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EDITORIAL

NASS-CDS national estimates of fatalities do not match FARS census

Summary

NHTSA claims that NASS-CDS is a representative sample of crashes in the United States. They provide a case weight for each crash to estimate national incidence. NASS-CDS and the Fatality Analysis Reporting System (FARS) were analyzed using similar sorting parameters to compare annual fatality estimates from NASS-CDS to the census counts in FARS.

Existing analyses of NASS-CDS and FARS were reexamined to compare the consistency of the annual fatality estimates and counts from the NHTSA databases. NASS-CDS was analyzed to determine fatalities in light vehicles from calendar years 1994 to 2013. Light vehicles were defined by body type (0 < BODY_TYP < 50) with 1994+ model year (MY) and no ejection (EJECTION = 0). Fatalities were grouped by 4 occupant ages 0–3, 4–7, 8–14, and 15+ years old and by front (first-row outboard) and rear (second-row) seats. Fatalities in NASS-CDS were defined by treatment (TREATMNT = 1), injury severity (ISS = 75), or police injury severity (INJSEV = 4). The average annual fatalities were determined with standard errors. FARS census counts were determined from 1996 to 2013 using the same parameters as NASS-CDS. Fatalities in FARS were defined by injury severity (INJ_SEV = 4). The average fatalities and standard deviation were determined.

NASS-CDS estimated 6,736 ± 1,115 deaths per year to front outboard and second-row occupants in light-vehicle crashes. FARS counted 12,447 ± 3,857 deaths per year using the same search parameters. The NASS-CDS estimate was 54% lower than the FARS count. The difference was statistically significant (t-statistic 522, $P < .0001$). NASS-CDS estimated 223 deaths per year to 0- to 14-year-old children. FARS counted 523 child deaths per year. The NASS-CDS estimate was 57% lower than the FARS estimate. NHTSA's decision to stop investigating older vehicles in 2009 increased the underestimation by NASS-CDS from 39% in 1996–2009 to 68% in 2010–2015 compared to FARS. NASS-CDS and the Crash Investigation Sampling System (CISS) undersample older vehicles.

NASS-CDS underestimates by 46% the census count of fatalities in FARS. The underestimates occurred for occupants of all ages in front and rear seats. NASS-CDS and CISS are not representative samples of fatal crashes in the United States.

Introduction

In 2015 the author compared the annual fatality estimates from NASS-CDS to the census counts from FARS (Fatality Analysis Reporting System). He noted significantly lower national estimates by NASS-CDS. The findings were not presented until today. They are being given because of a recent study identifying serious errors in the CISS (Crash Investigation Sampling System) that existed in NASS-CDS. Viano (2025) found errors in sampling frequencies and case weighting procedures that make national estimates of serious injury from NASS-CDS unreliable and inaccurate. The author recalled the earlier study of fatalities and decided to share the findings.

The analysis presented here follows methods consistent with the practices of automotive safety researchers and NHTSA. For this study, the data from NASS-CDS and FARS were available from other studies (Viano and Parenteau 2016, 2022). The analyses use the same variables in each database. They compare 2 field accident databases that should be consistent if the data from NASS-CDS are nationally representative. The analysis conducted here is one that NHTSA should have conducted years ago to prove that their field data sampling methods in NASS-CDS were accurate. It is my understanding that NHTSA never conducted self-critical analysis of their field data methods and procedures.

NHTSA routinely studied the effectiveness of safety standards until the retirement of Dr. Charles Kahane. Over his 30+-year career, Dr. Kahane evaluated most FMVSS by analyzing field accident data from FARS, NASS-CDS, and other sources. Kahane (2015) summarized many of his studies and provided citations for the source data and analyses of the effectiveness of FMVSS in preventing death and injury in motor vehicle crashes. It is my understanding that Dr. Kahane never evaluated NHTSA's field data methods. NHTSA never verified the consistency of its field data.

The analysis presented here compares fatality estimates from NASS-CDS to census counts in FARS to see the representativeness of national estimates from NASS-CDS. The comparison shows the invalidity of the sampling frequencies and weighting procedures used by NASS-CDS to estimate fatalities in U.S. crashes. NHTSA has been misleading Congress, the Office of Management and Budget, and the public about the representativeness of NASS-CDS and CISS field data (*Federal Register* 2015, 2022; GAO 2015; NHTSA 2023; Viano 2025).

Methods

NASS-CDS

The NASS-CDS is a stratified multiphase, unequal selection probability sample of motor vehicle crashes that are

prospectively selected for in-depth investigation (Shelton 1991; Radja 2012; Zhang and Chen 2013). The data can found at: https://www.nhtsa.gov/crash-data-systems/national-automotive-sampling-system. NHTSA annually publishes a user manual for NASS-CDS with updates and revisions; see, for example, NHTSA (2009).

NHTSA claims that the sampling methods used by NASS-CDS and CISS (the predecessor data) result in a nationally representative sample of U.S. crashes (NHTSA 2009, 2010, 2023; *Federal Register* 2015, 2022). The data include information from crash investigation of the police report, crash site, vehicles, medical records, and personal interviews. Most of the vehicles were towed from the scene because of damage; hence the term "towaway crashes."

NASS-CDS data for calendar years 1994 to 2015 was available from an analysis of crash injuries by delta-V (Viano and Parenteau 2022). The analysis included motor vehicle occupants in light-vehicle crashes. The NASS-CDS data were analyzed with the following selections:

- Vehicle types: Vehicles with body type less than 50 (0 < BODY_TYP < 50) were included. They are passenger cars, SUVs, minivans, and light pickups with vehicle weight <4,546 kg (10,000 lb).
- Model years (MYs): Vehicles with MY 1994 or newer (1994+) were selected with model year (1993 < Mod_Year < 2016).
- Ejection: Only nonejected occupants (EJECTION = 0) were included.
- Occupant age: The NASS-CDS data were subdivided in 4 groups of occupant ages: 0 to 3 years old using (0 < AGE < 4), 4 to 7 years old using (4 < AGE < 8), 8 to 14 years old using (7 < AGE < 15), and 15+ years old using (14 < AGE < 105).
- Seating position: The data were subdivided by front seat or second row (SEATPOS 11, 13) and rear seat or second row (SEATPOS 21, 22, 23).
- Fatalities: The severity of injury was assessed the "TREATMNT" and "INJSEV" variables. The maximum Abbreviated Injury Scale (MAIS) represents the severity of life-threatening injuries at the time of first medical evaluation. It ranges from MAIS 0 to 6 and 9, where MAIS 9 is an injury with unknown severity. Fatalities were determined by treatment (TREATMNT = 1) because this means an occupant was fatally injured and not transported to hospital, with injury severity (ISS = 75) or police injury severity (INJSEV = 4) representing a fatality according to police rating K in KABCO.

National estimates for the number of occupants killed were made using the inflation ratio (RATWGT) variable in the NASS-CDS. Only cases with an RATWGT > 0 were included. All calculations were based on weighted data. Standard errors (SEs) were determined using the SAS procedure "SURVEYFREQ" accounting for PSU, PSUSTRAT and RATWGT factors. SAS software v9.4 was used (www.sas.com/en_us/software/stat).

The annual fatality counts for each age and seating group were averaged for the 20 years of NASS-CDS data. The standard error was determined for the annual average. A subset of data was averaged for the 1996–2009 and 2010–2013 NASS-CDS. There was a transition in the investigation of vehicles in 2009 NASS-CDS. Data after 2009 represent newer vehicles <10 years old. NHTSA decided to stop investigating older vehicles in 2009–2015 NASS-CDS. This was an unfortunate and ill-conceived decision.

FARS

FARS is a census of motor vehicle crashes resulting in the death of a vehicle occupant or nonmotorist within 30 days of the crash. The data can be found at: https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars.

FARS data for calendar years 1996 to 2013 were available from an analysis of the effectiveness of the revision to FMVSS 301 (Viano and Parenteau 2022). The following parameters were selected to match the NASS-CDS analysis:

- Vehicle types: Vehicles with body type less than 50 (0 < BODY_TYP < 50) were included.
- Model years: All vehicles with model year after 1993 (1994 < modelyr < 2016) were included.
- Ejection: Only nonejected occupants (EJECTION = 0) were included.
- Occupant age: The FARS data were subdivided in 4 groups of occupant ages: 0 to 3 years old using (0 < AGE < 4), 4 to 7 years old using (4 < AGE < 8), 8 to 14 years old using (7 < AGE < 15), and 15+ years old using (14 < AGE < 105).
- Seating position: The data were subdivided by front seat or first row (SEATPOS 11, 13) and rear seat or second row (SEATPOS 21, 22, 23).
- Fatality: A fatality was defined using the injury severity variable (INJ_SEV = 4).

The annual fatality counts for each age and seating group were averaged for the 18 years of FARS data. The standard deviation was determined for the annual average. A subset of data was averaged for the 1996–2009 and 2010–2013 FARS for comparison with a similar grouping from NASS-CDS.

Statistics

Differences between NASS-CDS estimated fatalities and the FARS census count were evaluated using the comparison of means test (Altman 1991). The test was run at https://www.medcalc.org/calc/. The difference was significant if $P < .05$. The statistics include the t-value and P-value.

Results

Table 1 shows the estimated annual fatalities from the 1994 to 2013 NASS-CDS by occupant age and seating position in the front outboard and second-row seats. Overall, there were 6,736 ± 1,115 deaths per year for the selected light-vehicle body types and known parameters. The majority of deaths

occurred in front outboard seats (91.6%). There were 223 deaths per year of 0- to 14-year-old children. The majority were in second-row seats (63.6%). The "All rows" column includes all occupant positions in the vehicle. The unweighted counts are given in Appendix Table A1 (see online supplement). The data for all rows of seating were greater than for the first and second rows because these data include fatalities in the center-front seat, third-row seat, and other positions in the vehicle.

Table 2 shows the annual fatality count from the 1996 to 2013 FARS by occupant age and seating position in the front- or second-row seats. Overall, there were 12,447 ± 3,857 deaths per year for the selected light-vehicle body types and known parameters. The majority of deaths occurred in front outboard seats (90.2%). There were 523 deaths per year of 0- to 14-year-old children. The majority were in second-row seats (61.9%).

The annual NASS-CDS estimate of fatalities was 6,736 ± 1,115 deaths per year. It was 54% lower than the FARS count of 12,447 ± 3,857 deaths per year based on the same analysis methods. NASS-CDS significantly underestimated fatalities compared to FARS (t-statistic 522, $P < .0001$). NASS-CDS underestimates fatalities by 57% for children 0 to 14 years old.

Table 3 summarizes the fatalities in NASS-CDS and FARS by years 1996–2009 and 2010–2015. The data look at the effect of NHTSA not sampling older vehicles in the 2010 to 2015 NASS-CDS. Overall, NASS-CDS underestimated fatalities by 46% compared to the census count of FARS. NHTSA's decision to stop investigating older vehicles in 2009 increased the underestimation from 39% in 1996–2009 to 68% in 2010–2015.

Discussion

NHTSA claims that NASS-CDS and CISS are nationally representative samples of injury and death in U.S. crashes (NHTSA 2009, 2010, 2023; *Federal Register* 2015, 2022; GAO 2015). The author is not aware of any studies conducted by NHTSA to verify the accuracy of the claim. He is unaware of any study by NHTSA showing that the sampling frequencies and case weighting procedures used by NASS-CDS and CISS are valid and lead to consistent counts with FARS. NHTSA has not verified that the NASS-CDS and CISS databases are representative of injuries treated in U.S. emergency departments or hospital admissions. NHTSA has repeated claims of national representativeness of NASS-CDS and CISS when they have asked Congress for more money. The claims have been shown to be false (Viano 2025).

There were only 86 unweighted cases of death to 0- to 14-year-old children in the front outboard and second-row seats that were investigated by NASS-CDS in 20 years of data collection. The NASS-CDS sampling procedure depends on the police report for information on the most serious injury based on KABCO and vehicle age. The sampling procedure is too restrictive to get a reasonable sample of subpopulations for the study of improvements needed in automotive safety. For example, the use of different child seats, proper restraint of child seats to the vehicle, and proper restraint of the child to the child seats cannot be studied with the in-depth investigation of only 46 fatalities of 0- to 7-year-old children in 20 years.

Fetal deaths in motor vehicle crashes are another example of too little data. NASS-CDS and CISS investigated 18 cases over 22 years of field data. The crashes involved belted and unbelted pregnant occupants in front, side, rear, and rollover crashes. Though the sample provides useful information on the causes for fetal death, it took 22 years to collect the cases. It took far too long to get the field experience. The CISS sampling procedures should include larger samples of subgroups of interest so that researchers can study the need for safety improvements for young children, pregnant occupants, elderly occupants, and others. It is more important that the CISS sample identify safety needs than it is to be representative of U.S. crashes. NASS-CDS and CISS are not representative of serious injury and death in U.S. crashes (Viano 2025).

In 2009 NHTSA made the decision to stop the in-depth investigation of vehicles ≥10 years old (NHTSA 2009). The decision was ill-informed because older vehicles make up more than 50% of off-road and rear-impact fatalities in the United States (Parenteau et al. 2022; Viano et al. 2024). Older vehicles are a surrogate characteristic for the influences of race, gender, and socioeconomic status on fatal and serious injury crashes. NASS-CDS and CISS undersample older vehicles and are not representative samples of serious injury and fatalities in U.S. crashes (Viano 2025).

Table 1. Annual fatality estimates by occupant age and seating position from 1994 to 2013 NASS-CDS.

	NASS-CDS fatalities per year[a]		
Age group (years)	First row	Second row	All rows
0–3	4	61	74
4–7	17	21	50
8–14	37	61	99
15+	6,111	363	6,509
All	6,170	507	6,736

[a]Unweighted counts <10 are a small sample.
Grey highlight is for unweighted counts <10.

Table 2. Annual fatality counts by occupant age and seating position from 1996 to 2013 FARS.

	FARS fatalities per year		
Age group (years)	First row	Second row	All rows
0–3	23	119	156
4–7	25	89	133
8–14	89	116	234
15+	11,084	685	11,921
All	11,225	1,009	12,447

Table 3. Annual fatalities from 1996 to 2009 and 2010 to 2013 NASS-CDS and FARS.

	Fatalities per year		
All occupants	1996–2009	2010–2013	All
NASS-CDS	7,284	4,544	6,736
FARS	11,949	14,191	12,447
Percent lower	39	68	46

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