

Mismatch Collisions



A 'Blossoming'
Problem



"You just parked on a Saturn."

CIREN Database

(As of March 13, 2003)

1,653 CIREN cases linked to NASS

973 involved in two-vehicle crashes

430 small vehicle drivers in frontal or left lateral crash

- 203 small vs. small

- 227 small vs. large

Summary Characteristics

(430 Drivers)

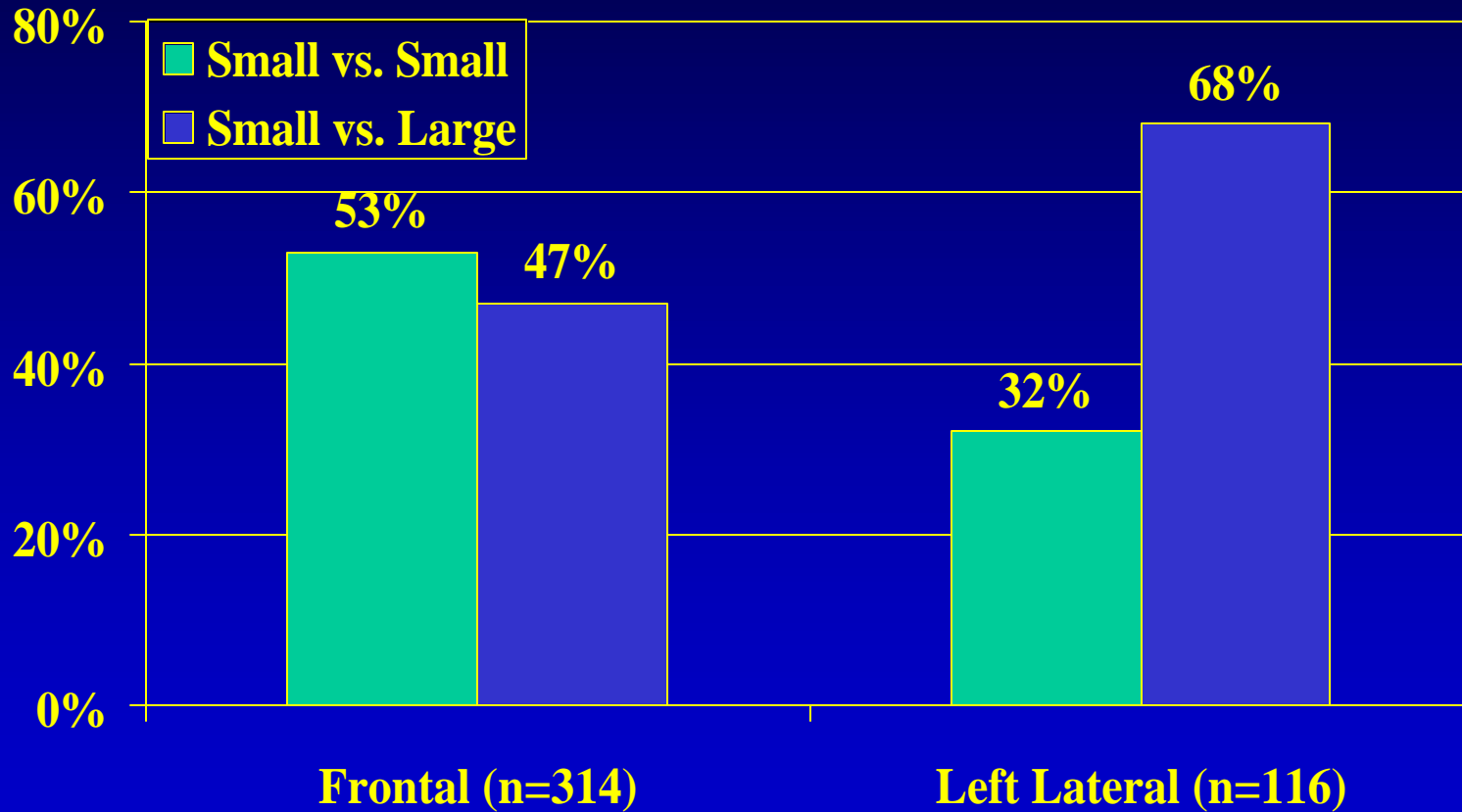
	Small vs. Small (n=203)	Small vs. Large (n=227)	p-Value
Median Age	42.5 years	35.0 years	NS
Male	46.0%	44.6%	NS
Died	11.8%	20.3%	0.017
Median ISS	14.0	19.5	<0.001
Median Total Charge	\$32,491	\$42,623	NS

Crash Characteristics

(N=430)

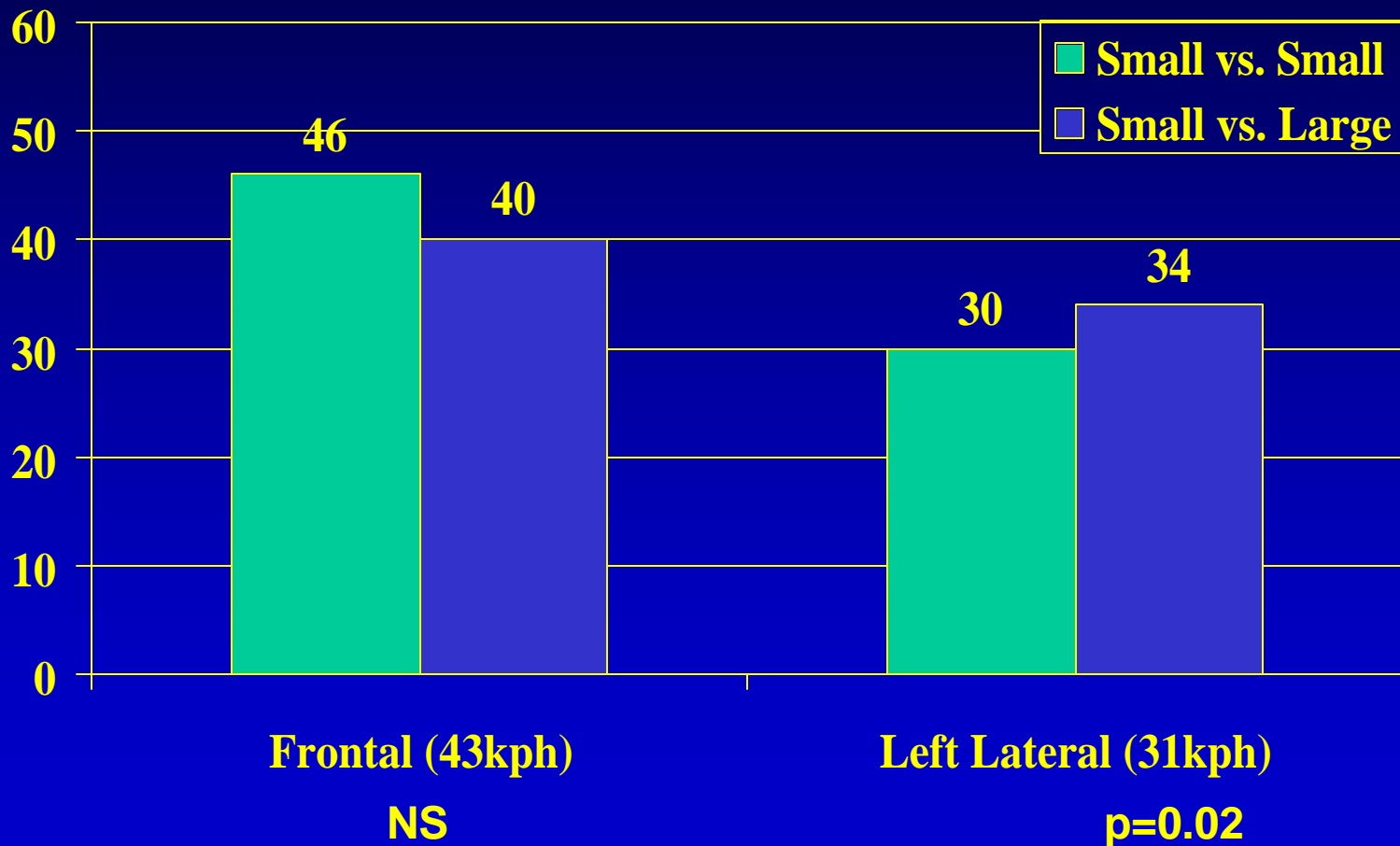
	Small vs. Small (n=203)	Small vs. Large (n=227)	p-Value
Belted	58.7%	58.5%	NS
Airbag Deployed	87.2%	77.2%	0.011
Frontal Crash	81.8%	65.2%	<0.001
Median Total Delta V	41.5 kph	38.0 kph	NS

Point of Impact by Vehicle Mix

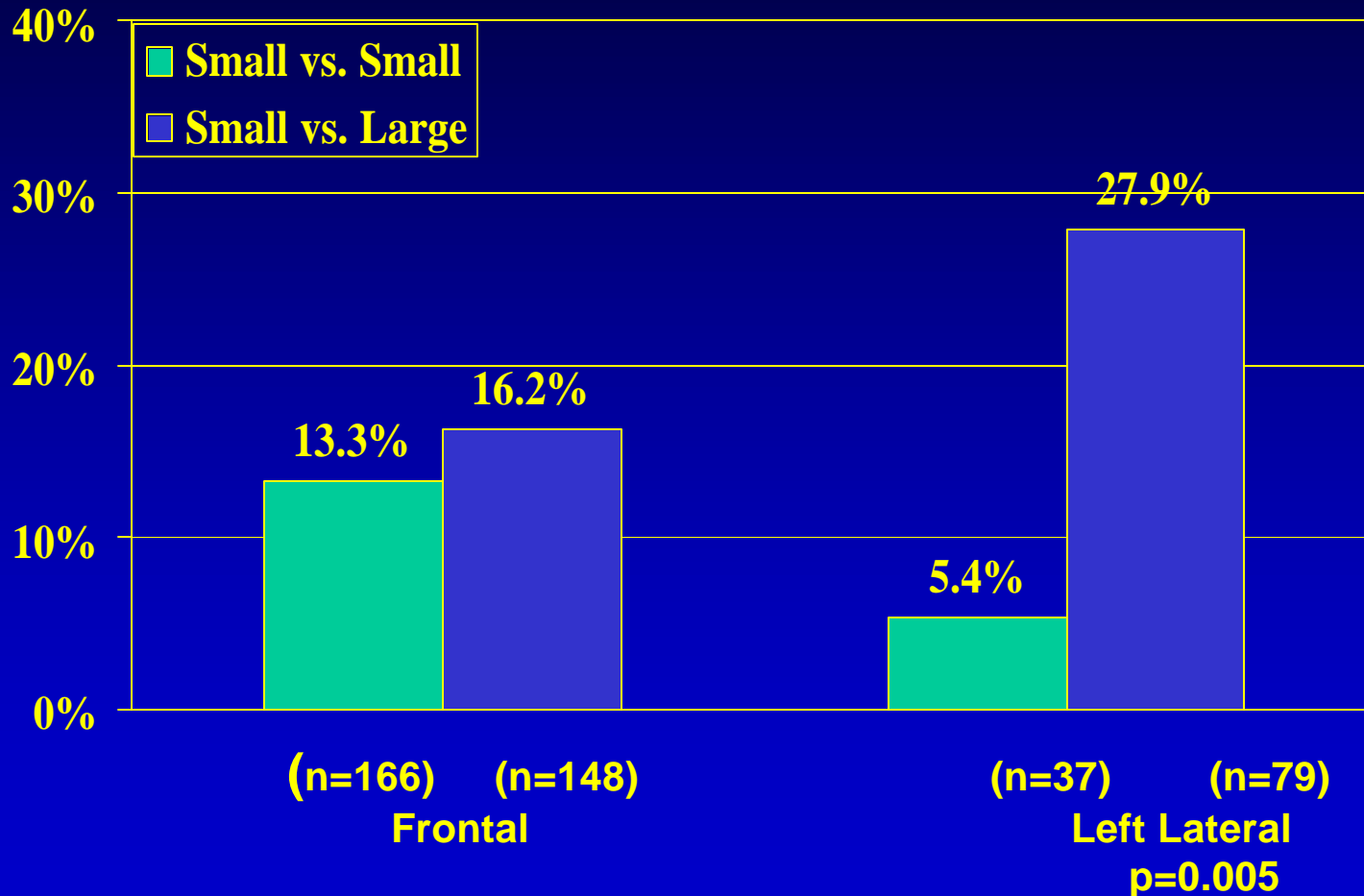


P<0.001

Median Delta V by Vehicle Mix Frontal / Lateral Crash



Percent Death by Point of Impact and Vehicle Mix



Incidence of Injury by Vehicle Mix (Frontal Crash)

(N=314)

	Small vs. small (n=166) (%)	Small vs. Large (n=148) (%)	p-Value
Head	34.3	45.3	0.048
Face	44.6	49.3	NS
Neck	9.6	9.5	NS
Thorax	57.8	48.7	NS
Abdomen	41.6	36.5	NS
Spine	15.1	16.9	NS
Upper Extremity	64.5	64.2	NS
Lower Extremity	80.1	76.4	NS

Incidence of Injury by Vehicle Mix (Left Lateral Crash)

(N=116)

	Small vs. Small (n=37) (%)	Small vs. Large (n=79) (%)	p-Value
Head	40.5	59.5	0.056
Face	27.0	45.6	0.057
Neck	2.7	8.9	NS
Thorax	46.0	74.7	0.002
Abdomen	37.8	46.8	NS
Spine	18.9	25.3	NS
Upper Extremity	51.4	57.0	NS
Lower Extremity	67.6	70.6	NS

Maryland CODES Data

Selection Criteria:

- 1997 to 2001
- Driver in small vehicle
- In Two-vehicle crash
- 1993 model year and newer
- Frontal or left lateral crash

Total 1,539

- Frontal 1,087 (70.6%)
- Left lateral 452 (29.4%)

Maryland CODES Data

Incidence of Injury (Left Lateral Crash)

(N=452)

	Small vs. Small (n=254) (%)	Small vs. Large (n=198) (%)	p-Value
Head	26.4	40.4	0.001
Face	15.4	28.3	<0.001
Neck	0.4	0.5	NS
Thorax	33.1	39.4	NS
Abdomen	21.7	21.2	NS
Spine	16.1	15.7	NS
Upper Extremity	23.2	31.3	0.054
Lower Extremity	44.1	36.9	NS

CODES vs. CIREN

Incidence of Injury

(Left Lateral Crash, Small vs Large)

	CODES (N=198) (%)	CIREN (n=79) (%)
Head	40.4*	59.5*
Face	28.3*	45.6*
Neck	0.5	8.9
Thorax	39.4	74.7*
Abdomen	21.2	46.8
Spine	15.7	25.3
Upper Extremity	31.3*	57.0
Lower Extremity	36.9	76.0

* Significantly higher in small vs large crashes

Case 1

Similar Vehicles

**1997 Chevrolet Camaro
(case vehicle)**

VS

1997 Nissan Altima

53 year old male

Height 5-10 Weight 170 pounds

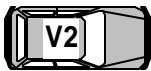
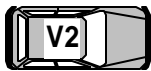
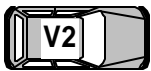
Case vehicle traveling north on a single lane with a stop sign to controlled intersection.

Striking vehicle traveling east on a two lane roadway.

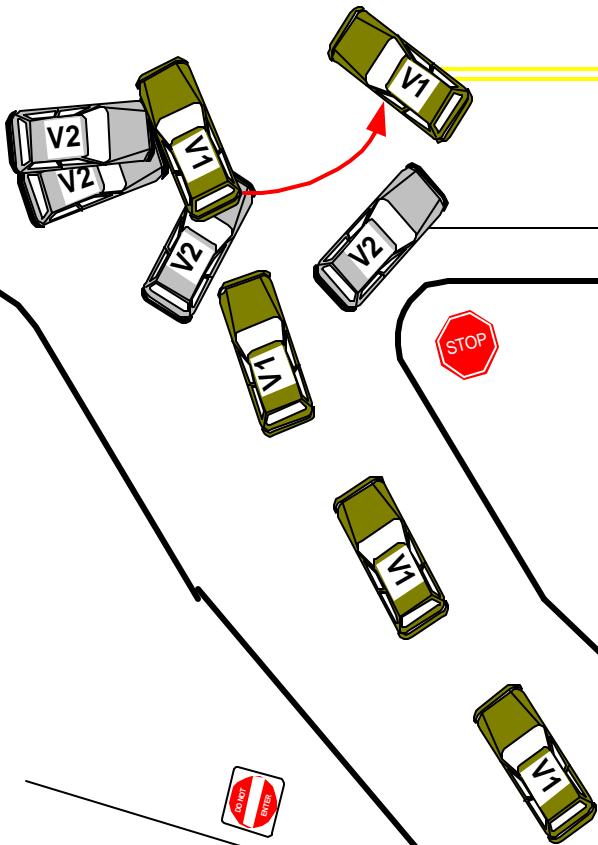
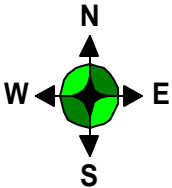
Case vehicle pulled away from stop sign and was attempting to turn left.

VEHICLE 1 1997 CHEVROLET CAMARO
VEHICLE 2 1997 NISSAN ALTIMA

SPEED
LIMIT
50



REDUCED
SPEED
AHEAD





Delta V

26.2 Km/h (16.3 MPH)

CDC

10LYEW3

PDOF

300 Degrees

Intrusions

Lower left side sill 22 cm Lateral

Left side kick panel 30 cm Lateral

Left side toe pan 29 cm Lateral

Contact areas

- Driver's frontal airbag (blood)**
- Passenger's frontal airbag (blood)**
- Center console**
- Left door panel**
- Lower left side instrument panel**
- Driver required extraction/ left side door removed, steering column removed and rim was cut on lower half**

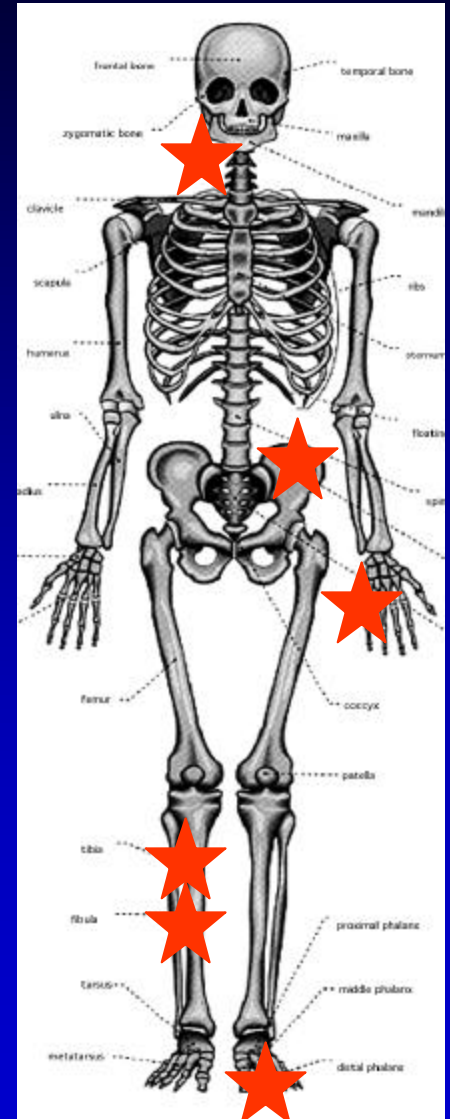


Vehicle 2 – 1997 Nissan Altima

Case Summary

Case 1

- 53 year old male
- 70 inches tall/170 lbs
- Driver of 1997 Chevrolet Camaro
- Vs. 1997 Nissan Altima
- Major injuries
 - Right forehead laceration
 - Grade II spleen laceration
 - Left ulna fracture
 - Right tibial plateau fracture
 - Left patella fracture
 - Left tibia/fibula fractures



Psychosocial Characteristics

At Discharge

- Acute hospital stay – 4 days
- Non-weightbearing
- In-patient rehabilitation – 7 days
- Outpatient therapy

At 6 months

- Rehospitalization secondary to infection
- Ambulates with assistance
- Outpatient therapy
- Restricted ADL's
- Disability Income/Unemployed
- Depression
- Cognitive problems
- Decreased drinking
- Legal issues

At 1 year

- Out patient therapy – 9 months
- Disability expired
- Forced medical retirement
- Ambulates with limp
- Wife returned to work
- Legal issues resolved
- Memory problems resolving
- Altered life style, strained marital relationship

- Costs

- Professional \$ 5,514

- Hospital \$31,324

- Rehab \$ 4,484

- Outpatient \$ 4,320

- TOTAL \$ 45,642

**1998 Chevrolet Malibu
(case vehicle)**

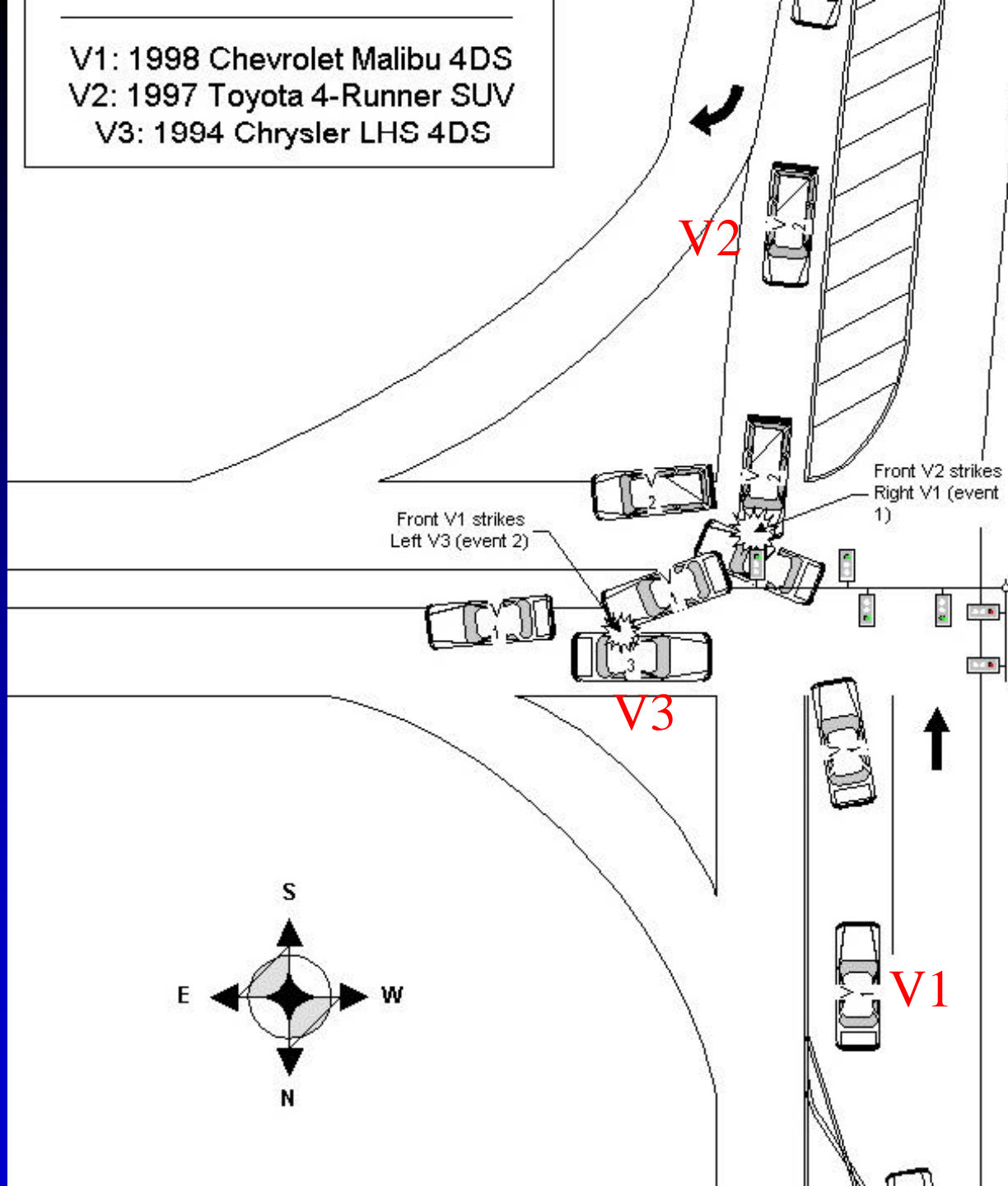
VS

1997 Toyota 4-runner

78 year old female

Height 5-1 Weight 148 pounds

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





CDC

02RYAW3

PDOF

70 degrees

Damage width

74 inches

Max crush

8 inches

Delta V

29 kph (18 mph)

Intrusions

Right door panel 13 cm Lateral

Right 'B' pillar 12 cm Lateral

Right roof side rail 8 cm Lateral

Contact areas

- **Airbag (blood)**
- **Right side interior/armrest (cracked)**
- **Right 'B' pillar**
- **Center arm rest (deformed)**



CDC

11FDEW2

PDOF

340 degrees

Damage width

63 inches

Max crush

14 inches

Delta V

21 kph (13 mph)



**Vehicle 1 –1998 Chevrolet Malibu
Case occupant - Right front passenger
78 year old female/61"/148 lbs**

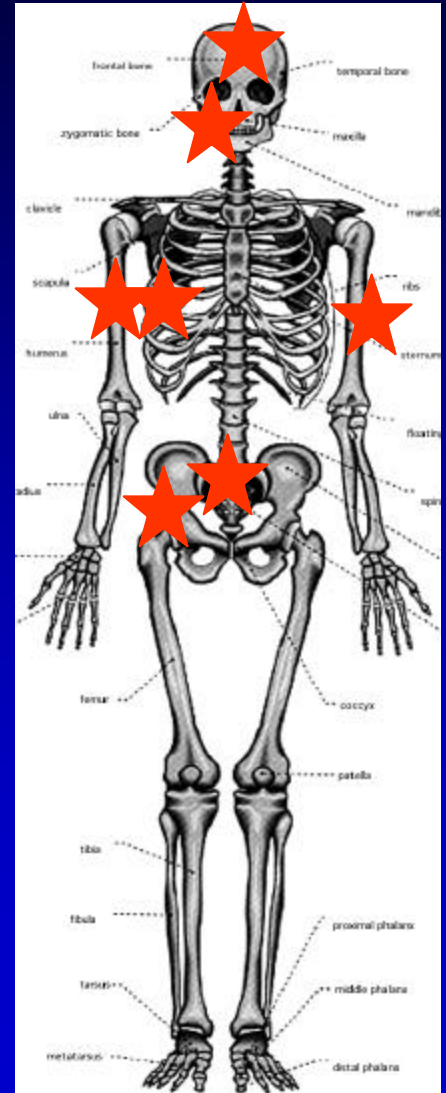


Vehicle 1 – Right front intrusions

Case Summary

Case 2

- 78 year old female
- 61 inches tall/148 lbs
- RF Pass. of 1998 Chevrolet Malibu
- Vs. 1997 Toyota 4-runner
- Major injuries
 - Closed head injury LOC<1hour
 - Right mandible fracture
 - Bilateral midshaft humerus fractures
 - Left Pneumothorax
 - Ruptured bladder
 - Pelvic fracture



78 year old female, 5'1" 148 lbs



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

R



L

Bilateral midshaft humerus fractures with possible contact points

Psychosocial Characteristics

At Discharge

- Acute hospital stay 15 days
- Non-weight bearing
- Discharged to in-patient rehab (5 weeks)
- Outpatient therapy

At 6 months

- Continues out patient.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

Outcomes

Outcomes (lateral crash)

Small vs Small

Small vs Large

Problems w/ambulation	40%	17%
Cognitive deficits	20%	50%
Behavioral changes	20%	33%
Depression	40%	67%
PTSD	20%	17%

Median Costs (lateral crashes)

	Small vs Small	Small vs Large
Hospital	\$9,184	\$22,053
Professional	1,250	3,385
Subtotal	9,434	26,123
Rehab	4,460	27,125
Total	\$24,830	\$76,947

Outcomes (frontal crashes)

Small vs Small

Small vs Large

Problems w/ambulation	43%	25%
Cognitive deficits	25%	44%
Behavioral changes	75%	75%
Depression	38%	50%
PTSD	19%	25%

Median Costs (frontal crashes)

	Small vs Small	Small vs Large
Hospital	\$36,468	\$41,315
Professional	7,094	12,324
Subtotal	43,427	54,291
Rehab	12,880	17,027
Total	\$56,645	\$81,812

Lateral Crash Summary

- Higher ISS
- Increased Traumatic Brain Injury & Lung/Rib injuries
- Highest Hospital, Prof. & Rehab costs
- Increased cognitive & behavioral problems at 1 year
- Higher depression at 1 year

Frontal Crash Summary

- Higher Delta V's
- Similar ISS
- Similar injury patterns
- Increased Lower Extremity injury
- Higher over-all costs:
(Small vs Large \$81,812;
Small vs Small \$56,645)

One Year Outcomes

- Different injury patterns/disabling outcomes
- 75% life-altering
- 30% do not return to work
- Significant cognitive deficits
- 20% experience Post Traumatic Stress Disorder
- Significant depression
- Significant ambulation problems

General Characteristics Same VS Mismatch

76%	Frontal	73%
24%	L. Lateral	23%
67%	Culpability	60%
62%	AB/Belt	60%
62%	Employed	64%
38%	Pre-injury	36%
	Depression	
24%	Income(\$35- 50,000)	23%

Same VS Mismatch Lateral Crashes

- | | | | |
|-------------|-------|-------------|-------|
| • Delta V | 26 | • Delta V | 26 |
| • ISS | 14/15 | • ISS | 21/25 |
| • AGCS (15) | 100% | • AGCS (15) | 50% |
| • DGCS (15) | 100% | • DGCS (15) | 83% |

Same VS Mismatch Lateral Crashes

- Traumatic Brain Inj. 20%
- Lung/Rib 60%
- Upper Extremity 60%
- Abdomen 100%
- Lower Extremity 60%
- Bilateral (20%)

- Traumatic Brain Inj 67%
- Lung/Rib 100%
- 33%
- Abdomen 33%
- Lower Extremity 33%

Same VS Mismatch Frontal Crashes

- Delta V 55
 - ISS 13/17
 - AGCS (15) 88%
 - DGCS (15) 94%
- Delta V 46
 - ISS 14/19
 - AGCS (15) 75%
 - (3-8) 19%
 - DGCS (15) 93%

Same VS Mismatch Frontal Crashes

- Traumatic Brain Inj 44%
 - Lung/Rib 25%
 - Upper Extremity 31%
 - Abdomen 38%
 - Lower Extremity 88%
 - (Bilateral 44%)
- Traumatic Brain Inj 38%
 - Lung/Rib 19%
 - Upper Extremity 44%
 - Abdomen 38%
 - Lower Extremity 100%
 - (Bilateral 32%)