Appendix for “Cellphone use while driving bans and traffic fatalities in the United States”

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**Table 1.** Cellphone bans applicable to drivers of all ages by state and year, United States, 1999-2016

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- refer to texting-only ban
- refer to texting plus ban
- refer to calling and texting ban
- refer to comprehensive handheld ban
Table 2. Cellphone bans and enforcement allowed

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| Calling-only ban: primary          | CA, NY  
| Calling-only ban: secondary        | NJ      
| Texting-only ban: primary          | AL, ID, IN, KS, KY, LA, ME, MD, MA, MI, NH, NC, PA, RI, SC, TN, VT, VA, WI, WY  
| Texting-only ban: secondary        | FL, IA, NE, OH, SD, VA, WA  
| Texting plus ban: primary          | AK, AR, CO, GA, IL, LA, MN, MS, NM, ND, OK, UT, WI  
| Texting plus ban: secondary        | --      
| Calling and texting ban: primary   | CT, NJ, WA  
| Calling and texting ban: secondary | WA      
| Comprehensive handheld ban: primary | CA, DE, HI, IL, MD, NV, NH, NY, OR, VT, WV  
| Comprehensive handheld ban: secondary | MD, NY, UT, WV  

* A state may be listed more than once in the table if it amended cellphone ban during the study period.

* If all the banned activities are at the primary enforcement level, it is defined as primary enforcement. Otherwise, it is defined as secondary enforcement (e.g., primary enforcement for texting, but secondary enforcement for calling).
**eTable 3.** Codes and texts for texting plus bans and comprehensive handheld bans

### 1. Codes and texts for texting plus bans

<table>
<thead>
<tr>
<th>State</th>
<th>Code</th>
<th>Period</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>AS 28.35.161</td>
<td>5/11/2012</td>
<td>A person commits the crime of driving while texting, while communicating on a computer, or while a screen device is operating if the person is driving a motor vehicle, and (1) the vehicle has a television, video monitor, portable computer, or any other similar means capable of providing a visual display that is in full view of a driver in a normal driving position while the vehicle is in motion, and the monitor or visual display is operating while the person is driving; or (2) the person is reading or typing a text message or other nonvoice message or communication on a cellular telephone, personal data assistant, computer, or any other similar means capable of providing a visual display that is in the view of the driver in a normal driving position while the vehicle is in motion and while the person is driving.</td>
</tr>
<tr>
<td>Arkansas</td>
<td>Arkansas Code § 27-51-1504</td>
<td>10/1/2009</td>
<td>Except as otherwise provided in this section, the driver of a motor vehicle shall not use a handheld wireless telephone for wireless interactive communication while operating a motor vehicle. “Wireless interactive communication” means typing, text messaging, emailing, or accessing information on the Internet with a handheld wireless telephone.</td>
</tr>
<tr>
<td>Colorado</td>
<td>C.R.S. 42-4-239</td>
<td>12/1/2009</td>
<td>A person shall not use a wireless telephone for the purpose of engaging in text messaging or other similar forms of manual data entry or transmission while operating a motor vehicle.</td>
</tr>
<tr>
<td>Georgia</td>
<td>O.C.G.A. § 40-6-241.2 or Hands-Free Georgia Act</td>
<td>7/1/2010</td>
<td>No person who is 18 years of age or older or who has a Class C license shall operate a motor vehicle on any public road or highway of this state while using a wireless telecommunications device to write, send, or read any text based communication, including but not limited to a text message, instant message, e-mail, or Internet data.</td>
</tr>
<tr>
<td>Illinois</td>
<td>625 ILCS 5/12-610.2</td>
<td>1/1/2010 to 7/19/2012</td>
<td>a person may not operate a motor vehicle on a roadway while using an electronic communication device to compose, send, or read an electronic message. electronic message includes, but is not limited to electronic mail, a text message, an instant message, or a command or request to access an internet site.</td>
</tr>
<tr>
<td>Illinois</td>
<td>625 ILCS 5/12-610.2</td>
<td>7/20/2012 to 12/31/2014</td>
<td>a person may not operate a motor vehicle on a roadway while using an electronic communication device to compose, send, or read an electronic message. Electronic message includes, but is not limited to electronic mail, a text message, an instant message, a digital photograph, a video, or a command or request to access an Internet site.</td>
</tr>
<tr>
<td>Louisiana</td>
<td>La. R.S. §32:300.5</td>
<td>8/1/2013</td>
<td>Except as provided in Subsection B of this Section, no person shall operate any motor vehicle upon any public road or highway of this state while using a wireless telecommunications device to write, send, or read a text-based communication. No person shall operate any motor vehicle</td>
</tr>
<tr>
<td>State</td>
<td>Statute/Codification</td>
<td>Effective Date</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Minn. Stat. § 169.475</td>
<td>8/1/2008</td>
<td>No person may operate a motor vehicle while using a wireless communications device to compose, read, or send an electronic message, when the vehicle is in motion or a part of traffic. An electronic message includes, but is not limited to, e-mail, a text message, an instant message, a command or request to access a World Wide Web page, or other data that uses a commonly recognized electronic communications protocol.</td>
</tr>
<tr>
<td>Mississippi</td>
<td>Miss. Code Ann. § § 63-33-1</td>
<td>7/1/2015</td>
<td>An operator of a moving motor vehicle is prohibited from writing, sending, or reading a text message and from accessing, reading or posting to a social networking site using a hand-held mobile telephone while driving said motor vehicle.</td>
</tr>
<tr>
<td>New Mexico</td>
<td>N.M. Stat. Ann. § 66-7-374</td>
<td>7/1/2014</td>
<td>A person shall not read or view a text message or manually type on a handheld mobile communication device for any purpose while driving a motor vehicle, except to ...; &quot;text message&quot; means a digital communication transmitted or intended to be transmitted between communication devices and includes electronic mail, an instant message, a text or image communication and a command or request to an internet site.</td>
</tr>
<tr>
<td>North Dakota</td>
<td>N.D. Cent. Code, § 39-08-23</td>
<td>8/1/2011</td>
<td>The operator of a motor vehicle that is part of traffic may not use a wireless communications device to compose, read, or send electronic message; &quot;Electronic message&quot; means a self-contained piece of digital communication that is designed or intended to be transmitted between physical devices. The term includes e-mail, a text message, an instant message, a command or request to access a world wide web page, or other data that uses a commonly recognized electronic communications protocol.</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>47 Okl. St. § 11-901d</td>
<td>11/1/2015</td>
<td>It shall be unlawful for any person to operate a motor vehicle on any street or highway within this state while using a hand-held electronic communication device to manually compose, send or read an electronic text message while the motor vehicle is in motion. &quot;Text message&quot; includes a text-based message, instant message, electronic message, photo, video or electronic mail.</td>
</tr>
<tr>
<td>Utah</td>
<td>Utah Code Ann. § 41-6a-1716</td>
<td>5/13/2014</td>
<td>A person may not use a handheld wireless communication device while operating a moving motor vehicle on a highway in this state to manually:(a) write, send, or read a written communication, including:(i) a text message; (ii) an instant message; or (iii) electronic mail; (b) dial a phone number; (c) access the Internet; (d) view or record video; or (e) enter data into a handheld wireless communication device.</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Wis. Stat. § 346.89</td>
<td>8/1/2014</td>
<td>(1) No person while driving a motor vehicle may be engaged or occupied with an activity, other than driving the vehicle, that interferes or reasonably appears to interfere with the person’s ability to drive the vehicle safely; 2. Subject to sub. 3) (a) No person may drive, as defined in s. 343.305 (1) (b), any motor vehicle while composing or sending an electronic text message or an electronic mail message.; Subject to subs. (3) and (6), no person while driving a motor vehicle, other than an authorized emergency vehicle, a commercial motor vehicle described in s. 340.01</td>
</tr>
</tbody>
</table>
or a tow truck, may operate or be in a position to directly observe any electronic device located within the vehicle that is activated and that is providing entertainment primarily by visual means. This subsection does not prohibit a person from using a cellular telephone for purposes of verbal communication.

2. Codes and texts for comprehensive handheld bans

<table>
<thead>
<tr>
<th>State</th>
<th>Code</th>
<th>Period</th>
<th>Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>Cal Veh Code § 23123.5</td>
<td>1/1/2009</td>
<td>(a) A person shall not drive a motor vehicle while holding and operating a handheld wireless telephone or an electronic wireless communications device unless the wireless telephone or electronic wireless communications device is specifically designed and configured to allow voice-operated and hands-free operation, and it is used in that manner while driving.</td>
</tr>
<tr>
<td>Delaware</td>
<td>21 Del. C. § 4176C</td>
<td>1/2/2011</td>
<td>(a) No person shall drive a motor vehicle on any highway while using an electronic communication device while such motor vehicle is in motion. &quot;Using&quot; shall mean holding in a person's hand or hands an electronic communication device while: a. Viewing or transmitting images or data; b. Playing games; c. Composing, sending, reading, viewing, accessing, browsing, transmitting, saving or retrieving e-mail, text messages or other electronic data; or d. Engaging in a call.</td>
</tr>
<tr>
<td>Hawaii</td>
<td>HRS § 291C-137</td>
<td>7/1/2013</td>
<td>No person shall operate a motor vehicle while using a mobile electronic device. &quot;Use&quot; or &quot;using&quot; means holding a mobile electronic device while operating a motor vehicle.</td>
</tr>
<tr>
<td>Illinois</td>
<td>625 ILCS 5/12-610.2</td>
<td>1/1/2014</td>
<td>A person may not operate a motor vehicle on a roadway while using an electronic communication device.</td>
</tr>
<tr>
<td>Maryland</td>
<td>Md. Transportation Code Ann. § 21-1124.1 &amp; 21-1124.2</td>
<td>10/1/2010</td>
<td>Subject to subsection (c) of this section, a person may not use a text messaging device to write or send a text message while operating a motor vehicle in motion or in the travel portion of the roadway. (2) A driver of a motor vehicle that is in motion may not use the driver's hands to use a handheld telephone other than to initiate or terminate a wireless telephone call or to turn on or turn off the handheld telephone.</td>
</tr>
<tr>
<td>Nevada</td>
<td>Nev. Rev. Stat. Ann. § 484B.165</td>
<td>1/1/2012</td>
<td>Except as otherwise provided in this section, a person shall not, while operating a motor vehicle on a highway in this State: manually type or enter text, voice communication; Manually type or enter text into a cellular telephone or other handheld wireless communications device, or send or read data using any such device to access or search the Internet or to engage in nonvoice communications with another person, including, without limitation, texting, electronic messaging and instant messaging; Use a cellular telephone or other handheld wireless communications device to engage in voice communications with another person.</td>
</tr>
<tr>
<td>State</td>
<td>Code/Amendment</td>
<td>Date of Amendment</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>-------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>RSA 265:79-c</td>
<td>7/1/2015</td>
<td>No person, while driving a moving motor vehicle upon a way or temporarily halted in traffic for a traffic control device or other momentary delay, shall use any hand-held mobile electronic device capable of providing voice or data communication, including but not limited to: reading, composing, viewing, or posting any electronic message; or initiating, receiving, or conducting a conversation; or initiating a command or request to access the Internet; or inputting information into a global positioning system or navigation device; or manually typing data into any other portable electronic device. An operator of a motor vehicle who holds a cellular telephone or other electronic device capable of voice communication in the immediate proximity of his or her ear while such vehicle is in motion is presumed to be engaging in a call within the meaning of this section.</td>
</tr>
<tr>
<td>New York</td>
<td>NY CLS Veh &amp; Tr § 1225-c &amp; NY CLS Veh &amp; Tr § 1225-d</td>
<td>11/1/2009</td>
<td>1225-c. Use of mobile telephones. Except as otherwise provided in this section, no person shall operate a motor vehicle upon a public highway while using a mobile telephone to engage in a call while such vehicle is in motion.... &quot;Using&quot; shall mean (i) holding a mobile telephone to, or in the immediate proximity of, the user's ear; and (ii) with respect to a person operating a commercial motor vehicle, holding a mobile telephone to, or in the immediate proximity of, the user's ear, or dialing or answering a mobile telephone by pressing more than a single button, or reaching for a mobile telephone in a manner that requires such person to maneuver so that he or she is no longer in a seated driving position, restrained by a seat belt that is installed in accordance with section 393.93 of title 49 of the code of federal regulations and adjusted in accordance with the vehicle manufacturer's instructions. 1225-d. Use of portable electronic devices. Except as otherwise provided in this section, no person shall operate a motor vehicle upon a public highway while using a mobile telephone to engage in a call while such vehicle is in motion; &quot;Using&quot; shall mean holding a portable electronic device while viewing, taking or transmitting images, playing games, or composing, sending, reading, viewing, accessing, browsing, transmitting, saving or retrieving e-mail, text messages, or other electronic data.</td>
</tr>
<tr>
<td>Oregon</td>
<td>ORS § 811.507</td>
<td>1/1/2010</td>
<td>A person commits the offense of operating a motor vehicle while using a mobile communication device if the person, while operating a motor vehicle on a highway, uses a mobile communication device.</td>
</tr>
<tr>
<td>Utah</td>
<td>Utah Code Ann. § 41-6a-1715</td>
<td>04/30/2007 to 5/12/2014</td>
<td>Utah Code Ann. § 41-6a-1715 (Repealed on 05/12/2014) a person operating a motor vehicle is guilty of careless driving if the person:</td>
</tr>
<tr>
<td>State</td>
<td>Code and Section</td>
<td>Effective Date</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
<td>-----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Utah</td>
<td>Utah Code Ann. § 41-6a-1715</td>
<td>… using a wireless telephone or other electronic device unless the person is using hands-free talking and listening features while operating the motor vehicle.</td>
<td></td>
</tr>
<tr>
<td>Vermont</td>
<td>23 V.S.A. § 1095b &amp; 23 V.S.A. § 1099</td>
<td>10/1/2014</td>
<td>(b) Use of handheld portable electronic device prohibited. A person shall not use a portable electronic device while operating a moving motor vehicle on a highway in Vermont.</td>
</tr>
<tr>
<td>West Virginia</td>
<td>W. Va. Code § 17C-14-15</td>
<td>7/1/2012</td>
<td>Except as provided in subsection (c) of this section, a person may not drive or operate a motor vehicle on a public street or highway while: 1) texting; or 2) using a cell phone or other electronic communications device; Plus: &quot;Using a cell phone or other electronic communication device&quot; means holding in a person's hand or hands an electronic communication device while: (A) Viewing or transmitting images or data; (B) Playing games; (C) Composing, sending, reading, viewing, accessing, browsing, transmitting, saving or retrieving e-mail, text messages or other electronic data; or (D) Engaging in a call. For purposes of this section; “Texting” means manually entering alphanumeric text into, or reading text from, an electronic communication device, and includes, but is not limited to, short message service, e-mailing, instant messaging, a command or request to access a World Wide Web page or engaging in any other form of electronic text retrieval or entry, for present or future communication.</td>
</tr>
</tbody>
</table>

Directed acyclic graph (DAG): Cellphone bans and traffic deaths

Study Variables.

**Cellphone use while driving bans.** The primary policy intervention was cellphone bans for drivers of all ages. These were classified as: 1) no ban, 2) calling-only ban, 3) texting-only ban, 4) texting plus ban (bans activities such as accessing the internet or social media as well as texting), 5) calling and texting ban (bans calling and texting, but not activities such as accessing the internet or social media applications), 6) comprehensive handheld bans that prohibit almost all handheld cellphone use.

**Outcome.** The outcome measure was the number of traffic fatalities from passenger vehicle crashes per 100,000 residents.

**Potential confounders and observed variables.** Additional traffic safety laws, socio-economic, and travel factors could confound the association by changing driving behavior or crash risk. We gathered information on seatbelt laws, maximum speed limits, impaired driving laws (pre-conviction administrative license suspension for driving under the influence), unemployment-population ratio, income per capita, cellphone ownership, vehicle miles traveled, gasoline price, and the percentage of rural roadway length out of total roadway length. Monetary information, such as income, was adjusted to 2016 dollars using the Consumer Price Index.

RoadDesignMaintenance: It cannot be directly measured. But we have a variable to measure the highway expenditure at the state level.

State indicator variables were used to adjust for differences in state crashes rates and safety environments such as quality of highways. Year indicator variables were used to control crash trends, because fatality rates were not linearly increasing or decreasing over 1999-2016. Seasonality was controlled by quarter indicator variable.

**Unobserved variables: shaded nodes**

- **StatePoliticalSocialEconomicFactors:** Each state may have its own political, social and economic environment that plays a key role to enact and enforce various traffic safety laws including cellphone laws. In combination with year, state political social economic factors determine cellphone ownership, employment rate, income per capita, and gas price at the state level.

- **VehicleSafetyTechnology:** Vehicle safety technology such as electronic stability control and emergency braking could affect the crash rate and crash fatality rate. It is determined by calendar year as vehicle safety technology becomes more popular and more advanced with more recent years.

- **RiskDrivingBehavior:** Risk driving behaviors are considered at the state level, and it is a combination of risky driving behaviors such as speeding, driving after drinking, no seatbelt use, and many other unmeasured factors such as aggressive driving.

- **LawEnforceStatus:** It refers to police enforcement efforts for seatbelt, speed, and alcohol-related driving, and this variable isn’t readily available.

- **CellphoneLawEnforce:** It refers to policy enforcement specific to cellphone violations, and this variable isn’t readily available.

**DAG Model**

**No Individual-level variables**
Since the analyses are done at the state-level, we do not include individual-level variables.

**No direct arrow from CellphoneLaw to TrafficCrash, Death**
There should be an arrow going directly from cellphone laws to fatal crashes according to a routine DAG. On the other hand, we think the mechanism for cellphone laws to reduce fatal crashes is through reducing driver cellphone use. Therefore the current draft model does not include this direct arrow from CellphoneLaw to TrafficCrash, Death.

**The minimal sufficient adjustment sets for estimating the total effect of cellphone laws on traffic deaths are:**

CellphoneOwnership, DrivingDistance, EmploymentRate, Gasprice, Income, QuaterYear(seasonality), RoadDesignMaintaince, RuralRoadway, SeatbeltLaw, speed law, alcohol law, Year, state

The figure and codes are below.

**Codes for dagitty (http://www.dagitty.net/dags.html#)**

```
dag {
"Crash, Death" [outcome,pos="0.724,0.109"]
"QuaterYear(seasonality)" [adjusted,pos="-0.125,0.123"]
"SeatbeltLaw, speed law, alcohol law" [adjusted,pos="-0.528,-1.970"]
CellphoneLaw [exposure,pos="-1.031,0.206"]
CellphoneLawEnforce [latent,pos="-1.006,-0.293"]
CellphoneOwnership [adjusted,pos="-1.106,-0.746"]
DriverCellphoneUse [latent,pos="-0.455,-0.372"]
DrivingDistance [adjusted,pos="0.151,0.544"]
EmploymentRate [adjusted,pos="-0.820,0.666"]
Gasprice [adjusted,pos="-0.754,1.518"]
Income [adjusted,pos="-0.765,1.092"]
LawEnforceStatus [latent,pos="-0.604,-1.452"]
RiskDrivingBehavior [latent,pos="-0.028,0.893"]
RoadDesignMaintaince [adjusted,pos="-0.442,-2.390"]
RuralRoadway [adjusted,pos="-0.881,-1.012"]
```
### eTable 4. Potential confounding factors

<table>
<thead>
<tr>
<th>Confounding Factor</th>
<th>Definition</th>
<th>Source of Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seatbelt laws</td>
<td>Separate, binary indicators for: no law, secondary enforcement law, primary enforcement law</td>
<td>IIHS², Dr. Scott Masten¹</td>
</tr>
<tr>
<td>Maximum speed limit</td>
<td>Separate, binary indicators for: 70, ≥75 miles per hour ³</td>
<td>IIHS², Dr. Scott Masten¹</td>
</tr>
<tr>
<td>Pre-conviction administrative license suspension for driving under the influence</td>
<td>Binary: 0=no law, 1=law</td>
<td>IIHS², Dr. Scott Masten¹</td>
</tr>
<tr>
<td>Unemployment-population ratio ³</td>
<td>Continuous, by year and quarter</td>
<td>BLS³, CDC⁸</td>
</tr>
<tr>
<td>Income per capita ³</td>
<td>Continuous, by year</td>
<td>USBEA⁹</td>
</tr>
<tr>
<td>Cellphone ownership ³</td>
<td>Continuous, subscriptions per residents of state, by year</td>
<td>FCC⁵, CDC⁸</td>
</tr>
<tr>
<td>Gasoline price ³</td>
<td>Continuous, by year</td>
<td>USEIA⁷</td>
</tr>
<tr>
<td>Percentage of rural roadway length out of total roadway length</td>
<td>Continuous, by year</td>
<td>USDOT⁶</td>
</tr>
<tr>
<td>Highway expenditure</td>
<td>Continuous, by year</td>
<td>USCB⁹</td>
</tr>
<tr>
<td>Vehicle miles travelled ³</td>
<td>Continuous, miles driven, by year ³</td>
<td>USDOT⁶</td>
</tr>
</tbody>
</table>


³ 1 mile = 1.61 kilometers

¹ Calculated using population estimate of year and quarter

³ Adjusted to the 2016 US dollar based on each year’s Consumer Price Index¹⁰
**Table 5.** Sensitivity analysis: Driver fatalities, fatality rates, and unadjusted and adjusted rate ratios for different effective durations of cellphone ban status, United States, 1999-2016

<table>
<thead>
<tr>
<th>Type of cellphone ban</th>
<th>No. of fatalities</th>
<th>Person-years</th>
<th>Unadjusted fatality rate per 100,000 person-years</th>
<th>Unadjusted rate ratio&lt;sup&gt;a&lt;/sup&gt; (95% CI)&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Adjusted rate ratio&lt;sup&gt;c&lt;/sup&gt; (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No ban</td>
<td>254,540</td>
<td>13,769,497,319</td>
<td>7.4</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Calling-only ban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year</td>
<td>1,445</td>
<td>156,671,549</td>
<td>3.7</td>
<td>0.45 (0.40, 0.51)</td>
<td>1.01 (0.93, 1.09)</td>
</tr>
<tr>
<td>1-2 years</td>
<td>985</td>
<td>111,244,620</td>
<td>3.5</td>
<td>0.44 (0.37, 0.51)</td>
<td>1.02 (0.98, 1.05)</td>
</tr>
<tr>
<td>≥ 2 years</td>
<td>4,142</td>
<td>540,021,228</td>
<td>3.1</td>
<td>0.37 (0.32, 0.44)</td>
<td>0.99 (0.96, 1.02)</td>
</tr>
<tr>
<td>Texting-only ban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year</td>
<td>6,187</td>
<td>420,903,618</td>
<td>5.9</td>
<td>0.77 (0.69, 0.86)</td>
<td>1.02 (0.99, 1.06)</td>
</tr>
<tr>
<td>1-2 years</td>
<td>7,848</td>
<td>529,723,712</td>
<td>5.9</td>
<td>0.76 (0.68, 0.85)</td>
<td>1.02 (0.99, 1.06)</td>
</tr>
<tr>
<td>≥ 2 years</td>
<td>28,202</td>
<td>1,900,127,260</td>
<td>5.9</td>
<td>0.74 (0.66, 0.84)</td>
<td>1.01 (0.97, 1.06)</td>
</tr>
<tr>
<td>Texting plus ban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year</td>
<td>2,616</td>
<td>169,777,801</td>
<td>6.2</td>
<td>0.87 (0.68, 1.11)</td>
<td>1.00 (0.94, 1.06)</td>
</tr>
<tr>
<td>1-2 years</td>
<td>3,275</td>
<td>216,592,634</td>
<td>6.0</td>
<td>0.85 (0.66, 1.10)</td>
<td>1.01 (0.95, 1.08)</td>
</tr>
<tr>
<td>≥ 2 years</td>
<td>10,162</td>
<td>746,432,292</td>
<td>5.4</td>
<td>0.71 (0.54, 0.93)</td>
<td>0.97 (0.91, 1.03)</td>
</tr>
<tr>
<td>Calling and texting ban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year</td>
<td>475</td>
<td>56,467,224</td>
<td>3.4</td>
<td>0.43 (0.32, 0.59)</td>
<td>0.92 (0.79, 1.07)</td>
</tr>
<tr>
<td>1-2 years</td>
<td>617</td>
<td>75,821,096</td>
<td>3.3</td>
<td>0.41 (0.33, 0.50)</td>
<td>0.96 (0.91, 1.01)</td>
</tr>
<tr>
<td>≥ 2 years</td>
<td>4,350</td>
<td>582,610,055</td>
<td>3.0</td>
<td>0.37 (0.31, 0.44)</td>
<td>0.99 (0.88, 1.12)</td>
</tr>
<tr>
<td>Comprehensive handheld ban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year</td>
<td>2,239</td>
<td>270,864,974</td>
<td>3.3</td>
<td>0.48 (0.37, 0.63)</td>
<td>0.93 (0.88, 0.99)</td>
</tr>
<tr>
<td>1-2 years</td>
<td>2,969</td>
<td>362,106,615</td>
<td>3.3</td>
<td>0.49 (0.38, 0.63)</td>
<td>0.95 (0.90, 1.01)</td>
</tr>
<tr>
<td>≥ 2 years</td>
<td>13,951</td>
<td>1,793,246,782</td>
<td>3.1</td>
<td>0.46 (0.37, 0.57)</td>
<td>0.93 (0.88, 0.97)</td>
</tr>
</tbody>
</table>

<sup>a</sup> The unadjusted rate ratio was calculated by including the durations of cellphone bans as the only predicting variable in the negative binomial regression with robust standard error estimates.

<sup>b</sup> Confidence interval.

<sup>c</sup> The adjusted rate ratio (aRR) was estimated using negative binomial regression with robust standard error estimates. The aRR compares the rates per quarter-year exposed to the corresponding durations of cellphone bans with no ban on cellphone use while driving. Comparisons are adjusted for state, year, quarter, traffic laws (i.e., seatbelt laws, maximum speed limits, and pre-conviction administrative license suspension for driving under the influence), socio-economic factors (i.e., unemployment-population ratio, income per capita, cellphone ownership, and highway expenditure), and travel factors (vehicle miles traveled, gasoline price, and the percentage of rural roadway length out of total roadway length).
eTable 6. Sensitivity analysis: adjusted rate ratios for driver fatalities

<table>
<thead>
<tr>
<th>Type of cellphone ban</th>
<th>Excluded 3 states with calling-only ban a</th>
<th>The 27 states with cellphone bans in effect between 2010 and 2016 and the 4 states without any phone bans in effect by 2016 b</th>
<th>Limiting data years to 2010-2016 and comparing comprehensive bans vs everything else c</th>
<th>Non-alcohol-related driver fatalities d</th>
</tr>
</thead>
<tbody>
<tr>
<td>No ban</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
<td>0.99 (0.96, 1.03)</td>
</tr>
<tr>
<td>Calling-only ban</td>
<td>NA</td>
<td>NA</td>
<td>Reference</td>
<td>1.02 (0.98, 1.06)</td>
</tr>
<tr>
<td>Texting-only ban</td>
<td>1.02 (0.98, 1.05)</td>
<td>1.04 (1.00, 1.08)</td>
<td>Reference</td>
<td>0.98 (0.93, 1.04)</td>
</tr>
<tr>
<td>Texting plus ban</td>
<td>0.98 (0.93, 1.04)</td>
<td>1.04 (0.97, 1.12)</td>
<td></td>
<td>1.01 (0.92, 1.11)</td>
</tr>
<tr>
<td>Calling and texting ban</td>
<td>0.96 (0.82, 1.13)</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehensive handheld ban</td>
<td>0.95 (0.91, 0.99)</td>
<td>0.94 (0.85, 1.03)</td>
<td>0.93 (0.91, 0.96)</td>
<td>0.91 (0.87, 0.96)</td>
</tr>
</tbody>
</table>

NA: not applicable.
a Excluded the three states with a calling-only ban in effect for at least a quarter between 1999 and 2016 (i.e., California, New Jersey, and New York).
b Restricted analysis to the 27 states with cellphone bans first taking effect between 2010 and 2016 and the 4 states without any cellphone bans in effect by 2016.
c Compared comprehensive bans vs everything else as the referent group for the period of 2010-2016.
d Restricted analysis to non-alcohol-related driver fatalities.
e The reference group included: no ban, calling-only ban, texting-only ban, texting plus ban, and calling and texting ban.
References

eFigure 1. Driver fatality rates by year for each of the 46 intervention states (states with cellphone bans) vs control states (Arizona, Missouri, Montana, and Texas without cellphone laws by 2016)
Alabama driver_fatality

![Graph showing fatality rates from 1999 to 2016 for Intervention and Control groups. The graph highlights a decrease in fatality rates after the introduction of texting bans only in 2013.](image_url)

- **Intervention group**
- **Control group**

Texting bans only
Alaska driver_fatality

Log (fatality per 100,000 population)


Intervention group  Control group

Texting+other bans
Arkansas driver_fatality

![Graph showing the trend of fatality per 100,000 population from 1999 to 2016 for the intervention and control groups. The graph highlights the impact of texting and other bans in 2010, leading to a decrease in fatality rates.](image-url)
California driver_fatality

Log (fatality per 100,000 population)


Intervention group

Control group

Calling bans

All bans
Colorado driver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting+other bans
Connecticut driver fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting+calling bans

Florida driver_fatality

Intervention group
Control group

Texting bans only
Hawaii driver_fatality

Log (fatality per 100,000 population)


Intervention group  Control group
Idaho driver fatality

- Intervention group
- Control group

Texting bans only

Log (fatality per 100,000 population)

Years: 1999 to 2016
Log (fatality per 100,000 population)

Indiana driver_fatality


Intervention group

Control group

Texting bans only


Intervention group

Control group

Texting bans only
Log (fatality per 100,000 population)

Iowa driver_fatality

- Intervention group
- Control group

Texting bans only
Kansas driver fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only

Maine driver fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting bans only
Maryland driver fatality

Intervention group

Control group

Texting bans only

All bans

Log (fatality per 100,000 population)
Massachusetts driver_fatality

Texting bans only
Michigan driver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only
Minnesota driver fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting+other bans
Nevada driver fatality

Log (fatality per 100,000 population)

干预组  对照组

All bans
New Jersey driver_fatality
New Mexico driver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting+other bans
New York driver_fatality

Log (fatality per 100,000 population)


Intervention group

Calling bans

Control group

All bans

North Carolina driver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only
Ohio driver fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only
Oregon driver_fatality

Log (fatality per 100,000 population)

干预组
对照组

所有禁令


干预组
对照组
South Carolina driver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only

Tennessee driver fatality

Intervention group

Control group

Texting bans only

Log (fatality per 100,000 population)
Utah driver fatality

![Graph showing the number of fatalities per 100,000 population from 1999 to 2016. The graph compares the intervention group and control group. The x-axis represents the years from 1999 to 2016, and the y-axis represents the log of fatalities per 100,000 population. The graph indicates a decrease in fatalities across all bans and texting+other bans.]

- Intervention group
- Control group
Vermont driver fatality

Log (fatality per 100,000 population)

- Intervention group
- Control group

Texting bans only

All bans
Washington driver fatality

Log (fatality per 100,000 population)


Intervention group
Control group

- Texting bans only
- Texting + calling bans

60
West Virginia driver_fatality

![Graph showing the trend of fatality per 100,000 population from 1999 to 2016]

- Intervention group
- Control group

All bans
Wisconsin driver fatality

- Intervention group
- Control group

Log (fatality per 100,000 population)
Wyoming driver fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only
eFigure 2. Non-driver fatality rates by year for each intervention state (states with cellphone bans) vs control states (Arizona, Missouri, Montana, and Texas without cellphone laws by 2016)
Arkansas nondriver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting+other bans

Florida nondriver_fatality

Log (fatality per 100,000 population)

- Intervention group
- Control group

Texting bans only
Georgia nondriver_fatality

Texting+other bans

Log (fatality per 100,000 population)
Hawaii nondriver_fatality

Log (fatality per 100,000 population)


Intervention group  Control group

All bans
Idaho nondriver_fatality

- Log (fatality per 100,000 population)

- Texting bans only

- Intervention group
- Control group
Illinois nondriver_fatality

- Intervention group
- Control group

Log (fatality per 100,000 population)

Years: 1999 to 2016

Bans:
- Texting+other bans
- All bans
Maryland nondriver_fatality

Log (fatality per 100,000 population)

- Intervention group
- Control group

- All bans
- Texting bans only
Massachusetts nondriver_fatality

Texting bans only

Intervention group  Control group
Michigan nondriver_fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting bans only
Minnesota nondriver_fatality

Intervention group

Control group

Texting+other bans
Nebraska nondriver_fatality

Texting bans only

Log (fatality per 100,000 population)


Intervention group
Control group
Nevada nondriver_fatality

Intervention group
Control group

Log (fatality per 100,000 population)
New Hampshire nondriver_fatality

Log (fatality per 100,000 population)


- Intervention group
- Control group

Texting bans only
All bans
New Jersey nondriver_fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Calling bans
Texting+calling bans
New Mexico nondriver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting+other bans
New York nondriver_fatality

Log (fatality per 100,000 population)

- **Intervention group**
- **Control group**

- **Calling bans**
- **All bans**
North Carolina nondriver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only
Oregon nondriver_fatalities

![Graph showing log fatality per 100,000 population from 1999 to 2016 for intervention and control groups. The graph indicates a reduction in fatalities post-intervention in the intervention group.](image-url)
Rhode Island nondriver_fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting bans only
South Dakota nondriver_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only
Virginia nondriver_fatality

Intervention group

Control group

Texting bans only
Washington nondriver_fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting+calling bans
Texting bans only

107
West Virginia nondriver_fatality

<table>
<thead>
<tr>
<th>Year</th>
<th>Intervention group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Wisconsin nondriver_fatality

Log (fatality per 100,000 population)

- Intervention group
- Control group

Texting bans only

Texting+other bans

Wyoming nondriver_fatality

Log (fatality per 100,000 population)

- Intervention group
- Control group
eFigure 3. Total fatality rates by year for each of the 46 intervention states (states with cellphone bans) vs control states (Arizona, Missouri, Montana, and Texas without cellphone laws by 2016)
Alabama all_fatality

Texting bans only

Intervention group

Control group
Alaska all_fatality

Log (fatality per 100,000 population)

Intervention group

Control group

Texting+other bans


113
California all_fatality

- Intervention group
- Control group
Log (fatality per 100,000 population)

- Intervention group
- Control group

Texting+other bans
Connecticut allFatalities

Intervention group

Control group

Texting+calling bans
Florida all_fatality

Intervention group

Control group

Texting bans only
Hawaii all_fatality

- Log (fatality per 100,000 population)
- Intervention group
- Control group

All bans

Iowa all_fatality

Log (fatality per 100,000 population)

125
Kentucky all_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only

127
Louisiana all_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only
Texting+other bans
Log (fatality per 100,000 population)
Maryland all_fatality

Intervention group

Control group

Texting bans only

All bans

Log (fatality per 100,000 population)


1 0.5 0
Massachusetts all_fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting bans only
Minnesota all_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting+other bans


Intervention group
Control group
Mississippi all_fatality

- Intervention group
- Control group

Texting+other bans
Nebraska all_fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting bans only
Nevada all_fatality

Log (fatality per 100,000 population)

Intervention group  Control group

Nevada all_fatality

136
New Jersey all_fatalities

Log (fatality per 100,000 population)


Intervention group
Control group

Calling bans
Texting+calling bans

138
Log (fatality per 100,000 population)

- Intervention group
- Control group

New Mexico all_fatality

Texting+other bans
Log (fatality per 100,000 population)

North Carolina all_fatality

Intervention group  Control group

Texting bans only
Log (fatality per 100,000 population)

Pennsylvania all_fatality

- Intervention group
- Control group

Texting bans only
Log (fatality per 100,000 population)

Texting bans only

Intervention group — Control group
South Carolina all_fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting bans only
South Dakota all_fatality

- Intervention group
- Control group

Texting bans only

Log (fatality per 100,000 population)
Log (fatality per 100,000 population)

Utah all_fatality

- Intervention group
- Control group

Virginia all_fatality

Log (fatality per 100,000 population)

- Intervention group
- Control group

Texting bans only

153
Washington all_fatality

Log (fatality per 100,000 population)


Intervention group
Control group

Texting+calling bans
Texting bans only

154
West Virginia all_fatality

Log (fatality per 100,000 population)


Intervention group  Control group

All bans
Wisconsin all_fatality

Log (fatality per 100,000 population)

Intervention group
Control group

Texting bans only
Texting+other bans


Intervention group
Control group
Wyoming all_fatality

Texting bans only