Use of Motorcycle Helmets: Universal Helmet Laws

Summary Evidence Table – Effectiveness Evidence

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Auman et al. (2002) **Study Objective:** Impact of partial to universal helmet law on motorcyclist fatalities in Maryland **Study Design:** Before-after	**Location:** Maryland, US **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** October 1, 1992 **Comparison:** Before and after law implementation	**Study duration:** Pre: Jan 90 to Sept 92 Post: Jan 93 to Sept 95 Comparable **Study population:** all motorcyclist fatalities from 1990 to 1995 in Maryland, US Total: 212 **Population characteristics:** Sex: 94.8% male Age: 56.1% 18-29 Race: 83.0% white Location: 73.4% urban	Helmet use among fatalities Fatalities: Total Fatalities: total, rural Fatalities: total, urban Fatalities/ 10,000 registered vehicles Fatalities, head injury-related	1990-92: 24.6% 1991: 49 1990-92: 28 1990-92: 72 1991: 10.2 1990-92: 101	1993-95: 80.5% 1993: 37 1996: 21 1993-95: 17 1993-95: 52 1993: 7.9 1996: 4.5 1993-95: 59	Absolute change: 56 pct pts; CI: 45-67 pct pts Relative change: 91 to 93: -24% 91 to 96: -57% -39% -28% 91 to 93: -23% 91 to 96: -56% 90-92 to 93-95: -42%	Motorcycle fatality rate per 10,000 registered vehicles fell steadily, while the number of registered vehicles remained relatively stable. Among fatalities, helmet use increased from 24.6% to 80.5%. Riders in both rural and urban settings had reduction in total motorcycle-related fatalities.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Bavon et al. (2010) **Study Objective:** Impact of repealing universal helmet law in Texas **Study Design:** Interrupted time series; used ARIMA modeling for fatality-related outcomes	**Location:** Texas, US **Type of law:** Partial **Type of legislative action:** Universal to Partial **Date of legislative action:** September 1, 1997 **Comparison:** Before-after law repeal	**Study duration:** 1994-2004 **Study population:** Motorcyclist fatalities recorded in the Fatality Analysis Reporting System (FARS) by the National Highway Transportation Safety Administration (NHTSA) **Population characteristics:** NR	Helmet use among fatalities:	1996: 77%	1998: 36%	Absolute percentage point change: -41 pct pts	Repeal of the universal helmet law had significant adverse effects on motorcyclist fatalities in Texas There were sharp increases in fatalities and fatality rates immediately after law repeal ARIMA model showed that repealing universal helmet laws led to statistically significant increases fatalities and fatalities per 100 billion VMT.
			Fatalities: Total	1996: 115	1998: 152 2004: 285	Relative change: 96-98: 32% 96-04: 148% ARIMA coefficient: 2.335; *t*-ratio: 2.819; p=0.006	
			Fatalities/ 100,000 registered motorcycles	1996: 91.6	1998: 105.6 2004: 101.2	96-98: 15% 96-04: 10% ARIMA coefficient: 0.187; *t*-ratio: 0.406; p=0.686	
			Fatalities/100bil Vehicle mile traveled (VMT)	1996: 60.3	1998: 73.9 2004: 124.3	96-98: 23% 96-04: 106% ARIMA coefficient: 1.176; *t*-ratio: 3.023; p=0.003	

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Berkowitz (1981) **Study Objective:** Comparison of states with universal helmet laws (14 states) vs. states with partial laws or no law (20 states) **Study Design:** Other design w/ concurrent comparison	**Location:** 34 US states **Type of laws:** comparison of states with universal, partial, or no helmet use law **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** 14 states with universal helmet laws compared to 20 states with partial laws or no law	**Study duration:** Oct 1978 to Dec 1980; specific data collection period varied by state Not comparable **Study population:** Motorcyclists involved in moving-motor vehicles crashes and treated in an emergency room at one of the 70 included hospitals in study states that report to the National Electronic Injury Surveillance System Population characteristics: NR	Head injury as proportion of total injuries Proportion of head injuries that was serious (NEISS scale; 8 categories; serious: >=4) Neck injury as % of total injuries; Proportion of neck injuries that was serious (NEISS scale; 8 categories; serious: >=4)	Partial + No law: 9.7% Partial + No law: 72.2% 1.6% 22.6%	Universal laws: 5.5% Universal: 65.4% 1.0% 16.7%	Absolute difference: U vs. P+N: -4.2 pct pts p<0.05 U vs. P+N: -6.8 pct pts; p<0.05 U vs. P+N: -0.6 pct pts; NS U vs. P+N: -5.9 pct pts; p<0.05	Fewer injuries to the head, face/eye/ mouth/ ear, neck, and all 3 combined among states with a universal helmet law compared to states with partial laws or no law. Significantly lower proportions of serious head and neck injuries among states with universal helmet laws compared to states with partial helmet laws or no helmet law.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Bledsoe et al. (2005) **Study Objective:** Impact of repealing the Arkansas universal motorcycle helmet law on helmet use and fatal and non-fatal injuries **Study Design:** Before-after	**Location:** Arkansas, US **Type of law:** Partial **Type of legislative action:** Universal to partial **Date of legislative action:** July 1, 1997 **Comparison:** Before and after law repeal	**Study duration:** Data provided from 1992 to 2001 **Study population:** Fatal and non-fatal injuries in AR during study period For helmet use and injury severity, patients admitted to UMAS after a motorcycle crash Total: 169 **Population characteristics,** of hospitalized motorcyclists only: Male: 152 (89.9%) Female: 17 (10.1%) Mean age:32.1	Helmet use among hospitalized motorcyclists Fatalities: Total: Per 10,000 registered motorcycles Per 1,000 crashes Injuries: Total Per 10,000 registered motorcycles Per 1,000 crashes	38 months pre law change: 75.3% 1996: 26 1996: 16.6 1996: 45.1 1996: 369 1996: 236.2 1996: 64.1	38 months post law change: 45.8% 1998: 27 2001: 46 1998: 12.8 2001: 14.8 1998: 43.2 2001: 44.6 1998: 541 2001: 919 1998: 255.8 2001: 295.1 1998: 86.6 2001: 89.1	Absolute change: -30 pct pts, p<0.001 Relative change: 96 to 98: 3.8% 96-01: 77% 96 to 98: -23.3% 96-01: -11% 96 to 98: -4% 96-01: -1% 96 to 98: 47% 96-01: 149% 96 to 98: 8% 96-01: 25% 96 to 98: 35% 96-01: 39%	After of the repeal of the universal helmet law to partial helmet law in AR in 1997, there was a decrease in helmet use, and an increase in total fatalities, total injuries and injury/ 10,000 registered motorcycles. There was however a decrease in fatality rate. Compared with helmeted riders, non-helmeted patients were significantly more injured, had a greater incidence of severe head injury, and more likely to have high BAC.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Branas et al. (2001) **Study Objective:** Compared motorcycle fatality rate between states with or without universal helmet law **Study Design:** Panel study	**Location:** 50 states, US **Type of law:** Universal vs. Partial + None **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** States with or without universal helmet laws	**Study duration:** 1994-1996 **Study population:** Motorcyclist fatalities in U.S. during study period **Population characteristics:** NR	Fatality per 10,000 registered motorcycles, controlling for (1) population density; (2) weather; (3) alcohol use; (4) maximum speed limit; (5) urban versus rural roads; (6) motorcycle engine size; and (7) age	Partial + no law states: N/A	Universal law states: N/A	Regression analysis: -4%; NS	After controlling for factors that affect motorcyclist fatalities through multivariate models, fatality rates in states with universal helmet laws were slightly lower than fatality rates in states without universal helmet laws (P=0.740).
Author (Year): Brooks et al. (2010) **Study Objective:** Comparison of under 18 motorcycle fatalities in no law vs. partial law states **Study Design:** Other design with concurrent comparison groups	**Location:** 6 states, US **Type of law:** Partial: CT, IN, WI No law: NH, IL, IA **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Under 18 group in partial law vs. no law states	**Study duration:** 1996-2005 **Study population:** Fatalities for motorcyclists under 18 years of age; **Population characteristics:** NR	Helmet use among fatalities Helmet use among fatalities, 17 or younger Fatality per 10,000 registered motorcycles Fatality per 10,000 registered motorcycles, 17 or younger	No law: 15.4% No law: 28.1% No law: 7.5 No law: 0.8	Partial law: 22.3% Partial law: 33.3% Partial law: 10.7 Partial law: 0.8	Absolute difference: 7 pct pts, CI: 4.4, 9.4 pct pts 5 pct pts; p=0.79 Relative difference: 43%, p=0.06 Relative difference: 0%, p=0.45	Partial helmet laws neither significantly reduce fatality rates nor increase helmet compliance rates among young riders. A partial helmet law is roughly equivalent to none at all; only universal helmet laws have been shown to effectively protect young motorcyclists.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Chenier et al. (1987) **Study Objective:** Impact of repealing or weakening motorcycle helmet law in 26 states between 1975 and 1982 compared to 22 states without substantial changes during the same time **Study Design:** Before-after with concurrent comparison	**Location:** 48 states +DC **Type of law:** Partial or none **Type of legislative action:** Universal to partial or none **Date of legislative action:** Variable **Comparison:** States that repealed universal helmet laws compared to states that didn't change their laws during the study period	**Study duration:** Pre: Jan 1 1975 to 3m prior to law change; Post: 3m post law change to Dec 31, 1982; Law weakened between 1976 and 1982 **Study population:** Fatalities in treatment and control states during the study period **Population characteristics:** NR	Fatalities: total	Changes in fatalities in states without change in helmet laws	Changes in fatalities in states with repealed universal helmet laws	Relative change: 25%	The increases in fatalities were higher in states that have repealed or weakened their motorcycle helmet law compared to those without change in the same time period in the United States Removing helmet laws is associated with increases in fatalities of approximately 25%.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Chiu et al. (2000) **Study Objective:** To determine the effect of the 1997 motorcycle helmet law in Taiwan on motorcycle-related injuries **Study Design:** Before-after	**Location:** Taiwan **Type of law:** Universal **Type of legislative action:** None to Universal **Date of legislative action:** June 1, 1997 **Comparison:** Before-after law implementation	**Study duration:** Before: June 1, 1996 to May 31, 1997 After: June 1, 1997 to May 31, 1998; **Study population:** all motorcyclists (and passengers) suffering head injuries form 1996 -1998 in Taiwan; **Population characteristics:** Ratio of male to female: 2:1 (66.9% vs. 33.1%) Age: mean 34.1 years	Helmet use, among head injuries hospitalized; Hospitalized motorcyclists with head injuries Severe head injuries, by GCS Head injury-related fatalities	1996-97: 2.9% Pre: 5260 Pre: 484 Pre: 211	1997-98: 46.1% Post: 3535 Post: 318 Post: 141	Absolute change: 43 pct pts Relative change: -33% -34% -33%	Motorcyclists with head injuries (hospitalized or fatally-injured) decreased significantly across gender and age groups with universal helmet law Number and proportion of those with severe head injuries as measured by the GSC scale decreased after universal law.
Author (Year): Coben et al. (2007) **Study Objective:** Comparing universal vs. partial vs. no helmet law and impact on motorcyclists hospitalization **Study Design:** Cross sectional	**Location:** 33 states in the US **Type of law:** Universal vs Partial +None **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Partial and No law states	**Study duration:** 2001 **Study population:** Motorcycle related hospitalization cases from 33 states in US that report to HCUP during 2001 Total: 25794 **Population characteristics:** Male: 23027 (89.3%) Female: 2767 (10.7%) **Mean age:** 34.8	% hospitalized motorcyclists whose primary diagnosis is head injury Length of hospital stay, mean days % of diagnosis relating to neck	No law (3 states): 18.4% Partial laws (13 states): 15.7% No law (3 states): 18.4% No or partial law: 5.8 days No or partial law: 0.11%	Universal laws (17 states): 11.5% Universal laws (17 states): 11.52% Partial laws (13 states): 15.75 Universal law: 5.4 days Universal law: 0.16%	U vs. N: -6.9 pct pts, p<0.0001 U vs. P: -4.2 pct pts, p<0.0001 P vs. N: -2.7 pct pts, p<0.0001 U vs. P+N: -0.4 days; -6.9% U vs. P+N: 0.05 pct pts, NS	There is a lower percentage of motorcyclists hospitalized with head injury in states with universal law vs. states with partial or no law; there is also a slight reduction in the length of hospital stay in the states with universal helmet laws.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
			injury				
Author (Year): Dao et al. (2012) **Study Objective:** Evaluating impact of helmet laws on cervical spinal injuries in 2008; universal vs. partial + none **Study Design:** Cross sectional	**Location:** 50 states in US **Type of law:** Universal vs Partial +None **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Universal laws compared to partial laws or no law	**Study duration:** 2008 **Study population:** Patients admitted to participating hospitals due to motorcycle crashes Data from the Nationwide Inpatient Sample from the Healthcare and Utilization Project **Population characteristics:** Universal law states: 12418 Partial law states: 17783 Mean age: 40.6 ± 14.6 years White: 79.9% Male: 87.6%	% of hospitalized motorcyclists who died % of hospitalized patients with C-spine injuries Median length of stay, entire patient sample	Partial law states: 2.6% Partial law states: 6.9% Partial law states: 4.0 days Range: 0-257	Universal law states: 1.8% Universal law states: 6.3% Universal law states: 3.0 days Range: 0-139	U vs. P: -0.8 pct pts; p=0.0001; Relative difference: -30.8% U vs. P: -0.6 pct pts; p=0.03; Relative difference: -8.7% U vs. P: -1 days; NS Relative difference: -25%	The study shows a statistically significant reduction in C-spine injuries and inpatient mortality in states with universal helmet laws Multinomial logistic regression analysis shows that the only factor associated with presence of C-spine injuries was occurrence of trauma in partial law states; OR: 1.1; CI: 1.1-1.23; p=0.04.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): De Wolf (1986) **Study Objective:** To obtain a national estimate of the effect of repealing universal helmet laws on fatalities **Study Design:** Panel study	**Location:** 50 states in US **Type of law:** Partial **Type of legislative action:** Universal to partial or no law **Date of legislative action:** repeals between 1975 and 1984 **Comparison:** Before and after repealing of universal helmet laws, over 10 years	**Study duration:** 1975-1984 **Study population:** Motorcycle fatalities in the U.S. during study period **Population characteristics:** NR	Fatalities per crash, regression analysis that controlled for state and year specific effects	NA	Coefficient associated with repeal: 0.193, SE 0.048	Converted to relative change: 21.3%; 95%CI: 10.4% to 33.3%	Repeal of universal helmet laws was associated with an increase of 21.3% in fatalities per crash, other factors held constant If states had not repealed their laws, fatalities per crash would have been 9.4% to 25% lower.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Dee (2009) **Study Objective:** Evaluating impact of universal helmet laws on fatalities in U.S. during study period **Study Design:** Panel study	**Location:** 48 contiguous states in US **Type of law:** Universal, partial, no law; all examined **Type of legislative action:** implementing and repealing universal helmet laws **Date of legislative action:** b/w 1988 and 2005 **Comparison:** Universal laws compared to partial laws or no law	**Study duration:** 1988-2005 **Study population:** fatalities in 48 states during study period reported by FARS **Population characteristics:** NR	Fatalities, total; regression analyses controlled for state-specific trends, motorcycle registration, and state-year observables	NA	Coefficient associated with having universal helmet law: -0.312 SE 0.055	Converted to relative change: -27%, p<0.01 95%CI: -34% to -18%	Based on modeling used in this study, introducing universal helmet law would reduce fatalities by 27 percent or potentially avert 644 deaths per year.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): DOT-Wisconsin (1981) **Study Objective:** Impact of weakening a universal helmet law in Wisconsin on helmet use (among riders in accidents), injuries, and fatalities **Study Design:** Before-after	**Location:** Wisconsin, US **Type of law:** Partial **Type of legislative action:** Universal to partial **Date of legislative action:** March 19, 1978 **Comparison:** Before and after law implementation	**Study duration:** Pre: 1975 to 1977 Post: 1978 to 1980 Not comparable (post-period included 2.5 months of the pre-law period) **Study population:** Wisconsin motorcyclists involved in accidents from 1975 to 1980 (helmet use, fatal and non-fatal injuries) Total: ~24,500 riders involved in accidents over study period **Population characteristics:** NR	Helmet use, motorcyclists involved in crashes Fatalities, total Fatalities/10,000 registered vehicles Fatalities/100 crashes Fatalities due to head injuries, total Fatalities due to head injuries, per 10,000 registered motorcycles Fatalities due to head injuries, per 100 crashes Non-fatal head injuries	1975-1977: 100% 1977: 68 Pre: 5.1 Pre: 19.6 Pre: 149 Pre: 4.0 Pre: 1.5 Pre: 2327	1978-1980: 42.7% 1979: 123 Post: 7.3 Post: 28.9 Post: 246 Post: 5.0 Post: 2.0 Post: 4267	Absolute change: -57 pct pts Relative change: 81% 42% 47% 65% 25% 35% 83.4%	Lower rate of helmet use among motorcyclists involved in accidents; also, lower rates of fatal and non-fatal head injuries among helmeted riders.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Ferrando et al. (2000) **Study Objective:** Impact of Spain extending helmet law to urban areas on motorcyclists fatalities **Study Design:** Before-after	**Location:** Barcelona, Spain **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** 1992 **Comparison:** Before and after law implementation	**Study duration:** Pre: 01/1990 to 12/1992; Post: 01/1993 to 12/1995 **Study population:** Motorcycle and moped riders fatalities in Barcelona, Spain, during study duration **Population characteristics:** NR	Helmet use (observed) Fatalities: Per 10mill VMT Per 1000 crashes Per 100,000 registered motorcycles Head injury related fatalities Fatality avoided with law, Poisson regression model	1992: 36.0% 1991: 46.0 1991: 6.9 1991: 27.5 Pre, 90-92: 117 NA	1995: 91.0% 1995: 26.2 1995: 5.2 1995: 14.1 Post, 93-95: 58 NA	Absolute change: 55 pct pts Relative change: -43% -25% -49% -50%; p<0.01 35 lives saved, 93-95, 3yr after law passage -25%	The implementation of the universal helmet law in Barcelona Spain resulted in increased helmet use, and reduced total fatalities, fatality rates and severe head injuries.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Fleming et al. (1992) **Study Objective:** Impact of universal helmet law on fatal and non-fatal injuries in TX **Study Design:** Interrupted time series	**Location:** Texas, US **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** September 1, 1989 **Comparison:** Time series study using ARIMA model; before and after law implementation	**Study duration:** Pre: Sept 1984 to Aug 1989; Post: Sept 1989 to Aug 1990 **Study population:** Motorcyclists fatally and non-fatally injured in TX during study period, 18 and older **Population characteristics:** NR	Fatalities	Secular trend prior to law: annual reduction of 9.6%	Additional impact due to law: -13%	-13% 95%CI: -29.7% to 0%	Despite a pre-existing decrease for motorcycle crash related injuries and deaths corresponding to a 9.4% average annual decline in motorcycle registrations, statistically significant decreases in all examined outcomes were found.
			Head-related fatalities	Secular trend prior to law: no sig reduction	Impact due to law: -57%	-57% 95%CI: -65.5% to -46.5%	
			Total injuries	Secular trend prior to law: annual reduction of 10.5%	Additional impact due to law: -12%	-12% 95%CI: -21.7% to -1.7%	
			Head-related injuries	Secular trend prior to law: annual reduction of 11.1%	Additional impact due to law: -53%	-53% 95%CI: -59.4% to -45.3%	
			Severely injured	Secular trend prior to law: annual reduction of 10.8%	Additional impact due to law: -13%	-13% 95%CI: -24.9% to 0%	
			Head-related severe injuries	Secular trend prior to law:	Additional impact due to	-55% 95%CI: -59.9% to	

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
				annual reduction of 10.8%	law: -55%	-48.7%	
Author (Year): Foldvary et al. (1964) **Study Objective:** Impact of universal helmet law on motorcycle crash fatalities in Victoria, Australia **Study Design:** Before-after with concurrent comparison group	**Location:** Victoria, Australia **Type of law:** Universal **Type of legislative action:** None to Universal **Date of legislative action:** Jan 1, 1961 **Comparison:** before-after law, Victoria vs. rest of Australia	**Study duration:** Pre: 1959-60 Post: 1961-62 Comparable: Can't tell **Study population:** all motorcyclists fatality injured in Victoria and rest of Australia from 1959 to 1962 Total fatalities: 96 in Victoria; 447 in rest of Australia **Population characteristics:** NR	Fatalities, total Fatalities/10,000 registered motorcycles	59-60: Victoria: 65.0; Rest of Australia: 249.0 59-60: Victoria: 29.9; Australia: 30.6	61-62: Victoria: 31.0; Rest of Australia: 198.0 61-62: Victoria: 18.2; Rest of Australia: 29.1	Relative change: Victoria: -52.3% Rest of Australia: -20.5%; Victoria vs. Rest: **-40%** Victoria: -39.2% Rest of Australia: -4.9%; Vitoria vs. Rest: **-36%**	Motor cyclist fatalities post-intervention reduced nearly by half, suggesting effectiveness of the mandatory use of helmets.
Author (Year): French et al. (2009) **Study Objective:** Universal vs. partial law states in fatal and non-fatal	**Location:** 48 states, US **Type of law:** Universal vs. partial + none **Type of legislative action:** N/A	**Study duration:** 1990-2005 **Study population:** Fatal and non-fatal injuries in 48 states during study period recorded by FARS and state agencies, respectively	Fatalities, total Regression model controlling for various state characteristics Non-fatal injuries, total Regression model controlling for	NA NA	NA NA	Universal vs. Partial + None: -24% Universal vs. Partial + None: -20%	State-level longitude data suggest that of all traffic-related policies examined (universal helmet law, mandatory rider education, speed limit on rural interstates, BAC limit, zero tolerance,

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
injuries **Study Design:** Panel study	**Date of legislative action:** N/A **Comparison:** universal vs. partial + no law	Population characteristics: NR	various state characteristics				admin license revocation), universal helmet laws were most effective in reducing fatal and non-fatal injuries.
Author (Year): French et al. (2012) **Study Objective:** Universal vs. partial law states in fatalities **Study Design:** Panel study	**Location:** 48 states, US **Type of law:** Universal vs. partial + none **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** universal vs. partial + no law	**Study duration:** 1988-2008 **Study population:** Fatalities in 48 states during study period recorded by FARS **Population characteristics:** NR	Fatalities; regression analysis taking secular trend into account	NA	NA	Universal vs. Partial + None: -23%	Results reconfirm the effectiveness of universal helmet laws and offer new evidence suggesting that states without such policies may attract more risky riders from out-of-state.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Gilbert et al. (2008) **Study Objective:** Impact of implementing universal helmet laws in Louisiana on helmet use, fatal and non-fatal injuries **Study Design:** Before-after	**Location:** Louisiana, US **Type of law:** Universal **Type of legislative action:** Partial to universal **Date of legislative action:** August 15, 2004 **Comparison:** before-after universal law	**Study duration:** 1999-2005 Pre: 1999 to July 2004 Post: August 04 to 2005 **Study population:** Motorcyclists observed for helmet use at the same time as statewide seat belt use survey; Motorcyclists involved in crashes, had fatal or non-fatal injuries **Population characteristics:** motorcyclists involved in crashes; Sex: 96% male Race: 75% white; 25% black Age: mean of 36 years	Helmet use (observed) Fatalities, total; logistic regression model that controlled for gender, age, race Fatalities per 100 crashes Non-fatal injuries, severe; logistic regression model that controlled for gender, age, race Non-fatal injuries, severe, per 100 crashes Non-fatal injuries, moderate; regression model that controlled for gender, age, race Non-fatal injuries, severe, per 100 crashes	2003: 60% N/A Pre: 4.95 N/A Pre: 9.36 N/A Pre: 38.01	2005: 100% N/A Post: 4.35 N/A Post: 7.15 N/A Post: 34.68	Absolute change: 40 pct pts OR: 0.70 p=0.012 Relative change: -12% 95%CI: -30% to 11% OR: 0.62 p<0.001 Relative change: -24% 95%CI: -36% to -9% OR: 0.74 p<0.001 Relative change: -9% 95%CI: -15% to -2%	Reinstatement of universal helmet law in Louisiana increased helmet use and decreased fatal and nonfatal injuries.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
			Fatalities & severe injuries; ARIMA modeling	N/A	N/A	-46% t=2.093; p=0.04	
Author (Year): Graham et al. (1986) **Study Objective:** Comparison of universal vs. partial + no helmet law and their impact on motorcycle-related fatalities **Study Design:** Panel study	**Location:** 50 states, US **Type of law:** Universal vs. Partial + None **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** universal vs. partial + none	**Study duration:** 1975-1984 **Study population:** motorcycle fatalities recorded in FARS during study period **Population characteristics:** NR	Fatalities, total: regression analyses that controlled for state and year specific characteristics, secular trend, motorcycle registration Fatalities per registered motorcycles: regression analyses as described above	N/A N/A	N/A N/A	Universal vs. Partial + No law: -22% Universal vs. Partial + No law: -12%	Universal helmet laws reduced motorcycle-related fatalities and fatality rate when compared to partial or no helmet law.
Author (Year): Grima et al. (1995) **Study Objective:** Impact of Spain helmet law going from partial to universal in September of	**Location:** Pamplona, Spain **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of**	**Study duration:** June – November 1992 Pre: June –August 1992 Post: September – November 1992 **Study population:** Motorcyclists and passengers observed for helmet use in	Helmet use (observed) Helmet use: Riders Helmet use: Passengers	Pre: 9.70% Pre: 20.10% Pre: 17.20%	Post: 94.80% Post: 97.50% Post: 77.50%	Absolute change: 75 pct pts 77 pct pts 60 pct pts	The implementation of the universal helmet law increased helmet use in Pamplona, Spain.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
1992 **Study Design:** Before-after	**legislative action:** Sept 1992 **Comparison:** Before-after universal law	Pamplona during study period **Population characteristics:** NR					
Author (Year): Hartunian et al. (1983) **Study Objective:** Impact of weakening universal helmet laws on fatalities **Study Design:** Panel study	**Location:** 48 states, US **Type of Law:** Partial or none **Type of legislative action:** Universal to Partial or None **Date of legislative action:** 1975-1980 **Comparison:** universal to partial or none	**Study duration:** 1975-1980 **Study population:** motorcycle-related fatalities in 48 states during study period **Population characteristics:** NR	Fatalities: deaths occurring within 30 days of crash Fatalities, male Fatalities, male, 0-19 years Fatalities, female Fatalities, female, 0-19 years		Fatalities in 1980: 2137 Attributable to law change: 24.2% Fatalities in 1980: 1941 Attributable to law change: 22.3% Fatalities in 1980: 402 Attributable to law change: 42.9% Fatalities in 1980: 196 Attributable to law change: 42.9% Fatalities in 1980: 68	Relative percentage change: 32% increase in overall fatalities 29% increase in male fatalities 21% increase in male, 0-19 year fatalities 75% increase in female fatalities 124% increase in female fatalities	516 excess deaths occurred in 1980 in the 28 states that weakened or repealed their helmet laws, representing 24% of total motorcycle fatalities occurring in those states; Women and younger cyclists of both sexes comprised a disproportionate share of excess deaths;

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
					Attributable to law change: 55.3%		

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Ho et al. (2004) **Study Objective:** Impact of repealing universal helmet law in Louisiana on helmet use, fatal and non-fatal injuries **Study Design:** Before-after	**Location:** Louisiana, US **Type of law:** Partial **Type of legislative action:** Universal to Partial **Date of legislative action:** August 15, 1999 **Comparison:** Before and after law implementation	**Study duration:** Pre: 1994-1998/99 Post: 1999/00-2002 **Study population:** all motorcyclist fatalities and injuries from Jan 94-02 in Louisiana, US; Total crashes: 8916; Total fatalities: 300; Among patients entered into the trauma center: 934 (243 excluded due to incomplete records) sample total = 691 **Population characteristics:** Sex: 93.4% male Mean age: 29.2 years	Fatalities: Deaths occurring within 30 days of collision:	Pre, annual:28	Post, annual: 60	Relative change: 114%;p<0.05	Helmet use in Louisiana decreased significantly following repeal of the universal helmet law. As a consequence, there are higher rates of head injuries and fatalities.
			Fatalities/10,000 registered vehicles:	Pre, annual: 7.6	Post, annual: 12.3	62%	
			Fatalities/1,000 crashes;	Pre, annual: 29.8	Post, annual: 39.4	32%	
			Total injuries:	Pre, annual: 39.2	Pre, annual: 125.3	220% p<0.001	
			Cervical spine injuries among all hospitalizations in NO trauma center	Pre: 1.9%	Post: 2.1%	Absolute change: 0.2 pct pts; NS	
			Helmet use among hospitalized;	Pre: 78.9%	Post: 44.2%	-35 pct pts; p<0.001	
			Helmet use among hospitalized, <18	Pre: 14.3%	Post: 15.0%	0.7 pct pts; NS	

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Hotz et al. (2002) **Study Objective:** Impact of FL going from universal to partial on crashes, hospital admissions, and helmet use in Miami-Dade county **Study Design:** Before-after	**Location:** Miami Dade county, FL **Type of Law:** Partial **Type of legislative action:** Universal to partial **Date of legislative action:** July 1, 2000 **Comparison:** Before-after law implementation	**Study Duration:** Pre: 07/1999–12/1999 Post: 07/2000-12/2000 **Study population:** Motorcyclists admitted to Ryder Trauma center and surgical ER at UM/JMMC in Dade County in Miami Total: 146 Population characteristics: Male: 127 (87.0%) Female: 19 (13.0%) Mean age: 30.2	Helmet use among motorcyclists seen at the Ryder Trauma Center in Dade County, Miami Hospitalization of motorcyclists	Pre: 82.60% Pre: 42	Helmet use (crashes): 56.10% Post: 65	Absolute change: -27 pct pts Relative change: 55%	The repeal of the universal helmet law resulted in a immediate decrease in helmet use and increase in hospitalization of motorcyclists in Miami-Dade county, FL.
Author (Year): Houston (2007a) **Study Objective:** Impact of universal, partial and no helmet law on youth fatalities in U.S. **Study Design:** Panel study	**Location:** 50 states+DC, US **Type of law:** universal, partial, and no law **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Universal vs. none; Partial vs.	**Study duration:** 1975 to 2004 **Study population:** motorcycle fatalities among 15-20 year olds in 50 states + D.C. during study period **Population characteristics:** NR	Fatalities among 15-20 year olds, controlled for 15-20 population size, state and year specific effects	N/A	N/A	Relative difference: Universal law vs. no law: -31% Partial laws covering 18-20 year olds vs. no law: -1% Partial laws covering 15-17 year olds vs. no law: 0%	Universal laws were effective in reducing fatalities among youth; in contrast, partial laws were not associated with reduction in fatalities among youth even though these laws apply to youth

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
	none						
Author (Year): Houston et al. (2007b) **Study Objective:** Impact of universal, partial and no helmet law on motorcycle-related fatalities in US Subset analysis: Impact of repealing universal helmet law in 6 states on motorcycle-related fatalities	**Location:** 50 states + DC, US Subset analysis: 6 states, US (AK, FL, KY, LA, PA, TX) **Type of law:** universal, partial and no law **Type of legislative action:** N/A Subset: universal to partial **Date of legislative action:** N/A Subset: 1997-2003 **Comparison:** Universal vs.	**Study duration:** 1975 to 2004 **Study population:** motorcycle fatalities recorded in FARS during study period **Population characteristics:** NR	Fatalities per registered motorcycle; regression analyses controlled for % of young adults, adults, adults who are male; income; alcohol consumption; population density	N/A	N/A	Relative difference: Universal law vs. partial or no law: -11%; p<0.01 Universal law vs. no law: -14%; p<0.01 Relative change: Subset analysis, 6 states, universal to partial: 12%; p<0.1	Universal helmet laws were associated with reduced fatality rate when compared to states with partial or no helmet laws; Subset analysis showed that repealing of universal helmet laws led to increased fatality rate

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Study Design: Panel study	none; Universal vs. partial + none; Subset: pre vs. post						
Author (Year): Houston et al. (2008) **Study Objective:** Impact of universal and partial helmet laws on fatalities per registered motorcycle, VMT, or residents **Study Design:** Panel study	**Location:** 50 states + DC, US **Type of law:** universal, partial, and no law **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Universal vs. partial + none; Universal vs. none; Partial vs. none;	**Study duration:** 1975 to 2004 **Study population:** motorcycle fatalities recorded in FARS during study period **Population characteristics:** NR	Fatalities per 10,000 registered motorcycles; Fatalities per 10 Bil VMT; Fatalities per 100,000 population;	N/A	N/A	Relative difference: Universal vs. partial + none: -15%; p<0.01 Universal vs. none: -22%; p<0.01 Partial vs. none: -10%; p<0.01 Universal vs. partial + none: -27%; p<0.01 Universal vs. none: -32%; p<0.01 Partial vs. none: -8%; p<0.01 Universal vs. partial + none: -29%; p<0.01 Universal vs. none: -33%; p<0.01 Partial vs. none: -8%; p<0.5	"Depending on the particular measure that is employed, states with universal helmet laws have motorcyclist fatality rates that are on average 22–33% lower in comparison to the experience with no helmet law. Additionally, partial coverage helmet laws are associated with reductions in motorcyclist fatality rates of 7–10%, on average"

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Koehler (1978) **Study Objective:** Impact of TX going from universal to partial on helmet use and fatalities **Study Design:** Before-after	**Location:** Texas, US **Type of law:** Partial law **Type of legislative action:** Universal to Partial **Date of legislative action:** August 29, 1977 (Universal to Partial) **Comparison:** Before and after law implementation	**Study duration:** Pre: August 29th 1976 – August 28th 1977 Post: : August 29th 1977 – August 28th 1978 **Study population:** Fatally and non-fatally injured motorcycle accident riders in Harris and Dallas counties, Texas; Total crashes (Partial law) N = 10,651 (Universal law) N = 10,116 **Population**	Helmet use, among fatally and non-fatally injured; Fatalities Total in 2 counties studied	1976-77: 94.8% 1976-77: 41	1977-1978:48.1% 1977-78: 84	Absolute change: -46.7 pct pts Relative change: 104.9%	Total fatalities, injuries, and crashes increased after repeal of the universal law. Among fatally and non-fatally injured, helmet use decreased from 94.8% to 48.1% after the repeal of the law.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
		characteristics: Male: 97%; Age range (males): approximately 50% were 18 to 25					
Author (Year): Kraus et al. (1994) **Study Objective:** Impact of CA going from partial to universal helmet law on fatal and non-fatal injuries **Study Design:** Before-after	**Location:** California, US **Type of Law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** Jan 1, 1992 **Comparison:** Before and after implementation of the law	**Study Duration:** Pre: 1991, or Jan to Sept 91; Post: 1992; or Jan to Sept 92 **Study population:** Fatal or non-fatally injured motorcyclists in CA during study duration (28 hospitals in 10 counties) Total: 850 **Population characteristics:** Male: 791 (93.1%) Female: 59 (6.9%) Mean age: 29.6	Helmet use (crashes) Fatalities, Total: Fatalities per 100,000 registrations: Head injuries fatalities: Non-fatal injuries, Total: Non-fatal Head injuries: Mean MAIS (non-fatal head injuries) Mean ISS (non-fatal injuries) Severe head injuries (non-fatal):	Helmet use (crashes): 22.3% 91: 5230 91: 70.1 91: 292.0 91: 1969 91: 769 91: 1.00 91: 9.80 91: 22.7%	Helmet use (crashes): 83.1% 92: 327.0 92: 51.5 92: 143.0 92: 1283 92: 316 92: 0.70 92: 8.80 92: 16.2%	Helmet use (crashes) : 60.8 pct pts Relative change: -37.5% -26.5% -51.0% -34.8% -58.9% -30.0% -10.2% -28.6%	The implementation of the universal helmet law in California has increased the helmet use and decreased the fatalities, injuries and hospital stay days.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
			Severe neck injury(non-fatal):	91: 0.10%	92: 0.10%	0.00%	
			Hospital stay	91: 9.36 days	92: 8.15 days	-12.9%	
Author (Year): Kraus et al. (1995) **Study Objective:** To evaluate impact of CA universal helmet law on helmet us, injuries, and injury severity **Study Design:** Before-after	**Location:** California, US **Type of law:** Universal **Type of legislative action:** Partial to Universal Partial was only for riders 15 ½ and younger; **Date of legislative action:** January 1, 1992 **Comparison:** Before and after law implementation;	**Study duration:** Pre: Jan to Dec, 91 Post: Jan 92 to Dec 93 Comparable; **Study population:** non-fatal injuries among motorcyclists crashed between Jan and Dec 93, and were treated in 18 hospitals in 10 CA counties; N=4790 For helmet use study, motorcyclists passing through 60 observational points throughout CA **Population characteristics:** NR	Injuries, total:	1991: 2037;	1992: 1388;	Relative change: -31.9%	Helmet law decreased number of injured riders with head injuries, decreased the number of riders treated for injuries, and increase the number of riders using helmets Severe head injuries also reduced, as measured by AIS or IIS score
			Injuries, head:	1991: 657; 32.3% of injured	1992: 293; 21.1% of injured	Relative change: -55.4% Absolute change: -11.2 pct pts	
			Head injuries, sever: max AIS>2:	1991: 438; 21.5% of injured	1992: 209; 15.1% of injured;	Relative change: -52.3% Absolute change: -6.4 pct pts	
			Head injuries, sever, IIS score 4 to 6:	1991: 68 3.3% of injured	1992: 21 1.5% of injured	Relative change: -69.1% Absolute change: -1.8 pct pts, p<0.001	
			Helmet use, observational:	1991: 56.2%	1992: 99.6%	Absolute change: 43.4 pct pts	
			Neck injuries	1991: 0	1992: 0	No change	

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Kyrychenko et al. (2006) **Study Objective:** Impact of Florida repealing universal helmet law on helmet use and fatalities **Study Design:** Before-after	**Location:** Florida, US **Type of law:** Partial Type of legislative action: Universal to Partial **Date of legislative action:** July 1, 2000 **Enforcement:** Only if there is reasonable suspicion that operator or passenger is younger than 21; **Comparison:** Before and after law implementation	**Study duration:** Pre: 1998-99; Post: 2001-02, comparable **Study population:** All motorcyclist deaths per crash involvement in Florida from 2001 -2002. N= 10,982 (1998–99 crash involvement) N= 14,917 (2001–02 crash involvement) **Population characteristics:** 92.1% male	Helmet use among fatalities: Total Male Female Rider Passenger Fatalities: Total Male Female Rider Passenger Age=< 20 Fatalities/crash, regression analysis controlling for gender, age, etc. Fatalities/1,000 crashes: Male Female	 Pre: 88% Pre: 87% Pre: 91% Pre: 88% Pre: 92% 1999: 165 1999: 302 1999: 11 1999: 313 1999: 24 1999: 25 N/A Pre: 35 Pre: 14	 Post: 39% Post: 41% Post: 37% Post: 41% Post: 17% 2001: 276 2002: 303 2001: 506 2001: 19 2001: 525 2001: 53 2001: 54 N/A Post: 43 Post: 19	Absolute change: -49 pct pts -46 pct pts -54 pct pts -47 pct pts -75 pct pts Relative change: 67% 84% 68% 73% 68% 121% 116% 25%, 9 to 43% Relative change: 23%; 7 to 42% 33%; -36 to 175%	Fatalities and fatalities per 10,000 registered vehicles and 100 crashes increased after enactment of the partial law Among motorcycle fatalities, helmet use decreased overall and across all subgroups after a change from a universal to a partial law Modeling estimated that 117 fewer motorcyclist deaths would have occurred during 2001–2002 had the universal helmet law remained in place

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
			Rider Passenger Age=<20 Fatalities/10,000 registered motorcycles	Pre: 32 Pre: 22 Pre: 19 1999: 7.0	Post: 40 Post: 35 Post: 37 2001: 9 2002: 8.8	23%; 7 to 41% 61%; 0 to 159% 97%; 23 to 315% 29% 26%	
Author (Year): La Torre et al. (2007) **Study Objective:** Impact of Italy passing universal helmet laws for scoter riders **Study Design:** Before-after	**Location:** Rome, Italy **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** March 2000 **Comparison:** Before and after law implementation	**Study duration:** March-June 1999 ; March-June 2000 (first post-legislation period); comparable Sept-Nov 2000 (second post-legislation period) *not reported in results;* **Study population:** Injured scooter drivers from Emergency Dept of Policlinico 'Umberto I' in Rome from 1999-2000. Scooter: any 2 wheeled motor vehicle. N=858 **Population characteristics:** 61.8% male; 6.8% < 18 years; 52.9% 18-29; 40.% >= 30 years	Helmet use among injured Injuries: Total Age <18 Head injuries: Total Age <18 Age >=18	1999: 4.9% 1999: 384 1999: 29 1999: 150 1999: 11 1999: 139	2000: 97.3% 2000: 474 2000: 29 2000: 158 2000: 8 2000: 150	Absolute change: 92 pct pts; p<0.001 Relative change: 23% 0% 5% -27% 8%	Total injuries increased after the implementation of the law but total injuries for those under 18 stayed the same. Head injuries overall increased slightly, but reduced for scoter riders under 18 years of age

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Lloyd et al. (1987) **Study Objective:** Impact of Texas repealing universal law on helmet use and motorcycle-related fatal and non-fatal injuries **Study Design:** Before-after	**Location:** Texas, US **Type of law:** Partial **Type of legislative action:** Universal to partial **Date of legislative action:** August 29, 1977 **Comparison:** Before and after law repeal	**Study duration:** 1975-1986 Pre: 1975-1976 Post: 1978-1985 **Study population:** all fatal and non-fatally injured motorcyclists in Texas from 1975-1985 Population characteristics: NA	Helmet use among injured Non-fatal injuries /10,000 vehicles Fatalities/10,000 registered vehicles	1976: 90% 1976: 300 1976: 7.0	1978: 26% 1978: 450 1978: 15.0	Absolute change: -64 pct pts Relative change: 50% 114%	The repeal of the universal motorcycle helmet use to partial helmet law increased the percent of fatal and non-fatal injuries and decreased the use of helmets.
Author (Year): Lummis et al. (1981) **Study Objective:** To examine the impact of universal helmet law	**Location:** Kansas, US **Type of law:** Partial **Type of legislative action:** Universal to Partial	Study duration: Pre: 1975; Post: 1977-78; Note - Data provided for all of Kansas helmet law history; Comparable; **Study population:** All motorcyclists	Helmet use among injured: Injuries/10,000 registered vehicles: Total fatalities: Fatalities/10,000 registered vehicles:	1975: 86.1 1975: 47.7 1975: 38.0 1975: 4.2	1978: 34.4 1978: 88.1 1977: 55.0 1978: 6.5	Absolute change: -52 pct pts Relative change: 84.7% 44.7% 54.8%; p<0.001	Repeal of the universal helmet law in Kansas is associated with significant increases in injuries involving motorcycle crashes. Note: This study also reports financial data related to the

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
repeal on motorcycle crashes and injuries in Kansas **Study Design:** Before-after	**Date of legislative action:** July 1, 1976 **Comparison:** Before and after the law implementation	involved in crashes **Population characteristics:** NR	Head injuries/1,000 injured:	1975: 100.0	1978: 177.0	77%; p<0.001	costs of crashes including property damage, medical and hospital treatments, and rehabilitation and severity of for helmeted vs non-helmeted riders
Author (Year): Lund et al. (1991) **Study Objective:** Impact of universal helmet law on helmet use in TX **Study Design:** Before-after	**Location:** Texas, US **Type of law:** Universal Type of legislative action: Partial to Universal **Date of legislative action:** September 1, 1989 Comparison: Before and after the law implementation	**Study duration:** 06/1987-11/1989 Pre: 0687, 01/88, 06/88, 01/89, 06/89, 08/89 Post: 09/89, 11/89 Used for analysis: 08 and 09 of 89 **Study population:** motorcycle drivers and passengers who pass by observational posts during study period in 18 TX cities **Population characteristics:** Urban and suburban Total observations: 4380	Helmet use Total Helmet use Driver Helmet use Passenger	Aug: 41% Aug: 44% Sept: 32%	Sept: 90% Aug:91% Sept: 76%	Absolute change: 49 pct pts 47 pct pts Sept: 44 pct pts	The implementation of the universal motorcycle helmet use law in Texas in Sept 1, 1989 increased the use of helmets amongst motorcycle drivers and passengers.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Max et al. (1998) **Study Objective:** Impact of CA universal helmet law on fatal and non-fatal injuries and associated costs **Study Design:** Before-after	**Location:** California, US **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** January, 1992 **Comparison:** Before and after law implementation	**Study duration:** 1987-1995 Pre: 1991 Post: 1992-1993 Comparable; Can't tell **Study population:** All motorcyclists deaths, injuries and hospitalizations due to motorcycle accidents in CA; Total: Fatalities, 91-92: 839; Injuries, 91-92: 29234 **Population characteristics:** Among fatalities: Sex: 91% male Mean age: NR; < 30 years: 63%	Fatalities: Total <21 years of age Fatalities/100,000 registered vehicles Injuries: Total Hospitalized head injury Injuries/100,000 registered vehicles Hospitalized head injuries/100,000 registered vehicles Average length of stay, days	 1991: 512 1991: 102 1991: 80 1991: 16910 1991: 1468 1991: 2645 1991: 230 1991: 7.9	 1992: 327 1992: 53 1992: 56 1995: 50 1992: 12324 1995: 8690 1991: 751 1992: 2113 1995: 1667 1992: 129 1992: 7.3	Relative change: -32% -48% -30% -38% -27% -49% -49% -20.1% -37% -44% -8%	CA full helmet-use law was consistently associated with lower rates of motorcycle fatalities and injuries, and hospitalization. Note – study also reports economic data as well as data on hospitalizations

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Mayrose (2008); **Study arm 1** **Study Objective:** Evaluate effect of universal helmet law on helmet use among fatally injured motorcyclists in U.S. **Study Design:** Time series with comparison groups	**Location:** 48 states + DC, US **Type of law:** Universal vs. partial vs. none **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Universal vs. partial vs. none	**Study duration:** Data from 1995 through 2003 States with different laws might not be comparable **Study population:** States with universal law: N=6772 States with partial law: N=6269 States with no law: N=1189 **Population characteristics:** Sex: 87.1% male Mean age:34.7 Range: 2 to 88	Helmet use among fatally injured motorcyclists Helmet use among fatally injured motorcyclists, <18	No law: 18% No law: 18% Partial law: 36% No law: 17% No law: 17% Partial law: 34%	Partial law: 36% Universal: 84% Universal: 84% Partial law: 34% Universal: 76% Universal: 76%	Absolute change: 19 pct pts 66 pct pts 48 pct pts 17 pct pts 59 pct pts 42 pct pts	Motorcyclists were more likely to wear a helmet in states with a universal helmet law than motorcyclists in states with only a partial helmet law or no law.
Author (Year): Mayrose (2008); **Study arm 2** **Study Objective:** Impact of AR	Texas and Arkansas were analyzed separately because these states dropped their primary helmet (universal) law to a secondary	TX and AR, pre-repeal: 307 TX and AR, post-repeal: 823	Fatalities/10,000 registered motorcycles Helmet use among fatalities	Fatalities/ 10,000, pre-repeal: AR: 11.3 TX: 8.4 Helmet use, pre-repeal:	Fatalities/ 10,000, post-repeal: AR: 11.4 TX: 10.0 Helmet use post repeal:	Relative change: AR: 0.88% TX: 19.0%; p<0.01 Absolute change:	A significant decrease in helmet use in TX and AR, as well as a significant increase in fatalities resulting from motorcycle crashes after repeal of the primary

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
and TX repealing universal helmet law on fatalities and fatality rate **Study Design:** Before-after	(partial) law during the study period.			76.2%	39.3%	-36.9 pct pts	helmet law in both states
Author (Year): McGwin et al. (2004) **Study Objective:** Population-based study to evaluate impact of helmet law on motorcycle driver mortality rates in US from 97-99 **Study Design:** Other design with concurrent comparison group	**Location:** All states plus DC, US **Type of law:** Universal vs. Partial+ No law **Type of legislative action:** NA **Date of legislative action:** Varies by state **Comparison:** Compares states with universal laws to states without universal laws	**Study duration:** 1997-1999 **Study population:** Motorcycle drivers fatally injured in a motorcycle accident in the US during the study years; Total driver fatalities: 6,312 driver fatalities during study period **Population characteristics:** NR	Fatalities/10,000 drivers: Fatalities/10mil VMT:	NA NA	NA NA	Rate ratio (Universal vs. Partial+ No law): 0.77; 95%CI: 0.72 – 0.82 Rate ratio (Universal vs. Partial+ No law): 0.78; 95%CI: 0.73 – 0.83	Compared to states without helmet laws, states with universal laws experience 22% less fatalities

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): McHugh et al. (1985) **Study Objective:** Impact of repealing universal helmet laws on motorcycle-related fatalities and fatality rates **Study Design:** Before-after	**Location:** South Carolina, US **Type of law:** Partial **Type of legislative action:** Universal to Partial (1980) No law to Universal (1967) **Date of legislative action:** June 17, 1980 **Comparison:** Before-after law implementation	**Study duration:** 1965-1984 Pre:1965-79; 1975-1979 Post: 1981-84 **Study population:** All reported motorcycle-related accidents and deaths during 20 year study period; Total crashes: 28045 Total fatalities: 820 **Population characteristics:** NR	Total fatalities: Universal to partial None to universal Fatalities/10,000 registrations: Universal to partial None to universal Crashes: Universal to partial None to universal Crashes/10,000 registrations: Universal to partial None to universal	 1979: 42 1966: 23 1979: 11.2 1966: 20.4 1979: 1543 1966: 591 1979: 411.8 1966: 525.4	 1981: 46 1968: 9 1981: 10.8 1968: 7.4 1981: 1934 1968: 280 1981: 457.7 1968: 238.6	Relative change: 9.5% -60.9% -3.6% -63.7% 25.3% -52.6% 11.1% -54.6%	While fatalities/10,000 registrations went down, the number of total fatalities and crashes, and the number of crashes/10,000 increased post repeal of the universal helmet law. In contrast, enactment of the universal law was followed by significant decrease in all study outcomes.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): McSwain, et al. (1985) **Study Objective:** Impact of implementing universal helmet law on helmet use and motorcycle-related fatalities **Study Design:** Before-after	**Location:** Louisiana, US **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** 1982 **Comparison:** Before and after law implementation;	**Study duration:** Pre: 6/81-9/81 Post: 6/82-9/82 Comparable; Can't tell **Study population:** All motorcycle injury accidents and fatalities for the state of Louisiana; part of study focused on three specific areas (Lake Charles, Baton Rouge, and New Orleans) Total crashes for LA: 6,633 Total crashes for 3 study areas704 (616 reports) **Population characteristics:** 3 study areas: Sex: 94% male	Helmet use, observed, total Helmet use among crashes: <19 Fatalities, total Head-related fatalities Neck injury as primary reason for fatalities	1981: 50% 1981: 41.9% 1981: 132 1981: 77 1981: 5	1982: 95% 1982: 95% 1982: 91 1982: 43 1982: 3	Absolute change: 45 pct pts 31 pct pts Relative change: -31.1% -44.2% -40.0%	Louisiana mandatory helmet law was associated with increased helmet use and reductions in head injuries and fatalities and for all age groups. Note: study includes data for injuries by other body areas, and injuries by whether the rider was wearing a helmet; this study also reports average length of hospital stay and medical costs related to motorcycle injuries.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Mertz et al. (2008) **Study Objective:** Impact of PA universal to partial helmet law on fatal and non-fatal injuries, head injuries **Study Design:** Before-after	**Location:** Pennsylvania, US **Type of law:** Partial Type of legislative action: Universal to partial **Date of legislative action:** 2003 **Comparison:** Before and after repeal	**Study Duration:** Pre: 2001-02; Post: 2004-05 **Study population:** Motorcyclists in PA and were in motorcycle crash from 2001-2005 **Population characteristics:** NR	Helmet use among crashes Hospitalization: Total: Per 10,000 registered vehicles: Per 1000 crashes: Head injury hospitalizations: Total: Per 10,000 registered vehicles: Per 1,000 crashes: Fatalities: Total Per 10,000 registered vehicles Per 1000 crashes Head injury fatalities Total	2001-02: 82.0% 2002: 1319 2002: 53.0 2002: 381.8 2002: 393 2002: 15.8 2002: 113.7 2002: 116.0 2002: 4.7 2002: 33.6 2002: 48.0	2004-05: 58.0% 2004:1645 2004: 56.5 2004: 398 2004: 602 2004: 20.7 2004: 145.7 2004: 133.0 2004: 4.6 2004: 32.2 2004: 51.0	Absolute change: -24 pct pts Relative change: 25% 7% 4% 53% 31% 28% 15% -2% -4% 6%	The repeal of the universal helmet law in PA resulted in a decrease in helmet use, and an increase in hospitalizations due to fatal and non-fatal injuries (total and head).

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
			Per 10,000 registered vehicles	2002: 1.9	2004: 1.8	-9%	
			Per 1000 crashes	2002: 13.9	2004: 12.3	-11%	
Author (Year): Mock et al. (1995) **Study Objective:** To examine the effect of helmet promotion efforts on the overall occurrence of motorcycle-related head injuries **Study Design:** Before-after	**Location:** Washington state, US **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** June 7, 1990 **Comparison:** Before-after law implementation	**Study duration:** Jan1, 86 to Dec 31, 1993 **Study population:** Motorcyclists involved in crashes and admitted to the Harborview Medical Center (level 1 trauma center) for motorcycle related injuries during study period; Total: 992 **Population characteristics:** Age: 28.2±9.7 years Sex: 90% male	Helmet use among hospitalization	Before law: 41.0%	After law: 80.0%	Absolute change: 39 pct pts; p<0.001	Washington's universal helmet law is associated with increased helmet use and decreases in fatalities and injury admissions.
			Fatalities as part of hospitalized motorcyclists	Before law: 10%	After law: 6%	Relative change: -40%; p=0.03	
			Hospitalization per year	Before law: 134	After: 114	-15%	
			Hospitalization% that was severe head injury, AIS score of 4 or 5:	Before law: 20.0%	After law: 8.6%	Absolute change: -11 pct pts; p<0.01	
			Length of stay, days	Before law: 12.4	After law: 11.3	Relative change: -9%; NS	
Author (Year): Morris (2006) **Study Objective:** To assess the association of universal helmet laws	**Location:** 50 states, US **Type of law:** Universal vs. Partial + None **Type of legislative action:** N/A	**Study duration:** 1993-2002 **Study population:** Motorcyclist fatalities during study period as recorded by FARS **Population characteristics:**	Fatalities/10,000 registered motorcycles; linear regression analyses controlled for temperature and precipitation	N/A	N/A	Relative change: -12%; p=0.053	Universal helmet laws reduce motorcycle-related fatality rate after controlling for weather pattern across 50 states in U.S.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
with U.S. motorcyclist fatality rates from 1993 through 2002 **Study Design:** Panel study	**Date of legislative action:** N/A **Comparison:** universal vs. partial + none	NR					
Author (Year): Mounce et al. (1992) **Study Objective:** Impact of TX universal helmet law on fatal and non-fatal injuries **Study Design:** Interrupted time series	**Location:** Texas, US **Type of law:** Universal Type of legislative action: Partial to Universal **Date of legislative action:** Sept 1, 1989 **Comparison:** time series analysis of before and after law implementation	**Study duration:** Pre: Sept 86 to May 87 Post: Sept 89 to May 90 **Study population:** Motorcyclist with fatal or non-fatal injuries in TX during study period recorded by TX Dept of Public Safety **Population characteristics:** NR	Helmet use among injured motorcyclists who went to hospital Injuries per 100,000 registered motorcycles, ARIMA modeling: Total (fatal + incapacitating + non-incapacitating + possible) Serious (fatal + incapacitating + non-incapacitating) Severe (fatal + incapacitating) Fatalities per 100,000 registered motorcycles, ARIMA modeling	Pre: 32% NR NR NR NR	Post: 84% NR NR NR NR	Absolute change: 52 pct pts Relative change: -9%; p<0.05 -11%; p<0.05 -11%; p<0.05 -10%; NS	Time series analyses of police-reported crashes in Texas indicated that after implementation of universal helmet law, there was an 11% reduction in serious and severe injury rates, a 10% reduction in fatality rate, and a 9% reduction in injury rate

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Muelleman et al. (1992) **Study Objective:** Impact of reinstating a universal helmet law on crashes, injuries, fatalities, and helmet use in Nebraska **Study Design:** Before-after	**Location:** Nebraska, US **Type of law:** Universal Type of legislative action: None to Universal **Date of legislative action:** January 1, 1989 **Comparison:** before and after law implementation;	**Study duration:** Pre-legislation: 1988 Post- legislation: 1989 **Study population:** All motorcyclist injured from 1988 to 1989 in Nebraska (2 counties), US; N= 671 (286 transported to hospital or deceased) **Population characteristics:** Among reported injured: Mean age: 26 years Sex: 91% male	Helmet use, among injured Total reported injured Injuries/10,000 registered motorcycles Serious injuries, AIS >=3 Serious head injuries, AIS>=3 Neck and cervical spinal injuries Total fatalities Fatalities/10,000 registered motorcycles	Pre: 15% Pre: 421 Pre: 473 Pre: 48 Pre: 23 Pre: 11 Pre: 12 Pre: 13.5	Post: 85% Post: 250 Post: 340 Post: 28 Post: 9 Post: 8 Post: 6 Post: 8.2	Absolute pct pts change: 70 Relative change: -41%; p<0.05 -28%; p<0.05 -42%; p<0.05 -61%; p<0.05 -27% -50%; NS -39%; NS	Declines in the number (and rates) of reported injured, severe head injuries, and fatalities after reenactment of a helmet use law.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Muller (2004) **Study Objective:** To examine impact of FL repealing universal helmet law ion fatal and non-fatal injuries **Study Design:** Interrupted time series	**Location:** Florida, US **Type of law:** Partial **Type of legislative action:** Universal to Partial **Date of legislative action:** Jul1, 2000 **Comparison:** ARIMA modeling to examine time series before and after law repeal	**Study duration:** July 94 to June 01 **Study population:** Fatalities in Florida during study period **Population characteristics:** NR	All estimates based on ARIMA models Fatalities: Total Per 10,000 registered motorcycles Per billion VMT			Relative change: 49% 21% 38%	This study finds that repealing universal helmet law in Florida resulted in increased motorcyclist deaths, even after adjusting for motorcycle registrations or miles traveled
Author (Year): NHTSA (1980) **Study arm 1** **Study Objective:** To examine impact of repealing	**Location:** Colorado, US **Type of law:** None **Type of legislative action:** Universal to None	**Study duration:** Pre-repeal: 1976 Post-repeal: 1978 **Study population:** Motorcyclists involved in fatal and non-fatal crashes in the study states	Helmet use, observational Head injuries per 1,000 crashes Neck injuries per 1,000 crashes	Pre: 99.7% Pre: 110 Pre: 25	Post: 57.7% Post: 279 Post: 37	Absolute change: -42, p<0.001 Relative change: 154%, p<0.0001 48%; NS	Repealing universal helmet law in Colorado resulted in decreased helmet use and increased head-injury related fatal and non-fatal injuries per 1,000 crashes

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
universal helmet law in several states **Study Design:** Before-after	**Date of legislative action:** July 1, 1977 **Comparison:** before and after law repeal;	Motorcyclists observed on road for helmet use study **Population characteristics:** NR	Head injuries per 1,000 crashes, head as the most severely injured body part Head-related fatalities per 1,000 crashes	Pre: 66 Pre: 16	Post: 169 Post: 73	156%; p<0.0001 356%; p<0.0001	
Author (Year): NHTSA (1980) **Study arm 2** **Study Objective:** To examine impact of repealing universal helmet law in several states **Study Design:** Before-after	**Location:** Kansas, US **Type of law:** Partial Type of legislative action: Universal to Partial **Date of legislative action:** July 1, 1976 **Comparison:** before and after law repeal;	**Study duration:** Pre-repeal: 1975 Post-repeal: 1977 **Study population:** Motorcyclists involved in fatal and non-fatal crashes in the study states; **Population characteristics:** NR	Helmet use, among motorcycle-related crashes Non-fatal injuries per 1,000 crashes, head + face Non-fatal injuries per 1,000 crashes, neck Non-fatal injuries per 1,000 crashes, head + face as the most severely injured body part Fatalities per 1,000 crashes, head	Pre: 94.4% Pre: 118 Pre: 23 Pre: 63 Pre: 6	Post: 57.1% Post: 184 Post: 20 Post: 143 Post: 28	Absolute change: -37 pct pts Relative change: 56%, p<0.0059 -13%; NS 127%; p=0.0238 367%; p=0.0091	Repealing universal helmet law in Kansas resulted in decreased helmet use and increased head-injury related fatal and non-fatal injuries per 1,000 crashes
Author (Year): NHTSA (1980) **Study arm 3** **Study Objective:** To examine impact of	**Location:** South Dakota, US **Type of law:** Partial Type of legislative action: Universal to Partial	**Study duration:** Pre-repeal: 1976 Post-repeal: 1978 **Study population:** Motorcyclists involved in fatal and non-fatal crashes in the study states	Helmet use, observed Driver Passenger Non-fatal injuries per 1,000 crashes, head	Pre: 99.5% Pre: 99.6% Pre: 99.3% Pre: 109	Post: 59.0% Post: 57.3% Post: 60.7% Post: 149	Absolute change: -41; p<0.001 -42 pct pts -39 pct pts Relative change: 37%, p<0.0217	Repealing universal helmet law in South Dakota resulted in decreased helmet use and increased head-injury related fatal and non-fatal injuries per 1,000 crashes

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
repealing universal helmet law in several states **Study Design:** Before-after	**Date of legislative action:** July 1, 1977 **Comparison:** before and after law repeal;	Motorcyclists observed on road for helmet use study **Population characteristics:** NR	Non-fatal injuries per 1,000 crashes, neck Non-fatal injuries per 1,000 crashes, head as most severely injured Fatalities per 1,000 crashes, head	Pre: 25 Pre: 49 Pre: 15	Post: 14 Post: 73 Post: 24	-44%; NS 49%; p=0.0446 60%; p=0.1335	
Author (Year): NHTSA (1980) **Study arm 4** **Study Objective:** To examine helmet use among motorcycle-related fatalities in states with universal, partial, or no helmet law **Study Design:** Cross-sectional	**Location:** 32 states, US **Type of law:** Universal vs. Partial vs. None **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Universal (20 states) vs. Partial (14 states) vs. None (8 states)	**Study duration:** 1978 **Study population:** Motorcyclists involved in fatal crashes in the study states **Population characteristics:** NR	Helmet use among fatalities, under 18 years of age Helmet use among fatalities, over 18 years of age	No law: 28.7% No law: 28.7% Partial laws: 38.5% No law: 23.9% No law: 23.9% Partial laws: 23.9%	Universal: 69.5% Partial laws: 38.5% Universal: 69.5% Universal: 76.7% Partial laws: 23.9% Universal: 76.7%	Absolute change: 41 pct pts, p<0.001 10 pct pts 31 pct pts, p<0.001 53 pct pts, p<0.001 0 pct pts 53 pct pts, p<0.001	Helmet use among fatalities, for both motorcyclists over and under 18 years of age, was highest in states with universal helmet laws, while helmet use in states with partial laws or no law was similar

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Nurchi et al. (1987) **Study Objective:** Impact of a universal motorcycle helmet law on morbidity and mortality in Cagliari, Italy and surrounding areas **Study Design:** Before-after	**Location:** Cagliari, Italy **Type of law:** Universal **Type of legislative action:** None to Universal **Date of legislative action:** 1/11/1986 (effective 7/18/86) **Comparison:** Before-after law implementation	**Study duration:** Pre: 8/85-12/85 Post: 8/86-12/86 Comparable; Can't tell **Study population:** 372 accidents involving motorcycles (219 pre and 153 post) in Cagliari, Italy and the surrounding area **Population characteristics:** NR	Total head injuries: Inpatients with head injuries: Fatalities with head injury: Days of hospitalization	Pre: 86 Pre: 79 Pre: 9 Pre: 6.4	Post: 40 Post: 37 Post: 3 Post: 2.5	Relative change: -54% -53% -67% -61%	The Universal Motorcycle helmet law is associated with reduced number of head injuries in motorcycle accidents and, subsequently, with a reduction in fatalities. Note: This study also reports data for total crashes, type of head injury, head injury as proportion of crashes, and hospitalization
Author (Year): O'Keeffe (2007) **Study Objective:** To examine the impact of Florida's 2000 helmet law repeal on motorcycle ridership and fatalities for residents of Miami-Dade County, FL from January 1, 1997 to December	**Location:** Miami-Dade County, Florida, US **Type of law:** Partial **Type of legislative action:** Universal to Partial **Date of legislative action:** July 1, 2000 **Comparison:**	**Study duration:** Pre: 1997-1999 Post 1: 2001 Post 2: 2003 **Study population:** All fatally injured motorcycle riders in Miami-Dade County FL between January 1, 1997 and December 31, 2003 N= 197 Population characteristics: Sex: Male 94.4% Age: median of 28, SD 10.5	Fatalities: Total Fatalities/10,000 registered motorcycles: Helmet use (among fatalities, estimate):	1999: 21 1991: 11.8 1999: 81%	2001: 36 2003: 43 2001: 15.0 2003: 11.0 2001: 53% 2003: 32%	Relative change: 2001/1999: 71.4% 2003/1999: 104.8% 2001/1999: -27.1% 2003/1999: -6.8% Absolute change 2001/1999: -28 pct pts 2003/1999: -49 pct pts	After repeal of the law fatalities increased dramatically but the fatality rate per 10,000 registered motorcycles declined Among fatalities, helmet use rate decreased from, from 81.0% pre-law to 53.0% and 32.0% respectively in the post-law period Of note, there was

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
31, 2003 **Study Design:** Before-after	Before and after law implementation;						also an increase in motorcycle riders after the repeal of the law
Author (Year): Paulsrude et al. (1967) **Study Objective:** To examine the effectiveness of motorcycle safety laws in reducing the number of accidents involving motorcycles and reducing severity of motorcycle accidents during the study period; **Study Design:** Before-after	**Location:** Washington, US **Type of law:** Universal **Type of legislative action:** None to Universal **Date of legislative action:** 1967 **Comparison:** Before and after law implementation	**Study duration:** Pre: 1/1/60-1966 Post: 1968-12/31/71 **Study population:** Motorcycle riders from the State of Washington Total: NR **Population characteristics:** NR	Injuries: Total: Per 10,000 registered vehicles: Per 1000 crashes Fatalities: Total: Per 10,000 registered vehicles: Per 1000 crashes Due to head injury:	 1966: 1558 1966: 280.8 1966: 840.8 1966: 46 1966: 8.3 1966: 24.8 1966: 23	 1968: 943 1971: 1405 1968: 202.2 1971: 189.6 1968: 829.4 1971: 834.3 1968: 20 1971: 46 1968: 4.3 1971: 6.2 1968: 17.6 1971: 27.3 1968: 11 1971: 20	Relative change: -39% -10% -28% -32% -1% -1% -57% 0% -48% -25% -29% 10% -52% -13%	The 1967 motorcycle safety laws were effective reducing the total, injury, and fatal number of motorcycle crashes after the enactment of the law for residents in the State of Washington. Note: Study also reports decreases in total crashes fatalities due to head injuries/10,000 vehicles

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Pickrell et al. (2008) **Study Objective:** To evaluate helmet use among motorcycle riders involved in fatal crashes **Study Design:** Time series with concurrent comparison group	**Location:** 50 States, US **Type of law:** Universal, partial, or none **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Before-after law implementation	**Study duration:** 1997-2006 **Study population:** Motorcycle-related fatalities during study period, stratified based on whether the crash occurred in states with or without universal helmet laws; Results limited to riders 21 or older **Population characteristics:** Male: 97%	Helmet use among fatalities, overall	Partial or no law: 28%	Universal laws: 82%	Absolute percentage point difference: 54 pct pts	Factors most highly correlated with motorcycle rider helmet use include the following: universal helmet law in the State where the crash occurred; the rider's age and blood alcohol level at the time of crash; motorcycle engine size; whether the crash occurred at night or during the day
Author (Year): Preusser et al. (2000) **Study arm 1** **Study Objective:** Impact of repealing universal	**Location:** Arizona, US **Type of law:** Partial **Type of legislative action:** Universal to Partial	**Study duration:** 1996-1998; Data available from 1975-98 **Study population:** Motorcyclists involved in fatal or non-fatal crashes in Arizona during the study period	Helmet use among motorcyclists treated by EMS Injuries: Total: Per 10,000 registered motorcycle Head-related	1996: 53% 1996: 444 1996: 268.7 1996: 87	1998: 29% 1998: 551 1998: 261.1 1998: 155	Absolute change: -24 pct pts Relative change: 24% -3% 78%	Repealing universal helmet laws in Arizona resulted in decreased use of motorcycle helmet and increased fatal and non-fatal injuries, but this effect was not observed for fatal and non-fatal injury

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
helmet laws in AR on helmet use, motorcyclist injuries and fatalities, and costs **Study Design:** Before-after	**Date of legislative action:** Aug 1, 97 **Comparison:** before and after law change	**Population characteristics:** NR	Per 10,000 registered motorcycle Fatalities: Total Per 10,000 registered motorcycle	 1996: 52.7 1996: 19 1996: 11.5	 1998: 73.5 1998: 23 1998: 10.9	 39% 21% -5%	rates. Head injury and head injury rates, however, increased by a large magnitude
Author (Year): Preusser et al. (2000) **Study arm 2** **Study Objective:** Impact of repealing universal helmet laws in TX on helmet use, motorcyclist injuries and fatalities, and costs **Study Design:** Before-after	**Location:** Texas, US **Type of law:** Partial Type of legislative action: Universal to Partial **Date of legislative action:** Sept 1, 97 **Comparison:** before and after law change	**Study duration:** 1996-1998; Data available from 1975-98 **Study population:** Motorcyclists involved in fatal or non-fatal crashes in Texas during the study period **Population characteristics:** NR	Helmet use among observed motorcyclists Injuries: Total: Per 10,000 registered motorcycle Severe injuries Fatalities: Total Per 10,000 registered motorcycle	1996: 97% 1996: 3279 1996: 226.9 1996: 923 1996: 101 1996: 7	1998: 66% 1998: 3356 1998: 225 1998: 854 1998: 132 1998: 8.9	Absolute change: -31 pct pts Relative change: 2% -1% -7% 31% 27%	Repealing universal helmet laws in Texas resulted in decreased use of motorcycle helmets, slight increase in non-fatal injuries, and increases in fatal injuries and fatal injury rates.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Prinzinger (1982) **Study Objective:** Impact of universal helmet laws on fatal injuries in the U.S. **Study Design:** Panel study	**Location:** 50 states, US **Type of law:** Universal, partial, or none Type of legislative action: N/A **Date of legislative action:** N/A **Comparison:** Universal vs. Partial + None	**Study duration:** 1975-1978 **Study population:** motorcycle fatalities during study period that were recorded in FARS; **Population characteristics:** NR	Fatalities in universal helmet law states compared to partial or no law states; regression analysis controlled for alcohol consumption, incomes, etc.	N/A	1978: N/A	-22%, p<0.05	Having universal helmet laws is associated with reduced number of fatal crashes.
Author (Year): Proscia et al. (2002) **Study Objective:** To evaluate the effects of motorcycle helmet use between states with (NY) and without (CT) a universal helmet law **Study Design:** Cross-sectional	**Location:** New York and Connecticut, US **Type of law:** Universal, partial **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** Universal vs. partial	**Study duration:** 1996 to 1998 **Study population:** Motorcycle injury admissions at two Level 1 Trauma Centers in NY and CT **Population characteristics:** Male: 91.7% Age: mean 32.7 years	Helmet use among those admitted to hospital: Fatality as proportion of hospital admissions Head injury as proportion of all admissions, moderate/severe	Bridgeport Hospital CT (Partial law): 18.0% Bridgeport Hospital CT (Partial law): 15.0% Bridgeport Hospital CT (Partial law): 27%	Westchester Medical Centre NY (Universal law): 91.0% Westchester Medical Centre NY (Universal law): 6.0% Westchester Medical Centre NY (Universal law): 18%	Absolute Change 73 pct pts; p<0.01 -9 pct pts; p<0.05 -10 pct pts; NS	Among those admitted to the hospital, helmet use was much higher in the state with universal helmet law; Among those admitted to the hospital, fatalities in the universal state was lower by 9 percentage points compared to the partial law state

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Robertson (1976) **Study arm 1** **Study Objective:** To compare helmet use in states with or without universal helmet law **Study Design:** Cross-sectional	**Location:** Various states, US **Type of law:** Universal vs. no law **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** universal (GA and MD) to no helmet law states (CA and IL)	**Study duration:** 1975 **Study population:** All motorcyclist observed for helmet use in states with or without universal helmet law (1 city in each state) during September 1975 N = 2842 **Population characteristics:** NR	Helmet use, observed :	No helmet law states: 51.0%	Universal helmet law: 99.9%	Absolute difference: 49 pct pts	Helmet use is greater in states with universal helmet laws than states without helmet laws
Author (Year): Robertson (1976) **Study arm 2** **Study Objective:** To evaluate the effect of helmet use laws on fatalities in states that had implemented a universal helmet law compared to	**Location:** Several states, US **Type of law:** Universal, partial or none **Type of legislative action:** None or partial to universal **Date of legislative action:** 68-72 **Comparison:**	**Study duration:** 01/01/1968 to 07/01/1972 Pre: 1 year before enactment of law (years vary by state) Post : 1 year after enactment of law (years vary by state) **Study population:** All motorcycle fatalities in states with or without helmet laws during the study period.	Fatalities/10,000 registered vehicles	States without universal helmet law, didn't change law during study period, pre: 10 States implemented universal helmet law, pre: 11	States without universal helmet law, didn't change law during study period, post: 11 States implemented universal helmet law, post: 7	Relative change: 10% -36%	States that implemented universal helmet law reduced motorcycle-related fatality rate by 42% when compared to states that stayed without universal helmet law

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
states that had no universal law **Study Design:** Before-after with comparison group	State implemented universal helmet law: AZ, CO, ID, KS, KY, LA, MD, MN Control states: no universal helmet law, didn't change law status during study period, and comparable to study states: CA, NM, MT, IA, VA, MI, WV	**Population characteristics:** NR				Relative difference between states implemented universal helmet law and states stayed without universal helmet law: -42%	
Author (Year): Sass et al. (2000) **Study Objective:** Impact of universal helmet law on fatalities **Study Design:** Panel study	**Location:** 50 states, US **Type of law:** Universal vs. partial or no law **Type of legislative action:** N/A **Date of legislative action:** N/A **Comparison:** universal vs. partial + no law states	**Study duration:** 1976-1997 **Study population:** fatalities in 50 states during study period **Population characteristics:** NR	Fatalities, regression analysis controlling for climate, alcohol consumption, time trend, and various other factors	N/A	N/A	Relative difference, universal helmet law states compared to partial or no law states: -29%; p<0.05	

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Scholten et al. (1984) **Study Objective:** To examine the effect of Indiana's mandatory helmet law repeal on motorcycle fatalities **Study Design:** Before-after	**Location:** Indiana, US **Type of law:** Universal **Type of legislative action:** Universal to None **Date of legislative action:** September 1, 1977 **Comparison:** Before and after law repeal	**Study duration:** Helmet use Pre: 5/1977-8/1977 Post: 5/1978-8/1978 Fatality rates: Pre: 1962-67 Post: 1968-73 **Study population:** Helmet use: motorcycle riders in the state of Indiana involved in crashes Fatality rates: motorcycle-related fatalities in state during study period **Population characteristics:** NR	Helmet use among motorcyclists involved in crashes Fatalities per 100,000 registrations Fatalities per 1,000 crashes	1977: 75.6%; 1962-67: 101.2; 1962-1967: 23.3;	1978: 36.8%; 1968-73: 71.8; 1968-73: 22.4;	Absolute change -39 pct pts Relative change: -29%; p<0.05 -4%;	The repeal of Indiana's universal helmet law in 1977 resulted in a drastic decrease in helmet use, while increasing the death rate per 1,000 crashes and the death rate per 100,000 registered motorcycles.
Author (Year): Servadei et al. (2003) **Study Objective:** To evaluate the effect of revision of the Italian motorcycle-moped-scooter helmet law on helmet use and traumatic brain injury (TBI) occurrence	**Location:** Italy **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** March 2000 **Comparison:** Before and after	**Study duration:** For helmet use: Pre: 2/00-3/00 Post: 4/00-6/00 Traumatic brain injury Pre: 3/99-3/00 Post: 3/00-3/01 **Study population:** Motorcyclist from the Ramagna region of Italy **Population characteristics:** NR	Helmet use; TBI due to motorcycles and moped crashes per 100,000 pop; Age specific TBI hospitalization per 100,000 pop;	Pre: 19.5%; Pre: 7.0 Pre: 0-13 yrs.: 1.0 14-17 yrs.: 56.3 18-30 yrs.: 15.2 31-60 yrs.:	Post: 97.5%; Post: 2.3 Post: 0-13 yrs.: 0.0 14-17 yrs.: 22.4 18-30 yrs.: 4.4 31-60 yrs.:	Absolute change: 78 pct pts Relative change: -67%; p<0.001 100% 14-17 yrs.: -60% 18-30 yrs.: -71% 31-60 yrs.: -70%	The universal helmet law implemented in Italy in March 2000 was effective in increasing helmet use and reducing traumatic brain injuries for persons of all ages.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Study Design: Before-after	law implementation			4.6 >60 yrs.: 1.9	1.4 >60 yrs.: 0.8	 >60 yrs.: -58%	
Author (Year): Singh et al. (1975a) **Study Objective:** Change in fatalities among motorcyclists before and after universal helmet law in New Zealand **Study Design:** Before-after	**Location:** New Zealand **Type of law:** Universal **Type of legislative action:** Partial to Universal **Date of legislative action:** 12/11/73 **Comparison:** Before-after law implementation	**Study duration:** 1973-1974 **Study population:** Motorcyclists and power cyclists in New Zealand **Population characteristics:** Urban and rural	Fatalities Total: Fatality/10,000 registered motorcycles:	1973: 130 1973: 16.8	1974: 106 1974: 11.4	Relative change: -19% -32%	The implementation of the universal helmet law in New Zealand on Dec 1, 1973 decreased the total number of fatalities due to motorcycle crashes.
Author (Year): Singh et al. (1975b) **Study Objective:** To determine the change in helmet use among motorcyclists before and after	**Location:** Auckland, Wellington, Christchurch, Hamilton and Cambridge, New Zealand **Type of law:** Universal **Type of**	**Study duration:** NR **Study population:** motorcyclists and power cyclists observed during checks Observations made 7-9am and 4-6pm on weekdays;7-9pm on Saturdays	Helmet use, Total: Urban: Rural: Riders: Passengers:	 73.8% 65.7% 89.9% 78.3% 48.1%	 99.3% 99% 99% 99.6% 99.1%	Absolute change: 26 pct pts 33 pct pts 10 pct pts 21 pct pts 51 pct pts	The implementation of the universal helmet law in New Zealand on Dec 1, 1973 increased the use of helmets in both rural as well as urban areas, amongst riders and passengers and at all times of the day.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
implementation of universal helmet law in New Zealand **Study Design:** Before-after	**legislative action:** Partial to Universal **Date of legislative action:** Dec 1, 1973 **Comparison:** before and after law implementation	Additional checks: In urban areas, noon to 1pm on weekdays, 3-5pm on Sundays **Population characteristics:** NR **Total observations:** Before: 3845 After: 3582 Total: 7427					
Author (Year): Sosin (1992) **Study Objective:** To examine motorcycle-related in states with or without universal helmet law, 79 to 86	**Location:** 50 states, US **Type of law:** Universal, partial, and no law **Type of legislative action:** N/A **Date of legislative**	**Study duration:** 1979-1986 **Study population:** Motorcycle riders in the US involved in motorcycle fatalities **Population characteristics:** NR	Fatalities per 10,000 registered vehicles Fatalities per 1000 crashes Head-injury related fatalities per 10,000 registered vehicles Head injury related fatalities per 1000 crashes	No or partial law: 6.4; No or partial law: 22.1 No or partial law: 3.6 No or partial law: 12.4	Full law: 6.5; Full law: 19.1 Full law: 3.0 Full law: 9.0	Relative change: 1.6%; -13.6%; -16.7%; -27.4%	Full helmet-use laws were consistently associated with lower rates of head injury-associated death. However, the rate of fatality per 10,000 motorcycles increased slightly from 1979-1986.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Study Design: Time series with concurrent comparison	**action:** N/A **Comparison:** Universal vs. Partial + No law		Fatalities with head injuries as proportion of overall fatalities	No or partial law: 56%	Full law: 47%	-6%	
Author (Year): Stolzenberg et al. (2003) **Study Objective:** Impact of Florida repealing universal helmet law on fatal and serious non-fatal injury rates **Study Design:** Interrupted time series	**Location:** Florida, US **Type of law:** partial **Type of legislative action:** Universal to partial **Date of legislative action:** July 01, 2000 **Comparison:** time series before and after law change	**Study duration:** Jan 86 to Dec 01 **Study population:** crashes in FL during study period **Population characteristics:** NR	Serious injuries per 100,000 registered vehicles; ARIMA modelling using monthly data Fatalities per 100,000 registered vehicles; ARIMA modelling using monthly data	N/A N/A	N/A N/A	No change, p=0.636 14.2%, p<0.12	Repealing universal helmet law in Florida didn't have much impact on serious injury rate; an increase in fatality rate was derived from the ARIMA model
Author (Year): Struckman et al. (1980) **Study Objective:** To assess changes in levels of helmet use, state-wide	**Location:** South Dakota, US **Type of law:** Partial **Type of legislative action:** Universal to Partial	**Study duration:** Pre: July 1976- June 1977 Post I: June 1977 – June 1978 Post II: July 1978- June 1979 **Study population:** All motorcyclists over the age of 14	Helmet use, injured motorcyclists Total injuries Injuries/1000 crashes Total fatalities	76-77: 94.9% Pre: 403 Pre: 885.7 Pre: 11	77-78: 49.8 Post I: 409 Post II: 461 Post I: 816.4 Post II: 824.7 Post I: 14	Absolute change: -45 pct pts Relative change: 1% 14% -8% -7% 27%	Total fatalities, injuries, and crashes increased after repeal of the universal law. Among fatally or non-fatally injured helmet use slightly decreased, from -45.1% pre-law to -

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
accident experience, and incidence of cyclist injury between pre- and post-repeal years **Study Design:** Before-after	**Date of legislative action:** July 1, 1977 **Comparison:** Before and after law implementation	involved in a motorcycle accident. N=12000 observations (approx.) N= 1515 motorcycle accidents Population characteristics: NR	Fatalities/1000 crashes	Pre: 24.2	Post II: 17 Post I: 27.9 Post II: 30.4	55% 16% 26%	53.0% post-law
Author (Year): Taggi (1988) **Study Objective:** To examine the effectiveness of a universal helmet law for motorcycle riders and a partial helmet law for teenagers using mopeds	**Location:** Country-wide, Italy **Type of law:** Universal **Type of legislative action:** None to Universal **Date of legislative action:** July 18, 86	**Study duration:** Helmet use: June-October 1986, February 1987; Fatality and injury data: Pre: Sept.-Nov. 1986 Post: Sept.-Nov. 1986 **Study population:** Motorcycle and moped riders in Italy. Italy has approximately 1.7 million motorcycle	All results are for motorcyclists only; Helmet use, observed Head injury cases seen at hospitals Head injury cases admitted to hospital	Pre: 15.1% Pre: 263 Pre: 159	Post: 96.1% Post: 162 Post: 87	Absolute change: 81 pct pts Relative change: -38% -45%	The Italian government's implementation of a universal helmet law for motorcycle riders drastically improved helmet use and reduced the number of head injury cases seen and admitted into hospitals. Additionally, the partial helmet law implemented for teenagers also improved helmet

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Study Design: Before-after	Note: Universal helmet law was for motorcycle riders, while a partial law was implemented for teenage moped riders; results for motorcyclists only **Comparison:** Before and after law implementation	and 3.5 million moped riders; Population characteristics: NR					use.
Author (Year): Tsai et al. (1999) **Study Objective:** Impact of universal helmet law in Taiwan of fatal and non-fatal head and body injuries **Study Design:** Before-after	**Location:** Taiwan **Type of law:** Universal **Type of legislative action:** None to Universal **Date of legislative action:** 6/1/1997 **Comparison:** Before-after law implementation	**Study duration:** Pre: Jun to Nov 1996 Post: Jun to Nov 1997 Comparable by time of year, but not symmetry around ban implementation **Study population:** all motorcyclist fatal and non-fatal injuries from 1990 to 1995 in Taiwan Total: ~2,300 **Population characteristics:** NR	Non-fatal head injuries admitted to hospital Total admission to hospital Fatal head injuries Fatalities, total	Jun-Nov96: 284 Pre: 615 Pre: 581 Pre: 732	Jun-Nov97: 166 Post: 422 Post: 450 Post: 631	Relative change: -42% -31% -22.5% -13.8%	Reductions in both fatal and non-fatal head injuries following implementation of the universal helmet law.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Author (Year): Turner et al. (2004) **Study Objective:** To analyze motorcycle-related trends in Florida before and after the repeal of universal helmet law **Study Design:** Before-after	**Location:** Florida, US **Type of law:** Partial helmet law **Type of legislative action:** Universal to partial **Date of legislative action:** July 1, 2000 **Comparison:** before and after law repeal	**Study duration:** Pre: January 1, 1999-June 30, 2000; Post: July 1, 2010-Decomeber 31, 2001 **Study population:** Motorcycle riders and passenger in the State of Florida **Total:** NR **Population characteristics:** NR	Helmet use, observed: Helmet use among fatalities, <21 Injuries: Total: Per 10,000 registered motorcycles: Per 100mil VMT: Per 1000 crashes: Fatalities Total: 20 and younger: Per 10,000 registered motorcycles: Per 100mil VMT: Per 1000 crashes:	1998: 99.5%; 1999: 59.7% 1999:4463 1999: 189.3 1999: 1,154; Pre: 902.5 1999: 166 Pre: 20 1999: 7 1999: 51 Pre: 39.7	2002: 52.7%; 2001: 53.2% 2001: 5755 2001: 188.4 2001: 1,056; Post: 896.8 2001: 276 Post: 45 2001: 9 2001: 58 Post: 49.2	Absolute change: -47 pct pts -6 pct pts Relative change: 29% 0% -8% -1% 66% 125% 29% 14% 24%	The July 2000 repeal of Florida's universal motorcycle helmet law to a partial law resulted in a decline in helmet use, while also increasing the total number of injuries and fatal crashes. Increases in the number of motorcycle registrations and VMT also increased after repeal of the law.
Author (Year): Ulmer et al. (2003) **Study arm 1** **Study Objective:** Impact of repealing universal helmet law in Kentucky on fatal and non-fatal injuries **Study Design:** Before-after	**Location:** Kentucky, US **Type of law:** Partial Type of legislative action: Universal to partial **Date of legislative action:** July 15, 1998 **Comparison:** Before and after	**Study duration:** 1996-2000 **Study population:** motorcyclists observed for helmet use; involved in fatal and non-fatal motorcycle-related crashes in Kentucky during study period **Population characteristics:** NR	Helmet use, observational Injuries: Total: Per 10,000 registered motorcycles: Fatalities: Total Per 10,000 registered motorcycles	1997: 96% 1997: 695 1997: 180 National increase: 17% National increase: 8%	1999: 65% 1999: 934 1999: 223 KY increase: 67% KY increase: 53%	Absolute change: -31 pct pts Relative change: 34% 24% KY vs. National: 42% KY vs. National: 42%	Repealing of universal helmet law in Kentucky resulted in decreased helmet use and increased fatal and non-fatal injuries. The increases in fatality total and rate remain after accounting for national trend.

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
with comparison group	law repeal						
Author (Year): Ulmer et al. (2003) **Study arm 2** **Study Objective:** Impact of repealing universal helmet law in LA on fatal and non-fatal injury **Study Design:** Before-after with comparison group	**Location:** Louisiana, US **Type of law:** Partial **Type of legislative action:** Universal to partial **Date of legislative action:** August 15, 1999 **Comparison:** Before and after law repeal	**Study duration:** 1996-2000 **Study population:** motorcyclists observed for helmet use; involved in fatal and non-fatal motorcycle-related crashes in Louisiana during study period **Population characteristics:** NR	Helmet use, observational Injuries: Total Per 10,000 registered motorcycles Fatalities: Total Per 10,000 registered motorcycles	1997: 100% 1997: 692 1997: 121 National increase: 26% National increase: 13%	1999: 52% 1999: 1101 1999: 152 LA increase: 68% LA increase: 34%	Absolute change: -48 pct pts Relative change: 59% 26% LA vs. National: 33% LA vs. National: 19%	Repealing of universal helmet law in Louisiana resulted in decreased helmet use and increased fatal and non-fatal injuries. The increases in fatality total and rate remain after accounting for national trend.
Author (Year): Ulmer et al. (2005) **Study Objective:** Impact of repealing universal helmet law in Florida on helmet use, fatal and non-fatal injuries	**Location:** Florida, US **Type of law:** Partial **Type of legislative action:** Universal to Partial **Date of legislative action:** July 1, 2000	**Study duration:** 1994-2003 **Study population:** Helmet use: motorcyclists observed during study period at observation spots Fatal and non-fatal injuries: motorcyclists involved crashes as recorded by FL state	Helmet use, observed: Helmet use among fatalities, <21yrs: Injuries: Total: Per 10,000 registered motorcycles Per 1,000 crashes	1998: 100% 1997-99: 74.3% 1999: 4465 1999: 202 1999: 958	2002: 53% 2001-03: 55% 2001: 5776 2001: 199 2001: 952	Absolute change: -47 pct pts -19.3 pct pts Relative change: 29% -1% -1%	Repealing universal helmet law in Florida resulted in decreased helmet use and increased fatal and non-fatal injuries across age groups; ARIMA modeling using monthly fatality data found that repealing universal helmet law resulted in an

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Study Design: Before-after	**Comparison:** Before and after the law change	**Population characteristics:** Motorcyclists hospitalized in Florida during study period N = 8553 Male: 87.1% Age: 12.3% <21; 58.8% 21-44; 28.9% >=45	Incapacitating injuries Head injury Neck injury Fatalities: Total: Per 10,000 registered motorcycles Per 1,000 crashes Fatalities<21	1999: 1428 1999: 263 1999: 29 1999: 164 1999: 7.4 1999: 35.2 97-99: 35	2001: 1890 2001: 445 2001: 42 2001: 274 2001: 9.5 ARIMA modelling 2001: 59 01-03: 101	32% 69% 45% 67% 27% Additional 9.1 fatalities per month 68% 189%	additional 9.1 motorcycle-related fatalities per month
Author (Year): Watson et al. (1980) **Study Objective:** Impact of helmet law changes in 26 states during study period on fatal injuries **Study Design:**	**Location:** 48 states, US **Type of law:** Partial or no law Type of legislative action: Universal to partial; Universal to none **Date of legislative action:** During	**Study duration:** 1975-78 **Study population:** motorcyclists fatally wounded in motorcycle-related crashes during study period that were recorded in FARS database **Population characteristics:** NR	Fatalities, total Regression analysis; Predicted fatalities compared to actual fatalities for each law change state	N/A	N/A	Relative change: Universal changed to partial or no law: 38% +/- 13% Universal changed to partial law: 46% +/- 18% Universal changed to no law: 24% +/- 27%	Of 26 law changes, 23 resulted in a greater number of actual deaths in the period following the repeal of universal law than were predicted to occur if the law had not been changed. It is estimated that the repealing universal helmet

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
Panel study	study period **Comparison:** States with changed helmet laws were matched with geographically close states that didn't change helmet law during study period						laws resulted in almost 40% increases in the numbers of fatally injured motorcyclists.
Author (Year): Weiss et al. (2010) **Study Objective:** Comparing TBI among youth in US between states with different helmet laws **Study Design:** Other design	**Location:** Various states, US **Type of law:** Universal vs. partial **Type of legislative action:** N/A **Date of legislative action:** N/A	**Study duration:** 2005-07 **Study population:** Youth <21 years with motorcycle-related TBI, recorded in SIDs, in study states **Population characteristics:** Age: all under 21 years of age Male: 88.6%	TBI as proportion of hospitalized youth Severe TBI as proportion of hospitalized youth Severe TBI as proportion of youth with TBI	Partial: 35.2% Partial: 14.2% Partial: 40.3%	Universal: 30.9% Universal: 10.3% Universal: 33.5%	Absolute difference: -4 pct pts Relative risk: -12% Absolute difference: -4 pct pts Relative risk: -27% Absolute difference: -6.8 pct pts	States only with youth-specific laws, compared with states with universal helmet law, had an increased risk of TBI that required hospitalization, serious and severe TBI, TBI-related disability, and in-hospital death among youth

Study Details	Intervention Characteristics	Population Characteristics	Outcome	Reported baseline	Reported effect	Value used in summary [95%CI]	Summary
with concurrent comparison groups	**Comparison:** Universal vs. partial law					Relative risk: -17%	
Author (Year): Williams et al. (1979) **Study Objective:** Impact of universal, partial, or no helmet law on helmet use in U.S. **Study Design:** Cross-sectional	**Location:** 6 states, US **Type of law:** universal, partial, or no law **Type of legislative action:** N/A **Date of legislative action:** N/A Comparison: universal vs. partial vs. no helmet law	**Study duration:** September to November, 1978 **Study population:** motorcyclists observed at major intersections in the selected cities; one city per state selected **Population characteristics:** NR	Observed helmet use	No law: 46.3% No law: 46.3% Partial law: 47.9%	Partial law: 47.9% Universal law: 99.4% Universal law: 99.4%	Absolute difference: 2 pct pts 53 pct pts 52 pct pts	States with universal helmet law had much higher percentages of helmet use when compared to states with partial or no helmet laws; States with partial helmet laws experienced similar level of helmet use as states with no helmet law