DOT HS 809 450

Estimates of Alcohol Involvement in Fatal Crashes

U.S. Department of Transportation
National Highway Traffic Safety Administration

New Alcohol Methodology

Introduction

The National Highway Traffic Safety Administration (NHTSA) has adopted a new method to estimate missing blood alcohol concentration (BAC) test result data. This new method, *multiple imputation*, will be used by NHTSA's National Center for Statistics and Analysis (NCSA) to improve the scope of alcohol involvement statistics generated by the Fatality Analysis Reporting System (FARS).

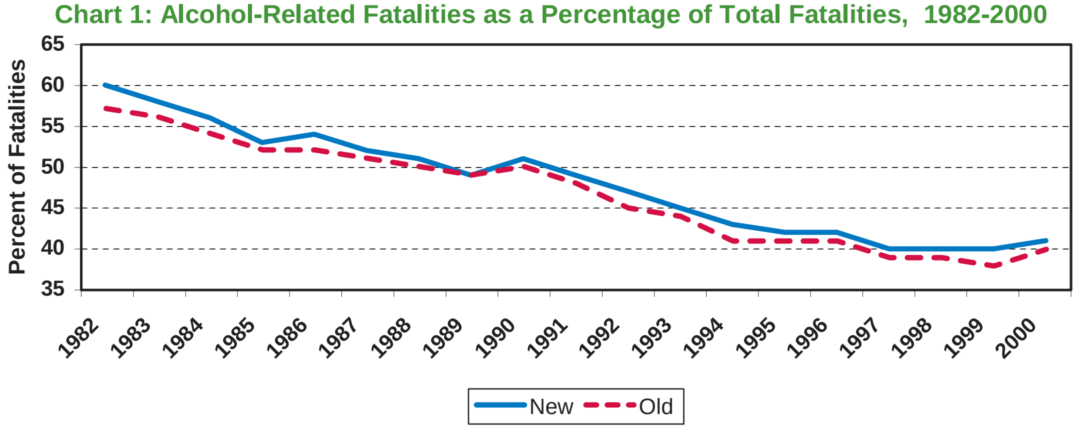
The old estimation method used by NHTSA calculated the chance that a driver, pedestrian or a pedalcyclist with unknown or missing alcohol results had a BAC in each of the three categories: 0, 0.01 to 0.09, or 0.10 and greater. Beginning with the 2001 data, NCSA will use multiple imputation to estimate missing BAC values in FARS. Multiple imputation offers NHTSA significant advantages over the old method in analyzing and reporting estimates of alcohol involvement. Instead of estimating alcohol involvement by the three aforementioned categories, the new method will estimate BAC along the entire range of plausible values (0 to 0.94 g/dl). **Estimating missing BAC this way will enable NHTSA to report the extent of alcohol involvement at any BAC level.**

This fact sheet is intended to inform NHTSA's partners of this methodology change, and to compare estimates of alcohol involvement using the old and new methods, as well as to address anticipated questions.

Alcohol Involvement: Comparing Estimates from the New and Old Methods

Chart 1 shows the estimated extent of alcohol-related fatalities from 1982-2000 based on the new and old methods of BAC estimation.

Chart 1: Alcohol-Related Fatalities as a Percentage of Total Fatalities, 1982-2000



The overall trend of alcohol involvement is similar for the estimates from both methods. At the national level, differences between the estimates tend to be two percentage points or less. For smaller sub-populations such as states, age groups, etc., estimates from the two methods will differ. This variation can be attributed to the inherent differences in the way the two processes work and because the new method employs a more rigorous procedure of defining the relationship between BAC and the factors that predict BAC. Additionally, the sensitivity of the estimates depends on how much data is missing. The difference between the estimates produced by the two methods tends to be greater in states that have very low BAC reporting levels.

National Estimates:

Table 1 shows the estimated rates of alcohol involvement among drivers involved in fatal crashes as estimated using the two methods from 1982-2000. The numbers in Table 1 reflect the percentage of all drivers (killed or survived) who had a BAC of 0.01 or greater. Table 2 shows the percentage of all fatally injured pedestrians and pedalcyclists who had a BAC of 0.01 or greater.

Table 1: Alcohol Involvement Among Drivers in Fatal Crashes by their Survival Status: A Comparison of Estimates Using the New and Old Methods, 1982-2000*

Year	Killed		Survived		Total	
	New	Old	New	Old	New	Old
1982	55	53	29	28	41	39
1983	54	51	28	27	39	38
1984	51	49	27	25	38	36
1985	49	48	23	23	35	34
1986	50	48	25	23	36	34
1987	48	47	23	23	34	33
1988	47	47	22	22	33	33
1989	46	46	20	21	31	32
1990	46	46	23	21	33	32
1991	45	44	21	21	31	31
1992	43	42	19	19	30	29
1993	41	40	18	18	28	27
1994	38	37	18	16	27	25
1995	39	38	16	16	26	25
1996	38	37	16	16	26	25
1997	36	35	15	15	24	24
1998	36	35	15	15	24	23
1999	36	35	14	14	24	23
2000	37	36	16	15	26	24

Based on 1982-1999 Final FARS Files and 2000 Annual Report File

Table 2: Alcohol Involvement Among Fatally Injured Pedestrians and Pedalcyclists: A Comparison of Estimates Using the New and Old Methods, 1982-2000*

Year	Pedestrians		Pedalcyclists	
	New	Old	New	Old
1982	42	41	22	20
1983	42	40	18	20
1984	40	39	18	18
1985	40	39	15	18
1986	39	39	17	18
1987	38	38	19	21
1988	37	37	18	19
1989	39	39	18	19
1990	38	38	20	21
1991	38	38	24	24
1992	39	38	20	22
1993	38	37	22	23
1994	36	36	20	21
1995	37	37	23	24
1996	38	38	22	23
1997	35	34	22	23
1998	38	37	24	24
1999	38	37	26	26
2000	38	37	25	26

Based on 1982-1999 Final FARS Files and 2000 Annual Report File

The NHTSA Technical Reports cited at the end of this document offer a more technical view into the new method and have detailed tabulations of alcohol involvement in various categories (age, sex, time of day, etc.). The reports compare the estimates from both methods for each category.

***State-level Alcohol Estimates*:**

Table 3 compares the estimates of alcohol-related fatalities by state from 1998-2000. Table 4 compares the extent of alcohol involvement among drivers involved in fatal crashes by state from 1998-2000. As shown in Tables 3 and 4, although there is a minor shift in the extent of alcohol involvement from 1998-2000 in most states, the year-to-year changes appear to be similar using both estimation methods. For example, if the extent of alcohol involvement increases each year in a given state from 1998-2000 using the old method, then this will likely be true using the new method as well.

Table 3: Fatalities in Alcohol-Related Crashes: A Comparison of Estimates Using the New and Old Methods, 1998-2000*

State	Percentage with BAC 0.01 g/dl or Greater												
	1998		1999		2000		State	1998		1999		2000	
	New	Old	New	Old	New	Old		New	Old	New	Old	New	Old
Alabama	41	38	41	38	43	40	Montana	44	44	49	47	49	46
Alaska	44	45	51	52	54	52	Nebraska	38	38	43	42	38	37
Arizona	45	43	41	40	45	44	Nevada	49	49	44	45	43	45
Arkansas	35	31	35	31	34	31	New Hampshire	49	48	47	49	37	39
California	39	38	39	38	39	37	New Jersey	36	35	39	40	44	44
Colorado	39	37	37	35	40	38	New Mexico	46	45	45	45	49	48
Connecticut	44	43	45	45	47	46	New York	30	26	30	27	32	29
Delaware	40	39	42	40	50	49	North Carolina	36	35	38	36	39	36
DC	57	51	57	53	38	39	North Dakota	50	47	49	47	49	48
Florida	37	33	39	36	43	40	Ohio	37	33	37	35	41	38
Georgia	34	33	35	34	38	37	Oklahoma	35	33	35	33	36	34
Hawaii	49	49	45	44	43	41	Oregon	43	43	42	41	41	42
Idaho	38	34	37	36	43	41	Pennsylvania	43	42	40	38	43	41
Illinois	44	43	44	44	44	43	Rhode Island	49	48	41	41	52	51
Indiana	41	39	38	36	34	31	South Carolina	37	31	37	31	41	40
Iowa	36	37	34	33	30	28	South Dakota	41	41	44	43	48	47
Kansas	34	32	36	34	35	33	Tennessee	42	41	40	38	43	39
Kentucky	36	33	37	35	34	31	Texas	49	50	48	50	49	50
Louisiana	48	47	47	46	49	48	Utah	18	14	25	21	28	24
Maine	28	28	33	32	31	30	Vermont	38	37	39	38	41	39
Maryland	37	34	36	34	40	38	Virginia	38	37	38	36	38	37
Massachusetts	45	48	47	49	49	50	Washington	47	46	43	42	45	44
Michigan	40	39	41	40	38	37	West Virginia	42	41	38	37	45	43
Minnesota	44	43	33	32	41	41	Wisconsin	43	42	42	41	44	43
Mississippi	38	37	40	39	41	40	Wyoming	46	44	38	37	32	30
Missouri	44	45	40	40	44	44	**U.S. Total**	40	39	40	38	41	40

****Based on 1998-1999 Final FARS Files and 2000 Annual Report File***

Table 4: Alcohol Involvement Among Drivers Involved in Fatal Crashes: A Comparison of Estimates Using the New and Old Methods, 1998-2000*

State	Percentage with BAC 0.01 g/dl or Greater						State						
	1998		1999		2000			1998		1999		2000	
	New	Old	New	Old	New	Old		New	Old	New	Old	New	Old
Alabama	26	24	26	24	29	26	Montana	32	32	40	38	33	32
Alaska	32	32	35	36	40	38	Nebraska	27	27	27	27	23	23
Arizona	26	24	22	21	26	25	Nevada	30	30	27	27	30	31
Arkansas	22	19	24	21	23	21	New Hampshire	29	28	34	35	29	30
California	22	21	22	22	22	21	New Jersey	21	21	22	23	24	25
Colorado	24	23	23	23	24	22	New Mexico	29	29	28	29	29	28
Connecticut	29	29	29	29	32	30	New York	17	15	17	15	18	16
Delaware	21	20	21	20	31	29	North Carolina	19	18	21	19	24	21
DC	35	32	35	32	24	24	North Dakota	36	35	35	33	39	38
Florida	19	17	20	19	24	22	Ohio	23	20	22	21	26	24
Georgia	20	19	20	19	22	22	Oklahoma	23	22	22	21	22	21
Hawaii	30	29	30	29	27	25	Oregon	27	27	25	24	24	24
Idaho	24	22	26	25	30	28	Pennsylvania	28	26	25	24	27	25
Illinois	26	25	26	26	27	26	Rhode Island	33	32	29	29	38	37
Indiana	26	25	23	22	22	19	South Carolina	22	18	22	18	26	26
Iowa	22	23	21	20	19	17	South Dakota	29	27	30	30	30	29
Kansas	23	22	24	22	23	22	Tennessee	26	25	26	25	27	25
Kentucky	22	20	24	23	23	20	Texas	31	32	30	32	31	33
Louisiana	30	29	31	31	32	32	Utah	12	9	18	14	19	16
Maine	20	19	21	21	20	19	Vermont	27	26	27	26	31	30
Maryland	20	19	20	19	21	21	Virginia	24	23	24	23	24	22
Massachusetts	29	31	31	33	31	32	Washington	29	28	28	27	29	28
Michigan	24	23	24	23	22	21	West Virginia	27	26	24	23	31	29
Minnesota	27	26	20	19	26	26	Wisconsin	27	27	28	28	28	27
Mississippi	27	26	26	27	28	27	Wyoming	35	34	27	26	23	22
Missouri	28	28	26	26	28	28	**U.S. Total**	24	23	24	23	26	24

**Based on 1998-1999 Final FARS Files and 2000 Annual Report File*

Frequently Asked Questions (FAQ)

This section answers some of the most frequently asked questions about the change to the new methodology. NHTSA reports that explain the technical details of the new methodology are listed in the Further Information section at the end of this fact sheet.

1. **What is the proportion of the cases in FARS that do not have a known BAC?**

   A. On an average, approximately 60 percent of the Blood Alcohol Concentration (BAC) values for Drivers, Pedestrians and Pedalcyclists are missing in FARS each year as a result of alcohol tests not being administered or test results not being reported.

2. **How do you address the problem of missing information?**

   A. Imputation is the practice of 'filling in' missing data with plausible values using proven, scientific methods. The ideal scenario for any database like FARS is to have a variable (e.g., BAC) known for all the records. However, important variables are often missing from crash data, and so estimated values are used instead of unknown or blank values, enabling valid conclusions to be made.

3. **Why impute Missing BAC in FARS?**

   A. If estimates of alcohol involvement are based only on BAC values that are reported for some persons, invalid inferences will result because the characteristics of the persons with unknown BACs can be significantly different from those with reported BACs.

4. **What is Multiple Imputation (MI)?**

   A. MI is a proven technique in which each missing value in a dataset is replaced by more than one simulated version using rigorous statistical techniques. These techniques establish the inter-relationships between the characteristics (variables) of cases with reported values. These relationships are then applied on the same set of variables in the cases where the missing values are to be imputed. Multiple values of the missing item are then generated.

5. **Why use MI in FARS?**

   A. For each missing BAC value in FARS, MI simulates actual values of BAC in the plausible range (0<=BAC<=0.94). This makes it possible to analyze the extent of alcohol involvement at any level of BAC (e.g., 0.07+, 0.08+, etc.). MI also allows for the computation of Standard Errors and Confidence Intervals, which enable NHTSA to report measures of statistical confidence about the generated estimates.

6. **Can the new estimates be used in regression analysis or other analysis?**

   A. Yes, since the new estimates are actual values of BAC.

7. **Why are there differences between the results from MI and the old method?**

   A. The imputation methodologies employ different statistical models to estimate missing BAC values. The old method computes the chance of involvement along definite categories (0, 0.01 to 0.09, and 0.10+) of BAC while MI imputes actual values of BAC (0 to 0.94). The MI estimates are generally between 0 to 2 percentage points higher than the estimates from the old methodology.

Conclusion

NHTSA will use the new procedure for estimating missing BAC values because of the significant analytical advantages it provides over the earlier method. Multiple imputation enables NHTSA to better support changing legislative needs such as the adoption of 0.08 as the illegal BAC level. The overall trend of alcohol involvement is similar for the estimates from both methods, though minor differences exist when estimating alcohol involvement in small sub-populations. The standard errors now available from using the new estimation method will enable NCSA to provide statistical measures of confidence about the imputed estimates.

Further Information

The following publications provide more detailed information and can be requested from NHTSA through the contact information given below:

1. Rubin, D.B., Schafer, J.L., and Subramanian, R. (1998) *Multiple Imputation of Missing Blood Alcohol Concentration (BAC) values in FARS,* Report DOT-HS-808-816, National Highway Traffic Safety Administration, Department of Transportation.
   (This report presents an in-depth technical view of the *multiple imputation* process and its implementation in the FARS system. Detailed specifications of the statistical models used to estimate missing BACs are provided. Examples are also given of how the new data can be analyzed and used in models.)

2. Subramanian, R. (2002) *Transitioning to Multiple Imputation: A New Method to Estimate Missing BAC in FARS*, Report DOT-HS-809-403, National Highway Traffic Safety Administration, Department of Transportation.
   http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2002/809-403.pdf
   (This report has detailed tabulations of the extent of alcohol involvement from 1982 to 2000 using estimates generated with both the old and new methods. Alcohol Involvement is reported according to various categories of interest (age, sex, time of day, day of week, etc.)

Contact Information

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