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Imputation of Missing Blood Alcohol Concentration (BAC) Data in the Fatality Analysis Reporting System (FARS)

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Agenda

- Why we Need to Impute
- Overview of Current Method
- Why a Change is Needed
- Introduce New Method
- A Look at Implications

The Problem: Missing BAC Values

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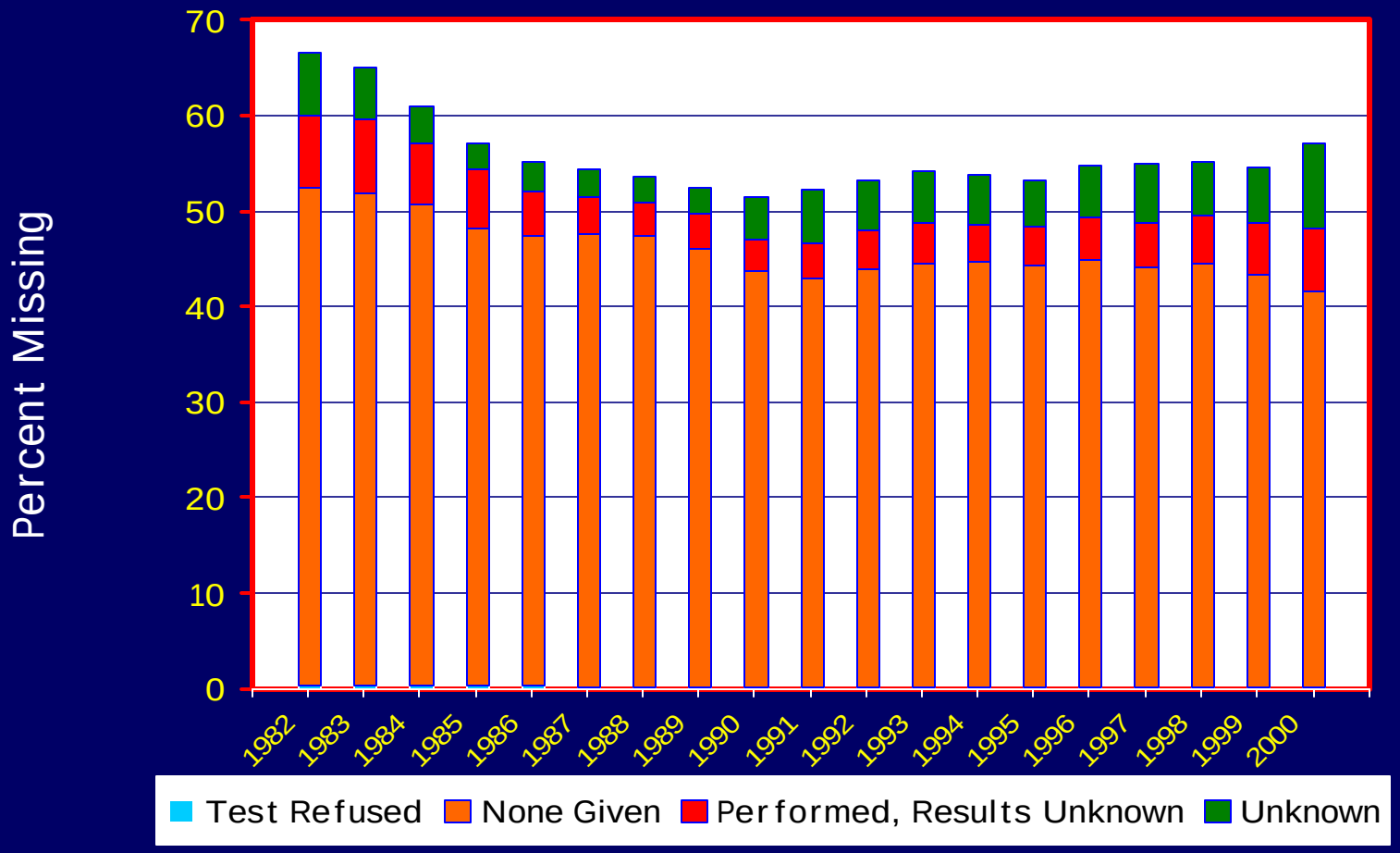

Source: 1982-1999 Final FARS, 2000 Annual Report File

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Effect of Missing BACs

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- Present National Statistics on Alcohol Related Crashes Based on All Cases
  - Imputing missing BAC provides a way to evaluate extent of alcohol involvement in all fatal crashes

- Invalid inferences can be drawn on alcohol-related crash characteristics if based only on known BACs

Imputation . . .

- A Procedure Used to Adjust Survey Data or Estimates for Missing Response items
  - An accepted process, commonly used by most statistical organizations
  - Has a strong basis in statistical theory

- Makes Use of ...
  - Data and characteristics of complete responses
  - Known characteristics of responses with missing items

Imputation …

- Is A Constantly Evolving Science
  - Improving with advances in computational power and statistical techniques

- At NHTSA - A Progression..
  - From various forms of “Hot-Decking”
  - Through a two-category discriminant analysis
  - To the current method of three-category discriminant analysis

Why Change Imputation Methodology?

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- Ongoing Effort to Improve Methodology
  - To be current with the State of the Art in Statistical Techniques of Imputation

- Introduction of Current Method was Accompanied by Calls to Evaluate Alternative Methods

- Current Method Limits Analysis

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Another Reason to Change...

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- Legislative changes created new data needs
  - .08 BAC established as definition of intoxication
  - NHTSA has no way to estimate Alcohol Involvement at .08 and above with the current method

- New method can meet changing needs

Multiple Imputation is the New Method that...

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- Is Based on State of the Art Statistical Theory and Practice
  - Procedure has been Peer Reviewed
  - Published in leading Professional Journals

- Creates "a" BAC Value

  for Each Missing Response Item

Users of Multiple Imputation

- Federal Agencies
  - National Center for Health Statistics
  - National Center for Education Statistics
  - Bureau of the Census
  - Federal Reserve Board
  - Social Security Administration

- Private Industry
  - Pharmaceutical companies' submissions to Food and Drug Administration

New Method - Description

Uses FARS Variables That Are Important Predictors of BAC

To	**Create BAC Distributions Based on Reported BACs**
From Which	**Ten Separate Values for Each Missing BAC are Selected**
That Are	**Combined into One Estimate when doing Analyses**

Comparison of Estimates

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Year	Fatalities	Estimate of Persons killed in Alcohol Related Crashes, by Imputation Method			
		Fatalities in alcohol-related crashes [1]		Percentage of all fatalities	
		Old Method	New Method	Old Method	New Method
1998	41,501	16,020	16,284	38.6	39.2
1999	41,717	15,976	16,192	38.3	38.8
2000	41,821	16,653	16,792	39.8	40.1

[1] Crashes where at least one driver or nonoccupant had a BAC of 0.01 g/dl or greater (alcohol-related crashes)

Source: 1998-1999 Final FARS, 2000 Annual Report File

Comparison of Estimates of Alcohol Involvement (.01+), FARS 1982-2000

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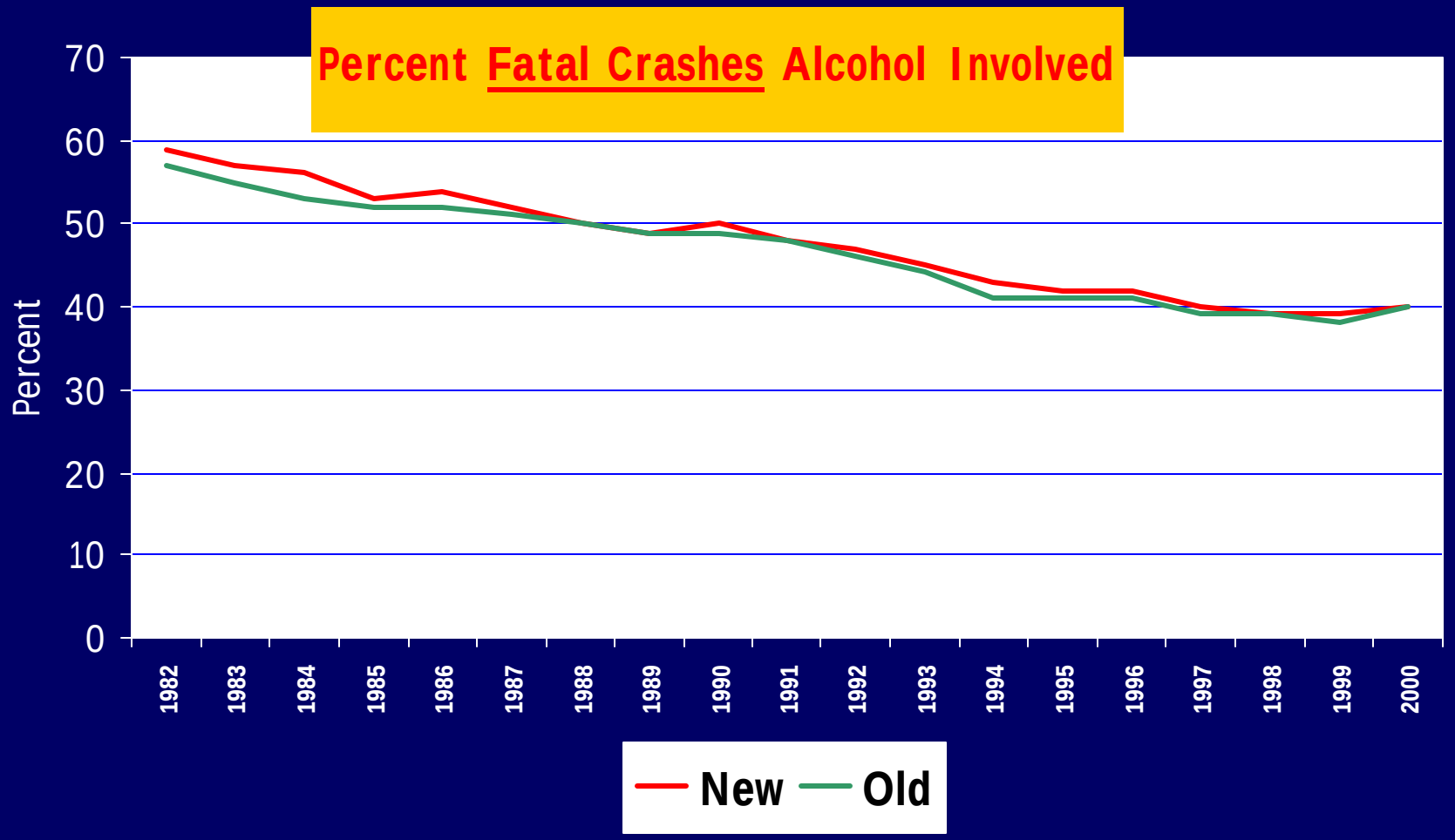

Source: 1982-1999 Final FARS, 2000 Annual Report File

Comparison of Estimates of Alcohol Intoxication (.10+), FARS 1982-99

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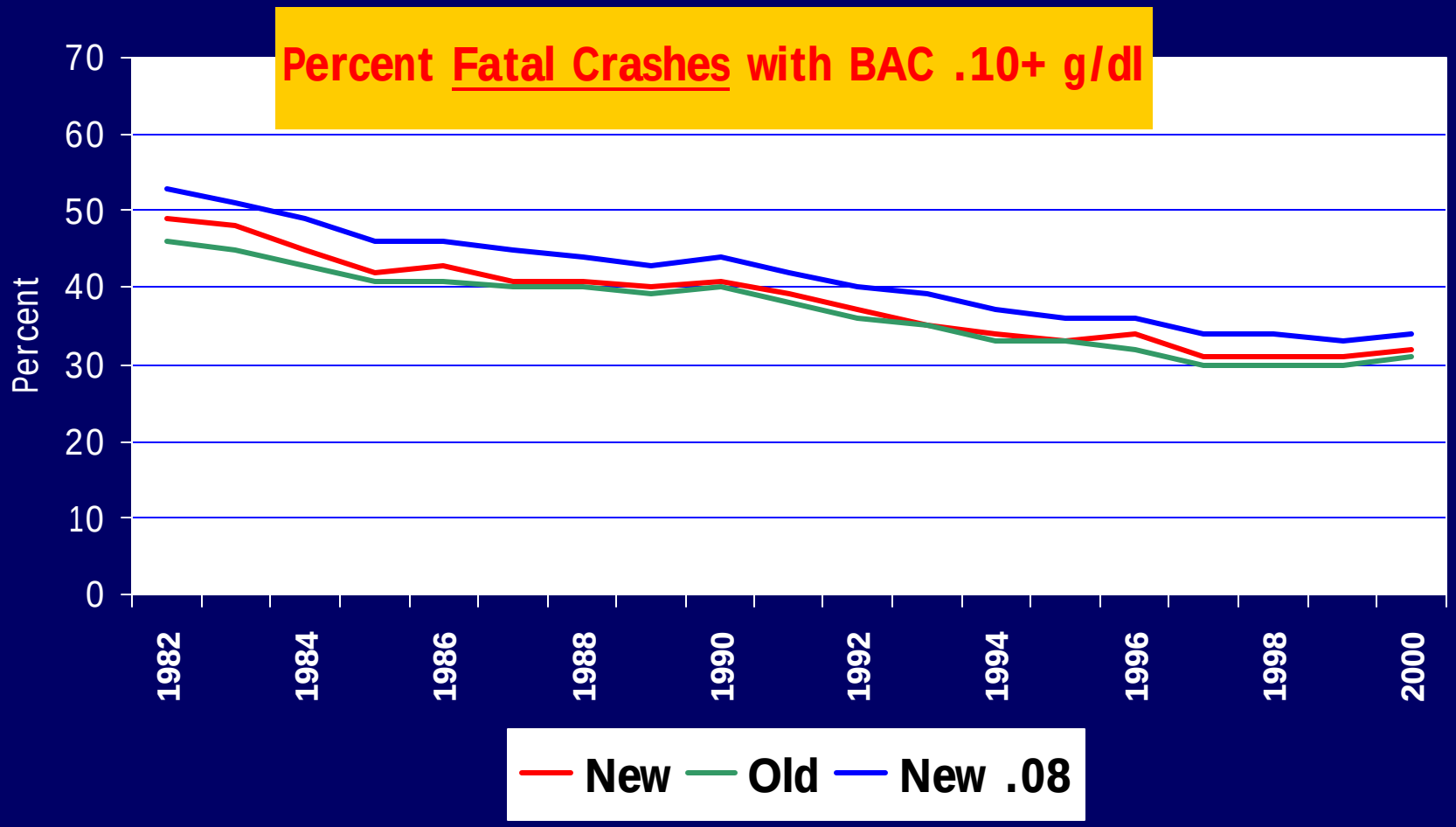

Source: 1982-1999 Final FARS, 2000 Annual Report File

Comparison of Estimates of Fatal, Intoxicated Drivers, FARS 1982-99

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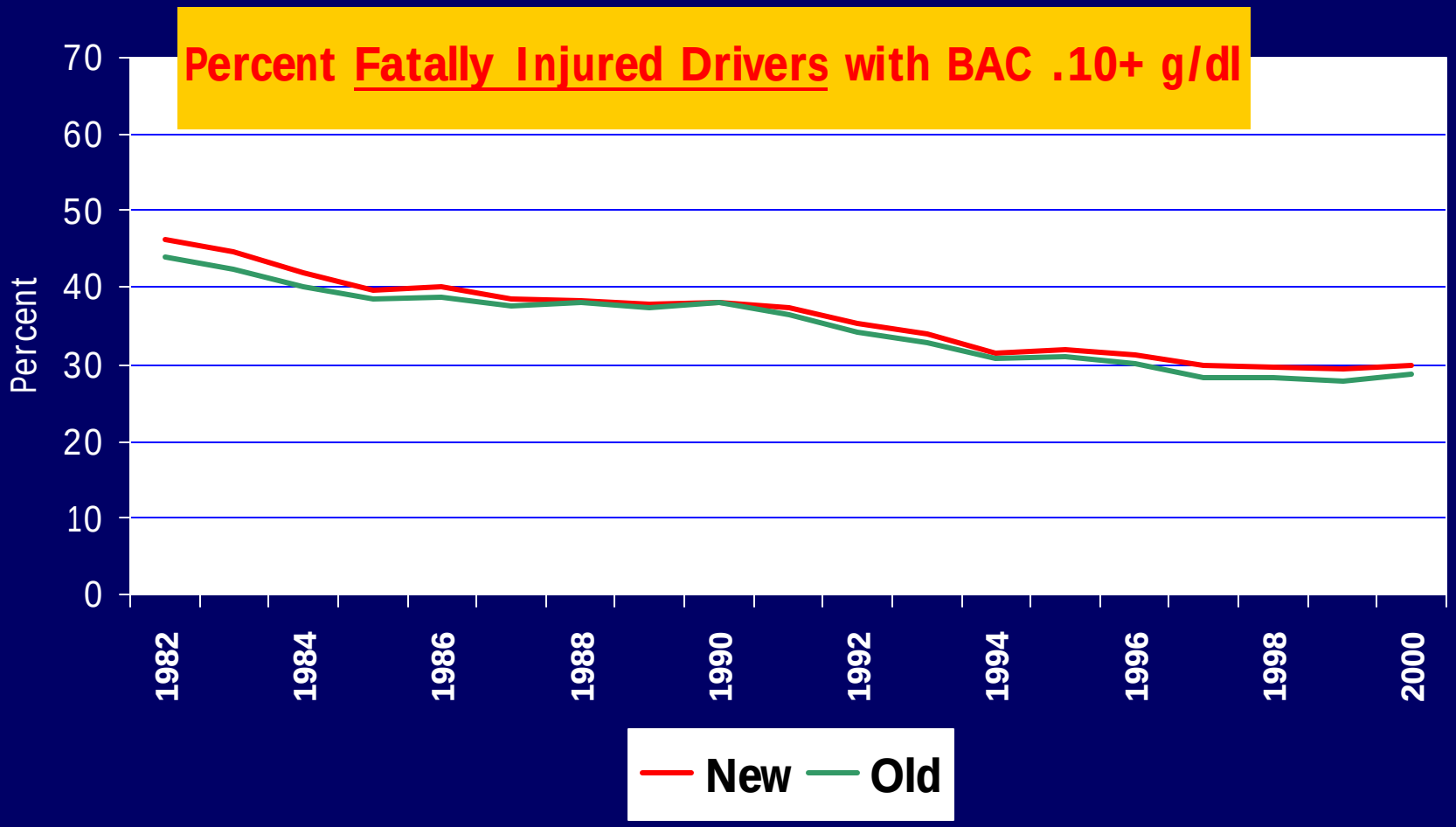


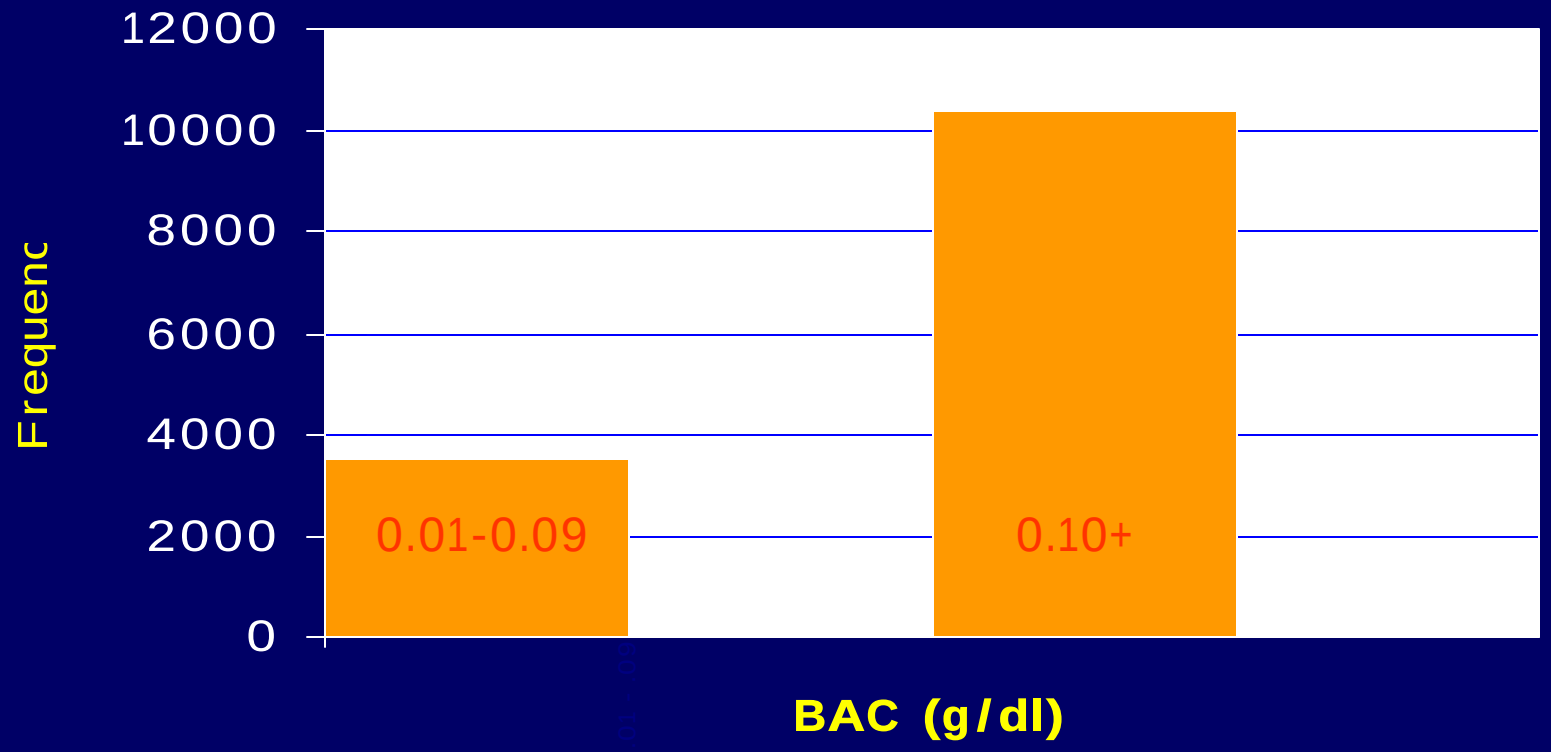
Source: 1982-1999 Final FARS, 2000 Annual Report File

New Method – Other Advantages

- Estimates for Any Defined Category Possible
  - Including the important 0.08+ category
- Permits Use of Entire Dataset in Analysis and Modeling
  - Not possible under current methodology
- Permits Estimation of Error Due to Imputation
  - Not possible under current methodology

Old Method

Distributions of BAC for Drivers Involved in Fatal Crashes (excluding BAC=0), FARS 2000



Source: 2000 Annual Report File

New Method - Advantages

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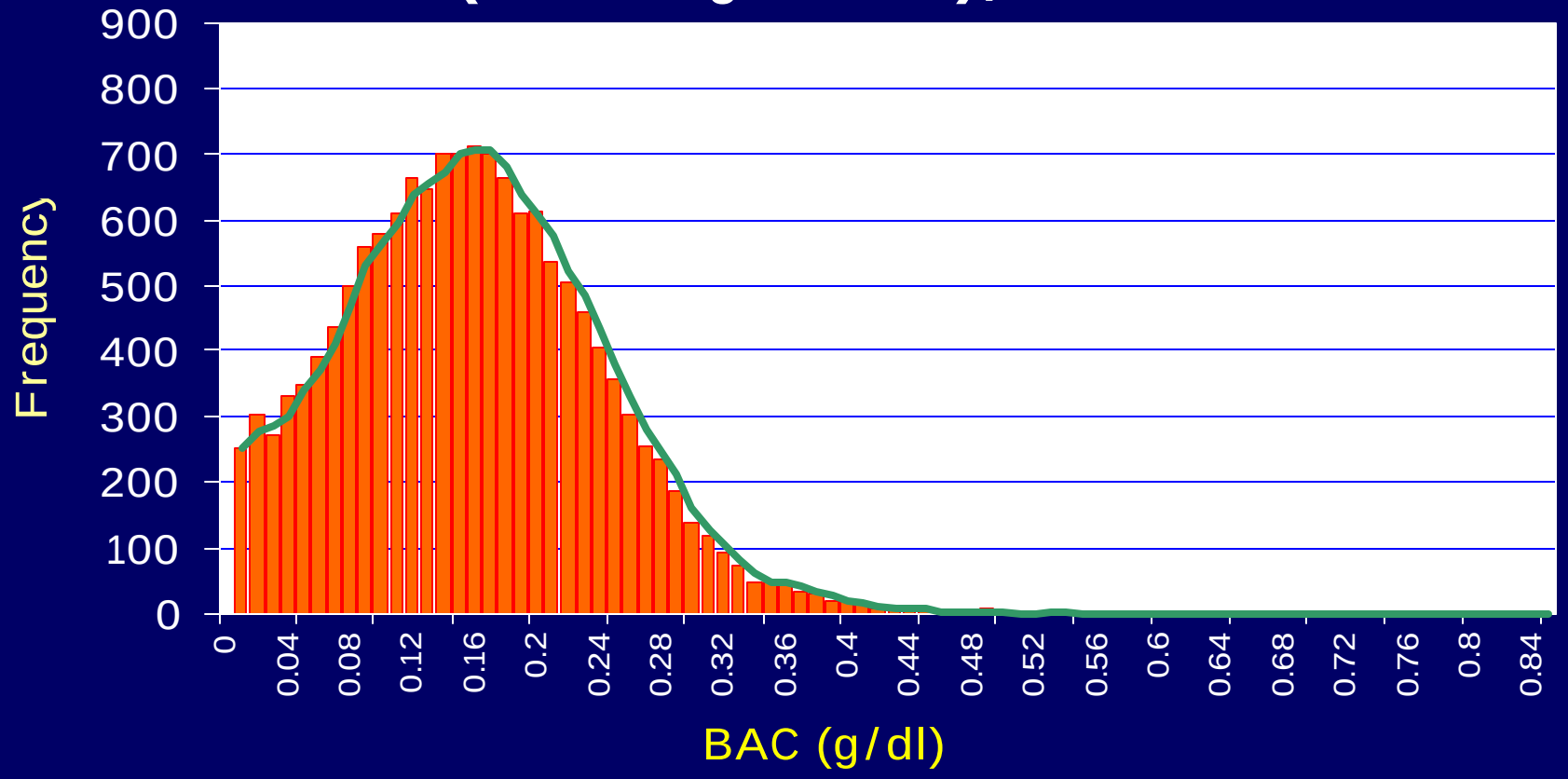
Distributions of BAC for Drivers Involved in Fatal Crashes (excluding BAC=0), FARS 2000



Source: 2000 Annual Report File

Implications of Making Change: State Estimates

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- Will Change State Alcohol Estimates
  - Varies by frequency of missing BACs
    - More Missing BACs Implies
      Greater Potential for a Change
      -- in either direction --

New Methodology - Implementation

- Use Current Method for 2000 Early Assessment, Fact Sheets / Annual Report
- Recalculate 1982 -2000 Estimates using New Methodology
- Issue Report Comparing Results with those for Current Method
- Use Exclusively in 2001
  - Early Assessment
  - Fact Sheets / Annual Report

Questions?