Changes in Injury Patterns in Frontal Crashes: Injuries to Drivers of Vehicles Model Year 1993-1997 *vs.* Drivers of Vehicles 1998-2003

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Objectives… To Continue…

- To evaluate whether there have been any detectable changes in the frequency and severity of injuries to drivers of vehicles model year 1998 and more recent in frontal crashes, and
- To investigate whether those changes related to differences in driver, vehicle or crash characteristics, including airbag deployment

Methods

- Cross sectional study design
- NASS CDS years 1993-2002.
  - Inclusion criteria:
    - Vehicles model year 1993-2003
    - Passenger cars, light trucks or minivans
    - Equipped with frontal driver-side airbags
    - Drivers, ages 16 or older
      - If death, not due to medical illness
    - In frontal or near frontal crashes (10-2 o'clock)
    - With known longitudinal Delta V

Variables

- **Dependent**:
  - Driver injury severity:MAXAIS, MAXAIS2+, or MAXAIS3+
  - Body region of injury with highest MAXAIS
- **Independent:**
  - Model Year 93-97 or 98-03
  - Driver's gender
  - Driver's age
  - Longitudinal Delta V (km/h)
  - Passenger car, SUV, light truck and minivan
  - Safety belt use
  - Single vs. multiple crash
  - Pure frontal crash
  - Airbag deployment
  - Age of vehicle

Analyses

- Descriptive
- Bivariate
  - Including the comparison of proportions of MAXAIS, MAXAIS2+, MAXAIS3+ and body region with MAXAIS between MY93-97 and MY 98-03. (Statistical significance defined at p<=0.05)
- Multivariate logistic regression
  - First, with covariates that are significantly different by MY
  - Then, adding more covariates

Results

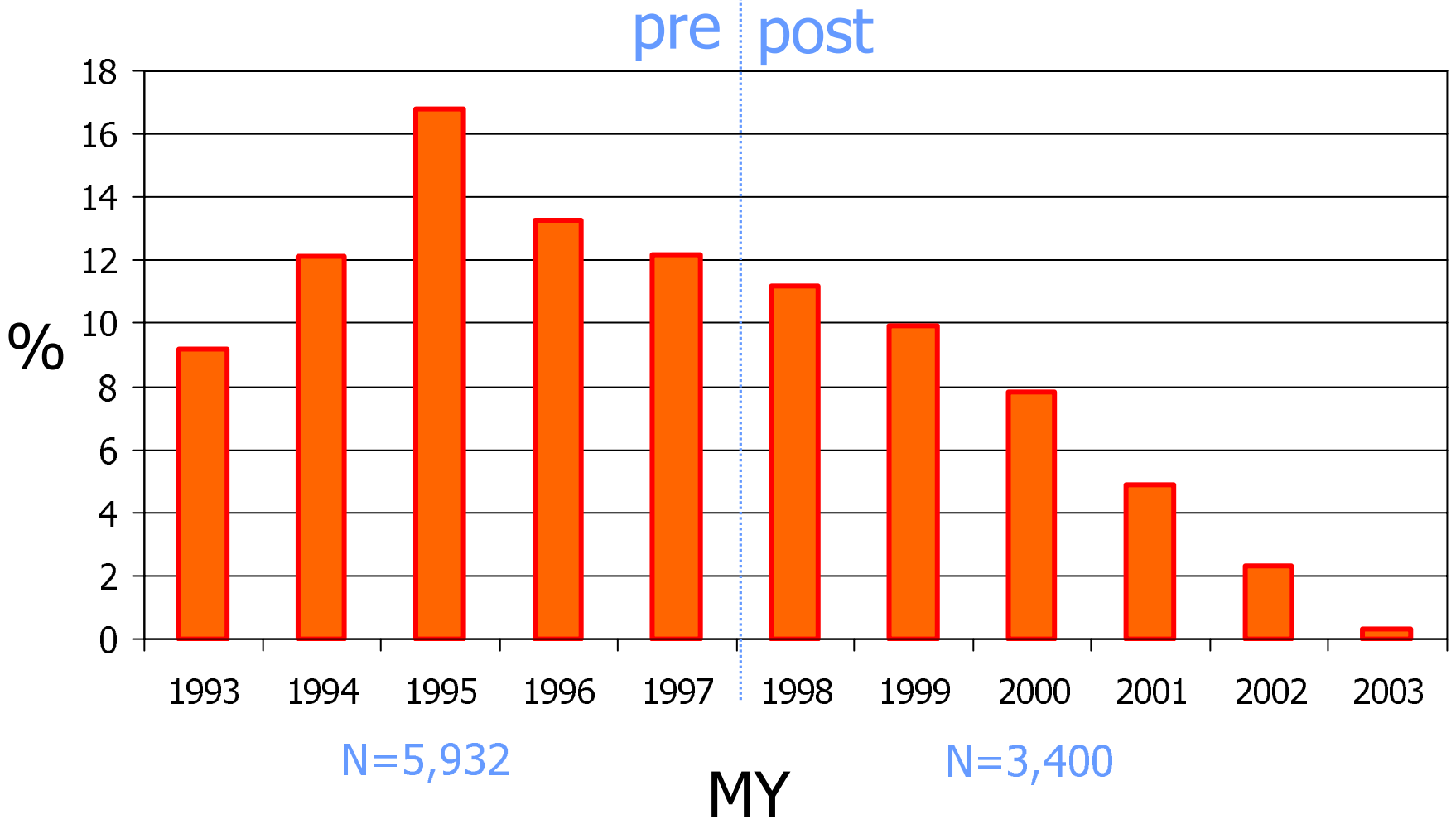
- All drivers in NASS CDS 93-02 = 63,723

  Meeting inclusion criteria= **9,332 (wgt 3,99M)**

From 2002 ->

6,601 drivers, out of which 2,066 met inclusion criteria (1,300 of MY98-03)

MY distribution (N=9,332)



NASS CDS 1993-2002 (N=9,332). See inclusion criteria.

Drivers and Cars

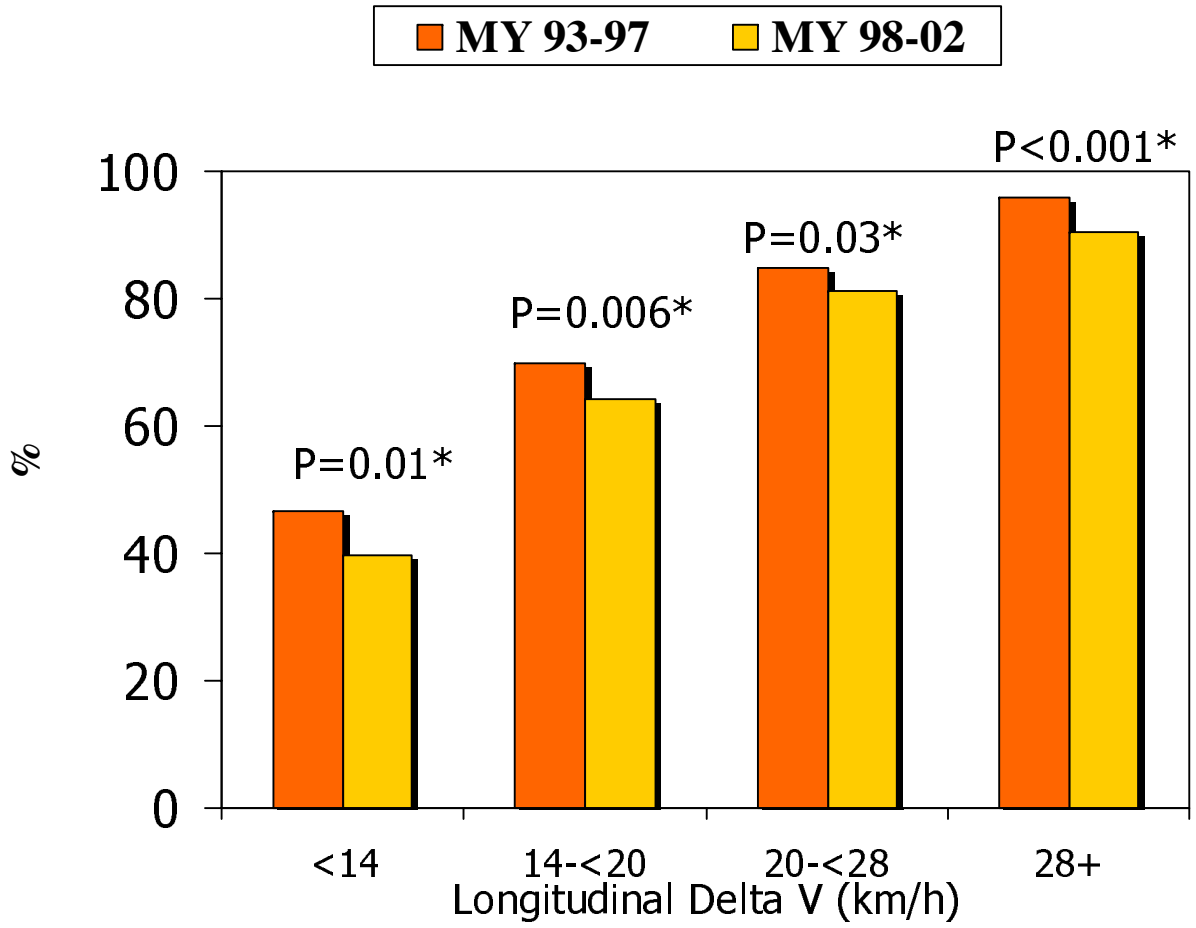
39% of which are new thanks to 2002 data

Percent distributions of driver, and car characteristics		All	MY93-97	MY98-03	p
		N=9,332	N=5,932	N=3,400	
MY		100.0	63.6	36.4	N/A
Male		51.2	50.4	52.5↑	0.05 *
Age:	**16-25**	29.7	30.2	29.0	0.22
	26-39	30.4	29.8	31.4	
	40+	39.9	40.1	39.7	
Sb use (yes)		78.9	76.4	83.3 ↑	<0.001*
Vehicle:	**Pass. Car**	72.9	77.6	64.7↓	<0.001*
	SUV	10.3	7.3	15.4 ↑	
	Light t.	10.0	7.7	13.9 ↑	
	Minivan	6.8	7.4	5.9 ↓	

Crashes

Percent distributions of crash characteristics		All	MY93-97	MY98-03	p
		N=9,332	N=5,932	N=3,400	
Car older 6 years at time of crash		20.8	32.6	0	
Long Delta V (km/h):	<24	65.4	65.2	65.6	0.96
	24-32	16.6	16.6	16.6	
	32-39	8.4	8.4	8.3	
	40+	9.7	9.8	9.5	
	Quartile distribution (all): <14, 14-<20, 20-<28, 28+				
Single car crash		48.5	47.9	49.6	0.1
Pure frontal crash		46.5	45.7	48.1 ↑	0.03*
Ab deployed (in pure crashes)		71.2 (77.0)	73.5 (79.5)	67.3 ↓ (72.9 ↓)	<0.001* (<0.001*)

Percent airbags deployed by MY



NASS CDS 1993-2002 (N=9,332). See inclusion criteria.

In Sum, bivariate analyses of driver, car and crash characteristics by MY show…

- No differences in
  - Driver's age distribution
  - crash severity distribution
  - Single vs. multiple crash
- Drivers in MY1998-2003 more likely to
  - be male
  - be belted
  - be in SUVs or light trucks
  - Be in pure frontal crashes
  - not have airbag deploy
    - Both in pure and almost frontal crashes
    - Across crash severity

  than drivers in MY 1993-1997

Outcomes

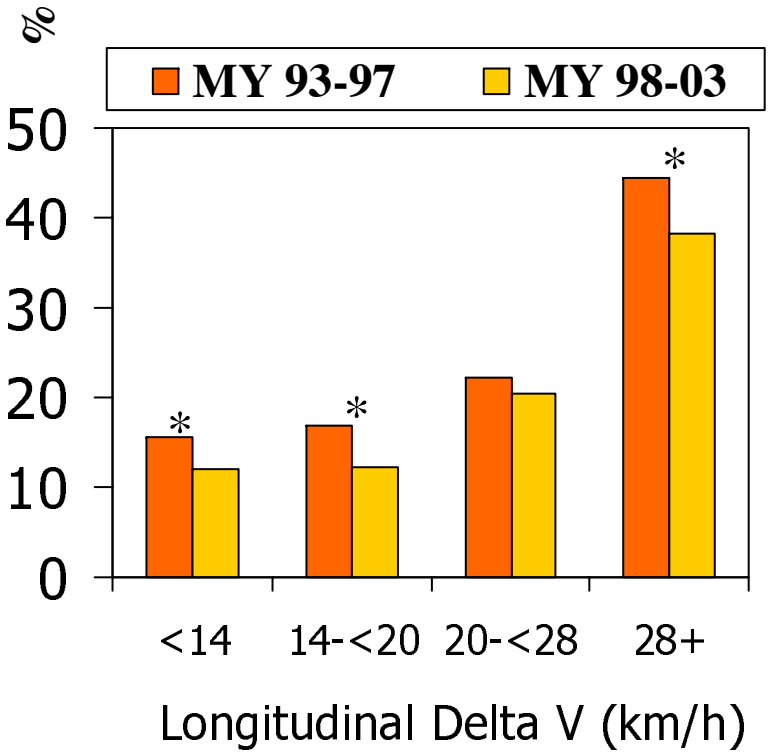
Percent distributions of selected outcomes		All	MY93-97	MY98-03	p
		N=9,332	N=5,932	N=3,400	
Treatment:	**Death**	2.7	2.9	2.3 ↓	<0.001*
	Hospitalized	18.1	18.9	16.8 ↓	
	None	29.4	27.5	32.7 ↑	
	Others	*49.8*	*50.7*	*48.2*	

Outcomes (II)

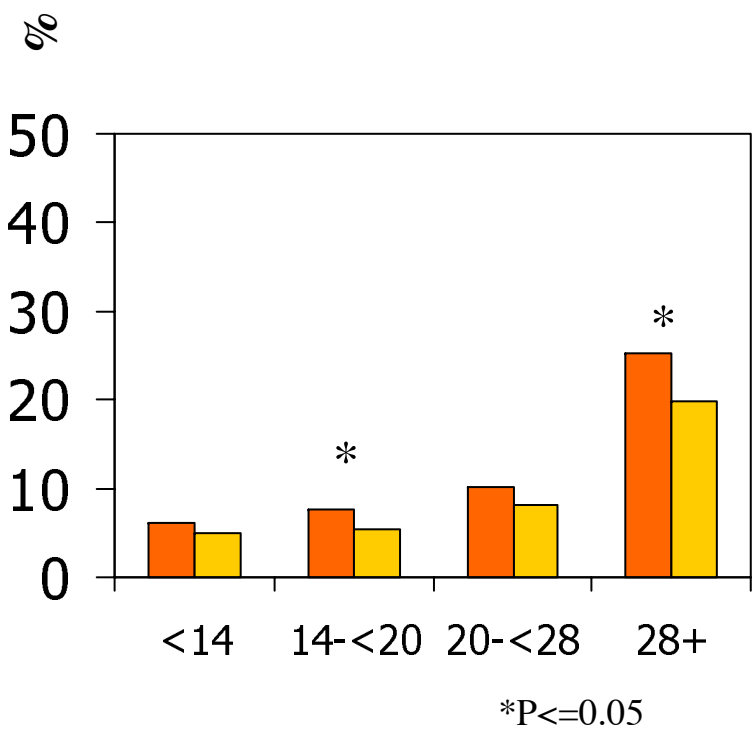
Percent distributions		All	MY93-97	MY98-03	p
		N=9,332	N=5,932	N=3,400	
MAXAIS:	**None**	21.7	20.0	24.8 ↑	<0.001*
	1	49.1	49.8	48.0	
	2	11.7	12.2	10.7	
	3	7.1	7.8	5.9	
	4	1.3	1.4	1.2	
	5	0.7	0.9	0.6	
	6 (includes death)	2.7	2.9	2.3	
	UK	5.7	5.2	6.5 ↑	
MAXAIS 2+ (excluding UK)		23.1	24.6	20.4 ↓	<0.001*
MAXAIS 3+ (excluding UK)		11.2	12.2	9.5 ↓	<0.001*

MAXAIS2+ or 3+ by MY and Crash Severity

Percent MAXAIS 2+



Percent MAXAIS 3+

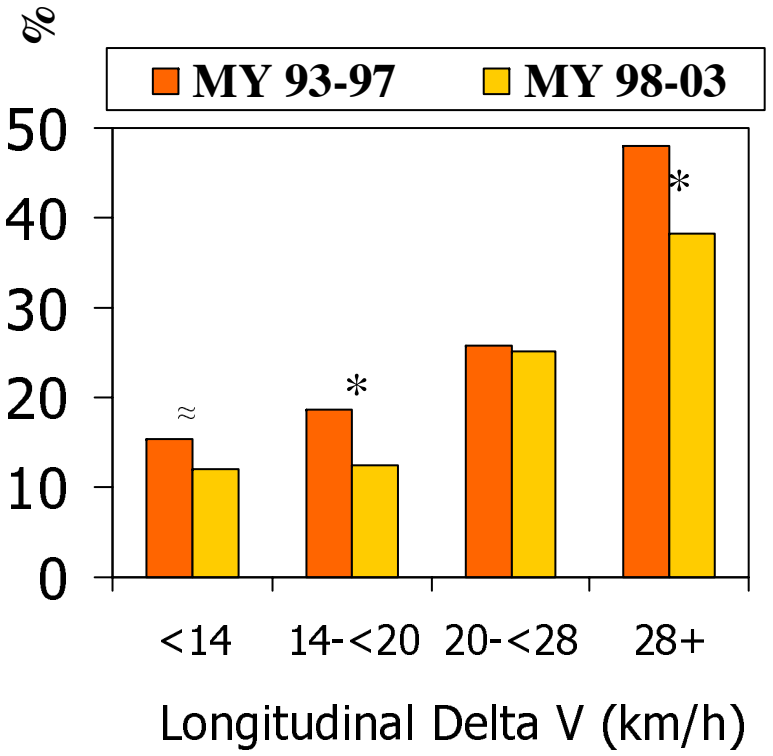


*P<=0.05

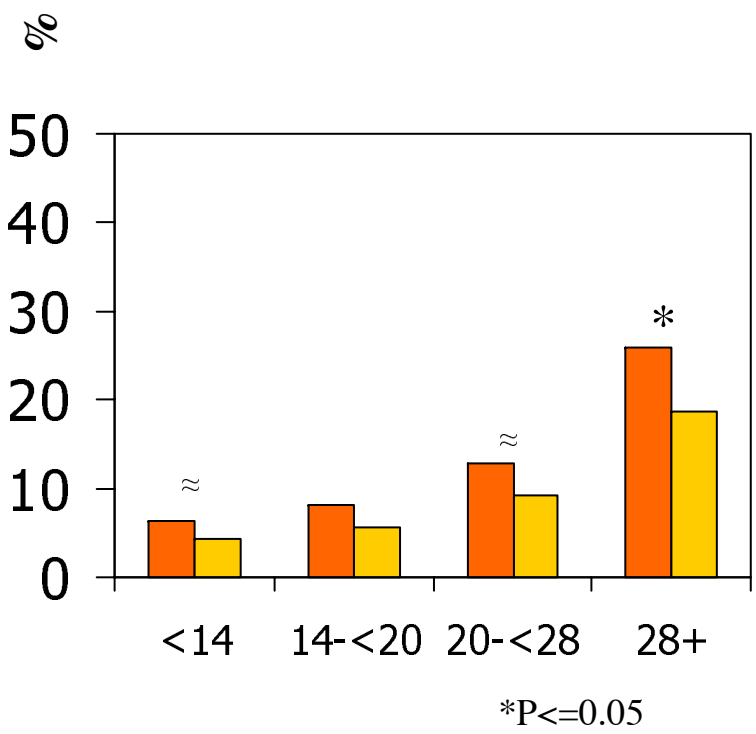
NASS CDS 1993-2002 (N=9,332). See inclusion criteria.

MAXAIS2+ or 3+ by MY and Crash Severity. Females

Percent MAXAIS 2+



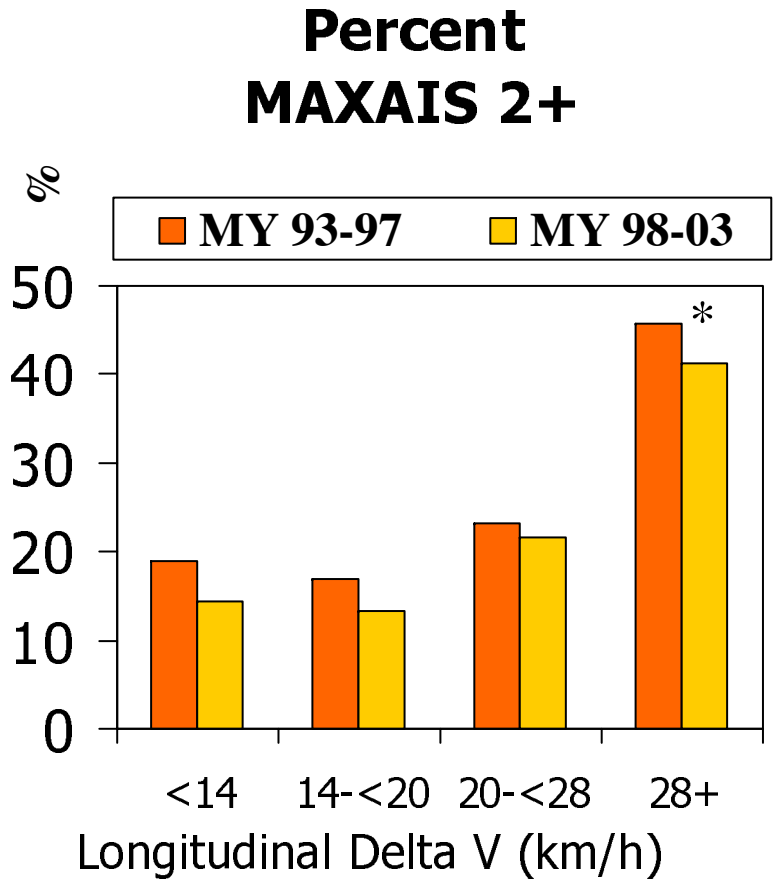
Percent MAXAIS 3+

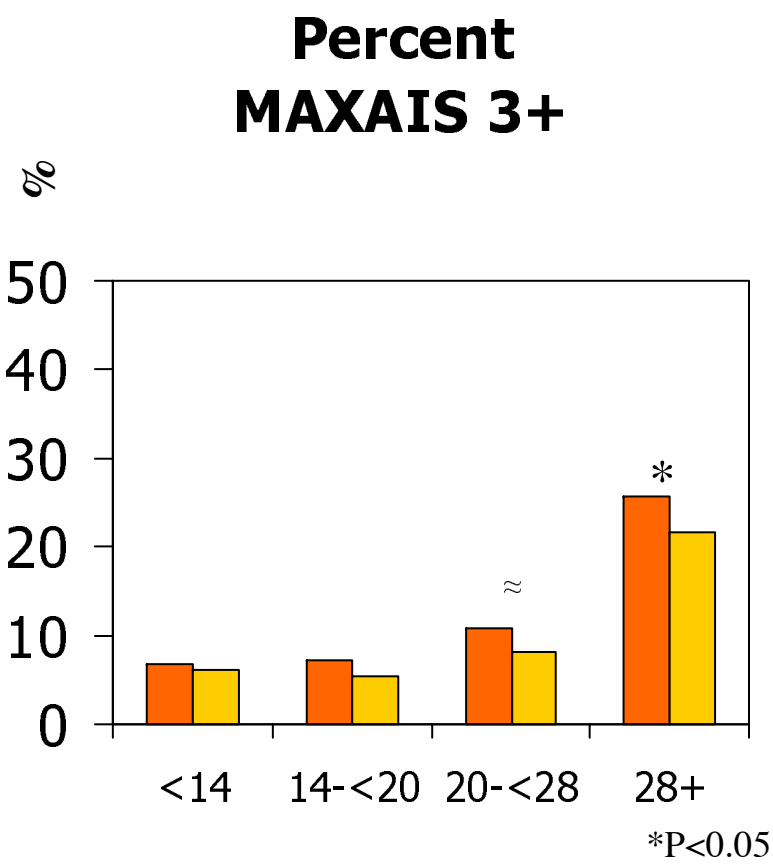


*P<=0.05

NASS CDS 1993-2002 (N=9,332). See inclusion criteria.

MAXAIS2+ or 3+ by MY and crash severity if airbags deploy





NASS CDS 1993-2002 (N=6,478). See inclusion criteria

In Sum, bivariate analyses of outcomes by MY show…

- MY1998-2003 less likely to
  - die or require any medical treatment
  - sustain injuries,
    - including not having MAXAIS2+ nor MAIS3+
  - have as their most severe injury an injury to the upper extremity and face*

  than MY 1993-1997

- In contrast, there is some indication than drivers of MY 1993-1997 to
  - have as their most severe injury an injury to the lower extremity and thorax*
  - If their MAXAIS is 3+, the body region injured be face, thorax and upper extremity

*borderline significance

Logistic Regression (1)

P(mais_+) = f{pre1998, gender, sb use, vehicle type, age, dvlong, single car crash, age of vehicle}

- MAIS2+
  - $OR_{1998\text{-}2002 \text{ vs } 1993\text{-}1997}$ =0.88, 95%CI (0.77-0.99)*
- MAIS3+
  - $OR_{1998\text{-}2002 \text{ vs } 1993\text{-}1997}$ =0.91, 95%CI (0.73-0.99)*

* $p<0.05$

Logistic Regression (2)

P(mais_+) = f{as before} ONLY IN PURE FRONTAL CRASHES

- MAIS2+
  - $OR_{1993\text{-}1997 \text{ vs. } 1998\text{-}2003}$ =0.84, 95%CI (0.70-1.0)
- MAIS3+
  - $OR_{1993\text{-}1997 \text{ vs. } 1998\text{-}2003}$ =0.84, 95%CI (0.65-1.0)

P(mais_+) = f{as before} ONLY IN PURE FRONTAL CRASHES AND IF AIRBAG DEPLOYED

- MAIS2+
  - $OR_{1993\text{-}1997 \text{ vs. } 1998\text{-}2003}$ =0.89, 95%CI (0.72-1.1)
- MAIS3+
  - $OR_{1993\text{-}1997 \text{ vs. } 1998\text{-}2003}$ =0.82, 95%CI (0.63-1.1)

In Sum, multivariate analyses of outcomes by MY show…

- MY1998-2003 less likely to sustain MAXAIS2+ and MAXAIS3+ than MY 1993-1997 even when controlling for confounders and other covariates
- These differences are borderline or disappear if:
  - One restricts the analysis to purely frontal crashes or
  - Crashes where the airbags deployed
    - In both cases, maybe due to sample size limitations
  - One uses the weighted data
    - Probably due to over control (weights + covariates)

Conclusions

- Drivers in frontal crashes of known severity in vehicles MY 98-03 sustain significantly fewer and less severe injuries than their counterparts in MY pre 1998
- This is true for all drivers, males, females, MAXAIS2+, 3+, and across crash severity
- This is not explained by differences in gender, belt use, or vehicle type

Conclusions (2)

- Most of these benefits seem to derive from the fewer airbag deployments among MY98-03 vehicles.