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The impact of pesticide regulations on suicide in Sri Lanka

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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.

Keywords suicide, pesticides, Sri Lanka, time trends

Introduction

In the early 1990s Sri Lanka (population 19 million) had one of the highest suicide rates in the world. Between 1950 and 1995 rates increased 8-fold to a peak of 47 per 100 000 in 1995. In the 10 years after 1995, Sri Lanka's suicide rates declined by 50% (Figure 1). Understanding the reasons for this transformation in the incidence of suicide in Sri Lanka may have important implications for suicide prevention in other low- and middle-income countries.

Research in high-income countries indicates that the main potential contributors to temporal trends in suicide rates are: economic recession, increases in divorce, changing levels of alcohol misuse, periods of war, improvements in the treatment of mental disorder and changes in the availability or lethality of commonly used suicide methods.[1–7]

Pesticide self-poisoning is one of the most commonly used methods of suicide in Asia with an estimated 300 000 deaths each year.[8,9] Previous research indicates that pesticide poisoning accounts for two-thirds of Sri Lanka's suicide deaths.[6,10,11] Case-fatality following pesticide self-poisoning can be over 50 times higher than following paracetamol poisoning,[12] the most commonly used method of self-poisoning in Britain and other developed countries. The use of pesticides in acts of self-harm may therefore have profound effects on the epidemiology of suicide in countries where pesticides are commonly ingested in acts of self-poisoning.[8]

Pesticides vary greatly in their toxicity to humans. For example, paraquat self-poisoning has a case-fatality in excess of 60%,[47] whereas case-fatality following chlorpyrifos (an organophosphate) self-poisoning is 8% and with

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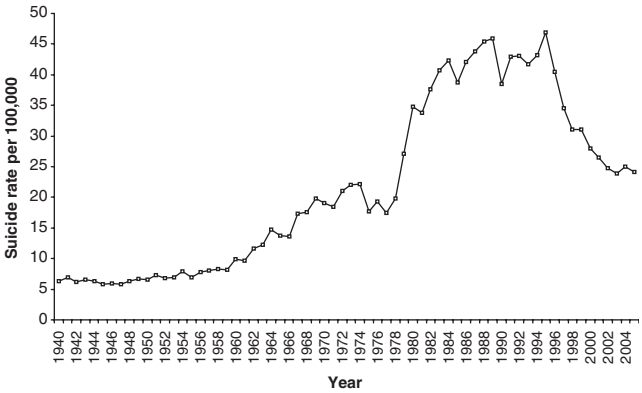

Figure 1 Suicide rates in Sri Lanka 1940–2005

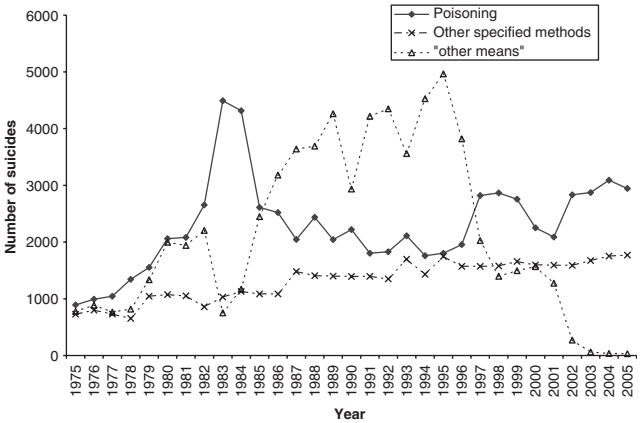

Figure 2 Trends in suicides specified as poisoning, other specified methods and other non-specified methods

dimethoate is 23%.[13] We hypothesized that Sri Lanka's robust approach to banning the most toxic pesticides in the 1980s and 90s contributed to its fall in suicide mortality between 1995 and 2005. Previous research has shown that such restrictions influence the pesticides taken by people who self-harm and the case-fatality associated with pesticide self-poisoning.[14,15]

Methods

Suicide data

We obtained data on the number of suicides in Sri Lanka from the following sources: (i) total suicides and suicide rates between 1940 and 1975 from two previous analyses of suicide in Sri Lanka both based on data from Sri Lanka's Registrar General[16,17]; (ii) age-, sex- and method-specific suicide data from 1975 to 2005 from the Department of Police, Division of Statistics, Sri Lanka. Due to civil war, suicide data from two districts (Killinochi and Mullaitivu) do not appear in the recent suicide statistics. These districts comprise <2% of the population of Sri Lanka and so are unlikely to influence observed patterns.

For most of the time period covered by the data on method-specific suicides (1975–96) the method of death was categorized into one of eight groups: poisoning/acetic acid, hanging, jumping in front of a train, drowning, burning, shooting, use of sharp cutting instruments and 'other means'. Since the terms 'acetic acid' and 'poisoning' were used interchangeably up to 1996, we have categorized both as poisoning. In 1997, the number of specific methods of suicide was expanded to include pesticide poisoning and in 2002 six additional categories were added (explosives, ingestion of acids, ingestion of fuel, plant poisoning, jumping from a height and addictive drug ingestion/injection). The most commonly recorded method of suicide in the study period was 'other means'—accounting for 38% of all suicides. We have four reasons to believe those coded as 'other' were mainly deaths from self-poisoning. First, in 2 years when the numbers of poisonings doubled (1983 and 1984) the number of suicide coded as 'other' halved, but there was no effect on the numbers of suicides using other specified methods (hanging, etc.) (Figure 2). Second, previous studies of suicide in Sri Lanka in the 1980s and 1990s indicate that the principle method used for suicide is self-poisoning. In three population-based studies in different regions of Sri Lanka, self-poisoning with pesticides accounted for over two-thirds of suicides.[6,10,11] Third, as noted earlier, pesticide suicides were categorized as a separate specific method of suicide from 1997 onwards and in that year 2589 pesticide suicide deaths were recorded. In the same year the total number of 'poisoning' suicides dropped from 1954 in 1996 to 231; likewise the number of deaths coded as due to 'other means' declined from 3818 in 1996 to 2027 in 1997 and 1397 in 1998 and continued to decline to 31 by 2005. At this time, no other specific methods of suicide showed a marked increase in numbers. This suggests that most, if not all, the 'transfer' from 'other means' to specific means was to the pesticide poisoning category. Lastly, for the period covered by our analysis, the specific methods of suicide listed in the mortality data were self-poisoning (acetic acid), hanging, drowning, self-burning, firearms, self-piercing or jumping in front of a train—and that these seven methods account for over 90% of suicide deaths in most countries.[18,19] The 'other' category, therefore, is unlikely to consist of a different (unspecified) method. Based on these observations, in our analysis of trends in method-specific suicide rates, we combined 'other' and 'all self-poisoning' categories into a single class—self-poisoning.

To assess whether any changes in suicides were due to declines in pesticide self-poisoning, we obtained data on the number of hospital admissions for pesticide poisoning and the number of in-hospital deaths from pesticide poisoning throughout the whole of Sri Lanka from published sources[20] and from Sri Lanka's Health Statistics Unit 1980–2003 (Colombo).

Population data

To estimate age- and sex-specific suicide rates we used estimated mid-year population data (in 5 year age/sex bands) obtained from the Registrar General for Sri Lanka. Censuses were carried out in 1971, 1981 and 2001 in Sri Lanka. To calculate sex-specific age-standardized suicide rates, we used the World Standard Population. Based on the 2001 census it is estimated that 14.6% of the population live in

Municipal or Urban areas and the predominant religion is Buddhism (77% of the population) (http://www.statistics.gov.lk/census2001/index.html).[21] A total of 74% of the population of Sri Lanka are Sinhalese and around 18% Tamil.

Data on risk factors for suicide

Trends in national suicide rates are adversely influenced by economic recession/unemployment as well as rises in levels of divorce and alcohol misuse. [1–5] We obtained data on levels of unemployment between 1971 and 2005 from figures published by the Central Bank of Sri Lanka.[22] To investigate trends in the use and misuse of alcohol we obtained data on trends in alcohol consumption and cirrhosis mortality from Sri Lanka's Department of Census and Statistics (http://www.statistics.gov.lk/index.asp,accessed 10 July 2006).[21] We used information in published papers to assess trends in divorce in Sri Lanka. [23]

Periods of war tend to be associated with reductions in suicide.[6,7] There has been a longstanding civil war in Sri Lanka. The conflict is between the Sri Lankan Government and the Liberation Tigers of Tamil Eelam (LTTE) who are fighting to gain independence for a separate state for Tamils in the North and East of the country.[24] The main period of civil war in the period studied was 1983–2002.

To assess whether there were changes in the total amount of pesticides available in Sri Lanka we obtained published data on pesticide imports and consumption in Sri Lanka (1995–2000) (http://www.fao.org/docrep/008/af340e/af340e0k.htm).[25]

Four further initiatives that may have influenced suicide rates in Sri Lanka were: (i) the Control of Pesticides Act that created the position of the 'Registrar of Pesticides' in 1983—this post carries the authority to set regulations and standards for pesticides; (ii) the establishment of National Poisons Information Centre in 1988;[26] (iii) the creation of the Presidential Task Force on Suicide, which developed a National Policy and Action Plan on the Prevention of Suicide published in December 1997[27] and (iv) the de-criminalization of suicide in Sri Lanka in 1998.

Analysis of time trends in suicide

We used graphical approaches to investigate secular trends in age-, sex- and method- specific suicide rates. We related these trends to the timing of specific interventions by Sri Lanka's Registrar of Pesticides.

From the late 1970s until the early 1990s, WHO Class I ('extremely or highly toxic')[28] organophosphorus (OP) insecticides such as parathion, methyl parathion, monocrotophos and methamidophos were the commonest poisons taken in fatal self-harm.[29,30] The Registrar of Pesticides banned methyl parathion and parathion in 1984 and over the following years gradually phased out all the remaining Class I organophosphate pesticides, culminating in July 1995 with bans on the remaining Class I pesticides monocrotphos and methamidophos. During this transitional period, farmers switched their agricultural practice to the Class II ('moderately hazardous')[28] (http://www.who.int/ipcs/publications/pesticides_hazard_rev_3.pdf, accessed 22 May 2007) organochlorine pesticide, endosulfan, which proved clinically to be highly toxic.[15] Imports of endosulfan were banned in December 1998.[15]

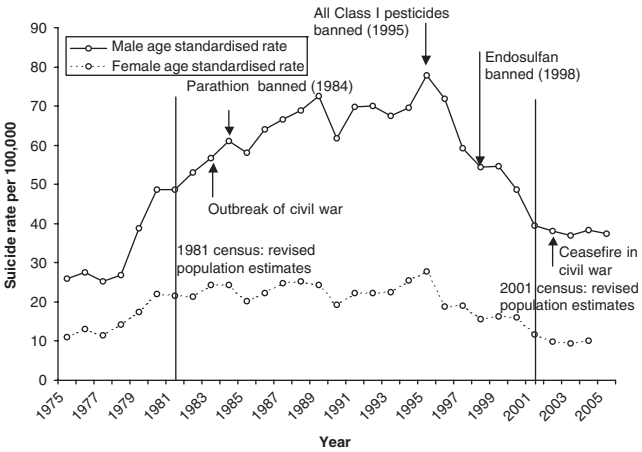

Figure 3 Age standardized suicide rates for males and females, Sri Lanka 1975–2005

Results

Overall suicide rates

Sri Lanka's suicide rates rose gradually from 6.3 per 100 000 in 1940 to 9.9 per 100 000 in 1960. Thereafter, the rate of suicide increased more sharply, doubling between 1961 and 1971 and doubling again between 1971 and 1983, before reaching a peak of 47 per 100 000 in 1995. The period of rapid rise in suicides in the late 1950s and early 1960s coincided with the first reported cases of pesticide-associated deaths in Sri Lanka.[31] There were brief interruptions to this year on year rise in 1975–78 and in 1990–94. Rates halved between 1995 and 2005 (Figure 1). There were 19 769 fewer suicides in 1996–2005 as compared with 1986–1995.

The rises in suicide rates between the late 1970s and the early 1990s were similar in males and females. In 1975, age standardized suicide rates were 25.9 per 100 000 in males and 10.9 per 100 000 in females. Rates rose by 3-fold in both sexes to a peak in 1995 of 77.9 per 100 000 in males and 27.8 per 100 000 in females (Figure 3). Subsequently rates halved in both sexes. By 2005, suicide rates were 37.3 per 100 000 and 9.7 per 100 000 in males and females, respectively. The highest rates occurred between 1987 and 1995 in both men and women and the timing of the reduction in rates was identical.

There appeared to be little impact on suicides of the bans placed on methyl parathion and parathion in 1984, other than perhaps a slowing of the rapid rise in suicide rate noticed between 1961 and 1983. However, the ban on the final permitted class I pesticides methamidophos and monocrotophos (1995) and the class II pesticide endosulfan (1998) were both followed by marked reductions in overall suicides. The National Suicide Prevention Policy (December 1997) post-dated the decline in suicides and the National Poisons Information Service was introduced 7 years before the suicide reductions commenced (1988).

The method-specific suicide data in Figure 4 indicate that the reduction in suicide occurred largely as a consequence of a reduction in self-poisoning and 'other' methods of suicide.

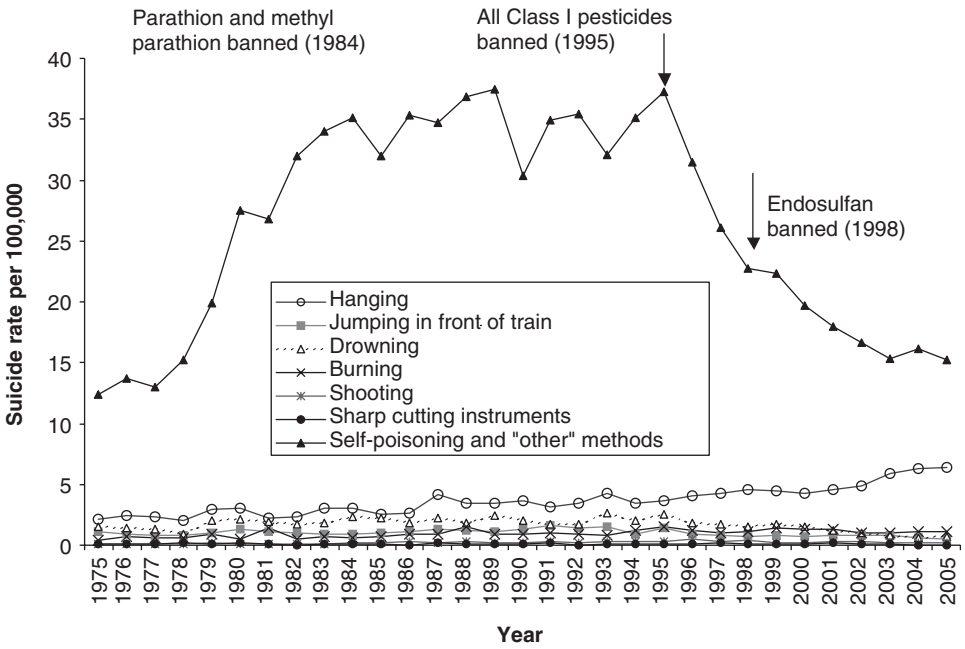

Figure 4 Method specific suicide rates: Sri Lanka 1975–2005

This interpretation is supported by hospital mortality data which show that in-hospital death rates from pesticide self-poisoning halved from 12.0 per 100 000 in 1998 to 6.5 per 100 000 in 2005. By 2005, in-hospital pesticide poisoning mortality rates (6.5 per 100 000) were lower than they had been in 1975 (6.9 per 100 000). Of note, however, there was a rise in in-hospital pesticide poisoning deaths from 8.7 per 100 000 in 1995 to 12.0 in 1998 following the 1995 ban on Class I pesticides (see Supplementary data at *IJE* on online).

The reduction in suicides was not due to a reduction in levels of self-poisoning. Between 1993 and 1995 47 411 people were admitted to hospital following pesticide poisoning (accidental and deliberate), this number increased by 16% to 55 160 in 2003–05. Furthermore, the reduction in suicides was not due to the reduced overall availability of pesticides. In 1995, 1736 metric tones of insecticides, herbicides and fungicides were used in Sri Lanka, this amount decreased only slightly (by 2%) to 1696 metric tons in 2000 (http://www.fao.org/docrep/008/af340e/af340e0k.htm).[25]

Age-specific suicide rates

Age-specific suicide rates were investigated to determine whether the patterns of rise and decline differed by age (see Supplementary data at *IJE* on online). There was some evidence that in 17–35-year-old males and females, rates peaked earlier (the late 1980s) than in the older age groups. However, in all three age groups, in both males and females, the main period of decline in suicide was after 1995.

Trends in risk factors associated with suicide

Data on unemployment in Sri Lanka prior to 1990 were sparse. Available data (see Figure on web) show that the highest recorded levels of unemployment were in 1971 for males (14.3% unemployed) and 1981 for females (32.9%). Levels of unemployment declined steadily throughout the 1990s. Male and female unemployment declined in the 5 years before, and continued to decline in the 5 years after, the marked down turn in suicides in 1995. Male unemployment declined from 11.1% in 1990, to 9% in 1995 and 5.5% in 2005; female unemployment declined from 23.4% in 1990 to 18.7% in 1995 and 11.5% by 2005.

Data on alcohol sales indicate that per capita alcohol consumption increased year on year from 1.81 litres per capita in 1981 to 7.37 litres per capita in 2003. Similarly, deaths from alcoholic liver diseases rose between 1991 and 1999. Such trends are likely to have an adverse rather than a beneficial impact on suicide rates.

Published data indicate that divorce is unusual in Sri Lanka and there is little evidence of a sizeable change in divorce in recent years. Around 0.4% of 45–49-year old Sri Lankan women were divorced in the 1990 compared with 0.5% around 2000.[23]

The temporal changes in suicide do not appear to correspond with the period of civil war (1983–2002).[24] By the time of the outbreak of the civil war in 1983, Sri Lankan suicide rates were already extremely high—37.6 per 100 000 in 1982. In subsequent years, suicide rates stabilized. The civil war was still in progress at the time suicide rates began declining in 1995. By the time of the ceasefire in 2002, rates had already halved and suicides rates were relatively stable in the 3 years after the ceasefire.

Discussion

The period of rapid rise in Sri Lanka's suicide rate coincided with the emergence of the first reported cases of pesticide

poisoning and a rapid rise in pesticide-related deaths between 1954 and 1963.[31] Around this period the proportion of suicides due to poisoning increased from 37% (1959) to 72% (1969).[32] The marked decline in Sri Lanka's suicide rates in the mid-1990s coincided with the culmination of a series of legislative activities that systematically banned the most highly toxic pesticides that had been responsible for the majority of pesticide deaths in the preceding two decades.[15] Other, earlier measures, such as the 1980 Control of Pesticides Act and the establishment of the National Poisons Information Centre in 1988 may have contributed to the levelling off of the epidemic rise in suicide in the 1970s but preceded the marked reductions by over 10 years. The decriminalization of suicide in 1998 is unlikely to be responsible for the decline in suicides after that year. If anything, decriminalization would be expected to lead to an increased willingness to report suicides, thereby resulting in an underestimation of suicide reductions occurring after that year.

Of note, these reductions in suicide occurred against a background of rising levels of hospital admissions for pesticide self-poisoning.[15] Nevertheless, increases in admissions do not necessarily signal increases in incidence; increased admissions could be due to changes in help-seeking, referral or admission policies. Whilst the earlier restrictions on pesticides in the 1990s were not associated with a marked impact on suicide rates, the halting of the year on year rise in suicides in the early 1990s occurred against a background of increases in pesticide self-poisoning incidents providing some evidence of their beneficial impact. In keeping with these findings, research in two different regions of Sri Lanka has documented a decline in the case-fatality of pesticide self-poisoning during 1997–2002 [14] and 1991–2000.[15]

In-hospital pesticide deaths increased for a short period after the ban on class I pesticides. This was most likely due to the increased incidence of endosulfan poisoning after 1995.[14,15] Endosulfan is a highly toxic pesticide, with a delayed time to death, resulting in more patients surviving to hospital admission. The Class I OP pesticides previously available had a far quicker onset of action with many patients dying before hospital admission.

The impact of the import bans in 1995 and 1998 on the pesticides used for self-poisoning are seen in two studies documenting changes in the pesticides ingested in acts of self-poisoning in Sri Lanka.[14,15] Following the ban on Class I pesticides, there was a rise in the use of endosulfan for self-poisoning and a marked reduction in the use of Class I pesticides. The last cases of class I pesticide poisoning deaths were seen in 1997 in Anuradhapura and 1999 in southern Sri Lanka. Endosulfan fatalities had declined markedly by 2000 in Anuradhapura and by 2002 in southern Sri Lanka from peaks in 1997/1998.[14,15]

Before accepting that the reduction in suicide is the result of Sri Lanka's restrictions on the sales of toxic pesticides it is important to review alternative explanations. We found no evidence that the trends were specifically associated with beneficial changes in levels of employment, alcohol sales, divorce or with periods of civil war. Data on alcohol sales must be treated with caution as these figures do not include illegally brewed alcohol that is consumed in large quantities in rural areas, but we are aware of no evidence of declining use of such alcohol between 1995 and 2005.

The effects of any improvements in the recognition and treatment of depression following the Presidential Task Force's report on suicide in 1997[27] are not possible to assess, but its publication post-dated the large fall in suicides between 1995 and 1997 and we are aware of no national mental health initiatives in Sri Lanka that are likely to have resulted in the observed 50% reduction in suicide. We were unable to investigate whether the favourable trends in suicide were due to changes in coding practices, i.e. self-inflicted deaths being more often coded as accidental. We feel this is unlikely. First, because following the decriminalization of suicide in 1998 it is likely that, if anything, more deaths previously coded as accidental would be coded as suicidal. Second, a detailed analysis of deaths in one region between 1990 and 2002 indicated that only 12% of fatal cases of pesticide poisoning were accidental.[14] Third, rates of suicide by hanging increased and we would expect any changes in the classification of suicides to accidental deaths to affect all methods.

As well as restricting or withdrawing a number of pesticides, Sri Lanka has also actively pursued a number of initiatives to reduce use and increase the safety of pesticide use by farmers—'Integrated Pest Management'. Furthermore, there has been considerable research interest in Sri Lanka in the medical management of self-poisoning and so it is possible that the improved management of pesticide self-poisoning has contributed to the favourable trends we observed.[26,33–35] However, there has been no consistent marked improvement in the practice of, or facilities for, management of pesticide poisoning during this time that might explain the 50% reduction in suicides reported here.

It has previously been hypothesised that the rise in suicide in Sri Lanka in the 1950–80s might have been due to a combination of increased levels of internal migration, with consequent social disruption, and high levels of youth unemployment in the context of improved education leading to changes in career aspirations.[17,36] Over the period covered by our analysis we documented falling levels of unemployment, but these falls preceded the reductions in suicide by over 5 years.

Limitations

An important weakness in our analysis is the poor quality of the method-specific suicide data. Over the period of time covered by the data, the categories used to identify the specific methods used for suicide changed. Furthermore, extensive use was made of the 'other means' of suicide category, despite the most commonly used methods of suicide in Sri Lanka (i.e. hanging, poisoning, drowning, burning and jumping in front of trains[6,10,11]) being available as specific coding categories throughout the study period. Nevertheless, it is of note that deaths by hanging, the second commonest method of suicide in Sri Lanka, rose throughout the study period. This provides some evidence that favourable trends in overall suicides were driven by a reduction in poisoning deaths rather than some other factor influencing all suicides regardless of method. Whilst deaths by self-poisoning and 'other' methods of suicide declined after 1995, the number of hospital

admissions for self-poisoning continued to rise[14,15] indicating either a reduction in the toxicity of the agents consumed or an improvement in their medical management. This suggestion is supported by the reduction in case-fatality from pesticide poisoning in the 1990s.[14,15]

The second limitation of our analysis is that the data are ecological, thus limiting causal inference. Whilst the timing of reductions in suicide rates corresponds with pesticide related interventions and such downturns did not appear to be associated with changes in other risk factors for suicide, we cannot rule out the impact of other (unrecognised) factors in the absence of a control population. Our data are, however, supported by recent declines in the case-fatality of pesticide poisoning in Sri Lanka.[14,15] Furthermore, data from two other Asian countries where pesticide regulation has not occurred—India and Korea—reveal differing trends in suicide. In India, Sri Lanka's closest neighbour, self poisoning (mainly insecticides) accounts for 37% of suicides and there has been no equivalent decline in suicide rates.[37] Suicide rates in India were 9.7 per 100 000 in 1995, 10.8 per 100 000 in 1998 and 10.3 per 100 000 in 2005.[37,38] In Korea, rates of pesticide suicide doubled between 1991 and 2001.[39]

The effect of suicide on changes in the availability of commonly used suicide methods

There is a growing body of evidence showing that changes in the availability of a commonly used method of suicide may influence not only method-specific, but also overall suicide rates. The strongest evidence for this comes from the natural experiment afforded by the detoxification of the domestic gas supply in Britain in the 1960s.[2] Similar effects on method specific and overall suicides have been documented following the enactment of gun-control legislation[40–43] and restricting the availability of barbiturates in Australia.[44]

The most relevant example of the influence of the easy availability of lethal methods of suicides in relation to pesticide suicide comes from Western Samoa.[45] In the 1970s and 80s there were marked fluctuations in Western Samoa's imports of paraquat, a pesticide associated with a particularly high case-fatality (>60%[46,47]). These variations closely followed rise and falls in fatal episodes of paraquat self-poisoning and overall suicide. Indeed in the late 1970s/early 1980s, the period associated with the highest levels of paraquat imports, paraquat suicides accounted for around three quarters of suicides in West Samoa.[45]

A concern with using method restriction as an approach to suicide prevention is that substitution of methods may occur. This will have an adverse effect on population suicide rates if the new methods are associated with a higher case-fatality than those they are replacing. The small rise in hanging (Figure 4) may signal such an effect is occurring in Sri Lanka. However, hospital admission data show there has been no decline in admissions for pesticide self-poisoning (see Results section) over the years suicides declined. This suggests people continue to self-poison with pesticides that have not been banned, thus case-fatality has declined because the available products are less toxic to humans.

Implications

Pesticides are readily available in most rural households in low income countries, they are commonly used by young people who impulsively poison themselves in moments of crisis.[48–50]. Pesticides are one of the most frequently used methods of suicide worldwide.[8,9] For this reason, strategies to reduce pesticide self-poisoning deaths may have a major impact on global patterns of suicide.

A number of strategies have been suggested to reduce these deaths.[8,51] Our data suggest that restricting the availability of toxic pesticides should be prioritised. Such a response would be in keeping with previous calls for the WHO to introduce a minimum pesticides list to restrict the use of pesticides to a small number of pesticides least dangerous to humans.[52] As well as import restrictions such as those imposed in Sri Lanka, other means of restricting the availability of pesticides include ensuring they are stored safely in locked boxes in rural households and restricting their sale to licensed premises and to licensed farmers.

The high number of deaths from pesticide poisoning has been recognized for over 25 years[20] but the international response has been slow and disjointed.[53] In part, this reflects obvious tensions between the benefits and harms of pesticide use. The pesticide industry has developed its own response—most notably, the 'Safe Use' campaign in the early 1990s[54] and several nations, such as Sri Lanka, have developed their own legislative frameworks to limit the use of the more toxic pesticides.

We propose other countries such as China and India, where pesticide self-poisoning is a major health problem,[18,55,56] follow Sri Lanka's example in comprehensively regulating pesticide imports and sales. At the same time there is an urgent need for public health research to identify clearly the full range of costs and benefits associated with the widespread use of pesticides. This will allow nations to make policy decisions based on agricultural, environmental, nutritional and health grounds.

Supplementary data

Supplementary data are available at *IJE* online.

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Conflicts of interest: D.G., R.F. and M.E. are on the scientific advisory group of a Syngenta-funded study to assess the toxicity of a new formulation of paraquat, and have received travel expenses to attend research group meetings. D.G. and R.F. are on the scientific advisory group for a pesticide safe-storage project funded by Syngenta.

KEY MESSAGES

- Pesticide self-poisoning is thought to account for an estimated 300 000 deaths in Asia—over a third of the world's suicides. Pesticides vary in their toxicity to humans. Case-fatality following self-poisoning with commonly used products ranges from <10% to over 60%.
- Marked reductions in suicide in Sri Lanka occurred at the same time as import restrictions were placed on the most toxic pesticides.
- National and international policies restricting the pesticides that are the most toxic to humans may have a major impact on world suicides.

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Commentary: Preventing suicide: need for a life course approach

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In this edition of the *IJE*, Gunnell *et al*.[1] describe the impact of the regulation of pesticides on completed suicide rates in Sri Lanka, a country that has the unhappy distinction of one of the highest rates of suicide in the world—a health indicator in stark contrast to most other health indicators. Sri Lanka is, in fact, an outstanding example in Asia of a low income country which has invested in a basic health care system that has led to health indicators which other countries, particularly its larger neighbours in south Asia, can only dream of. Yet, for reasons that remain unclear, Sri Lanka has a very high suicide rate. It is apparent from this case study of one country that, at the very least, suicide is not an accurate reflection of overall health care standards. More than a century ago, Durkheim had proposed that social and structural determinants influenced the risk of suicide in a population. In Sri Lanka, Gunnell *et al*. did not find strong associations between trends in suicide rates and societal determinants such as unemployment level. It may well be that we may never quite be able to identify consistent and generalizable population level social determinants that are amenable to public health strategies to reduce suicide rates. That this is of great public health importance, particularly for young people in Asia for whom suicide is now one of the leading causes of death, is now well-established.[2,3]

It is therefore reassuring to read that the analysis of Gunnell *et al*. suggests that the reasonably well-established evidence that

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