



Independence Day 2016 Holiday Period Traffic Fatality Estimate

The 2016 Independence Day holiday period begins at 6:00 p.m., Friday, July 1, and ends at 11:59 p.m., Monday, July 4. Our estimate of traffic fatalities for this 3.25-day holiday period is **466** deaths with a 90% confidence interval (C.I.) of **388** to **556** deaths. Nonfatal medically consulted injuries, i.e. injuries serious enough that a medical professional was consulted, are estimated at 53,600 with a range of 44,700 to 64,000. The Independence Day Holiday period may vary from 1.25 to 4.25 days in length, depending on which day of the week the holiday falls. The estimated fatality total for 2016 is about 10% higher than the average actual number of fatalities (425) that occurred during the previous six 3.25-day Independence Day holiday periods. An evaluation of recent Independence Day holiday period estimates is presented in Table 1.

Table 1. Evaluation of Recent Independence Day Holiday Period Estimates

Year	Number of Days	Estimate	90% Confidence Interval	Actual
2009	3.25	381	336-431	398
2010	3.25	361	310-420	365
2011	3.25	374	320-436	405
2012	1.25	173	135-219	157
2013	4.25	540	477-610	461*
2014	3.25	385	328-450	347

*=outside of 90% confidence interval.

Studies have shown that seat belts, when used, are 45% effective in preventing fatalities among front-seat passenger car occupants. Although the reduction in the risk of fatal injury from wearing seat belts is higher for light-truck occupants at 50%, the lower figure for passenger car occupants is used in the calculations here as the more conservative measure. The most recent data from the Fatality Analysis Reporting System (FARS) indicate that seat belt use by fatally injured passenger vehicle (passenger cars, pickup trucks, vans, and SUVs) occupants was 47.4%. Based on this information it is estimated that **181** person's lives may be saved this Independence Day holiday period because they will wear their safety belts and an additional **110** lives could be saved if all wore safety belts.

The average number of traffic fatalities during the six most recent 3.25-day Independence Day holiday periods was 8.5% *higher* than similar non-holiday periods (425 vs. 392 deaths). The difference is not statistically significant.

The terms used in the above discussion were chosen carefully to reflect the level of accuracy of the quantities involved. *Estimate* is used because the fatality figures are calculated approximately, as opposed to the precision of calculation inferred by the use of the word *predict*. *May* is used to indicate the figures express a contingency, whereas *will* is used to express something that may be expected or is supposed to occur.

Details of the estimating methodology and a discussion of holiday deaths compared to non-holiday periods are included in the following paper.



Independence Day Holiday Period Traffic Fatality Estimate, 2016

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Holiday period definition

Independence Day is July 4 and it is observed on that day. The length of the holiday period varies depending on what day of the week July 4 falls. In 2016, the holiday period is 3.25 days and extends from 6:00 p.m. Thursday, July 1, to 11:59 p.m. Monday, July 4.¹

Method and results

The objective is to estimate the number of deaths that will occur in traffic crashes during the Independence Day holiday period based on data available several weeks before the holiday. The estimate developed here includes all traffic deaths from crashes that occur during the holiday period.²

The general procedure involves three steps. First, historical data are used to determine the average fraction holiday fatalities are of total deaths for the month. Second, total traffic deaths for the coming month in which the holiday falls are estimated using a time series forecasting model. Third, the projected total for the month is multiplied by the fraction to obtain the holiday estimate.

Holiday as percent of month. Total July deaths are the estimates published in *Injury Facts*[®] two years after the year of the estimate (e.g., the July 2014 estimate as published in the 2016 edition of *Injury Facts*[®]). This figure is used, rather than a revised estimate or the National Center for Health Statistics final count, because it closely approximates the level of accuracy that the time series estimate will give for total monthly deaths in the current year. Fatality Analysis Reporting System (FARS) data were used to obtain deaths during the holiday periods.

Table 1 shows the total traffic fatalities for the month of July and fatalities from crashes that occurred during the holiday period. Over the six most recent 3.25-day Independence Day holidays, fatalities from crashes during the holiday period averaged 12.06% of the total fatalities in July.

Time series model and projection. A time series model was developed to forecast an estimate of total traffic deaths for July 2016. An Autoregressive Integrated Moving Average (ARIMA) model was constructed based on 48 months of traffic deaths recorded from May 2012 through April 2016. An ARIMA model was chosen because of the seasonal pattern in traffic deaths. The model was developed using the SPSS/PC+ Version 5.0 statistical computer package. The model forecasts total traffic fatalities for July 2016 to be 3,867.

Holiday estimate. Multiplying the projected total fatalities by the fraction obtained in the first step gives an estimate of 466 traffic fatalities from crashes during the holiday period.

Confidence interval

There is uncertainty associated with any estimate. The 90% confidence interval for the estimate of total July deaths is 3,502 to 4,271. If we assume that the fraction of July deaths that occur during the Independence Day period is normally distributed, then the 90% confidence interval for that fraction is 11.09% to 13.02%. Combining these two gives the confidence interval for the Independence Day period estimate: 388 to 556 traffic deaths.

Medically consulted injuries

Based on the current medically consulted injury to death ratio of 115:1, and rounded to the nearest hundred, the estimate of the number of nonfatal medically consulted injuries that will result from crashes during the holiday

period is 53,600 with a range of 44,700 to 64,000. Medically consulted injuries are injuries serious enough that a medical professional was consulted and they are not comparable to previous disabling injury estimates.

Holiday comparison

A frequently asked question is "How much more dangerous is travel over the Independence Day holiday?" There are two aspects of this question that must be considered. First, compared to what? And, second, what about changes in the amount of driving?

We chose to compare the holiday to periods of similar length before and after the holiday. Specifically, from 6:00 p.m. Thursday to 11:59 p.m. Sunday of the weeks immediately before and after the Independence Day weekend. Table 2 shows the fatality data from FARS for comparable weekends. The average number of traffic deaths during Independence Day over those six years is 8.5% higher than the average number of traffic deaths during the comparison periods (425 vs. 392 deaths). The difference between these two means is *not* statistically significant.

The second question concerns changes in the amount of travel, or exposure. We know of no data system that tracks changes in vehicle miles of travel by day of the year on a national basis. Lacking an objective measure of exposure change, we assume that travel is greater on holiday weekends than on nonholiday weekends.

If the assumed travel increase exceeds 8.5%, then the risk of dying in a traffic crash during the Independence Day holiday period is less than during comparable nonholiday periods. If the travel increase is less than 8.5% or if travel is actually lower, then the risk of dying on the holiday is greater than during comparable periods.

Arnold and Cerrelli (1987) also examined the variation in fatalities during holiday periods.³ They used FARS data for 1975-1985 to determine average daily fatalities for each day of the week in each month (e.g., Tuesdays in July). For the Independence Day holiday period, they found that fatalities rose 20% on July 3 and 37% on July 4, but were normal on July 2 and 5.

Evaluation

Table 3 compares the actual FARS counts with the Council's estimates for all holidays for which data are available. One-hundred-twenty of the 139 actual counts fall within the 90% confidence interval of the estimate.

Notes

1. The National Highway Traffic Safety Administration extends the holiday period to 5:59 a.m. the following morning in its published tabulations of holiday deaths.
2. This differs from holiday estimates published by the Council in 1991 and earlier years. Comparisons should *not* be made between the holiday data and estimates shown here and holiday data and estimates published in 1991 and earlier years.
3. Arnold, R., & Cerrelli, E.C. (1987). *Holiday Effect on Traffic Fatalities*. DOT HS 807 115. Springfield, VA: National Technical Information Service.

Table 1. Traffic Deaths During 3.25-day Independence Day Periods as a Percent of Total July Traffic Deaths.

YEAR	JULY	INDEPENDENCE DAY PERIOD	PERCENT
2005	4,450	565	12.70%
2008	3,420	472	13.80%
2009	3,250	398	12.25%
2010	3,390	365	10.77%
2011	3,350	405	12.09%
2014	3,227	347	10.75%
<i>6-year avg.</i>	<i>3,515</i>	<i>425</i>	<i>12.06%</i>

Source: *Injury Facts* and FARS.

Table 2. Traffic Deaths During 3.25-day Independence Day Periods and Equivalent Nonholiday Periods.

YEAR	INDEPENDENCE DAY PERIOD	EQUIVALENT PERIODS	
		BEFORE	AFTER
2005	565	521	463
2008	472	406	393
2009	398	423	393
2010	365	384	353
2011	405	391	344
2014	347	305	326
<i>6-year avg.</i>	<i>425</i>	<i>392</i>	

Source: FARS.

Table 3. Holiday Estimate Evaluation

YEAR	ESTIMATE	90% C. I.	ACTUAL	YEAR	ESTIMATE	90% C. I.	ACTUAL
New Year's Day				Labor Day			
1995.....		(no estimate)		1995.....	512	457 – 574	490
1996.....	392	331 – 461	414	1996.....	544	494 – 598	508
1997.....	184	124 – 254	176	1997.....	492	426 – 566	485
1998.....	514	453 – 581	532	1998.....	498	447 – 554	447
1999.....	391	348 – 439	349	1999.....	468	422 – 518	469
2000.....	364	322 – 411	* 458	2000.....	481	430 – 538	514
2001.....	399	359 – 443	* 338	2001.....	474	420 – 533	432
2002.....	533	467 – 608	554	2002.....	474	413 – 542	536
2003.....	184	140 – 235	203	2003.....	488	429 – 555	490
2004.....	524	450 – 609	549	2004.....	486	421 – 558	480
2005.....	392	338 – 453	449	2005.....	475	420 – 537	500
2006.....	399	347 – 457	432	2006.....	533	477 – 595	487
2007.....	405	354 – 463	387	2007.....	490	440 – 544	508
2008.....	498	447 – 555	* 407	2008.....	439	384 – 501	473
2009.....	445	394 – 502	458	2009.....	404	356 – 457	* 351
2010.....	301	260 – 347	286	2010.....	368	320 – 422	390
2011.....	308	259 – 364	304	2011.....	400	337 – 472	373
2012.....	297	249 – 353	348	2012.....	405	336 – 485	378
2013.....	407	347 – 475	* 343	2013.....	394	338 – 459	371
2014.....	156	124 – 194	126	2014.....	395	338 – 460	362
Memorial Day				Thanksgiving Day			
1995.....	456	381 – 543	471	1995.....	527	465 – 596	519
1996.....	478	411 – 552	494	1996.....	528	465 – 597	570
1997.....	473	408 – 546	498	1997.....	541	480 – 609	554
1998.....	470	419 – 528	* 383	1998.....	541	485 – 603	586
1999.....	470	414 – 534	494	1999.....	500	441 – 566	* 567
2000.....	461	404 – 525	451	2000.....	497	432 – 570	497
2001.....	468	419 – 523	499	2001.....	532	455 – 619	580
2002.....	498	423 – 582	484	2002.....	575	493 – 667	527
2003.....	464	396 – 542	472	2003.....	544	459 – 642	544
2004.....	476	409 – 551	496	2004.....	556	476 – 646	556
2005.....	471	410 – 540	512	2005.....	610	505 – 735	605
2006.....	541	487 – 601	493	2006.....	555	500 – 615	* 623
2007.....	497	450 – 548	475	2007.....	564	499 – 635	542
2008.....	468	420 – 520	* 414	2008.....	479	415 – 551	484
2009.....	366	324 – 415	* 462	2009.....	447	392 – 508	401
2010.....	353	319 – 391	389	2010.....	441	378 – 513	417
2011.....	406	351 – 468	389	2011.....	434	368 – 509	375
2012.....	420	361 – 489	367	2012.....	451	384 – 528	405
2013.....	407	358 – 461	* 334	2013.....	436	365 – 517	* 360
2014.....	382	327 – 445	337	2014.....	418	367 – 474	403

Source: Estimates from National Safety Council; actual counts from FARS. * = outside of 90% confidence interval.

Table 3. Holiday Estimate Evaluation (cont.)

YEAR	ESTIMATE	90% C. I.	ACTUAL	YEAR	ESTIMATE	90% C. I.	ACTUAL
Independence Day				Christmas Day			
1995.....	636	553 – 731	631	1995.....	422	351 – 502	* 342
1996.....	653	580 – 734	609	1996.....	145	113 – 182	136
1997.....	469	411 – 535	492	1997.....	563	458 – 680	466
1998.....	498	448 – 552	458	1998.....	406	350 – 468	354
1999.....	503	446 – 567	499	1999.....	369	316 – 428	* 456
2000.....	645	578 – 719	683	2000.....	359	300 – 424	419
2001.....	198	144 – 260	173	2001.....	522	417 – 641	575
2002.....	648	565 – 743	662	2002.....	160	131 – 193	* 114
2003.....	520	449 – 602	500	2003.....	529	438 – 636	488
2004.....	522	451 – 602	502	2004.....	440	356 – 536	370
2005.....	498	444 – 557	* 565	2005.....	443	352 – 546	383
2006.....	751	680 – 828	* 629	2006.....	415	332 – 507	379
2007.....	203	160 – 251	184	2007.....	497	424 – 579	454
2008.....	449	396 – 507	472	2008.....	432	371 – 500	409
2009.....	381	336 – 431	398	2009.....	317	253 – 388	* 248
2010.....	361	310 – 420	365	2010.....	303	233 – 384	249
2011.....	374	320 – 436	405	2011.....	287	220 – 365	256
2012.....	173	135 – 219	157	2012.....	377	320 – 441	351
2013.....	540	477 – 610	* 461	2013.....	105	82 – 132	88
2014.....	385	328 – 450	347	2014.....	366	330 – 407	355

Source: Estimates from National Safety Council; actual counts from FARS. * = outside of 90% confidence interval.