

////Title: Does 'Safer Storage' Reduce Agricultural Pesticide Self-poisoning in Rural Asia?

////Stand-first: Attempting suicide by ingesting pesticides is a major public health problem in rural Asia. In Sri Lanka, pesticide self-poisoning is the most common method used in suicide attempts in many rural areas. Globally, it accounts for as many as one in every five of the world's suicides. Many people have recommended 'safer storage and use' as the answer to the problem. A group of Sri Lankan and international researchers took on the challenge to test, on a large scale, whether improving pesticide storage in households would actually reduce the frequency of self-poisoning with pesticides. Remarkably, they found no benefit from this approach at all. These findings have important implications for global policies aiming to reduce the incidence of suicide and self-harm.

////Body text:

Suicide is a global concern. Risk factors for suicide include poor mental health, acute distress, relationship breakdown, loss of employment, addiction, a childhood history of abuse, and previous self-harm. However, a key issue that the World Health Organization (WHO) has emphasised is the danger of having ready access to potentially lethal means of suicide.

Self-poisoning is the most frequently adopted method for attempting suicide worldwide. Often, individuals impulsively consume poisons that are most readily accessible to them. In rural areas of low- and middle-income countries, these poisons are often pesticides since changes in agricultural practice during the 1950s (termed the Green Revolution) placed highly hazardous pesticides into poor households that were completely unable to use or store them safely. As a result of this change in rural life, as many as fourteen million premature deaths resulted from pesticide suicides over the last 60 years.

Means restriction is, therefore, a critical approach for the prevention of suicide. The rationale is that reducing the accessibility of these highly lethal means at moments of crisis will force individuals to use less harmful alternative methods or postpone their plans, markedly increasing the likelihood of survival.

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From around 2004, the WHO, pesticide industry, and suicide prevention charities began to recommend reducing access to highly hazardous pesticides through improved household and community storage using locked boxes or lockers. Known as 'safer storage', small pilot studies in Sri Lanka, China, and India demonstrated that this approach was well received by farming communities. However, these studies were not designed to test the ability of these storage methods to actually reduce the use of pesticides as agents of self-harm or suicide.

There were concerns that, rather than reducing the potential for self-harm, such storage might inadvertently increase the risk of self-poisoning by bringing storage in from the field to the house. If secure locking away did not occur after every time pesticides were used, pesticides would become even more accessible to vulnerable household members.

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A group of researchers from the Universities of Peradeniya, Kelaniya, and Rajarata in Sri Lanka together with colleagues from universities in Edinburgh, Copenhagen, Bristol, Oxford, and Sydney

decided to robustly test whether this 'safer storage' approach worked. With funding from the Wellcome Trust and American Foundation for Suicide Prevention, they set up a large community-based trial in the intensely irrigated Mahaweli H region of Sri Lanka's North Central Province. This region is associated with high use of pesticides in agriculture, and likewise, a high incidence of pesticide self-poisoning. Indeed more than 50% of all suicides in the district were due to pesticide poisoning. It was believed that ready access to pesticides accounted for this Province's high suicide rate.

The researchers recruited over 223,000 people in 53,000 households in 180 villages to the study. Each village was chosen at random to be allocated to either the intervention group or the control group. In the intervention group, households were given a lockable storage container that had been designed closely with farming communities to ensure acceptability. The container was made from ultraviolet-resistant plastic; the researchers recommended that it should be buried in the ground outside of the house, in the home garden. A check at 2 weeks after delivery showed that the vast majority were indeed buried in the ground. It was fitted with a lock and keys were provided to the household members. Communities who received containers were reminded about the importance of using them at six-month intervals. In contrast, households in the control villages received no intervention or encouragement to use locked containers.

During the course of three years of follow-up, all cases of fatal and non-fatal pesticide self-poisoning, of accidental poisoning, and of all forms of self-harm (both non-fatal and fatal) were identified by researchers from multiple sources, in particular, local hospitals, police stations, and coroners. The researchers were blinded, that is to say naïve, as to whether any patient's household had received a lockable container or not.

The primary outcome was the incidence of pesticide self-poisoning, regardless of whether fatal or non-fatal, in individuals aged 14 years or older, over the course of three years. At the end of the study, there was no statistically significant difference between the arms of the study.

The researchers also investigated the incidence of pesticide poisoning in younger children, aged 13 years or less, as a secondary outcome. Here, the incidence rates were much lower than for older children and adults, but again there was no statistical difference between the intervention and control groups.

They carefully considered whether individuals had simply switched from pesticide self-poisoning to other forms of fatal or non-fatal self-poisoning but found no evidence to suggest this was the case. No evidence for substantial increases in the rates of other common forms of self-harm and suicide, such as hanging, burning, or cutting, were found. Of interest, there was more fatal self-harm (suicide) in the control part of the study but this again was not statistically significant.

Finally, the researchers assessed what proportion of households who received the container were actually using it at the end of three years, by looking at a large subsample of the recruited households. Adherence was approximately 70% at the end of the first year, falling to just over 50% by the end of the third year, indicating a drop in the appropriate use of the containers, despite reminders. While repeated reminders over the effective use of the lockable storage containers may help improve compliance, this is unlikely to be an effective strategy since there was no evidence of benefit in the trial even in the first few months when compliance was at its peak.

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The researchers concluded that the prevention of pesticide suicides is complex, requiring work at individual, community, and population levels. In consideration of their finding that lockable household storage containers do not reduce the incidence of pesticide self-poisoning, they note that this intervention requires a very active form of prevention on the part of households. For example, individuals and families are required to consistently store pesticides safely, to keep keys hidden safely, and to ensure containers and locks are repaired or replaced after damage. Much smaller studies have looked at the storage of pesticides in central storage facilities, akin to railway station lockers. Unfortunately, this is unlikely to work since the studies have shown relatively poor uptake – likely because the central facilities are usually located in the middle of towns or villages, away from the fields on the outside of town.

To more effectively reduce pesticide suicides, Professor Eddleston and his colleagues emphasise the utility of replacing highly hazardous pesticides with alternative approaches in standard agricultural practice, including both less toxic pesticides and non-chemical forms of crop protection. This form of harm minimisation will make pesticide self-poisoning less harmful, leading to far fewer deaths as has been seen dramatically in Sri Lanka.

The study was published in 2017 in the international medical and public health journal, The Lancet. This definitive proof that 'safer storage' is not effective at preventing pesticide self-poisoning has resulted in WHO and Food and Agriculture Organization of the United Nations (FAO) publishing policy documents that recommend reducing deaths and illness through the removal of highly hazardous pesticides from agricultural practice in Low- and middle-income countries.

Meet the Principal Investigators

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Key Collaborators

This study was carried out as a collaboration of many researchers in Sri Lanka and overseas. It was led by Melissa Pearson with the support of Manjula Weerasinghe and Ravi Pieris, as well as Shaluka Jayamanne in Sri Lanka. Chris Metcalfe led the statistical analysis while David Gunnell was pivotal for the study methodology. Funding was received from the Wellcome Trust, with additional support from the American Foundation for Suicide Prevention, Lister Institute of Preventive Medicine, Chief Scientist Office of Scotland, University of Copenhagen, and NHMRC Australia.

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