell D, Eddleston M, Phillips MR *et al.* (2007) The Global Distribution of fatal pesticide self-poisoning: Systematic review. *BMC Public Health* **7**, E1–E15.

Hettiarachchi J & Kodithuwakku GC (1989a) Self-poisoning in Sri Lanka: factors determining the choice of the poisoning agents. *Human Toxicology* **8**, 507–510.

Hettiarachchi J & Kodithuwakku GC (1989b) Pattern of poisoning in rural Sri Lanka. *International Journal of Epidemiology* **18**, 418–422.

van der Hoek W, Konradsen F, Athukorala K *et al.* (1998) Pesticide poisoning: a major health problem in Sri Lanka. *Social Science and Medicine* **46**, 495–504.

Jeyaratnam J (1990) Acute pesticide poisoning: a major global health problem. *World Health Statistical Quarterly* **43**, 139–144.

Kalkan S, Erdogan A, Aygoren O *et al.* (2003) Pesticide poisonings reported to the drug and poison information center in Izmir, Turkey. *Veterinary & Human Toxicology* **45**, 50–52.

Konradsen F, van der Hoek W, Gunnell D *et al.* (2005) Missing deaths from pesticide self-poisoning at the IFCS Forum IV. *Bulletin of the World Health Organization* **83**, 157–158.

Moghadamnia AA & Abdollahi M (2002) An epidemiological study of poisoning in northern Islamic Republic of Iran. *East Mediterranean Health Journal* **8**, 88–94.

Mohanty M, Kumar V, Bastia B *et al.* (2004) An analysis of poisoning deaths in Manipal, India. *Veterinary & Human Toxicology* **46**, 208–209.

Naskar KR (1998) *Indian Sundarban and the Mangroves*. West Bengal State Book Bureau, Kolkata.

Nesime Y, Lokman B, Akif IM *et al.* (2004) Acute pesticide poisoning related deaths in Turkey. *Veterinary & Human Toxicology* **46**, 342–344.

Peden M, McGee K & Sharma G (2002) *The Injury Chart Book: A Graphical Overview of the Global Burden of Injuries*. World Health Organisation, Geneva.

Phillips MR, Li X & Zhang Y (2002) Suicide rates in China 1995–99. *Lancet* **359**, 835–840.

Pimentel D (1996) Green revolution agriculture and chemical hazards. *The Science of the Total Environment* **188** (Suppl.1), S86–S98.

Roberts DM, Karunarathna A, Buckley NA *et al.* (2003) Influence of pesticide regulation on acute poisoning deaths in Sri Lanka. *Bulletin of the World Health Organization* **81**, 789–798.

Srinivas RC, Venkateswarlu V, Surender T *et al.* (2005) Pesticide poisoning in south India: opportunities for prevention and improved medical management. *Tropical .Medicine & International Health* **10**, 581–588.

Thanh TTH, Jiang G-X, Van TN *et al.* (2005) Attempted suicide in Hanoi, Vietnam. *Social Psychiatry & Psychiatric Epidemiology* **40**, 64–71.

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