

Side Impact Collisions in an Aging Population

Patricia Dischinger, Andrew Burgess, Kathleen Read,
Timothy Kerns, Jalal Al-Zawarhri, Carl Schmidhauser,
Joe Kufera, Michael Parsons

INJURY PATTERNS ASSOCIATED WITH DIRECTION OF IMPACT: DRIVERS ADMITTED TO TRAUMA CENTERS

Patricia C. Dischinger, PhD,^{a,c} Brad M. Cushing, MD,^{a,b,d} and Timothy J. Kerns, MS^a

Clinical data on the nature and severity of injuries was linked with data from police crash reports for 3675 car or truck drivers admitted to trauma centers. Different patterns of injuries were noted for drivers in frontal compared with left lateral collisions. Injuries to the face and lower extremities were significantly greater in frontal collisions; thorax, abdominal, and pelvic injuries were significantly greater in lateral collisions. In addition, drivers in lateral collisions were found to have significantly more multiple injuries to the abdomen and thorax. Despite no difference in mean Injury Severity Score, drivers in left lateral collisions had a significantly higher mortality rate; moreover, this increased mortality was not merely a reflection of the increased incidence of lateral collisions among older drivers. In conclusion, information on direction of impact has potential use for clinical decisionmaking, since drivers in lateral collisions have a higher incidence of occult abdominal and thoracic injuries.

Frontal vs Lateral Crashes

CIREN Cases 1997-1998**

	Frontal	Lateral
Mean DeltaV*	43 km/h	36 km/h
Facial Injury*	45%	24%
Chest Injury*	53%	67%
Abdominal Inj*	41%	55%
Lower extremity*	67%	55%

*p<0.05

** Data from 5 CIREN centers (n=316)
(NJ, UMD, UM, Seattle, SD)

Frontal vs Lateral Crashes

Maryland Crashes (1994-1996)**

	Frontal (n=4899)	Lateral (n=1109)
Median ISS	5	8*
Median LOS	2	2*
Median Charges	\$3500	\$3800*

*p<0.05 (Wilcoxon)

** hospitalized MV drivers

Frontal vs Lateral Crashes

Maryland Crashes (1994-1996)**

Injury	Frontal	Lateral
Brain	20.7%	22.3%
Skull*	11.8	6.9
Facial fx	10.5	4.9
Rib fx*	17.3	26.2
Aortic injury	0.3	0.6
Lung*	4.4	8.9

*p<0.05

** hospitalized MV drivers

Frontal vs Lateral Crashes

Maryland Crashes (1994-1996)**

Injury	Frontal	Lateral
Liver*	3.3%	2.1%
Spleen*	2.2	6.7
Bladder*	0.3	1.5
Kidney*	1.2	3.9

*p<0.05

** hospitalized MV drivers

Frontal vs Lateral Crashes

Maryland Crashes (1994-1996)**

Injury	Frontal	Lateral
Radius/Ulna fx*	5.9%	4.2%
Pelvic fx*	4.4	18.3
Femur fx*	6.1	4.1
Patella fx*	3.0	0.4
Ankle fx*	6.1	2.9

*p<0.05

** hospitalized MV drivers

Contributing Circumstances by Crash Type

Frontal Crashes

38% Failed to give full
time/attention

8% Failed to yield

8% Too fast for
conditions

5% Alcohol

3% Follow too close

n=200,228

Lateral Crashes

18% Failed to give full
time/attention

13% Failed to yield

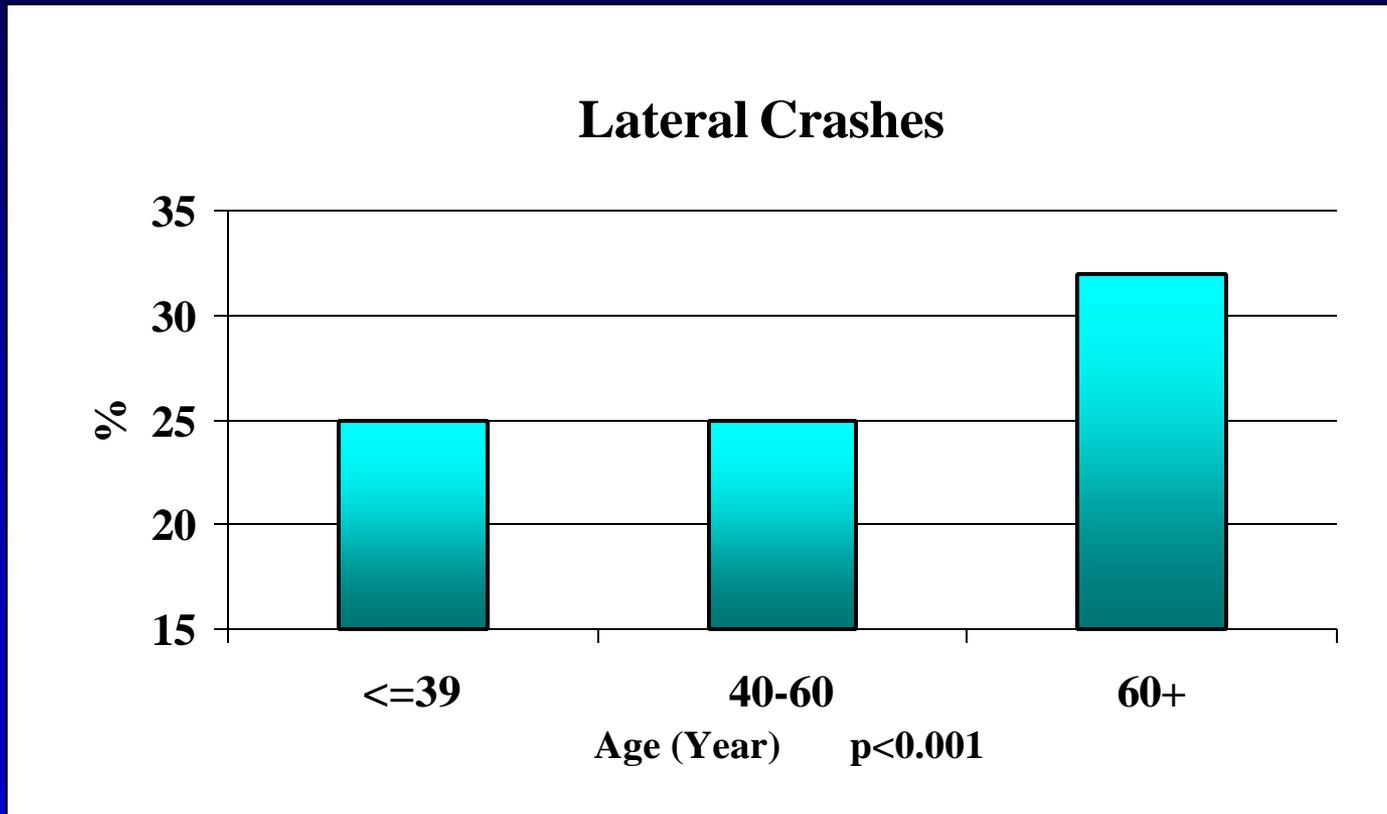
4% Too fast for
conditions

2% Alcohol

2% Improper turn

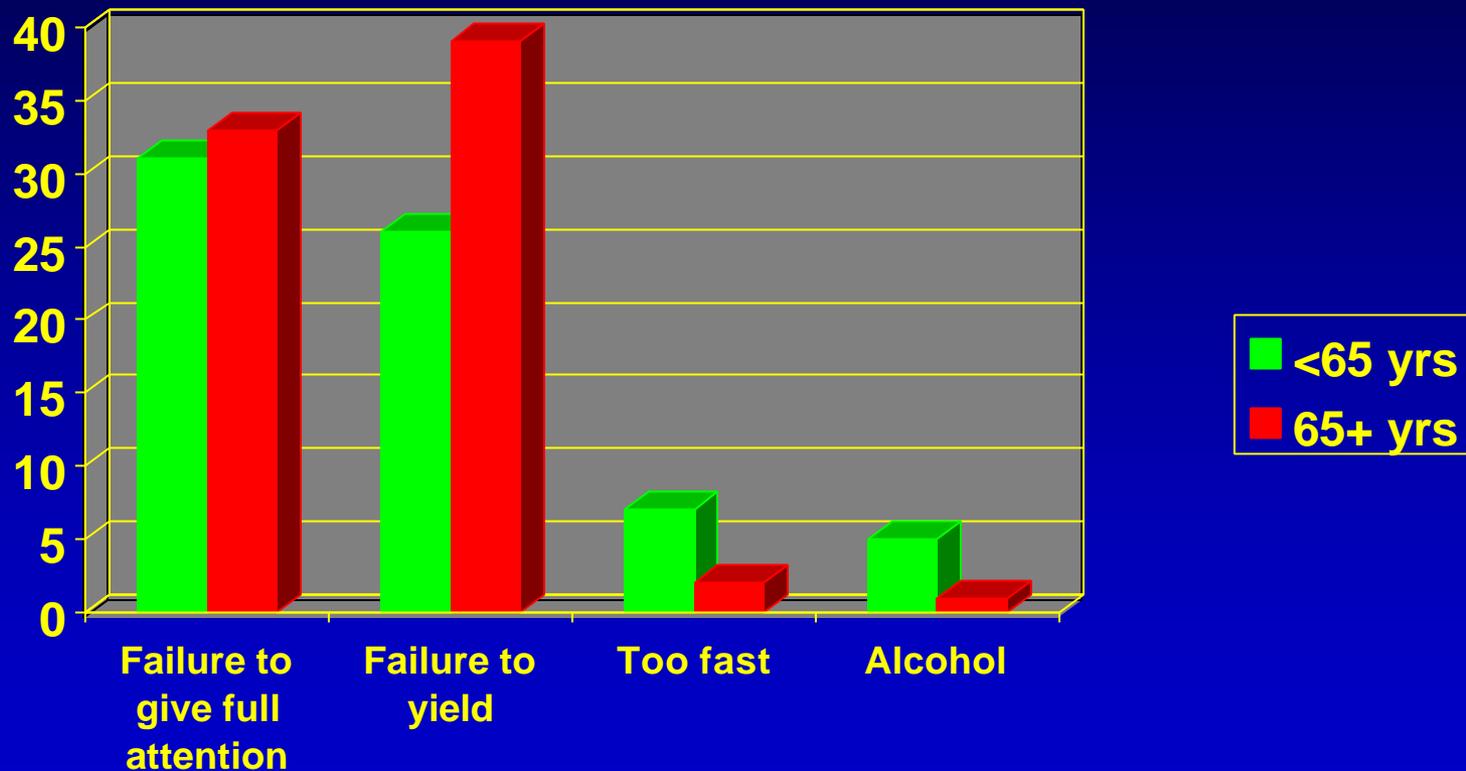
n=45,665

Age Distribution



Contributing Circumstances by Age

Lateral crashes only – Maryland Drivers



Injuries by Age (Left lateral crashes only)

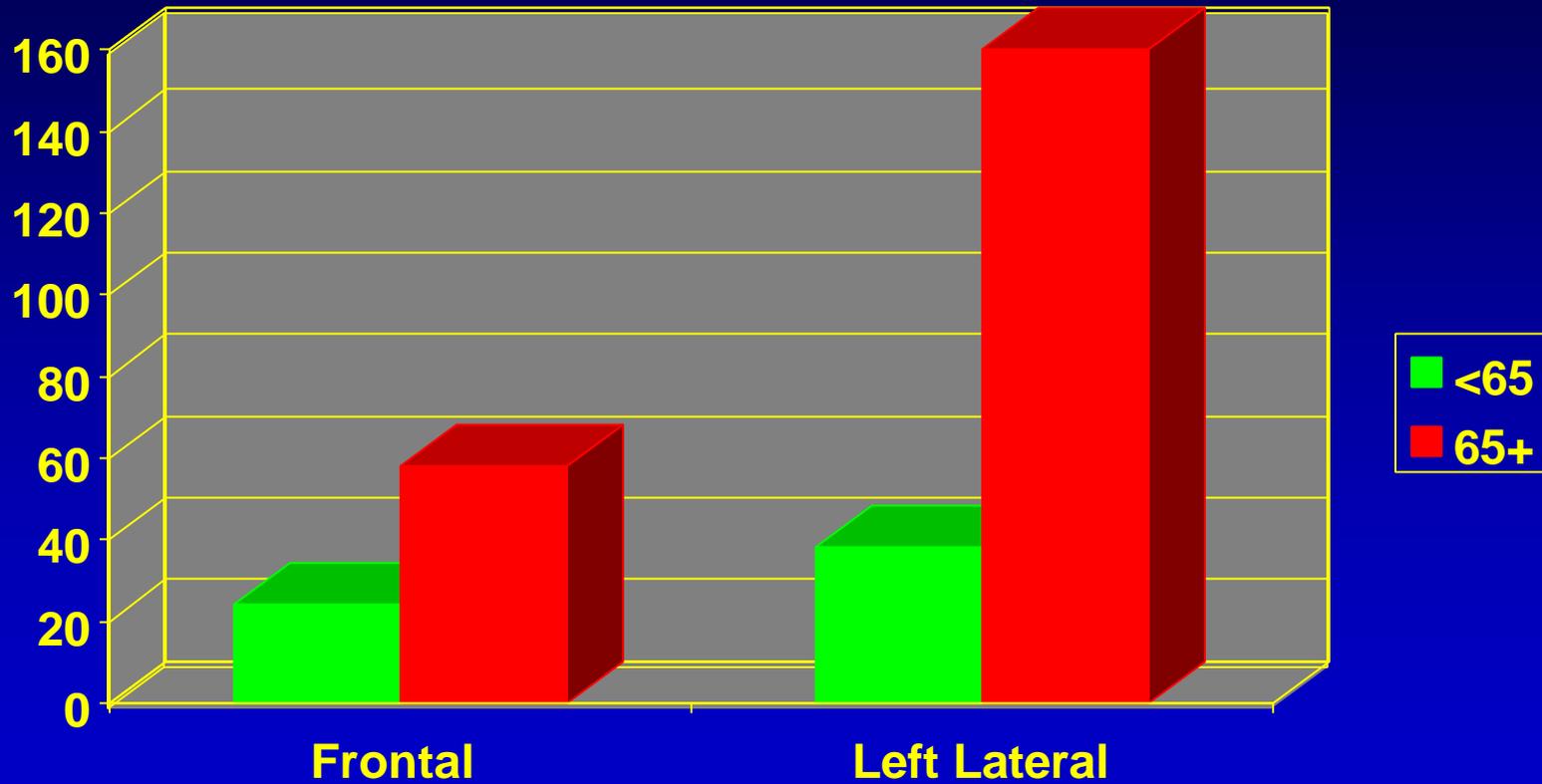
	<65 yrs (n=928)	65+ yrs (n=180)
Concussion*	16.7%	7.8%
Clavicle fx*	5.4	11.1
Chest* (rib fx)	19.2	42.8
Aorta*	0.4	1.7
Pelvic*	16.7	26.7

*p<0.05

**Maryland hospitalized MV drivers

Mortality Rate

Age and Direction of Impact



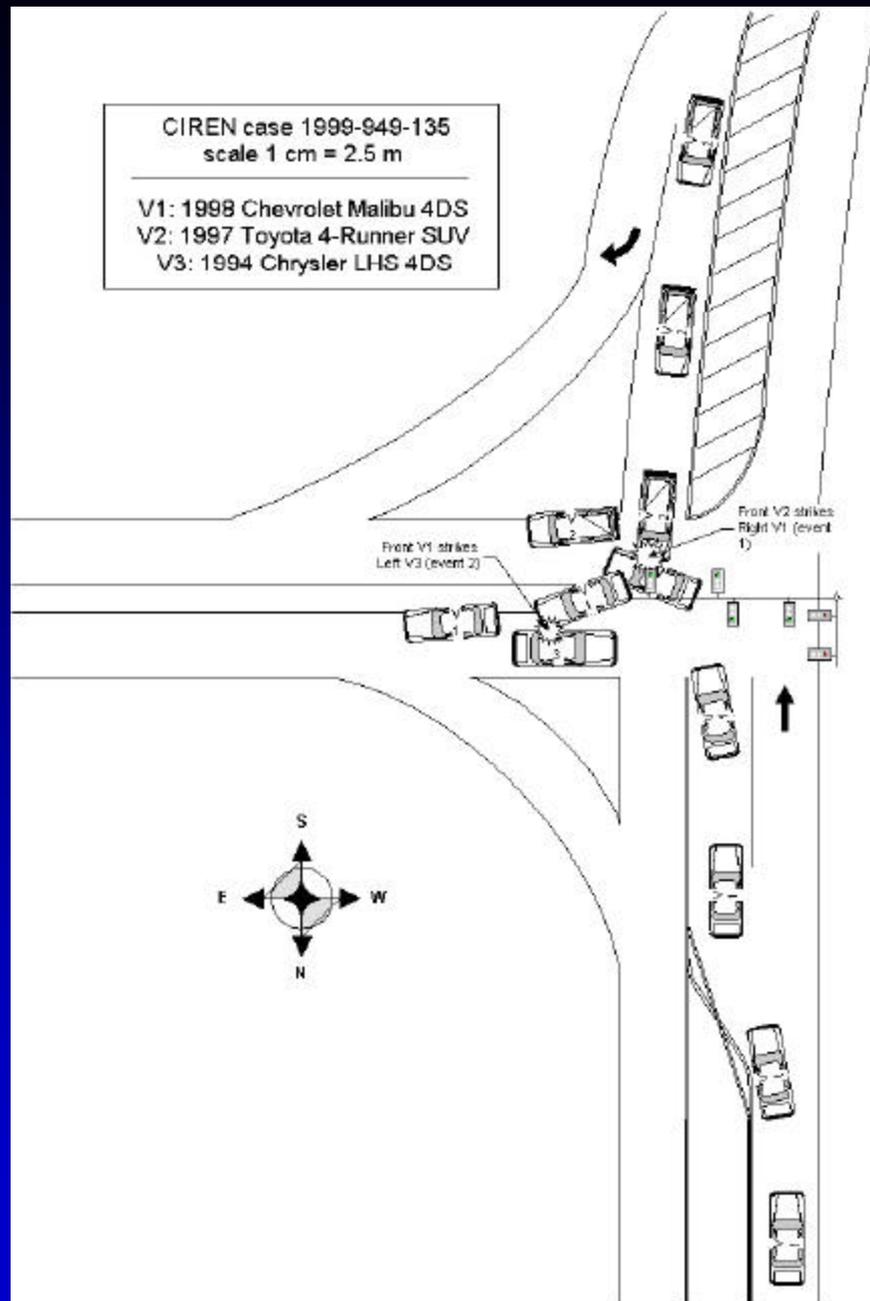
Rate per 10,000 persons

University Of Maryland
Medical System
National Study Center
for Trauma / EMS

CIREN
99-949-135

CIREN case 1999-949-135
scale 1 cm = 2.5 m

V1: 1998 Chevrolet Malibu 4DS
V2: 1997 Toyota 4-Runner SUV
V3: 1994 Chrysler LHS 4DS





Vehicle 1 – Approach path



Vehicle 1 – Approach path



Vehicle 1 – POI (event 1)



Vehicle 1 – POI (event 2)



Vehicle 1 – Lookback from final rest



Vehicle 2 – Approach path



Vehicle 2 – Approach path



Vehicle 2 – Point of impact



Vehicle 2 – Lookback from POI



Vehicle 3 – Point of impact



Vehicle 3 - Lookback



Vehicle 1 – 1998 Chevrolet Malibu



CDC

02RYAW3

PDOF

70 degrees

Damage width

74 inches

Max crush

8 inches



Vehicle 1 – Calculated Delta V 18mph

WinSMASH damage only algorithm



Event 2 damage



CDC
PDOF

12FLEE6
0 degrees

CIREN Case #

Case C03 CIRE

Summary Detail

Description

▶ 802.26 - CLOS

807.01 - CLOS

808.42 - CLOS

812.21 - FRAC

812.21 - FRAC

850.1 - CONCL

860.0 - TRAU

867.0 - INJUR

910.0 - ABRA

911.0 - ABRA

920 - CONTUS

922.1 - CONTU

922.8 - CONTU

923.00 - CONT

923.02 - CONT

923.03 - CONT

Injury

Summary Detail Intrusion Points of Contact Biomechanics Radiology Invasive Procedures Images Note

Intrusions Sketch Seat Plus Toe Pan

Row	Position	Area	Intruded Component	Comparison	Intruded	Intrusion	Magnitude	Crush Direction	
▶	Front Seat	Right	Interior	Door panel (side)	65	52	13	>= 8 to < 15 cms	Lateral
	Front Seat	Right	Interior	Floor pan (includes	60	51	9	>= 8 to < 15 cms	Lateral
	Front Seat	Right	Interior	Roof side rail	50	42	8	>= 8 to < 15 cms	Lateral
	Front Seat	Right	Interior	B-pillar	63	51	12	>= 8 to < 15 cms	Lateral
	Second Seat	Right	Interior	Door panel (side)	65	56	9	>= 8 to < 15 cms	Lateral
	Front Seat	Right	Interior	A (A1/A2)-pillar	57	50	7	>= 3 to < 8 cms	Lateral
	Second Seat	Right	Interior	Roof side rail	50	44	6	>= 3 to < 8 cms	Lateral
	Second Seat	Right	Interior	Floor pan (includes	60	59	1	<= 2 cms	Lateral

Current Injury

OK

Close

Close



Vehicle 2 – 1997 Toyota 4-Runner LTD



CDC

PDOF

Damage width

Max crush

11FDEW2

340 degrees

63 inches

14 inches



Vehicle 2 – Calculated Delta V 13mph

WinSMASH damage only algorithm



**Vehicle 1 – Case occupant
Right front passenger
78 year old female/61"/148 lbs**



Vehicle 1 – Right front intrusions



Vehicle 1 – Driver's air bag



Vehicle 1 – Passenger's air bag
Asymetrical deployment



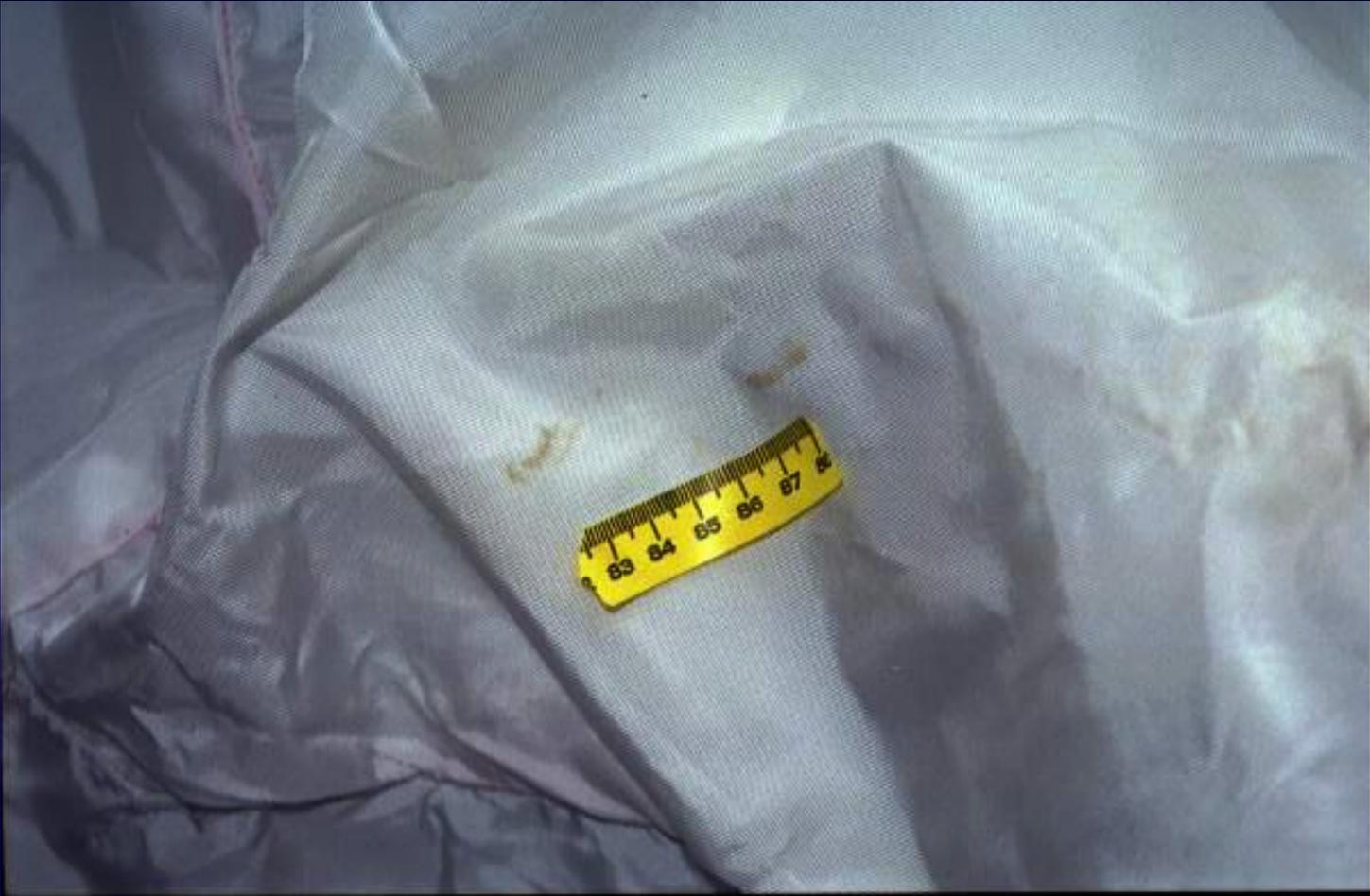
Vehicle 1 – Passenger restraints



Vehicle 1 – Restraint use



Vehicle 1 – Occupant contact



Vehicle 1 – Occupant contact point



Vehicle 1 – Right front door panel



Vehicle 1 – Right front door handle



Vehicle 1 – Right front door panel



Vehicle 1 – B-pillar intrusion



Vehicle 1 – Center console deformation

CIREN Case Form Case# 99-949-135

Case C03 CIREN_BALTIMORE Demographics Admissions Injury Analysis Events Crash Summary Vehicle Scene

Summary Detail Discharge Dx

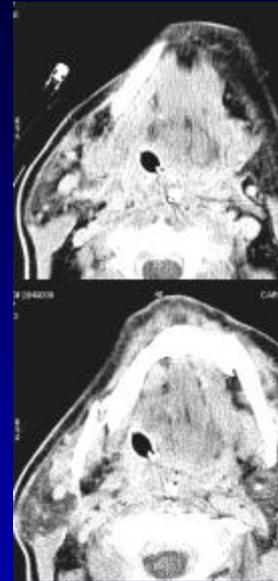
Description

▶ 802.26 - CLOSED FRACTURE OF SYMPHYSIS OF BODY OF MANDIBLE
807.01 - CLOSED FRACTURE OF ONE RIB
808.42 - CLOSED FRACTURE OF ISCHIUM
812.21 - FRACTURE OF SHAFT OF HUMERUS, CLOSED
812.21 - FRACTURE OF SHAFT OF HUMERUS, CLOSED
850.1 - CONCUSSION WITH BRIEF LOSS OF CONSCIOUSNESS
860.0 - TRAUMATIC PNEUMOTHORAX WITHOUT MENTION OF OPEN WOUND INTO THORAX
867.0 - INJURY TO BLADDER AND URETHRA WITHOUT MENTION OF OPEN WOUND INTO CAVITY
910.0 - ABRASION OR FRICTION BURN OF FACE, NECK, AND SCALP EXCEPT EYE, WITHOUT MENTION O
911.0 - ABRASION OR FRICTION BURN OF TRUNK, WITHOUT MENTION OF INFECTION
920 - CONTUSION OF FACE, SCALP, AND NECK EXCEPT EYE(S)
922.1 - CONTUSION OF CHEST WALL
922.8 - CONTUSION OF MULTIPLE SITES OF TRUNK
923.00 - CONTUSION OF SHOULDER REGION
923.02 - CONTUSION OF AXILLARY REGION
923.03 - CONTUSION OF UPPER ARM



CIREN CASE 135

78 year old female, 5'1" 148 lbs



+LOC at scene, arrival GCS=10
Right mandible fracture





Bilateral midshaft humerus fractures



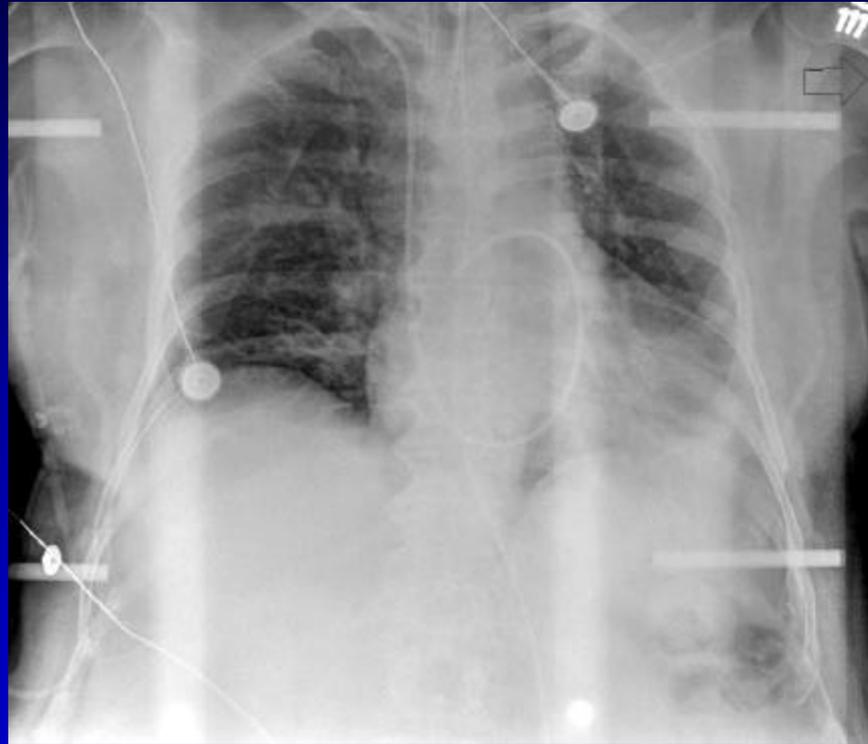
Bilateral midshaft humerus fractures



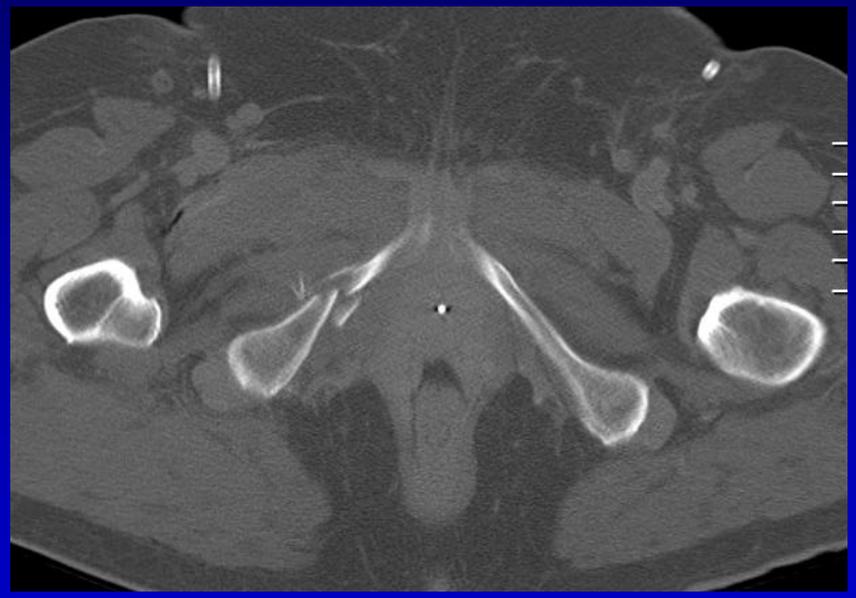
Right chest contusion



Left hip contusion/abrasion



Bilateral hemothoraces
Rib fractures (Right 1,2 Left 7,8 posterior)



Bilateral pubic rami fractures/Right sacral fracture



**Ruptured bladder
(extraperitoneal)**





Left knee contusion/abrasion

Psychosocial Characteristics and SF36

Pre-Injury

- 78 y.o., 5'1", 148lb, MF

At Discharge

- Non-weight bearing
- D/C to in-patient rehab (5 weeks)
- LOS 15 days

At 6 months

- Continues o.p. rehab x 6 months
- Hired home companion and nurse
- Ambulates with assistance
- Disrupting pain
- Experiences depression/sleep disturbances
- Legal problems
- Cognitive problems
- Auditory deficits

At 1 year

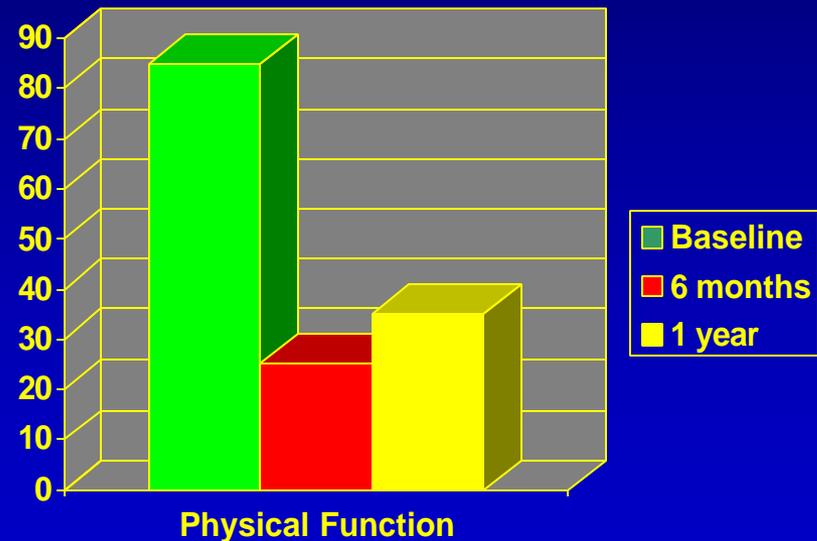
- Life altering
- Increased isolation
- Disrupting pain
- Depression
- Cognitive problems persist

- Costs

– Professional	\$14,400
– Hospital	\$62,736
– Rehab	\$25,000
– Outpatient	\$ 2,500
– Home care	\$ 5,400
– TOTAL	\$110,036

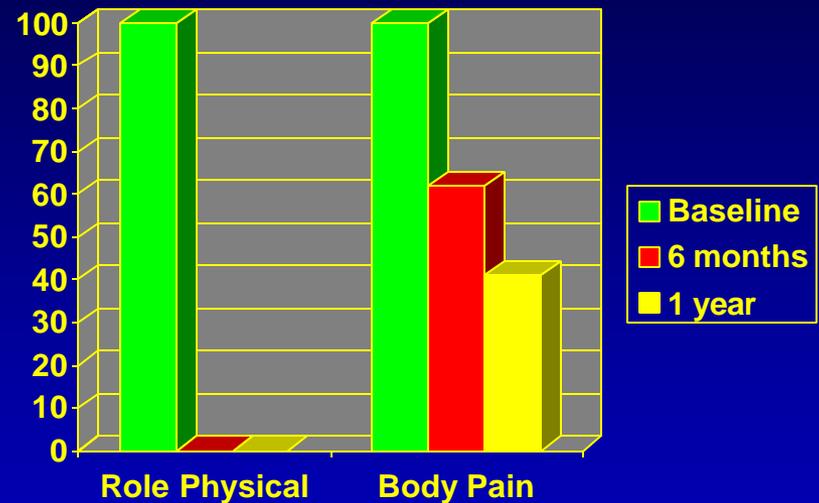
PHYSICAL FUNCTIONING (PF)

- Vigorous activities, such as running, lifting heavy objects, strenuous sports
- Moderate activities, such as moving a table, vacuuming, bowling
- Lifting or carrying groceries
- Climbing several flights of stairs
- Climbing one flight of stairs
- Bending, kneeling, or stooping
- Walking more than a mile
- Walking several blocks
- Walking one blocks
- Bathing or dressing



ROLE-PHYSICAL (RP)

- Cut down the amount of time spent on work or other activities
- Accomplished less than would like
- Limited in the kind of work or other activities
- Difficulty performing the work or other activities



BODILY PAIN (BP)

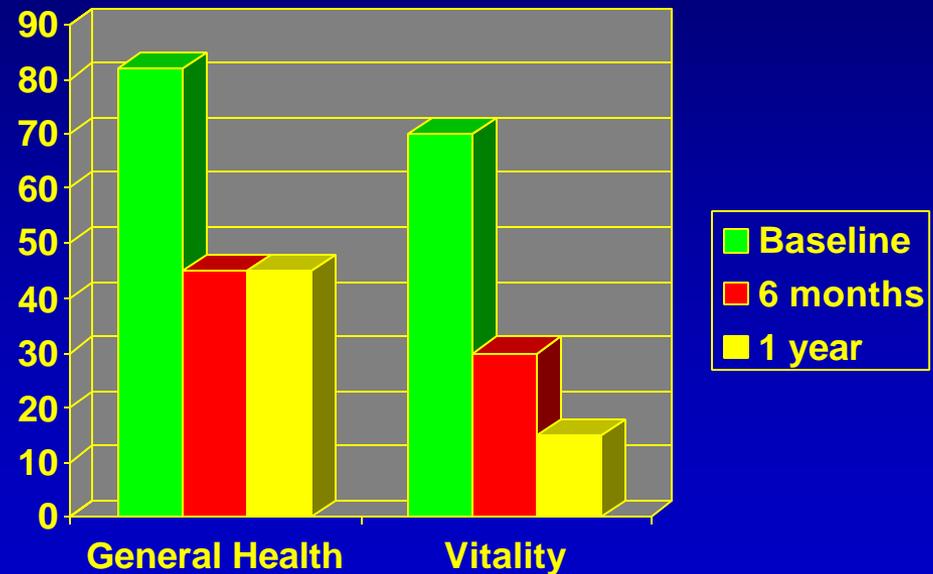
- Intensity of bodily pain
- Extent pain interfered with normal work

GENERAL HEALTH (GH)

- Is your health: excellent, very good, good, fair, poor
- I seem to get sick a little easier than other people
- I am as healthy as anybody I know
- I expect my health to get worse
- My health is excellent

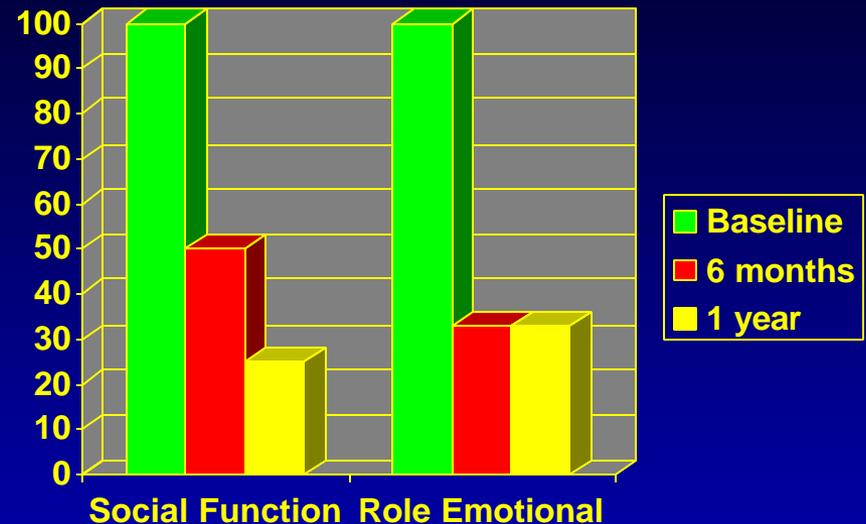
VITALITY (VT)

- Feel full of pep
- Have a lot of energy
- feel worn out
- Feel tired



SOCIAL FUNCTIONING (SF)

- Extent health problems interfered with normal social activities
- Frequency health problems interfered with social activities

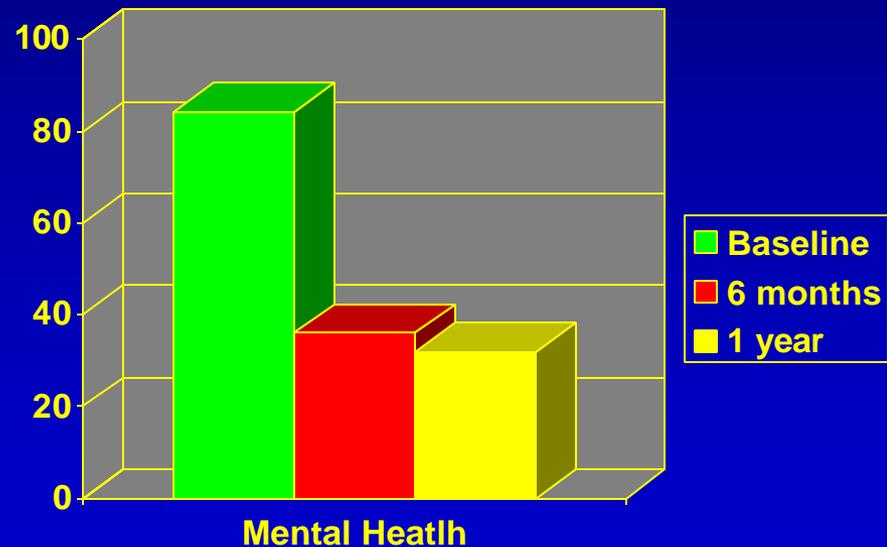


ROLE -- EMOTIONAL (RE)

- Cut down the amount of time spent on work or other activities
- Accomplished less than would like
- Didn't do work or other activities as carefully as usual

MENTAL HEALTH (MH)

- Been a very nervous person
- Felt so down in the dumps nothing could cheer you up
- Felt calm and peaceful
- Felt downhearted and blue
- Been a happy person



Case 949-135

Older Drivers

Perception of risk as a factor in behavior

- Psychological
 - Vulnerability
 - Insurance
 - Citations
- Physiological
 - Perception
 - Cognition
 - Reaction time
- Sociological
 - Ageism
 - Stereotyping

Older Drivers Compensatory Attitudes

- **Responsible**
 - Law abiding
 - Self-policing
- **Deferential**
 - Non-competing
 - Cautiousness
- **Denial**
 - “Not me” syndrome
 - Ignoring problems

Older Drivers

Compensatory Behavioral Strategies

- Preventive
 - Planning routes
 - Maintaining car
 - Regular vision checkups
- Avoidance
 - Reduced travel
 - Reduced “high risk” exposure
- Denial
 - Non-limited driving exposure

Coping with Injury

- Face physical problems
- Loss of friends/spouse
- Geographic distance
- Changed lifestyle
- Stoicism
- Self-sacrifice
- Sense of humor