

Nos. 25-238 & 25-566

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IN THE  
**Supreme Court of the United States**

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CUTBERTO VIRAMONTES, *et al.*,  
*Petitioners,*

v.

COOK COUNTY, ILLINOIS, *et al.*,  
*Respondents.*

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EDDIE GRANT, JR., *et al.*,  
*Petitioners,*

v.

RONNELL HIGGINS, IN HIS OFFICIAL CAPACITY AS  
COMMISSIONER OF THE CONNECTICUT  
DEPARTMENT OF EMERGENCY SERVICES AND  
PUBLIC TRANSPORTATION, *et al.*,  
*Respondents.*

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**On Writs of Certiorari to the  
United States Courts of Appeals  
for the Seventh and Second Circuits**

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**BRIEF OF EXPERTS IN BALLISTICS, TRAUMA  
MEDICINE, PUBLIC HEALTH, AND  
FIREARMS HISTORY AND LAW AS *AMICI  
CURIAE* IN SUPPORT OF RESPONDENTS**

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AARON R. MARCU  
*Counsel of Record*  
TAYLOR JACHMAN  
AEDAN COLLINS  
AUDREY STONE  
FRESHFIELDS US LLP  
3 World Trade Center  
175 Greenwich Street  
51st Floor  
New York, NY 10007  
(212) 277-4000  
aaron.marcu@freshfields.com

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**INTEREST OF AMICI CURIAE<sup>1</sup>**

*Amici curiae* are leading scholars, scientists, and clinical practitioners in wound ballistics, trauma surgery, public health, and firearms history and law.<sup>2</sup> Amici have spent their careers studying the mechanics of ballistic injury, treating victims of firearm violence, analyzing population-level firearm trauma, and researching the historical and legal regulation of lethal weaponry.

Amici submit this brief to assist the Court by providing objective, empirical evidence regarding the biomechanical and ballistic profile of AR-15-style semiautomatic rifles—specifically, how high muzzle velocity, energy transfer, and cavitation produce exceptional tissue lethality compared to standard handguns and historic long guns. This empirical analysis bears directly on whether such firearms constitute “dangerous and unusual” weapons under the Second Amendment’s historical tradition of arms regulation.

**Bishwajit Bhattacharya, MD, FACS** is a trauma and critical care surgeon at Yale New Haven Hospital’s Level 1 Trauma Center and an Associate Professor of Surgery at Yale School of Medicine.

**Charles Branas, PhD** is Gelman Professor of Epidemiology and Chair of the Department of Epidemiology at the Columbia University Mailman School of Public Health. He is a founding Principal Investigator of two CDC-funded research institutions: the Columbia Center for Injury Science and Prevention and the Penn Injury

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<sup>1</sup> Pursuant to Rule 37.6, *amici* certify that no party’s counsel authored this brief in whole or in part. No one other than *amici* or their counsel funded its preparation or submission.

<sup>2</sup> Institutional affiliations are provided solely for identification purposes. *Amici* appear in their individual capacities, and this brief does not reflect the views of their respective institutions.

Science Center. His landmark studies on gun violence have been cited by this Court, Congress, and major news organizations.

**Shani Buggs, PhD, MPH** is an Associate Professor of Emergency Medicine at the University of California Davis Centers for Violence Prevention. Her research uses qualitative, quantitative, and mixed-methods approaches to examine firearm laws and policies, weapon availability, and violence reduction initiatives.

**Kimberly Davis, MD, MBA, FACS, FCCM** is the Chief of General Surgery, Trauma, and Surgical Critical Care for Yale Medicine, and the Medical Director of Trauma for Yale New Haven Hospital, a Level 1 Trauma Center. She is also a Professor of Surgery at Yale School of Medicine.

**David J. Milia, MD, FACS** is the Trauma Medical Director at the Medical College of Wisconsin. He is a co-author of *Experimental Wound Ballistic Study to Understand Biomechanical Differences in Gunshot Wounds from Various Bullets and Firearms*, 22 Forensic Sci., Med. & Pathology 277 (2026), a peer-reviewed, first-of-its-kind comparative wound ballistics study quantifying tissue damage metrics over a range of firearms.

**Darrell Miller, JD** is the Harry N. Wyatt Professor of Law at the University of Chicago Law School. A leading scholar on the Second Amendment, he co-authored the casebook *The Second Amendment: Gun Rights and Regulation* (2025), and a monograph, *The Positive Second Amendment: Rights, Regulation, and the Future of Heller* (2018). His work has been published in the University of Chicago Law Review, the Harvard Journal of Law & Public Policy, the Yale Law Journal and other leading journals. See, e.g., *What Is Gun Control? Direct Burdens, Incidental Burdens, and the Boundaries of the Second Amendment*, 83 U. Chi. L. Rev. 295

(2016); *Common Good Gun Rights*, 46 Harv. J.L. & Pub. Pol’y 1029 (2023).

**Frank A. Pintar, PhD** is a Professor in the Joint Department of Biomedical Engineering at Marquette University and Medical College of Wisconsin. He has authored more than 500 research publications, including two books on head and neck trauma and over 320 peer-reviewed papers. He is a co-author of *Experimental Wound Ballistic Study to Understand Biomechanical Differences in Gunshot Wounds from Various Bullets and Firearms*, 22 Forensic Sci., Med. & Pathology 277 (2026), a peer-reviewed, first-of-its-kind comparative wound ballistics study quantifying tissue damage metrics over a range of firearms.

**Therese S. Richmond, PhD, RN, FAAN** is a Professor of Nursing at the University of Pennsylvania and the co-founder of the Penn Injury Science Center. Dr. Richmond is an elected member of the National Academy of Medicine and has extensive clinical trauma-care experience. She has published a substantive body of research focused on preventing firearm violence and the outcomes of serious injury.

**Jennifer Tucker, PhD** is a Professor of History at Wesleyan University and the Founding Director of the Center for the Study of Guns & Society at Wesleyan. A leading historian of science, medicine, and technology, her research examines a wide variety of topics in firearms history including the technologies, manufacture, and possession of historical arms and ammunition, and their associated rights and regulations. She has authored two books and authored or co-authored over thirty research articles in leading peer-reviewed books and journals. *See, e.g.,* Tucker et al., eds., *The Contested Role of History in Contemporary Debates on the Second Amendment* (Smithsonian Institution Scholarly Press, 2019); Darrell

Miller & Jennifer Tucker, *Common Use, Lineage, and Lethality*, 55 U.C. Davis L. Rev. 101 (2022); and the Journal of American Medical Association *Report on Reducing Firearm Violence and Harms* (2025). She is a member of the American Historical Association and Fellow of the Royal Historical Society.

### SUMMARY OF ARGUMENT

Under this Court’s jurisprudence, the Second Amendment inquiry is “whether the challenged regulation is consistent with the principles that underpin our regulatory tradition.” *United States v. Rahimi*, 602 U.S. 680, 692 (2024). The historical tradition rests on the principle of regulating “dangerous and unusual weapons” to protect the public from exceptional threats of harm. *District of Columbia v. Heller*, 554 U.S. 570, 627 (2008). Applying that principle requires judges to ask a practical question: What is this weapon capable of doing?

Lethality is an objective measure of dangerousness. It is a physical property of the weapon, determined by its design and the laws of physics: the energy its projectile delivers to the human body, the damage that energy does to tissue, and the speed, accuracy, and repetition with which the weapon can deliver every round. Lethality looks past categorical labels, appearance, marketing, and resemblance to earlier firearms. It measures a weapon’s capacity to harm.

To assist the Court’s analysis, *Amici* present newly available empirical evidence that demonstrates the lethal capacity of various modern and historical firearms across the same objective metrics. Those measurements provide a

common basis for evaluating the inherent lethality of the AR-15<sup>3</sup> against modern and historical firearms.

The physics is undeniable. Across every objective lethality metric, the AR-15 is nothing like the handguns addressed in *Heller*. By contrast, across those same metrics, the AR-15 is functionally indistinguishable from the U.S. military's M16. This makes sense: the AR-15 was specifically designed to empower U.S. soldiers to exert extraordinary lethal force on the battlefield.

And the AR-15's phenomenal lethality is not confined to a single shot. Its destructive force can be delivered rapidly, accurately, and repeatedly. The result is extraordinary even by modern standards: lethal force that once required a battalion of armed individuals is now concentrated in a single weapon and a single shooter. A lone individual armed with an AR-15 can murder classrooms full of children, religious worshippers, concertgoers, families at a Fourth of July parade, and ordinary people doing their grocery shopping in minutes.

*Amici* urge the Court to evaluate these weapons for what they are: what they were designed for, how they are used, and what they do. By that measure, AR-15s and similar semiautomatic rifles are extraordinarily lethal. Governments in the United States have long regulated and even banned weapons like them. The Court should look past sales figures, the label "rifle," and superficial mechanical similarities between the challenged firearms and other firearms. Banning the AR-15 does not violate the Second Amendment.

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<sup>3</sup> "AR-15" refers to AR-15s and similar semiautomatic rifles. See Greg Myre, *A Brief History of the AR-15*, NPR (Feb. 28, 2018), <https://perma.cc/UNB9-9KA2> ("AR-15 has become the umbrella term for a range of semi-automatic rifles.").

## ARGUMENT

### I. THE SECOND AMENDMENT INQUIRY HAS ALWAYS BEEN CONCERNED WITH DANGEROUSNESS

This case asks whether the Second Amendment permits state and local governments to enact regulations prohibiting certain AR-15 platform rifles. Under the test announced in *New York State Rifle & Pistol Ass’n v. Bruen*, courts must determine whether a challenged regulation is “consistent with this Nation’s historical tradition of firearm regulation,” recognizing that “cases implicating unprecedented societal concerns or dramatic technological changes may require a more nuanced approach” to that historical inquiry. 597 U.S. 1, 17, 27 (2022). *Rahimi* makes clear that historical “precedents were not meant to suggest a law trapped in amber.” 602 U.S. at 691. The relevant inquiry is “whether the challenged regulation is consistent with the *principles* that underpin our regulatory tradition.” *Id.* at 692 (emphasis added).

Those principles consistently converge on a core concept: dangerousness. In *District of Columbia v. Heller*, the Court recognized this Nation’s historical tradition of regulating “dangerous and unusual” weapons. 554 U.S. at 627. The Founding generation would have understood that phrase as a hendiadys: two words joined to express a single idea, much like “cruel and unusual” or “nice and hot.” See Darrell A.H. Miller et al., *Lethality and the Historical Principles of Arms Regulation*, 54 Pepperdine L. Rev. (forthcoming 2026) (manuscript at 3).<sup>4</sup> It thus describes weapons that are *unusually dangerous* or *exceptionally dangerous*. See Samuel L. Bray, “Necessary and Proper” and “Cruel and Unusual”: *Hendiadys in the Constitution*, 102 Va. L. Rev. 687, 699 (2016). Blackstone points the same way,

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<sup>4</sup> [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=7525418](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=7525418)

describing the long-accepted offense at common law of “riding or going armed, with dangerous *or* unusual weapons, [to] terrify[] the good people of the land.” 4 William Blackstone, *Commentaries on the Laws of England* 148–149 (1769); see *Rahimi*, 602 U.S. at 697. As the Seventh Circuit recently explained, “[u]sing one or another label—‘dangerous and unusual,’ ‘unusually dangerous,’ ‘especially dangerous,’ ‘particularly capable of unprecedented lethality’”—nearly every court to confront the issue has “coalesced around a largely overlapping set of historical regulations imposing targeted restrictions on weapons whose danger and lethality stand out.” *Barnett v. Raoul*, 180 F.4th 1035, 1047 (7th Cir. 2026) (St. Eve, J.). See, e.g., *Ocean State Tactical, LLC v. Rhode Island*, 95 F.4th 38, 44–52 (1st Cir. 2024); *Capen v. Campbell*, 134 F.4th 660, 669–73 (1st Cir. 2025); *Nat’l Ass’n for Gun Rts. v. Lamont*, 153 F.4th 213, 240–47 (2d Cir. 2025); *Bianchi v. Brown*, 111 F.4th 438, 464–72 (4th Cir. 2024); *Duncan v. Bonta*, 133 F.4th 852, 874–84 (9th Cir. 2026); *Hanson v. District of Columbia*, 120 F.4th 223, 234–40 (D.C. Cir. 2024).

The historical tradition responded to exceptional dangers a weapon posed to public safety. See Miller et al., *Lethality*, *supra*, at 32–43. Dangerousness is not to be considered in the abstract. It asks what a weapon enables its user to do and the danger that capability poses to human life and public safety. The constitutional significance of a weapon lies not in what it is called, what it looks like, or how popular it is, but in what it is capable of doing. See *id.* at 32–33.

Lethality is the most direct and objective measure of dangerousness. *Id.* at 20–23. It is an inherent function of the weapon’s technological design and the laws of physics. A firearm’s capacity to kill and injure derives from physical characteristics that can be observed and compared: the velocity with which it fires a projectile, the energy with

which that projectile impacts the human body, the resulting tissue damage, and the speed, accuracy, and repetition with which that force can be delivered. Those metrics permit courts to compare weapons across different designs, technologies, and historical eras using common objective criteria. *Id.* at 26–28.

Lethality looks beyond appearance and superficial resemblance to historical predecessors. It cuts through marketing and categorical labels. And it is indifferent to popularity and manufacturing statistics. Instead, it asks a concrete question: how dangerous is the weapon, measured by what it is inherently capable of doing?

## **II. AR-15 PLATFORM RIFLES ARE EXTRAORDINARILY LETHAL IN ABSOLUTE AND COMPARATIVE TERMS**

Objective measurements of lethality become especially clear through comparison. *Heller* supplies two natural benchmarks: the handgun, which the Court identified as the “quintessential self-defense weapon,” and the M16, which is among the weapons that the Court described as “most useful in military service” and that “may be banned.” 554 U.S. at 627, 629.

Much of the evidence regarding the AR-15’s lethality comes from clinical, forensic, and other first-hand observations of the injuries it causes. The evidence is powerful and directly related to the “unprecedented societal concerns” that have motivated efforts to regulate these dangerous weapons. *Bruen*, 597 U.S. at 27. Because photographs of the horrific wounds caused by an AR-15 are too shocking to be released for public review, critics have debated the veracity or weight of these observations, arguing that the descriptions are “overdramatized” or “exaggerated” and reflect factors other than the firearm itself. Brief of *Amici Curiae* Ballistics Experts & Second

Amend. Law Professors in Supp. of Pet’rs (“Ballistics Amicus Br.”) 25–27.

Newly available empirical data settles that debate by providing objective evidence of the AR-15’s lethality compared to modern and historical firearms.

#### **A. New Empirical Data Permit Direct, Objective Comparison of the AR-15’s Lethality**

Recent advances in synthetic ballistic gelatin and high-speed video technology made it possible for researchers to test a wide range of firearms under uniform conditions and measure tissue damage metrics—such as velocity, energy transfer, and temporary cavity formation—with a level of precision that earlier studies could not achieve.

The first-of-its-kind peer-reviewed comparative study published in *Forensic Science, Medicine and Pathology* provides objective evidence of a weapon’s capacity for injury. See Joseph LeSueur et al., *Experimental Wound Ballistic Study to Understand Biomechanical Differences in Gunshot Wounds from Various Bullets and Firearms*, 22 *Forensic Sci., Med. & Pathology* 277 (2026).<sup>5</sup> An interdisciplinary team from the Medical College of Wisconsin and Marquette University’s Departments of Biomedical Engineering, Neurosurgery, Surgery and Emergency Medicine, and the Comprehensive Injury Center, working with the Wisconsin Department of Justice’s Firearms and Toolmark Analysis Unit, tested 21 firearm-and-ammunition combinations, including handguns, a nineteenth-century lever-action rifle, an AR-15, an M16, and a submachine gun. *Id.* at 279. Each weapon was fired into synthetic ballistic gelatin blocks approximating the tissue depth of an adult human torso or limb. *Id.* The gelatin was validated against human and animal data to accurately

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<sup>5</sup> <https://perma.cc/V69S-B7K6>

simulate biological muscle tissue. *Id.* at 278. Pressure sensors and high-speed video (capturing up to 100,000 frames per second) were used to quantify a bullet's effects at the moments of and immediately after impact. *Id.* at 281. Because every round was tested in the same validated medium under identical conditions, the study was able to isolate differences attributable to the firearms themselves. *Id.* at 279, 284.

The table below shows the measurements collected for firearms relevant to this Court's Second Amendment jurisprudence: a Founding-era musket; a Winchester 1873 rifle; modern handguns; the AR-15, and the M16.<sup>6</sup>

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<sup>6</sup> Researchers at Cranfield Defence and Security were able to substantially replicate the experiment, using similar synthetic ballistic gel and high-speed video technology. Katherine Hewins & Rachael Hazael, *Temporary Wound Cavitation Data from Clear Ballistic Gel with a Selection of Weapon Systems* (Aug. 28, 2026), <https://perma.cc/3D5W-N2DB>. Their results closely track the Wisconsin findings. The Cranfield team also tested a weapon the Wisconsin study did not test: the Brown Bess flintlock musket, the standard British infantry arm of the Revolutionary Era. The musket provides the Court an additional benchmark not present in the Wisconsin testing, one from the period of the Nation's Founding. The Brown Bess measurements are the average of the three tests performed in the Cranfield study. *Id.* at 6, 8. All other measurements referenced in the table and throughout this brief are from the study at the Wisconsin Crime Lab. LeSueur et al., *supra*, at 279, 281. Velocity and cavity diameter measurements were converted from metric to imperial units.

| Firearm                     | Bullet           | Bullet Mass | Velocity  | Energy Transfer | Cavity Size |
|-----------------------------|------------------|-------------|-----------|-----------------|-------------|
| Brown Bess Flintlock Musket | .75" musket ball | 41.2 g      | 732 ft/s  | 924.5 J         | 3.17 in     |
| Winchester 1873 Rifle       | .32-20 caliber   | 7.45 g      | 1150 ft/s | 312.6 J         | 1.46 in     |
| Polymer80 PMF               | 9 mm             | 7.45 g      | 1258 ft/s | 154.9 J         | 2.24 in     |
| Handgun                     | .32 caliber      | 4.60 g      | 912 ft/s  | 90.6 J          | 1.46 in     |
| AR-15 16"                   | 5.56 mm NATO     | 3.56 g      | 3283 ft/s | 1612.4 J        | 7.13 in     |
| M16                         | 5.56 mm NATO     | 3.56 g      | 3257 ft/s | 1438.7 J        | 6.97 in     |

Physics explains the AR-15's extraordinary lethality. Kinetic energy is measured as one-half of the bullet mass multiplied by the square of the bullet's velocity [ $\frac{1}{2}$  (Bullet Mass)  $\times$  (Velocity)<sup>2</sup>]. LeSueur et al., *supra*, at 280. Thus, speed of the projectile is the critical engine of destructive force.

An AR-15 fires a light, thin bullet at extraordinary speed: more than 3,200 feet per second. That is more than twice the speed of sound, and more than twice the velocity of the fastest handgun round (the 9mm) fired. The resulting energy transferred from the projectile into its target—a direct indicator of the damage the projectile will cause—was more than ten times greater for the AR-15 (1612 joules) than for the 9mm handgun (155 joules).

As a projectile penetrates the surface of its target, it sets surrounding material in motion, driving it outward around the channel through which the bullet passes. *Id.* at 278. The resulting expansion is the so-called "temporary cavity," which reflects how extensively, and where, the surrounding

material was displaced. *Id.* In the human body, that material is comprised of tissue, organs, blood vessels, nerves, and sometimes bone. The violent displacement in biological tissue caused by the temporary cavity results in crushing, laceration, stretching, and injury outside the projectile's direct track. *Id.*

The AR-15 projectile was less than a quarter-inch wide, yet produced a temporary cavity more than seven inches across (*see* above table)—roughly thirty times the projectile's diameter. Despite having larger bullets than the AR-15, no handgun cavity exceeded three inches. *Id.* The AR-15 and the M16 U.S. military rifle produced cavities of similar sizes. The AR-15 cavity also reached its maximum width roughly eight inches beneath the surface. LeSueur et al., *supra*, at 282. In the adult torso, that is the depth at which the liver, spleen, kidneys, intestines, and major blood vessels lie. These tissue damage metrics (speed, energy transferred, and temporary cavity) quantify a firearm's capacity to kill and injure—its lethality. The AR-15's measurements across all three metrics reflect a phenomenal capacity for lethality.

Researchers published video footage from the experiment capturing the .32-caliber handgun projectile and the AR-15 projectile moving through the ballistic gelatin. *See Comparison of Visual Dynamics in Ballistic Gelatin Between Lower-and-Higher-Energy Bullets and Guns*, JAMA Network (Dec. 9, 2024).<sup>7</sup> The video demonstrates the stark difference between the two projectiles and illustrates just how devastating the AR-15 can be. Whereas the projectile from the .32-caliber handgun can be seen taking a linear path through the gelatin, disrupting only the gelatin close to the bullet, the

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<sup>7</sup> <https://www.youtube.com/watch?v=1ZlgiTrg56w>

AR-15 projectile causes massive disruption that continues to reverberate violently after the bullet exits the gelatin.

Perhaps the most striking demonstration of the AR-15's power came when the researchers embedded a porcine (pig) femur bone in the gelatin. Pig femurs are very similar in density to human femurs and are therefore frequently used as a close biomedical model for human bone research and experiments. LeSueur et al., *supra*, at 285. Researchers deliberately fired the AR-15 bullet into the gelatin more than three inches away from the bone. The bone broke nonetheless. *Id.* at 284. The energy from the AR-15 projectile was so massive that it broke a femur bone it never came close to touching. The bone experiment established that the expanding temporary cavity of disturbed tissue caused by an AR-15 bullet can fracture a substantial structure outside the bullet's path. By contrast, a 9mm handgun round failed to produce any indirect bone fracture even when the bullet path was just one centimeter from the bone. *Id.* at 285.

Compared with handguns and historical rifles, the AR-15 strikes with much greater force, causes much wider and deeper wounds, and causes devastating damage that extends far outside the path of its projectile. Its comparative lethality is self-evident.

### **B. Clinical Observations Confirm Empirical Data**

Controlled experiments measure a weapon's capacity to injure. First-hand observations from the physicians who treat those injuries show the significance of the physics when the target is a human being.

To give context to the study's measurements, trauma surgeon Rochelle Dicker reviewed the footage of the AR-15 projectile passing through the ballistic gelatin, *see supra*, n.7, and explained what those effects would mean in

treating a patient. *See* 5.56 *NATO Bullet Travels Through Gelatin*, Medical College of Wisconsin (Feb. 18, 2026).<sup>8</sup> She described “absolute mutilation inside the body.” *Id.* at 05:10. If the victim makes it to the hospital, they will require immediate surgery, but “they may not make it out of the trauma bay to the operating room with this kind of an injury.” *Id.* at 02:30. If the patient does make it to surgery, “you also can’t really anticipate that there’s going to be just one cavity that’s impacted.” *Id.* at 03:01. The initial task of stopping the bleeding can be “an hours-long project . . . and the further out you get into those hours, the more likely that you’ll have significant secondary issues . . . and you start to spiral into this endless, significant, life-threatening situation.” *Id.* at 04:44.

Other physicians’ clinical experience confirms the same devastating injuries. Trauma surgeon Babak Sarani explained that the energy transferred from an AR-15 projectile “is so massive . . . your body will literally tear apart.” N. Kirkpatrick, et al., *The Blast Effect*, Wash. Post (Mar. 27, 2023).<sup>9</sup> Another trauma surgeon Jeremy Cannon said: “The tissue destruction is almost unimaginable. Bones are exploded, soft tissue is absolutely destroyed. The injuries to the chest or abdomen – it’s like a bomb went off.” Gina Kolata & C.J. Chivers, *Wounds From Military-Style Rifles? ‘A Ghastly Thing to See’*, N.Y. Times (Mar. 4, 2018).<sup>10</sup> Even nonfatal wounds can be catastrophic. *Id.* Dr. Cannon explained that when an AR-15 bullet hits an arm or a leg, “the limb often hangs at an unnatural angle.” *Id.* These victims can require numerous surgeries over months and may not be able to avoid amputation. *Id.*

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<sup>8</sup> <https://vimeo.com/1166125062>

<sup>9</sup> <https://www.washingtonpost.com/nation/interactive/2023/ar-15-damage-to-human-body>

<sup>10</sup> <https://www.nytimes.com/2018/03/04/health/parkland-shooting-victims-ar15.html>

Clinical observations also confirm the stark difference between handgun and AR-15 wounds demonstrated by the experimental data. Dr. Martin Schreiber—Director of Surgical Research at Madigan Army Medical Center and former Director of the Joint Theater Trauma System for U.S. Central Command—explained that “energy imparted to a human body by a high velocity weapon is exponentially greater” than that from a handgun: “You will see multiple organs shattered. The exit wounds can be a foot wide. I’ve seen people with entire quadrants of their abdomens destroyed.” *Id.*<sup>11</sup> Trauma surgeon Peter Rhee explained that an AR-15 wound “looks like a grenade went off” in the body, whereas a 9mm handgun wound “looks like a bad knife cut.” Sarah Zhang, *What an AR-15 Can Do to the Human Body*, WIRED (June 17, 2016).<sup>12</sup>

Radiologist Heather Sher, who diagnoses handgun wounds “almost daily,” explained that a handgun bullet typically leaves a laceration that appears as a “linear, thin, gray bullet track through the organ.” Heather Sher, *What I Saw Treating the Victims From Parkland Should Change the Debate on Guns*, The Atlantic (Feb. 22, 2018).<sup>13</sup> But when Dr. Sher treated victims of the mass shooting at Marjory Stoneman Douglas High School—in which a lone gunman with an AR-15 rifle shot 34 people, killing 17, of whom 14

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<sup>11</sup> Petitioners’ *amici* dismiss Dr. Schreiber’s observation as among the “overdramatized and unscientific” descriptions of AR-15 wounds. Ballistics Amicus Br. 25–26. That characterization is difficult to square with his extensive experience as a trauma surgeon in combat hospitals in Iraq and Afghanistan and the consistent clinical observations of the numerous trauma surgeons and other physicians discussed in this section. See Martin Schreiber, Biography, <https://www.martinschreiber.co/biography/>.

<sup>12</sup> <https://perma.cc/SHH7-MTJR>

<sup>13</sup> <https://www.theatlantic.com/politics/archive/2018/02/what-i-saw-treating-the-victims-from-parkland-should-change-the-debate-on-guns/55393>

were students—the injuries were shockingly different. *Id.* On the CT scan of one teenage victim, an “organ looked like an overripe melon smashed by a sledgehammer, and was bleeding extensively.” *Id.* “One of the trauma surgeons opened [another] young victim in the operating room, and found only shreds of an organ that had been hit by a bullet from an AR-15. . . . Nothing was left to repair—and utterly, devastatingly, nothing could be done to fix the problem.” *Id.* The injury was fatal. *Id.*

Indeed, the disparity in tissue damage can translate into whether a wound is treatable or fatal. Trauma surgeon Alok Gupta explained that, because a “wound from a handgun follows a narrow path,” it is “easier to figure out what is injured.” Kolata, *supra*. Even a handgun bullet wound to the heart can be repaired, Dr. Gupta said. *Id.* But with an AR-15, “[i]f they are shot in the torso, there often is not a whole lot we can do,” said trauma surgeon Jeffrey Kerby. *Id.* Trauma surgeon Nicholas Namias explained the difference this way: “If you have an injury from a bullet going through an artery at a low velocity [referring to a handgun projectile], you repair it and go on your way. If you have a high velocity bullet, now you have a huge cavity. Imagine a cavity the size of your fist where everything that should have been there no longer is. How do you fix that?” Alex Daugherty, *Why AR-15 injuries are so devastating*, Miami Herald (Feb. 25, 2018).<sup>14</sup> “We’re surgeons, we’re not gods.”

A young child’s smaller body will suffer still more severe consequences from these weapons. A 10-year-old child struck in the torso with an AR-15 projectile would sustain “devastating [injuries] to vital structures in the abdomen or the chest that very well will not be survivable,” said pediatric trauma surgeon Katy Flynn-O’Brien after reviewing the video of the ballistic gelatin test. *Pediatric Trauma*

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<sup>14</sup> <https://perma.cc/FD66-B34H>

*Surgeon Describes Effects of 5.56 NATO Bullet in Pediatric Trauma Patient* at 00:12, Medical College of Wisconsin (May 29, 2026).<sup>15</sup> If the child makes it to surgery, “hopefully, we’ll be able to address whatever we find. But as you can see from this video [of the AR-15 projectile in the ballistic gelatin], what I might see” on the operating table “truly won’t represent the damage that has been done to this child’s body. Blast injury can affect organs well beyond the holes I see.” *Id.* at 01:27. And that damage often continues to develop even after the initial injury has been treated. Dr. Flynn-O’Brien explained that she would likely have to leave the patient’s abdomen or chest open after surgery to assess the “continued destruction that happened to this child’s tissues from a bullet like this . . . that which I can initially see and that which potentially will take days to show itself.” *Id.* at 01:47–02:16.

None of the twenty children and six adults killed by an AR-15 at Sandy Hook Elementary School “had survivable or even treatable injuries,” according to former Connecticut Chief Medical Examiner H. Wayne Carver. Deposition of H. Wayne Carver II, M.D. at 23:13–14, *Pozner v. Fetzer*, No. 18-cv-3122 (Wis. Cir. Ct. Dane Cty. May 21, 2019). A pediatrician in Uvalde, Texas recalled seeing children “whose bodies had been so pulverized by the bullets fired at them, over and over again, whose flesh had been so ripped apart, that the only clue as to their identities were the blood-spattered cartoon clothes still clinging to them.” Testimony of Dr. Roy Guerrero, H. Comm. on Oversight and Reform (June 8, 2022).<sup>16</sup>

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<sup>15</sup> <https://vimeo.com/1196737168>

<sup>16</sup> <https://perma.cc/PHN8-XCNW>

### **C. AR-15s and Similar Semiautomatic Rifles Are Lethal at Scale**

The distinct lethality of the AR-15 and similar semiautomatic rifles is measured not only by a single shot. The weapon was designed to enable shooters to inflict extraordinary firepower on human victims again and again, as fast as the shooter can pull the trigger.

Petitioners place enormous weight on a single distinction: “Unlike the M-16, the semiautomatic AR-15 . . . fires just one round per pull of the trigger.” Pet’rs Br. 8. Their argument would have the Court draw the line for permissible firearm regulation at automatic weapons, which fire continuously with one pull of the trigger until the magazine is empty. By Petitioners’ logic, if a rifle requires a separate trigger pull for each shot, it cannot be regulated.

As shown in the table above, however, measured by its capacity for destruction, the AR-15 is indistinguishable from the M16. In the controlled testing, an AR-15 and M16 firing the same ammunition from the same barrel length produced nearly identical results across every metric for injury severity: impact velocity, energy transferred, and wound cavity. *Heller* recognized that weapons “most useful in military service—M-16s and the like—may be banned.” 554 U.S. at 627. The AR-15 is the clearest example of “the like.” Interpreting *Heller* to mean that the ability to continue firing while the trigger is depressed is a bright and dispositive line which regulators and legislators are prohibited from crossing finds no support in the historical record or this Court’s jurisprudence.

Nor is semiautomatic fire a civilian compromise. What semiautomatic fire gives up in raw speed, it gains in control, and control makes each round count. The AR-15’s military value, like its lethality, does not rise and fall with automatic

fire. See *Operate Your Rifle Like a Pro—U.S. Army Official Manual* § 7-8 (2024) (semiautomatic fire is “[t]he most important firing technique during modern, fast moving combat” and “the most accurate means of delivering suppressive fire”).

### **1. The Lethal Capacity of AR-15s and Similar Semiautomatic Rifles is a Direct Product of Their Technological Design**

The original AR-15 was developed in the middle of the 20th Century and used extensively by the U.S. military, under the designation M16. Sara Swann, *The History of the AR-15 and How It Became a Symbol of American Gun Culture*, Poynter (June 29, 2022).<sup>17</sup> Later, a version was developed for the civilian and law enforcement market. The principal difference was that the civilian version lacked a toggle to enable automatic fire. In all other material respects, the M16 and AR-15 had identical mechanisms, technology, and lethal force. See Stephen P. Halbrook, *Illustration: ATF Ruling 81-4 and AR-15 Rifle Prosecutions, in Firearms Law Deskbook* § 9:5 (2025) (the AR-15’s parts “are interchangeable with M-16 machine gun parts” and how an AR-15 rifle can easily be converted to a machine gun); Cameron McWhirter & Zusha Elinson, *American Gun: The True Story of the AR-15* 248 (2023).

In particular, the AR-15 combines high velocity with the ability to fire shots in rapid succession due to its low recoil. It can fire “in rapid succession on a precise target, even while standing or moving, because a shooter’s position is relatively unaffected by the recoil of each shot.” *Capen v. Campbell*, 708 F. Supp. 3d 65, 86 (D. Mass. 2023), *aff’d*, 134 F.4th 660 (1st Cir. 2025); see also *Rifle Marksmanship*, U.S. Dep’t of the Army, §§ 7-8, 7-23–7-24 (2003).<sup>18</sup> Low recoil

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<sup>17</sup> <https://perma.cc/64EZ-G2CZ>

<sup>18</sup> <https://perma.cc/U3SJ-KP75>.

makes AR-15s “uniquely dangerous” compared to other high-powered rifles, which tend to have greater recoil that “necessarily disrupts follow-on shots.” *Capen*, 708 F. Supp.3d at 86. Those features minimize the time and disruption between shots and enable a shooter to shoot and kill or disable multiple targets in rapid succession.

There is a range of estimates of the rate of fire of AR-15s, but by any measure, they can fire a large volume of bullets in a very short time, and each bullet carries devastating lethal force. While Petitioners’ *amici* argue that the Seventh Circuit’s finding that an AR-15 can shoot 30-rounds in as little as five seconds is “absurd” because “[t]hat would require a superhuman trigger finger,” Ballistics Amicus Br. 10, their own counsel of record reports that he can personally empty a 30-round magazine using an AR-15 in about seven seconds. See E. Gregory Wallace, “Assault Weapon” *Myths*, 43 S. Ill. U. L.J. 193, 218 (2018). To a classroom full of 7-year-old children facing a shooter with an AR-15, 30 shots every five seconds versus every seven seconds is truly a distinction without a difference.<sup>19</sup>

The range of AR-15s compounds their lethal capability. The AR-15’s velocity allows the projectile to retain its force and accuracy at hundreds of yards. A victim cannot readily evade a projectile fired by a shooter they cannot see and that can reach them in less than one second from hundreds of yards away. It is also much more difficult for law enforcement to locate and disarm a shooter operating from substantial distance.

Other features of the challenged firearms also contribute to their capacity for lethality at scale. The AR-15’s barrel

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<sup>19</sup> Firing three 10-round magazines instead of a 30-round magazine would not make a meaningful difference with respect to lethality because it takes around two seconds for a shooter to reload a magazine. Wallace, *supra*, at 218, 237.

and stock form a straight line, reducing muzzle rise and facilitating the aiming of subsequent shots. The pistol grip accommodates the trigger hand within that configuration. Thus, it is misleading to argue that these features do not affect rate-of-fire mechanics or power. *See* Pet'r's Br. 20. Those regulated features work together to reduce the disruption between shots. They help the shooter absorb recoil, recover the sights, maintain control, and engage another target. These features are all designed to enhance the lethality of each individual shot. Every trigger pull launches another high-velocity rifle round. Every trigger pull creates another opportunity for catastrophic injury. The first shot may kill or incapacitate one victim. The shooter can then immediately redirect the rifle toward the next.

Moreover, the premise that semiautomatic fire is a civilian rather than a military attribute is a false one. The United States armed forces have long favored semiautomatic fire over full automatic *because* it is more effective: it is more accurate, which allows the shooter to deliver lethal force on the first shot and rapidly move on to the next target and leads to fewer wasted, off-target rounds. McWhirter, *supra*, at 21–25, 219. U.S. Army training materials describe semiautomatic fire as the most important firing technique during modern combat and emphasize the effectiveness of rapid semiautomatic fire. *See, e.g., Rifle Marksmanship, supra* at § 7-8; *Operate Your Rifle Like a Pro—U.S. Army Official Manual* § 7-8. The Marine Corps abandoned its use of fully automatic fire and instead adopted semiautomatic fire to “enhance lethality.” *Capen*, 708 F. Supp. 3d at 85. What matters is the destructive force and how quickly that force can be delivered. As established above, the lethality of an AR-15 far outstrips that of traditional civilian firearms.

## 2. Real-World Evidence Confirms What the Weapon's Design and Physics Predict

What laboratory testing predicts, real-world events repeatedly demonstrate. The AR-15's phenomenal capacity for lethality explains why it is so often chosen by those who set out to kill as many innocent civilians as possible, as quickly as possible.

For example, at Sandy Hook Elementary School, a gunman fired 150 rounds from an AR-15-platform rifle, murdering 20 first-graders and six adults. The entire attack lasted less than **5 minutes**. None of the children that were shot survived. Not one. They never had a chance.

In the deadliest mass shooting in U.S. history, a gunman fired more than 1,000 shots using multiple AR-platform rifles from the 32nd floor of a Las Vegas hotel into an open-air music festival nearly five football fields away. He murdered 60 people and shot a total of more than 400 in just **11 minutes**. See Darrell A.H. Miller et al., *Technology, Tradition, and 'The Terror of the People'*, 99 Notre Dame L. Rev. 1373, 1375 (2024).

Five weeks later, a gunman armed with an AR-15-platform rifle fired 450 rounds at the First Baptist Church in Sutherland Springs, Texas, murdering 26 congregants. The attack lasted just **7 minutes**. U.S. Secret Service, *Report on First Baptist Church of Sutherland Springs* (April 2025).<sup>20</sup>

In Uvalde Texas, a gunman armed with an AR-15-platform rifle fired more than 100 rounds almost immediately upon entering Robb Elementary School. 19 children and two teachers were murdered, most of whom were killed in the initial **2.5 minutes**. The children were so unrecognizable that families had to provide DNA samples to identify their bodies. See Michael Levenson, *Parents were*

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<sup>20</sup> <https://perma.cc/BKM7-WYUH>

*asked for DNA samples to help identify victims*, N.Y. Times (May 25, 2022).<sup>21</sup>

Petitioners’ *amici* argue that AR-15s account for a minority of all mass shootings historically. Ballistics Amicus Br. 34–35. But a weapon’s lethality is not dependent on its use. For example, the number of deaths caused by VX nerve agent in the last 10 years worldwide is estimated to be just one. *See North Korea used VX nerve agent to kill leader’s brother*, BBC (Mar. 7, 2018).<sup>22</sup> It is nonetheless nearly universally banned because of its exceptional lethality. *See* Chemical Weapons Convention, S. Treaty Doc. No. 103–21, 1974 U.N.T.S. 317, 358, Schedule 1 (A)(3). AR-15s, as shown by the experimental data, are both exceptionally lethal *and* commonly used to perpetrate some of the most shocking atrocities of the modern age. Indeed, they were used to perpetrate 8 of the 10 deadliest mass shootings in the United States this century. *See* Mark Follman et al., *US Mass Shootings, 1982–2026*, Mother Jones (last updated Oct. 16, 2026).<sup>23</sup> Governments have the obligation and the authority to keep the public safe. *See Kanter v. Barr*, 919 F.3d 437, 451 (7th Cir. 2019) (Barrett, J., dissenting) (governments have an “undeniably compelling interest in protecting the public from gun violence”).

**D. The historical record reflects a consistent principle: legislatures respond to exceptional danger with regulation**

The empirical and real-world evidence discussed above gives concrete meaning to the “dramatic technological changes” and “unprecedented societal concerns” that call for a “more nuanced approach” to the historical inquiry. *Bruen*, 597 U.S. at 27. Comparing the objective metrics of

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<sup>21</sup> <https://www.nytimes.com/texas-shooting-parents-dna-victims>

<sup>22</sup> <https://perma.cc/R7LN-5QMJ>

<sup>23</sup> <https://perma.cc/NK5W-4TDJ>

the Founding-era Brown Bess flintlock musket and the AR-15 reveals more than a difference in degree. The musket ball's diameter was three times that of the AR-15 bullet and more than 10 times the weight of the AR-15 bullet, yet the AR-15 produced a cavity more than twice the size of the musket ball. The extraordinary speed with which the AR-15 propels a bullet caused that outsized cavity. Miller et al., *Lethality, supra*, at 27. The design of the AR-15 thus constitutes a dramatic technological change in weaponry that could not have been envisioned by the Founders and that the *Bruen* Court acknowledged requires a more nuanced approach when analyzing efforts to regulate it.

Rate of fire magnifies the technological difference exponentially. Rate of fire is critical to assessing a firearm's lethality because it determines how rapidly, and to how many victims, the weapon can deliver its destructive force. A trained Revolutionary soldier could fire at most three rounds per minute with a Brown Bess musket. David Vergun, *The Many Weapons Used During the Revolutionary War*, Pentagon News (Mar. 6, 2026).<sup>24</sup> By contrast, the Sutherland Springs shooter fired approximately 450 rounds from an AR-15 in 7 minutes, an average of roughly 64 rounds per minute. See U.S. Secret Service, *supra*. That average is conservative because it is calculated across the entire duration of the attack rather than only periods of active firing. Even so, that translates into more than 103,000 joules of energy potentially released into human tissue per minute compared to approximately 2,774 joules for the Brown Bess. See LeSueur et al., *supra*. That is a more than 37-fold difference in the destructive force.

The “unprecedented societal concerns” are equally profound. For most of American history, a single individual lacked the practical ability to inflict mass casualties in

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<sup>24</sup> <https://perma.cc/4P6P-Q8DA>

seconds or minutes. A total of 25 mass shootings occurred in the U.S. between 1900 and 1965. *See* Bonnie Berkowitz & Chris Alcantara, *The terrible numbers that grow with each mass shooting*, Wash. Post (May 9, 2021).<sup>25</sup> In astonishing contrast, the U.S. experienced 407 mass shootings in 2025 alone; and a total of 3,514 just since 2020—an average of nearly 2 per day. *See* Gun Violence Archive (last visited Oct. 26, 2026).<sup>26</sup> The proliferation of mass shootings is not simply a familiar problem occurring more often. They are a distinctly modern phenomenon made possible by the interaction of modern weapons technology and modern societal conditions. Schools containing hundreds or thousands of students, malls and supermarkets, skyscrapers and hotels, music festivals, and rapid transportation have created circumstances that previous generations scarcely could have imagined: a lone individual with one weapon capable of inflicting casualties on a scale that historically required the coordinated efforts of many armed persons. Legislatures confronting this reality are not responding to ordinary crime. They are responding to an unprecedented societal concern.

This experimental and real-world evidence give context for what it means for a firearm to be the product of “dramatic technological change” and the principles underpinning the regulations challenged here. “[W]hether the challenged regulation is consistent with the principles that underpin our regulatory tradition” is not an inquiry that can be conducted in the abstract. *Rahimi*, 602 U.S. at 692. To determine whether the modern regulation is consistent with historical principles, the Court must understand the nature of the modern problem to which the principle must be applied.

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<sup>25</sup> <https://perma.cc/LHM8-WXQM>

<sup>26</sup> <https://perma.cc/Y692-ZTJ3>.

The historical record reveals that governments consistently used regulation to address extraordinary threats to public safety. The sources of danger may vary, but not the principle of protecting the public. Governments have always attempted to prevent mass terror and violence by armed individuals. Regulations going back to English common law prohibited threats like armed assembly, riot, and affray and became part of the American tradition of regulation after independence, and remained the law during the Antebellum and Reconstruction periods. See Miller et al., *Lethality*, *supra*, at 34–39.

Across centuries, the animating concern underlying such regulation was the capacity of concentrated force to terrorize the public and inflict harm on a mass scale. *Id.* at 38. Governments historically addressed this concern by prohibiting armed groups because, with the technology then available, inflicting physical harm on a large scale could only be accomplished through coordinated armed action. See Mark A. Frassetto, *Mass Violence and the Second Amendment*, 76 Ala. L. Rev. 43, 49 (2024). The ability for one individual to perpetrate mass violence is a distinctly modern invention. The AR-15's extraordinary destructive force and ability to dispense that force at scale with accuracy and speed concentrates in a single weapon and shooter the lethal capacity that could only have been generated by dozens, if not hundreds, of Founding Era militiamen. See Miller et al., *Lethality*, *supra*, at 33. The historical solution need not retain its group-based form after technology has concentrated, in a single individual, the group's ability to terrorize the public and inflict mass violence. Applying the tradition's underlying principle to the modern source of concentrated force is precisely the

kind of nuanced analogical reasoning this Court required in *Bruen* and *Rahimi*.<sup>27</sup>

The historical tradition of regulation to address threats to public safety also resulted in regulations on weapons that posed an extraordinary danger to the public. This was the motivating concern underlying Founding Era regulations on gunpowder. Miller et al., *Lethality*, *supra*, at 39. Gunpowder was lawful, common, and indispensable to ordinary firearm operation. Historical lawmakers nonetheless prohibited possession of concentrated quantities that created catastrophic risks extending far beyond the individual possessor. *See, e.g.*, 1784 N.Y. Laws 627–629; 11 Pa. Stat. 209; 1786 N.H. Laws 383–84. The fact that gunpowder was commonly used for self-defense did not render irrelevant the dangers it could simultaneously pose to others.

Early nineteenth century regulation of Bowie knives confirms the point. Bowie knives were widely possessed and commonly used for self-defense. David B. Kopel et al., *Knives and the Second Amendment*, 47 U. Mich. J. L. Reform 167, 180, 184–5 (2013). The Texas Supreme Court described the Bowie knife as “ordinary” and “accessible,” yet also “the most deadly of all weapons in common use” and “an instrument of almost

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<sup>27</sup> Petitioners argue that the going-armed and affray traditions are not appropriate analogues here because they regulated public conduct rather than individual possession. Pet’rs Br. 44–46. *Rahimi* forecloses precisely that objection: the Court upheld a firearm possession restriction by analogy to surety and going-armed laws, holding that the modern law was “by no means identical to these founding era regimes, but . . . does not need to be.” 602 U.S. at 698. The purpose of examining the historical record is to identify the concerns that historical regulation sought to address, not to match object or mechanism. *See Bruen*, 597 U.S. at 30 (The Second Amendment does not require modern regulations to be a “historical twin” to their predecessors.).

certain death.” *Cockrum v. State*, 24 Tex. 394, 402, 403–04 (1859). Governments responded to that danger with substantial regulation in numerous states, including restrictions designed to prevent their acquisition and possession. *See, e.g.*, 1837 Ala. Acts 7; 1838 Tenn. Pub. Acts 200; 1881 Ark. Acts 191, 192. The historical tradition did not treat common use and dangerousness as mutually exclusive concepts. To the contrary, widespread possession often brought a weapon’s dangers into sharper focus, and thus impelled governments to respond. History does not support a rule where mass distribution becomes a constitutional safe harbor for exceptionally dangerous weapons.

Nor was the Bowie knife immunized because it belonged to the broader category of “knives.” Governments regulated that unusually dangerous type of knife, while leaving the public free to buy steak knives and other knives for self-defense. So too here: An AR-15 is a semiautomatic rifle, but calling it a “rifle” does not immunize this exceptionally lethal type of rifle from regulation any more than calling a Bowie knife a “knife” did historically. The challenged laws do not constitute a categorical ban on rifles; they prohibit a particular subset of rifles that pose an exceptional danger to the public. The Second Amendment inquiry does not turn on finding the lowest common denominator into which a weapon can be classified. It asks whether the regulation is consistent with the principles reflected in our historical tradition. *Rahimi*, 602 U.S. at 692.

The point is not that Bowie knives were as lethal as modern firearms, much less AR-15s. But governments have always had the power to regulate, and even prohibit, implements of exceptional lethality. Miller et al., *Lethality*, *supra*, at 41–42. The historical principle is sound, and modern medical science allows that principle to be applied with greater precision. Rather than relying on categorical

labels, manufacturing statistics, or assumptions, courts can examine what a weapon actually does and compare its capacity for harm with that of other weapons. The data presented here provide a better-informed basis for identifying weapons that are exceptionally dangerous. Here, the evidence is clear. The AR-15's unprecedented capacity for lethality is not conjecture, stereotype, or label. It is a measurable and undeniable fact.

### **CONCLUSION**

For centuries, American legislatures have responded to weapons of exceptional danger with regulation. The principle has never changed: the Second Amendment protects the arms of ordinary self-defense, but it does not disable government from confronting weapons whose destructive power sets them apart. The enduring principle of dangerousness does not ask the Court to suspend reality.

The reality here is explained by physics. The AR-15 was designed to deliver extraordinary force. It does so with devastating effect. Its bullets strike with several times the energy of a handgun round, create wound cavities of an entirely different magnitude, destroy tissue far beyond the bullet's path, and inflict injuries that highly trained medical professionals cannot repair. Measured by every objective metric, it is materially indistinguishable from the U.S. military's M16 when fired semiautomatically.

The Constitution has always preserved the right of self-defense while permitting governments to regulate weapons of extraordinary danger to protect their communities.

*Amici* respectfully submit that the judgments of the Seventh and Second Circuits be affirmed.

Respectfully submitted,

AARON R. MARCU  
*Counsel of Record*  
TAYLOR JACHMAN  
AEDAN COLLINS  
AUDREY STONE  
FRESHFIELDS US LLP  
3 World Trade Center  
175 Greenwich Street  
51st Floor  
New York, NY 10007  
(212) 277-4000  
aaron.marcu@freshfields.com

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