

REPORT 6 OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH (A-09)
Use of Tasers® by Law Enforcement Agencies
(Reference Committee D)

EXECUTIVE SUMMARY

Objective: To review the technology of conducted electrical devices (CEDs) such as Tasers®, the evidence on their direct physiological effects, and existing data on the morbidity and mortality associated with their use by law enforcement personnel. General guidelines on use-of-force policies and the role played by CEDs also are noted, and their relevance to public health and the health care system is discussed.

Methods: English-language reports on studies using human or animal subjects were selected from a PubMed search of the literature from 1985 to March 2009 using the text terms “taser,” or “conducted electrical device” or the MeSH terms “law enforcement/methods” or “weapons,” in combination with “electric injuries,” and “diagnosis,” “etiology,” “physiopathology,” “prevention and control,” “mortality,” or “forensic medicine.” Additional articles were identified by manual review of the references cited in these publications. Web sites of Taser International, the U.S. Department of Justice, the Canadian House of Commons, Amnesty International, and the International Association of Police Chiefs also were searched for relevant resources.

Results: The design of CEDs has evolved over the last 20 years. Tasers® are the primary CEDs used by law enforcement. Despite the designation of the Taser® as a less lethal or less-than-lethal weapon, Amnesty International has catalogued a temporal association between the use of CEDs and more than 330 in-custody sudden deaths in North America between June 2001 and August 2008, all involving M-26 or X-26 Tasers®. Swine models have demonstrated the ability of Tasers® to induce ventricular arrhythmias. Limited Taser® discharges applied to healthy human volunteers generally appear to be safe. Such studies cannot fully evaluate the responses of individuals who are confrontational, have taken drugs, or are desperate for escape, highly agitated, and combative.

Higher risk situations for restraint-related fatalities seem to be associated with pre-existing cardiovascular disease in individuals who have taken psychostimulants or other drugs and engage in a struggle against law enforcement personnel and then are subjected to restraint maneuvers (with or without Taser® use). The sudden in-custody deaths of individuals who are combative and in a highly agitated state have been attributed to the presence of “excited delirium.” The latter is not a validated diagnostic entity in either the International Classification of Diseases or the *Diagnostic and Statistical Manual of Mental Disorders*, but is a more generally accepted entity in forensic pathology.

Conclusion: Concerns about the use of CEDs fall into three general areas: (1) they are used too frequently and at lower levels on the use-of-force continuum than indicated; (2) appropriate training and supervision of CED use is lacking in some jurisdictions; and (3) CEDs may contribute to the death of suspects, either directly or indirectly. Arrest-related deaths are not new and predate the deployment of CEDs. Most studies undertaken by law enforcement agencies (and others) indicate that deploying CEDs relative to other use-of-force options, such as pepper spray, physical force, police dogs, and batons, reduces injuries to officers and suspects and reduces the use of lethal force. If deployed according to an appropriate use-of-force policy, and used in conjunction with a medically driven quality assurance process, Taser® use by law enforcement officers appears to be a safe and effective tool to place uncooperative or combative subjects into custody.

REPORT OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH

CSAPH Report 6-A-09

Subject: Use of Tasers® by Law Enforcement Agencies
(Resolution 401, A-08)

Presented by: Carolyn B. Robinowitz, MD, Chair

Referred to: Reference Committee D
(James L. Milam, MD, Chair)

1 Resolution 401, “Tasers,” introduced by the American Academy of Child and Adolescent
2 Psychiatry, American Psychiatric Association, American Academy of Psychiatry and the Law, and
3 the
4 American Academy of Pediatrics and referred at the 2008 Annual Meeting, asks:

5
6 That our American Medical Association (AMA) Council on Science and Public Health
7 prepare a report summarizing the scientific data on morbidity and mortality associated with
8 the use of Tasers;

9
10 That our AMA advocate for the development of appropriate guidelines to ensure that
11 Tasers are only used in a manner which minimizes the risk of injury or death; and

12
13 That our AMA encourage The Joint Commission and other appropriate accreditation and
14 regulatory agencies to develop standards and guidelines regarding the use of Tasers in
15 hospitals and other health care facilities.

16
17 Conducted electrical devices (CEDs) were designed as non-lethal weapons to assist law
18 enforcement personnel in subduing subjects who actively resist arrest, or who present a serious
19 threat to themselves or others. As these new tools have become more prominent in the law
20 enforcement arsenal, their deployment has been temporally associated with more than 330 arrest-
21 related or in-custody deaths since 2001.¹ The association of CEDs such as Tasers®^a with fatalities,
22 dramatized by video evidence, has led to further scrutiny of their use by human rights advocacy
23 groups, government oversight bodies, law enforcement organizations themselves, and the media.
24

25 This report reviews the technology of CEDs, evidence of their direct physiological effects, and data
26 on the morbidity and mortality associated with their use by law enforcement. The vast majority of
27 published data concern the use of Tasers®. General guidelines on use-of-force policies and the
28 role played by CEDs are noted, and their relevance to public health and the health care system is
29 discussed.

30 31 METHODS

32
33 English-language reports on studies using human or animal subjects were selected from a PubMed
34 search of the literature from 1985 to March 2009 using the text terms “taser,” or “conducted
35 electrical device” or the MeSH terms “law enforcement/methods” or “weapons,” in combination

^a TASER is an acronym for Thomas A. Swift Electronic Rifle

1 with “electric injuries,” and “diagnosis,” “etiology,” “physiopathology,” “prevention and control,”
2 “mortality,” or “forensic medicine.” Additional articles were identified by manual review of the
3 references cited in these publications. Web sites of Taser International, the U.S. Department of
4 Justice, the Canadian House of Commons, Amnesty International, and the International
5 Association of Police Chiefs also were searched for relevant resources.

6 7 BACKGROUND

8 9 *Conducted Electrical Weapons*

10
11 The design of CEDs, especially Tasers®, has evolved over the last 20 years. Early versions of
12 CEDs (e.g., stun guns) did not incapacitate subjects, and primarily attempted to achieve compliance
13 through the infliction of pain. Current Taser® models are more efficient in incapacitating criminal
14 suspects, and are the primary CEDs used by law enforcement. According to the manufacturer,
15 Tasers® are currently used in more than 12,750 law enforcement, military, and correctional
16 agencies around the world, including more than two-thirds of law enforcement agencies in the
17 United States.² Taser International produces various models for law enforcement personnel (M-26
18 and X-26), as well as civilian models (C2 and X-26C), which are less powerful.

19
20 The most recent evolution of the Taser® for law enforcement is the X-26 model. The X-26 is
21 battery operated with a removable cartridge containing coiled electrical wires at the front, coupled
22 with a data port that records the time and date of activation, and also incorporates an audio and
23 video recording camera. Propelled by compressed nitrogen, the X-26 cartridge can launch the two
24 tethered insulated wires with barbed probes up to 35 feet. When the trigger is depressed, a pulse
25 wave with a high voltage leading edge (up to 50,000 V in open circuit) is delivered followed by a
26 pulsed low amperage current delivered over 5 seconds. Both probes must attach to the skin or
27 clothing. The initial short duration, high voltage signal allows a current path to be established
28 through clothing via an “arc” of ionized air. The standard discharge cycle can be terminated early
29 by the officer or can be extended, as long as the barbs remain in sufficient contact with the
30 individual, by holding or repeatedly depressing the trigger. With the cartridge removed, the Taser®
31 also can be used in push stun mode by directly applying a pair of electrical contact points
32 (approximately 1.5 inches apart at the tip) to the subject. In comparison, the most recent civilian
33 model (C2) can launch the probes up to 15 feet and can deliver a 30-second energy burst, thus
34 enabling the subject to escape during that time period. The C2 also can be used in stun mode.

35
36 When used in the probe mode (i.e., barbed wires propelled by compressed nitrogen), the pulsed,
37 low-amperage current activates α -motor neurons causing strong, repetitive contractions of skeletal
38 muscles and temporary immobilization. The affected muscle mass area is determined by the
39 probe’s position and separation. In addition to temporary incapacitation, sensory nerves are
40 stimulated causing substantial discomfort and pain.

41
42 Another company, Stinger Systems, also markets a projectile CED in the United States (the S-
43 200).³ The open circuit maximum voltage, pulse waveform, cycle duration, current characteristics,
44 and peak amperage of the S-200 differ somewhat from the Taser X-26.

45 46 *Federal, State, and Local Laws*

47
48 Because they use compressed nitrogen rather than gunpowder to propel the probes, the federal
49 Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) does not classify the Taser® as a
50 firearm; therefore, their sale to civilians is not subject to federal restrictions. The Transportation

1 Safety Administration prohibits airline passengers from possessing Tasers®, but can authorize their
2 use by trained flight crew members.

3
4 Outside of the realm of law enforcement, at least 43 states allow civilians to purchase Tasers®,
5 based on variable state statutes or local ordinances.⁴ Some jurisdictions regulate CEDs as firearms
6 or restrict where such devices can be carried. The issue of CED availability and potential use by
7 civilians is not further examined in this report.

8 9 POLICIES AND PROCEDURES RELATED TO USE OF FORCE, INCLUDING TASERS®

10
11 Police officers are legally and morally required to use the lowest level of force necessary to control
12 a situation and to deescalate at the earliest opportunity. Use-of-force policies are based on a
13 continuum that provides various recommended options when encountering a subject based on the
14 subject's actions and the officer's perception of the situation. Subject actions are classified as: (1)
15 compliant; (2) passive resistance; (3) active resistance; (4) assault causing physical injury; or (5)
16 assault that could cause serious physical injury or death. A model (continuum) for use-of-force
17 options has been developed by the Federal Law Enforcement Training Center (FLETC),
18 Department of Homeland Security.^{5,6} When confronted with the potential for serious physical
19 injury or death, police officers can respond with lethal force (i.e., firearms). The use of firearms
20 under such circumstances is associated with a subject mortality of approximately 50%. Thus,
21 alternatives to lethal force and better methods to subdue individuals that limit injuries and death are
22 important tools.

23
24 Some semantic confusion exists regarding the classification of CEDs. The Department of Justice's
25 National Institute of Justice (NIJ) classifies CEDs as a "less-lethal" technology. The NIJ defines a
26 less-lethal weapon as "any apprehension or restraint device that, when used as designed and
27 intended, has less potential for causing death or serious injury than conventional police weapons."⁷
28 Such weapons (i.e., CEDS, chemical sprays, blunt force projectiles, directed energy devices) are
29 designed to temporarily incapacitate or restrain an individual when lethal force is not appropriate.
30 The ideal less-lethal weapon incapacitates a potentially dangerous person to facilitate his or her
31 safe arrest, with only minimal risk of injury or death to the subject, law enforcement personnel, or
32 bystanders. Others classify CEDs as a "less-than-lethal" weapon, which implies that use ordinarily
33 will not result in lethality, but that a greater likelihood of serious bodily injury or death exists
34 compared with "non-lethal" interventions.^{8,9}

35
36 Although many law enforcement agencies rely on the FLETC continuum for training and decision-
37 making in the field, a report issued by the General Accounting Office in 2005 found that the
38 threshold at which Taser® use is deemed appropriate varied among police departments.⁵ Some
39 departments restricted its use to situations involving harmful assault or serious threats to oneself or
40 others, while others permitted Taser® deployment at much lower thresholds; for example, on
41 subjects who were "passively resisting" by not responding to lawful verbal commands of the
42 officer. Training and recertification requirements for Taser® use also varied among police
43 departments.

44 45 *Guidelines for CED Use*

46
47 Law enforcement agencies attempt to ensure proper deployment of CEDs by establishing and
48 employing use-of-force policies, training requirements, operational protocols, and safety
49 procedures. Because questions have been raised about the patterns of CED use and whether their
50 use poses significant health risks, many related issues have emerged among law enforcement
51 agencies. These include appropriate placement of CEDs on the use-of-force continuum; activation

1 parameters involving at-risk populations (see below); training questions, including mandatory
2 exposure of officers to these devices; risks for injury and death in exposed subjects; and policies
3 and procedures that are necessary to better ensure safe encounters between police officers and
4 criminal suspects. Accordingly, detailed national guidelines, containing more than 50 provisions
5 for CED use, have been developed by the U.S. Department of Justice and Police Executive
6 Research Forum to inform officers on their appropriate deployment within the use-of-force
7 continuum.¹⁰

8
9 The discussion below focuses on research that has been conducted on the physiologic effects of
10 CEDs in animals and humans, their effects on subjects who have been targeted, and information
11 relevant to their impact (after deployment) on police injuries and the use of lethal force.

12 13 PHYSIOLOGIC EFFECTS: ANIMAL MODELS AND HUMAN SUBJECTS

14
15 The occurrence of sudden deaths in close proximity to CED use immediately raised speculation
16 about their potential direct effects on cardiac and respiratory function.

17 18 *Cardiac Effects*

19
20 Several studies on the cardiac effects of Tasers® have been conducted in anesthetized, ventilated
21 swine models, both by industry-sponsored and independent investigators. Standard Taser®
22 discharges are largely ineffective in generating ventricular fibrillation in the swine model,¹¹ and
23 other studies support the view that a large safety factor, proportional to body mass, exists for
24 inducing ventricular fibrillation.^{12,13} Other studies have demonstrated the ability of Tasers® (or
25 devices modified to generate Taser-like waveforms) to provoke ventricular tachycardia, and rarely,
26 ventricular fibrillation. Ventricular arrhythmias typically are provoked only with prolonged
27 discharges and electrode placements that bracket the heart, ensuring a transcardiac path.¹⁴⁻¹⁷
28 Standard Taser® discharge can induce capture of implantable pacemakers and provoke discharge
29 of implantable defibrillators in swine models, but sustained arrhythmias generally do not occur
30 under such conditions.^{18,19} These results have led some to hypothesize that thin stature and chest
31 impalement may lower the safety margin for Taser® discharges in human subjects.⁷

32
33 Because they have a heart-body weight ratio and general cardiac anatomy similar to that of
34 humans, swine have been used in the testing and development of pacemakers and implantable
35 cardiac defibrillators. However, swine have a relatively low threshold for ventricular fibrillation,
36 in part, because their Purkinje fibers cross the entire ventricular wall, in contrast to human hearts in
37 which these fibers are largely confined to a thin layer in the endocardium. Additionally, the
38 cardiac impulse proceeds from the epicardium to the endocardium in swine, potentially increasing
39 their sensitivity to externally applied electrical currents compared with humans. These differences
40 diminish the relevance of this model for evaluating the safety of CED exposure in humans.²⁰

41
42 Theoretical modeling suggests that Tasers® are extremely unlikely to directly trigger cardiac
43 arrhythmias in humans.²¹ Experimental human studies have examined the cardiac and metabolic
44 safety of Tasers®, largely using limited duration discharges applied to the dorsum of healthy,
45 resting volunteers. In such subjects, a 2- to 10-second Taser® discharge provokes a modest
46 increase in heart rate (generally already high due to anticipatory anxiety) and changes in the PR
47 and QT interval that are not clinically significant.²²⁻²⁶ Additionally, short-lived increases in minute
48 ventilation and tidal volume occur, accompanied by small changes in serum lactate, bicarbonate
49 and creatine kinase (at varying time points), but no clinically significant changes in systemic pH or
50 electrolyte balance. Similarly, a 15-second discharge from a Taser X-26 does not increase the core
51 body temperature of resting, non-environmentally stressed adult subjects.²⁷ Furthermore, no

1 evidence of dysrhythmia or myocardial ischemia is apparent, even when the barbs are positioned
2 on the thorax and cardiac apex.²³ Case reports indicate that standard Taser® discharges induce
3 ventricular capture in patients with pacemakers, and also can capture, but do not trigger the
4 discharge of implantable cardiac defibrillators.^{28,29} Whether the pacemaker is signaling that
5 Tasers® induce ventricular capture, or whether the pacemaker is simply capturing the electrical
6 train of the Taser® pulse is not established.

7
8 Although CED activation in normal volunteers appears to be very safe, these studies do not
9 sufficiently reproduce the risks of Taser® exposure among criminal suspects, in whom coexisting
10 medical and psychiatric conditions, alcohol and drug use, and other factors are often present.
11 Human volunteers report that CED exposure is an extremely unpleasant experience, inducing both
12 physiologic and psychological stress. Some experimental studies have begun to address these
13 confounding factors. For example, preliminary reports of CED exposure in healthy volunteers
14 designed to simulate (to a degree) the physiologic effects of fleeing from or struggling with police
15 officers suggest that changes in systemic pH, lactate, and other markers are comparable to those
16 associated with exercise of the same duration.³⁰⁻³³ Such studies cannot fully evaluate the responses
17 of individuals who are confrontational, have taken drugs, or are desperate for escape, highly
18 agitated, and combative.

19 20 MORBIDITY AND MORTALITY

21
22 The emerging relevance of Taser® use for emergency room care was noted almost 25 years ago.³⁴
23 Despite the designation of the Taser® as a less lethal, or less-than-lethal weapon, Amnesty
24 International has catalogued a temporal association between the use of CEDs and more than 330 in-
25 custody sudden deaths in North America between June 2001 and August 2008, all involving M-26
26 or X-26 Tasers®.¹ Therefore, some debate still centers on whether to describe CEDs as non-lethal,
27 less-than-lethal, or less lethal, and as impact or non-impact weapons. Because CEDs have been
28 deployed at lower thresholds on the use-of-force continuum, deaths occurring in association with
29 their use make the safety and deployment of CEDs a significant public health issue.

30
31 Most but not all studies undertaken by law enforcement agencies (and others) indicate that
32 deploying CEDs relative to other use-of-force options such as pepper spray, physical force, police
33 dogs, and batons reduces injuries to officers and suspects and reduces the use of lethal force.^{8,35-40}
34 CED activation also has recognized risks. For example, a potential exists for the probes to
35 penetrate vulnerable parts of the body such as the eyes, mouth, head, or genitals, or large vessels in
36 the neck and groin region. The strong muscle contractions induced by CEDs cause falls and
37 impact-related injuries (e.g., fractures and head injuries), particularly in elderly individuals or
38 pregnant women. Because experimental studies are inherently limited, epidemiologic and
39 prospective investigations during actual weapon use are vitally important in conducting a realistic
40 risk assessment of these weapons.

41 42 *Mortality*

43
44 Arrest-related deaths are not new and predate the deployment of CEDs. Initial studies on early
45 CED weapons concluded that their association with in-custody deaths shared characteristics (to a
46 large degree) with other in-custody deaths. Deceased subjects had a high prevalence of alcohol or
47 other drug use, especially stimulants or phencyclidine (PCP), were agitated or exhibited otherwise
48 bizarre behavior, engaged in intense physical struggle, and were subjected to various types of
49 physical restraint.⁴¹⁻⁴³

1 In 43% of autopsy reports reviewed by Amnesty International, the deceased had been shocked in
2 the chest.¹ In more than half of the autopsy reports, the subjects (average age 36 years) had evident
3 cardiovascular disease, an incidence that is significantly higher than that occurring in the general
4 population of 36-year-old adult males. Some of those who died had no underlying disease or drugs
5 in their system, but collapsed after being subjected to repeated or prolonged shocks and/or shocks
6 to the chest, heightening concern that these factors may increase the risk of death or injury, even in
7 relatively healthy individuals. These findings led Amnesty International to call for a suspension in
8 the use of CEDs pending further (objective) study, or, at a minimum to “limit their use to situations
9 where they are immediately necessary to avoid or reduce the likelihood of recourse to firearms.”¹

10
11 One case series based on a convenience sample of in-custody deaths between January 2001 and
12 January 2005 identified 75 deaths that were associated with Tasers®.⁴⁴ Thirty-seven autopsy
13 reports were made available for review. This study also revealed cardiovascular disease in more
14 than half of the deceased subjects. Additionally, 78% had used substances, mostly stimulants, and
15 76% exhibited features typical of “excited delirium” (see below). Taser® use was considered a
16 potential or contributory cause of death in 27% of these subjects. The generalizability of this study
17 is limited because it was based on easily identifiable cases, was restricted to available autopsy
18 reports, relied on (historical) information from police reports, and lacked access to official medical
19 records. However, the overall findings are consistent with prior studies of restraint-related
20 fatalities, with the authors noting:

21
22 As has been stated elsewhere, it is likely that such pre-existing disease, when combined
23 with stimulant use, struggle against law enforcement, and definitive restraint maneuvers
24 (Taser® or otherwise), creates a high-risk situation for restraint-related fatalities.⁷

25
26 Similarly, the Police Executive Research Forum referred to a study it had commissioned of 118
27 deaths following Taser® activations, noting that “the results indicated that multiple and continuous
28 activations of CEDs may increase the risk of death or serious injury, and that there may be a higher
29 risk of death in people under the influence of drugs.”¹⁰

30 31 *Excited Delirium*

32
33 Although not a validated diagnostic entity in either the International Classification of Diseases or
34 the *Diagnostic and Statistical Manual of Mental Disorders*, “excited delirium” is a widely accepted
35 entity in forensic pathology and is cited by medical examiners to explain the sudden in-custody
36 deaths of individuals who are combative and in a highly agitated state.⁴⁵ Excited delirium is
37 broadly defined as a state of agitation, excitability, paranoia, aggression, and apparent immunity to
38 pain, often associated with stimulant use and certain psychiatric disorders. The signs and
39 symptoms typically ascribed to “excited delirium” include bizarre or violent behavior,
40 hyperactivity, hyperthermia, confusion, great strength, sweating and removal of clothing, and
41 imperviousness to pain. Speculation about triggering factors include sudden and intense activation
42 of the sympathetic nervous system, with hyperthermia, and/or acidosis, which could trigger life-
43 threatening arrhythmias in susceptible individuals. Biochemical studies have shown alterations in
44 the function of dopamine neurons and specific gene activation products in the central nervous
45 system of such individuals.⁴⁵ The intense pain associated with Taser® exposure, the psychological
46 distress of incapacitation, and hazards associated with various restraint methods also could
47 contribute.

48
49 Of note, one study of emergency department cases over a six-year period evaluated 216 subjects
50 who had been restrained in the “hobble” position; 20 of these subjects died suddenly and
51 unexpectedly.⁴⁶ Almost all of these subjects had cardiovascular disease or were under the influence

1 of a stimulant. Four had been exposed to pepper spray, three to CEDs, and two had both
2 exposures. The authors concluded that “such individuals are at a higher risk for sudden death,
3 particularly those who are obese, under the influence of stimulant drugs, or have underlying
4 (cardiovascular) disease.” Ongoing debate exists on whether certain forms of physical restraint
5 such as the “hobble” position and “hogtying” place some individuals at risk for positional asphyxia,
6 even in the absence of the use of pepper spray or CEDs.

7 8 *Governmental Review*

9
10 Widespread media attention to some Taser®-associated deaths has triggered governmental review
11 of their use in both Canada and the United States.^{5,7,47} In June 2008, the National Institute of
12 Justice published an interim report of its ongoing inquiry into deaths following police use of
13 CEDs.⁷ Although this interim report acknowledged the need for more research into the effects of
14 CEDs, it concluded that medical evidence is lacking to support the view that CEDs pose a
15 “significant risk” for inducing cardiac dysrhythmia when “deployed reasonably” and that law
16 enforcement officials “need not refrain from deploying CEDs provided the devices are used in
17 accordance with accepted national guidelines.”^{10,36} The report also urged “caution” in the use of
18 “multiple activations.” In its guidelines for CED use, the Police Executive Research Forum also
19 recommends that, following the application of a CED, officers should “use a restraint technique
20 that does not impair respiration.”^{10,36}

21
22 In response to the highly publicized death of a subject in the Vancouver airport, the Canadian
23 House of Commons Standing Committee on Public Safety and National Security evaluated CED
24 use and recommended that the Royal Canadian Mounted Police restrict the use of the Taser® by
25 classifying it (effective no later than December 15, 2008) as an “impact weapon” rather than an
26 intermediate weapon, so that its “use can be authorized only in situations where the subject is
27 displaying assaultive behaviour or posing a threat of death or grievous bodily harm to the police,
28 himself or the public.”⁴⁷ The Committee further advised that this restriction should not be lifted
29 “before independent research has indicated that use of the Taser® poses no unreasonable risk for
30 the subject.”

31
32 To more clearly establish the potential role of Tasers® in arrest-related deaths, the following
33 information would be useful: (1) total in-custody deaths (or deaths proximate to restraint); (2)
34 total Taser® deployments (or field applications); and (3) total in-custody deaths not involving
35 Taser® use. Since 2003, all U.S. law enforcement agencies are required to not only report, but also
36 categorize all in-custody deaths.⁴⁸ During the period from 2003 to 2005, 47 states and the District
37 of Columbia reported 2,002 arrest-related deaths proximal to law enforcement’s use of force,
38 including 1,095 homicides by law enforcement personnel, 96% of which involved the use of a
39 firearm by the arresting officer.⁴⁹ Approximately 4% of persons who died had been placed under
40 physical restraints. CEDs were involved in 36 arrest-related deaths during this period. In 17 of
41 these, the CED was causally linked to the death. This report acknowledges that the ability of CEDs
42 to cause death is a subject of debate, and that due to reporting gaps, these 36 cases do not represent
43 a complete count of all deaths in which the use of a CED was involved.

44 45 *Prospective Field Evaluations*

46
47 Two recent studies are instructive.^{50,51} One prospective, multicenter, observational study tracked a
48 consecutive case series of all CED weapon uses against criminal suspects at six U.S. law
49 enforcement agencies for three years (2005-2008).⁵⁰ Physician site investigators reviewed police
50 and medical records to identify and classify injuries sustained by subjects after CED use. To
51 quality for consideration, law enforcement agencies had to use conducted electrical weapons, have

1 a physician already affiliated with the agency's tactical team with access to agency records, provide
2 routine pre-incarceration medical screening to all arrestees (jail intake, paramedic evaluation at the
3 scene, physician evaluation in hospital emergency departments), and perform mandatory use-of-
4 force reviews after each CED use. CEDs were used against 1,201 subjects during a 36-month
5 period; probe mode was used in 65% of subjects, stun mode in 27%, and both modes in the
6 remainder. The mean number of discharges was 1.8 (median = 1).

7
8 Significant injuries (i.e., those requiring hospital admission, producing long-term disability, or that
9 were life threatening) occurred in three subjects (0.25%), including two intracranial injuries from
10 falls and one case of rhabdomyolysis. The remainder were classified as suffering minor or no
11 injuries. The majority of mild injuries were superficial puncture wounds from the darts, and some
12 blunt trauma or bruising attributable to falls. Two subjects died in police custody, but medical
13 examiners eliminated CED use as a causal or contributory factor in both cases. Both subjects had
14 struggled violently with police, and required additional restraint measures. One suffered from
15 cardiomyopathy and had cocaine in his system; the other was being treated for mental illness
16 (unspecified), and was subdued only after pepper spray application, two CED discharges, and
17 restraint in the prone position. The subject collapsed 5 minutes after CED discharge, and was
18 subsequently found to have an extremely high serum concentration of olanzapine. This outcome
19 was judged to be "typical of other in-custody deaths."

20
21 The most carefully controlled prospective study involved an analysis of 426 consecutive CED
22 activations in the Dallas police department from November 2004 through January 2006.⁵¹ The
23 study established an ongoing registry of CED application (Taser® X-26) after introduction of the
24 device into the force continuum. All suspects who were subdued following CED activation were
25 evaluated by paramedics, the jail intake nurse, or a police department tactical physician. In
26 addition, the on-call tactical physician, if not already on the scene, was notified of the activation.
27 Medical review of the registry entrants ultimately was conducted by the physician-led medical
28 team.

29
30 One subject collapsed during transfer from the ground to the ambulance (after two standard
31 discharges) and subsequently died. This individual had high serum concentrations of cocaine and
32 metabolites and a core body temperature of > 107° F on arrival at the emergency room. No other
33 suspect had an injury requiring treatment other than simple first aid. In 5.4% of the deployments
34 the Taser® was deemed to have clearly prevented the use of lethal force. This study helps to
35 corroborate the safety profile for CED use when a prescribed policy is followed. The use of a
36 comprehensive training program likely contributed to the strong safety record in this study, as well
37 as the fact that police personnel knew all Taser® applications would be strictly evaluated for
38 compliance with established departmental use-of-force policies.

39 40 USE OF CONDUCTED ELECTRICAL DEVICES IN HEALTH CARE FACILITIES

41
42 In many hospitals security is provided by contract agencies or off-duty law enforcement personnel.
43 The Joint Commission standard EC.2.10 addresses security, noting: "The hospital identifies and
44 manages its security risks." The Element of Performance for EC.2.10.1 states: "The hospital
45 develops and maintains a written management plan describing the process it implements to
46 effectively manage the security of patients, staff, and other people coming to the hospital's
47 facilities." Furthermore, the Joint Commission surveys hospitals to ensure that the hospital
48 complies with the policies that it has established based on the risk assessment for that facility.
49 Available personnel and security assessments vary greatly among hospitals, so a uniform Joint
50 Commission-based guideline on the use of CEDs in hospitals is probably not warranted.

1 Concern has been expressed, as noted above, about the use of CEDs in individuals who are not
2 compliant with law enforcement because of existing mental health problems. Although a few
3 media reports of CED use in violent patients confined to mental health facilities have appeared, no
4 systematic review or study of CED use for controlling violent patients or their use as negative
5 reinforcement in uncooperative patients is available. Psychiatric facilities that accept Medicaid or
6 Medicare payments are not permitted to use CEDs. Regardless, CEDs should not be used for the
7 purpose of negative reinforcement in such patients.

8 9 SUMMARY AND CONCLUSION

10
11 Concerns about the use of CEDs fall into three general areas: (1) they are used too frequently and
12 at lower levels on the use-of-force continuum than indicated; (2) appropriate training and
13 supervision of CED use is lacking in some jurisdictions; and (3) CEDs may contribute to the death
14 of suspects, either directly or indirectly.

15
16 CEDs have a role to play in law enforcement and prudent use can save lives during interventions
17 that would otherwise involve the use of deadly force. If deployed according to an appropriate use-
18 of-force policy, and used in conjunction with a medically driven quality assurance process, Taser®
19 use by law enforcement officers appears to be a safe and effective tool to place uncooperative or
20 combative subjects into custody. Treating CEDs as “only a substitute for deadly force, would
21 endanger officers and negate the benefit that has been demonstrated.”⁸ Training protocols should
22 emphasize that multiple activations and continuous cycling of CEDs appear to increase the risk of
23 death or serious injury.¹⁰

24
25 The growing use of CEDs makes it virtually inevitable that more cases of in-custody death are
26 occurring in proximity to CED activation. As noted by Link and Estes, important variables
27 confounding Taser®-related deaths “cannot be fully investigated in retrospective reviews,
28 registries, or reproduced in clinical investigations.”⁵² The “influence of confounding clinical
29 factors such as excited delirium, physical restraint techniques, underlying cardiovascular disease,
30 hyperadrenergic states, metabolic derangements, or the influence of alcohol, stimulants, or other
31 drugs remains unknown in epidemiologic investigations, and uncontrollable in clinical
32 investigations.”

33
34 Ongoing issues include: (1) the need for clear usage guidelines, including restrictions on the
35 application of multiple discharges; (2) an appreciation of the potential risks of injury and death
36 associated with CED use and the gaps in knowledge about potential factors that affect the relative
37 safety of deployment, and the risks of sudden death after exposure and physical restraint; (3) the
38 need for independent peer-reviewed research into the safety (and usefulness) of CEDs in field
39 applications; and (4) the need to establish a more comprehensive national database of in-custody
40 deaths.

41 42 RECOMMENDATIONS

43
44 The Council on Science and Public Health recommends that the following statements be adopted in
45 lieu of Resolution 401(A-08) and the remainder of the report be filed:

- 46
47 1. That our American Medical Association establish policy that law enforcement departments and
48 agencies should have in place specific guidelines, rigorous training, and an accountability
49 system for the use of conducted electrical devices (CEDs) that is modeled after available
50 national guidelines. (New HOD Policy)

- 1 2. That our AMA encourage additional independent research involving actual field deployment of
2 CEDs to better understand the risks and benefits under conditions of actual use. Federal, state,
3 and local agencies should accurately report and analyze the parameters of CED use in field
4 applications. (Directive to Take Action)
5
- 6 3. That our AMA establish policy that law enforcement departments and agencies have a
7 standardized approach to the medical evaluation, management and post-exposure monitoring of
8 subjects exposed to CEDs. (New HOD Policy)

Fiscal Note: Less than \$500

REFERENCES

1. Amnesty International. Less than lethal? The use of stun weapons in U.S. law enforcement. Amnesty International Publications. London, England. 2008.
2. Taser. Taser International. www.taser.com. Accessed January 28, 2009.
3. S-200 Stun Gun. Stingers Systems. www.stingersystems.com. Accessed January 31, 2009.
4. State statutes summary. Taser International. www.taser.com/SiteCollectionDocument/Controlled%20Documents/Legal/7-2007%20State%20Statute%20Summary.pdf. Accessed January 20, 2009.
5. United States Government Accountability Office. Taser weapons: use of tasers by selected law enforcement agencies. Report to the Chairman of the Subcommittee on National Security, Emerging Threats and International Relations. Committee on Government Reform, House of Representatives. Washington, DC; 2005.
6. Federal Law Enforcement Training Center. Department of Homeland Security. www.fletc.com. Accessed January 30, 2009.
7. U.S. Department of Justice Office of Justice Programs. National Institute of Justice. Study of deaths following electro muscular disruption: interim report. Washington, DC; 2008.
8. Roskker B, Hanser L, Hix W, et al. Evaluation of the New York City police department firearm training and firearm-discharge review process. Santa Monica, CA: Rand Corporation-Center on Quality Policing; 2008.
9. Young D. Definition and explanation of less-lethal. Community emergency response team. <http://www.policeone.com/CERT/articles/94021-Definition-and-explanation-of-less-lethal/>. Accessed March 24, 2009.
10. Cronin JEJ. Conducted Energy Devices: Development of Standards for Consistency and Guidance. Washington, DC: U.S Department of Justice Office of Community Oriented Policing Services and Police Executive Research Forum; 2006.
11. Lakkireddy D, Wallick D, Verma A, et al. Cardiac effects of electrical stun guns: does position of barbs contact make a difference? *Pacing Clin Electrophysiol*. 2008;31:398-408.
12. Lakkireddy D, Wallick D, Ryschon K, et al. Effects of cocaine intoxication on the threshold for stun gun induction of ventricular fibrillation. *J Am Coll Cardiol*. 2006;48:805-811.
13. McDaniel WC, Stratbucker RA, Nerheim M, Brewer JE. Cardiac safety of neuromuscular incapacitating defensive devices. *Pacing Clin Electrophysiol*. 2005;28(Suppl 1):S284-S287.
14. Dennis AJ, Valentino DJ, Walter RJ, et al. Acute effects of TASER X26 discharges in a swine model. *J Trauma*. 2007;63:581-590.
15. Nanthakumar K, Billingsley IM, Masse S, et al. Cardiac electrophysiological consequences of neuromuscular incapacitating device discharges. *J Am Coll Cardiol*. 2006;48:798-804.

16. Valentino DJ, Walter RJ, Dennis AJ, et al. Taser X26 discharges in swine: ventricular rhythm capture is dependent on discharge vector. *J Trauma*. 2008;65:1478-1485.
17. Walter RJ, Dennis AJ, Valentino DJ, et al. TASER X26 discharges in swine produce potentially fatal ventricular arrhythmias. *Acad Emerg Med*. 2008;15:66-73.
18. Lakkireddy D, Khasnis A, Antenacci J, et al. Do electrical stun guns (TASER-X26) affect the functional integrity of implantable pacemakers and defibrillators? *Europace*. 2007; 9:551-556.
19. Calton R, Cameron D, Masse S, Nanthakumar K. Duration of discharge of neuromuscular incapacitating device and inappropriate implantable cardioverter-defibrillator detections. *Circulation*. 2007;15:e472-e474.
20. Pippin JJ. Taser research in pigs not helpful. *J Am Coll Cardiol*. 2007;49:731-732.
21. Ideker RE, Dossall DJ. Can the direct cardiac effects of the electric pulses generated by the TASER X26 cause immediate or delayed sudden cardiac arrest in normal adults? *Am J Forensic Med Pathol*. 2007;28:195-201.
22. Ho JD, Miner JR, Lakireddy DR, Bultman LL, Heegaard WG. Cardiovascular and physiologic effects of conducted electrical weapon discharge in resting adults. *Acad Emerg Med*. 2006;13:589-595.
23. Ho JD, Dawes DM, Reardon RF, et al. Echocardiographic evaluation of a TASER-X26 application in the ideal human cardiac axis. *Acad Emerg Med*. 2008;15:838-844.
24. Levine SD, Sloane CM, Chan TC, Dunford JV, Vilke GM. Cardiac monitoring of human subjects exposed to the taser. *J Emerg Med*. 2007;33:113-117.
25. Vilke GM, Sloane C, Levine S, Neuman T, Castillo E, Chan TC. Twelve-lead electrocardiogram monitoring of subjects before and after voluntary exposure to the Taser X26. *Am J Emerg Med*. 2008;26:1-4.
26. Vilke GM, Sloane CM, Bouton KD, et al. Physiological effects of a conducted electrical weapon on human subjects. *Ann Emerg Med*. 2007;50:569-575.
27. Dawes DM, Ho JD, Johnson MA, Lundin E, Janchar TA, Miner JR. 15-second conducted electrical weapon exposure does not cause core temperature elevation in non-environmentally stressed resting adults. *Forensic Sci Int*. 2008;176(2-3):253-257.
28. Cao M, Shinbane JS, Gillberg JM, Saxon LA. Taser-induced rapid ventricular myocardial capture demonstrated by pacemaker intracardiac electrograms. *J Cardiovasc Electrophysiol*. 2007;18:876-879.
29. Haegeli LM, Sterns LD, Adam DC, Leather RA. Effect of a Taser shot to the chest of a patient with an implantable defibrillator. *Heart Rhythm*. 2006;3:339-341.
30. Ho J, Dawes DM, Calkins H, et al. Absence of electrocardiographic change following prolonged application of a conducted electrical weapon in physically exhausted adults. *Acad Emerg Med*. 2007;14:S128-S129.

31. Ho JD, Dawes DM, Bultman LL, et al. Physiologic effects of prolonged conducted electrical weapon discharge on acidotic adults. *Acad Emerg Med.* 2007;14:S63.
32. Vilke G, Sloane C, Suffecool A, et al. Physiologic effects of the Taser on human subjects after exercise. *Ann Emerg Med.* 2007;50:S55.
33. Vilke G, Sloane C, Suffecool A, et al. Crossover-controlled human study of the physiologic effects of the Taser after vigorous exercise. *Acad Emerg Med.* 2009;15:S155-S156.
34. Koscove EM. The Taser weapon: a new emergency medicine problem. *Ann Emerg Med.* 1985;14:1205-1208.
35. Jenkinson E, Neeson C, Bleetman A. The relative risk of police use-of-force options: evaluating the potential for deployment of electronic weaponry. *J Clin Forensic Med.* 2006;13:229-241.
36. PERF Center on Force & Accountability. PERF Conducted Energy Device. Policy and Training Guidelines for Consideration . 2005. Washington, DC.
37. Smith MR, Kaminski RJ, Rojek J, et al. The impact of conducted energy devices and other types of force and resistance on officer and suspect injuries. *Policing.* 2007;30:423-446.
38. Taser International. TASER electronic control devices (ECDs): field data and risk management. [www.taser.com/research/statistics/Pages/Field Use and Statistics.aspx](http://www.taser.com/research/statistics/Pages/Field%20Use%20and%20Statistics.aspx). Accessed January 28, 2009.
39. White MRJ. The TASER as a less lethal force alternative: finding on use and effectiveness in a large metropolitan police agency. *Police Q.* 2007;10:170-191.
40. Lee B, Vittinghoff E, Whiteman D, Park M, Lau L, Tseng Z. Relation of Taser (electrical stun guns) deployment to increase in in-custody sudden deaths. *Am J Cardiol.* 2009;103:877-880.
41. Bleetman A, Steyn R, Lee C. Introduction of the Taser into British policing: implications for UK emergency departments: an overview of electronic weaponry. *Emerg Med J.* 2004; 21:136-140.
42. Kornblum RN, Reddy SK. Effects of the Taser in fatalities involving police confrontation. *J Forensic Sci.* 1991;36:434-438.
43. Ordog GJ, Wasserberger J, Schlater T, Balasubramanium S. Electronic gun (Taser) injuries. *Ann Emerg Med.* 1987;16:73-78.
44. Strote J, Range HH. Taser use in restraint-related deaths. *Prehosp Emerg Care.* 2006;10:447-450.
45. Department of Neurology. Brain Endowment Bank. Excited delirium: education, research and information. For Pathologists. University of Miami School of Medicine. <http://www.exciteddelirium.org/indexForPathologists.html>. Accessed March 24, 2009.

46. Stratton S, Rogers C, Brickett K, Gruzinski G. Factors associated with sudden death of individuals requiring restraint for excited delirium. *Am J Emerg Med.* 2001;19:187-191.
47. Report of the Standing Committee on Public Safety and National Security. Study of the conductive energy weapon-Taser. House of Commons, 39th Parliament, 2nd Session. Canada. 2008.
48. The Death in Custody Reporting Act of 2000 (P.L.106-297). 2000.
49. Mumola C. Bureau of Justice Statistics Special Report. Arrest-related deaths in the United States, 2003-2005. Washington, DC: U.S. Department of Justice; 2007.
50. Bozeman WP, Hauda WE, Heck JJ, Graham DD, Martin BP, Winslow JE. Safety and injury profile of conducted electrical weapons used by law enforcement officers against criminal suspects. *Ann Emerg Med.* 2009;53:480-489.
51. Eastman AL, Metzger JC, Pepe PE, et al. Conductive electrical devices: a prospective, population-based study of the medical safety of law enforcement use. *J Trauma.* 2008; 64:1567-1572.
52. Link MS, Estes NA. Cardiac safety of electrical stun guns: letting science and reason advance the debate. *Pacing Clin Electrophysiol.* 2008;31:395-397.