

# Changes in the epidemiology of Traumatic Brain Injury following road traffic collision after legislative measures enforcement in France

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# Traumatic Brain Injury

- In USA
  - 18.4 to 100/100 000 hab per year (Stroke 183/100 000; *Hirtz 2007*)
  - 1.7 millions TBI
  - 52 000 fatalities per year
  - 11% to 60% from Road Injury
  - Trend : 3% reduction per year (1997-2007) (*Coronado 2011*)
- In France
  - 50% of TBI coming from RTC
  - Leader cause of Major Trauma

Major Changes since 2002

# Legislative changes

2002	The French President announced that road safety was to be one of the 3 main priorities of his term of office
2003	Automatic speed enforcement First automatic radar speed traps Stiffer penalties for unintentional manslaughter and wounding Stiffer penalties (drink-driving, not wearing a safety belt or helmet, or mobile telephone use) Stiffer penalties for re-offending Systematic drugs screening of crash-involved drivers Safety belt wearing made compulsory for drivers of HGVs and coaches Introduction of a probationary driving licence for young drivers
2004	Reduction of the legal limit for alcohol for public transport vehicle drivers to 0.2g/l Introduction of specific penalties for exceeding the speed limit by over 50 km/h
2005	Speed limiting devices made compulsory for HGVs weighing over 3.5 tonnes and public transport vehicles weighing over 10tonnes Legal obligation for drivers to make sure that any minors they are carrying have fastened their safety belt

# Material and methods

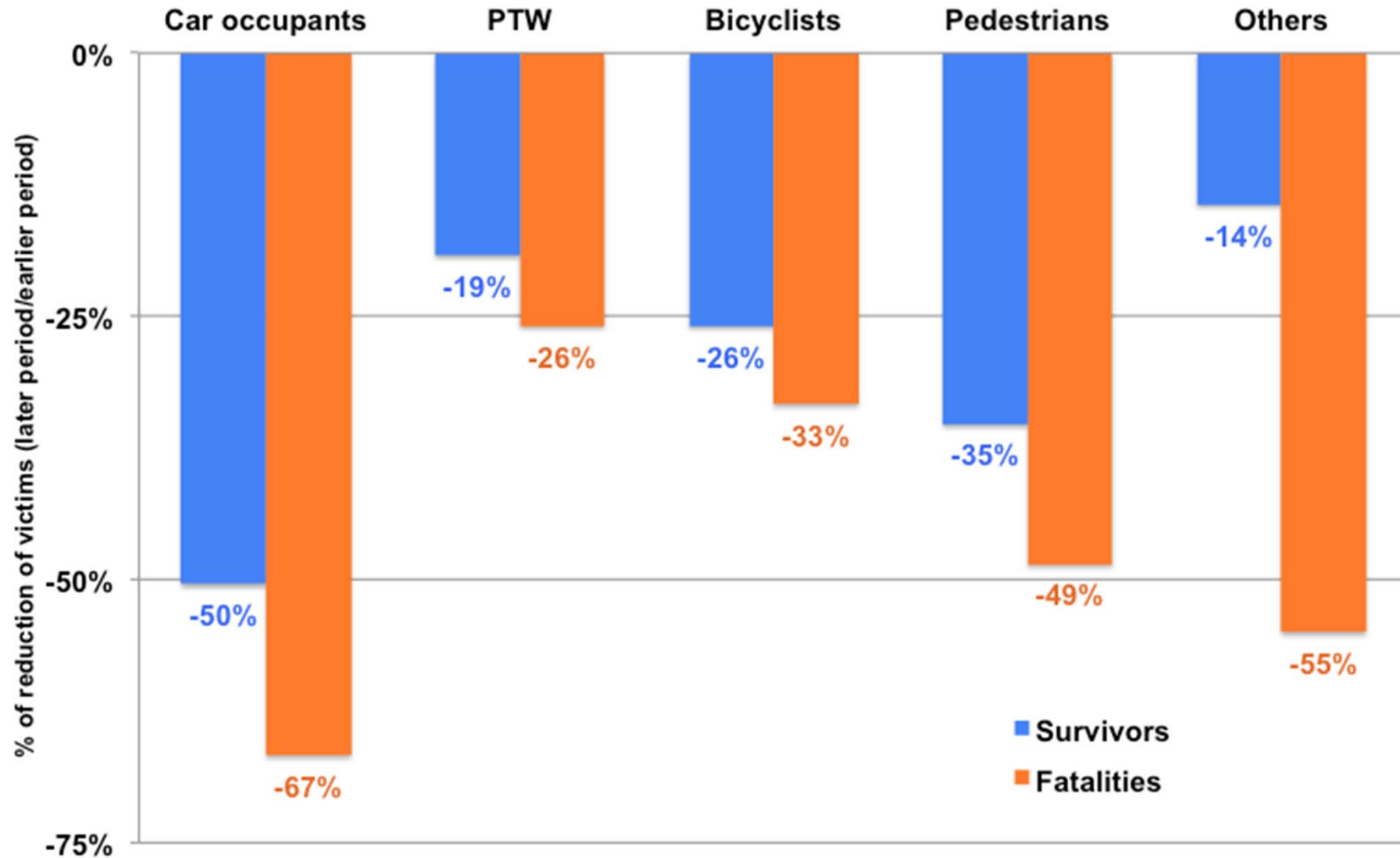
1. Rhone Trauma Registry (since 1995/01)
2. Every RTC with casualty requiring health care activity
3. Cooperation of 245 health care services
4. Limited geographical area (Rhone County, 1.6 millions inhab)
5. Abbreviated Injury Scale (1990)
6. TBI selection casualties with AIS  $\geq 2$
7. Associated body lesions with AIS  $\geq 3$

Comparison of two 6-year periods :  
1996-2001 vs 2003-2008

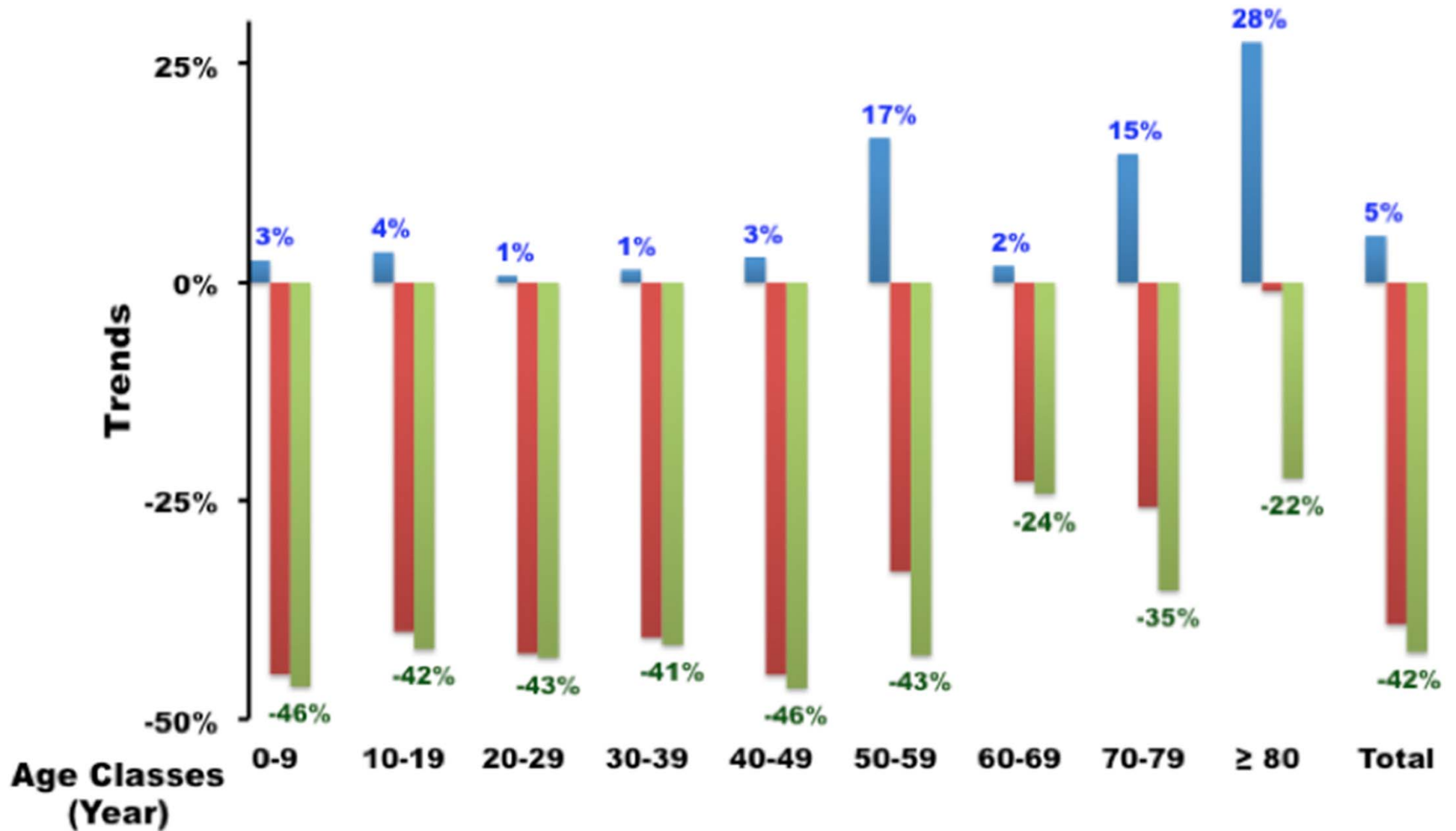
# Results: Incidence, Mortality, Lethality

Period	1996-2001			2003-2008			Trends between periods	p
Population (Inhabitants)	9 451 938			9 959 966				
	N	Incidence/1,000,000		N	Incidence/1,000,000			
All casualties	64 312	6 804.1		50 746	5 095.0		-25%	< 0.001
Casualties with a TBI	5 558	588.0		3 375	338.9		-42%	< 0.001
Death with a TBI	514	54.4		241	24.2		-56%	< 0.001
<i>Severity of brain lesions</i>								
Mild to moderate TBI	AIS 2	4 303	455.3	2 527	253.7	281.7	-44%	< 0.001
	AIS 3	486	51.4	279	28.0	281.7	-46%	< 0.001
Severe TBI	AIS 4	421	44.5	375	37.7	54.5	-15%*	< 0.001
	AIS 5	228	24.1	168	16.9	54.5	-30%	< 0.001
Fatal TBI	AIS 6	120	12.7	26	2.6		-80%**	< 0.001
Lethality rate			9.2%		7.1%		-22.8%	< 0.001

1996-2001	2749	971	688	922	228
2003-2008	1321	779	508	579	190



# TBI and population variation



# Associated body lesions (AIS ≥ 3) with TBI (AIS ≥ 2)

Period		1996-2001	2003-2008	1996-2001	2003-2008	Trend (Injury per victim)		p
		Survivors		Non-Survivors		Survivors	Non Survivors	
<b>Victims with TBI (Mortality rate %)</b>		<b>5 044</b>	<b>3 134</b>	<b>514 (9.2%)</b>	<b>241 (7.1%)</b>			
Thorax	AIS3	211	163	50	36	<b>+30.3%*</b>	<b>+19.1%</b>	0.036
	AIS4	120	104	85	63			
	AIS5	5	5	72	42			
	AIS6	-	-	58	7			
		<b>336</b>	<b>272</b>	<b>265</b>	<b>148</b>			
Abdomen	AIS3	50	29	33	13	<b>-21.5%</b>	<b>+60.0%*</b>	0.947
	AIS4	32	10	22	33			
	AIS5	2	2	20	9			
	AIS6	-	-	1	2			
		<b>84</b>	<b>41</b>	<b>76</b>	<b>57</b>			
Spine and Spinal cord injury	AIS3	51	46	12	19	<b>+50.6%*</b>	<b>+177.9%*</b>	< 0.001
	AIS4	1	3	0	0			
	AIS5	10	9	9	18			
	AIS6	-	-	12	6			
		<b>62</b>	<b>58</b>	<b>33</b>	<b>43</b>			
Lesions in other body regions	AIS3	534	285	197	110	<b>-14.7%</b>	<b>+10.2%</b>	0.026
	AIS4	11	4	26	14			
	AIS5	0	0	16	1			
	AIS6	-	-	3	0			
		<b>545</b>	<b>289</b>	<b>242</b>	<b>125</b>			
<b>Total Associated Injuries (Number of Injury per Victim)</b>		<b>1027 (0.20)</b>	<b>660 (0.21)</b>	<b>616 (1.20)</b>	<b>373 (1.55)*</b>	<b>+3.4%</b>	<b>+29.1% *</b>	<b>0.443</b>

\* means p < 0.05 for the difference between periods for the number of lesion per victims

The ratio of decrease is calculated by dividing the ratio between the number of lesions among the deceased and the survivors in the later period by the same ratio obtained in the former period

S one patient can have multiple lesions at the same body regions and/or in multiple zones (polytrauma)



# Odds ratio of death

<b>Period</b>	2003-2008	<b>0.55 [0.43-0.71]</b>
<b>Age</b>	50-64y	1.70 [1.17-2.46]
	65-79y	2.78 [1.88-4.13]
	≥80	<b>10.46 [6.10-18.07]</b>
<b>TBI severity</b>	MAIS 3	15.41 [10.63-22.33]
	MAIS 4	20.50 [14.27-29.48]
	MAIS 5	<b>100.18 [67.67-148.3]</b>
<b>Injury Severity score (excluding Head Injury)</b>	9-16	2.55 [1.82-3.58]
	17-25	5.79 [4.08-8.21]
	> 25	<b>32.86 [23.75-45.47]</b>
<b>Neurosurgical Unit Admission</b>	Yes	<b>0.15 [0.09-0.24]</b>

# Conclusions

- TBI decreased in the recent period twice higher than all casualties after law enforcement
- TBI lethality decreased 23%
- Car occupants were the target population
- Neurosurgical unit admission reduced mortality
- New adaptations are required now in France for
  - PTW users
  - Pedestrians