



**IASP Special Interest Group (SIG) on the Prevention of Intentional Pesticide Poisoning**

**Bibliography: Topic - Policy**

Chowdhary, A. N., S. Banerjee, et al. (2007). "Pesticide poisoning in nonfatal, deliberate self-harm: A public health issue." Indian J Psychiatry **49**(2): 117-120.

**BACKGROUND:** Nonfatal, deliberate self-harm (DSH), particularly with pesticides, is a major public health problem in many developing countries of the world. Agriculture is the primary occupation of most people living in the Sundarban region in West Bengal, India. Pesticides are extensively used in agriculture and these agents are most frequently used in DSH. **AIM:** This study sought to identify the nature of methods and agents used in nonfatal DSH attempts in the Sundarban area under South 24 Parganas district of West Bengal. **MATERIALS AND METHODS:** Detailed demographic and clinical data on DSH cases of 13 Block Primary Health Centres (BPHCs) admission registers were analysed. Focus Group Discussions (FGDs) were conducted with the Panchayat Samithy of each block to elicit their perception about the problem of pesticide-related DSH or suicide in the region. **RESULTS:** Five thousand, one hundred and seventy-eight (1,887 male and 3,291 female) subjects were admitted in the BPHCs during the study period from 1999 to 2001. Organophosphorous pesticide poisoning was found to be the most common method (85.1%) in DSH. This emphasizes the importance of developing an urgent poisoning prevention program with a special focus on improving clinical services as well as initiating farmers' education programs focusing on safe pesticide practices at the primary care level.

Chowdhury, A. N., A. Brahma, et al. (2009). "Deliberate self-harm prevention in the Sundarbans region need immediate public health attention." J Indian Med Assoc **107**(2): 88, 90, 92-83.

Deliberate self-harm is a major public health problem. This study is aimed to examine the sociodemographic characteristics of both non-fatal and fatal deliberate self-harm cases admitted at the 13 block primary health centres of the Sundarbans region under South 24 Parganas district, West Bengal. Retrospective deliberate self-harm data from the admission registers of 13 block primary health centres was collected for the year 1999. A total of 1850 deliberate self-harm cases (639 males and 1211 females) were admitted at the 13 block primary health centres, of which 159 (60 males, 99 females) were fatal (completed suicide). A higher fatality rate for male than female (9.4% compared to 8.2%) was observed. Women (65.5%), especially of younger age groups constituted the major cases. Poisoning (96.9%) was the commonest method of self-harm. Easy availability of pesticides was a common factor. Marital status and seasonal trend (March-April) had important contribution in self-harm incidents. Planned psychosocial intervention as a part of community mental health programme may help to reduce the deliberate self-harm morbidity and mortality at this primary care level.

Cole, D. C., F. Carpio, et al. (2000). "Economic burden of illness from pesticide poisonings in high Ecuador. [Spanish]." Revista Panamericana de Salud Publica Pan American Journal of Public Health **8** (3): 196-201.

Active surveillance of acute pesticide poisonings in a potato-growing region of highland Ecuador during 1991-1992 uncovered a rate of 171/100 000, due predominantly to occupational exposures to organophosphate and carbamate pesticides. Occupational exposure among agricultural workers

was the most common reason for poisoning (32 male workers and 1 female worker, out of a total of 50 cases). Of these 33 cases, 28 of them reported pesticide application as the work task just prior to poisoning, with over 80% citing the use of World Health Organization Hazard Category I pesticides. The suicide rate of 17.1/100 000 and the overall mortality rate of 20.5/100 000 that we found are among the highest reported anywhere in the world. At the exchange rates prevailing at that time, median costs associated with these poisonings were estimated as follows: public and social security health care direct costs of US\$ 9.85/case; private health costs of US\$ 8.33/case; and lost-time indirect costs of US\$ 8.33/ agricultural worker. Each one of those costs was over five times the daily agricultural wage, which was then about US\$ 1.50. Further costing of pesticide poisonings should be carried out in other settings to provide appropriate information for decisions about pesticide use. In addition, integrated pest management should be further evaluated as an appropriate technology to reduce the economic burden of illness from pesticide poisonings in developing countries.

Eddleston, M., S. Adhikari, et al. (2012). "Effects of a provincial ban of two toxic organophosphorus insecticides on pesticide poisoning hospital admissions." Clin Toxicol (Phila) **50**(3): 202-209.

**BACKGROUND:** Pesticide self-poisoning causes one third of global suicides. Sri Lanka halved its suicide rate by banning WHO Class I organophosphorus (OP) insecticides and then endosulfan. However, poisoning with Class II toxicity OPs, particularly dimethoate and fenthion, remains a problem. We aimed to determine the effect and feasibility of a ban of the two insecticides in one Sri Lankan district. **METHODS:** Sale was banned in June 2003 in most of Polonnaruwa District, but not Anuradhapura District. Admissions with pesticide poisoning to the district general hospitals was prospectively recorded from 2002. **RESULTS:** Hospital admissions for dimethoate and fenthion poisoning fell by 43% after the ban in Polonnaruwa, while increasing by 23% in Anuradhapura. The pesticide case fatality fell from 14.4% to 9.0% in Polonnaruwa (odds ratio [OR] 0.59, 95% confidence interval [CI] 0.41-0.84) and 11.3% to 10.6% in Anuradhapura (OR 0.93, 95%CI 0.70-1.25;  $p = 0.051$ ). This reduction was not sustained, with case fatality in Polonnaruwa rising to 12.1% in 2006-2007. Further data analysis indicated that the fall in case fatality had actually been due to a coincidental reduction in case fatality for pesticide poisoning overall, in particular for paraquat poisoning. **CONCLUSIONS:** We found that the insecticides could be effectively banned from agricultural practice, as shown by the fall in hospital admissions, with few negative consequences. However, the ban had only a minor effect on pesticide poisoning deaths because it was too narrow. A study assessing the agricultural and health effects of a more comprehensive ban of highly toxic pesticides is necessary to determine the balance between increased costs of agriculture and reduced health care costs and fewer deaths.

Eddleston, M., N. A. Buckley, et al. (2006). "Identification of strategies to prevent death after pesticide self-poisoning using a Haddon matrix." Inj Prev **12**(5): 333-337. Despite pesticide self-poisoning causing around 300 000 deaths each year in the rural Asia Pacific region, no comprehensive public health response has

yet been formulated. The authors have developed a Haddon matrix to identify factors that increase the risk of fatal rather than non-fatal pesticide self-poisoning in Sri Lanka. Many important host factors such as age, gender, and genetics are not alterable; factors that could be changed-alcohol use and mental health-have previously proved difficult to change. Interventions affecting agent or environmental factors may be easier to implement and more effective, in particular those limiting the human toxicity and accessibility of the pesticides, and the quality, affordability, and accessibility of health care in the community. Controlled studies are required to identify effective strategies for prevention and harm minimization and to garner political support for making the changes necessary to reduce this waste of life. Lessons learnt from Sri Lanka are likely to be highly relevant for much of rural Asia.

Eddleston, M., N. Udayakumara, et al. (2007). "The importance of poisoning vs. road traffic injuries as a cause of death in rural Sri Lanka." *PLoS One* **2**(7): e599.

**BACKGROUND:** Road traffic crashes are considered by the WHO to be the most important global cause of death from injury. However, this may not be true for large areas of rural Asia where road vehicles are uncommon. The issue is important, since emphasising the importance of road traffic crashes risks switching resources to urban areas, away from already underfunded rural regions. In this study, we compared the importance of road traffic crashes with other forms of injury in a poor rural region of South Asia.

**METHODOLOGY/PRINCIPAL FINDINGS:** We collected data on all deaths from injury in the North Central Province of Sri Lanka (NCP; population 1,105,198 at 2001 census) over 18 months using coronial, hospital, and police data. We calculated the incidence of death from all forms of intentional and unintentional injury in the province. The annual incidence of death from injury in the province was high: 84.2 per 100,000 population. Half of the deaths were from self-harm (41.3/100,000). Poisoning (35.7/100,000)-in particular, pesticide self-poisoning (23.7/100,000)-was the most common cause of death, being 3.9-fold more common than road traffic crashes (9.1/100,000).

**CONCLUSIONS/SIGNIFICANCE:** In poor rural regions of South Asia, fatal self-harm and pesticide self-poisoning in particular are significantly more important than road traffic injuries as a cause of death. It is possible that the data used by the WHO to calculate global injury estimates are biased towards urban areas with better data collection but little pesticide poisoning. More studies are required to inform a debate about the importance of different forms of injury and how avoidable deaths from any cause can be prevented. In the meantime, marked improvements in the effectiveness of therapy for pesticide poisoning, safer storage, reduced pesticide use, or reductions in pesticide toxicity are required urgently to reduce the number of deaths from self-poisoning in rural Asia.

Gunnell, D., R. Fernando, et al. (2007). "The impact of pesticide regulations on suicide in Sri Lanka." *Int J Epidemiol* **36**(6): 1235-1242.

**BACKGROUND:** Between 1950 and 1995 suicide rates in Sri Lanka increased 8-fold to a peak of 47 per 100,000 in 1995. By 2005, rates had halved. We investigated whether Sri Lanka's regulatory controls on the import and sale of pesticides that are particularly toxic to humans were

responsible for these changes in the incidence of suicide. **METHODS:** Ecological analysis using graphical and descriptive approaches to identify time trends in suicide and risk factors for suicide in Sri Lanka, 1975-2005. **RESULTS:** Restrictions on the import and sales of WHO Class I toxicity pesticides in 1995 and endosulfan in 1998, coincided with reductions in suicide in both men and women of all ages. 19,769 fewer suicides occurred in 1996-2005 as compared with 1986-95. Secular trends in unemployment, alcohol misuse, divorce, pesticide use and the years associated with Sri Lanka's Civil war did not appear to be associated with these declines. **CONCLUSION:** These data indicate that in countries where pesticides are commonly used in acts of self-poisoning, import controls on the most toxic pesticides may have a favourable impact on suicide. In Asia, there are an estimated 300,000 deaths from pesticide self-poisoning annually. National and international policies restricting the sale of pesticides that are most toxic to humans may have a major impact on suicides in the region.

Konradsen, F., A. H. Dawson, et al. (2007). "Pesticide self-poisoning: thinking outside the box." Lancet **369**(9557): 169-170.

Konradsen, F., W. van der Hoek, et al. (2003). "Reducing acute poisoning in developing countries--options for restricting the availability of pesticides." Toxicology **192**(2-3): 249-261.

Hundreds of thousands of people are dying around the world each year from the effects of the use, or misuse, of pesticides. This paper reviews the different options to reduce availability of the most hazardous chemicals, focusing on issues in developing countries. Emphasis is placed on the fatal poisoning cases and hence the focus on self-harm cases. Overall, it is argued here that restricting access to the most hazardous pesticides would be of paramount importance to reduce the number of severe acute poisoning cases and case-fatalities and would provide greater opportunities for preventive programmes to act effectively. The aim should be to achieve an almost immediate phasing out of the WHO Classes I and II pesticides through national policies and enforcement. These short-term aims will have to be supported by medium- and long-term objectives focusing on the substitution of pesticides with safe and cost-effective alternatives, possibly guided by the establishment of a Minimum Pesticide List, and the development of future agricultural practices where pesticide usage is reduced to an absolute minimum. Underlying factors that make individuals at risk for self-harm include domestic problems, alcohol or drug addiction, emotional distress, depression, physical illness, social isolation or financial hardship. These should be addressed through preventive health programmes and community development efforts.

London, L. and R. Bailie (2001). "Challenges for improving surveillance for pesticide poisoning: Policy implications for developing countries." International Journal of Epidemiology **30** (3): 564-570.

Background: Surveillance is a critical public health tool for the control of pesticide poisoning. However, surveillance activities in developing countries are bedevilled by multiple problems, and inferences made from review of flawed data may lead to mistaken policy decisions. Methods: Results of

intensified surveillance from an intervention project in the Western Cape Province of South Africa were compared to the pattern of poisonings reported in routine notifications to the health authorities for a control farming district and in the study district over a 5-year period preceding the study. Intensified surveillance data results were also contrasted with policy approaches based on routine notifications and on Regional Poison Centre reports. Results: Poisoning rates reported in the study area increased almost 10-fold during the intervention period. Compared to intensified surveillance, hospital and health authority sources greatly underestimate the proportion of cases due to occupational poisoning, and overestimate suicide as a proportional cause. In addition, the risks for women appear underestimated from routine notifications. Assumptions that a lack of awareness is responsible for most poisonings are not borne out by the empirical data when reporting is intensified. Conclusions: Current policy assumptions are faulty, may result in inappropriate blame being attributed to victims and, by relying on information as the main element of education, may shift responsibility onto the individual. Improvements in the surveillance system should aim to restructure the types of data collected, and facilitate intra-governmental and inter-sector collaboration. The culture of monitoring based on report writing must change to one of surveillance that leads to intervention.

Manuweera, G., M. Eddleston, et al. (2008). "Do targeted bans of insecticides to prevent deaths from self-poisoning result in reduced agricultural output?" Environ Health Perspect **116**(4): 492-495.

BACKGROUND: The pesticides monocrotophos, methamidophos, and endosulfan were a very common cause of severe poisoning in Sri Lanka during the 1980s and early 1990s, before they were banned in 1995 and 1998. Now, the most commonly used insecticides are the less toxic World Health Organization Class II organophosphorus pesticides and carbamates. These bans were followed by a large reduction in both fatal poisonings and suicide in Sri Lanka. OBJECTIVE: We aimed to see if these bans adversely affected agricultural production or costs. METHODS: We used data from the World Resources Institute to compare the yields of the main crop groups in Sri Lanka with those from surrounding South Asian countries for 1980-2005. We also examined data from the Sri Lankan Department of Census and Statistics to examine the yields of 13 specific vegetable crops and rice for 1990-2003, along with the costs of rice production. RESULTS: We found no drop in productivity in the years after the main bans were instituted (1995, 1998). We observed substantial annual fluctuation in estimated yields in all data sources, but these did not coincide with the bans and were no larger than the fluctuations in other countries. Also, there was no sudden change in costs of rice production coinciding with bans. CONCLUSIONS: Countries aiming to apply restrictions to reduce deaths from pesticide poisoning should evaluate agricultural needs and develop a plan that encourages substitution of less toxic pesticides. If farmers have an affordable alternative for pest control for each crop, there is no obvious adverse effect on agricultural output.

Miller, M. and K. Bhalla (2010). "An urgent need to restrict access to pesticides based on human lethality." PLoS Medicine **7** (10)(e1000358).

Pearson, M., Z. B. Anthony, et al. (2010). "Prospective policy analysis: how an epistemic community informed policymaking on intentional self poisoning in Sri Lanka." Health Res Policy Syst 8: 19.

**BACKGROUND:** Policy analysis is often retrospective and not well suited to helping policy makers decide what to do; in contrast prospective policy analysis seeks to assist in formulating responses to challenging public policy questions. Suicide in Sri Lanka is a major public health problem, with ingestion of pesticides being the primary method. Previous policy interventions have been associated with reduced mortality through restricting access to the most toxic pesticides. Additional means of reducing access are still needed. **METHODS:** The prospective policy analysis comprised two stages. The first used a consensus activity within a well defined policy community to generate and frame policy options. The second broadened the analysis to include other stakeholders. We report the consensus activity with seven actors from agriculture, health, and academia. Policy options were identified through two rounds of discussion along with ratings by each participant on their degree of support for each option. Data were analysed quantitatively and discussions analysed with Nvivo 8 to code prominent and recurrent themes. **RESULTS:** The main finding was the strong support and consensus for two proposals: further regulation of pesticides and the novel idea of repackaging pesticides into non-lethal doses. Participants identified several factors that were supportive of future policy change including a strong legislative framework, good links between agriculture, health and academia, and a collaborative relationship with industry. Identified barriers and potential threats to policy change included political interference, difficulties of intersectoral collaboration, acceptability of options to the community, difficulty of implementation in rural communities and the challenge of reducing mortality. **CONCLUSIONS:** The development and consideration of policy options within this epistemic community reflected an appreciation and understanding of many of the factors that can facilitate or thwart policy change. The understanding of context, evidence and ideas, implementation and impact influenced how the participants considered and rated the options. Use of epistemic community actors identified the level of support for each option, helped elaborate the particularities of context, as well as the power and influence of ideas. Further examination of the potential barriers and opportunities for these options will determine if broader consensus, involving a wider range of stakeholders, can be achieved and policy change promoted.

Pearson, M., A. B. Zwi, et al. (2013). "Policymaking 'under the radar': a case study of pesticide regulation to prevent intentional poisoning in Sri Lanka." Health Policy Plan.

**BACKGROUND:** Suicide in Sri Lanka is a major public health problem and in 1995 the country had one of the highest rates of suicide worldwide. Since then reductions in overall suicide rates have been largely attributed to efforts to regulate a range of pesticides. The evolution, context, events and implementation of the key policy decisions around regulation are examined. **METHODS:** This study was undertaken as part of a broader analysis of policy in two parts-an explanatory case study and stakeholder analysis. This

article describes the explanatory case study that included an historical narrative and in-depth interviews. RESULTS: A timeline and chronology of policy actions and influence were derived from interview and document data. Fourteen key informants were interviewed and four distinct policy phases were identified. The early stages of pesticide regulation were dominated by political and economic considerations and strongly influenced by external factors. The second phase was marked by a period of local institution building, the engagement of local stakeholders, and expanded links between health and agriculture. During the third phase the problem of self-poisoning dominated the policy agenda and closer links between stakeholders, evidence and policymaking developed. The fourth and most recent phase was characterized by strong local capacity for policymaking, informed by evidence, developed in collaboration with a powerful network of stakeholders, including international researchers. CONCLUSIONS: The policy response to extremely high rates of suicide from intentional poisoning with pesticides shows a unique and successful example of policymaking to prevent suicide. It also highlights policy action taking place 'under the radar', thus avoiding policy inertia often associated with reforms in lower and middle income countries.

Roberts, D. M., A. Karunaratna, et al. (2003). "Influence of pesticide regulation on acute poisoning deaths in Sri Lanka." Bull World Health Organ **81**(11): 789-798.

OBJECTIVES: To assess in a developing Asian country the impact of pesticide regulation on the number of deaths from poisoning. These regulations, which were implemented in Sri Lanka from the 1970s, aimed to reduce the number of deaths - the majority from self-poisoning - by limiting the availability and use of highly toxic pesticides. METHODS: Information on legislative changes was obtained from the Ministry of Agriculture, national and district hospital admission data were obtained from the Sri Lanka Health Statistics Unit, and individual details of deaths by pesticide poisoning were obtained from a manual review of patients' notes and intensive care unit records in Anuradhapura. FINDINGS: Between 1986 and 2000, the total national number of admissions due to poisoning doubled, and admissions due to pesticide poisoning increased by more than 50%. At the same time, the case fatality proportion (CFP) fell for total poisonings and for poisonings due to pesticides. In 1991\_92, 72% of pesticide-induced deaths in Anuradhapura were caused by organophosphorus (OP) and carbamate pesticides - in particular, the WHO class I OPs monocrotophos and methamidophos. From 1991, the import of these pesticides was reduced gradually until they were banned for routine use in January 1995, with a corresponding fall in deaths. Unfortunately, their place in agricultural practice was taken by the WHO class II organochlorine endosulfan, which led to a rise in deaths from status epilepticus - from one in 1994 to 50 in 1998. Endosulfan was banned in 1998, and over the following three years the number of endosulfan deaths fell to three. However, at the end of the decade, the number of deaths from pesticides was at a similar level to that of 1991, with WHO class II OPs causing the most deaths. Although these drugs are less toxic than class I OPs, the management of class II OPs remains difficult because they are, nevertheless, still highly toxic, and their toxicity is exacerbated by the paucity of available facilities. CONCLUSION: The fall in



CFP amidst a rising incidence of self-poisoning suggests that Sri Lanka's programmes of pesticide regulation were beneficial. However, a closer inspection of pesticide-induced deaths in one hospital revealed switching to other highly toxic pesticides, as one was banned and replaced in agricultural practice by another. Future regulation must predict this switching and bear in mind the ease of treatment of replacement pesticides. Furthermore, such regulations must be implemented alongside other strategies, such as integrated pest management, to reduce the overall pesticide availability for self-harm.

Sarchiapone, M., L. Mandelli, et al. (2011). "Controlling access to suicide means." International Journal of Environmental Research and Public Health **8** (12): 4550-4562.

Background: Restricting access to common means of suicide, such as firearms, toxic gas, pesticides and other, has been shown to be effective in reducing rates of death in suicide. In the present review we aimed to summarize the empirical and clinical literature on controlling the access to means of suicide. Methods: This review made use of both MEDLINE, ISI Web of Science and the Cochrane library databases, identifying all English articles with the keywords "suicide means", "suicide method", "suicide prediction" or "suicide prevention" and other relevant keywords. Results: A number of factors may influence an individual's decision regarding method in a suicide act, but there is substantial support that easy access influences the choice of method. In many countries, restrictions of access to common means of suicide has lead to lower overall suicide rates, particularly regarding suicide by firearms in USA, detoxification of domestic and motor vehicle gas in England and other countries, toxic pesticides in rural areas, barriers at jumping sites and hanging, by introducing "safe rooms" in prisons and hospitals. Moreover, decline in prescription of barbiturates and tricyclic antidepressants (TCAs), as well as limitation of drugs pack size for paracetamol and salicylate has reduced suicides by overdose, while increased prescription of SSRIs seems to have lowered suicidal rates. Conclusions: Restriction to means of suicide may be particularly effective in contexts where the method is popular, highly lethal, widely available, and/or not easily substituted by other similar methods. However, since there is some risk of means substitution, restriction of access should be implemented in conjunction with other suicide prevention strategies. 2011 by the authors; licensee MDPI, Basel, Switzerland.

Wickramasinghe, K., P. Steele, et al. (2009). "Cost to government health-care services of treating acute self-poisonings in a rural district in Sri Lanka." Bull World Health Organ **87**(3): 180-185.

OBJECTIVE: To estimate the direct financial costs to the Sri Lanka Ministry of Health of treating patients after self-poisoning, particularly from pesticides, in a single district. METHODS: Data on staff, drug, laboratory and other inputs for each patient admitted for self-poisoning were prospectively collected over a one-month period from one general hospital (2005) and five peripheral hospitals (2006) in the Anuradhapura district. Data on transfers to secondary- and tertiary-level facilities were obtained for a 6-month period from 30 peripheral hospitals. The cost of the inputs in United States dollars

(US\$), using 2005 figures, was derived from hospital accounts. FINDINGS: The average total cost of treating a self-poisoned patient at the general hospital was US\$ 31.83, with ward staff input and drugs being the highest expenditure category and only US\$ 0.19 of this sum related to capital and maintenance costs. The average total cost of treatment was highest for self-poisoning with pesticides (US\$ 49.12). The patients placed in the intensive care unit, who comprised 5% of the total, took up 75% of the overall treatment cost for all self-poisoned patients at the general hospital. The average total cost of treating self-poisoned patients at peripheral hospitals was US\$ 3.33. The average patient cost per transfer was US\$ 14.03. In 2006, the total cost of treating self-poisoned patients in the Anuradhapura district amounted to US\$ 76,599, of which US\$ 53,834 were comprised of pesticide self-poisonings. Based on the total treatment cost per self-poisoned patient estimated in this study, the cost of treating self-poisoned patients in all of Sri Lanka in 2004 was estimated at US\$ 866,304. CONCLUSION: The cost of treating pesticide self-poisonings may be reduced by promoting the use of less toxic pesticides and possibly by improving case management in primary care hospitals. Additional research is needed to assess if increasing infrastructure and staff at peripheral hospitals could reduce the overall cost to the government, optimize case management and reduce pressure on secondary services.