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State violence against protesters: Perspectives and trends in use of less lethal weapons.

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Key points of interest:

- Certain types of less lethal weapons are increasingly being used to disperse peaceful protesters, in violation of international human rights law, norms and policing standards.
- Though referred to as 'less lethal' or 'non-lethal', these weapons have caused numerous serious injuries and deaths.

Abstract:
Introduction: In recent years mass protest movements have taken to the streets in many countries across the world. Despite strong international and domestic legal protections for the right to freedom of peaceful assembly and other fundamental human rights, entire assemblies are frequently labelled violent and less lethal weapons are used to disperse them. *Methods:* This article examines the weapons often used by police against public assemblies. Focusing on striking weapons (batons), chemical irritants, kinetic impact projectiles and stun grenades, the article uses examples from various countries to illustrate how these weapons are being used and the associated human rights and health impacts. *Results:* Worrying trends identified include the use of dangerous or untested equipment, such as thermal foggers to deploy chemical irritants; the use of inherently abusive weapons, such as whips or sjamboks; and the increasing use of certain types of munitions, specifically indiscriminate kinetic impact projectiles. *Discussion:* The article seeks to support medical and legal professionals becoming more familiar with the weapons being used in the countries they practice in, the effects of those weapons, and clinical aspects in the presentation and care of those exposed.

Key words: Less lethal weapons, tear gas, rubber bullets, police, protest

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Introduction

With the rapid advance of mobile technology and social media in recent decades and the growth of citizen journalism, we have grown accustomed to seeing protests around police behaviour, labour rights, climate, and the pandemic being met with violence. Scenes of fleeing protesters enveloped by clouds of smoke or drenched with water cannon have sparked global conversations on the role of law enforcement in managing protests and the dangers associated with their use of force.

This article examines some of the less lethal weapons most frequently used and misused against protesters around the world, from the perspective of international use of force standards and the absolute prohibition of torture and other cruel, inhuman and degrading treatment or punishment (hereinafter, "torture and other ill-treatment"). Not all police use of force is unlawful; in fact, law enforcement officials are sometimes legally required to use force, for example, to defend an individual or group against violent acts. However, states are under an obligation to ensure that their officials are held accountable for their acts, and this is particularly important where force is used, given the potentially irreversible effects.

The official justification for the use of force against protesters is frequently the maintenance of public safety or order, and this is sometimes legitimate, but all too often the underlying motive is to silence dissent, both directly, by stopping the protest, and also indirectly, by intimidating others into refraining from participating in future protests. This becomes evident when the official response to 'pro-government' protests is contrasted with the response to protests that challenge or criticise the government, with the former frequently facilitated with a small police presence and no recourse to violence, while the latter are more likely to be violently dispersed (see, for example, Voule, 2023, paras. 66-67). Thus, force is used either unnecessarily, to discriminate against, punish, injure and disfigure those not engaged in violence, or disproportionately and/or excessively against those who are. This type of state violence robs a sector of the public of their agency and their voice, and prevents them from convening in the public space to exercise their fundamental rights to the freedom of expression and peaceful assembly. In all of these scenarios, the state uses violence and the infliction of pain and suffering to assert its dominance.

Though the vast majority of assemblies pass off peacefully, excessive force has been documented in all regions, resulting in large numbers of deaths and serious injuries. Such injuries include thousands of instances of life changing disfigurement and disability every year worldwide. Between 2019 and 2023, small protests, demonstrations, strikes and mass protest movements were met with state-sanctioned police violence and excessive use of force in many countries, including Belarus, Bolivia, Chile, Colombia, France, Hong Kong, India, Indonesia, Iran, Lebanon, Nigeria, occupied State of Palestine, Peru, Sri Lanka, Sudan, Thailand, among others. Black Lives Matters protests shook the United States (US) and spread around the world, frequently facing the kind of police violence and repression that spurred the protests in the first place (Physicians for Human Rights, 2020).

This article focuses on "less lethal" weapons. These are weapons which, in the course of expected or reasonably foreseen use, carry a lower risk of causing death or serious injury than firearms (United Nations Office of the High Commissioner for Human Rights, 2020b, p. 45). Recent years have seen a growing body of evidence gathered concerning the health impact of less lethal weapons, and it is crucial that health professionals address any knowledge gaps in this area and remain abreast of further developments, as novel mechanisms of injury will inevitably continue to emerge (International Network of Civil Liberties Organizations et al, 2023, p. 152).

Notwithstanding the continuous development of new less lethal technologies, the types of weapons most frequently used to police public gatherings, and whose use continues to cause serious injuries and death, have essentially remained technologically unchanged and been in use for decades and evidence suggests their use is increasing. This article will explore recent trends in the use of striking weapons, kinetic impact projectiles, chemical irritants and stun grenades, as well as presenting general information on the associated health impacts and the treatment of those affected. The text is intended to inform professionals acting in various disciplines.

Technical knowledge of less lethal weapons is frequently carefully guarded by law enforcement agencies, and this acts as a barrier to effective oversight. With the appropriate knowledge and conditions, health professionals can help to address this imbalance. It is essential that health professionals faced with the assessment of patients injured by less lethal weapons have the necessary expertise and technical knowledge to be able to detect symptoms and signs of injury and be able to support and care for their patients effectively. Similarly, legal professionals, activists and survivors who understand less lethal weapons, their health impacts and the standards governing their use are well-placed to cast a more effective critical eye over instances involving the use of force.

This article will first consider several contextual interlinked issues which frequently result in inappropriate or unsafe weapons, equipment and tactics being deployed by law enforcement officials. Then we will discuss the several less lethal weapons that are most frequently used to police public assemblies: ba-

tons, kinetic impact projectiles, chemical irritants and disorientation devices. For each of these weapons, we review their mechanism of action, health concerns and several notable cases globally where they have been used and/or caused injuries.

Contextual issues

While the use of force by law enforcement officials is governed by international law and policing norms and standards, the weapons and equipment they utilise are not. There are no international technical, manufacturing, testing, performance or trade standards for less lethal weapons (Dymond et al, 2014). This absence has resulted in a very wide range of products being marketed directly to law enforcement, some of which are inherently unsuitable and should be prohibited (for example, spiked batons and shields, or weighted restraints), and others with widely varying performance characteristics, resulting in unacceptable risk of injury (for example, multiple kinetic impact projectiles, or high concentration chemical irritant sprays). Although no international standards exist, some states have national standards for some weapons, for example, the UK has a technical standard for personal chemical irritant spray (United Kingdom Home Office - Centre for Applied Science and Technology, 2014) and the US National Institute of Justice maintains a performance standard for handcuffs and standards for certification (US National Institute of Justice, 2017 and 2019). The absence of international standards, administered by globally recognised standards authorities, continues to result in law enforcement agencies often having to rely on manufacturer data and company marketing alone.

Secondly, selection and testing of less lethal weapons prior to deployment can reduce the risk of subsequent harms. However, such processes are often inadequate or absent in states with fewer policing resources, resulting in inappropriate or dangerous weapons being deployed. The UN Human Rights Guidance on Less-Lethal Weapons and Related Equipment in Law Enforcement (hereinafter, the "UN Guidance") clearly establishes states' responsibility to take a precautionary approach and conduct testing, ideally by an independent body,

Figure 1.1. *Law enforcement officials attired in military-style uniforms with armoured vehicles. Source: Jamelle Bouie, "swat team, fully assembled". 13 August 2014. Ferguson, Missouri. CC BY 2.0.*

of all less lethal weapons and law enforcement equipment prior to its procurement and the equipping of law enforcement officials (United Nations Office of the High Commissioner for Human Rights, 2020b, section 4.2). The Model Protocol for Law Enforcement Officials to Promote and Protect Human Rights in the Context of Peaceful Protests states that "untested or unproven new technologies... should not be deployed during protests" (Voule, 2024, para. 33). Testing should evaluate the effects of all reasonably likely or expected uses of the weapons, and particular consideration should be given to assess the potential effects on persons who may be especially at risk, for example children, the elderly, pregnant persons, the medically unwell. Ongoing monitoring of injuries caused by less lethal weapons is crucial in providing data to feed back into the testing and selection process, as well as to inform changes in policy, procedure and guidelines for use.

Thirdly, the trade in law enforcement equipment is poorly regulated by states, resulting in inappropriate goods being transferred to abusive regimes, where they may be used to commit human rights abuses. Many states do not control the trade (import and export) of law enforcement equipment, beyond those classified as 'conventional arms', such as small arms, ammunition and certain chemical irritants (see, for example, The Wassenaar Arrangement, 2020). This often excludes such goods as pepper and tear gas sprays, kinetic impact projectile munitions, electric shock weapons, water cannon, batons, and restraints, as well as other weapons used in policing public assemblies. There have, however, been important advances made in this area including at EU level and most recently internationally (see Omega Research Foundation, 2023), such trade control standards are a vital component in controlling the trade (and use) of less lethal weapons.

A fourth key cause underlying violent policing of protests is the militarisation of public security that has occurred in response to perceived "new threats", particularly terrorism and drug trafficking (Centro de Estudios Legales y Sociales, 2018). Militarisation of public security encompasses both military personnel carrying out law enforcement duties, and the use of military tactics and equipment by law enforcement officials. The inherent differences between the military and law enforcement paradigms mean that this blurring of roles, tactics, and equipment can be problematic. Where soldiers are primarily trained for combat and to kill enemy combatants, law enforcement officials must instead fulfil their duty "by serving the[ir own] community and by protecting all persons against illegal acts, consistent with the high degree of responsibility required by their profession" (United Nations, 1980). Figure 1.1 is illustrative of the type of transformation many police forces have undergone, with traditional uniforms being replaced by military-style fatigues, helmets and combat boots, and assault rifles being carried routinely rather than exceptionally.

Finally, police training on managing crowds and using crowd control weapons is often inadequate and focuses on protecting property, rather than on their fundamental human rights obligations and strict limits on the use of force. Whilst police may receive extensive training and re-training on firearms, they frequently receive less than an hour or two of total training on the use of a range of crowd control weapons from pepper spray to projectiles. As new weapons are added to police arsenals, each with different uses, firing ranges, safety profiles and potential injuries, there is rarely adequate additional training, or refresher training, and a lack of minimum proficiency standards. Moreover, especially in States healing from a colonial past, police are often trained based on mentalities, laws and policies entrenched in the era of Empire and colonization, rather than with a mission to support the communities they live in and serve.

Less Lethal Weapons

Hand-held Kinetic Impact / Striking Weapons

Global context

In a report documenting the misuse of striking weapons and batons worldwide, Amnesty International with assistance from Omega Research Foundation verified over 188 videos of incidents of the misuse of striking weapons including police batons, lathis (long sticks), sjamboks (rigid whips) and improvised weapons in 35 countries, covering all regions of the globe. This highlighted examples of striking weapons, including police batons frequently used for torture and other ill-treatment, both in places of detention and outside of custodial settings, including violent crackdowns on mass protests in countries as diverse as Belarus, Colombia, France, India and Myanmar (Amnesty International, 2021). The following examples illustrate the widespread and contemporary nature of such abusive practices.

In the US, during the 2020 nationwide Black Lives Matter and anti-police violence protests, human rights monitors reported the widespread abusive use of batons to beat protestors. Such violence included incidents where police, standing above a crowd on police vehicles, used batons to beat people's heads, a practice which carries a high risk of causing serious injury. This violence often occurred when no threat existed or when protestors were detained in a police cordon or 'kettle' and unable to escape (Human Rights Watch, 2020a).

Figure 1.2. *Plastic sjambok. Source: OwenX. "A 90 cm (3 ft) plastic sjambok used by South African Police". 30 December 2005. Ontario, Canada. CC BY-SA 3.0.*

In Iran, widespread protest erupted in September 2022 following the death of Mahsa Amini aged 22, who was arrested for wearing an improper hijab. The violent security force responses to the protests included widespread use of beatings, for example including the death of 16-year-old Nika Shakarami, whose skull was reportedly severely damaged with injuries consistent with being struck repeatedly on the head (Chulov, 2022).

Whips have also been used in certain states, such as by the Central Cossack Battalion in Moscow, who attacked and whipped peaceful protestors and journalists in May 2018 (Gershkovich, 2020; European Centre for Press and Media Freedom, 2018). Long plastic or animal hide whips (sjamboks), as shown in Figure 1.2, were used during the policing of Covid-19 restrictions in South Africa, where reporters filmed police assaulting civilians with sjamboks (Reddy and Allison, 2020), and in Uganda, where police were photographed using whips to "clear" market vendors (Olewe, 2020).

Characteristics and techniques

Hand-held kinetic impact weapons, also known as striking weapons, include a range of specially manufactured batons and truncheons. Batons are perhaps the oldest type of weapon in use by law enforcement and are ubiquitous worldwide due to their low cost. The visual message from an officer wielding a baton is universally understood as a sign of authority with the baton as a pain compliance tool.

Specially manufactured weapons can be made of rubber, wood, plastic, or metal. They vary in width and length, from 20cm for close use, up to 2m for greater stand-off distance. Batons can be straight, extendable/expandable (collapsing to a short length for ease of carrying or concealment), or side-handled (commonly referred to as a tonfa). Longer batons can deliver greater impact energy, increasing the risk of serious injury. Use of overarm strikes or from an elevated position, such as from a police horse, or standing on a police vehicle, increases the risk of fatal head injuries caused by baton strikes.

Other hand-held kinetic impact weapons may be made of natural materials, such as the bamboo cane 'lathi' in India, or the rattan cane used in various Asian jurisdictions. Sticks and clubs are also widely used by law enforcement, and the use of short and long whips (sjamboks) has also been documented in some countries. According to the UN special Rapporteur on torture, whips, sjamboks and lathis fulfil no legitimate law enforcement purpose that cannot be achieved through the use of other less harmful means (Edwards, 2023, Annex I).

Striking weapons can be used offensively or defensively. They are used by law enforcement officials to strike a subject to cause physical pain or to threaten physical pain in order to force them to comply or to deter them from an action. Such weapons should only ever be used on the larger muscle groups on the limbs; even then, striking weapons can cause severe bruising,

lacerations and broken bones, especially if the joints are targeted or hit. They can also be used defensively by law enforcement officials as a blocking instrument, for instance, to protect themselves from blows from assailants. The use of a baton, and the force inflicted, is greatly dependent on the individual user, and is dependent on their height, strength, technique (e.g. side or over-arm strikes), and their training and oversight.

Batons are also used as a tool of restraint, including to immobilise limbs or hold people down. Dangerous and potentially lethal 'neck holds' or 'carotid holds' using batons have been used by law enforcement officials to detain and subdue individuals. However, the UN Guidance states that neck holds should "not be employed, as they present an especially high risk of death or serious injury as a result of compression of large blood vessels or the airway" (United Nations 2020, para. 7.1.5).

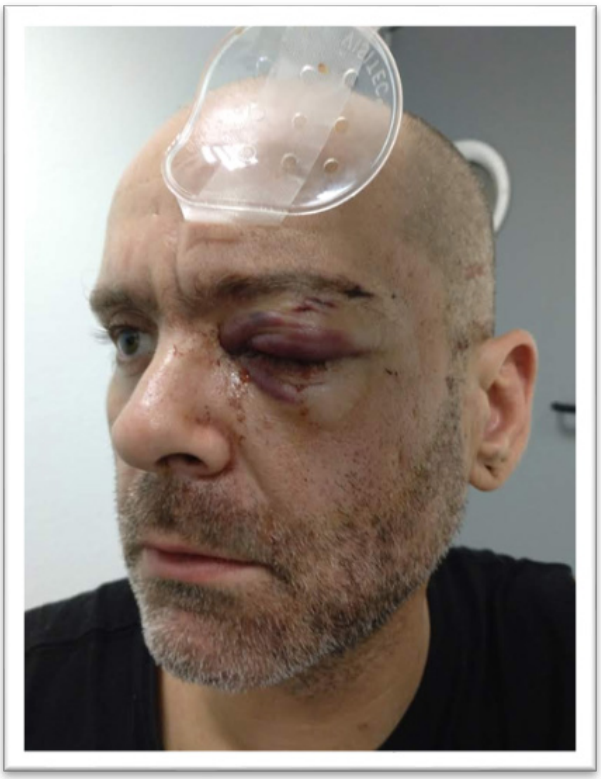
Officers must reassess the need for any further strikes after each strike, to make sure additional force is strictly necessary and proportional. Nonetheless, media images and footage of protests often show law enforcement officials repeatedly striking and beating people, often individuals who are on the ground, or chasing people whilst repeatedly striking them, including on the head.

Health concerns

Batons and other such weapons can cause serious injury and death. The fundamental mechanism of injury is direct blunt force trauma to a part of the body. Depending on the number of impacts and their intensity, different structures may be affected.

Figure 1.3. *Loss of teeth due to blunt trauma with a striking weapons. Source: ©Centro de Atención a Víctimas de Tortura Sir[a].*

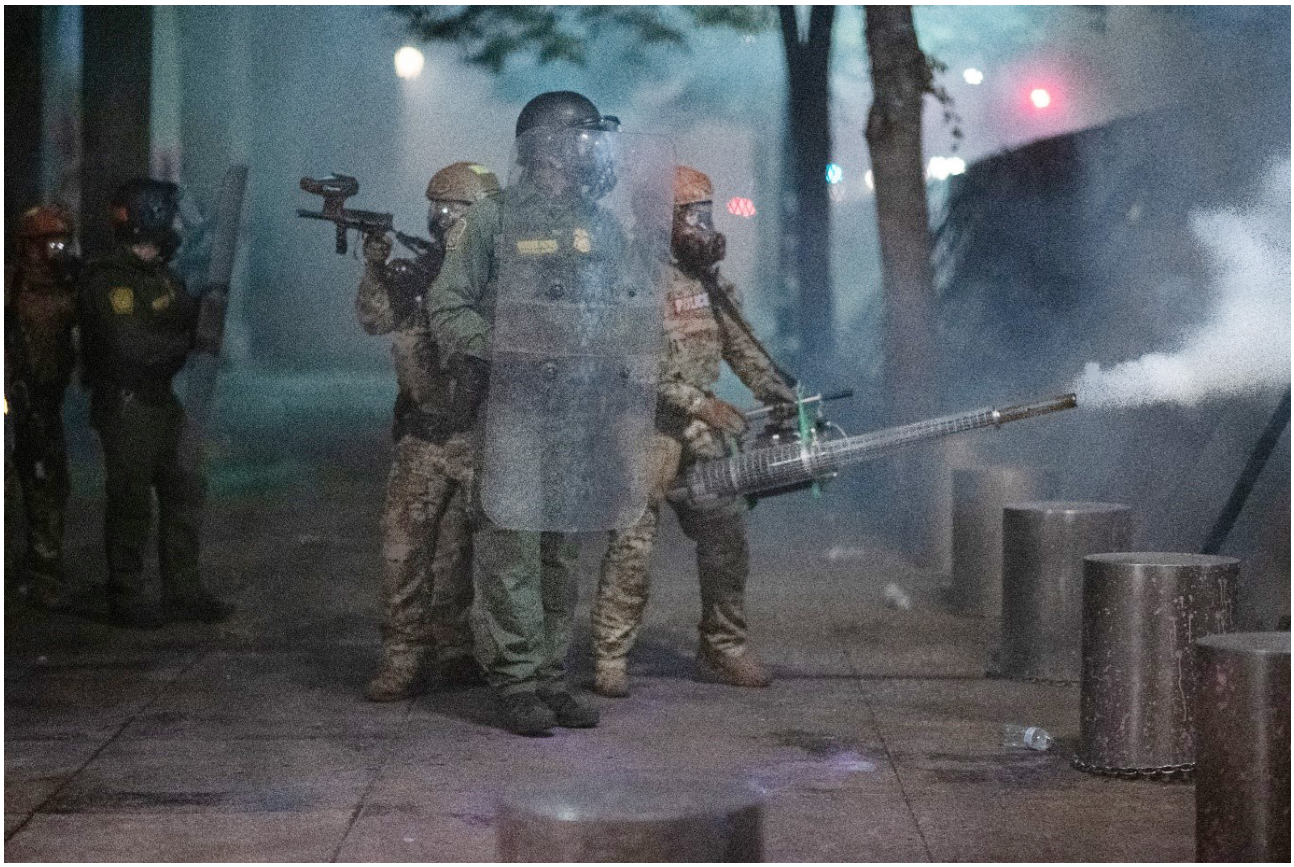
Figure 1.4. *Ruptured eyeball caused by a projectile impacting the eye. Source: ©Centro de Atención a Víctimas de Tortura Sir[a].*



While bruising and contusions are common after baton use, these must be carefully examined to ensure that deeper injuries are not present. On the skin, a contusion will cause local reddening, depending on the intensity, bruising and even open wounds, with or without bleeding. The main symptom is pain, which can be measured using pain scales such as the VAS scale.[1] Higher impact energy may injure deeper structures. If muscle tissue is affected, there can be local inflammation, swelling or haematoma, intense pain, as well as muscle strain or weakness. In the case of large muscles or multiple muscle involvement due to repeated trauma, rupture of muscle fibres can result in flooding of the bloodstream with myoglobin (muscle proteins)

1 VAS (visual analogue scale): This consists of a horizontal line of 10 centimetres, at the ends of which are the extreme expressions of pain. The left end indicates the absence or lesser intensity and the right end indicates the greater intensity. The patient is asked to mark on the line the point indicating the intensity and it is measured with a millimetre ruler. The intensity is expressed in centimetres or millimetres. It will be mild up to 4 cm, moderate from 5-7 cm and severe if greater than 7 cm.

Figure 1.5*. Federal law enforcement agents use a thermal fogger during a Black Lives Matters protest. Source: ©Doug Brown, ACLU of Oregon. 29 July 2020. Portland, Oregon, USA.*



which can lead to collapse of the kidney causing renal failure (rhabdomyolysis).

Bone fractures differ depending on the type of bone and the main symptoms are intense pain and functional disability (inability to perform certain movements). Among the most fragile bones and therefore most susceptible to fracture are the facial bones (bones of the nose, zygomatic bone), the lower or floating ribs and the fingers and toes (phalanges). When the trauma occurs to a joint, it will usually be accompanied by joint effusion, with local swelling, haematoma and functional disability. Other musculoskeletal injuries, such as spinal cord injuries and nerve injuries can also be the result of direct blunt trauma.

In some parts of the body, deeper organs may be affected, such as the liver or spleen, adding to the potential lethality. Severe injury and death most frequently result from strikes to the head and face, due to skull or facial fractures, ruptured eyes or traumatic brain injuries accompanied by internal haemorrhage. The risks to health are worsened when there are multiple strikes (i.e. beatings), or when the target is not able to shield themselves or maintain a defensive position (i.e. handcuffed).

In caring for those who have been struck by kinetic impact weapons, the Advance Trauma Life Support framework may be followed. This should include a rigorous history when possible, a thorough and systematic physical inspection of the skin, imaging tests in the case of suspicion of deeper injuries (X-rays, ultrasounds and CT scans) as well as laboratory tests to rule out rhabdomyolysis or renal failure. It is important that clinicians evaluate for internal bleeding, especially for any pain that feels different from a temporary bruise, or for symptoms such as blood in the urine, swelling, severe pain or difficulty moving or breathing. For minor injuries, treatment will usually be aimed at pain management with analgesics and anti-inflammatory drugs and local treatment with cold packs and immobilisation if necessary.

Chemical Irritants

Typical images in media reports of the policing of assemblies or protests shows streets filled with clouds of white or off-white /

yellow smoke, or police using aerosol sprays against individuals or crowds. These are two examples of chemical irritants, one of the most widely used less lethal weapons in law enforcement worldwide, with almost every country using some form of chemical irritant weapon in certain contexts.

Global context:

In a report documenting the misuse of tear gas worldwide, published in June 2020 (updated in February 2021), Amnesty International with assistance from Omega Research Foundation verified over 500 videos of more than 100 events in some 31 countries and territories where tear gas has been misused (Amnesty International, 2020a). Incidents included cases of security forces firing projectiles and grenades into cars, inside a school bus and in hospitals, residential buildings, metro stations and shopping centres, as well as directly at individuals, and against others in confined spaces, as well as excessive quantities being fired.

The use of large quantities of chemical irritant has increasingly been reported, either by the firing of tear gas projectiles and grenades, or dispersal using sprayers and other equipment.

During escalating protests in 2019 in Hong Kong, police used chemical irritants in large quantities, firing 800 tear gas projectiles in a single day, and in some cases in confined spaces. For example, on 11 August 2019, police fired multiple rounds of tear gas inside the Kwai Fong Mass Transit Railway station, a confined space with limited exits (Omega Research Foundation and Amnesty International, 2020). Tunisian police used large amounts of launched tear gas cartridges during unrest in the city of Tataouine between 23 and 26 June 2020. Volunteers reportedly collected and counted almost 18,000 cartridges from the city after the operation had finished. People were affected in hospitals, places of worship and their homes, with at least 180 people reportedly admitted to hospital for emergency treatment after inhaling tear gas and 26 others were injured when struck with tear gas projectiles (Amnesty International, 2020b).

In 2020 Federal Agents from the Department of Homeland Security were deployed to protect federal property in Portland, Oregon. Protests occurred over many weeks and federal agents repeatedly deployed massive quantities of chemical irritants and smoke including via thermal foggers, as shown in Figure 1.5 – hand-held devices producing large volumes of tear smoke from water or oil-based solutions, as well as from 'smoke pots' – open pots of burning incandescent substance (believed to be HC – Hexachloroethane) that produced dense clouds of grey/white smoke. Protesters reported a wide range of respiratory and/or reproductive health impacts after attending protests and being exposed to the chemical irritants, including unusual effects on menstrual cycles (see Torgrimson-Ojerio et al, 2021).

States must give due attention to the risk of the use of less lethal weapons causing panic, including the potential for a stampede (United Nations Office of the High Commissioner for Human Rights, 2020b, para. 6.3.4). In October 2022, Indonesian police began firing tear gas projectiles directly into the stands, when football supporters invaded the pitch after a match in Malang, East Java. The tear gas caused supporters to panic and attempt to flee the ground, heading to the exits, some of which were locked. The panic and stampede caused by the tear gas resulted in a crush. At least 132 people died, including 32 children and two police officers, and over 600 were injured. (Tempo.Co, 2022, Ratcliffe, 2022).

Direct firing of grenades of projectiles at individuals can result in serious injuries or death via blunt or penetrative trauma. Such launched projectiles or grenades are designed to be launched into open areas to land on the ground and disperse chemical irritant. However, their use against individuals continues to be reported. Particularly horrific injuries and deaths were reported in Iraq in 2019, when 'anti-riot police' and other security forces in Baghdad fired grenades, referred to by local people as 'smokers', directly at individuals. The 40mm military grade, heavy, Iranian- and Serbian-manufactured grenades caused severe injuries and many deaths when the metal projectiles impacted and penetrated the skull (Hoz et al, 2020; Amnesty International, 2019).

Characteristics and techniques:

Chemical irritants are highly potent substances that produce sensory irritation and pain in the eyes, skin and upper respiratory tract. These properties are utilised to deter individuals from violence, disperse crowds or otherwise gain compliance with police orders through the infliction of pain. The chemicals most commonly used is the irritant agent chlorobenzalmalononitrile (CS) and its derivates and similar compounds (CS1, CS2) – often called tear gas, though the active agent is actually distributed as a fine powder – and the inflammatory agents Oleoresin capsicum (OC) or its synthetic version, N-Vanillylnonamide (pseudocapsaicin) (PAVA) – often called pepper spray. A number of other irritant agents, such as 1-chloroacetophenone (CN) and dibenzoxazepine (CR), are marketed and held by States, but are not commonly encountered (see Organisation for the Prohibition of Chemical Weapons 2019, Annex 4).

Chemical irritants are delivered via a wide range of methods and means. These include handheld aerosol sprays, weapon fired spray, shoulder-worn and backpack sprayers, handheld or vehicle mounted smoke generators or foggers, hand-thrown grenades, weapon-launched projectiles and grenades, as well

as via water cannon and more recently via unmanned air or ground vehicles. Handheld aerosol sprays range in size from 25ml to 500ml, sometimes more, while shoulder-worn and backpack-style sprayers and smoke generators generally have a much larger capacity and can cover a wider area often in a very short time. Hand-thrown and weapon-launched projectiles/ grenades and water cannons can be used from greater ranges and can be used to contaminate a wide area.

A particular issue with the majority of chemical irritant sprayers / foggers is that they have no dose control or cut-off trigger mechanism to control the amount dispersed. Under international laws of law enforcement only the minimum amount of force should be used (and only when strictly necessary and proportionate to the threat) and force must cease when the threat from the individual ceases. In operational practice, law enforcement officials are expected to use the minimum 'effective dose', i.e. one very short burst of spray, and then re-assess the threat. However, sprays are frequently continually discharged at individuals or groups, dispersing large quantities of chemical irritant of unknown concentration. Design changes to sprayer equipment, to introduce 'dosing' triggers that release only small quantities with each trigger pull, might help overcome this issue but are not generally in use at the time of writing.

A range of factors can determine the effects of chemical irritants, including the type of chemical agent and means of delivery used, the location and environmental conditions in which they are used (heat, humidity), and the concentration and quantity of irritant. The amount of active irritant agent in products available to law enforcement officials varies widely, and manufacturers frequently offer a range of percentages for any given product, or offer custom fills for customers. This results in those using, affected or treating the affected not knowing what amount of chemical irritant has been delivered, or can lead to speculation and confusion as to the type of irritant being used, and may also result in unusual medical effects being encountered. For example, PepperBall, a commonly used compressed gas launcher system, which delivers chemical irritant via 0.68 calibre plastic encapsulated projectiles, advertises a range of projectiles with a wide range of percentage of irritant: "VXR LIVE-X a more concentrated formula, containing approximately 10x the PAVA of the VXR LIVE projectile" (Pepperball, 2023).

Chemical irritants are indiscriminate in nature, and the UN Special Rapporteur on the Rights to Freedom of Peaceful Assembly and of Association has warned that they fail to differentiate "between demonstrators and non-demonstrators, healthy people and people with health conditions" (Kiai, 2012, para. 35). Even the use of small, handheld sprays risks affecting innocent bystanders in a public gathering.

Figure 1.6. *Severe chemical burns and blistering following exposure to French CS spray. Source: Omega Research Foundation, 2003, Crowd Control Technologies : An Assessment Of Crowd Control Technology Options For The European Union.*

Severe involvement of the face 24 hours after exposure.

International human rights bodies have created strict standards concerning the use of chemical irritants. The UN Guidance states that chemical irritants, including those delivered via handheld sprays, should only be used when there is an imminent threat of injury, and warns against repeated or prolonged exposure to irritants (United Nations Office of the High Commissioner for Human Rights, 2020b, paras. 7.2.3 and 7.3.5). The United Nations *Resource book on the use of force and firearms in law enforcement* (hereinafter UN Resource Book) also recommends against chemical irritants being used against the same people several times in a short time period, or in confined spaces (United Nations Office on Drugs and Crime and Office of the High Commissioner for Human Rights, 2017 p. 88). The same document stresses that delivery for wider areas should only be used "for dispersing groups that present an immediate and direct threat and when conventional methods of policing have been tried and have failed, or are unlikely to succeed" (United Nations Office on Drugs and Crime and Office of the High Commissioner for Human Rights, 2017, p. 87).

The Chemical Weapons Convention bans the use of chemical irritants, which it refers to as "riot control agents" (RCAs), as a method of warfare (Organisation for the Prohibition of Chemical Weapons, 1993, Art. I.5). The same instrument permits the use of RCAs for "law enforcement including domestic riot control purposes", provided they are used in "types and quantities" consistent with such purposes (Organisation for the Prohibition of Chemical Weapons, 1993, Arts. II.9 and II.1.a).

Health concerns:

Chemical irritants primarily affect the skin and mucous membranes. When a person comes into contact with a chemical irritant it mixes with moisture on the skin, or in the eyes and respiratory and oral tracts, and activates the TRPA 1 and TRPV1 pain receptors located in the peripheral nervous system. Their use is most frequently linked to sudden onset and severe burning sensations and tearing in the eyes, pain on exposed skin, vomiting, coughing and restricted breathing (Haar et al, 2017b).

In the eyes, severe redness, intense pain and tearing will occur, resulting in blepharospasm (eyelid spasm characterized by frequently blinking) and sometimes, temporary blindness. Within seconds, exposed skin will feel a painful burning sensation. Depending on the dose, redness may appear on the skin and in cases of allergy or hypersensitivity blistering lesions such as those seen below in Figure 1.6 may occur (even one week after exposure).

As the chemical is breathed in, it will irritate the oropharyngeal and lung linings, causing pain, coughing and sensations of respiratory distress. Many people also experience anxiety and panic reactions. The most dangerous effects include laryngeal inflammation obstructing the upper airway, inflammation in the tracheobronchial tree inducing tracheobronchitis or bronchospasm of varying intensity that hinders normal breathing. There are circumstances that may increase the risk of complications, such as the use of these substances in enclosed spaces that make ventilation difficult.

Certain groups that are particularly susceptible to the effects of chemical irritants, including older people, children, people who are pregnant or people with respiratory problems such as asthma or chronic obstructive pulmonary disease. Airway obstruction or inflammation in vulnerable people could lead to cardiorespiratory arrest and death. According to the American Academy of Paediatrics, "children are uniquely vulnerable to physiological effects of chemical agents. A child's smaller size, more frequent number of breaths per minute and limited cardiovascular stress response compared to adults magnifies the harm of agents such as tear gas." (Kraft, 2018).

The half-life of most chemical irritants is short and the symptoms are transient, lasting less than an hour after exposure for most people, although for some people the effects can be more severe, long lasting and cause ongoing health impacts (Centers for Disease Control and Prevention, 2018). The dose-exposure will increase when chemical irritants are used in enclosed spaces (where the irritant cannot disperse) or in cases of prolonged and/or repeated exposure (when people cannot escape the effects), resulting in exacerbated harm (see, United Nations Committee against Torture, 2017, paras. 24-25). In some cases, higher doses have been known to cause gastrointestinal distress, corneal burns, pulmonary edema and fatal acute lung injury. In addition, repeated exposure to some CS gases can result in hypersensitivity reactions, with allergic responses worsening with each exposure.

Despite being widely available and used for nearly a century, there are few studies establishing the safety of chemical irritants, and none on newer compositions. Of the reports and studies on chemical irritants that have been conducted, almost all note the need for more research.

The use of chemical irritants during the COVID-19 pandemic highlighted the risk of law enforcement contributing to the spread and impact of respiratory viruses, due to their effect on breathing and the lungs, and the risk of infection through induced coughing or sneezing (Omega Research Foundation, 2020). In 2020 the American Thoracic Society called for a moratorium on the use of tear gas and other chemical agents deployed by law enforcement against protestors participating in demonstrations, citing "the lack of crucial research, the escalation of tear gas use by law enforcement, and the likelihood of compromising lung health and promoting the spread of COVID-19" (American Thoracic Society, 2020).

An area of increasing importance, but where no clinical studies have yet been published, is the growing awareness of the effects of chemical irritants on different human bodies and reproductive health. Reports have suggested that there may be a relationship between use of tear gas and miscarriage (Physicians for Human Rights, 2012). Following the widespread use of large quantities of chemical irritants during Black Lives Matter and other protests in the US in summer 2020, media reports emerged of physiological effects for people who menstruate (see, for example, Slisco, 2020; Stunson, 2020; Nowell, 2020). Stress may also play a role. One peer-reviewed study based on a web-based survey of 2257 adults reporting recent exposure to tear gas in Portland, Oregon (U.S.), found that 54.5% of 1650 respondents who potentially menstruate reported menstrual changes. The most reported issues were increased menstrual cramping, unusual spotting, increased bleeding, and more days of bleeding (Torgrimson-Ojerio et al, 2021).

Care for those affected by chemical irritants should include decontamination, to prevent the penetration of more toxic substances into the body once exposure has ended, in order to avoid further damage. To do this, objects that have been impregnated by the toxin and are in contact with the skin or mucous membranes should be removed, such as contaminated clothing and contact lenses. In addition, the skin and eyes should be thoroughly irrigated with fresh water or saline solution for at least 20 minutes. Health professionals should warn the patient that

initially the stinging sensation and pain in the skin or mucous membranes may worsen. While there are anecdotal reports of a variety of substances helping with symptoms, there is little evidence to support their use. In the case of eye pain, anaesthetic eye drops may be prescribed. For individuals with respiratory symptoms, inhalers with bronchodilator and/or corticoids can be used for bronchospasm, and oxygen administration may also be necessary. In some cases, hospitalization and even ICU level care may be necessary to treat exposed patients.

In addition to the above, chemical irritant projectiles and grenades can cause significant trauma, when they strike a person directly or when they explode in close proximity to a person (Abdullah Yasa and Others v. Turkey, 2013; Omega Research Foundation and OSCE Office of Democratic Institutions and Human Rights, 2021). The risks associated with explosive grenades include burns, shrapnel wounds and explosive trauma. Therefore, eye damage lasting more than an hour should lead health professionals to suspect that a foreign body impact injury to the cornea. In such cases, a complete eye examination is essential, including fluorescein staining to identify corneal abrasions or other ocular lesions. Because launched cartridges are large and dense, when the cartridge itself strikes an individual, it can cause trauma ranging from bruising to facial and limb fractures to internal bleeding to brain injury and death.

Kinetic Impact Projectiles

Global context

Kinetic impact projectiles, commonly referred to as rubber or plastic bullets, are used in the context of public assemblies by law enforcement agencies in many states. Worrying trends include the use of large quantities of projectiles, frequently affecting peaceful protesters or bystanders, and the increasing prevalence of ocular injuries (Omega Research Foundation and Amnesty International, 2023).

French police used large quantities of less lethal weapons in response to *Gilets Jaunes* protests. The Council of Europe Commissioner for Human Rights reported that from 17 November 2018, when the protests began, to 4 February 2019, police fired 12,122 40 mm kinetic impact projectiles (Mijatović, 2019b, para. 16). The protest movement fully mobilised on a weekly basis, on Saturdays. There were 12 Saturdays in the date range mentioned above, so it is reasonable to conclude that close to 1,000 projectiles a day were launched during the most intense *Gilets Jaunes* protests. In Chile during the *Estallido Social*, the *Carabineros de Chile* revealed that they fired 151,288 shotgun cartridges containing 12 pellets each between 18 October and 31 December 2019. In the first two weeks of protests, Carabinero launched 104,341 rounds, a rate of 7,453 per day (Weibel Barahona and Jara, 2020).

Historically, the use of large quantities of kinetic impact projectiles is most commonly associated with The Troubles in Northern Ireland. The use of "Plastic Baton Rounds" against protesters by the Royal Ulster Constabulary and the British Army was "the most controversial aspect of public order policing" during The Troubles in Northern Ireland (The Independent Commission on Policing in Northern Ireland, 1999, para. 9.12). According to the Patten Report, between 1981 and 1999 over 56,000 plastic baton rounds were fired by the police and the army, resulting in 11 deaths Ireland (The Independent Commission on Policing in Northern Ireland, 1999, para. 9.12), of the 17 overall caused by rubber or plastic im-

Figure 1.7. *Number of kinetic impact projectiles used during mass protests in Northern Ireland, France and Chile.*

	Number of rounds launched over entire period	**Total number of rounds launched during most intense periods**	**Average number of rounds launched per day during most intense periods**
The Troubles, Northern Ireland	56,000 over 18 years	8,165 (7 – 14 July 1996)	1,021
Gilets Jaunes protest movement, France	12,122 over 80 days	12,122 (Every Saturday for 12 weeks, 17 November 2018 – 4 February 2019)	1,010
Estallido Social, Chile	151,288 over 75 days	104,341 (18 – 31 October 2021)	7,453

pact projectiles. According to available data, 7 – 14 July was the period when most plastic baton rounds were fired, 8,165 in total (British Irish Rights Watch, 2005, p. 7). Thus, security forces used around 1,000 plastic baton rounds per day during the most intense protests of the Troubles.

Although France and Chile are both much larger countries than Northern Ireland, it is still striking that use of kinetic impact projectiles in these countries equalled or far exceeded use during even the most difficult times during the Troubles.v

During the 2019-2020 protests in Chile, police used 12-gauge shotgun cartridges containing 12 small balls or pellets each. The National Human Rights Institute reported that 460 protesters suffered ocular injuries (Instituto Nacional de Derechos Humanos, 2020). A medical study into cases of ocular trauma treated at the Eye Trauma Unit in Hospital del Salvador, Santiago, found that 182 (70.5%) of 259 patients had been injured by rounds containing multiple kinetic projectiles (Rodríguez et al, 2021). Of the 182 patients whose injuries were caused by kinetic impact projectiles, 33 had total blindness in the affected eye and 90 had severe visual impairment or were blind at first examination (Rodríguez et al, 2021, p. 3).

An independent study revealed that the projectiles contained just 20% rubber, with the other 80% made up of silica, barium sulphate, and lead (Jorquera and Palma, 2019). This composition reportedly provided added hardness and energy, "which significantly increases the damage caused by the projectiles" (Mechanical Engineering Department of the Faculty of Physical and Mathematical Sciences of the University of Chile, 2019). Thus, the type of ammunition being used, the manner in which they were being used (aimed at the upper body) and the composition of the projectiles all contributed to large numbers of serious injuries.

During the *Gilets Jaunes* protests, use by French police of 40 mm projectiles launched with the *Lanceur de balles de défense* (*LBD*), was the cause of widespread public anger. Unlike the shotgun ammunition used in Chile, the 40 mm ammunition used in France, manufactured by the French company SAE Alsetex (part of the Etienne Lacroix Group), contains single projectiles. These 40 mm kinetic impact projectiles are designed to impact head on, with the foam nose absorbing the energy upon impact and thereby reducing injuries, but the prevalence of serious injuries presented indicates that they do not always do that.

The types of ammunition in use are designed to be launched from different ranges, with the longer-range ammunition containing more propellant. The French Ombudsperson (Défenseur des droits) has called for the use of this weapon system to be prohibited during public gatherings, in part due to the difficulty of determining the range and assessing the risk of hitting bystanders, as people are usually grouped and mobile in such a context (Toubon, 2019). As with other kinetic impact projectiles, there is an increased risk of serious injury or death when rounds are used from close range or impact sensitive parts of the body (e.g. head or upper body). In January 2019, the Ombudsperson reported that use of the LBD was the cause of or implicated in 18 of the 45 complaints he had received of "extremely serious injury" or "permanent mutilation".

Even when kinetic impact projectiles are aimed below the waist, their use can lead to serious injury or death. For instance, in the Brazilian state of Pernambuco in 2017, a Military Police officer shot Edvaldo da Silva Alves in the thigh with a kinetic impact projectile during a peaceful protest. The projectile was fired from a distance of less than 5m, resulting in penetration. Although the projectile was surgically removed from the victim's body, he later died of a general infection caused by his injuries (Folha de Pernambuco, 2017; Further information on file at Omega).

Characteristics and techniques

Kinetic impact projectiles are often made of hardened rubber, but they can also be made from other materials including wood, metal composite or plastic/PVC. 'Less lethal' ammunition can contain single or multiple projectiles including, for example, pellets, balls, blocks, cylinders, or fabric bags filled with pellets ("bean bags").

Due to their indiscriminate effects and the danger they present, the Council of Europe Commissioner for Human Rights has expressed concern at the unsuitability of certain less lethal weapons that are increasingly used for the policing of protests. In this context, she stated that the number of serious injuries caused by the use of kinetic impact projectiles was "particularly striking" (Mijatović, 2019a).

There is some divergence between international human rights standards on the lawful threshold for using kinetic impact projectiles. The UN Guidance states that they should only be used to strike a violent individual posing "an imminent threat of injury" (United Nations Office of the High Commissioner for Human Rights, 2020b, para. 7.5.2). Both the OSCE-ODIHR *Human Rights Handbook on Policing Assemblies* and the UN Resource Book impose a stricter standard, however, stating kinetic impact projectiles should only be used against individuals posing an immediate threat of *serious* injury or death (OSCE Office of Democratic Institutions and Human Rights, 2016 p. 81; United Nations Office on Drugs and Crime and Office of the High Commissioner for Human Rights, 2017, pp. 94-95).

Figure 1.8. *Examples of multiple projectiles (left) and single projectiles (right). Source: ©Omega Research Foundation. June 2018. Paris, France.*

These international human rights instruments also share important commonalities. All state that kinetic impact projectiles should only be used to target individuals posing a threat, not groups, and that the use of ammunition containing multiple projectiles, such as those shown below in Figure 1.8, does not comply with international human rights standards due to their inherent lack of accuracy. Both the UN Guidance and the ODIHR Handbook stipulate that kinetic impact projectiles should only be aimed at the lower abdomen or legs (United Nations Office of the High Commissioner for Human Rights, 2020b, para. 7.5.2; Organisation for Security and Cooperation in Europe, 2016, p. 81), and this is complemented by the Resource Book which states that they should not be fired at sensitive parts of the body, "in particular the head, neck, chest and groin" (United Nations Office on Drugs and Crime and Office of the High Commissioner for Human Rights, 2017. p. 95).

Advocates should insist that kinetic impact projectiles are sufficiently accurate to strike an individual within a 10 centimetre diameter of the targeted point from the designated range (United Nations Office of the High Commissioner for Human Rights, 2020b, para. 7.5.4). They should also insist on thorough initial and refresher training, with officers having to reach minimum proficiency standards in order to be certified to carry kinetic impact projectiles.

In some countries such as India (United Nations Office of the High Commissioner for Human Rights, 2019), shotgun cartridges containing multiple metal projectiles, often called birdshot or pellet rounds, are used as crowd control weapons. Their use has been associated with deaths and thousands of blindings and other serious injuries (Omega Research Foundation and Amnesty International, 2023, pp. 21 – 23). Such metal pellet ammunition is designed for hunting and its use for policing is entirely inappropriate and unlawful, with the UN guidance stating that "metal pellets, such as those fired from shotguns, should never be used" (United Nations Office of the High Commissioner for Human Rights, 2020b, para. 7.5.6). Similarly, rubber-coated metal bullets, such as those used in Israel (United Nations Commission of Inquiry on the 2018 protests in the Occupied Palestinian Territory, 2019, para. 294), are particularly dangerous and should not be used (United Nations Office of the High Commissioner for Human Rights, 2020b, para. 7.5.8).

Figure 1.9. *Injury caused to person deprived of their liberty by impact of kinetic impact projectile. Source: ©Brazilian National Mechanism to Combat and Prevent Torture, 2017.*

Health concerns

Kinetic impact projectiles, designed to cause pain, cause damage in the same way as striking weapons, by blunt trauma that injures the affected areas. The main symptom is again intense pain. Though designed to cause blunt, non-penetrative trauma, they can perforate the skin, particularly when fired from close range or at sensitive areas of the body, particularly the head, face and eyes (Haar et al, 2017a).

Some characteristics of KIPs can potentiate injury. The use of dense material, such as metal, can exacerbate the risk of penetration and injury. Projectiles incorporating metal, such as rubber-coated metal bullets (used by Israeli forces in the Occupied Palestinian Territories), projectiles with metal fragments (used in several contexts including in Chile) and bean bag rounds (used in the USA and elsewhere) are well known to cause significant injuries, especially when fired at close range. Ammunition dispersing multiple projectiles at once, two to many dozens, cannot be aimed at a single target, and can hit multiple people or sites of the body, causing variable and indiscriminate injury.

KIPs can and have caused serious injuries, disability and death. In a 2017 systematic review of 26 studies over 25 years, data on nearly 2000 persons impacted by KIPs identified 300 people with permanent disabilities and 53 who died from their injuries [Haar et al, 2017a]. Injuries were found in all body systems.

On the skin, in addition to pain, redness localised to the area of impact may appear, and could be accompanied by bruising, laceration, wounds, etc. As described above, if the deeper muscles are damaged, local inflammation may appear, with difficulty in mobilising the affected muscle, and there may be deformity and functional disability if bone fractures or joint injuries have occurred.

Some projectiles have been found to be inaccurate and inconsistent (Kenny et al, 2001 and Hughes et al, 2007). Particularly when fired from a distance, it is often difficult to control the area of impact, so that particularly vulnerable areas such as the face are often hit, with maxillofacial fractures and eye injuries of varying degrees of severity. Given their large size and the fragile bony structure and supple eye tissues, ocular injuries frequently result in permanent vision loss. 261 of the 300 permanent injuries in the systematic review mentioned above were ocular injuries, almost all with permanent vision loss in that eye [Haar et al, 2017a].

KIP trauma to the head have caused blunt trauma resulting in internal bleeding and in a number of cases, have penetrated the skull. Impact to the head can result in traumatic brain injury, haemorrhagic strokes and permanent disability.

Health professionals must treat facial and neck trauma with special caution and almost all require urgent medical attention to assess the airway and prevent it from being compromised (e.g. fractures of teeth, haematomas affecting the major vessels of the neck that can obstruct the airway by compression, etc.). The treatment of superficial injuries is based on applying cold compress, local wound dressings, immobilisation in certain injuries and analgesia.

Stun Grenades

Global context

Originally designed as a training aid to simulate explosions, stun grenades were initially adopted for use by military special forces units, and later, by law enforcement special weapons and tactics (SWAT) teams, during room clearance or hostage situations. In some countries, stun grenades have become more widely used by law enforcement personnel for crowd-control purposes. When used in the context of a public gathering, the aim is to disorient those present and cause them to disperse. Use in this context carries with it an increased risk of secondary injuries from falls, as the detonation of stun grenades risks causing panic or stampedes among large groups of people. States may need to re-assess their use of stun grenades during public gatherings in light of the UN Human Rights Committee General Comment on the right of peaceful assembly, which states "when [less lethal] weapons are used, all reasonable efforts should be made to limit risks, such as causing a stampede or harming bystanders" (United Nations Human Rights Committee, 2020, para. 87).

Stun grenades were used in the law enforcement response to large protests that erupted against the contested results of the Belarusian presidential election in August 2020, leading to many serious injuries (Boika et al, 2020). The Belarusian security forces used several types of stun grenade, including the Russian-manufactured SV-1319 Viyushka (AbraxasSpa, 2020), which, upon detonation, emits a loud bang, a bright flash of light, and 750 rubber pellets with a diameter of 7.5mm. According to company information, these grenades produce a sound not less than 130 decibels measured at a distance of 10 metres from the explosion (Rosoboronexport, 2023).

In Belarus, stun grenades were reportedly used directly against crowds of people, exploding at thigh height or lower (Boika et al, 2020). Serious injuries reportedly included broken bones in the finger, foot, and calf. In in one instance, a man's foot was reportedly ripped off when a stun grenade exploded near him (Boika et al, 2020). Many protesters were injured by fragments of exploded stun grenades (Karmanau, 2020), including serious injuries such as pneumothorax (Boika et al, 2020), and some people also suffered eardrum damage (Mardilovic, 2020).

Stun grenades were previously also used against large crowds of peaceful protesters in Yerevan, Armenia, on 29 July 2016. Police reportedly both launched and threw stun grenades into groups of peaceful protesters, with grenades exploding and emitting thick smoke and loud blasts, resulting in first- and second-degree burns, fragmentation wounds, and one protester reportedly lost an eye after being hit by fragments (Human Rights Watch, 2016).

Characteristics and techniques

Stun grenades, also known as "flashbangs" and "distraction" or "disorientation" devices, are explosive devices that can be either hand-thrown or weapon-launched. Upon detonation, they emit an extremely loud noise and/or bright flash(es) of light. The flash causes temporary blindness for several seconds by activating photoreceptor cells in the eye, and the loud blast can cause temporary loss of hearing and loss of balance, as well as a sense of panic (International Network of Civil Liberties Organizations et al, 2023, p. 88). Some stun grenades have ridges to limit their movement after detonation, while other types move around and have multiple explosions, causing loud blasts and bright flashes. The casing on some stun grenades has several circular cut-outs, such as those shown in Figure 1.10, to allow the sound and light from the explosion through. Some types also disperse chemical irritants and/or kinetic impact projectiles. The intensity of the noise and flash emitted varies from manufacturer to manufacturer. Some manufacturers market grenades with rubber casing as suitable for indoor use (see, for example, Condor Tecnologias Nao Letais, 2023). Others claim that their grenades emit less heat upon detonation, lowering the fire risk, or are designed not to move upon detonation (see Pacem Defense, 2023).

***Figure 1.10**. Hand-thrown stun grenades. Source: ©Omega Research Foundation. November, 2017. Paris, France*

Health concerns

Stun grenades contain an oxidising metallic pyrotechnic mixture, usually of magnesium or aluminium. Upon detonation, they emit extremely loud noise and/or bright flash(es) of light. The flash of light can saturate the retina, causing temporary blindness. During the following minutes, vision will gradually recover, with flashes of light persisting until it returns to normal. Acoustic waves can cause persistent hearing damage through ruptured eardrum and acoustic trauma with hearing loss that may persist.

Like all explosive devices, stun grenades carry the risk of blast injury. Blast injury results from the pressure waves caused by the blast on ambient air. As the proximity of a person or group of people to the explosion increases, so too does the risk of serious injury or death. The primary blast can cause injuries to the ear drum and lung membranes, especially when they discharge in close proximity to an individual.

Figure 1.11. *"A stun grenade exploded on Philippi High School pupil Bunzi Akhona, ripping through her tracksuit pants and searing skin off the back of her left leg." Source: Daneel Knoetze, Cape Town, 6 March 2015. CC by 4.0.*

Secondary blast can cause blunt and penetrating injury from the explosion and fragmentation of the device itself. Some stun grenades can produce high velocity fragments when they explode, which can have sufficient energy to cause serious injury or death. Safer grenades split, rather than fragment. Some stun grenades contain multiple kinetic impact projectiles which forcefully disperse across the blast area upon detonation.

The height at which stun grenades may explode at is a factor in the injuries they may cause, due to the proximity of the explosion to vital organs and other vulnerable parts of the body. The risk is lowered when grenades are rolled along the ground, rather than thrown or launched. This was tragically evident in the death of Remi Fraisse, who was killed during a protest against the construction of a dam in France in October 2014. A stun grenade thrown by the French Gendarmerie reportedly exploded near his back, severing his spinal cord and killing him instantly (Désarmons-les !, 2018).

Tertiary blast can cause blunt and penetrating trauma such as fractures and head trauma from pushing people into solid objects, or entraining projectiles in the blast wave. Quaternary blast can result in burns, smoke inhalation, crush injuries from a resulting stampede or psychiatric trauma (International Network of Civil Liberties Organizations et al, 2023). Stun grenades burn extremely hot, and the risk of fire, smoke inhalation and serious burns is higher in enclosed spaces. A 2015 Propublica investigation reports in more than 50 cases of death and serious injury from law enforcement use of stun grenades (many of them when they were launched into residential spaces). (Propublica, 2015).

As blast injuries have variable effects, early medical attention should be sought for any injuries to the head/face or other sensitive body parts such as the genitalia or hands. Prolonged headaches, hearing or vision loss would require in-depth evaluation for concussion, tympanic membrane rupture or globe rupture as a result of blast pressure or foreign bodies.

Burns, blisters and skin injuries, such as those seen in Figure 1.11, should be treated as explosive injuries, irrigated and dressed. The main symptom of burns will be pain and, depending on the severity, the skin may show erythema or local redness as in sunburn (first degree burns), or blistering or even tissue necrosis with permanent scarring in third degree burns, depending on the layers of skin affected. These burns can be complicated by toxic gas inhalation injuries, making the prognosis much worse. In these cases, urgent medical assessment is necessary as facial burns or burns accompanied by inhalation can endanger the airway and the ventilatory capacity of the patients. This requires early oxygen therapy and assessment of the need for intubation or intensive care. Second- and third-degree burns will require treatment with balanced fluid administration depending on their extent, and local treatment of the lesions to avoid superinfection.

Other less lethal weapons

There are a wide range of other less lethal weapons and devices in use, although perhaps not as commonly observed as those covered above, all would merit thorough examination, but a lack of space prevents it here. Water cannon are becoming more prevalent globally, due in part to lower cost arising from manufacture in China and South Korea (see, for example, Jino Motors, 2023), but also from more modern designs (see, for example, Albert Ziegler GmbH, 2023). There are reports that water cannons are being further weaponized by adding dye, chemical agents or foul-smelling contaminants to exert secondary impacts. Injury intensity is influenced by the pressure, distance, duration and composition of the water stream. Direct injury from the water jets is rare, but include loss of the eyes and facial fractures (Grimley, 2014). Secondary effects include being knocked over, pushed off high ground, or objects being entrained in the water stream impacting the body.

Acoustic and optical devices are increasingly encountered. Acoustic devices were introduced for warning or as loud hailers, however some have 'warning tones' at high frequency or sound pressure levels, which can lead to hearing loss (Amnesty International USA, 2014, p. 14). Optical devices that interfere with an individuals' vision are designed to warn or to dazzle (see, for example, B.E. Meyers & Co. Inc., range of GLARE products). They have the potential to cause irreversible sight

loss. Dogs and horses are also commonly deployed in crowd control settings where dog bites, trampling by horses and other traumas can occur when confronted by these animals (Omega Research Foundation and OSCE Office of Democratic Institutions and Human Rights, 2021).

An emerging issue in crowd control weaponry is the use of remote drone technology, either for surveillance of crowds or for deployment of lethal and less lethal weapons. Surveillance using drone or other remote technology is growing in recent years, with the potential to identify and later arrest or persecute demonstrators. The use of chemical irritant projectiles or grenades via drone has been increasingly reported and a number of manufacturers offer such systems (ISPRA, 2023) , underscoring the need for consistent monitoring of such technological developments.

Conclusion

The vast majority of public assemblies transpire peacefully and many do not even require the presence of law enforcement officials. Where police or other law enforcement officials are present, their primary duty is to facilitate, respect and protect the exercise of fundamental rights, enabling the assembly to take place as intended and minimising the potential for injury to any person or damage to property (United Nations Human Rights Committee, 2020, paras. 74-76). Nonetheless, in many countries policing of assemblies is politicised, and there is also a tendency to label entire assemblies as violent and use less lethal weapons to disperse them. This does not solely affect those who are hurt or even those who are present at the assembly, as it can have a wider chilling effect on the enjoyment of the right to freedom of peaceful assembly and civic engagement.

In cases of assemblies which may be non-peaceful, and where force against those who are violent may be justified, there is often no attempt to distinguish between individuals engaged in unlawful conduct and others exercising their right to peaceful assembly. Sporadic instances of violence by individuals in an assembly does not mean the whole assembly can be classed as violent, and non-violent individuals still retain their rights which must be protected. The obligation to prioritise non-violent means of conflict resolution is frequently ignored in such circumstances, with the violence of a few used to justify the vilification of the many and the discrediting of the message they seek to convey.

There are various factors that contribute to law enforcement officials continuing to use excessive and arbitrary force to police assemblies, but one crucial issue is impunity. Impunity is, in turn, facilitated by a series of interrelated causes. These include unprofessional and permissive police cultures, weak use of force protocols, inadequate training, an absence of effective, independent oversight mechanisms, allegations of police abuse being investigated by the same agency, overly close relationships between police and prosecutors, and a lack of knowledge among judges and other legal professionals concerning international use of force standards and the technical characteristics of the weapons used by law enforcement agencies.

Reliable forensic evidence and effective oversight are of fundamental importance to addressing impunity and achieving accountability for the excessive or arbitrary use of force. As such, we encourage medical and legal professionals to ensure they have up-to-date knowledge of the characteristics of less lethal weapons used in the jurisdictions where they practice, the techniques used for their employment, and the risks associated with their use. If health professionals are called on for forensic evaluation or testifying in civil or criminal litigation, it is important to provide information on the weapons, the methods of use, resulting injuries, as well as the functional and long-term sequalae. Professional bodies should offer training and support on these matters, complementing other training on the implementation of the Istanbul and Minnesota Protocols.

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ANNEX – Synopsis of key information on the medical effects of less lethal weapons

CHEMICAL IRRITANT AGENTS: TEAR GAS[1] & PEPPER SPRAY[2]

	SYMTOMS	SIGNS	DIAGNOSIS	TREATMENT
SKIN	Pain Stinging	Local redness (erythema) Blistering lesions	Ocular inspection	Removing contaminated clothing or objects Irrigation with fresh water or saline solution
EYES	Pain[3] Stinging Decreased visual sharpness	Redness Profuse tearing Blinking	Ocular inspection	Irrigation with fresh water or saline solution for at least 20 minutes Analgesic eye drops Antiseptic eye drops
NOSE	Nasal itching	Rhinitis Sneezing	Inspection	Irrigation with fresh water or saline solution
RESPIRATORY APPARATUS	Shortness of breath (dyspnoea)	Cough Sensation of a foreign body in the throat Wheezing	Inspection of the mouth and throat Lung auscultation	Oxygen therapy Bronchodilators Corticosteroids

BLUNT TRAUMA

	SYMPTOMS	SIGNS	DIAGNOSIS	TREATMENT
SKIN	Pain Stinging	Local redness (erythema) Haematoma Erosion, laceration (wounds)	Visual inspection	Analgesics Local cold therapy Local wound dressing with soap and water Antiseptics Suture assessment

1 Though commonly referred to as tear gas, CS (clorobenzilideno malononitrilo) is a white crystalline powder that is projected through the air and deposited on mucous membranes by binding to a protein receptor in the human body. Other irritant agents used for law enforcement include CN and CR.

2 Capsaicin is the active irritant agent in pepper spray. It causes irritation to the skin and especially the mucous membranes.

3 Some chemical irritant agents are dispersed as solid particles, so if ocular symptoms last more than 1-2 hours, a possible foreign body injury to the cornea should be assessed by fluorescein staining.

		BLUNT TRAUMA		
MUSCLES	Pain Cramps Contraction	Local inflammation Compartment syndrome due to compression of adjacent structures (vascular and nervous system)[4] Haematoma Functional disability (difficulty in performing certain movements) Rhabdomyolysis (flooding of the bloodstream with muscle proteins) Kidney failure	Visual inspection Ultrasound Analysis	Local cold therapy Analgesic Immobilisation Bandaging Specific treatment of: Compartment syndrome: Surgical drainage Rhabdomyolysis : intravenous serotherapy
BONES	Pain Functional disability	Fractures Haematoma Deformity	Inspection by palpation X-rays	Analgesic Immobilisation (casts, splints, orthoses) Surgical intervention
JOINTS	Pain Functional disability	Hematoma Deformity	Inspection by palpation	Analgesic Local cold therapy Immobilisation
ORGANS:				
CENTRAL NERVOUS SYSTEM	Headache Confusion Convulsions	Neurological abnormalities Vomiting	Neurological examination Computerised axial tomography	Analgesic Anti-emetics Evaluate surgical intervention
LUNGS	Shortness of breath (dyspnoea) Pain	Expectoration of blood (haemoptysis) Pneumothorax	Auscultation Chest X-ray Pulmonary ultrasound	Analgesic Oxygen therapy Surgical intervention
HEART	Chest pain		Auscultation Electrocardiogram	Analgesic Monitoring
ABDOMINAL VISCERA: KIDNEY, LIVER, SPLEEN	Abdominal pain Back pain Vomiting Dizziness	Haematoma Hypotension and tachycardia Blood in urine (haematuria)	Physical examination Analysis Imaging tests: Ultrasound, Computerised Axial Tomography	Analgesic Blood transfusion Surgical intervention

4 The muscle groups of the human limbs are divided into sections or compartments formed by strong, inflexible fascial membranes. Compartment syndrome occurs when increased pressure within a compartment compromises the circulation and function of the tissues within that space.