



Real ^(Leg) Injuries, Real People

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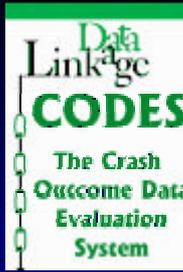
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Leg Injury Epidemiology 101

Lower extremity injuries are frequent.



Maryland CODES Data

Police Crash Reports

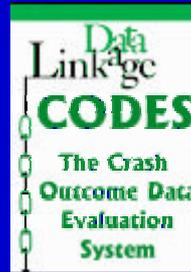


Linked motor vehicle drivers of non-rollover, passenger cars only, 1994 model year and newer, data from calendar years 1997-2000

Hospital Records

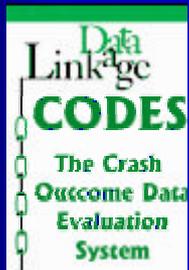


N=4,061

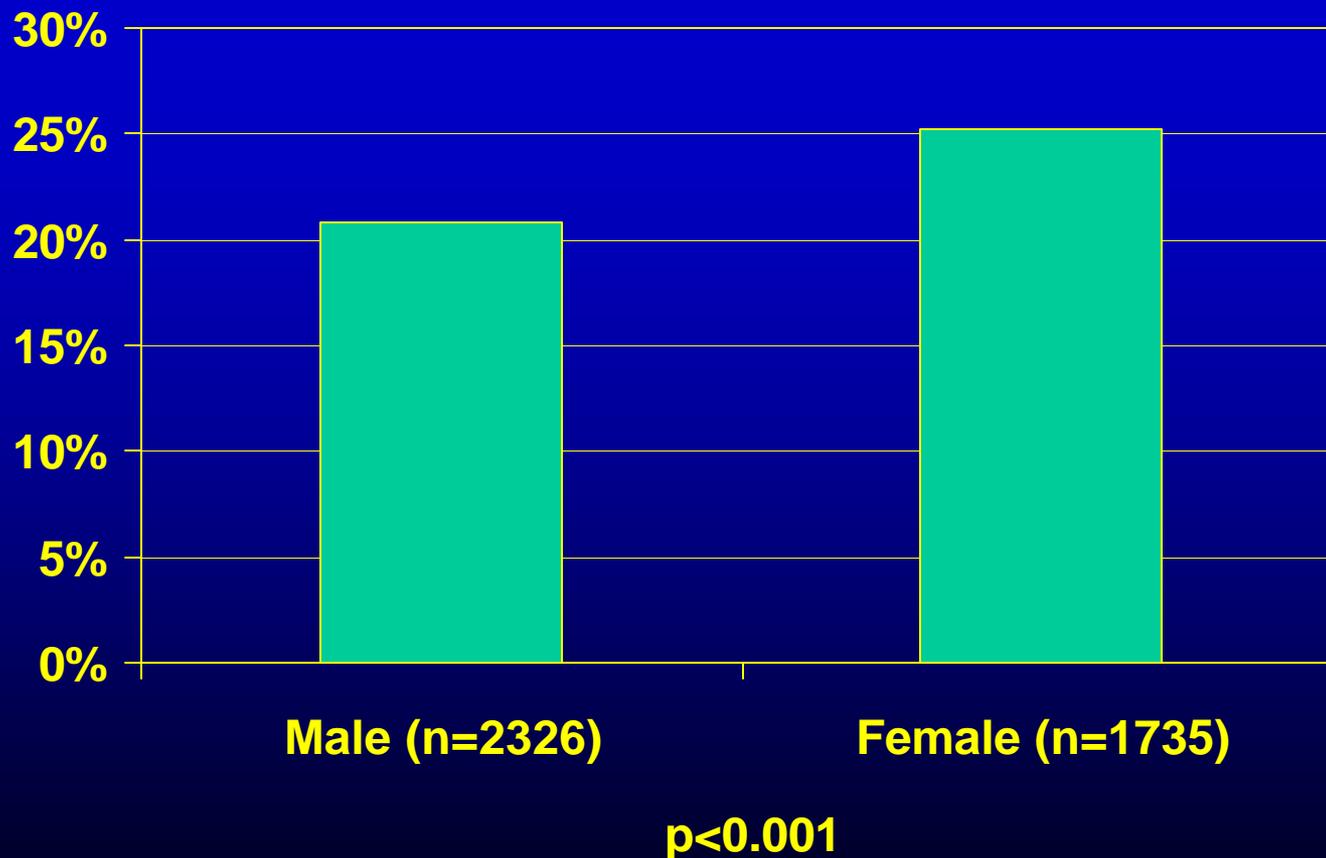


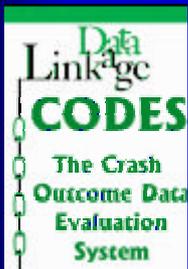
Results

- 22.7% of hospitalized drivers had at least one lower extremity or pelvic fracture
- 52.4% of those were male



Lower Extremity Fractures by Gender



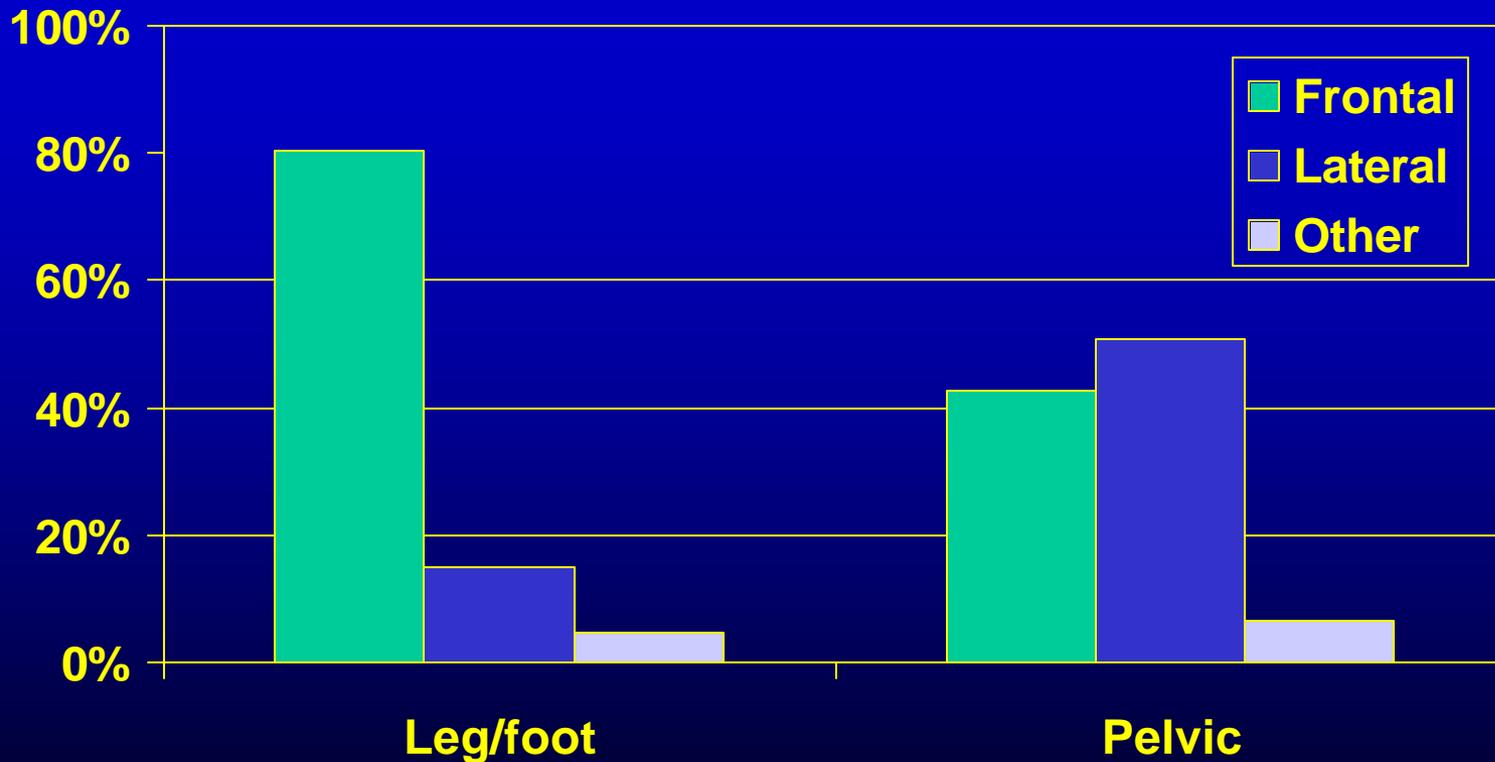


Incidence of Specific Fractures

(N=4,061)

	Men (%)	Women (%)	p-Value
Pelvis	6.2	8.0	0.02
Femur	6.5	4.7	0.01
Patella	1.8	2.0	NS
Tib/Fib	4.6	5.2	NS
Ankle	4.0	6.7	<0.001
Tar/Met/Calcaneus	2.9	5.1	<0.001
Other	0.3	0.3	NS

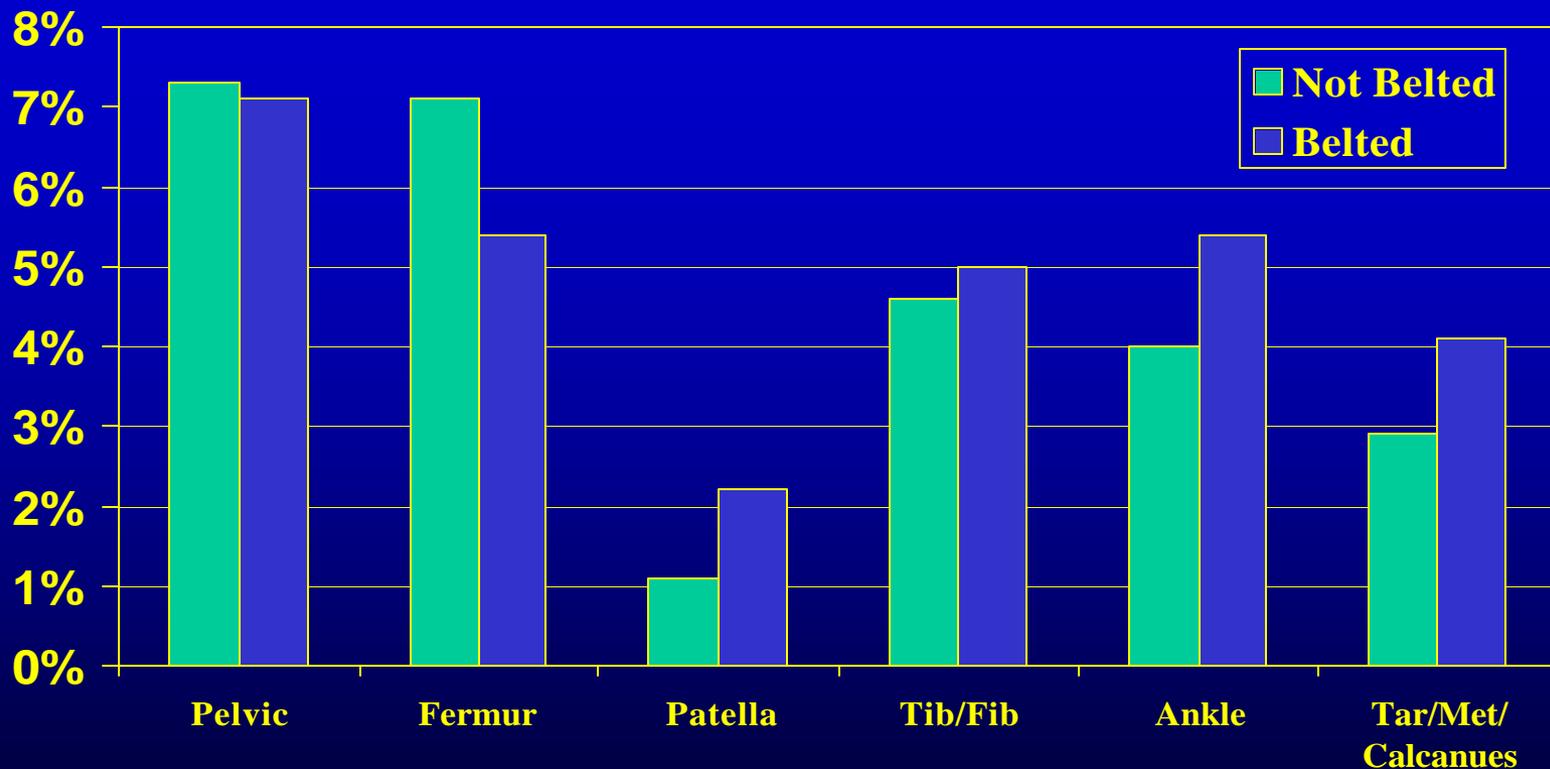
Lower Extremity Fractures Point of Impact (N=4,061)



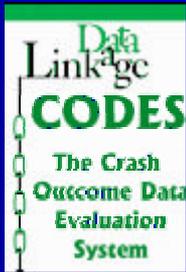
$P < 0.001$

Motor vehicle accidents caused lower extremity injuries have become relatively more important.

Lower Extremity Fractures Reported Belt Use (N=4,061)

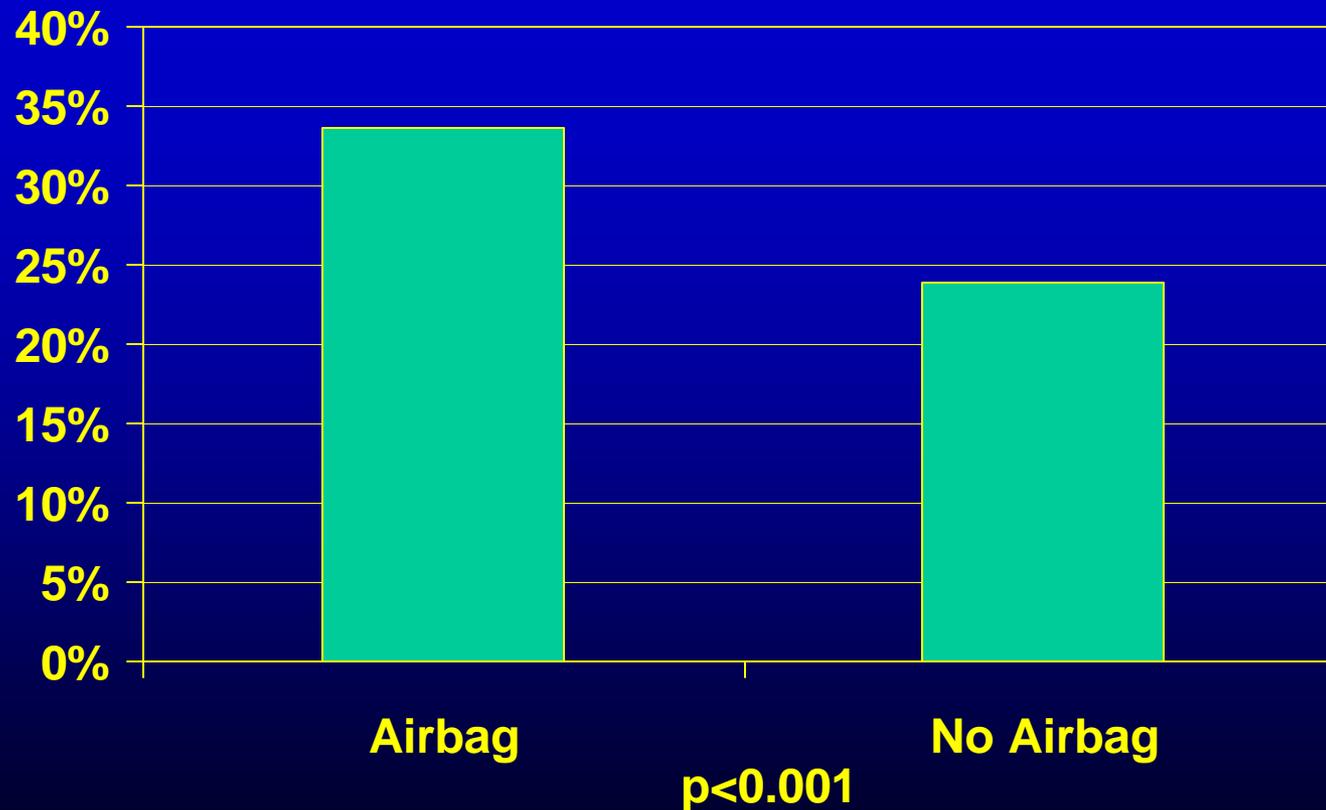


*all comparisons p=NS



Lower Extremity Fractures by Airbag

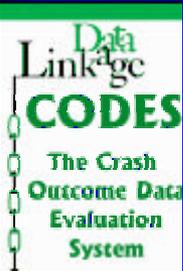
Frontal Collision Only (n=2,390)



Lower extremity injuries are costly.

Median ISS, Hospital Length of Stay and Charges by Airbag Use (Frontal Collision Only)

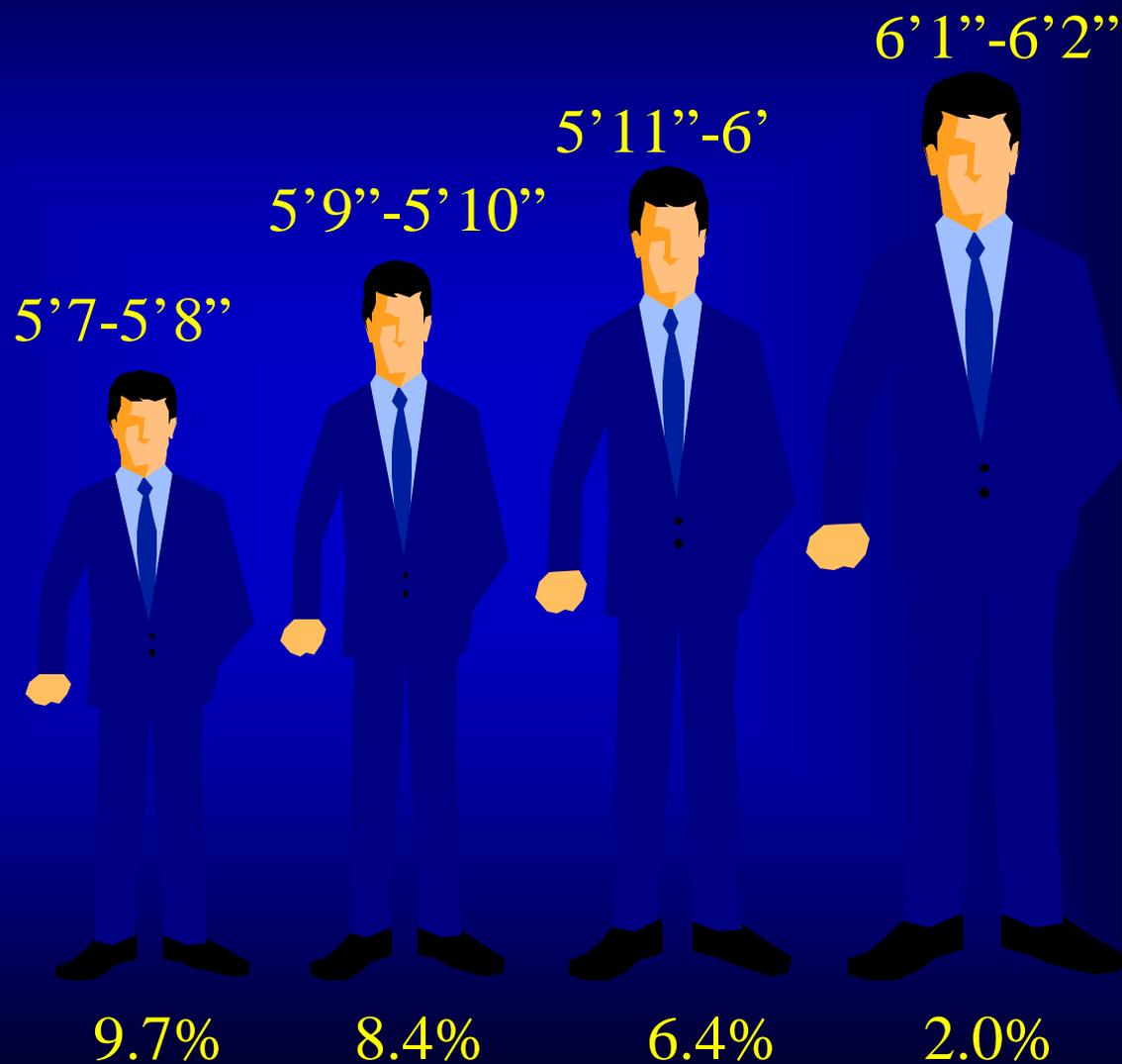
	Airbag (n=696)	No Airbag (n=1,694)	P-value	Total (N=2,390)
ISS (25%-75%)	5 (2-9)	5 (2-9)	NS	5 (2-9)
LOS (days) (25%-75%)	2 (1-5)	2 (1-4)	0.010	2 (1-4)
Charges \$	4,356	3,691	0.006	3,873



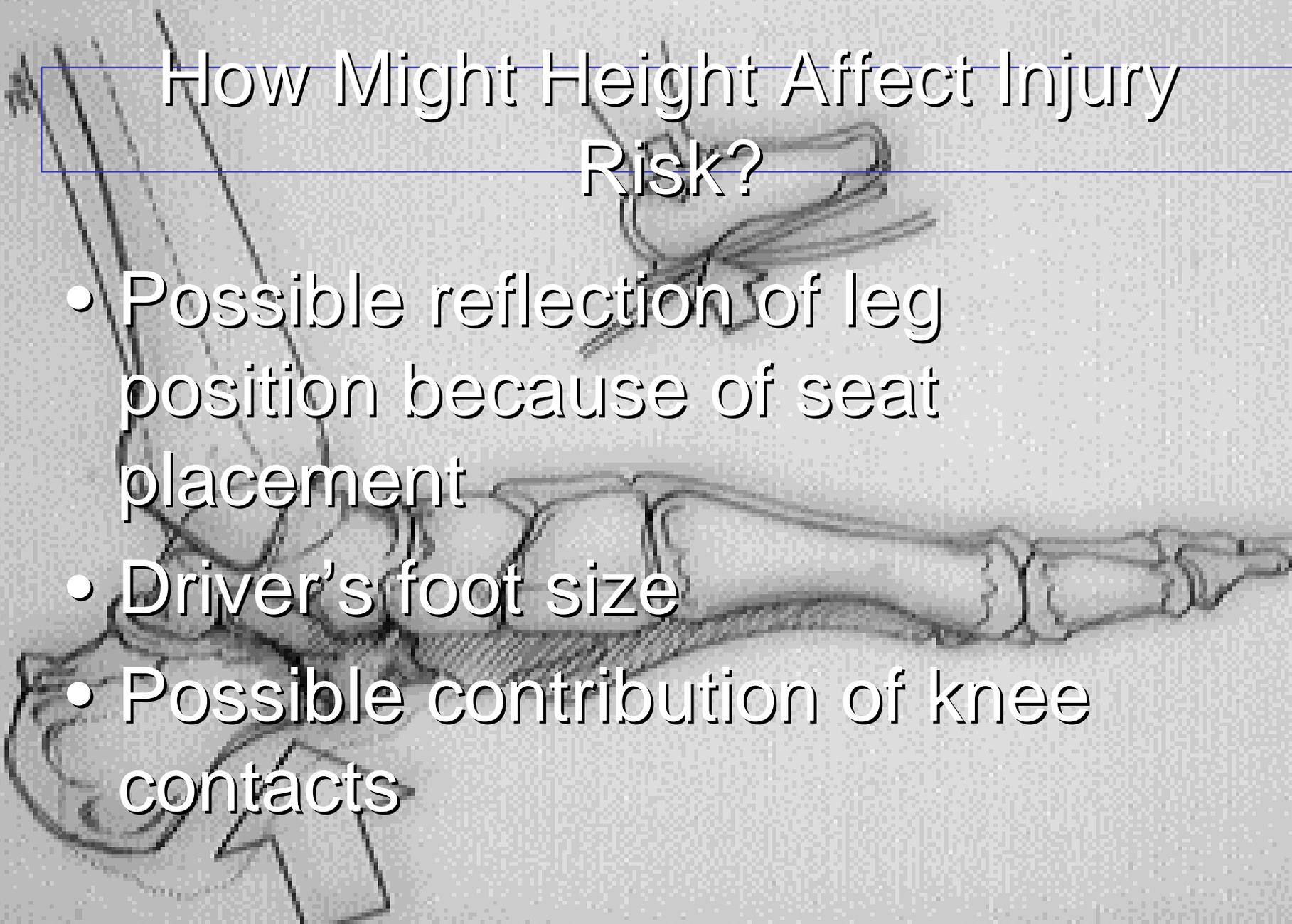
Median ISS, Hospital Length of Stay and Charges by Lower Extremity Fractures (Frontal Collision Only)

	Lower ext. fracture (n=638)	No Lower ext. fracture (n=1,752)	P-value	Total (N=2,390)
ISS (25%-75%)	9 (4-13)	4 (1-6)	<0.001	5 (2-9)
LOS (days) (25%-75%)	4 (2-8)	1 (0-3)	<0.001	2 (1-4)
Charges \$	12,926	3,056	<0.001	3,873

Incidence of Ankle/Tarsal Injury in Males



How Might Height Affect Injury Risk?

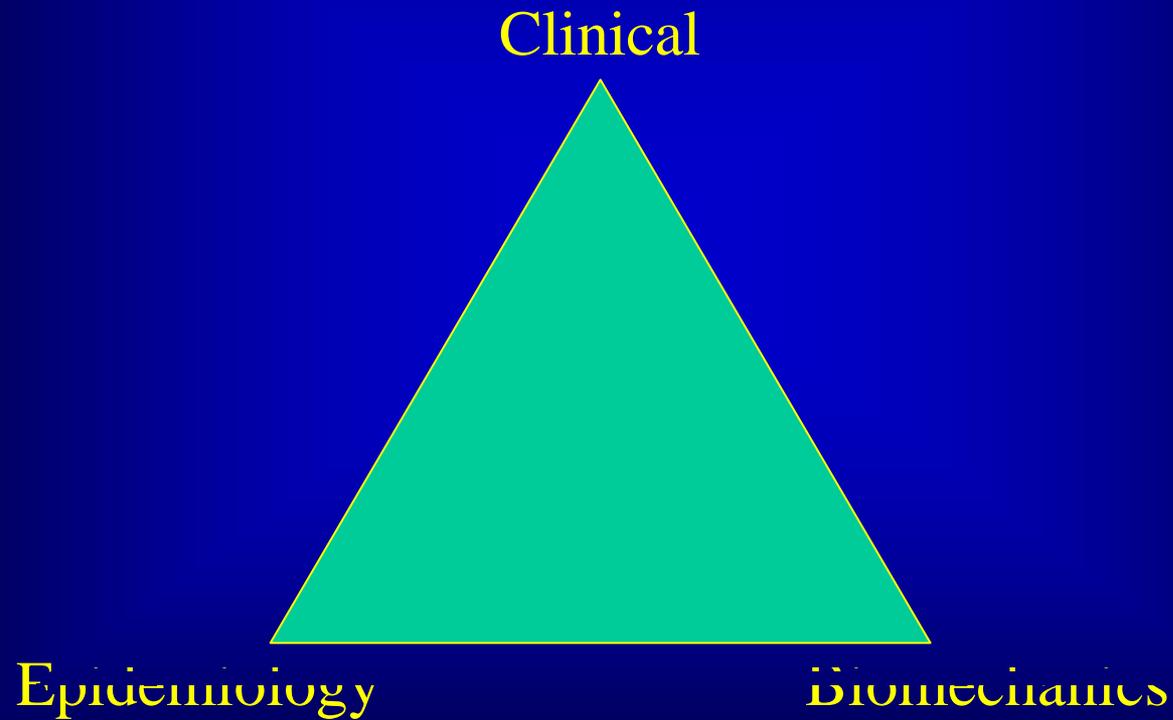


- Possible reflection of leg position because of seat placement
- Driver's foot size
- Possible contribution of knee contacts

Complementary efforts:

- Other databases , magnitude of the problem, and the overall magnitude of motor vehicle-related injury in the population.
- CIREN provides biomechanical data on the mechanism of injury and detailed diagnostic information including prognostic outcomes in addition to precise information on the forces, contact points, and locations of these injuries/.

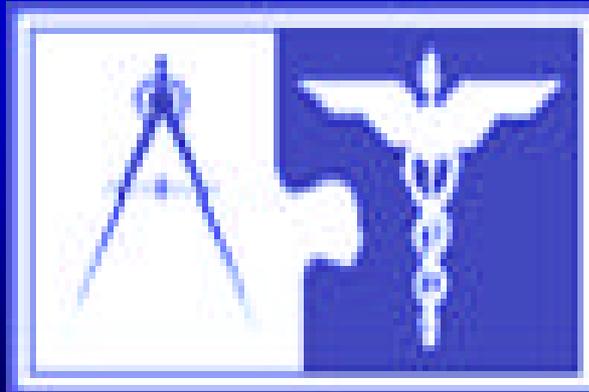
Multidisciplinary Approach to Motor Vehicle Injuries



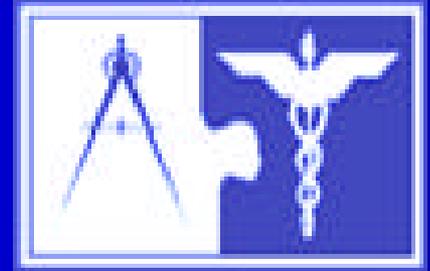
Clinical Observations of Real World Crashes



CIREN Analysis



CIREN Database

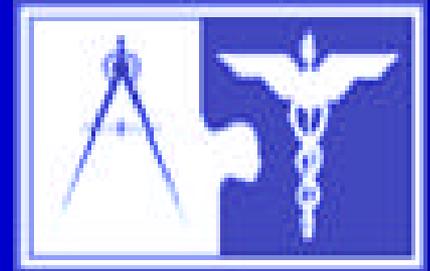


1,636 persons included as of 8/13/2002

Age	0-19	23.1%
	20-39	35.3%
	40-59	23.7%
	60+	17.9%

Men 49.7%

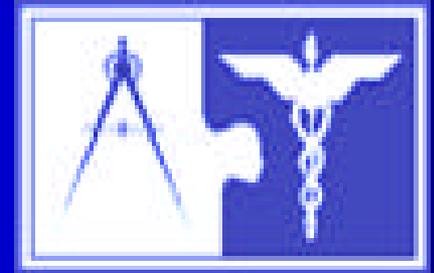
CIREN Database



- **1,345 cases with AIS score**
- **751 cases with at least one lower extremity fracture***
- **1,754 total fractures**

* First 4 digits of AIS code between 8514 and 8536, with 2+ severity

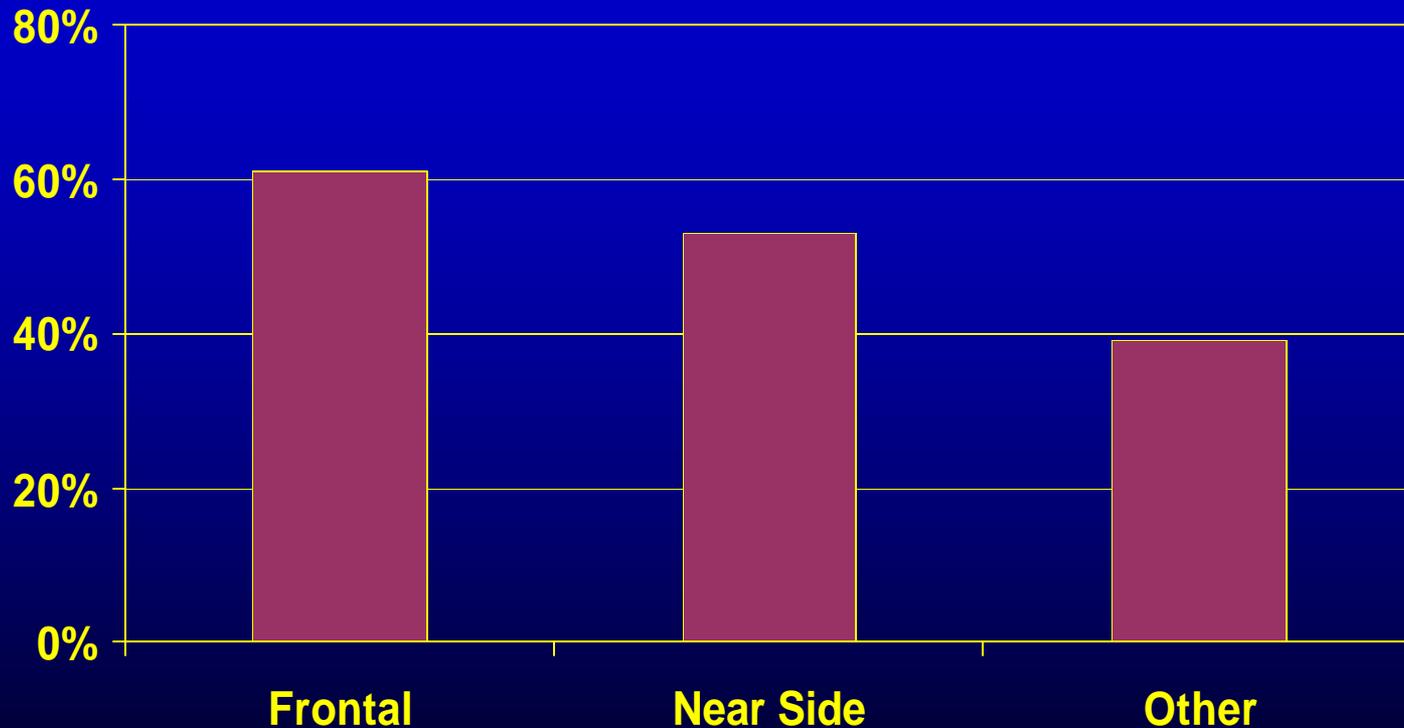
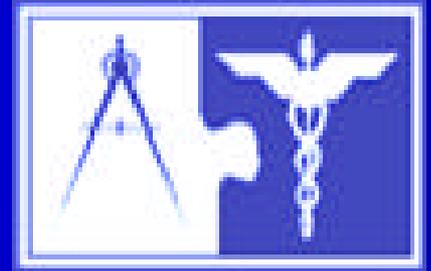
CIREN Database



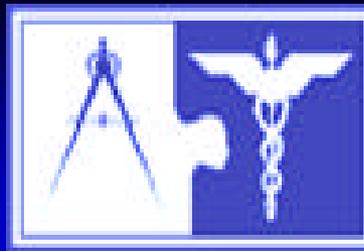
<u>Characteristics</u>		<u>Percent with Lower Extremity FX</u>	
		(%)	p
Age	0-19	32	< 0.001
	20-39	64	
	40-59	62	
	60+	62	
Gender	Male	55	NS
	Female	57	

Lower Extremity Fracture by Case

Criteria
(1,345 cases)

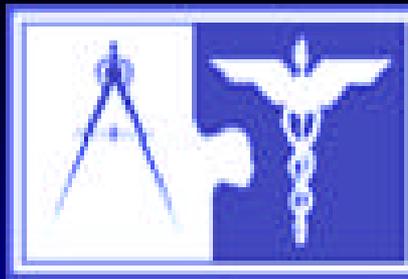


$p < 0.001$



Median ISS, and Delta V by Lower Extremity Fractures (1345 cases)

	Lower ext. fracture (n=751)	No Lower ext. fracture (n=594)	P-value	Total (N=1,345)
ISS (25%-75%)	17 (10-29)	14 (9-26)	<0.001	16 (10-29)
Total Delta V (25%-75%)	43 (31-57)	33 (24-45)	<0.001	38 (28-53)



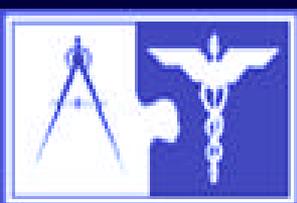
Distribution of Fracture Type (1,754 fractures)

Pelvic	26%
Tibia/Fibula*	23%
Femur	21%
Ankle/Hindfoot	13%
Tarsal/Metatarsal	7%
Patella	4%
Other	7%

* Excluding ankle/hindfoot

Top 10 Injury Sources of Lower Extremity Fractures (1,754 fractures)

<u>Rank</u>		<u>%</u>
1	Floor (including toe pan)	22.7
2	Knee bolster	17.2
3	Left instrument panel and below	8.3
4	Left side interior surface, excluding hardware or armrests	7.0
5	Foot controls including parking brake	5.6
6	Center instrument panel and below	3.4
7	Right side interior surface, excluding hardware and armrests	3.1
8	Left side hardware or armrest	2.9
9	Glove compartment door	2.2
10	Right instrument panel and below	2.1

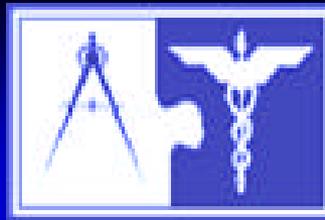


Most Common Injury Source by Fracture Type

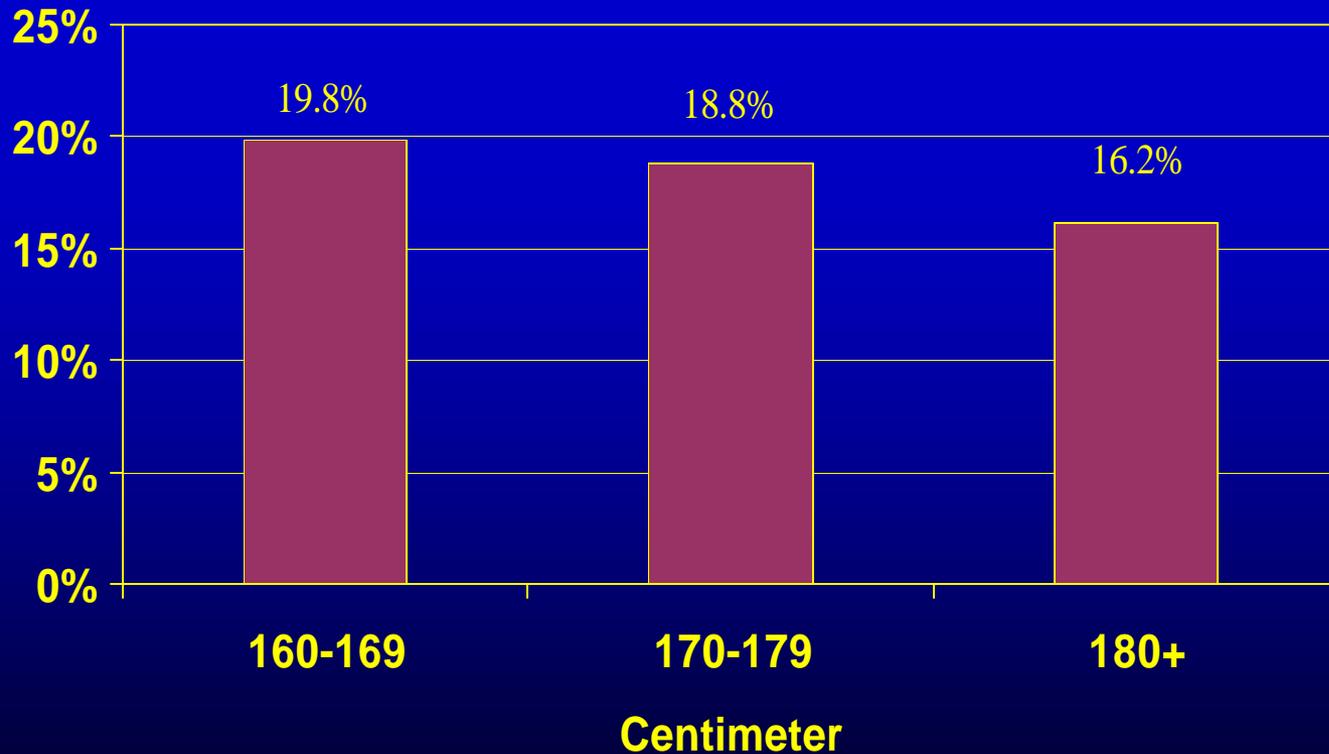
(1,754 fractures)



Rank	Pelvic	Tib/fib	Femur	Ankle/ Hind foot	Tarsal/ Metatarsal	Patella
1	Knee bolster	Floor/ toe pan	Knee bolster	Floor / toe pan	Floor/ toe pan	Knee bolster
2	Left side interior surface	Left instrument Panel	Left instrument Panel	Foot controls	Foot controls	Left instrument Panel
3	Left side hardware or armrest	Knee bolster	Glove comp. door	Non-contact injury source	Unknown injury source	Glove comp. door
4	Right side interior surface	Foot controls	Center instrument panel	Right side interior surface	Non-contact injury source	Steering column
5	Left instrument Panel	Center instrument panel	Right instrument panel	Left instrument panel	Right side interior surface	Center instrument panel



Incidence of Ankle/Hindfoot/Tarsal Fracture by Height (1,345 cases)



**Lower extremity injuries are quite disabling
and have a major impact on quality of life**

Purpose

- To describe pre-injury and long term psychosocial and physical motor vehicle crash

Patient Population

(N = 65)

- Occupant of a vehicle equipped with a modern restraint system
 - Deployed airbag
 - Seatbelt
- Sustained lower extremity injuries in a motor vehicle crash
- Admitted to a Level I trauma center
- Enrolled in the CIREN study and followed up to one year post trauma

Crash Characteristics

(N = 65)

- 91% drivers
 - 69% culpable
- Point of impact
 - 89% frontal
 - 9% lateral
- Restraint use
 - 80% airbag & seatbelt
 - 14% airbag only
 - 5% seatbelt only

Injury Characteristics

(N = 65)

- Lower extremity fractures
 - 56% left fracture
 - 76% right fracture
 - 37% bilateral fractures
 - 55% ankle or foot fracture
- Median Injury Severity Score (ISS) = 12
 - 65% with ≤ 1 FFI
- 28% as a result of fall
- 89% ≤ 14 or 15
- Median length of hospital stay = 7 days

Patient Characteristics

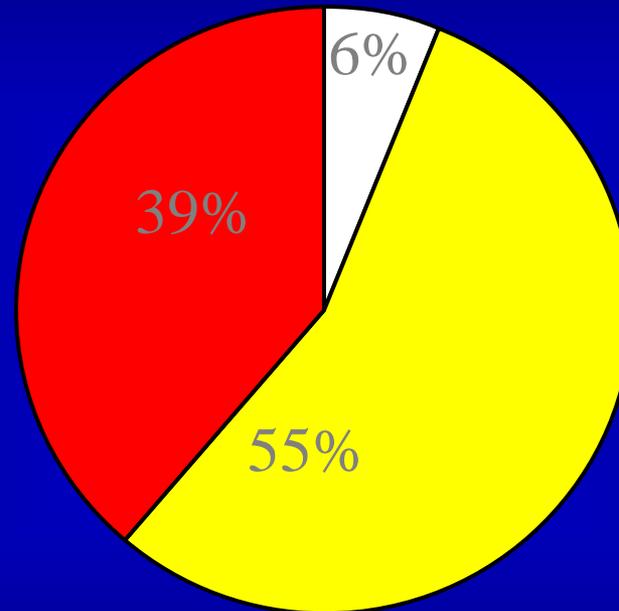
(N = 65)

- Mean age= 39 years
- 63% female
- 89% white
- 51% college educated
- 51% married or living with partner
- 60% full-time employed
- 52% income > \$35,000
- 64% private insurance or HMO

Pre-injury Patient Characteristics (N = 65)

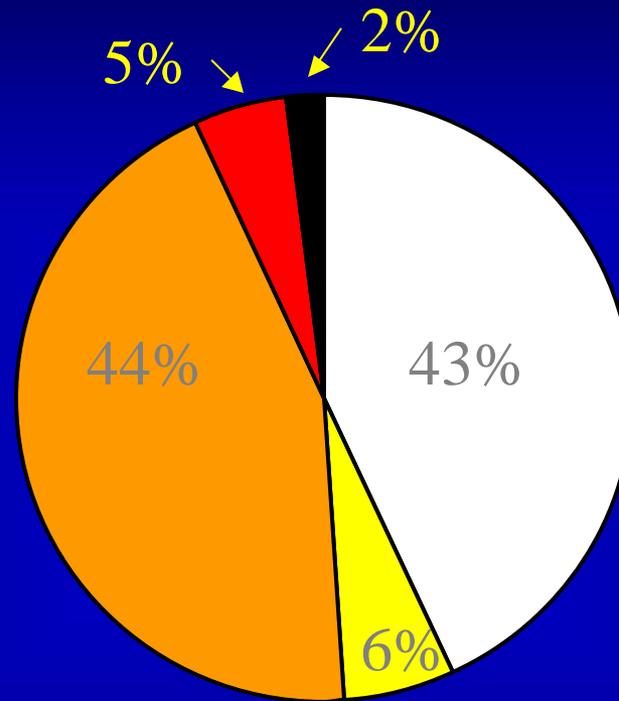
- 52% prior medical condition
 - 44% obese
 - 28% hypertension
 - 18% diabetes
 - 80% on medication
- 26% prior trauma
- 14% prior DWI
- 30% smokers
- 26% positive CAGE (2+)
- 57% recent crisis
 - 51% relocation
 - 49% job loss
 - 32% divorce or break-up
- 40% prior or current depression
 - 35% prior depression
 - 35% on medication

Weight-bearing Status at Discharge



- Fully weight-bearing
- Partially weight-bearing
- Non weight-bearing

Hospital Discharge Disposition



- Home with therapy
- Home without therapy
- Inpatient rehabilitation
- Nursing home
- Expired

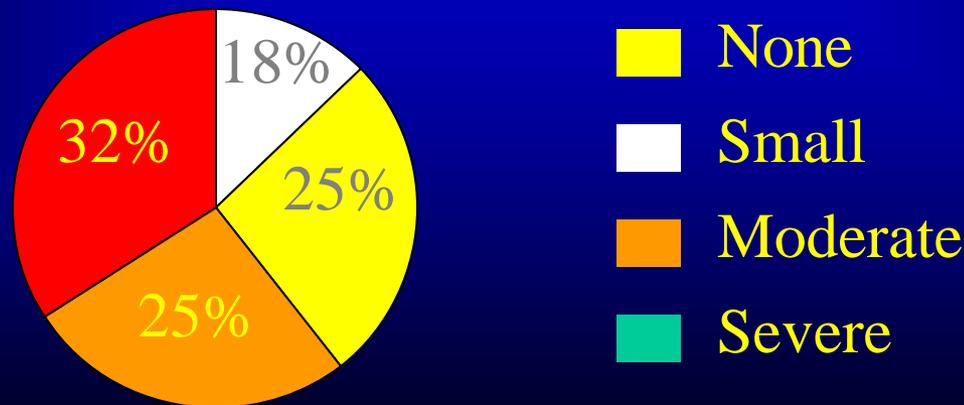
Median Costs and Financial Impact

(N = 65)

- Median costs

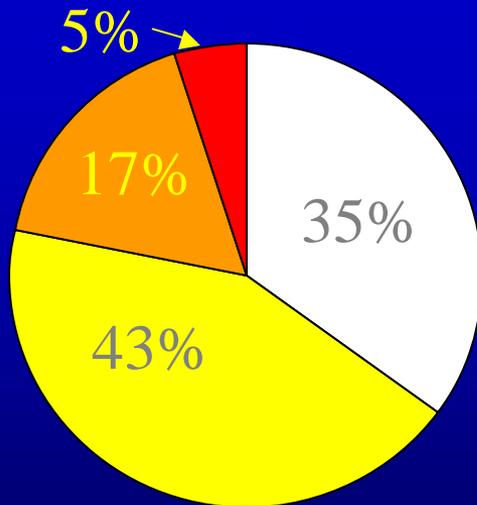
- Hospital & professional \$44,068
- Inpatient rehabilitation \$16,238
- Outpatient rehabilitation \$ 3,500

- Financial impact

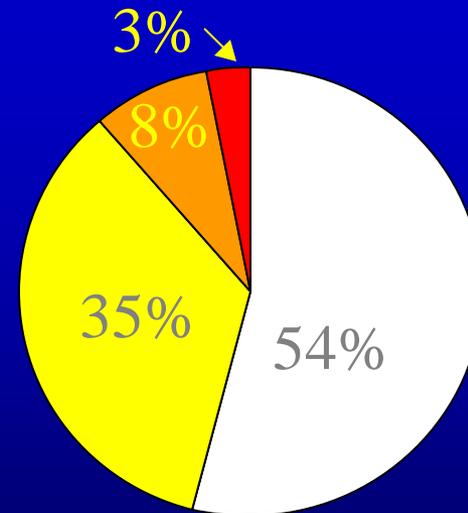


Ambulation

6 months



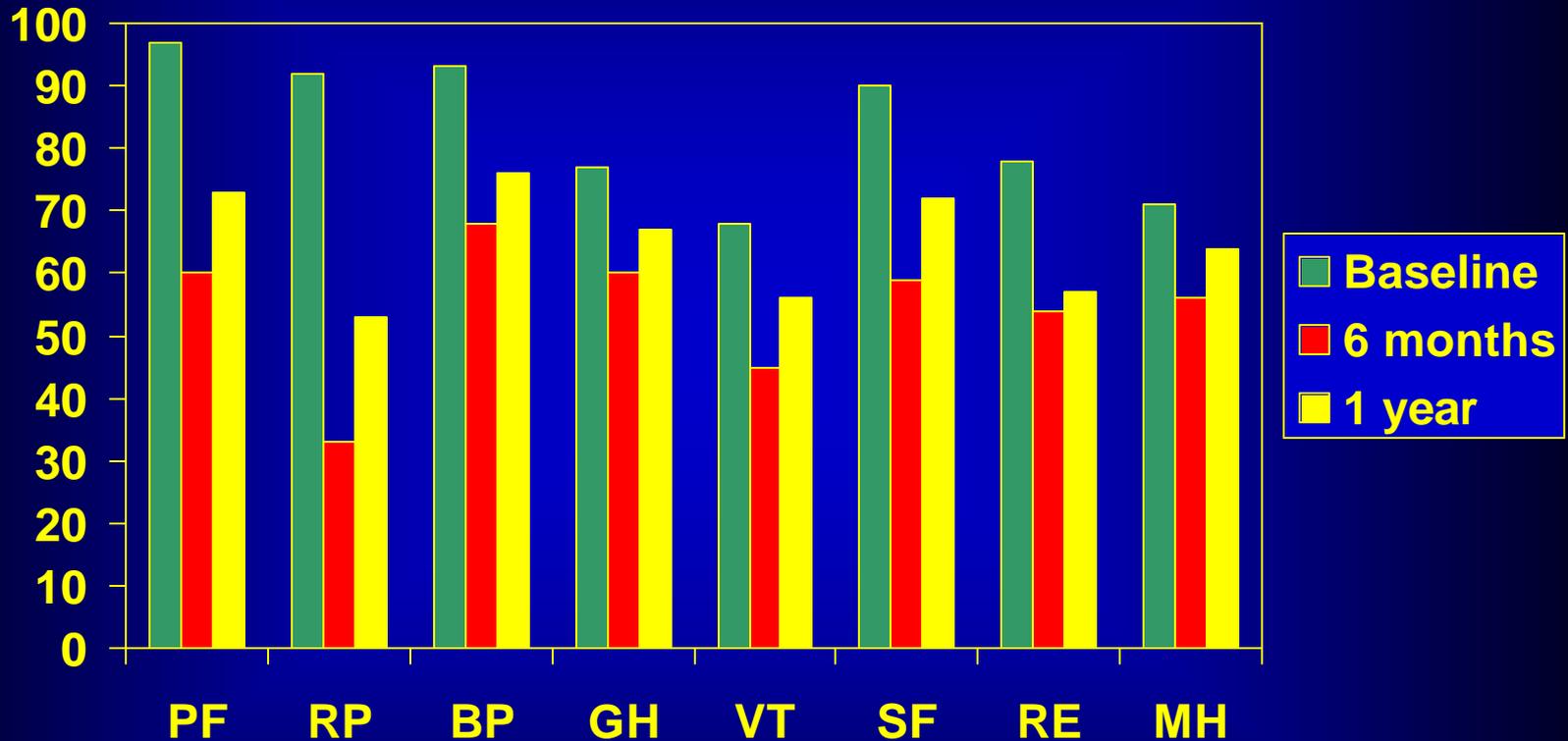
1 year



 No limitations
 With difficulty

 With assistance
 Unable to ambulate

Short Form 36 Health Survey (N = 65)



PF=Physical Functioning, RP=Role Physical, BP=Lack of Bodily Pain,
GH=General Health, VT=Vitality, SF=Social Functioning,
RE=Role Emotional, MH=Mental Health

Ankle/foot Fracture vs. No Ankle/foot Fracture

(N = 65)

	<u>A/F Fracture</u> (N=36)		<u>No A/F Fracture</u> (N=29)	
	n	%	n	%
ISS* < 8	13	36	3	10
9 - 24	20	56	21	73
25 – 75	3	8	5	17
MAIS = 2 for LEI	25	69	17	59

*p<0.05

Ankle/foot Fracture vs. No Ankle/foot Fracture

(N = 65)

	<u>A/F Fracture</u>		<u>No A/F Fracture</u>	
	(N=36)		(N=29)	
	n	%	n	%
Cannot return to driving				
6 months	15	42	6	21
1 year	9	25	4	14
Cannot return to work				
1 year*	8	22	1	3

*p<0.05

Ankle/foot Fracture vs. No Ankle/foot Fracture

(N = 65)

	<u>A/F Fracture</u> (N=36)		<u>No A/F Fracture</u> (N=29)	
	n	%	n	%
Ambulation problems				
6 months*	27	75	15	52
1 year	20	56	10	34
Depressive symptoms				
6 months	20	56	11	38
1 year	14	39	11	38

*p<0.05

Psychosocial Consequences

(N = 65)

	<u>6 months</u>		<u>1 year</u>	
	n	%	n	%
Legal Issues	38	63	21	32
Return to Driving	43	67	52	80
Post Trauma Pain	46	71	33	51
Return to Full-Time Employment*	22	56	27	69
Life-altering	47	72	50	77

*Of those who were employed full-time at baseline

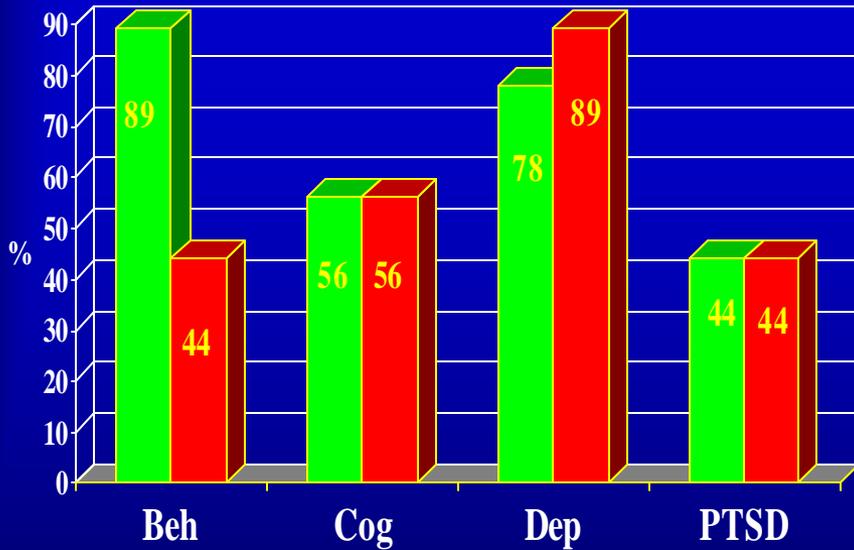
Psychosocial Consequences

(N = 65)

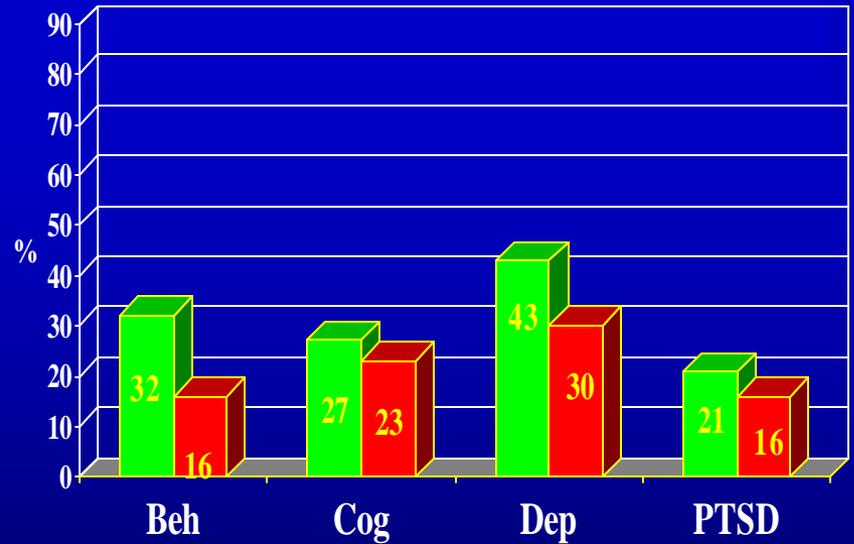
	<u>6 months</u>		<u>1 year</u>	
	n	%	n	%
Behavioral changes	26	40	13	20
Depression	31	48	25	38
Cognitive Problems	20	31	18	28
Cognitive, Depression & Behavioral	10	15	10	15
PTSD	16	25	13	20

Depression

(N = 65)



Pre-injury Depression



No pre-injury depression

6 months

1 year

Summary

- Despite their low ISS scores, lower extremity injuries have significant long-term effects on the individual, the family, and the community
- The significance of these injuries is increasing as more occupants survive high energy collisions
- Data from CIREN can provide information required to prevent lower extremity injuries