Federally mandating motorcycle helmets in the United States

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Abstract
Background: Motorcycle helmets reduce both motorcycle-related fatalities and head injuries. Motorcycle crashes are a major public health concern which place economic stress on the U.S. healthcare system.

Discussion: Although statewide universal motorcycle helmet laws effectively increase helmet use, most state helmet laws do not require every motorcycle rider to wear a helmet. Herein, we propose and outline the solution of implementing federal motorcycle helmet law, while addressing potential counterarguments.

Conclusions: The decision to ride a motorcycle without a helmet has consequences that affect more than just the motorcyclist. In an effort to prevent unnecessary healthcare costs, injuries, and deaths, public health efforts to increase helmet use through education and legislation should be strongly considered. Helmet use on motorcycles fits squarely within the purview of the federal government public health and economic considerations.

Keywords: Motorcycle helmet, Health policy, Injury prevention

Background
Motorcycle helmets reduce both motorcycle-related fatalities and head injuries [1, 2]. Motorcycle crashes are a major public health concern which place economic stress on the healthcare system. Although statewide universal motorcycle helmet laws effectively increase helmet use [1], most state helmet laws do not require every motorcycle rider to wear a helmet.

The human and economic cost of motorcycle crashes
In 2011, 4612 people died in motorcycle crashes in the United States, representing a 217% increase from 1997 [3], while in 2009, there were over 90,000 motorcyclists injured [4]. Regardless, if this increase in deaths is due to the increasing numbers of motorcyclists or if it represents an increased fatality rate, the number of deaths itself is large and therefore important. Motorcycles account for less than 3% of all registered vehicles nationwide, yet they constitute 14% of all traffic-related fatalities [4]. Motorcyclists are 30 times more likely to die in a traffic-related crash than individuals riding in a car, for each mile traveled [4].

Helmets are beneficial in preventing head injury, as non-helmeted motorcyclists are more likely to experience traumatic brain injury (TBI) compared to those wearing helmets [5]. Median hospital costs for motorcyclists with TBI are 13 times greater than those without TBI [5], and severe TBI patients average 55 days of acute rehabilitation [6].

Injured, non-helmeted motorcyclists require substantially more healthcare resources than helmeted motorcyclists: the differential healthcare costs between non-helmeted and helmeted motorcyclist injuries account for an additional $290 million (inflation adjusted from 2006 data to represent 2015 values using Consumer Price Index data provided by the U.S. Department of Labor Bureau of Labor Statistic [7]) in healthcare costs per year [8].

Initial hospitalization and emergency treatment account for only 67% of total medical costs in motorcycle accident victims [9]. Additional medical charges include hospital readmissions, professional fees, ambulatory care services, rehabilitation, and long-term nursing home care. Medical and productivity costs saved from helmet use are estimated to be $1,316,469.58 per fatality, $186,434.37 per serious injury, and $8166.06 per minor injury (inflation adjusted to current year) [10]. The public must also pay for higher insurance rates, increased taxes, and
lost tax revenue [11]. In a single year, the economic cost of motorcycle-related crashes total over $12.8 billion nationwide (inflation adjusted to current year) [12].

An important consideration in this major public health issue is that the cost of medical care for motorcycle crash patients is largely transferred to society. The majority of motorcycle crash victims’ medical care is paid for by public funds [13], as non-helmeted motorcyclists are more likely to be covered by government-funded health insurance or have no health insurance at all compared to helmeted motorcyclists [14].

**Helmets prevent head injuries and deaths**

Helmets prevent fatalities and can reduce the number and severity of head injuries [1, 2]. After implementation of the California statewide universal motorcycle helmet law, fatalities decreased by 37.5 % [2]. Furthermore, helmets reduce the risk of head injury in motorcycle riders by 69 % [15]. In 2010 alone, an estimated 1550 motorcycle-related fatalities were prevented by helmet use and 706 more lives could have been saved if all motorcyclists had worn helmets [4].

**Helmet use increase with universal helmet laws**

Universal helmet laws require all motorcyclists to wear helmets, and effectively increase helmet use [1]. Currently, each individual state determines its own helmet law. States that have enacted universal helmet laws have witnessed substantial increases in helmet use; [16–20] whereas, states that repeal universal helmet laws have witnessed substantial decreases in helmet use [16, 21–23].

**Current helmet laws**

Only 20 states require all motorcyclists to wear helmets. Twenty-seven other states only require certain individuals to wear helmets when riding motorcycles, and three states have no helmet laws whatsoever [24].

**History of motorcycle helmet law in the U.S.**

Motorcycles first entered mainstream markets during the 1940 and 1950s. When veterans returned from WWII, they brought home a passion for motorcycles after being introduced to them overseas [25]. In 1966, the National Highway Safety Act (NHSA) was passed with an eye towards decreasing motorcycle-related head injuries and fatalities. The NHSA granted states federal funds to develop programs aimed at improving traffic safety, such as vehicle registration, accident record systems, and traffic control [26]. What made this law so effective was the inclusion of a provision that allowed only those states that adopted the 1966 NHSA to be eligible to receive federal funding for highway safety programs. By 1975, every state except for California had implemented laws requiring the use of helmets while riding motorcycles [27, 28].

Opponents of the newly passed helmet statues claimed that the laws infringed upon their constitutional liberties, depriving them of their right to monitor their own safety without government intervention [29]. The American Motorcycle Association and other motorcyclist rights organization began to gain traction in court arguing that mandating motorcycle helmets represented constitutional infringement [30].

On December 13, 1975, the Senate repealed the provision of the NHSA that withheld federal funds from states unwilling to enact comparable statutes. As a result, motorcycle-related accidents increased 20 % during the next four years [31]. Motorcycle-related injuries and fatalities continued to increase over the next decade, leading to a 200 % increase in medical costs for non-helmeted motorcyclists [32–37].

Hartunian et al. compared costs between states with enforced helmet statues to those states that had repealed such laws, and found differential costs amounting to more than $412.9 million (inflation adjusted to current year) [38]. In May 1989, Senator John Chafee introduced the National Highway Fatality and Injury Reduction Act of 1989. The Act partly resurrected the provision attached to the 1966 NHSA by granting the federal government the power to withhold up to 10 % of federal highway aid from states refusing to enforce helmet usage. The bill was passed in 1991 with some amendments—although only 3 % of highway funds, rather than the proposed 10 %, would be withheld from states refusing to comply with the enactment [39].

In 1995, the national motorcycle lobby successfully lobbied to repeal the Federal 3 % highway safety fund penalty [31]. Arkansas and Texas were among the first states to repeal universal helmet laws in 1997. Arkansas and Texas saw fatalities rise by 21 and 31 %, respectively [40]. Even so, more states followed suit. In the coming years, Kentucky observed a 50 % increase in fatalities after the repeal of its helmet law; Louisiana observed a 100 % increase; and Florida observed a 25 % increase [31].

**Mandating motorcycle helmet usage**

Convincing all motorcyclists to wear helmets will require a system-wide change. In an effort to prevent undue cost to the healthcare system due to head injury and to prevent future unnecessary deaths, Congress may wish to adopt a federal universal motorcycle helmet law. Compared to incentivizing each state to pass its own universal helmet law, a federal mandate would ensure broader adoption and expedite implementation. Although state rights are critical, motorcyclists can crash outside their home state, making this a federal issue. Given the efficacy of universal helmet laws on helmet use, a substantial impact on federal healthcare spending could be
expected. Because helmets can save lives and financial resources, this solution should be attractive to a broad coalition of support from providers, insurers, and the public.

Potential counterarguments
Special interest groups may lobby against such a federal law [41]. In the United States, certain political groups vocalize that the freedom to choose is more important than making the right choice [42]. For example, despite the increasing frequency of catastrophic mass shootings, the U.S. Congress is unwilling to pass federal gun control laws due to strong pro-gun lobbying efforts from groups that benefit from gun use [43]. To overcome special interests, widespread support must be gained through voter education. For public education efforts to successfully affect behavioral change, the Organization for Economic Co-operation and Development recommends campaigns include nation-wide promotional efforts, user-friendly websites with specific information, information provided at different levels in order to best meet readers’ comprehension capabilities, use numerous available media platforms for disseminating messages, and/or relate to individual experiences by creating different approaches for unique sub-groups [44]. Voters tell their elected legislators what bills to pass. If a majority of voters feels strongly about a law, legislators will pass the law. In other words, legislators must believe that if they don’t pass such a law, they won’t be reelected. Public health initiatives are usually more successful and affect deeper change when they involve both legislation and education [44].

Conclusions
The decision to ride a motorcycle without a helmet has consequences that affect more than just the motorcycle list. In an effort to prevent unnecessary healthcare costs, injuries, and deaths, public health efforts to increase helmet use through education and legislation should be strongly considered. Primary care providers also have opportunities to directly educate and encourage patient helmet use. Helmet use on motorcycles fits squarely within the purview of the federal government public health and economic considerations.

Ethics
No human subjects were used in this study and was therefore not subject to Ethics or IRB review.

Competing interest
The authors declare that they have no competing interest.

Authors’ contributions
AEME: Contributed to study conception, study design, manuscript drafting, and critical manuscript revision for important intellectual content. CS: Contributed to manuscript drafting, and critical manuscript revision for important intellectual content. AC: Contributed to manuscript drafting, and critical manuscript revision for important intellectual content. #H: Contributed to manuscript drafting, and critical manuscript revision for important intellectual content. CTB: Contributed to study conception, manuscript drafting, and critical manuscript revision for important intellectual content. AHD: Contributed to study conception, study design, manuscript drafting, and critical manuscript revision for important intellectual content. All authors read and approved the final manuscript.

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References
1. Goodwin A, Kirley B, Sandt L, Hall W, Thomas L, O’Brien N, Summerlin D. Countermeasures that work: A highway safety countermeasures guide for State Highway Safety Offices. 7th edition. (Report No. DOT HS 811 727). Washington, DC: National Highway Traffic Safety Administration; 2003.
2. Kraus JF, Pek C, McArthur DL, Williams A. The effect of the 1992 California motorcycle helmet law use on motorcycle crash fatalities and injuries. JAMA. 1994;272(19):1506–11.
3. Fatality Analysis Reporting System: 2011. Washington, DC: National Highway Traffic Safety Administration, U.S. Department of Transportation. (Accessed July 23, 2013, at http://www.fars.nhtsa.dot.gov/Main/index.aspx).
4. Traffic Safety Facts 2010 Data: Motorcycles. Washington, DC: National Highway Traffic Safety Administration, U.S. Department of Transportation, 2012. (Accessed July 24, 2013, at http://www-nrd.nhtsa.dot.gov/Pubs/811639.pdf).
5. Cook LI, Kerns T, Burch C, Thomas A, Bell E. Motorcycle helmet use and head and facial injuries: Crash outcomes in CODES-linked data. Washington: National Highway Traffic Safety Administration, U.S. Department of Transportation; 2009. (Accessed July 23, 2013 http://www-nrd.nhtsa.dot.gov/pubs/811208.pdf).
6. Whitlock JA, Hamilton BB. Functional outcome after rehabilitation for severe traumatic brain injury. Arch Phys Med Rehabil. 1995;76:1103–12.
7. US Inflation Calculator. http://www.usinflationcalculator.com/(Accessed November 6, 2015).
8. Eastridge BJ, Shafi S, Miney JP, Culica D, McConnel C, Gentiliello L. Economic impact of motorcycle helmets: from impact to discharge. J Trauma. 2006; 60(5):978–83. discussion 983–4.
9. Max W, Stark B, Root S. Putting a lid on injury costs: the economic impact of the California motorcycle helmet law. J Trauma. 1998;45(3):550–6.
10. Centers for Disease Control and Prevention. Helmet use among motorcyclists who died in crashes and economic cost savings associated with State Motorcycle Helmet Laws — United States, 2008–2010. MMWR. 2012;61:425–30.
11. McSwain Jr NE, Belles A. Motorcycle helmets—medical costs and the law. J Trauma. 1990;30(10):1189–97, discussion 1197–9.
12. Naumann RB, Dellinger AM, Zaloshnja E, Lawrence BA, Miller TR. Incidence and total lifetime costs of motor vehicle-related fatal and nonfatal injury by road user type, United States, 2005. Traffic Inj Prev. 2010;11(4):355–60.
13. Rivara FP, Dicker BG, Bergman AB, Dacey R, Herman C. The public cost of motorcycle trauma. JAMA. 1988;260(2):221–3.
14. Hundleby JC, Kilgo PD, Miller PR, Chang MC, Hensbergen RA, Meredith JW, et al. Non-helmeted motorcyclists: a burden to society? A study using the National Trauma Data Bank. J Trauma. 2004;57(5):944–9.
15. Liu BC, Ivers R, Norton R, Boufous S, Blows S, Lo SK. Helmets for preventing injury in motorcycle riders. Cochrane Database Syst Rev. 2008;1:CD004333.
16. Derrick AJ, Faucher LD. Motorcycle helmets and rider safety: a legislative crisis. J Public Health Pol. 2009;30(2):226–42.
17. Muellerman RL, Milinek EJ, Collisct PE. Motorcycle crash injuries and costs: effect of a reenacted comprehensive helmet use law. Ann Emerg Med. 1992;21(3):266–72.
18. Auman KM, Kufara JA, Ballesteros MF, Smialek JE, Dischinger PC. Autopsy study of motorcyclist fatalities: the effect of the 1992 Maryland motorcycle helmet use law. Am J Public Health. 2002;92(8):1352–5.
19. Rowland J, Rivara F, Salzberg P, Soderberg R, Maier R, Koepsell T. Motorcycle helmet use and injury outcome and hospitalization costs from crashes in Washington State. Am J Public Health. 1996;86(1):41–5.

20. Ellison-Potter P. Evaluation of the reinstatement of the motorcycle helmet law in Louisiana. Washington (DC): National Highway Traffic Safety Administration, U.S. Department of Transportation; 2008.

21. Ulmer RG, Preusser DF. Evaluation of the repeal of motorcycle helmet laws in Kentucky and Louisiana. Washington: National Highway Traffic Safety Administration, U.S. Department of Transportation; 2003.

22. Ulmer RG, Northrup VS. Evaluation of the repeal of the all-rider motorcycle helmet law in Florida. Washington: National Highway Traffic Safety Administration, U.S. Department of Transportation; 2005.

23. Mertz KJ, Weiss HB. Changes in motorcycle-related head injury deaths, hospitalizations, and hospital charges following repeal of Pennsylvania’s mandatory motorcycle helmet law. Am J Public Health. 2008;98(8):1464–7.

24. Traffic Safety Facts Laws, Motorcycle Helmet Use Laws. Washington, DC: National Highway Traffic Safety Administration, U.S. Department of Transportation; 2008. (Accessed November 20, 2013, at https://www.nhtsa.dot.gov/statistics/DOT-NHTSA/Rulemaking/Articles/Associated%20Files/03%20Motorcycle%20Helmet%20Use.pdf).

25. Anonymous. An inside look at outlaw motorcycle gangs. Boulder: Paladin Press; 1992. p. 3.

26. United States Congress. Public Law 89-563. National Traffic and Motor Vehicle Safety Act of 1966. September 9, 1966.

27. Institute of Medicine. National Academy of Sciences. Healthy People. The Surgeon General’s Report on Health Promotion and Disease Prevention. Background Papers. Washington: U.S. Government Printing Office, DHEW (PHS) Publication No. 79-55071A; 1979.

28. Knowles JH. The responsibility of the individual. Daedalus. 1977;106(1):57–80.

29. Simon v. Sargent, D.C. Mass. 346 F. Supp. 277, affirmed 93 S.Ct. 463, 409 U.S. 1020, 34 L.Ed.2d 312 (1973).

30. American Motorcycle Association v. Department of State Police. Docket No. 4445. Court of Appeals of Michigan; April 30, 1968.

31. Jones MM, Bayer R. Paternalism and its discontents: motorcycle helmet laws, libertarian values, and public health. Am J Public Health. 2007;97(2):208–17.

32. Geoffrey W, Zador P, Wilks A. The repeal of helmet use laws and increased motorcyclist mortality in the United States, 1975–1978. Am J Public Health. 1980;70:579–84.

33. McSwain Jr NE, Petrucelli E. Medical consequences of motorcycle helmet nonusage. J Trauma. 1984;24(3):23–6.

34. Scholten DJ, Glover JL. Increased mortality following repeal of mandatory motorcycle helmet law. Indiana Med. 1984;77(4):252–5.

35. Chenier TC, Evans L. Motorcyclist fatalities and the repeal of mandatory helmet wearing laws. Accid Anal Prev. 1987;19(2):133–9.

36. Lloyd LE, Lauderdale M, Betz TG. Motorcycle deaths and injuries in Texas: helmets make a difference. Tex Med. 1987;83(4):30–3.

37. Evans L, Frick MC. Helmet effectiveness in preventing motorcycle driver and passenger fatalities. Accid Anal Prev. 1988;20(6):447–58.

38. Hartunian NS, Smart CN, Willemain TR, Zador PL. The economics of safety deregulation: lives and dollars lost due to repeal of mandatory motorcycle helmet laws. J Health Politi Policy Law. 1983;8(1):76–98.

39. Curtin WT. Focus + Unity = Repeal of Federal Helmet Law. Motorcycle Riders Foundation White Paper, September 1996. (Accessed November 20, 2013, at http://www.mrf.org/pdf/whitepapers/volume4-1996/repealoffederalhelmetlaw.pdf).

40. Motorcycle Helmet Law Repeal Evaluated In Texas And Arkansas. Washington, DC: National Highway Traffic Safety Administration, 2000. (Accessed December 23, 2013, at http://www.nhtsa.gov/About+NHTSA/Traffic+Techs/current/Motorcycle+Helmet+Law+Repeal+Evaluated+In+Texas+And+Arkansas).