

Highway Traffic Injury Studies Jackson Memorial Hospital

4th Public R & D Meeting

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NHTSA
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Jackson Memorial Hospital Ryder Trauma Center

- **World's largest & most comprehensive**
- **166,000 square feet of space**
- **4 Operating rooms**
- **20 ICU beds + 60 care beds**
- **DOT \$1 million over 4 years**

Jackson Memorial Hospital Ryder Trauma Center Highway Traffic Injury Study

Information Sought:

- Injury Mechanisms Insights**
- Injury & Outcome Relationships**
- Injury Consequences & Costs Data**
- Restraint Improvement Needs**
- Improvements in Trauma Treatment**
- Improvements in NASS Data**

Jackson Memorial Hospital Highway Traffic Injury Study

Scope: ~50 Cases per year
(sample from ~1,000 MV injuries)

Focus: Frontal, Restrained, Killed or Injured

Team: Trauma / NASS / Biomechanics

Data: Injuries / Crashes / Forces & Motions

"Detection of Internal Injuries in Drivers Protected by Air Bags"

- **Discovery of New Injury Pattern**
- **Development of "Lift & Look" Triage Aid**

- **(See Research Note Attached)**

"Occult" Injuries

- 1. Hidden, concealed,**
- 2. Denoting a concealed hemorrhage**

Stedman's Pocket Medical Dictionary

Air Bag Occult Internal Injuries Fatal & Near Fatales @ Jackson T.C.

Case #	Vehicle	SW/Deform'n	Injury	Notes
91-002	91 Volvo	8"	AIS 4 Bowel	Fatal (Compl.)
Close Calls				
92-004	92 Lincoln	2"	AIS 4 Spleen	O Trauma Crit. EMS Suspicion
92-006	92 Honda Civ	4"	AIS 2 Liver	Hospital>T.C.
92-017	91 Merc Marq	3"	AIS 4 Cardiac AIS 3 Lung C. AIS 3 Ribs F.	Belted Hospital>T.C.
92-023	1990 Porsche	1"	AIS 2 Liver AIS 2 Ribs F.	Belted Hospital>T.C.

New Air Bag Injury Patterns

Creates appearance of no or minor injury to:

- **Motorists**
- **Police**
- **EMS workers**
- **Physicians**

Occult Injury

Diagnosis Techniques

- **Diagnostic Peritoneal Lavage (DPL)**
Used when indicated, but invasive
- **Computerized Axial Tomography (CAT)**
Used when indicated, and where available,
time 10–30 minutes (Fast or Slow)
- **Ultrasonography**
Use @ TC, image interpretation difficult

Air Bag Occult Injury Indicator

Steering Wheel Deformation

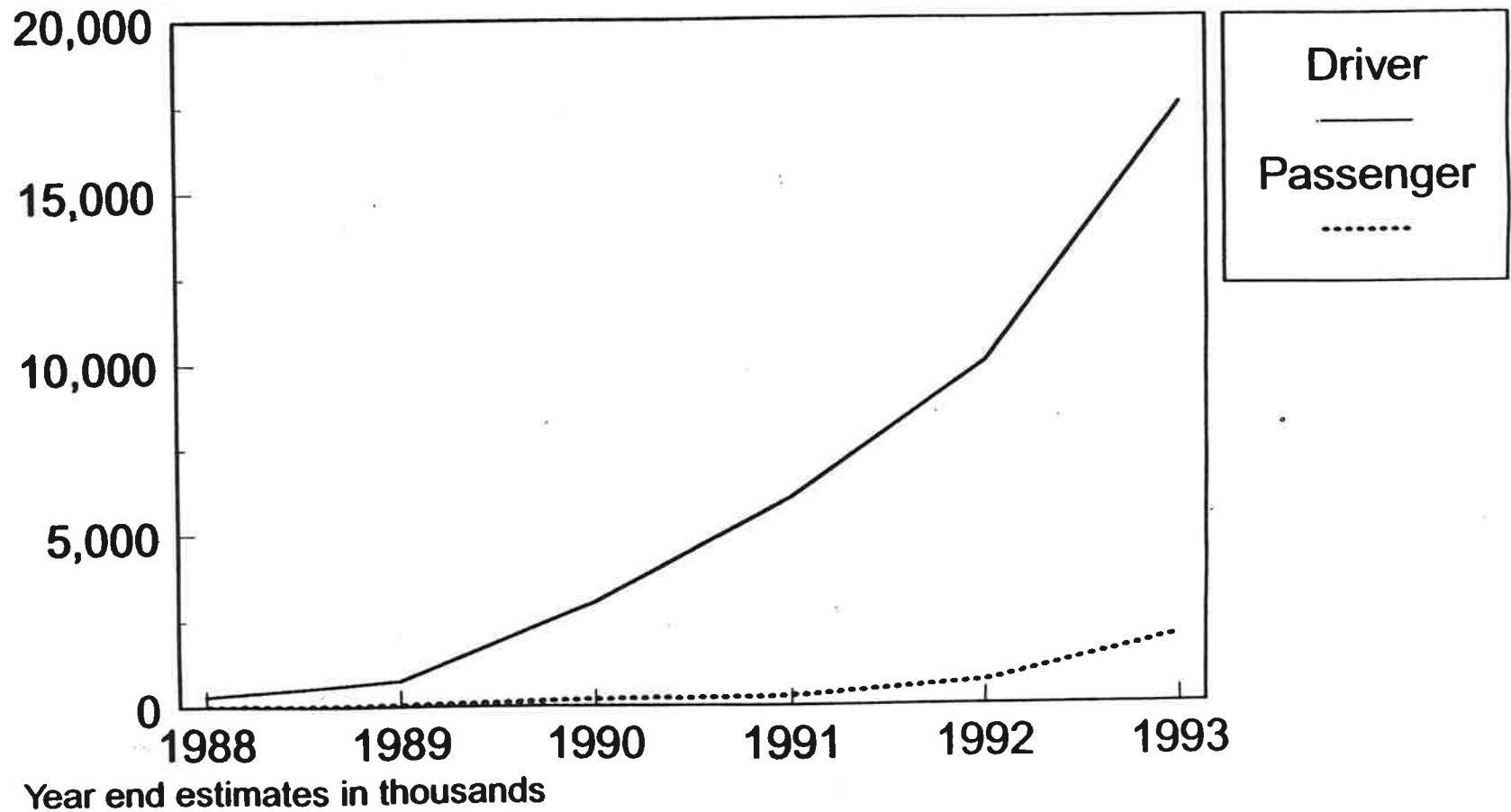
- **"Lift & Look" Quick, Easy & Economical**
- **Part of Normal EMS Procedures**
- **Presence Raises Index of Suspicion**
- **Compensates for Lack of Visible Injuries**
- **Tangible & Objective Indicator for Motorists, Police, EMS and Physicians**
- **Indicator Not Infallible**

How Big is Occult Injury Problem?

- Unknown at this time
- If 1 - 10% of air bag fatalities,
then ~1 - 10 fatalities per month currently
- Growing with increasing air bags in fleet

Potential for Occult Injuries

Air Bags in Fleet



Effectiveness of Air Bags

- >500 lives saved by 1992
- ~2,400 lives saved by 1995
- >40,000 injuries prevented by 1992
- ~200,000 injuries prevented by 1995

Air Bag Fatalities

Cal. Yr.	1991	1992	1993	Total ('87-'92)
Fatalities	499 + (4P)	680 + (15P)	?	1631

Guesstimating the Magnitude of Occult Injury Problem

- Jackson Memorial Hospital
 - 1 O.I. fatal / 50 cases
 - (4 close calls / 50 cases)
- Special Investigations File
 - 3 O.I. fatalities / 60 air bag fatalities
- NASS '91 File
 - 2 O.I. fatal cases wtd to 74/499 ~~~15%

Air Bags & Fatality Estimates

Cal. Yr.	1991	1992	1993	2000
Air Bags:				
Driver Side	6,000,000	10,000,000	17,500,000	~75,000,000
Passenger	275,000	700,000	2,000,000	~50,000,000
Deployments*	~24,000	~40,000	~70,000	~300,000
Fatalities	499 + (4P)	680 + (15P)	~1,200	~5,000
F/100 Depl.	~2	~1.7	~1.7	~1.7
ABF/10,000 V	~0.83	~0.68	~0.68	~0.68
F Rate/day	1.4	1.9	~3.3	~14
Lives Saved	172	238	~300	~1,250
Inj Prevented	11,000	23,500	~40,000	~180,000

* State Farm rate 4/1,000 IVY, SAE 940802

Q. What is NHTSA doing?

- **Improving NASS data collection**
- **Creating CODES (7 States) Linked Data**
- **Biomechanics R&D on torso injuries**
- **Hospital studies**
- **EMS communications**
- **Looking for continuous improvements**

Opportunities for Improvements

- **Surveillance: NASS, CODES, EMS State Data**
- **Prevention: S.W's., Air Bags, Belts**
- **Triage: Injury indicators**
- **Treatment: Diagnostics, Acute Care**

Occult Injury Fatalities

NASS Initiatives

- **More Complete SW Deformation Data**
- **Better photos of SW & Air Bags**
- **1994 Logs to Record Emergency Transfers**
- **Narrative Summaries To Be Computerized(?)**
- **Cases on Optical Disk (Exploratory Proj.)**

Jackson Memorial Hospital Highway Traffic Injury Study

Jackson HTIS Accomplishments:

- **Discovered New Air Bag Injury Pattern**
- **Developed New Triage Technique**
- **Research Note Published (see attached)**
- **Improvements in Data Collection/Analysis**
- **Found Air Bag & Belt "Success Stories"**
- **Improved Understanding of Injuries, Costs and Consequences**
- **Improved Injury Care**



Research Note

August 1993

Detection of Internal Injuries in Drivers Protected by Air Bags

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Early results from research being conducted for the National Highway Traffic Safety Administration at Jackson Memorial Hospital in Miami by a team of medical, engineering and crash investigators suggest the emergence of changing injury patterns in motor vehicle crashes in which an air bag has deployed. Emergency medical services (EMS), both prehospital and hospital personnel, as well as the public, could benefit by becoming aware of these changing injury patterns.

Prior to air bags, drivers involved in crashes often had visible injuries such as bleeding, facial lacerations, abrasions, bruises, and broken facial bones that were obvious to rescue personnel. Now, drivers protected by air bags and safety belts often do not have visible injuries.

The research team has found that among drivers protected by air bags, in some severe crashes, serious internal injuries may be present but not be externally apparent. As is the situation with so many cases of blunt trauma (regardless of restraint system) that EMS providers encounter, internal injuries often are survivable if detected and treated in time, but can be fatal if not detected and treated appropriately and promptly.

EMS personnel conducting initial injury assessments should not be deceived by the lack of external injury signs and symptoms customarily associated with crash injuries. The driver protected by an air bag may look fine and feel fine, but not be fine. This may be important even for drivers who are fully ambulatory and apparently uninjured at the crash scene.

To address this situation and increase the chances that these crash victims receive timely and appropriate emergency care, the research team has offered suggestions for improved internal injury detection. One "tell-tale" indicator of injury is deformation of the steering wheel. In the case of a motor vehicle crash in which an air bag has deployed, rescue personnel should **lift the deployed air bag** to look for steering wheel deformation. After removal of the occupant, rescue personnel can easily lift the deflated air bag out of the way and make a visual check of the steering wheel.

Thus, a quick "lift and look" under the air bag should be a part of the routine examination of the steering wheel. Any visible deformation of the steering wheel should be regarded as an indicator of potentially serious internal injury, and appropriate action should be taken.

Steering wheel deformation under the air bag should be used in triage decisionmaking as a supplementary, but not sole, indicator of the possibility of internal injuries. Since steering wheel deformation varies with differing interior design characteristics of vehicles, conditions of the crashes, and occupant kinematics, internal injuries may still be present whether or not the steering wheel has been deformed. The potential for internal injuries is also related to the age, size, and health status or physical condition of the occupant.

One of the findings of this research is the revalidation of the importance of the rapid application of EMS trauma triage criteria. Trauma triage criteria, including such current measures as the Glasgow Coma Score, are essential to providing the best possible lifesaving care to crash victims.

U.S. Department
of Transportation

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