PREVENTING SUICIDE

A resource for pesticide registrars and regulators

World Health Organization

Food and Agriculture Organization of the United Nations

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ISBN 978-92-4-151638-9 (WHO)
ISBN 978-92-5-131787-7 (FAO)

Suggested citation. Preventing suicide: a resource for pesticide registrars and regulators. Geneva: World Health Organization and Food and Agriculture Organization of the United Nations; 2019. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

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Design and layout by Studio FFFOG

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FOREWORD

Suicide is a leading cause of premature mortality among young people in many countries, making it a serious global public health problem. Suicides are preventable but preventing them is no easy task. Interventions range from providing the best possible conditions for bringing up our children and young people, through accurate and timely assessment of mental disorders and their effective treatment, to responsible reporting of suicide by the media and the environmental control of risk factors.

Pesticide poisoning is one of the commonest, and most readily preventable, methods of suicide in certain parts of the world. Overall, pesticide poisoning accounts for as many as one in every five of the world's suicides. Appropriate action by pesticide registrars and regulators has the potential to save thousands of lives every year.

This booklet is one of a series of resources for specific groups who are in a unique position to prevent deaths by suicide.[1] Suicide prevention involves the concerted efforts of many social sectors and professional groups – national and local government, legislators, law enforcers, health workers, educators, social agencies, the media, families, schools, workplaces and communities. This resource is targeted at pesticide registrars and regulators who have an important role in reducing access to, and regulating the use of, highly hazardous pesticides.

Throughout the booklet "pesticide registrars and regulators" are referred to as a shorthand for all persons involved in the policy development, evaluation, authorization and management of pesticides – whether in a pesticide regulatory unit within a ministry, or in a dedicated pesticide registration authority or a member of a pesticide registration board.

WHO and FAO are particularly grateful to Professor David Gunnell, University of Bristol, United Kingdom of Great Britain and Northern Ireland (UK), Professor Michael Eddleston, University of Edinburgh, UK, and Professor Flemming Konradsen, University of Copenhagen, Denmark who produced the first version of this booklet with inputs from Mark Davis, former team leader of Pest and Pesticide management, Plant Production and Protection Division, Food and Agriculture Organization of the United Nations.

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[1] See: : https://www.who.int/mental_health/resources/preventingsuicide/en/ (accessed 24 August 2019).

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David Bramley, Prangins, Switzerland, edited the text.

This resource is being widely disseminated in the hope that it will be translated into local languages and adapted to local situations. Such adaptation is a prerequisite for its effectiveness. Comments and requests for permission to translate and adapt the resource are welcome.

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GLOSSARY

HHP	Highly hazardous pesticide
HIC	High-income country
FAO	Food and Agriculture Organization of the United Nations
ILO	International Labour Organization
IPM	Integrated pest management
IVM	Integrated vector management
JMPM	Joint Meeting on Pesticide Management (of FAO and WHO)
LMIC	Low- and middle-income countries
UN	United Nations
UNEP	United Nations Environment Programme (or UN Environment)
WHO	World Health Organization

EXECUTIVE SUMMARY: WHAT PESTICIDE REGISTRARS AND REGULATORS CAN DO TO PREVENT PESTICIDE SUICIDES

Self-poisoning with pesticides causes up to one in five of the world's suicides.

Regulatory action in Bangladesh, the Republic of Korea, Sri Lanka and other countries indicates that many suicide deaths can be prevented by bans on specific pesticides. In Sri Lanka, for instance, bans are thought to have led to 93 000 fewer suicide deaths between 1995 and 2015.

There is no evidence that bans in these countries have adversely affected crop yields.

Pesticide registrars and regulators have a key role to play in suicide prevention. Important approaches they can take include:

- identifying the pesticides most commonly used in fatal self-poisoning
- identifying highly hazardous pesticides for withdrawal
- taking regulatory actions to phase out the most hazardous pesticides, along with advice and training about low-risk alternatives
- requiring data on human risk assessments, particularly in relation to acute toxicity when ingested, for national registration of new pesticide products
- facilitating the registration and use of low-risk pesticides
- strengthening inspection and other regulatory control
- being aware of the conflicting agendas of different stakeholders
- supporting research into safer alternatives to highly hazardous pesticides.

BACKGROUND

Pesticide registrars and regulators have a key role to play in ensuring food security for their populations and in preventing vector-borne diseases. Their tools often include the use of chemical pesticides. Without these pesticides, food insecurity would have been greater and the incidence of vector-borne disease higher over the last 70 years. However, pesticides are designed to be toxic to living organisms and are often not selective in their toxicity. There is growing recognition of alternatives to intensive pesticide use – including integrated pest management (IPM) and integrated vector management (IVM) approaches as promoted by the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) (FAO, 2016). There is also growing awareness that sustainable crop production is possible using agroecology.

Over time, it has become evident that some pesticides are extremely toxic to humans. Long-term occupational or domestic exposure can result in chronic illnesses – including dermatitis, respiratory problems and cancer, as well as reproductive, neurodevelopmental and behavioural disorders. Some pesticides cause acute poisoning and have resulted in many deaths. In some cases, the acute toxic effects of pesticides are reversible if the right treatment is administered in time. In other cases (e.g. paraquat and aluminium phosphide), no effective treatment is available.

WHO and the United Nations Environment Programme (UNEP, or UN Environment) have shown the high cost to human health and the environment from continued pesticide use (WHO & UNEP, 1990; UNEP, 2013). Furthermore, the International Labour Organization (ILO) recognizes the harms caused to farm workers who work with highly hazardous pesticides (ILO, 2019). The FAO Council has suggested that the actions of FAO could include pesticide risk reduction, including the progressive ban on highly hazardous pesticides (FAO, 2006).

Vector control, if based on indoor residual spraying, is mainly carried out by large-scale government programmes or, in some countries, private pest-control agencies. However, in many farming communities around the world, agricultural pesticides are present in homes and workplaces, where they are used on both food and non-food (e.g. cotton) crops as well as for grain storage. Pesticides are also commonly used in urban settings for household pest control; in some countries hazardous agricultural pesticides are commonly decanted into unmarked containers and sold for domestic pest control (Rother, 2010).

Many people know others who have had suicidal thoughts or who have harmed themselves. WHO's World Mental Health Surveys indicate that around 3% of people make a suicide attempt at some point in their lives (Nock et al., 2008). Risk factors for suicide are multifaceted and

include factors that are psychological (e.g. depression), social (e.g. family conflicts), cultural (e.g. religious views about suicide) and economic (e.g. poverty, debt, bankruptcy). Self-poisoning is the most frequently used method for attempting suicide, and suicidal people often act impulsively by ingesting the most readily accessible poison. In low- and middle-income countries (LMICs) this is often a pesticide (Eddleston, 2000; Mew et al., 2017). The high toxicity of many pesticides means that such suicide attempts often lead to death, particularly in situations where medical facilities are far away or where no effective treatment is available.

Experience in some countries has shown that replacing the agricultural pesticides that are most toxic to humans with less hazardous products significantly reduces deaths and illness from pesticide exposure without affecting agricultural yield (Gunnell et al., 2017; Manuweera et al., 2008).

Pesticide registrars and regulators therefore have a major role in preventing suicides through such activities as strengthening the lifecycle management of pesticides – particularly requirement for data on risk assessment for product registration – phasing out highly hazardous pesticides, proper management of unused stocks in communities and households, and raising awareness about pesticide suicides.

Prevention of pesticide suicides is relevant to achieving the United Nations Sustainable Development Goals (SDGs) and indicators, such as: Goal 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture, with indicator 2.4.1 on Proportion of agricultural area under productive and sustainable agriculture) and Goal 3 (Ensure healthy lives and promote well-being for all at all ages, with indicator 3.4.2 on reduction of suicide mortality rate). United Nations Member States have committed to achieving the SDGs and governments now need to ensure that these goals are achieved by 2030.

This resource sets out the case for regulatory actions around highly hazardous pesticides with the aim of helping pesticide registrars and regulators in their work of reducing deaths and illness associated with these products, particularly in rural agricultural communities.

Credit: WHO/Angeliki Antonia Balayannis

SUICIDE FACTS AND FIGURES

It is estimated that close to 800 000 people die by suicide every year (WHO, 2019). Suicide is the second leading cause of death (after road injuries) in 15-29-year-olds worldwide and is one of the top 10 causes of death in many countries. Over three quarters (79%) of all suicides occur in LMICs (WHO, 2019). Each death by suicide has devastating consequences for families, friends and communities.

For every person who dies by suicide around 20 people make a suicide attempt (WHO, 2014). Many people who attempt suicide are prevented from dying only because of the availability of intensive care facilities and effective treatments for some poisons.

The disease burden from pesticide self-poisoning

Between 110 000 and 168 000 pesticide self-poisoning deaths (suicides) occur each year worldwide (Mew et al., 2017). Since the 1950s, when the Green Revolution brought highly hazardous pesticides into small-scale farming, an estimated 14 million premature deaths have resulted from pesticide self-poisoning.[2] Over 95% of these deaths have occurred in LMICs. It is notable that self-poisoning deaths are lower in high-income countries (HIC) where highly hazardous pesticides are banned, restricted or used only by professional sprayers using mechanized approaches.

Pesticides vary in their toxicity when ingested in acts of self-poisoning (Box 1) (Dawson et al., 2010). The herbicide paraquat, for instance, kills about half of all people who ingest it, even in quantities as small as a spoonful, whereas some of the new (less hazardous) pesticide products kill less than 1% of those who ingest them. The relative toxicity of pesticides does not always directly follow WHO's classification of toxicity (WHO, 2010) because this classification is mainly based on an assessment of acute toxicity in rats after ingestion (i.e. LD_{50} values – the dose that kills half of exposed animals), which is a standard parameter in toxicology.

However, it is recognized that, in some cases, the acute hazard to humans may differ from the hazard indicated by LD_{50} assessments alone. For example, although research (e.g. Dawson et al., 2010) has shown that the herbicide paraquat has an extremely high case fatality rate after ingestion, it is classified as a WHO class II compound (i.e. a moderately hazardous pesticide) on the basis of the LD_{50} value in rats.

[2] Karunarathne A, Gunnell D, Konradsen F, Eddleston M. How many premature deaths from pesticide suicides have occurred since the agricultural Green Revolution? Clin Toxicol (in press).

Box 1. Estimated case fatality rate of commonly-used pesticides (proportion of people who die following self-poisoning using each product)

PRODUCT	CASE FATALITY
Herbicides	
Paraquat	43-68%
Propanil	11%
MCPA (2-methyl-4-chlorophenoxyacetic acid)	5%
Glyphosate	2%
Rodenticides and fumigants	
Aluminium phosphide	60-80%
Zinc phosphide	7%
Insecticides	
Monocrotophos	35%
Parathion	25%
Endosulfan	22%
Dimethoate	20%
Fenthion	15%
Carbosulfan	11%
Chlorpyrifos	8%

Sources: Dawson et al., 2010; Azrael & Miller, 2016; Trakulsrichai et al., 2017.

The pesticides most often ingested in fatal self-poisoning vary from country to country, depending on the products that are licensed and commonly used by farmers as well as their toxicity. The pesticides that have accounted for many deaths include paraquat, aluminium phosphide, highly toxic organochlorines (e.g. endosulfan, endrin), highly toxic organophosphorus insecticides (e.g. phorate, methyl parathion, parathion, methamidophos, monocrotophos, dimethoate, fenthion) and carbamate insecticides (e.g. aldicarb, carbofuran).

While there are effective treatments for some forms of pesticide poisoning if patients are treated early (e.g. atropine for carbamate and organophosphate insecticide poisoning, methylthioninium chloride for propanil induced methaemoglobinaemia), many deaths occur before the person reaches hospital. Furthermore, there is no effective treatment for toxicity associated with consumption of some of the most toxic products, such as paraquat and aluminium phosphide.

Risk factors for suicide

Risk factors for suicide include mental illness, acute distress, poverty, breakdown of a marriage or relationship, physical illness, job loss, exposure to violence, being bullied or abused as a child, alcohol or drug abuse, a previous suicide attempt and access to high-lethality suicide methods (WHO, 2014). A particular pressure for agricultural communities can be acute financial difficulties resulting from crop failure.

Suicide attempts often occur in the context of a short-lived life crisis such as family conflicts, the breakdown of a relationship or financial difficulties against a background of other factors that influence vulnerability.

Although mental illness is a well-known risk factor for suicide, many people who attempt suicide do not have a recognized mental health disorder and are not under the care of health professionals. Indeed, it is often the suicide attempt that first brings the person's distress to the attention of those around them. If persons survive their suicide attempt, they will usually go on to receive support from their family and community, as well as from mental health services if these are available. Those who die when they attempt suicide do not get a second chance. For this reason, easy access to highly lethal suicide methods for which there are no antidotes – such as pesticides – is a key risk factor for suicide.

There are a number of common myths about suicide (Box 2). For instance, it is wrongly believed that those who are determined to take their life will do so eventually; however, research shows that while a previous suicide attempt is a strong risk factor for suicide, most people who survive a suicide attempt do not go on to die by suicide or even make a repeat attempt (Carroll, Metcalfe & Gunnell, 2014). If they survive, they usually go on to lead productive lives.

Box 2. Common myths about suicide and suicidal behaviour

1 ***Myth: Banning pesticides will have a serious impact on agricultural production and the livelihood of low-income farmers***
Evidence indicates that selective bans on highly hazardous pesticides, along with promotion of suitable alternatives, does not influence crop yield (see Figure 2, Annex).

2 ***Myth: Only people with mental disorders are suicidal***
Suicidal behaviour indicates deep unhappiness but not necessarily mental disorder. Many people living with mental disorders are not affected by suicidal behaviour, and not all people who take their own lives have a mental disorder.

3 ***Myth: If someone is determined to die there's nothing that can be done to prevent it***
There is clear research evidence that many suicides are preventable using simple approaches such as recognizing a person as being at risk and talking to them, and restricting access to highly lethal methods of suicide to buy time while suicidal feelings pass.

4 ***Myth: Once someone is suicidal, he or she will always remain suicidal***
This is not true. Heightened suicide risk is often short-term and situation-specific. While suicidal thoughts may return, they are not permanent and a person with previously suicidal thoughts and attempts can go on to live a long life.

5 ***Myth: Someone who is suicidal is determined to die***
On the contrary, suicidal people are often ambivalent about living or dying. Someone may act impulsively by drinking pesticides, for instance, and die a few days later, even though they would have liked to live. Access to emotional support at the right time, and preventing access to highly lethal methods of suicide, can prevent suicide.

6 ***Myth: You need to be a psychiatrist or health expert to prevent suicide***
Government officials have a key role to play by removing or limiting access to the methods that people commonly use to attempt suicide. Anyone can help prevent suicides by looking out for early warning signs in other people and offering them help and by supporting friends, family members, co-workers and community members.

Suicide methods

Whether someone dies following a suicide attempt - i.e. becomes a suicide - often depends on the method they use. Worldwide, the three most common methods of suicide deaths are hanging, pesticide self-poisoning and firearms. The commonest method used in nonfatal suicide attempts is self-poisoning (Fleischmann et al., 2005). There are differences between the most commonly used methods in deaths by suicide and the methods used in suicide attempts because the lethality of different methods varies. Hanging and firearms are used relatively infrequently but, because of their high risk of death, they account for many suicides. In high-income countries, the poisons most frequently ingested in suicide attempts by self-poisoning – pain killers, antidepressants and tranquillizers – are relatively nontoxic and result in few deaths. In contrast, in LMICs, high-toxicity pesticides are often ingested, and some products have case fatality rates similar to those for suicide attempts by hanging and firearms.

The poison used in a suicide attempt depends to a large extent on what is most readily available during a moment of crisis (see Box 3 for three case histories). Research from China and Sri Lanka shows that over half of people who attempted suicide by drinking pesticides had planned their act less than 30 minutes earlier, using whatever poison was readily available in the house without regard for toxicity (Eddleston et al., 2006; Jiang et al., 2013).

The potential suicide methods readily accessible to someone in a moment of crisis therefore often play an important role in determining whether or not a person dies. A consistent body of research shows that restricting access to high-lethality methods of suicide, such as highly hazardous pesticides (Konradsen et al., 2003), saves lives (Mann et al.,2005; Zalsman et al., 2016).

Credit: WHO/TDR/Andy Craggs

Credit: Oulailax Nakhone/Shutterstock.com

Box 3. Circumstances surrounding three cases of pesticide self-poisoning

CASE 1

A 15-year-old girl drank 20% paraquat after an argument and fight with her 11-year-old brother. She told the doctors treating her that she had not known that it was paraquat and in her distress had simply grabbed the nearest bottle in the house and drunk from it. She died two days later.

CASE 2

A 12-year-old boy presented in a coma after drinking 200 mL of chlorpyrifos (an organophosphorus pesticide). He was intubated and transferred to intensive care, where he was ventilated for 10 days. At discharge, he told the psychiatrist that he had drunk the pesticide in front of his alcohol-dependent father in an attempt to shock him and stop him hitting his mother. Seven years later, he was taking advanced level school examinations in mathematics.

CASE 3

A 52-year-old man drank 400 mL of 40% dimethoate while under the influence of alcohol. Neither his family nor his friends knew the reason for his act of self-harm. He was intubated and given oxygen, atropine, pralidoxime and dopamine. He died within 15 minutes.

Source: Eddleston & Phillips, 2004.

Means restriction and suicide prevention

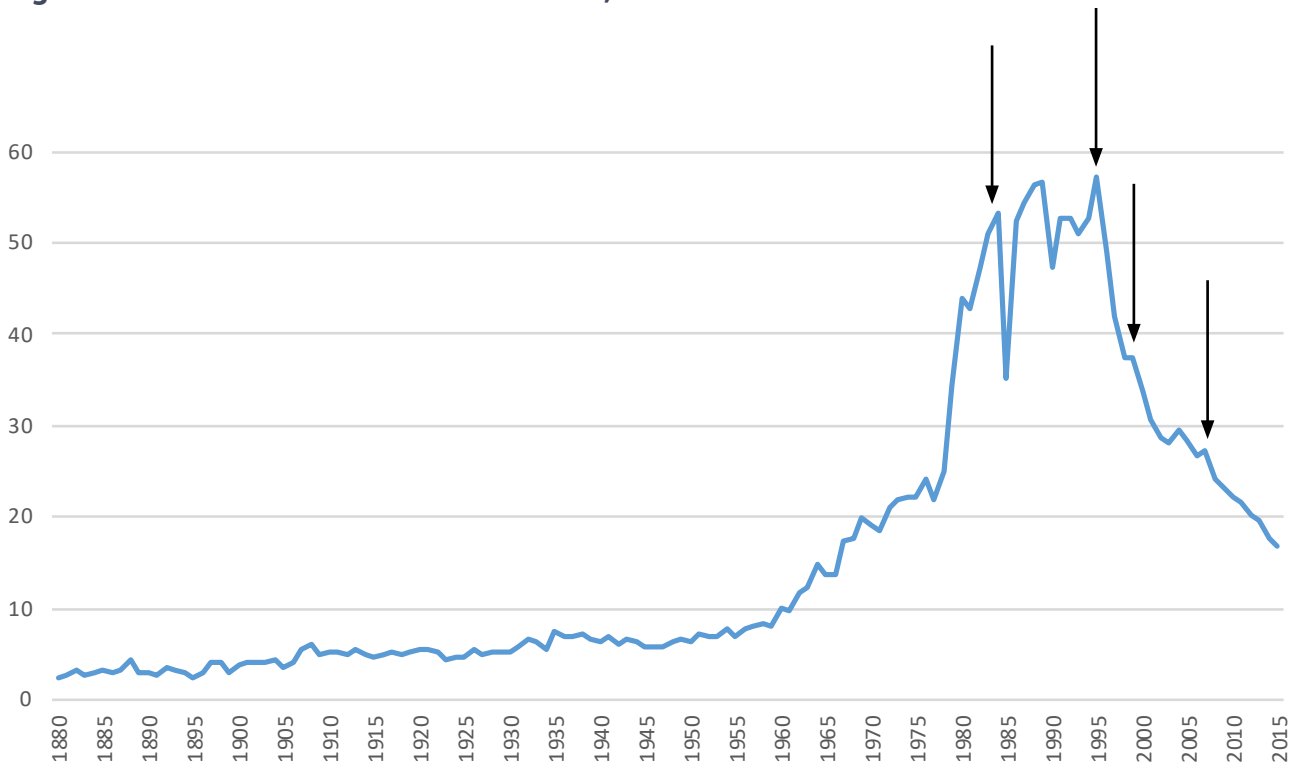
Research shows that changes in the availability of highly lethal suicide methods may have an impact on a country's overall suicide rates (see Figure 1) and may save lives (Kreitman, 1976; Knipe et al., 2017). For this reason, WHO, the International Association of Suicide Prevention (IASP) and leading suicide prevention experts recommend means restriction as one of the key effective interventions for the prevention of suicide (WHO, 2014).

For suicides by pesticide poisoning, regulations to ban the most toxic products are the most effective approach to reducing deaths (Gunnell et al., 2017). There is mixed evidence of the effectiveness of restricting sales to people for occupational use; if these restrictions cannot be enforced, as is the case in many countries, this will not reduce access to highly hazardous pesticides.

Alternative regulatory approaches, such as changes to pesticide product formulations or innovative packaging, have also been attempted but evidence for the effectiveness of these measures is limited. Studies that have looked at the impact of nonregulatory approaches to reducing pesticide suicides – such as non-pesticide agricultural management (e.g. farming using natural pesticides such as chillies), central storage facilities for pesticides, distribution of lockable storage containers to households, and local insecticide bans – have not shown clear evidence of effectiveness (Reifels et al., 2018; Knipe & Eddleston, 2019).

Means restriction in a historical context and evidence of the impact of banning toxic pesticides on suicides are described in Annex 1 and Annex 2.

Figure 1. Incidence of suicide in Sri Lanka, 1880-2015



Down arrows show the timing of pesticide bans (1984 parathion, methylparathion; 1995: all remaining WHO class I pesticides; including methamidophos and monocrotophos, 1998: endosulfan; 2008: dimethoate, fenthion, paraquat). Suicide data were obtained from police records.

Source: Knipe, Gunnell & Eddleston, 2017.

INTERNATIONAL CONVENTIONS AND UNITED NATIONS INITIATIVES RELATED TO REDUCING RELIANCE ON USE OF PESTICIDES

International conventions have been developed to reduce the risks of highly hazardous chemicals, including pesticides, to human health and the environment. Their implementation is intended to lead to sound management of chemicals, including agrochemicals, at all stages — including production, trade, transportation and use. In the context of highly hazardous pesticides (HHPs), successful implementation of these conventions could, in addition to having wider benefits for human health and the environment, greatly contribute to the prevention of pesticide suicides.

Rotterdam Convention

There is increasing international momentum to stop the use of pesticides that are known to harm human health and damage the environment. For instance, the Rotterdam Convention (1998) regulates international trade in hazardous chemicals, including pesticides. Exporting countries must label products according to international conventions and must inform importing countries of any known restrictions or bans. Parties to the Convention can decide whether to allow, with or without conditions, or to prohibit the import of chemicals listed in the treaty, and exporting countries are obliged to make sure that producers within their jurisdiction comply. When effectively implemented, the Convention prevents the export of a pesticide to a country without acceptance from its national authorities. The Rotterdam Convention supports, in particular, developing countries and countries with economies in transition in, inter alia, identifying so-called severely hazardous pesticide formulations. These are chemicals formulated for pesticidal use that are known to produce severe health or environmental effects which are observable within a short period of time after single or multiple exposure under conditions of use. While this can include lethal effects, intentional misuse of a pesticide, which would include use in suicide, is not within the scope of the Convention. Paraquat dichloride formulations are on the agenda of the Conference of the Parties to be considered for inclusion in the Convention's Annex, thus increasing information exchange and shared responsibilities among parties. This could in future contribute to a potential reduction of suicides with this easily available pesticide.

Stockholm Convention

The objective of the Stockholm Convention is to protect human health and the environment from persistent organic pollutants. These pollutants include pesticides and are organic compounds that are resistant to environmental degradation, bioaccumulative and toxic. Once a pollutant is listed, the Stockholm Convention prohibits or severely restricts its production and use.

International Code of Conduct of Pesticide Management and the Strategic Approach to International Chemicals Management (SAICM)

Recent United Nations initiatives aimed at eliminating or reducing the use of highly hazardous pesticides include the following:

1. The FAO/WHO International Code of Conduct on Pesticide Management calls for highly hazardous pesticides to be replaced with less harmful alternatives and the use of IPM and IVM. The Code includes guidelines on pesticide legislation and policy; pesticide registration, compliance and enforcement; distribution, sale and use; disposal of obsolete stock; post-registration surveillance; and identification and control of highly hazardous pesticides.[3]
2. The United Nations Environment Programme (UNEP) hosts the Strategic Approach to International Chemicals Management (SAICM) which calls for the promotion of alternatives to pesticides in order to reduce and phase out highly hazardous pesticides.[4]

Reducing reliance on use of pesticides

One effective way of preventing pesticide suicides is to limit access to pesticides, and to HHPs in particular. This can be effectively achieved by reducing the reliance on pesticide for pest management. FAO promotes an Integrated approach to Pest Management known as IPM.[5] This field-based approach is tailored to the specific needs of farmers. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest-control mechanisms. It blends traditional or local knowledge with modern technology and limits the use of pesticides to situations where they are necessary and ensures that, when used, they are applied in the most efficient and effective way possible with the aim of minimizing the impact on human health and the environment. One of the cardinal points of an IPM approach is that pesticides should be applied only as a last resort when there are no adequate non-chemical alternatives and the use of pesticides is economically justified.

[3] See: http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/code/list-guide-new/en/ (accessed 25 July 2019).
[4] See: https://sustainabledevelopment.un.org/content/documents/SAICM_publication_ENG.pdf (accessed 25 July 2019).
[5] IPM means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations, keep pesticides and other interventions to levels that are economically justified, and reduce or minimize risks to human and animal health and/or the environment. See: http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/ipm/en/ (accessed 25 July 2019).

IPM programmes have demonstrated that it is possible to reduce pesticide use significantly without reducing crop yield or farmer profits, even in areas with increased pressure from pests. Within regional IPM Farmer Field School (FFS) programmes, pest reduction of 70% has been achieved on rice, cotton and vegetables. Some 10 million farmers have so far been trained on IPM through FAO and the regional FFS programme in more than 95 countries in Africa, Latin America, the Caribbean, Asia and Eastern Europe.[6]

In the field of vector control, the only pesticides which are considered to be highly hazardous pesticides that are currently recommended by WHO for malaria vector control are DDT and clothianidin-based neonicotinoid products. These should be applied within an IVM approach.

WHAT PESTICIDE REGISTRARS AND REGULATORS CAN DO TO PREVENT PESTICIDE SUICIDES

It is a key responsibility of regulators to give consideration to the health and environmental impacts of pesticides. In countries where regulatory decisions have been taken to remove highly hazardous pesticides from use, viable and less hazardous products and approaches are available. These may cost less and be more sustainable.

Regulatory action can not only save many lives but also offers multiple benefits for agriculture. Such benefits include making farming safer, reducing risks of food contamination, conserving biodiversity that benefits farming by harbouring natural pest-control agents, and making agriculture more sustainable and resilient to the impacts of climate change. Actions for pesticide registrars and regulators include:

[6] See: http://www.fao.org/farmer-field-schools/en/ (accessed 25 July 2019).

Identify pesticides commonly used in fatal self-poisoning

Pesticide registrars and regulators should work closely with national poison centres (where these exist) and the public health units of ministries of health to carry out a situation analysis to determine the number of deaths and hospital admissions due to pesticide poisoning and to identify the specific pesticides and pesticide formulations most commonly involved. Particular attention should be paid to those pesticides most often ingested in self-poisoning (both in suicides and suicide attempts). Identification of these products may also be achieved through high-quality community, hospital and mortuary-based studies of a consecutive series of pesticide suicide deaths or serious poisonings. Such studies should ideally be nationally representative, covering the range of farming practices and settings (rural/urban). Further assessments every 3–5 years to assess the impact of regulatory action and changes in the pesticides commonly used for suicide would bring additional benefits. WHO has published guidance on establishing surveillance systems for self-harm (WHO, 2016).

Identify highly hazardous pesticides for withdrawal by using the criteria of the FAO/WHO Joint Meeting on Pesticide Management (JMPM)

Pesticide registrars and regulators should identify highly hazardous pesticides for withdrawal. The JMPM's criteria (FAO & WHO, 2016) for making these choices include:

- Criterion 1: all WHO class IA or class IB pesticides (WHO, 2010);
- Criteria 5, 6 and 7: pesticide ingredients and formulations listed in the Stockholm Convention,[7] Rotterdam Convention (FAO & UNEP, 2017) or Montreal Protocol (UNEP, adopted 1987);
- Criterion 8: pesticide active ingredients and formulations that have shown a high incidence of severe or irreversible effects on human health or the environment (e.g. WHO class II pesticides with high acute oral toxicity and high case fatality rates in self-harm, and toxic pesticides without a current antidote or effective treatment).

[7] UNEP Stockholm Convention on Persistent Organic Pollutants (POPs). Pesticides listed in Annexes A and B. The criteria of what may constitute a POP are listed in Annex D.
http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx (accessed 30 July 2019)

Put in place regulatory actions to phase out, through national policies and enforcement, the most hazardous pesticides, alongside advice and training about low-risk alternatives

Pesticide registrars and regulators should put in place regulatory actions to phase out, through national policies and enforcement, the most hazardous pesticides (identified using the approaches and criteria outlined above) and in particular those frequently used for suicides. Such actions should be carried out along with provision of advice and training about low-risk pesticides or alternatives through agricultural extension programmes (i.e. the education of farmers in agricultural practices) based on scientific research findings and new knowledge. This will reduce the number of cases of poisoning and death not only from self-poisoning (suicide) but also from accidental and occupational poisoning.

Require data on human risk assessments for national registration of new pesticide products

The withdrawal of highly hazardous pesticides must never be followed by the introduction of new, similarly hazardous products. It is crucial that the registration of new products should take into account their potential use in suicide attempts and suicides, as well as other concerns such as carcinogenicity and other chronic toxicity. Where effective antidotes exist to treat poisoning caused by a new pesticide, these should be clearly indicated on the product label.

The FAO has produced a toolkit to help pesticide regulators in the evaluation and authorization of pesticides in order to minimize the risks to human health and the environment.[8] This, and advice from other relevant agencies, should be used to:

- inform the registration of new pesticide products;
- prevent the introduction of new highly hazardous pesticides;
- identify low-risk products that are effective, including non-pesticide options for plant protection and pest control.

Facilitate the registration and use of low-risk pesticides

Regulatory authorities can facilitate the registration and use of low-risk pesticides in various ways. These can include differentiated registration fees (lower for low-risk products and higher for highly hazardous products), fast-tracking of the registration of low-risk (bio)pesticides, provision of longer validity periods for registration of low-risk pesticides, and a reduced sales tax or subsidies on the production and sale of biopesticides. Regulation of marketing and sales practices could also be used to change demand for specific products.

[8] See: http://www.fao.org/pesticide-registration-toolkit/en/ (accessed 25 July 2019).

Strengthen inspection and control

Many pesticide registrars and regulators not only evaluate and authorize pesticides but also enforce pesticide legislation. Among other activities they conduct inspections and control pesticide importation, production, sale and use. Banning or severely restricting a pesticide in a country may lead to illegal importation, production and use, especially if the available alternatives are not (yet) considered cost-effective by farmers or other pesticide users. Without effective inspection and control, regulatory decisions may be undermined; effective enforcement is therefore essential to ensure that regulatory decisions are in fact followed.

Regulatory activity should also include more effective policing of the sale and use of "street pesticides" — mixed unlabelled cocktails commonly sold in a number of countries. Risks associated with these mixtures include exposure during handling, transportation, and storage in people's homes in containers with little or no safety information.

Be aware of the conflicting agendas of different stakeholders

It is important for pesticide registrars and regulators to be aware of the different interests of stakeholders in the pesticide industry and among users of pesticides. A report by the United Nations Special Rapporteur on the Right to Food criticized the "aggressive, unethical marketing tactics"[9] (page 4) of the pesticides industry as well as the money it spent on influencing policy makers and disputing scientific evidence (Elver, 2017). Nevertheless, a dialogue with industry may be helpful in identifying and promoting safer alternatives.

It is essential to work closely with farmers, extension officers and pesticide retailers to explain the rationale for the withdrawal of commonly-used products and to advise that the use of low-risk alternatives is essential to ensure buy-in to any initiatives.

Support research into safer alternatives to highly hazardous pesticides

Long-term research studies into the most cost-effective and safer alternatives to the use of highly hazardous pesticides are needed. Such studies should be carried out from economic, health and agricultural perspectives. Studies should be carried out independently of industry and require the collaboration of the Ministry of Agriculture and farmers, as well as of the Ministry of Health.

[9] See: https://reliefweb.int/report/world/report-special-rapporteur-right-food-ahrc3448 (accessed 25 July 2019), p. 4

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ANNEXES

Annex 1: Means restriction in a historical context

Detoxification of Britain's domestic gas supply in the 1960s had a dramatic impact on suicide rates. At that time, domestic gas poisoning was the most common method of suicide among men and women. When Britain changed its gas supply from toxic coal gas (with a high carbon monoxide content) to relatively harmless natural gas, the suicide rate by gassing fell. People did not generally revert to other (more lethal) methods of suicide (such as shooting, pesticide ingestion or hanging), so overall suicides fell by some 20–30% (Kreitman, 1976)

.

In the 1980s and 1990s, Sri Lanka had one of the highest suicide rates in the world. This was thought to be due chiefly to the ready availability and unregulated use of highly hazardous (WHO Class I) and other pesticides by small-scale farmers. Suicides by pesticide poisoning accounted for two thirds of all suicides in Sri Lanka at that time. Regulatory action taken in the mid-1990s to ban or severely restrict the pesticides responsible for most deaths resulted in a 70% drop in deaths by any form of suicide over the ensuing 20 years (Knipe, Gunnell & Eddleston, 2017). In contrast, the introduction of one of the highest lethality pesticides – paraquat – into Western Samoa in the 1970s was followed by a large rise in pesticide suicide and overall suicide deaths (Bowles, 1995).

There are many other examples of the impact of the easy availability of suicide methods on suicide rates. In the USA, for example, variations between states in the levels of household firearm ownership are strongly associated with both rates of suicide by guns and overall (all-method) suicide rates (Miller et al., 2013). In Australia, regulations restricting the prescribing of barbiturates – a commonly-used method of suicide in the 1960s – led to reductions in suicides (Oliver & Hetzel, 1972).

There is now a growing body of international evidence indicating that regulations to prohibit the use of highly hazardous pesticides can lead to reductions in national suicide rates (see Annex 2).

Annex 2: Evidence of the impact of toxic pesticide bans on suicides

In several countries, ministries of agriculture have introduced regulations on specific pesticides or classes of pesticides. Researchers have studied the impact of such pesticide bans on suicide rates and crop yields.

The best-studied country is Sri Lanka, where a series of bans over a period of approximately 20 years led to a 70% fall in suicides and an estimated 93 000 lives saved between 1995 and 2015 (Figure 1). These reductions in suicide occurred despite increases in the number of hospital admissions for pesticide self-poisoning during this period. Because the pesticides that people were ingesting were less toxic, fewer people died. The bans were put in place in a stepwise way. Following the bans, local data were supplied to policy-makers on the impact of each ban and on changes in the specific pesticide products that subsequently contributed to the greatest number of suicides. These data contributed to subsequent regulatory initiatives.

In the Republic of Korea – where paraquat accounted for the majority of pesticide suicide deaths in the 2000s – a ban on paraquat in 2011-2012 was followed by a halving of suicide deaths from pesticide poisoning between 2011 and 2013; the ban is thought to have contributed to half of the fall in overall suicides over these years (Cha et al., 2016). Bans of highly hazardous pesticides in Bangladesh in the early 2000s resulted in a 65% reduction in pesticide suicides (Chowdhury et al., 2018).

An estimated 35 000 fewer people died from pesticide suicides between 2001 and 2014 compared to the number predicted on the basis of earlier trends before the bans. Importantly, in Bangladesh, the Republic of Korea and Sri Lanka, no impact of the pesticide bans on crop yield has been detected. Figure 2 shows trends in rice production in Sri Lanka since the 1950s. Production has increased since the 1990s when the first bans were introduced.

A recent review of the worldwide literature found evaluations of Ministry of Agriculture bans and/or regulations in 16 countries – five LMICs (Bangladesh, Colombia, India, Jordan and Sri Lanka), and 11 high-income countries (Denmark, Finland, Germany, Greece, Hungary, Ireland, Japan, Republic of Korea, Taiwan [China], United Kingdom, United States of America) (Gunnell et al., 2017). Bans were the most effective approach: in five of the six countries where the impact of bans was evaluated, the bans were followed by reductions in pesticide suicides and, in three countries, falls in overall suicides.

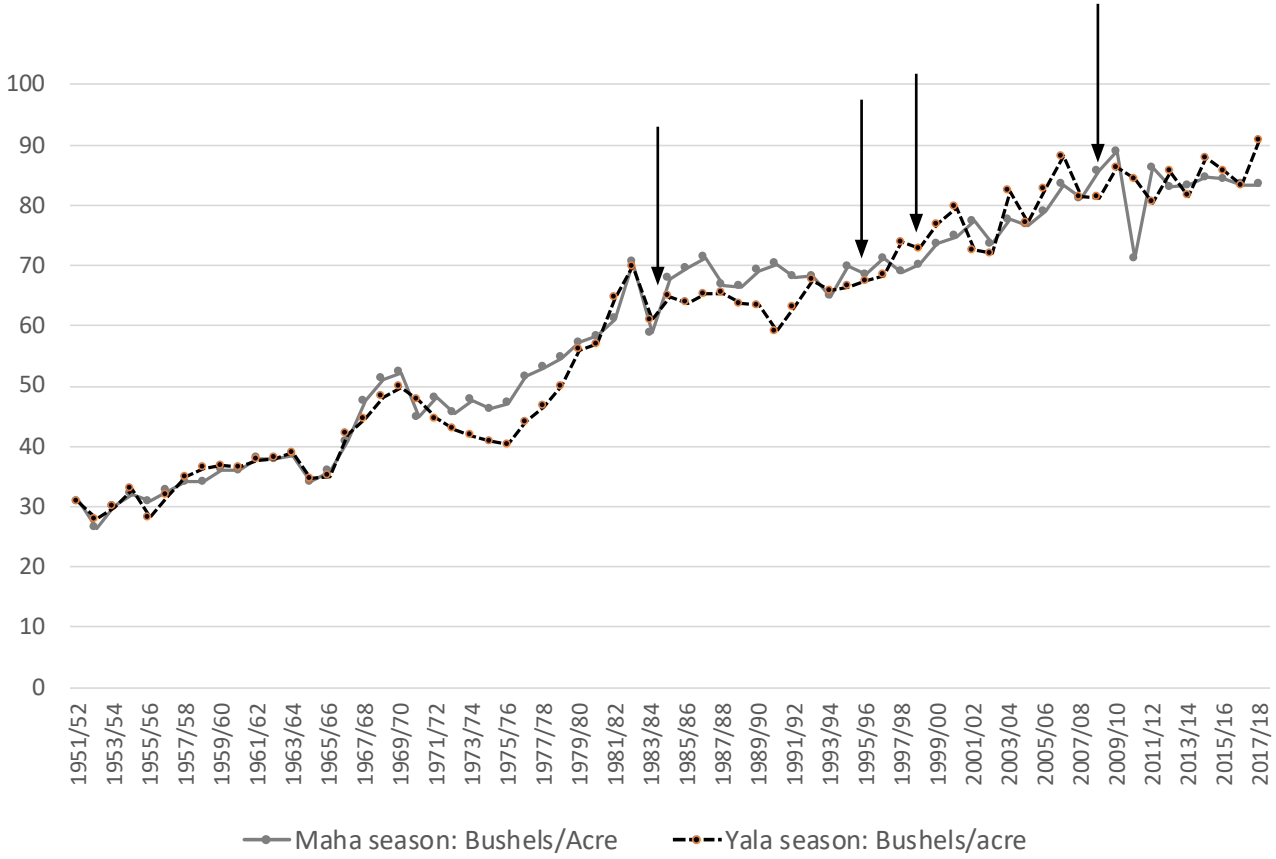
There was mixed evidence in the review that restricting sales to people for occupational use was effective. No studies reliably showed that such restrictions led

to reductions in overall suicides (all methods). The authors of the review concluded that a worldwide ban on the use of highly hazardous pesticides was likely to prevent tens of thousands of deaths every year.

Other approaches to reducing suicide by pesticide poisoning

A small number of studies have looked at the impact of nonregulatory approaches to reducing pesticide suicides. These measures include non-pesticide agricultural management, central storage facilities for pesticides, distribution of lockable storage containers for households, and local insecticide bans (Reifels et al., 2018; Knipe & Eddleston, 2019). In most cases the studies were pilots and were too small in scale to provide statistically reliable results. For example, in safer storage pilots of lockable boxes or central storage where access was provided via a facility keeper/key-holder, success was limited because the majority of pesticide users chose to continue storing their pesticides at home or in the fields (Reifels et al., 2018). The one randomized controlled trial that was large enough in scale (180 villages with 223 000 people taking part) to test the effectiveness of lockable household pesticide storage containers found no evidence of effectiveness (Pearson et al., 2017). By the end of the study only half of all households still stored their pesticides in locked containers, indicating that this was not a sustainable approach.

Figure 2. Trends in rice paddy production in Sri Lanka, 1951/52 to 2017/18



Down arrows show the timing of pesticide bans (1984 parathion, methylparathion; 1995: all remaining WHO class I pesticides; including methamidophos and monocrotophos, 1998: endosulfan; 2008: dimethoate, fenthion, paraquat). Suicide data were obtained from police records.

Source: Ministry of Agriculture statistics (http://www.statistics.gov.lk/agriculture/Paddy%20Statistics/PaddyStats.htm, accessed 13 May 2019).

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