

violence prevention the evidence

Guns, knives and pesticides: reducing access to lethal means

Series of briefings on violence prevention

This briefing for advocates, programme designers and implementers and others is one of a seven-part series on the evidence for interventions to prevent interpersonal and self-directed violence. The other six briefings look at increasing safe, stable and nurturing relationships between children and their parents and caregivers; developing life skills in children and adolescents; reducing availability and misuse of alcohol; promoting gender equality; changing cultural norms that support violence; and victim identification, care and support.

For a searchable evidence base on interventions to prevent violence, please go to: www.preventviolence.info

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Overview

Evidence suggests that limiting access to firearms, knives and pesticides saves lives, prevents injuries and reduces costs to society.

Homicide and suicide claim 600 000 and 844 000 human lives respectively, each year worldwide. This comes at a terrible cost to society – psychological and financial – and inhibits progress towards all eight of the United Nations’ Millennium Development Goals. This carnage could be significantly reduced, however, by limiting access to three of the most lethal means of violence: firearms, sharp objects (such as knives) and pesticides.

Firearms: Jurisdictions with restrictive firearms legislation and lower firearms ownership tend to have lower levels of gun violence.

Measures include bans, licensing schemes, minimum ages for buyers, background checks and safe storage requirements. Such measures have been successfully implemented in countries such as Austria and Brazil and in a number of states in the United States of America. Introducing national legislation can be complicated, but much can be done at local level. Stiffer enforcement, amnesties and improved security for state supplies of firearms are some of the other promising approaches. Multifaceted strategies are also needed to reduce demand for guns – diverting vulnerable youth from gang membership, for instance.

Sharp objects: As well as control measures, governments need broad strategies to reduce socioeconomic factors underlying the violent use of these weapons.

Less evidence is available on the impacts of efforts to reduce violence associated with sharp objects than for firearms. Until now concerned authorities have focused on similar measures to those used for the control of guns. In the United Kingdom these have included legislative reforms (bans on flick knives, minimum ages for purchasers etc.), stiffer enforcement (“stop-and-search” initiatives) and amnesties; however, their impact is not yet clear.

Pesticides: Safer storage, bans and replacement by less toxic pesticides could prevent many of the estimated 370 000 suicides caused by ingestion of pesticides every year.

Members of agricultural communities in low- and middle-income countries are heavily over-represented in the suicide death toll related to pesticides. Controlling access to pesticides is not only critical in reducing self-directed violence, it is key to preventing unintentional poisoning and terrorism. International conventions attempt to manage hazardous substances; however, many highly toxic pesticides are still widely used. Studies indicate that bans must be accompanied by evaluations of agricultural needs and replacement with low-risk alternatives for pest control.

Further research is needed, particularly in low- and middle-income countries.

The development of robust injury-data collection systems and further studies are required to deepen our understanding of the impacts of measures to reduce access to lethal means, especially in low- and middle-income countries.

1. Introduction

Each year, homicide and suicide take the lives of 600 000 and 844 000 people respectively, worldwide. Though not as devastating, in global terms, as diarrhoeal disease (which kills 2.16 million people each year) or HIV (2.04 million), these causes of death far exceed many others, including war and civil conflict (184 000) (1).

Evidence shows that preventing such interpersonal and self-directed violence demands broad strategies that limit access to common lethal means such as guns, sharp objects and pesticides, while reducing demand for these lethal means by addressing social determinants of this violence (2).

Whether people succeed in attempts at homicide and suicide depends heavily on the means used (3,4). Firearms and sharp objects are among the most common weapons used in homicide. The use of firearms accounts for 60% of all homicides, killing about 360 000 people per year, according to the latest estimates (5). Firearms are also commonly used in self-directed violence, as are acutely toxic substances such as pesticides. Ingestion of pesticides, for example, accounts for an estimated 370 000 suicides every year (6).

Access to and violent use of lethal means vary widely, as the below facts and figures on firearms, sharp objects and pesticides indicate (**Boxes 1, 4, 5**) (4,6–8). Equally variable is the staggering cost of lethal violence to society: its destruction of families, the heavy burden it places on public services and, in the case of interpersonal violence, the widespread fear it triggers. Reducing access to lethal

means is, therefore, a critical factor in addressing global priorities related to public health, access to basic needs, economic development and security. Specifically, lethal violence hampers progress towards all eight of the United Nations' (UN) Millennium Development Goals (9).

The good news is that violence is preventable. This briefing summarizes evidence from research on the impacts of strategies of violence prevention at all levels of government (national, state and local) that aim to reduce access to firearms, sharp objects and pesticides. The strategies addressed are legislative measures, enforcement of legislation, amnesties and collection schemes, managing state supplies, safer storage and safety features.

Evidence from research on measures to reduce access to firearms is far more abundant than the evidence available on policies and programmes for the control of sharp objects and pesticides. Furthermore, most studies of access to firearms and sharp objects have been conducted in higher income countries. Research on these topics in lower income countries is growing, however, and it warrants much greater support.

This document does not discuss international measures to control lethal means, though it recognizes that legal and illegal trade in lethal means operates across many borders. Controlling this trade through national, state-level and local interventions is the aim of a variety of international agreements and initiatives, and the responsibility of all nation states.

2. Reducing access to firearms

BOX 1

Firearms: facts and figures

- There are at least 875 million firearms in the world today of which 75% are owned by civilians (over a third by civilians in the United States). Just 9% of civilian firearms are estimated to be registered with authorities (8).
- An estimated 360 000 people are killed with firearms in non-conflict situations each year. A further 184 000 violent deaths occur annually in armed conflicts (1).
- Firearms are involved in the vast majority of homicides in many countries. In Medellín, Colombia, guns figure in 89% of homicides (10); Montenegro, 85% (11); Yemen, 80% (8); the United States, 70% (12); and Brazil, 69% (13). The proportion of homicides involving firearms ranges from 19% in western and central Europe to 77% in Central America (5).
- The proportion of suicides involving firearms ranges from 0.2% in Japan to 60.6% in the United States, among males, and from 0% in Iceland, Kuwait and other countries to 35.7% in Uruguay and the United States, among females (14). Among European males aged 15–24, the proportion of suicides involving firearms ranges from 2.3% in England to 43.6% in Switzerland (15).
- In South Africa, the cost of hospital treatment for serious abdominal firearms injuries alone is estimated at 4% of the annual national health budget (16). In England and Wales, each homicide is estimated to cost society £1.5 million (17).

Many studies have explored the impact of measures to reduce access to firearms on violence. Interventions discussed here include legislative measures, improving enforcement of legislation, firearms amnesties, managing state weapons supplies, promoting safer storage and firearm safety features. This range of interventions is by no means comprehensive – other activities that seek to reduce firearms access include preventing home manufacture of firearms or conversion of replica firearms and reducing illegal cross-border trafficking. Little research has been done, however, on the impact of such measures on violence prevention. Furthermore, while this briefing does not look at international firearms control measures, it is important to recognize that international agreements, specifically the UN *Protocol against the illicit manufacturing of and traf-*

ficking in firearms, their parts and components and ammunition (2001), commit signatory nations to implementing their own firearms legislation and control measures.

2.1 Legislative measures

Jurisdictions with more restrictive firearms policies and lower firearms ownership tend to experience lower levels of firearms violence (18–22). At all levels of government, therefore, measures to prevent violence involving firearms often focus on strengthening legislation to control the sale, purchase and use of these weapons. To be successful, such legislation must be effectively implemented, publicized and enforced. Legislative measures include:

- Bans on certain types of firearms;

- Licensing and registration schemes for owners and suppliers;
- Minimum ages for the purchase of firearms;
- Background checks and/or psychological testing of purchasers;
- Minimum waiting periods between licensing and purchasing;
- Limits on quantities purchased;
- Controls on the carrying of firearms; and
- Safe storage requirements.

Australia, Austria, Brazil and New Zealand provide examples of reforms of firearm laws at the national level that have had promising effects.

AUSTRALIA: Australian firearms laws were reformed in 1996 after a mass shooting. The new legislation prohibited semi-automatic and pump-action shotguns and rifles and introduced a national firearms licensing and registration scheme, including a written safety test for purchasers. The government also offered financial compensation to those surrendering weapons. Studies conducted after the reforms have provided mixed results and illustrated some of the difficulties in analysing the impacts of violence prevention measures (26–30). Some studies found reductions in both firearms homicides and firearms suicides (27,28), while another found only a decrease in firearms suicides (29). One study concluded that other methods of suicide had not increased, as firearm suicides decreased (27).

AUSTRIA: In 1997, Austria introduced new laws requiring that purchasers of firearms be at least 21, have a valid reason to purchase a firearm and undergo background checks and psychological testing. In addition, the legislation requires a three-day waiting period between licensing and purchasing, together with safer firearm storage. Suicide rates had been decreasing prior to the new laws, but the proportion of suicides involving firearms had been increasing. The reforms changed this dynamic, as the proportion of firearms suicides began to fall, without an accompanied increase in suicides by other means. Austria's new laws have also been associated with falling demand for firearms licences and a drop in the number of homicides involving guns (23).

BRAZIL: In response to some of the highest homicide rates in the world, Brazil reformed its firearms legislation in 2003. The new laws raised the minimum purchase age to 25, made it illegal to own unregistered firearms, prohibited the carrying of firearms outside the home or workplace, introduced background checks for buyers and control-

led imports of firearms. A voluntary disarmament scheme was also implemented, which official sources report returned over 450 000 firearms. Analyses suggested that the reforms were followed by an 8.8% decrease in firearms mortality between 2003 and 2005, with decreases in both firearms homicides (8.0%) and suicides (8.2%). Accidental firearm deaths dropped by 15.2% and firearm-related deaths of “undetermined intent” dropped by 26.3%. Gun-related hospitalization, meanwhile, mostly following attempted suicide or unintentional injury, decreased by 4.6% (25).

NEW ZEALAND: After a mass-shooting in 1990, the government established a rigorous licensing system. This requires photos of firearms owners and regular renewals, tests to ensure that applicants understand laws governing firearms and police assessment of all applicants. It also calls for safe and locked storage of guns in areas separate from ammunition. The system has significantly reduced firearms suicides, particularly among people 25 years and under. Studies, however, have yet to determine whether other forms of suicide increased as firearms suicides decreased (24).

At the state and municipal levels in Colombia, El Salvador and the United States, innovative legislation has reduced access to firearms.

COLOMBIA: Local legislation here banned the carrying of firearms in the cities of Cali and Bogotá on holidays, weekends following paydays and election days. The bans were enforced with police checkpoints, searches during traffic stops and routine police work. Studies showed that the incidence of homicides dropped in both cities on days when the ban was in place, compared to similar days when people were allowed to carry guns (31).

EL SALVADOR: Municipalities in an Arms-Free Municipalities project, which began in August 2005, have made it illegal to carry firearms in parks, schools, plazas, recreation centres and other locations. The project also aimed to increase police capacity to enforce firearms bans, run a media campaign on the danger of guns and the nature of the new regulations, implement a voluntary firearms surrender and collection scheme and evaluate the project. Despite some difficulties in implementation, the project initially reported a 47% reduction in homicides in participating municipalities, among other successes; however, reductions in homicides were not sustained over the first year of the project (32,33).

UNITED STATES: Box 2, below, offers examples of the impact of state-level firearms legislation on violence. While a United States review of firearms laws found insufficient evidence to establish the effectiveness of either individual laws or combinations of laws on interpersonal or self-directed violence (34), the authors stressed that this did not necessarily mean such laws were ineffective. Rather, they argued, more rigorous data and research were required to strengthen the evidence base.

2.2 Improving enforcement of legislation

Legislation to reduce access to firearms can only be effective if it is enforced. For example, despite controls on firearms dealers in the United States, a small number of rogue dealers are often responsible for selling a large proportion of the weapons used in crime (44). Furthermore, most firearms used in crime are initially purchased legally, yet transferred by illegal means to criminal hands (45). This explains why most guns recovered in criminal investigations in Canada, Haiti and Mexico have

been illegally imported from the United States (45,46). Firearms licensing systems, however, can allow data on transactions (firearm serial numbers, details about purchasers and dealers, etc.) to be collected and used to trace firearms involved in crime and, thus, capture and punish offenders (47). However, proactive enforcement can have strong deterrent effects and thus be important in controlling access to firearms.

At the state and local levels, a variety of measures can be used to enforce firearms licensing legislation. In some states in the United States, police officers have posed as criminals in undercover operations to purchase firearms from licensed dealers. Such operations were found to significantly reduce the supply of firearms to criminals when followed by lawsuits against offending dealers and high-level media coverage. By contrast, results were less positive when legal action was not taken and operations were less publicized (48). In Boston, Operation Ceasefire, implemented through the multi-agency Boston Gun Project (49), used research and firearms tracing data

BOX 2

Examples of state-led legislative controls of firearms in the United States

BANS ON CERTAIN FIREARMS: Maryland's ban on small, low-quality, inexpensive handguns was associated with an increase in gun purchases prior to implementation and an increase in firearms homicides immediately after the ban. Firearms homicides then decreased (35), however, suggesting that the ban had a delayed effect.

ONE-GUN-A-MONTH: Laws that limit the purchase of firearms to one per individual per month aim to reduce access to weapons among potential traffickers. The use of such legislation in Virginia was found to reduce interstate trafficking of firearms purchased in the state (36).

KEEPING GUNS OUT OF REACH OF CHILDREN: Child-access prevention (CAP) legislation requires owners to store firearms safely away from children (e.g. under lock and key) and makes the failure to do so a criminal offence (37). Studies have associated CAP laws with modest reductions in firearms (and overall) suicides among adolescents (38) and, in states where violation of CAP laws is a serious crime (felony), reductions in unintentional firearms fatalities among children (39–41).

GUN SHOW REGULATION: In California, where gun shows are regulated, promoters must be licensed and private firearms sales are highly restricted. These restrictions are associated with a lower incidence of anonymous, undocumented firearms sales and illegal *straw purchases* than in states with weaker regulation of private sales and gun shows (42). (A straw purchase is one undertaken by a proxy on behalf of somebody who is not permitted by law to purchase or own the item.)

KEEPING GUNS AWAY FROM VIOLENT OFFENDERS: Federal law prohibits possession of firearms by offenders who are subject to a restraining order protecting an intimate partner or their children; but not all offenders subject to these restraining orders are covered by this law. To close this gap, several states have enacted additional legislation. This allows for background checks of buyers to prevent those who have used violence against an intimate partner from possessing or purchasing firearms. These laws may also allow police to confiscate firearms at the scene of acts of violence against intimate partners. Research on the impact of such legislation has found that restraining order laws have reduced intimate-partner homicide in states where authorities have a strong ability to conduct background checks and prevent offenders from purchasing firearms (43).

to inform police enforcement and deterrence measures targeting firearms traffickers and violent gang members. The deterrence measures included meetings and outreach with gang members to inform them of increased enforcement activities and that violence would no longer be tolerated (49). An evaluation of the effectiveness of these measures, which however did not use a control area or group, found that they were associated with decreases in youth homicides, firearms assaults and calls for police to attend scenes where guns had been fired (50).

2.3 Firearms amnesties and collection schemes

Civilian firearms amnesties and buyback schemes are commonly used at national, state, or local level to remove illicit firearms from public possession. Amnesties can be voluntary or coercive and, as noted above, sometimes provide compensation for surrendered firearms. Also, as part of broader legislative reforms, they are often accompanied by awareness-raising activities, or, after armed conflicts, peacekeeping measures.

The 1996 Australian firearms reforms involved a buyback scheme whereby the state purchased newly prohibited firearms from civilians at cost. This resulted in the destruction of over 700 000 firearms (27). In addition, the legislation controlled civilians' access to replacement firearms. There is little evidence, however, indicating the effectiveness of buyback schemes as stand-alone measures. Studies of three schemes in the United States found no significant crime reduction (51), and that the types of firearms returned differ from those used in crime (52). Furthermore, they found little evidence that firearms are surrendered by those most likely to commit crimes (53). Economic analyses have suggested, meanwhile, that without measures preventing access to new weapons, repeated buyback schemes will only reduce the number of firearms in circulation temporarily. Worse, the studies suggest they may actually increase firearms holdings by lowering ownership costs (as the compensation for turning in used firearms reduces the actual cost of purchases) (54).

In post-conflict situations, however, disarmament can be an essential part of peace-building. In Cambodia, weapons collection after the civil war removed 130 000 non-government controlled firearms between 1998 and 2006. The measures, undertaken with international assistance, came with financial backing and support for local development projects in areas where firearms had been surren-

dered and for the development of government and police weapons registration and stockpile storage systems. Analysis suggests that the measures helped to reduce both firearms homicides and overall homicides (55).

El Salvador and Sudan provide other examples of post-conflict disarmament, but the impacts of these interventions on violence have not been measured. The end of the civil war in El Salvador prompted a major disarmament of guerrilla groups, which had gained political legitimacy in the peace process. The process was facilitated by former combatants, who provided a list of the weapons they had to the UN monitoring group. Two rounds of collection (the second of which included arms stored outside El Salvador's borders) brought in over 9000 individual arms, 9000 grenades and 4 million rounds of ammunition (56). In Sudan, weapon amnesties following years of civil war had varied success. In the northern Jonglai region, an (initially) voluntary amnesty contributed to increased political and tribal tensions, violence and food shortages owing to a failure to ensure civilian safety and clarify disarmament conditions; coercive disarmament eventually brought in more than 3000 firearms. A later disarmament programme in the Akobo region included security guarantees and compensation for weapons surrendered. It also used community-based committees to manage the disarmament and school teachers were trained to accept, register and store surrendered weapons. The programme, which ran for just a short period, led to the peaceful return of an estimated 1400 firearms (57).

2.4 Managing state weapon supplies

Poorly secured stocks of state weapons can be a major point of access to illicit firearms, through theft or unlawful sales. As in Cambodia (see [section 2.3](#)), weapons management programmes – often implemented with international support – are improving the storage and management of supplies of government and police weapons in many countries. In Papua New Guinea, for example, auditing suggested that 30% of police guns had fallen into criminal hands. Armoury development programmes, implemented with assistance from Australia and New Zealand, have built new armouries, destroyed surplus weapons, trained police and military staff and allowed for the creation of weapons inventories, among other benefits. The programmes are also thought to have dramatically reduced the leakage of police firearms into criminal hands (58). The Organization for Security and Co-operation in

BOX 3

Reducing demand for firearms and sharp objects – three key issues

HIGH LEVELS OF VIOLENCE: Self-protection in the face of high levels of violence is often the major reason given for individuals accessing, owning and carrying firearms and other lethal means. In countries such as Brazil (67) and Sudan (57), attempts at firearms control have been hampered by a perceived need of individuals for protection, owing to high levels of violence, civilian insecurity and a lack of faith in the ability of the police (or state) to protect them from violence. As a result, making criminal justice systems more effective and ensuring that they are perceived as just are critical steps in reducing civilian demand for lethal means.

GANG MEMBERSHIP: Gang membership has been shown to increase young people's access to weapons, particularly firearms (68–70). Measures to prevent young people joining gangs, and to divert members away from them, should help reduce access to weapons among youths. Such measures can include creating educational and employment opportunities for at-risk youth and cognitive-behavioural interventions, such as life-skills development. Recent systematic reviews, however, have identified an urgent need for rigorous studies of such measures to ascertain their effectiveness in preventing youths from joining gangs (71,72).

ILLEGAL DRUG MARKETS: A wide range of evidence links ownership and use of lethal means to the presence of, and involvement in, illegal drug markets (70,73,74). As these markets lack formal controls, violence is used for solving disputes, sanctioning informers, eliminating rivals, punishing debtors, among other purposes (73,75). Thus weapons are widely used for both committing violence and self-protection. Measures to disrupt illegal drug trades and reduce demand for drugs should also help reduce the need for and availability of lethal means.

Europe has produced a handbook with guidance on the management of national small arms and light weapons stocks (59).

2.5 Safer firearm storage

The presence of a gun in the home is a key risk factor for both firearms homicide and firearms suicide (60,61). Furthermore, many firearms that cause intentional and unintentional injuries in children are accessed via family members or friends, often within the home. Requirements for safe storage are therefore a part of firearms legislation reforms in several countries (see [section 2.1](#)). Safe storage techniques include storing firearms unloaded in a locked receptacle, storing firearms and ammunition separately and locking up ammunition. All these techniques have been associated with protective effects against youth firearms injuries (62). In the absence of legislation, measures to reduce access to firearms by children have focused on educating parents in safe storage techniques. Such interventions often involve health professionals providing advice to parents on firearms storage. One study found greater improvements in safe firearms storage practices among patients who had undergone a brief counselling session with a family physician (63). Other studies have found, however, that such measures in primary care settings have little effect

on either firearms ownership or storage practices (37,64).

2.6 Firearm safety features

There are a wide range of safety features and products that can be used to prevent accidental firearms injuries and the use of firearms by children and other individuals not authorized to use them. These include grip safety devices, magazine safety devices, drop safety devices and trigger locks. While it is considered likely that improved product safety measures have the potential to reduce firearms injuries and access, as yet there is little examination of this and concerns have been raised that the sheer numbers of non-personalised firearms in circulation would limit the utility of such measures at least in the short term (65).

2.7 Reducing demand for firearms

Alongside measures that aim to reduce access to firearms, there is much that can be done to reduce the demand for all weapons. A detailed discussion of the risk factors for firearms violence is beyond the scope of this briefing (66), but [Box 3](#) outlines three factors that should be addressed to reduce risk of individuals accessing firearms and sharp objects.

3. Reducing access to sharp objects

BOX 4

Sharp objects: facts and figures

- Sharp objects are commonly used weapons in homicides in Malaysia (sharp objects involved in 41% of homicides in Kuala Lumpur) (76), Scotland (knives, 47%) (77), Nigeria (knives, 40%) (78) and Australia (knives, 34%) (79).
- Almost one-in-ten Israeli boys (grades 7–11) report having carried a knife to school in the last month (80).
- In England and Wales, 6% of all violence against adults involves the use of knives and 4% involves the use of glasses or bottles as weapons (81).
- Typically, use of sharp objects accounts for only a minority of suicides: for example, 2.5% in Japan (82) and 2% in Australia (4).
- A study of 15- and 16-year-olds found self-cutting to be the most common form of deliberate self-harm in most participating countries (Australia, Belgium, England, Ireland, Netherlands, Norway). Prevalence of deliberate self-harm in the last year ranged from 1.6% to 4.2% in males and from 3.6% to 11.7% in females (83).

The research evidence on measures to reduce access to sharp objects is less well developed than for firearms, and most information stems from the United Kingdom where knife violence, particularly among youths, is a major social and political concern (84). Unlike firearms and pesticides, sharp objects are not common means in suicide; however, they are frequently used for non-suicidal self-harm (e.g. self-mutilation) (83), an issue beyond the scope of this briefing. Knives and other sharp objects are common household and workplace tools and their widespread availability and utility complicates control measures. Thus broader strategies to reduce individual, relationship, community and societal risk factors for violence are needed to prevent violence involving sharp objects. Until now, however, measures to prevent access to sharp objects for violent use have typically been similar to those used for firearms. This briefing focuses on legislative reforms, enforcement of legislation and weapons amnesties.

3.1 Legislative measures

As with firearms, legislation in many countries aims to limit access to knives and other sharp objects. In the United Kingdom, for example, it is a criminal offence to carry a knife or other sharp object¹ in public without good reason, and many types of knives (e.g. flick knives) and other offensive weapons have been banned. It is illegal to manufacture, sell, hire, possess or expose for the purpose of sale, lend or give to another person banned weapons (85). Since 2006, legislative changes have raised the minimum purchasing age for knives from 16 to 18, increased the maximum prison sentence for knife possession from two to four years, provided police with greater powers to search individuals for knives, provided teachers with powers to search pupils for knives and added replica samurai swords to the banned

¹ An exemption is made for folding (pocket) knives with blades less than three inches long.

weapons list. In Scotland, a licensing system is being introduced that will require any business dealing in knives and blades for use outside the home to be licensed. The impact of these legislative changes on access to knives or violence in the United Kingdom has not yet been measured, however.

At a local level, authorities in some countries have adopted legislation to reduce serious violence involving the use of broken glasses and bottles as weapons. Unlike other sharp objects, such as knives, which are often consciously obtained and carried by individuals, glasses and bottles are typically used opportunistically during violence in drinking environments.² In the United Kingdom, where all premises serving alcohol are required to be licensed, several local licensing authorities have used licensing conditions to require drinking premises associated with violence to use non-glass (e.g. polycarbonate³) drinking vessels. Although there is currently little evidence on the impact of such bans on violence, initial studies have found that the use of polycarbonate vessels increases customer perceptions of safety (86). The use of toughened glassware (intended to have higher impact resistance than standard glassware) has also been promoted in drinking settings. A study of the impact of toughened glassware, however, identified quality-control problems in the manufacture of this product; the toughened glassware tested actually had lower impact resistance and its use led to more injuries among bar staff (87). Increasing the impact resistance of drinking vessels used in drinking environments is, therefore, critical in injury prevention.

Bans preventing the consumption of alcohol or the carrying of open alcohol containers in designated public places have also been introduced locally in several countries such as the United Kingdom (88) and New Zealand (89). Such bans can reduce the presence of glasses and bottles in streets, where they can be accessed and used as weapons. Again, there is little evidence available on the impact of such bans, although their use in New Zealand is considered to have contributed to reductions in violence and disorder as well as littering of dangerous broken glass in public places (89).

² Alcohol use is a known risk factor for involvement in violence, and is regularly identified as a contributor to both homicide and suicide. Another briefing in this series addresses measures for reducing availability and misuse of alcohol.

³ Polycarbonate glassware is a form of plastic glassware that looks and feels similar to glass but is virtually unbreakable.

3.2 Enforcement of legislation

Although enforcement of firearm legislation has proved important in reducing access to firearms, little research has been conducted on enforcement measures tackling illicit possession or sales of knives. Under the Knives Act 1997, "stop-and-search" tactics are used by United Kingdom police to search individuals who they suspect may be carrying offensive weapons, yet the effectiveness of such methods has been questioned. Across England and Wales, stop-and-search techniques ("in anticipation of violence") were used on a total of 18 900 people in 2001–2002. Of this total, however, 1367 (7%) were found to be carrying an offensive or dangerous instrument and, of these, just 203 (15%) were arrested for possession (90). Moreover, perceived or actual disproportionate use of such powers against particular population groups (e.g. young black males) can create resentment and police mistrust, thus damaging relationships between communities and police (91).

3.3 Knife amnesties

Weapons amnesties are also commonly used to remove sharp objects, such as knives, from public possession. Knife amnesties are frequently implemented in the United Kingdom, yielding high return rates, yet demonstrating little long-term effectiveness. In 2006, for example, a national knife amnesty in England and Wales collected 89 864 knives over approximately two months. In London, the Metropolitan Police Service reported reductions in knife-enabled offences beginning five weeks into the amnesty, yet these were sustained for just eight weeks before returning to pre-operation levels (92). In Strathclyde, Scotland, a police-led initiative to prevent knife crime, Operation Blade, combined a knife amnesty with a high-profile media campaign, improved safety measures in drinking environments and communication with both knife retailers and young people. The intervention was followed by reductions in both knife crimes reported by police and serious stabbings treated at an accident and emergency department; however, effects were not sustained a year after the intervention (93).

3.4 Reducing demand for sharp objects

Many of the risk factors for accessing and using sharp objects for violent purposes are the same as those for firearms. Although a detailed discussion on such risk factors is beyond the scope of this briefing, **Box 3**, above, outlines three key factors that should be addressed to reduce the risk of individuals accessing and using sharp objects.

4. Reducing access to pesticides

BOX 5

Pesticides: facts and figures

- Pesticide ingestion accounts for an estimated 370 000 suicides each year, worldwide, more than one third of all suicides (6).
- The proportion of suicides by ingestion of pesticides varies from 4% in WHO's European Region to 56% in its Western Pacific Region (6). A disproportionate number of suicides by pesticide self-poisoning occur in low- and middle-income countries.
- In many rural areas of South-East Asia, pesticide ingestion accounts for over 60% of suicides (94). Estimates suggest that more than 160 000 people in this region kill themselves each year by ingesting pesticides (6).
- The toxicity of pesticides to humans varies widely; ingestion of paraquat is fatal in over 60% of self-poisoning cases (95), compared with less than 10% for the insecticide chlorpyrifos (96).
- Pesticide poisoning places huge burdens on health services in developing countries. In 1995–96, 41% of intensive care beds in a Sri Lankan hospital were occupied by people poisoned by organophosphates (97). The overall estimated cost of treating self-poisoning cases in Sri Lanka in 2004 was about \$1 million (98).

The issues surrounding pesticides can appear quite different from those posed by firearms and sharp weapons, yet the measures used to reduce access to them can be similar. Pesticides are predominantly associated with impulsive acts of self-harm and their burden falls largely on agricultural communities in developing countries. Furthermore, many acts of pesticide-related self-harm in which the individual does not intend to die actually result in death, owing to the high toxicity of pesticides and, particularly in rural areas, lack of available treatment. Controlling access to pesticides is not only critical for reducing self-directed violence, but also for preventing other forms of injury and violence, ranging from self-harm, through unintentional poisoning, to terrorist attacks. Although not discussed in this briefing, pesticides cause major damage through unintentional poisoning and could be used as deadly weapons to contaminate food (99).

Different pesticides have different levels of hu-

man toxicity, and consequently pose varying levels of risk to human health. Since 1975, the WHO has maintained a classification system to distinguish between more and less hazardous pesticides based on their acute risks to health (100).⁴ In 1985, the Food and Agricultural Organization of the UN produced an *International Code of Conduct on the Distribution and Use of Pesticides* (101). The code sets voluntary standards for all bodies involved in pesticide use and distribution, particularly those operating in countries with weak pesticide laws. A range of other international conventions have been implemented to encourage nations and the pesticide industry to manage hazardous substances effectively, such as the Stockholm Convention (2004), which seeks to eliminate use of nine of the

⁴ WHO Classifications: Class 1a = extremely hazardous; Class 1b = highly hazardous; Class 2 = moderately hazardous; Class 3 = slightly hazardous.

most harmful pesticides (102). Many high-income countries have already banned the use and export of such substances (e.g. the European Union (103)). Many are still used, however, in developing countries where safer use and management of pesticides are limited by a lack of funds, expertise, human resources, training, data, technology, public awareness and other resources (104–106). For example, according to Pesticide Action Network International, 73% of pesticides imported by Thailand are WHO Class 1a or 1b (107). Even where legislation exists, enforcement can be weak, while in many countries unauthorized, informal markets operate, supplying pesticides that are repackaged, diluted or mixed and, consequently, inaccurately labelled (108).

Preventing access to the more hazardous types of pesticides is an essential part of suicide prevention. Measures that can be undertaken to prevent such access include regulatory policies to restrict or ban production, import or sale of certain pesticides and measures to improve the safety of storage.

4.1 Legislative measures

Policies that restrict or ban the use of highly toxic substances can reduce access to lethal means and reduce suicide mortalities. Evidence of the impact of such bans on suicide mortality is available from several countries. For instance, after Jordan banned the organophosphate parathion (which had been responsible for over 90% of pesticide deaths) in 1981, there was an 80% decrease in poisoning deaths requiring autopsy in Amman (104). A later study showed that carbamates, rather than orga-

nophosphorus pesticides, had become the most common pesticides in fatal poisonings (109).

Probably the most widely studied pesticide regulation is Sri Lanka's (Box 6). The case of Sri Lanka also shows, however, that restrictions on specific pesticides can lead farmers to substitute other dangerous substances for banned pesticides. Consequently, while restrictions and bans on highly toxic substances can be effective, implementation of such measures should be accompanied by work to evaluate agricultural needs and encourage replacement by low-risk alternatives for pest control (110).

In Samoa, a rapid increase in self-poisoning and suicide occurred following the introduction of paraquat in 1974. Reduced imports of paraquat from 1982 onwards – rather than a legislative ban – resulted in a subsequent drop in suicide rates (104).

4.2 Safer pesticide storage

Access to pesticides can be reduced through developing and maintaining safer pesticide storage practices. In developing countries, much agriculture takes place on small-holdings, with each farming family storing and using its own pesticide stocks. Unsafe storage practices are often the norm. A survey of cotton and pineapple farmers in Benin, for example, found that the majority stored their pesticides in their homes – about 75% in bedrooms and 5% in kitchens. Less than one in ten kept them in a separate store outside the home, and the remainder either in fields or under granaries (113). Research has shown that many fatal self-poisoning cases in the developing world are impulsive acts

BOX 6

Impact of targeted pesticide bans in Sri Lanka

Suicide rates in Sri Lanka increased eightfold between 1950 and 1995 (111), with over two-thirds of suicides involving pesticide poisoning (112). From 1991, imports of WHO Class 1 (highly or extremely hazardous) pesticides were gradually reduced until a total ban on their import and sale was implemented in 1995. The ban was followed by a sharp decrease in suicide mortality. The number of hospital admissions for pesticide self-poisoning increased, however, as did the in-hospital mortality rate for pesticide poisonings. This occurred as the 1995 ban prompted farmers to switch to the Class 2 (moderately hazardous) insecticide endosulfan. This in turn led to an increase in self-poisoning with this substance, which, ironically, is more difficult to treat than poisoning by more toxic Class 1 pesticides. Endosulfan was itself banned in 1998, a move associated with further decreases in suicide mortality (including now in-hospital mortality). There were almost 20 000 fewer suicides in the period 1996–2005 compared with 1986–1995 (111,112). Other factors including civil war, unemployment, divorce, alcohol misuse, and actual levels of pesticide use were not associated with reduced suicide rates (111). Importantly, the pesticide bans were not associated with losses in agricultural output (110).

facilitated by the ready availability of pesticides in rural homes (114,115).

The WHO Initiative on the Impact of Pesticides on Health has identified a range of community interventions to encourage safer pesticide storage (116). These include:

- Providing locked boxes for storing pesticides in farming households;
- Encouraging centralized communal storage of pesticides; and
- Educating pesticide users about the health risks associated with pesticide use and about safe use, storage and disposal of pesticides.

The first two measures are discussed below. Until recently there have been few evaluations of the effectiveness of these measures on storage practices and pesticide poisoning, but these are now more numerous. To encourage the wider implementation and evaluation of safer storage and educational measures, WHO and the International Association for Suicide Prevention have published details about the activities needed to implement and evaluate these different interventions and have begun preparing demonstration studies (116,117).

4.2.1 Providing locked boxes for storing pesticides

Lockable storage boxes for families that use pesticides can help to reduce access to lethal means by improving users' home storage methods. Introduction of storage boxes should be accompanied by community and household education on the importance of safe pesticide storage, with instructions on how to use and maintain the box. Lockable storage boxes for pesticides have been provided in agricultural communities in Sri Lanka. A study exploring the impact of this scheme on storage practices found significant increases in safe pesticide storage: 82% of participating households reported storing pesticides at home in locked boxes seven months after the implementation of the scheme, compared with 2% at baseline. The proportion of households storing pesticides in fields, however, fell from 46% at baseline to 2% at follow-up, thereby increasing the storage of toxic pesticides in the home. This may have increased the risk of self-

poisoning, if all boxes are not kept locked all of the time (118).

A separate study providing lockable storage boxes in Sri Lanka found similar high levels of use 30 weeks after the intervention. By 18 months, some reduction in use had occurred although 75% of participating households were still using the box. Although data on suicide and self-harm were collected by the authors, the relatively small study size prevented any conclusions from being drawn on the impact of the intervention on pesticide self-poisonings (119). Further studies on the impact of locked boxes on intentional poisonings and suicide are underway in Sri Lanka (116,117).

4.2.2 Encouraging centralized communal storage of pesticides

Creating centralized pesticide storage facilities in farming communities can heighten supervision of pesticide access. Communal storage facilities can operate at several different levels. At a low-level facility, centralized storage with secure lockers provides families with access to their own pesticides at any time. Higher level facilities may employ a responsible individual to manage families' access to their pesticide stocks: for example, providing the required amount of pesticide on a daily basis. Alternately, they may use a centralized purchasing and distribution system with one authorized individual managing pesticide access for a whole community. These arrangements demand appropriate selection and training of managers, so that the system operates in a fair manner and managers are able to provide sound advice to participants about pesticide safety.

Communal storage units can also provide for the safe disposal of unwanted pesticides and empty containers. There is currently no published evidence on the effectiveness of community pesticide storage systems, yet the WHO Initiative on the Impact of Pesticides on Health is supporting efforts to develop and evaluate demonstration projects (117). A key concern with this approach is its sustainability, however, as it relies on individuals agreeing to store their pesticides in a central location although this practice increases the time and effort required to spray fields.

5. Summary

This briefing has outlined evidence of the impacts on violence of a range of measures to reduce access to firearms, sharp objects and pesticides. Despite a lack of evidence in some areas, overall the findings are promising, suggesting that well-implemented measures to reduce access to lethal means can help to reduce violence. The vast majority of current evidence focuses on the use of national or local legislation to control the purchase, sale and use of lethal means. Here, several studies have shown that legislation which effectively controls access to lethal means can reduce both homicides (involving firearms) and suicides (firearms and pesticides). Nonetheless, even for firearms, which have been the focus of most research, more rigorous data and studies are required to develop understanding of the impacts of these measures (34).

Strengthening national legislation to reduce access to lethal means, even where this is possible, can be a lengthy and complex process. Much can be done at a local level, however, to enforce existing legislation, promote safer storage of lethal means and remove lethal weapons from civilian hands. Promising examples of community measures are to be found in high-, middle- and low-income countries: e.g. safer pesticide storage in Sri Lanka, the Arms Free Municipalities project in El Salvador, the Boston Gun Project in the United States and Operation Blade in Scotland. Community programmes often combine measures to reduce access to lethal

means with training (for pesticide users, police and others) and public awareness-raising. Designed and run by members of the community, they can also be tailored to local needs. Such projects, nonetheless, require sustained commitment at a local level, which can be difficult to maintain; so, the benefits can be short-lived. Further developing the evidence base on effective community measures with sustainable outcomes is, therefore, an essential step in reducing violence through lethal means.

Evaluating any interpersonal and self-directed violence prevention measure is difficult when data are limited. While this is a universal problem, it is most keenly felt in developing countries where evidence is most urgently needed on the effectiveness of measures to reduce access to lethal means. The development of robust injury data collection systems must, therefore, be a top priority.

Preventing access to lethal means requires broad partnership at all levels, beginning with strong commitment and support from both governing authorities and communities. Interventions to reduce access to lethal means focus mainly on controlling the lethal means themselves; but to prevent individuals simply finding another means of violence, these interventions must be part of broader measures to reduce poverty and social inequalities, shutdown illicit drug markets, reduce crime and ensure criminal justice systems are efficient, fair and seen to protect society from violence.

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