Approved 3-11-91
Date

MINUTES OF THE House COMMITTEE ON Transportation.

The meeting was called to order by Representative Herman G. Dillon at
Chairperson

1:34 ~~a~~.m./p.m. on February 21, 1991 in room 519-S of the Capitol.

All members were present ~~except~~ XXXXX

Committee staff present:
Hank Avila - Legislative Research
Tom Severn - Legislative Research
Bruce Kinzie - Revisor of Statutes

Conferees appearing before the committee:
Representative Al Ramirez
Ed Klumpp - Kansans for Highway Safety
Andrea Ramsey - Lawyer, Wichita, Ks
Dan Lykins - Ks. Head Injury Assoc.
Donovan Lee - Ks. Rehabilitation Hospital Coordinator of Head Injuries
Paula Marmet - Health and Environment
Sgt. Walker - Topeka Police
Wayne Curtin - V-President of Government Relations Motorcycle Riders Foundation
Jacque Sue - ABATE

Joe Dick - Director of Motor Vehicles

The meeting was called to order by Chairman, Herman G. Dillon.

Chairman Dillon introduced Joe Dick, Director of Vehicles in regard to bill requests. He stated he had five (5) bill requests. They are the following:

1- Concerning the registration of antique vehicles
2- Relating to driver's licenses; extending the period for suspensions and revocations under certain circumstances.
3- Concerning driver's licenses; requiring licensee to provide a mailing address in addition to a residence address.
4- Concerning notice of security interest.
5- Amending the vehicle dealers and manufacturers licensing act.

Representative McKechnie moved for the request of Joe Dick's Committee Bills. Representative Freeman seconded it. Motion carried.

Chairman Dillon recognized Representative Everhart for bill request. Representative Everhart's request was relating to driver's licenses and instructional permits; concerning the age of the applicants.

Representative Shallenburger moved the motion and Representative Bryant seconded Representative Everhart's request. Motion carried.

Chairman Dillon recognized Representative Crowell in regards to a bill request. Representative Crowell's request was an act relating to property taxation; providing for the valuation of travel trailers.

Representative Crowell moved the motion and Representative

Shallenburger seconded Representative Crowell's request. Motion carried.

Chairman Dillon recognized Representative Shallenburger in regard to a bill request. Representative Shallenburger's request was an act relating to drivers' licenses; providing an extension for renewal for certain persons.

Representative McKechnie moved the motion and Representative Freeman seconded Representative Shallenburger's request. Motion carried.

Chairman Dillon explained this was the last day for Committee Bill requests beings we were not meeting Monday, February 25, 1991, which is the deadline for introduction of Committee Bills.

Discussion and questions followed.

Representative McKechnie made motion to reserve a slot for Representative Hamilton's bill request regarding auxiliary driving lamps. Representative Shallenburger seconded the motion. Motion carried.

Discussion and questions followed.

HB 2129 An act concerning motorcycles and motorized bicycles; relating to equipment required for operators and riders.

Chairman Dillon introduced Representative Al Ramirez who testified in support of HB 2129. (Attachment 1)

Chairman Dillon introduced Ed Klumpp who testified in support of HB 2129. (Attachment 2)

Questions and discussion followed.

Chairman Dillon introduced Andrea Ramsey who testified in support of HB 2129. (Attachment 3)

Questions and discussion followed.

Chairman Dillon introduced Dan Lykins who testified in support of HB 2129. (Attachment 4)

Questions and discussion followed.

Chairman Dillon introduced Donovan Lee who testified in support of HB 2129. (Attachment 5)

Questions and discussion followed.

Chairman Dillon introduced Paula Marmet who testified in support of HB 2129 (Attachment 6)

Questions and discussion followed.

Chairman Dillon introduced Sgt. Walker who testified in support of HB 2129. (Attachment 7)

Questions and discussion followed.

Chairman Dillon introduced Wayne Curtin who testified in opposition of HB 2129. (Attachment 8)

Questions and discussion followed.

Chairman Dillon introduced Jacque Sue who testified in opposition of HB 2129. (Attachment 9)

Hearing on HB 2129 ended, due to time and Chairman Dillon announced the Hearing would continue on Tuesday, February 26, 1991.

Meeting adjourned at 3:20 p.m.

GUEST LIST

COMMITTEE: HOUSE TRANSPORTATION COMMITTEE DATE: 2-21-91

NAME (PLEASE PRINT)	ADDRESS	COMPANY/ORGANIZATION
Andrea Ramsay	727 S. Edgemoor Wichita Ks.	Attorney
Lisa McLaury	5105 Nebraska Apt. A KCKS 66102	ABATE of Ks Dist. 5
Kristie K. Koelzer	2821 N. 43rd KCK 66104	ABATE of Ks Dist #5
Gina Murphy	15 S. 19th St. Kansas City, Ks. 66102	ABATE of Ks. Dist. #5
Jeff Foster	15 S. 19th KCKS 66102	ABATE of Ks Dist #5
LEONARD Koci	4823 SW 19th Topeka Ks.	ABATE of Ks. Dist 4
DONOVAN LEE	1504 S.W. 8th St Topeka, Ks 66606	Kansas Rehab. Hosp
STEVE BLYTHE	R2 Box 95 Council Grove Ks 66846	Farmer-Stockman
WAYNE CURTIN	P.O. Box 1808 Washington DC 20013	Motorcycle Riders Foundation
[illegible] Walters	3417 W. 10th Pl Lawrence Ks 66049	ABATE of Kansas Dist 1
R.W. Wright	RR#1 Box 162D Lawrence Ks 66044	ABATE of Ks Dist #1
BRIAN HARRIS	1003 North Cedar Ottawa, Ks 66067	ABATE of Ks Dist #1
Dan Cochran	805 N. Cherry Ottawa 66067	Franklin Co. Ind. Bikers.
BOB BLACK	736 So SYCAMORE OTTAWA, KS 66067	FRANKLIN COUNTY INDEPENDENT BIKERS
Tommy J. Slogle	P.O. Box 1846 MANHATTAN KS 66502	ABATE 15
Jim Schkeif	7355 Lost Creek Rd Belvue KS 66407	ABate Dist #15
RANDY HATCH	930 KEARNEY MANHATTAN KS 66502	ABATE DIST. 15 M.R.F.
Don Wurtenberger	8974 Rene Lenexa Ks 66215	ABATE Dist #5
mike Kashkin	1908 E. 19th Lot W-51 Lawrence, Kansas 66046	ABATE District 1
KENNETH M McNEILL	PO 850 ELM PERRY KS	ABATE OF KS.
Dave Mann	Box 308 McLouth, Ks	ABATE of KS.
[illegible] Marmet	Topeka	KDHE
[illegible]	Wichita	ABATE Dist 3
[illegible]	[illegible]	
John TENNYSON	KANSAS CITY	INTERNATIONAL CYCLE PARTS & ABATE DIST 5

GUEST LIST

COMMITTEE: HOUSE TRANSPORTATION COMMITTEE DATE: 2-21-91

NAME (PLEASE PRINT)	ADDRESS	COMPANY/ORGANIZATION
John Cools	HCI Box 131 Oakley KS 67748	Tri State Coalition of Concerned Motorcyclists
Linda Keith	706 Center Goodland, KS 67735	TSCCM
CASEY QUINT	Box 31 Cheyenne Wells Co 80810	Tri State Coalition
David Mitchell	1443 Wildcat Crk. Rd. Manhattan, Ks. 66502	Blue Valley Riders M/C 40 members
Brett Wilson	26 S 11 KCKS 66102	ABATE of KS
Steve Wilson	26 South 11th Kansas City Ks 66102	ABATE of KS Dist #5
Edna Bossella	7047 Leavenworth Rd. K.C. Ks. 66109	ABATE
Joan T Ryan	2011 S. 14th KCK 66103	AMA MSF-FORR KOG-ABATE of Ks
Russell Willbourn	Topeka	KDOT
Ken Stodgell	Topeka	KDOT
E. R. Kimber	1504 Central Ave KCK 66102	Abate + East Coast Als
Lisa Johnson	621 Sherman Olathe, KS 66061	Abate of KS
Mike Johnson	621 SHERMAN OLATHE KS 66061	ABATE of KS
JUAN A MAREZ	828 WILLOW ST	OTTAWA. BESTHETES-MC
HARRY HAMMER	Russell KS	
Victor E Paff	RR#6 Topeka, KS 66604	A.B.A.T.E. of KS
Charlene Aubert	9540 NW 13th Topeka	ABATE of KS Dist. 4
Charles A Aubert	9540 NW 13th Topeka	Abate of KS.
Cheryl K. Hawk	5780 Richards Circle Shawnee KS	Abate of KS
Jerry Thomas	2824 W. Casado Wichita, KS 67217	ABATE of KS Motorcycle Riders Foundation
Joy Ginsburg	2900 W. 26th A-5 Lawrence, KS. 66047	Donna Whiteman
Ed Kumpf	4339 SE 21 Topeka Ks.	Kansans for Highway Safety
CHARLIE WALKER	TOPEKA, KS	TOPEKA PD

STATE OF KANSAS

AL RAMIREZ
REPRESENTATIVE, FORTIETH DISTRICT
LEAVENWORTH AND WYANDOTTE COUNTIES
913 SHEIDLEY
BONNER SPRINGS, KANSAS 66012

TOPEKA

HOUSE OF
REPRESENTATIVES

COMMITTEE ASSIGNMENTS
RANKING MINORITY MEMBER: GOVERNMENTAL ORGANIZATION
MEMBER: EDUCATION
FEDERAL AND STATE AFFAIRS

TO: THE HOUSE TRANSPORTATION COMMITTEE

FROM: AL RAMIREZ, STATE REPRESENTATIVE 40th DISTRICT

DATE: FEBRUARY 21, 1991

SUBJECT: HELMET LAW HB-2129

Mr. Chairman and Members of the Committee:

Thank you for allowing us the opportunity to visit with you regarding H.B. 2129.

The proposed legislation would amend Sec. 1-K.S.A. 8-1598 by new language (a) No person shall operate or ride upon a motorcycle or a motorized bicycle unless wearing a helmet which complies with minimum performance requirements established by the national highway traffic safety administration pursuant to the national traffic and motor vehicle safety act of 1966 for helmets designed for use by motorcyclists and other motor vehicle users.

In the interest of the well being and safety of our citizens, I, along with some of my colleagues have introduced this proposed legislation.

Having researched reports on the number of persons killed and injured beginning with 1984 through 1989, it is clear the great majority were over 19 years of age.

Opponents to this legislation will undoubtedly state that we will be taking away their rights, however motorcycle riding is a privilege granted by the state, not a right. Complying with lawfully enacted safety regulations and laws is a condition which the state rightfully imposes upon that privilege.

House Transportation
2-21-91
ATTACHMENT 1-1

Mr. Chairman, due to the number of conferees wishing to address this proposed legislation and our limited time I would be happy to stand for questions.

1984

NUMBER OF PERSONS KILLED AND INJURED

AGE OF CASUALTY	Number of Persons			Pedestrians			Bicyclists			Motorcycle			Drivers			Passengers		
	TOTAL	KILLED	INJURED	TOTAL	KILLED	INJURED	TOTAL	KILLED	INJURED	TOTAL	KILLED	INJURED	TOTAL	KILLED	INJURED	TOTAL	KILLED	INJURED
0 to 4	902	5	897	70	3	67	9	0	9	0	0	0	0	0	0	823	2	821
5 to 9	1,137	12	1,125	129	4	125	114	2	112	0	0	0	0	0	0	894	6	888
10 to 14	1,640	28	1,612	80	2	78	157	2	155	53	3	50	394	12	382	956	9	947
15 to 19	5,883	66	5,817	98	4	94	81	1	80	362	4	358	3,132	25	3,107	2,210	32	2,178
20 to 24	5,867	88	5,779	81	9	72	49	0	49	542	15	527	3,732	47	3,685	1,463	17	1,446
25 to 34	6,973	104	6,869	105	6	99	42	1	41	437	15	422	5,008	67	4,941	1,381	15	1,366
35 to 44	3,510	54	3,456	50	4	46	14	0	14	140	3	137	2,626	37	2,589	680	10	670
45 to 54	2,193	44	2,149	36	1	35	5	0	5	63	6	57	1,604	31	1,573	485	6	479
55 to 64	1,783	32	1,751	39	1	38	1	0	1	25	1	24	1,297	20	1,277	421	10	411
65 to 74	1,283	36	1,247	32	3	29	3	0	3	13	0	13	883	18	865	352	15	337
75 & Older	866	40	826	24	7	17	1	0	1	0	0	0	537	20	517	304	13	291
Not Stated	785	1	784	14	0	14	14	0	14	106	0	106	218	1	217	433	0	433
Totals	32,822	510	32,312	758	44	714	490	6	484	1,741	47	1,694	19,431	278	19,153	10,402	135	10,267

RELATIONSHIP TO JCT.

		Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
R	Intersection	3,225	55	1,060	2,110
U	Intersection-Related	2,065	20	683	1,362
R	Driveway Access	1,546	9	386	1,151
A	Non-Junction	17,031	239	5,012	11,780
L	Total Rural	23,867	323	7,141	16,403
U	Intersection	14,720	29	5,322	9,369
R	Intersection-Related	7,324	14	2,383	4,927
B	Driveway Access	5,343	6	1,318	4,019
A	Non-Junction	18,525	80	5,435	13,010
N	Total Urban	45,912	129	14,458	31,325
	Total Rural - Urban	69,779	452	21,599	47,728

Approx 85% over 19 — 76% over 19

Traffic Control	Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
Stop sign	3,838	16	1,080	2,742
Signals or flashers	8,787	13	3,078	5,696
RR gates-signals	264	11	95	158
Warning signs	224	2	81	141
Centerline-edge mark	24,162	227	8,573	15,362
No-passing zone	1,889	49	760	1,080
No control present	28,345	134	7,428	20,783
Control not operating	194	0	49	145
Control not stated	2,076	0	455	1,621
Total	69,779	452	21,599	47,728

Manner of Two Motor Vehicle Collison	Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
Head On	1,789	57	789	943
Rear End	13,023	35	4,691	8,297
Angle	20,538	91	6,487	13,960
Sideswipe-Meeting	2,463	8	457	1,998
Sideswipe-Passing	4,559	7	518	4,034
Backed into	3,569	0	111	3,458
Not stated	23,838	254	8,546	15,038
Total	69,779	452	21,599	47,728

PEDESTRAIN ACCIDENTS	All Ped. Acc.	Fatal Acc.			Non-Fatal Injury Acc.		
		Drive-Way	Inter-Section	Non Inter-Section	Drive-Way	Inter-Section	Non Inter-Section
Car going straight	433	0	6	32	25	90	290
Car turning right	28				3	24	1
Car turning left	32				2	29	1
Car backing	29				10	4	15
All others	98				4	19	75
Not stated							
Totals	630	0	6	32	44	166	382

PEDESTRIAN ACTIONS	Pedestrians Killed	Ages of Pedestrians Killed and Injured								
		Total	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 44	45 to 64	65 & Older	Not Stated
Crossing at Intersection	4	126	4	14	17	12	13	29	19	18	
Same - not at Intersection	10	240	11	85	22	21	13	25	14	11	

NUMBER OF PERSONS KILLED AND INJURED 1985

AGE OF CASUALTY	Number of Persons TOTAL	KILLED	INJURED	Pedestrians TOTAL	KILLED	INJURED	Bicyclists TOTAL	KILLED	INJURED	Motorcycle TOTAL	KILLED	INJURED	Drivers TOTAL	KILLED	INJURED	Passengers TOTAL	KILLED	INJURED
0 to 4	930	18	912	47	4	43	2	0	2	0	0	0	0	0	0	881	14	
5 to 9	1,131	12	1,119	125	2	123	66	1	65	0	0	0	0	0	0	940	9	931
10 to 14	1,363	8	1,355	95	0	95	132	2	130	49	1	48	96	1	95	991	4	987
15 to 19	6,361	73	6,288	80	4	76	64	0	64	308	3	305	3,516	40	3,476	2,393	26	2,367
20 to 24	5,793	81	5,712	63	4	59	40	0	40	439	8	431	3,768	50	3,718	1,483	19	1,464
25 to 34	7,047	94	6,953	93	5	88	28	1	27	444	11	433	5,087	60	5,027	1,395	17	1,378
35 to 44	3,586	38	3,548	50	1	49	9	1	8	139	3	136	2,654	26	2,628	734	7	727
45 to 54	2,137	45	2,092	35	3	32	4	0	4	55	2	53	1,572	36	1,536	471	4	467
55 to 64	1,855	30	1,825	39	4	35	5	0	5	29	2	27	1,348	18	1,330	434	6	428
65 to 74	1,260	42	1,218	19	5	14	1	0	1	5	1	4	840	26	814	395	10	385
75 & Older	845	40	805	17	4	13	1	0	1	4	1	3	527	20	507	296	15	281
Not Stated	1,403	5	1,398	12	0	12	6	0	6	12	0	12	430	3	427	943	2	941
Totals	33,711	486	33,225	675	36	639	358	5	353	1,484	32	1,452	19,838	280	19,558	11,356	133	11,223

13% 37% over 19 — 75% over 19

RELATIONSHIP TO JCT.

		Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
R	Intersection	3,131	44	1,036	2,051
U	Intersection-Related	2,238	18	658	1,562
R	Driveway Access	1,560	12	389	1,159
A	Non-Junction	16,786	225	4,808	11,753
L	Total Rural	23,715	299	6,891	16,525
U	Intersection	15,641	32	5,506	10,103
R	Intersection-Related	8,332	10	2,525	5,797
B	Driveway Access	5,883	5	1,506	4,372
A	Non-Junction	19,112	83	5,479	13,550
N	Total Urban	48,968	130	15,016	33,822
	Total Rural - Urban	72,683	429	27,907	50,347

Traffic Control

	Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
Stop sign	4,043	13	1,067	2,963
Signals or flashers	9,369	19	3,292	6,058
RR gates-signals	276	8	80	188
Warning signs	235	2	84	149
Centerline-edge mark	24,987	209	8,601	16,177
No-passing zone	2,025	34	789	1,202
No control present	30,448	144	7,659	22,645
Control not operating	199	0	52	147
Other control present	52	0	18	34
Control not stated	1,049	0	265	784
Total	72,683	429	21,907	50,347

Manner of Two Motor Vehicle Collison

	Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
Head On	2,182	69	918	1,195
Rear End	14,340	21	5,048	9,271
Angle	23,019	98	6,962	15,959
Sideswipe-Meeting	2,676	11	453	2,212
Sideswipe-Passing	4,609	7	491	4,111
Backed into	3,525	0	108	3,417
Not stated	1,712	2	532	1,178
Total	52,063	208	14,512	37,343

PEDESTRAIN ACCIDENTS

	All Ped. Acc.	Fatal Acc. Drive-Way	Fatal Acc. Inter-Section	Fatal Acc. Non Inter-Section	Non-Fatal Injury Acc. Drive-Way	Non-Fatal Injury Acc. Inter-Section	Non-Fatal Injury Acc. Non Inter-Section
Car going straight	429	1	2	27	18	102	279
Car turning right	26				4	21	1
Car turning left	37	0	1	0	1	34	1
Car backing	16				5	0	11
All others	39	0	0	1	2	7	29
Not stated							
Totals	547	1	3	28	30	164	321

PEDESTRIAN ACTIONS

	Pedestrians Killed	Ages of Pedestrians Killed and Injured: Total	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 44	45 to 64	65 & Older	Not Stated
Crossing at Intersection	1	140	2	23	28	8	11	26	23	15	4
Same - not at Intersection	13	222	28	73	27	25	18	26	15	9	1
Walking; Standing in roadway	10	142	7	17	17	19	17	42	15	3	5
Playing in roadway	1	12	6	2	4	0	0	0	0	0	0

1986

NUMBER OF PERSONS KILLED AND INJURED

AGE OF CASUALTY	Number of Persons TOTAL	KILLED	INJURED	Pedestrians TOTAL	KILLED	INJURED	Bicyclists TOTAL	KILLED	INJURED	Motorcyclists TOTAL	KILLED	INJURED	Drivers TOTAL	KILLED	INJURED	Passengers TOTAL	KILLED	INJURED
0 to 4	875	9	866	46	0	46	13	0	13	3	0	3	3	0	3	810	9	801
5 to 9	1,162	14	1,148	147	3	144	142	0	142	12	0	12	1	0	1	860	11	849
10 to 14	1,398	16	1,382	93	3	90	197	2	195	92	2	90	90	3	87	926	6	920
15 to 19	6,637	85	6,552	76	3	73	92	0	92	390	12	378	3,648	35	3,613	2,432	35	2,396
20 to 24	5,452	77	5,375	59	7	52	57	0	57	470	6	464	3,491	43	3,448	1,377	21	1,354
25 to 34	6,903	105	6,798	109	5	104	50	0	50	447	14	433	4,928	71	4,857	1,371	15	1,354
35 to 44	3,687	49	3,638	54	6	48	19	0	19	165	0	165	2,750	38	2,712	699	5	694
45 to 54	2,084	39	2,045	34	2	32	8	0	8	55	1	54	1,565	27	1,538	422	9	413
55 to 64	1,758	40	1,718	26	3	23	8	1	7	30	2	28	1,248	25	1,223	447	9	437
65 to 74	1,279	34	1,245	19	5	14	4	0	4	12	1	11	875	24	851	369	4	365
75 & Older	928	31	897	32	4	28	1	0	1	3	0	3	576	16	560	316	11	305
Not Stated	487	1	486	14	0	14	12	0	12	15	0	15	91	1	90	355	0	355
Totals	32,650	500	32,150	709	41	668	603	3	600	1,694	38	1,656	19,266	283	18,983	10,384	135	10,243

63% over 19

71% over 19

RELATIONSHIP TO JCT.

		Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
R	Intersection	2,760	48	1,048	1,664
U	Intersection-Related	1,659	11	611	1,037
R	Driveway Access	1,234	11	392	831
A	Non-Junction	14,085	235	4,315	9,535
L	Total Rural	19,738	305	6,366	13,067
U	Intersection	14,674	18	5,542	9,114
R	Intersection-Related	6,760	14	2,435	4,311
B	Driveway Access	5,228	8	1,478	3,742
A	Non-Junction	15,584	68	5,154	10,362
N	Total Urban	42,246	108	14,609	27,529
	Total Rural - Urban	61,984	413	20,975	40,596

Traffic Control

	Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
Stop sign	3,436	12	1,082	2,342
Signals or flashers	8,303	8	3,223	5,072
RR gates-signals	195	12	57	126
Warning signs	194	3	89	102
Centerline-edge mark	22,315	212	8,088	14,015
No-passing zone	1,774	47	663	1,064
No control present	25,140	116	7,578	17,446
Control not operating	151	0	45	106
Other control present	48	2	13	33
Control not stated	428	1	137	290
Total	61,984	413	20,975	40,596

Manner of Two Motor Vehicle Collison

	Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
Head On	1,480	59	669	752
Rear End	12,615	25	5,086	7,504
Angle	20,149	91	6,725	13,333
Sideswipe-Meeting	1,975	9	409	1,557
Sideswipe-Passing	3,825	4	494	3,327
Backed into	2,607	0	98	2,509
Not stated	878	3	261	614
Total	43,529	191	13,742	29,596

	Total	Fatal Acc.	Injury Acc.	Killed	Injured
Day Accidents	41,325	202	13,849	254	21,299
Night Accidents	20,659	211	7,126	246	10,851
Alcohol Related	4,759	182	2,551	224	4,234
Teenage Accidents	16,852	88	6,175	106	9,915
Motorcycle/MoPed	1,644	37	1,412	43	1,783
Trucks/State System	1,706	55	549	69	833
School Bus Accidents	151	0	31	0	53
Single Vehicle	13,256	169	5,909	186	7,930

5-1

PEDESTRIAN ACTIONS

	Pedestrians Killed	Ages of Pedestrians Killed and Injured: Total	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 44	45 to 64	65 & Older	Not Stated
Crossing at Intersection	4	128	2	22	18	10	6	26	20	22	2
Same - not at Intersection	11	266	29	86	44	24	20	29	16	14	4

1987

NUMBER OF PERSONS KILLED AND INJURED

AGE OF CASUALTY	Number of Persons TOTAL	KILLED	INJURED	Pedestrians TOTAL	KILLED	INJURED	Bicyclists TOTAL	KILLED	INJURED	Motorcyclists TOTAL	KILLED	INJURED	Drivers TOTAL	KILLED	INJURED	Passengers TOTAL	KILLED	INJURED
0 to 4	847	13	834	65	1	64	11	1	10	0	0	0	0	0	0	771	11	760
5 to 9	1,175	13	1,162	140	1	139	154	1	153	0	0	0	3	1	2	878	10	868
10 to 14	1,423	14	1,409	93	2	91	200	1	199	56	0	56	80	4	76	994	7	987
15 to 19	6,845	80	6,765	93	4	89	103	0	103	311	5	306	3,802	47	3,755	2,536	24	2,512
20 to 24	5,145	84	5,061	59	2	57	50	1	49	361	15	346	3,384	42	3,342	1,291	24	1,267
25 to 34	7,025	107	6,918	109	3	106	45	1	44	402	11	391	5,119	71	5,048	1,350	21	1,329
35 to 44	3,743	42	3,701	57	4	53	27	1	26	152	4	148	2,827	23	2,804	680	10	670
45 to 54	2,093	29	2,064	30	0	30	10	0	10	35	0	35	1,557	23	1,534	461	6	455
55 to 64	1,750	39	1,711	22	1	21	5	0	5	22	0	22	1,286	33	1,253	415	5	410
65 to 74	1,263	28	1,235	28	3	25	7	0	7	8	0	8	857	22	835	363	3	360
75 & Older	894	41	853	22	4	18	5	0	5	2	0	2	592	22	570	273	15	258
Not Stated	477	1	476	21	0	21	13	0	13	10	0	10	103	1	102	330	0	330
Totals	32,680	491	32,189	739	25	714	630	6	624	1,359	35	1,324	19,610	289	19,321	10,342	136	10,206

RELATIONSHIP TO JCT.

		Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
R	Intersection	2,981	43	1,046	1,892
U	Intersection-Related	1,422	11	497	914
R	Driveway Access	1,296	12	366	918
A	Non-Junction	14,804	236	4,452	10,116
L	Total Rural	20,503	302	6,361	13,840
U	Intersection	14,596	25	5624	8,947
R	Intersection-Related	7,244	13	2,665	4,566
B	Driveway Access	5,575	8	1,557	4,010
A	Non-Junction	16,513	67	5,375	11,071
N	Total Urban	43,928	113	15,221	28,594
	Total Rural - Urban	64,431	415	21,582	42,434

Traffic Control

	Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
Stop sign	3,473	8	1,123	2,342
Signals or flashers	8,537	16	3,253	5,268
RR gates-signals	196	12	66	118
Warning signs	196	4	77	115
Centerline-edge mark	24,211	233	8,688	15,290
No-passing zone	1,690	33	667	990
No control present	25,934	105	7,653	18,176
Control not operating	168	0	49	119
Other control present	19	3	3	13
Control not stated	7	1	3	3
Total	66,431	415	21,582	42,434

Manner of Two Motor Vehicle Collison

	Total	Fatal Acc.	Injury Acc.	Property Damage Acc.
Head On	1,658	51	755	852
Rear End	13,536	24	5,364	8,148
Angle	21,083	88	6,906	14,089
Sideswipe-Meeting	1,863	16	374	1,473
Sideswipe-Passing	3,728	4	478	3,246
Backed into	2,675	0	120	2,555
Not stated	24	1	7	16
Total	44,567	184	14,004	30,379

	Total	Fatal Acc.	Injury Acc.	Killed	Injured
Day Accidents	43,804	204	14,475	248	21,788
Night Accidents	20,627	211	7,107	243	10,401
Alcohol Related	4,559	182	2,459	214	3,955
Teenage Accidents	17,725	96	6,465	120	10,219
Motorcycle/MoPed	1,534	35	1,316	42	1,638
Trucks/State System	1,643	56	503	82	728
School Bus Accidents	192	7	48	8	131
Single Vehicle	14,173	184	6,107	198	8,102

PEDESTRIAN ACTIONS

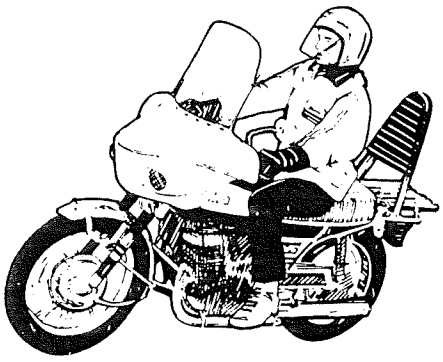
	Pedestrians Killed	Ages of Pedestrians Killed and Injured: Total	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 44	45 to 64	65 & Older	Not Stated
Crossing at Intersection	4	134	3	21	20	11	11	31	10	24	3
Same - not at Intersection	6	265	40	87	36	24	15	34	17	8	4
Walking; Standing in roadway	5	126	5	8	16	25	9	41	9	6	7
Playing in roadway	0	21	8	7	5	0	1	0	0	0	0
Other in roadway	8	106	6	8	8	20	15	34	9	4	2
Not in roadway	1	60	1	8	7	5	7	22	5	4	1

MOTORCYCLE STATISTICS

MOTORCYCLE RIDERS (Includes Motor Scooters)

AGE	FATALITIES	INJURIES
UNKNOWN	0	7
01 - 14	2	48
15 - 19	6	292
20 - 24	7	327
25 - 29	5	173
30 - 34	5	128
35 - 39	2	86
40 - 44	3	58
45 - 49	0	23
50 - 54	1	24
55 - 59	0	13
60 - 64	1	8
65 - 69	0	1
70 - 74	0	1
75 - OVER	0	2
TOTAL	32	1191

75% 19 71%



The overall number of motorcycle accidents is low, but almost all of these collisions result in injury.

MOTORCYCLE ACCIDENTS

Type of Accident (Vehicles Involved)	Number of Accidents	Number of Driver Fatalities	Number of Driver Injuries
Motorcycle only	592	14	528
Auto, motorcycle	590	9	491
Truck, motorcycle	141	5	116
Other, motorcycle	1	0	1
2 or more vehicles, motorcycle	28	2	18
2 motorcycles	25	1	36
Auto, 2 motorcycles	2	1	1
Total	1379	32	1191

77%

1-7

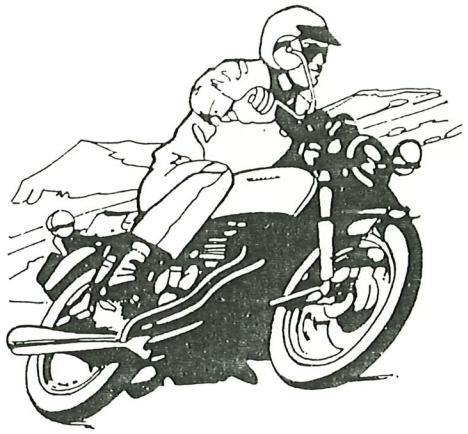
MOTORCYCLE STATISTICS

MOTORCYCLE RIDERS (Includes Motor Scooters)

AGE	FATALITIES	INJURIES
UNKNOWN	4	11
01 - 14	0	26
15 - 19	4	246
20 - 24	5	306
25 - 29	7	182
30 - 34	2	134
35 - 39	1	86
40 - 44	2	51
45 - 49	2	31
50 - 54	0	26
55 - 59	0	9
60 - 64	0	8
65 - 69	0	3
70 - 74	0	7
75 AND OVER	0	2
TOTAL	27	1128

83% 75%

The overall number of motorcycle accidents is low, but almost all of these collisions result in injury.



MOTORCYCLE ACCIDENTS

Type of Accident (Vehicles Involved)	Number of Accidents	Number of Rider Fatalities	Number of Rider Injuries
UNKNOWN	0	4	7
MOTORCYCLE ONLY	542	7	487
2 OR MORE MOTORCYCLES	16	1	25
AUTO, MOTORCYCLE	255	3	218
TRUCK,MOTORCYCLE	138	7	117
OTHER,MOTORCYCLE	3	1	2
2 OR MORE VEHICLES, MOTORCYCLE	311	4	262
AUTO, 2 MOTORCYCLES	6	0	8
>=2 VEHICLES,>=2 MOTORCYCLES	1	0	2
TOTAL	1272	27	1128

Kansans for Highway Safety

FEBRUARY 20, 1991

TESTIMONY BEFORE THE HOUSE TRANSPORTATION COMMITTEE
REFERENCE HOUSE BILL NO. 2129
HELMET USE BY MOTORCYCLISTS

The issue of mandatory helmet use by motorcyclist is a very difficult issue. Many equate it to interfering with the basic rights of an individual saying that non-use only effects the motorcycle operator and no one else. Obviously the best way to reduce head injuries in any class of motor vehicle accident is to eliminate the accident. It is also true that the majority of motorcycle accidents are caused by the drivers of other motor vehicles not seeing the cyclist and either turning in front of the cycle or pulling out in front of the cyclist. Let there be no doubt about it that a motor cycle helmet will not prevent the accident from happening. Some will even try to convince us that a helmet will even make an accident more likely to happen. We strongly disagree with this assessment of the helmet causing accidents. National studies show that helmet use increases to a near 100% level when the law requires helmet use. Studies also show that between 1966 and 1969 when helmet laws were passed in 40 states the fatality rate per 10,000 motorcycles registered dramatically dropped. From 1976 to 1979 when 27 states repealed their helmet laws the fatality rate per 10,000 motorcycles increased dramatically. (See graph on page 2 of attached document.) There is little doubt that once an accident occurs the helmet will prevent many fatal head injuries and many injuries with lifelong consequences.

Kansas currently has a helmet law that requires those under 18 years of age to wear a helmet. However, nationally over 90% of the fatalities have been older than 18. Another national study shows that just under 40% of all motorcycle fatalities died of injuries to the head and about ten percent of all of those injured suffered head injuries. In a four state study (Kansas, Colorado, Oklahoma, and South Dakota) the fatal head injuries per 1,000 crash involved riders was over four times as high for non-helmeted riders as it was with helmeted riders. In Kansas from 1984 through 1989 77% of the fatally injured motorcyclists (169 of the 217 killed) were not wearing a helmet and 80% of those seriously injured (2408 out of 2983) were not wearing a helmet.

A study also showed that the helmeted motorcycle operators are less often involved in alcohol related collisions. About 20% of the drinking cycle operators were wearing a helmet while nearly twice that percentage of non-drinkers involved in accidents were wearing helmets.

The question becomes **"WHY SHOULD WE REQUIRE MOTORCYCLISTS TO WEAR HELMETS?" and 'HOW WILL A CYCLIST NOT WEARING A HELMET EFFECT ME?"** Most operators of vehicles that are the fault of a motorcycle accident are just ordinary people driving in a normal manner that for one reason or another doesn't see the cyclist. Few of these people receive serious injuries from colliding with the cycle, but most will suffer from a life long feeling of guilt when their lack of attentiveness results in the death or permanent disability of another person.

The **MEDICAL COSTS** of motorcycle injuries are astronomical. On page 6 of the attached material is a copy of testimony given to the California Legislature in 1987. Steve Lambert was a 22 year old who lost control of his cycle and was not wearing a

House Transportation
2-21-91
ATTACHMENT 2-1

Route 4 • Box 241A • Leavenworth, Kansas 66048 • (913) 651-5591

helmet. His hospital bills totalled over **$800,000** in 1981 and after a year and a half of rehabilitation his medical expenses rose to **over 1 million dollars.** He is a quadreplegic and must use a respirator. His insurance paid over a million dollars and **now the taxpayers are paying about $100,000 annually for his care.** This is just one person. On page 9 are some other medical costs from motorcycle accidents. **WHO PAYS THIS BILL?** ***We do.*** Through **insurance rates** to cover what the insurance company pays for, through **taxes** to cover the state and federal health programs that pay these bill, and through **higher medical costs** to cover uncollectable bills owed to hospitals. Motorcycle accidents effect each of us regardless of whether we are the ones directly involved or not.

Do helmets create a vision obstruction? Helmet design standards that every legal helmet must meet require a 210^0 field of vision. That is equal to a filed of view from between 8 and 9 o'clock to between 3 and 4 o'clock if the cycle is heading towards the 12 o'clock position. A study of 900 motorcycle accidents showed that the 210^0 covered the location of the hazard to the cycle in over 94% of the accidents.

Do helmets cause a hearing problem? Any noise that can be heard over the sound of the cycle and wind should be able to be heard with a helmet on. A helmet will reduce the noise level of the wind and engine noise as well as the other "warning" noises. But if a rider is genuinely convinced that this will cause a hearing problem the so called half helmets are available where the ears are exposed.

Do helmets cause neck injuries? Modern helmets are lighter than they used to be and are designed so that the back of the helmet will not strike the neck.

Page 11 of the attached material covers these helmet myths along with others.

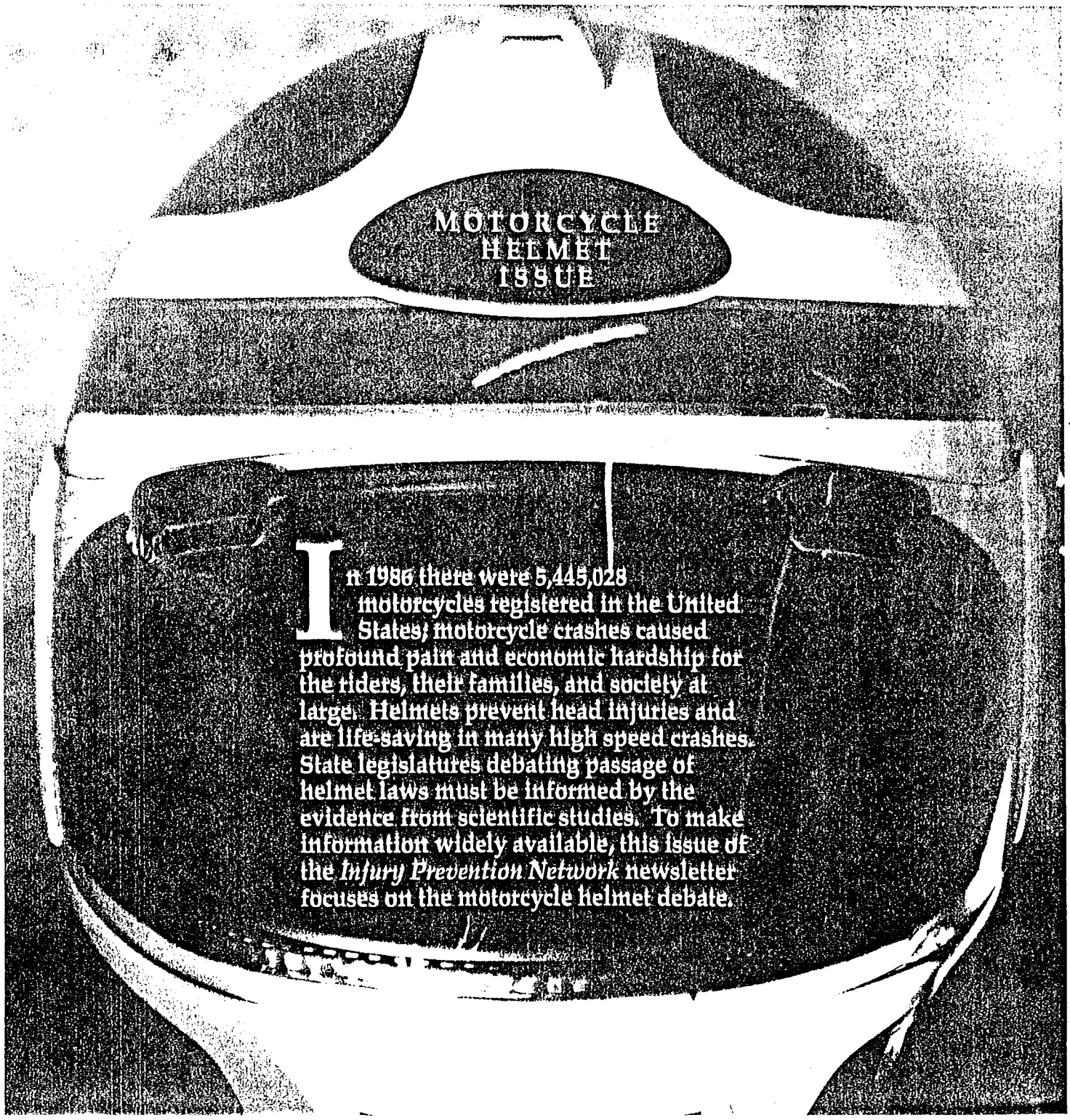
It is our opinion that a mandatory helmet law will reduce the permanent injuries and deaths on motorcycles when involved in an accident. This reduction should result in savings to the citizens of Kansas not only in needless suffering but in dollars by saving insurance costs, tax money used for medical care and hospital costs. We urge the committee to carefully weigh the benefits of passing this bill and recommend it favorably.

Ed Klumpp, President
Phone:913-354-9450

Injury Prevention Network

— NEWSLETTER —

Winter 1987-88 Volume 4 • Nos. 3 & 4



In 1986 there were 5,445,028 motorcycles registered in the United States; motorcycle crashes caused profound pain and economic hardship for the riders, their families, and society at large. Helmets prevent head injuries and are life-saving in many high speed crashes. State legislatures debating passage of helmet laws must be informed by the evidence from scientific studies. To make information widely available, this issue of the *Injury Prevention Network* newsletter focuses on the motorcycle helmet debate.

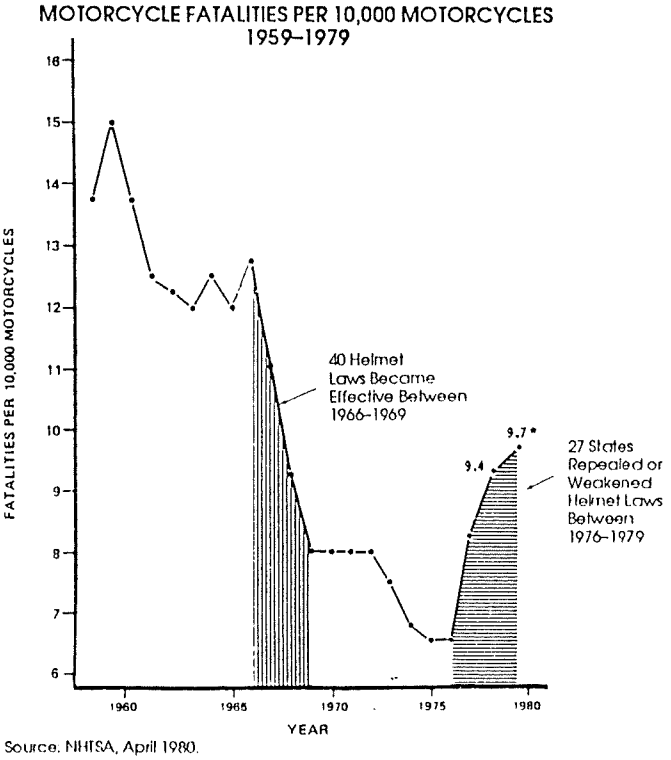
2-2

THE HISTORY OF MOTORCYCLE HELMET LAWS IN THE USA

THE HIGHWAY SAFETY Act of 1966 and its implementing regulations strongly encouraged the States to enact mandatory motorcycle helmet use laws. The Act stated that the Department of Transportation would withhold 10% of Federal highway construction funds and all Federal highway safety funds from States that were not implementing an approved highway safety program. Under the Department's implementing regulations, a State's highway safety program would not be approved unless its law provided that motorcycle operators and passengers wore an approved safety helmet. By 1975 the District of Columbia and 47 States required all motorcyclists to use helmets.

In 1975 the Department of Transportation began investigating whether Federal funds should be withheld from all non-compliant States. However, the passage by Congress of the Highway Safety Act of 1976 withdrew the Department's authority to withhold these funds from States that failed to adopt and enforce laws requiring motorcycle riders eighteen years of age or older to wear safety helmets when riding on the streets and highways of the State.

Between 1975 and 1983, 28 States either weakened or repealed their helmet use laws. The most "typical" change occurred in 1977 and 1978, modifying a law covering all riders to one covering only those under 18 years of age. In 1977 motorcycle crashes and fatality rates began to rise (see above right). The fatality rate went from 21.6 deaths per 1,000 crashes in 1976 to a high of 28 deaths per 1,000 crashes in 1980, and was 26.1 deaths per 1,000 crashes in 1984 (National Highway Traffic Safety Administration [NHTSA], 1986).



Source: NHTSA, April 1980.

Editor's Note: Elizabeth McLoughlin, Sc.D., contributing editor of this special issue of *Injury Prevention Network,* is a leader in the fight for mandatory helmet use in the state of California. As a member of Californians for Safe Motorcycling, she has been effective in linking research and action and has worked to highlight the role of the disabled community in injury prevention.

Sources for the information in these pages include a variety of scientific studies and government reports, and are listed on page 13. ■

Injury Prevention Network

NEWSLETTER

The **Injury Prevention Network** NEWSLETTER, formerly the Council on Injury Control Quarterly Newsletter, is a nonprofit, membership-supported publication, providing an injury prevention forum for current research, strategies and actions to promote the nation's health.

Published by the Trauma Foundation, Andrew McGuire, Executive Director.

Newsletter Staff:
Deane Calhoun, Editor
Kathee Ewing, Assistant Editor
Elizabeth McLoughlin, Contributing Editor
Paul K. Ehara, Design and Production

Address all correspondence to:

Injury Prevention Network NEWSLETTER
Trauma Foundation
Building One, Room 400
San Francisco General Hospital
San Francisco, CA 94110
(415) 821-8209

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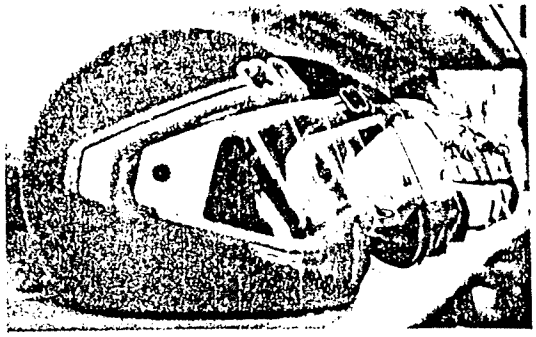
WHAT STATES



HAVE WHICH HELMET LAWS?

(As of June 1, 1987)

Full Use Requirement*

1. Alabama
2. Arkansas
3. District of Columbia
4. Florida
5. Georgia
6. Kentucky
7. Louisiana
8. Massachusetts
9. Michigan
10. Mississippi
11. Missouri
12. Nevada
13. New Jersey
14. New York
15. North Carolina
16. Pennsylvania
17. Tennessee
18. Vermont
19. Virginia
20. West Virginia
21. Puerto Rico

*19 States, District of Columbia and Puerto Rico

Required Use Under Specified Age

(18 years unless otherwise noted)

1. Alaska
2. Arizona
3. California (A)
4. Delaware (B)
5. Hawaii
6. Idaho
7. Indiana
8. Kansas
9. Maine (C)
10. Maryland
11. Minnesota
12. Montana
13. New Hampshire
14. New Mexico
15. North Dakota
16. Ohio (D)
17. Oklahoma
18. Oregon – [illegible] 1988
19. Rhode Island (E)
20. South Carolina (F)
21. South Dakota
22. Texas
23. Utah
24. Washington
25. Wisconsin (G)
26. Wyoming (F)

of age.
and
her

No Use Law Requirement

1. Colorado
2. Connecticut
3. Illinois
4. Iowa
5. Nebraska – Fully 1988

OLD INFORMATION — NEW STATE INFORMATION IS ATTACHED AT BACK OF PACKET.

"Statistically significant decreases in th[e] and severity of injuries to the head are sho[wn] the re-enactment period... The average cost [per] accident decreases by 48% from 1981 to 198[2]."

—NHTSA, 1984. Impact of the Re-e[nactment] of theMotorcycle Helmet Law in L[ouisiana]

[NHTSA] estimates that the repeal of [laws] was associated with a 10.4% to [20%] increase in the fatality rate (per accident)."

—NHTSA, 1986. The Effect of Helmet Law Repeal on Motorcycle Fatalities.

2-4

UPDATE ON CALIFORNIA'S HELMET USE BILL

CALIFORNIA IS THE only state in the USA that has never passed a law requiring all motorcyclists to wear helmets. Vigorous lobbying by California legislators influenced the "untying" of federal highway funds from the requirement for helmet laws in 1975. This resulted in the repeal or weakening of the laws in 26 states. There have been two previous and failed attempts to pass a helmet law in California in 1969 and in 1981.

AB 36: A Grassroots Effort

In 1986, Mary Price founded "Californians for Safe Motorcycling," after her 18 year old son, who did not wear a helmet, died of severe head injuries following a motorcycle crash. At her urging, Assemblyman **Richard E. Floyd** (D-Gardena) introduced Assembly Bill 36 (AB 36), which would require all motorcyclists on California roadways to wear helmets. The requirement applies to riders and passengers of motorcyles, mopeds, scooters—all motorized two wheel vehicles. The bill would merely remove the age designation from the existing California vehicle code which requires helmet use by motorcyclists under 15-1/2 years of age.

The bill has widespread support as well as intense opposition from a vocal minority of motorcycle riders. Resolutions in support of the bill have been passed by 25 counties and 75 cities and towns in California. Among those supporting the bill are the following major national medical and public health organizations:

- American Public Health Association
- American Academy of Pediatrics
- American Academy of Orthopedic Surgeons
- American College of Emergency Physicians
- Emergency Nurses Association
- American Trauma Society
- National Safety Council;

and the following public safety organizations:

- California Police Chiefs Association
- California State Sheriff's Association.

In addition, the following autmotive organizations and civic groups also support AB 36:

- California State Automobile Association
- Motorcycle Industry Council
- California Motorcycle Dealers Association Board of Directors;
- various Junior Leagues in California
- California P.T.A.
- California League of Cities
- California Taxpayers Association.

Among those on record as opposed to the bill are:

- ABATE (A Brotherhood Against Totalitarian Enactments) of California, Florida, Manitoba and Utah
- American Motorcyclist Association
- Bikers Against Manslaughter
- International Brotherhood of Bikers Teardrops (USA, Canada, Menlo Park)
- PAC for Motorcycle Awareness Now;

and several motorcycle dealers and some smaller establishments, such as:

- Cheri's Unique Tattoos
- Blue Bonnet Bar
- Little Elves Shoe Menders
- Old Auburn Yacht Club
- Yankee Engineuity.

AB 36 passed the 14-member Assembly Committee on Transportation by a vote of 10 to 4 (**For**: Assemblypersons **Areias, Eastin, Eaves, Frazee, Hansen, Harris, Killea, Polanco, Duplissea** and **Katz**; **Against**: Assemblymen **Clute, Ferguson, Lancaster, Wyman**) in April, 1987. It passed the Assembly Ways and Means Committee (12 For and 10 Against) in May and the full Assembly (45 For and 30 Against) in June. Later in June, it was heard by the 13 member Senate Committee on Transportation. The vote on the measure was as follows: **For**—4 (Senators **Bergeson, Hart, Kopp** and **Morgan**); **Against**—2 (Senators **Beverly** and **Ellis**), **Abstain**—6 (Senators **Deddeh, Green, McCorquodale, Robbins, Russell, Vuich**) and **Absent**—1 (Senator **Seymour**). However, instead of this vote killing the bill, the Committee voted to change its status to a "two-year bill." In November, the Senate Transportation Committee held a three and one half hour interim hearing on the subject of motorcycle helmets, to examine further the issues of medical costs due to motorcycle injuries, the effectiveness of helmets in mitigating injuries and the experience of other states relative to helmet laws. Much of the material in this newsletter was discussed at that hearing. A vote in the Senate Committee on Transportation is expected in February or March, 1988.

2-5

IF YOU MAKE RIDERS SAFER, WON'T THEY JUST TAKE MORE RISKS?

AN OFTEN-USED argument by those who resist supporting automatic protection is termed "risk compensation." It states that people will become careless or take more risks if they believe that they are automatically protected from injury. For example, nineteenth century railroad owners fought against automatic signal systems because they "would breed dependence and carelessness in employees" (Robertson, 1983, p. 145).

This "risk compensation" argument has been made about motorcycle helmets. A proponent of this view states that "the added sense of security provided by the helmet, and by the safety propaganda promoting the use of helmets, might lead riders to take more risks" (Adams, 1983). He challenges NHTSA's methodology and conclusions about the negative effects of repeal of helmet laws and then suggests "risk compensation" as an explanation why helmeted riders might crash more. *This argument fails to consider that the majority of crashes involving a motorcycle and another vehicle were the fault of the other driver, not of the motorcyclist* (Hurt, 1981). Other arguments against applying risk compensation theory to helmet use laws are provided by NHTSA (NHTSA, April 1980, page IV-21). Adams does not challenge the fact that helmets do protect motorcyclists in crashes.

"Risk compensation" is an element of economic theory, and should be considered when designing ways to prevent injuries. However, even if one accepts that helmeted riders take more risks (and there is little evidence to support this), the protection provided in a crash far outweighs the marginal increase in an already very risky mode of transportation. ■

WHAT IS WRONG WITH AGE-RESTRICTED HELMET USE REQUIREMENTS?

The problem is simple and two-fold:

1) Since 1981, over 90% of the motorcycle fatalities nationwide have been older than 18 years of age (NHTSA, 1986).

2) It results in less than half of all motorcyclists wearing helmets. A NHTSA 1986 helmet survey in selected cities found a 99.5% use rate in "law" cities, and a 45.9% use rate in "no-or-limited-law" cities (NHTSA 1987). See table at right. ■

Mary Price holds a photo of her 18 year old son at a press conference announcing AB 36 at San Francisco General Hospital. With Mary are Captain John Willet (far right) and other motorcycle officers of the SF Police Department.

Californians for Safe Motorcycling

CALIFORNIANS FOR SAFE Motorcycling was formed in 1986 to work actively for a mandatory helmet law. Its founder and President is Mary Price, and Robert Terry is the Executive Director. Members of this group— survivors of motorcycle crashes, families who have lost loved ones in motorcycle crashes, and others concerned about highway safety—have met with legislators, testified at public hearings, and educated the public about the problem of non-helmeted motorcyclists. Among those testifying were survivors who walked to the podium and spoke clearly, because they were wearing helmets at the time of their crash; and those who spoke more falteringly, because they had ridden without helmets and had sustained head injuries. Californians for Safe Motorcycling has also enlisted trauma doctors and injury prevention specialists to provide data and to explain scientific studies about motorcyclist deaths and injuries. Californians for Safe Motorcycling can be reached at 6931 Fifth St., Rio Linda, CA 95673, (916) 991-5091. ■

Per Cent Observed Motorcycle Helmet Use At Selected Sites in 19 Cities (Jan.-Dec. 1986)

Cities With Mandatory Helmet Use Laws		Cities With No Or limited Helmet Use Laws	
Boston	99.4	34.1	Providence
New York	98.3	54.6	Baltimore
Pittsburgh	100.0	20.8	Chicago
Miami	98.9	37.8	Minneapolis/St. Paul
Atlanta	100.0	36.7	Fargo/Moorhead
Birmingham	100.0	71.9	Seattle
New Orleans	99.2	56.2	San Francisco
		49.2	San Diego
		43.7	Los Angeles
		46.4	Phoenix
		44.6	Houston
		54.4	Dallas
AVE. OF 7 CITIES:	99.5%	48.2%:	AVE. OF 12 CITIES

2-6

Testimony Before the California State Assembly Committee of Transportation: April 22, 1987

MY NAME IS Steve Lambert. I am a 22 year old resident of Newark, California. I am a respirator dependent quadraplegic, the result of a motorcycle crash in 1981. While driving my motorcycle down a street I was unfamiliar with, I lost control of my bike while turning a corner. The motorcycle hit a curb, and at that point I was thrown from it and struck a portion of a telephone pole nearby. I was one of many riders who chose not to wear a helmet.

The injuries that I sustained severed my spinal cord at the C2 level, which means that for the rest of my life, not only will I be confined to a wheelchair, but I will never have sensation or movement below the nipple line, with the exception of partial use of my left arm.

Due to the severity of my injury, my hospital stay consisted of nine months in an intensive care unit after which I spent another eleven months in a rehabilitation unit. The cost of my hospital stay alone ran into the $800,000 figure. Add another 18 months of specialized home care following my hospitalization, and the costs reached one million, sixty thousand dollars.

I was one of a fortunate few who had private medical insurance which paid the one million and sixty thousand. Because my disability did not end

when my private insurance did, I am now on the California Medi-Cal system, which costs approximately $100,000 annually.

Because we all want to cut down on the number of motorcyclists injured and friends who do not learn by example, I strongly urge you to pass a law that would mandate the use of a helmet while operating or riding on a motorcycle. That law is AB 36! ■

IF MOTORCYCLISTS ARE JUST HURTING THEMSELVES, WHY NOT LEAVE THEM ALONE?

THE ANSWER IS that they are not just hurting themselves. They are hurting the taxpayer as well. The issue of individual liberty versus the public good was clearly examined in an exchange of articles in the *American Journal of Public Health* (Baker, 1980; Perkins, 1981; Baker and Teret, 1981). The issue was also fought out in the courts. In a case in Massachusetts which challenged the constitutionality of the motorcycle helmet use law, a lower court wrote an opinion which the United States Supreme Court upheld in 1972. The opinion reads in part:

> "While we agree with plaintiff that the act's only realistic purpose is the prevention of head injuries incurred in motorcycle mishaps, we cannot agree that the consequences of such injuries are limited to the individual who sustains the injury... The public has an interest in minimizing the resources directly involved. From the moment of the injury, society picks the person up off the highway; delivers him to a municipal hospital and municipal doctors; provides him with unemployment compensation if, after recovery, he cannot replace his lost job, and, if the injury causes permanent disability, may assume the responsibility for his and his family's subsistence. We do not understand a state of mind that permits plaintiff to think that only he himself is concerned."
>
> —*Simon vs. Sargent, 396 F. Supp. 277,279 (D.Mass.1972), Affirmed, 409 US 1020 (1972).* ■

"Nationwide, at least $61 million could be saved annually if all motorcyclists were to use helmets... It is concluded that helmet laws are effective in encouraging helmet use among motorcyclists and will prevent unnecessary medical expenditures as well as unnecessary pain and suffering among injured motorcyclists."

—Muller A. 1980: Evaluation of the Costs and Benefits of Motorcycle Helmet Laws. (*AJPH* 1980 70 [6]: 586-592.)

2-7

ALCOHOL, HELMETS, AND MOTORCYCLE CRASHES

Q: IS ALCOHOL A RISK FACTOR IN FATAL MOTORCYCLE CRASHES?

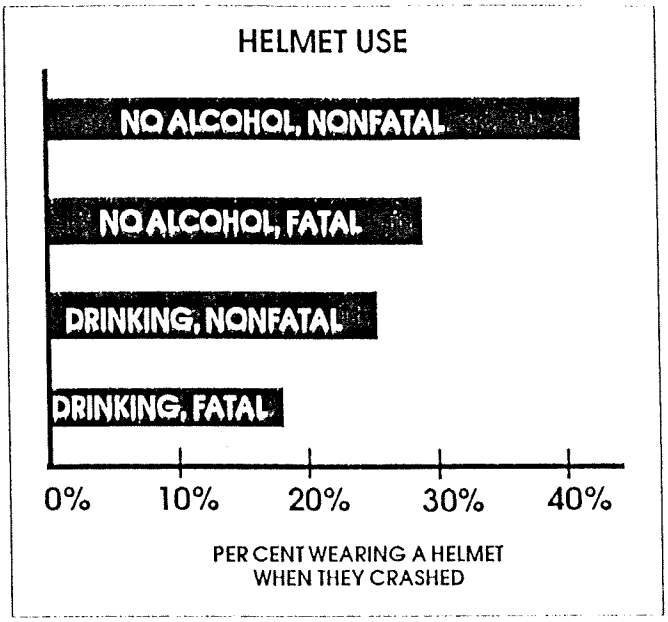
A: YES.

Of the 900 motorcycle crashes investigated by Hurt, *et al* (1981), 11% involved a rider who had been drinking. Of the 54 fatal crashes in that series, over 40% involved a drinking rider.

Q: DO DRINKING RIDERS WEAR HELMETS?

A: NOT VERY OFTEN.

The Hurt study (see chart at right) shows that riders who have been drinking are far less likely to wear helmets than those who have not been drinking. It also shows that the least likely to wear a helmet is the drinking rider involved in a fatal crash. Evidence from states with laws suggests that a helmet requirement increases helmet use among all riders, drinking and non-drinking alike. ■



Source: Adapted from Hurt, 1981.

"After repeal, motorcyclist fatalities increased more in the states which repealed their laws than in those which did not in 24 cases out of 26... It is therefore concluded that repeals of mandatory helmet wearing laws for motorcyclists were followed by substantial increases in motorcyclist fatalities."

—Chernier TC, Evans L. Motorcyclist fatalities and the repeal of mandatory helmet wearing laws. (*Accid. Anal. & Prev.* 1987 [19] 2: 133-139.)

What Kills Motorcyclists?

Fatal Head Injuries, That's What.

Data from the National Accident Sampling System (NASS) indicate that from 1982-1985 roughly 50 per cent of all fatalities were caused by injuries to the head, neck or face with about 3/4 of these injuries being to the head. For nonfatal injuries, roughly 20 per cent were head, face or neck injuries with roughly half being to the head.

NHTSA funded studies of the effect of helmet law repeal (see table at right). These studies provide documentation of the risk of fatal head injuries to helmeted and non-helmeted riders, should a crash occur (NHTSA, April 1980). ■

Fatal Head Injuries Per 1000 Crash-Involved Riders
(Helmeted vs. Nonhelmeted)

State	Helmeted	Nonhelmeted
Colorado	9	23
Oklahoma	11	63
South Dakota	13	38
Kansas	6	41

Source: NHTSA, April 1980.

"The crash helmet is effective in diminishing local damage to the brain and its coverings at the site of impact, and it tends to lower the incidences of prolonged amnesia."

—Cairns, H, Holbourn H. 1943. Head injuries in motorcyclists. (*British Medical Journal* 1943 1:591-598.)

2-8

SOME STATISTICS ABOUT MOTORCYCLISTS: DEATHS...

MOTORCYCLIST FATALITIES (1984-86) FOR THE UNITED STATES AND CALIFORNIA; CALIFORNIA DEATHS AS PERCENTAGE OF TOTAL USA DEATHS

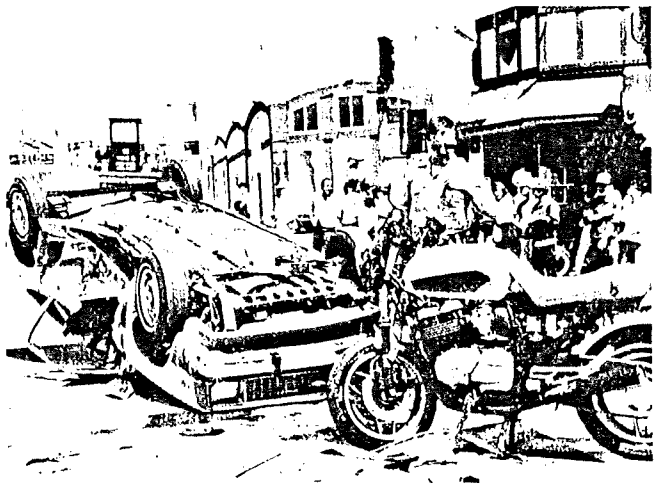
YEAR	USA*	CAL**	%USA
'84	4,608	833	18%
'85	4,570	791	17%
'86	4,531	879	19%

*Source: 1985 Fatal Accident Reporting System, U.S. Department of Transportation. 1986 (NHTSA, 1987).
**Source: Annual Report of Fatal and Injury Motor Vehicle Traffic Accidents, California Highway Patrol (1984,1985). 1986 (NHTSA, 1987).

Comment: While there appears to be a slight downward trend in the number of motorcyclist deaths in the USA as a whole, that is not the case in California. Here, no trend is apparent, and the number of deaths last year was higher than the previous two. The introduction of "racing-type motorcycles" could account in part for the increase in deaths in California.

An Anti-Helmet Argument

A single study continues to be cited by opponents of helmet use laws. Authored by JP Goldstein, this work claims that the major determinants of fatality are rider's crash speed and blood alcohol level. Goldstein asserts that helmets do reduce head injuries, but have no statistically significant effect on the probability of a fatality given that a crash has occurred. He also claims that helmets cause neck injuries. Respected injury researchers (i.e. *McSwain, Williams, Scott, Kraus*), and the scientists responsible for the original data collection (Hurt, Ouellet) have strongly criticized the author's statistical assumptions, variable definitions and handling of the original data. In Hurt and Ouellet's view, Goldstein's improper use of their data leads him to reach conclusions which directly contradict the findings of their original study.



California Highway Patrol

In 1983, a 21 year old male motorcyclist, traveling about 70-80 miles per hour, broadsided a car. The impact overturned the car and killed its driver instantly. The motorcyclist hit the edge of the roof at top of driver's door, then flew over the car and landed on the pavement. The motorcyclist was wearing a helmet. He suffered major injuries to the chest, shoulders, arms and face, but he survived and recovered partially at San Francisco General Hospital.

...AND INJURIES

MOTORCYCLIST INJURIES (1984-86) IN CALIFORNIA

YEAR	CRASHES	SEVERE	DEATHS
1984	27,344	3,676	833
1985	27,034	3,641	791
1986	25,846	3,701	879

Source: Annual Report of Fatal and Injury Motor Vehicle Traffic Accidents, California Highway Patrol (1984,1985). 1986 - unpublished figures.

Comment: Over the past three years, the number of reports of motorcycle crashes involving injury in California show a downward trend. However, there is no trend in reports of severe injuries and deaths, and there were more severe injuries and deaths in 1986 than in the previous two years.

"Statistically significant increases in the incidence and severity of injuries to the head occurred between the pre-repeal and post-repeal periods. Extremely significant differences were found between helmeted and non-helmeted persons when head injuries and fatalities were examined."

—NHTSA, 1980.
Impact of the Repeal of the Kansas Mandatory Motorcycle Helmet Law: 1975-78.

2-9

THE COSTS OF INJURIES TO MOTORCYCLISTS... AND WHO PAYS FOR THEM

Given the limitations of data on non-fatal injuries in the USA and the difficulties of documenting costs, we do not know how much these injuries cost, and how much burden the taxpayer bears. However, summarized below are some data indicative of what these costs might be:

SAN DIEGO COUNTY EMERGENCY MEDICAL SERVICES DATA: AUG '85- JULY '87.

1) The average hospital costs for:
   - injured *helmeted* motorcyclist was **$15,851;**
   - injured *non-helmeted* motorcyclist was **$42,291.**

2) The approximate total hospital costs for:
   - all injured *helmeted* motorcyclists were **$250,000;**
   - all injured *non-helmeted* motorcyclists were **$1,500,000.**

3) 26% reimbursed by MediCal or County medical system, 29% not reimbursed (Cooper, 1987).

ARIZONA HEALTH SCIENCES CENTER: JULY '85-JUNE '86.

1) The average hospital costs for:
   - injured *helmeted* motorcyclist was **$13,368;**
   - injured *non-helmeted* motorcyclist was **$17,120.**

2) Of the 12 (of 71) patients who became permanently impaired, *none had worn a helmet during the crash, and 10 sustained severe head injuries* (Bried *et al*, 1987).

BRACKENRIDGE HOSPITAL (AUSTIN, TEXAS): FEB '85 - JAN '86.

1) The average hospital costs for:
   - an injured *helmeted* motorcyclist was **$7,211;**
   - an injured *non-helmeted* motorcyclist was **$17,155.**

2) Regarding insurance:
   - 27% of injured *helmeted* motorcyclists had no insurance;
   - 41% of injured *non-helmeted* motorcyclists had no insurance (Lloyd, 1986).

UNIVERSITY OF CALIFORNIA-DAVIS MEDICAL CENTER: 1980-1983.

1) The average hospital charges for motorcyclists with open fractures were **$17,704.**

2) 72% of hospital charges paid by state of California; additional 10% by other tax-based sources (Bray, 1985).

MASSACHUSETTS GENERAL HOSPITAL: JULY '82-JUNE '83.

1) The average hospital charges for motorcyclists were **$15,114.**

2) *46% of these patients were uninsured* (Bach, 1986).

ILLINOIS REGIONAL TRAUMA CENTERS: 1981-82.

1) The average hospital costs for motorcyclists:
   - *with fatal head injuries* were **$19,166** (average non-fatal costs were $6,847);
   - *with fatal injuries* (other than head) were **$12,125** (non-fatal costs were $5,557).

2) 25% of patients had no insurance (Mortimer, 1984).

KENTFIELD HOSPITAL, MARIN COUNTY, CALIFORNIA: 1985-86.

This private rehabilitation hospital treated seven non-helmeted motorcyclists with severe head injuries. The average length of stay was 152 days, at $850 per day. This adds up to $904,400, paid by private insurance and Medi-Cal. All were in profound comas which resulted in transfers to long-term chronic care facilities, rarely covered by any private insurance (Flynn, 1987).

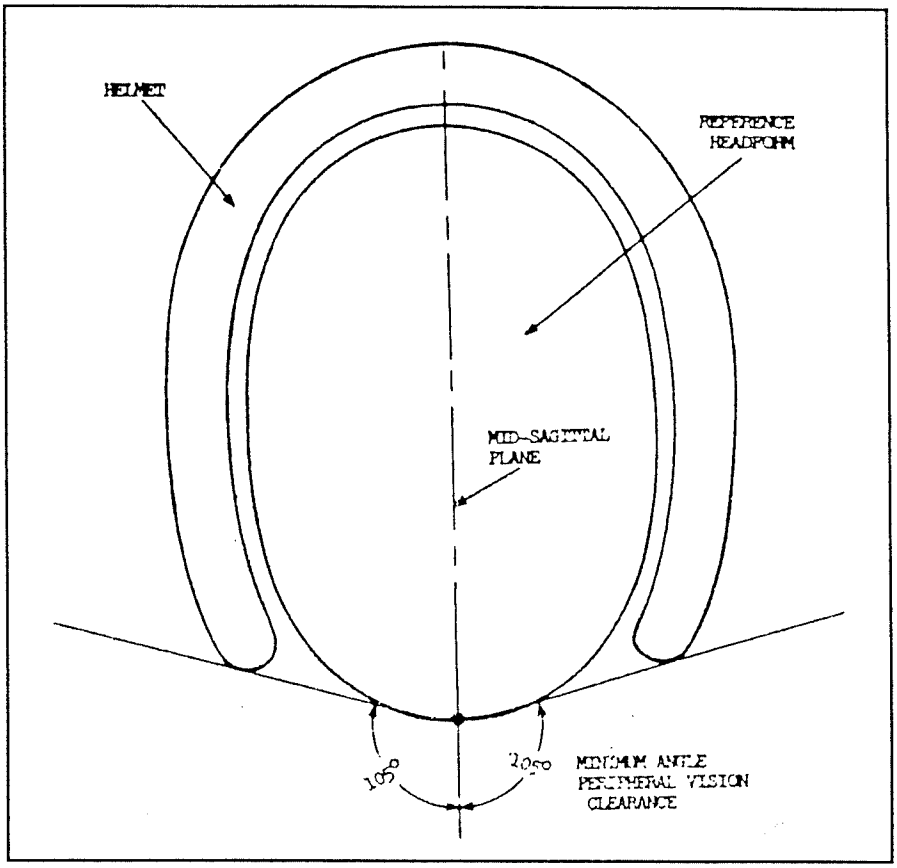
2-10

HOW MUCH PROTECTION DOES A STANDARD HELMET OFFER?

Most state helmet use laws require the wearing of helmets which meet existing standards. Below in extremely simplified form are the basic requirements of the DOT standard.

Department of Transportation Motorcycle Helmet Standard:

from the Code of Federal Regulations: Transportation (49): Section #571.218.



THE HELMET MUST "CUSHION" THE BLOW TO THE RIDER'S HEAD WHEN THE HELMET STRIKES A BARRIER.

The tests use an instrumented headform as a proxy. In a series of tests, the helmet is dropped in a guided free fall upon fixed hemispherical and flat steel anvils from the heights of 54.5 inches and 72 inches. Measurements on the headform must meet the following requirements:
"(a) Peak accelerations shall not exceed 400g;
(b) Accelerations in excess of 200g shall not exceed a cumulative duration of 2.0 milliseconds; and
(c) Accelerations in excess of 150g shall not exceed a cumulative duration of 4.0 milliseconds."

FOREIGN OBJECTS MUST NOT PENETRATE THROUGH THE HELMET TO THE RIDER'S HEAD.

The "foreign object" in the test is a 6 pound, 10 ounce pointed "striker" (point has included angle of 60 , a cone height of 1.5 inches, a tip radius of 0.5 millimeter radius). The "striker" is twice dropped in a guided free fall of 118.1 inches, and "the striker shall not contact the surface of the test headform."

THE HELMET'S STRAPS MUST STAY FASTENED WHEN STRESSED.

The test applies static tensile load to the straps, or "retention assembly." First, a 50-pound load is applied for 30 seconds, then an additional 250-pound load is applied for 120 seconds. The straps must not separate, and the adjustable portion cannot move more than one inch when the additional load is applied.

THE HELMET MUST NOT OBSTRUCT VISION.

Each helmet must provide "peripheral vision clearance of at least 105° to each side of the midsagittal plane," or in other words, provide 210° angle of vision for the wearer (see above).

THE HELMET MUST BE LABELED.

Each helmet must be permanently and legibly labeled with several items of information, including the symbol "DOT," the manufacturer's certification that the helmet conforms to the standard.

THE SNELL STANDARD

There are two major motorcycle helmet standards recognized in the United States, The U.S. Department of Transportation (DOT) standard and the "1985 Standard for Protective headgear, For Use with Motorcycles and Other Motorized Vehicles" developed by the Snell Memorial Foundation. The Snell standard, first proposed in 1959 for racing crash helmets and revised five times since then, is the more demanding of the two. Information about this standard can be obtained from the Snell Memorial Foundation, P.O. Box 733, Wakefield, RI 02880. ■

2-11

FACTS, NOT MYTHS, ABOUT MOTORCYCLE HELMETS

FACT ONE: *HELMETS DO NOT OBSTRUCT CRITICAL VISION.*

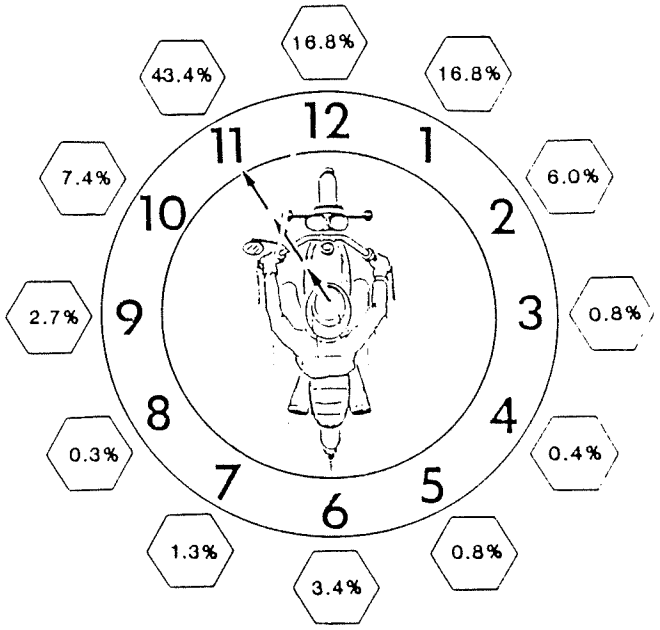
The figure at right shows where the crash hazards were located *from the rider's point of view* during the pre-crash phase in the 900 motorcycle crashes investigated by the USC Traffic Safety Center. For example, a car straight ahead would be at the 12 o'clock location. Seventy-seven per cent of the hazards were at the 11, 12 and 1 o'clock positions. Over 90 per cent fell within the 10 to 2 o'clock locations. The DOT standard requires no restriction of peripheral vision as far back as the 4 and 8 o'clock positions. The visual problem is not restriction of peripheral vision. Instead, it is a matter of watching what is directly in front of the motorcycle and protecting one's eyes to assure full visual acuity (Ouellet, 1987).

FACT TWO: *HELMETS DO NOT INTERFERE WITH CRITICAL HEARING.*

Any sound loud enough to be heard over the noise of the motorcycle and the wind will be loud enough to be heard inside the helmet. Motorcycles create noise in the range of 85-95 decibels. Helmets reduce the loudness of both the sound of interest (*e.g.*, a car's horn) and the motorcycle noise by an equal amount, but do not alter the ability to hear one over the other. No case of the 900 on-scene, in-depth investigations in the USC study revealed a failure to detect critical traffic sounds, for helmeted or unhelmeted riders (Hurt, 1981).

FACT THREE: *HELMETS DO NOT CAUSE NECK INJURIES.*

In the USC investigation (Hurt, 1981) of 900 motorcycle crashes, spinal cord injuries occurred only in very severe, high energy crashes. In these high-speed crashes the riders died of multiple injuries of which spinal cord injury was only one. In the 846 nonfatal crashes, no rider suffered a spinal cord injury. Helmeted riders get fewer neck injuries at most levels of severity. Helmets may help to REDUCE neck injuries (which are usually the result of head impact). They certainly have NOT been found to pose any increased hazard (Ouellet, 1987).



11+12+1: 77.0%

10+11+12+1+2: 90.4%

5+7: 2.1%

FACT FOUR: *HELMETS DO NOT BUILD UP DANGEROUS TEMPERATURES INSIDE THE HELMET.*

Motorcyclists are less likely to wear helmets voluntarily in very hot weather. However, the USC researcher testified that temperature readings inside helmets show that temperatures stabilize slightly above body temperature. The insulation of the helmet makes its interior more subject to body heat than to outside temperatures (Ouellet, 1987).

FACT FIVE: *HELMETS DO NOT CAUSE FATIGUE WHICH CAUSE CRASHES.*

The USC study of 900 motorcycle crashes found that 50% of the crashes occurred within six minutes from the start of the trip and over 90 per cent occurred in less than one hour of the start of the trip (Hurt, 1981). ■

"The only significant protective equipment is the qualified safety helmet, and it is capable of spectacular reduction of head injury frequency and severity. This research shows no reasons for a motorcycle rider to be without a safety helmet; qualified helmets do not limit vision or hearing in traffic or cause injury."

—Hurt HH, Ouellet JV, Thom DR. 1981. Motorcycle Accident Cause Factors and Identification of Countermeasures. (NHTSA, 1981)

2.12

WHY REQUIRE HELMET USE AND NOT MOTORCYCLIST TRAINING?

Right now, the evidence supports the effectiveness of helmet laws to reduce the likelihood of fatal and severe head injuries to motorcyclists. To date there exists little evidence of the effectiveness of motorcycle training programs to reduce the likelihood of crashes.

In early 1979, NHTSA decided to fund a large scale evaluation of the crash reduction effectiveness of revised motorcycle operator training and licensing programs and materials. After competitive bidding, the contract for the evaluation was given to the New York Department of Motor Vehicles. Investigators randomly assigned over 26,000 persons to one of four groups: 1) standard NYS program, 2) revised program including new knowledge and skill test, 3) revised program with a three hour training program, and 4) revised program with a 20 hour training program. They then examined crash records for these persons for five exposure periods (3, 6, 12, 18, and 24 months) after application for a motorcycle operator's permit.

The basic conclusions of the study completed in 1987 are stated as follows (Buchanan, 1987):

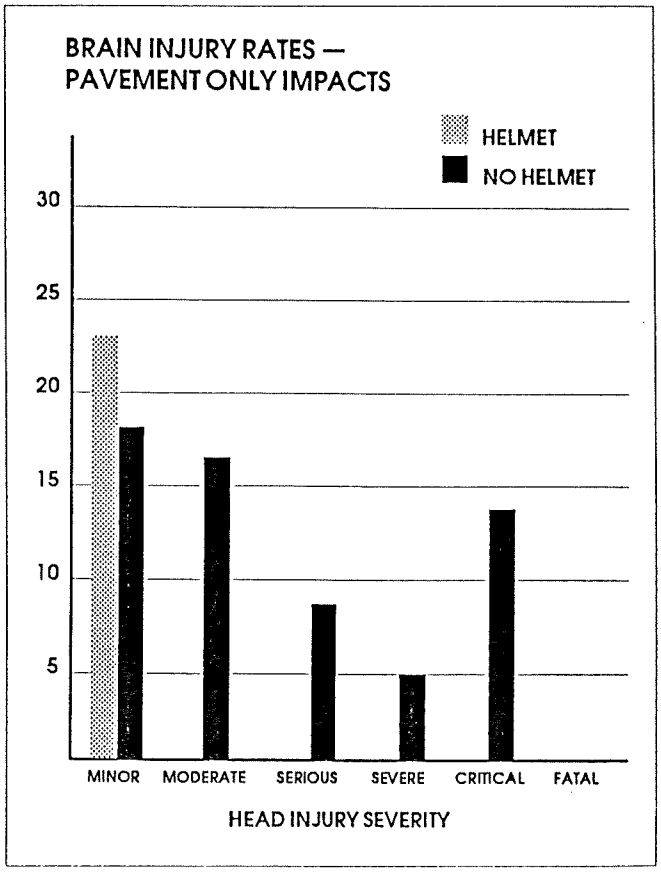
> "These analyses found no significant differences between the motorcycle accident rates of subjects assigned to the present New York State licensing system (control group) and those assigned to the new, experimental licensing system, either for all subjects from the point of motorcycle permit application date or for licensed subjects from the point of licensure date. In other words, the study was not able to document a crash reduction benefit for either the rider education programs or the improved licensing system."

These are disappointing results for riders and trainers whose personal experience convinces them of the benefits of training, but these findings must enter the public policy debate. In recent legislative debate, opponents of the helmet bill argue that training *rather than* mandatory helmet use is the answer to the problem of motorcyclist deaths and injuries. The data do not support this choice. ■

PAVEMENT-ONLY STRIKES IN MOTORCYCLE CRASHES

Pavement is the most common surface struck by motorcyclists, and helmets are extremely effective in pavement impacts (see right). When studying crashes when the pavement was the only surface against which the rider struck his head, the USC study found that none of the helmeted riders had any brain injury above the"minor" level. In contrast, riders without head protection suffered a total of 65 brain injuries per 1000 crashes, at all levels of brain injury severity, as a result of pavement-only strikes (Ouellet, 1987).

> *"Riders without helmets had twice the overall head injury rate as helmeted riders and up to six times the critical or fatal head injury rate. Helmet usage [in Colorado, South Dakota, Kansas and Oklahoma] decreased sharply after their helmet laws were repealed... head injury rates incresaed after helmet law repeal."*
>
> —NHTSA, 1981.
> The Effects of Motorcycle Helmet Usage on Head Injuries, and the Effects of Usage Laws on Helmet Wearing Rates.



2-13

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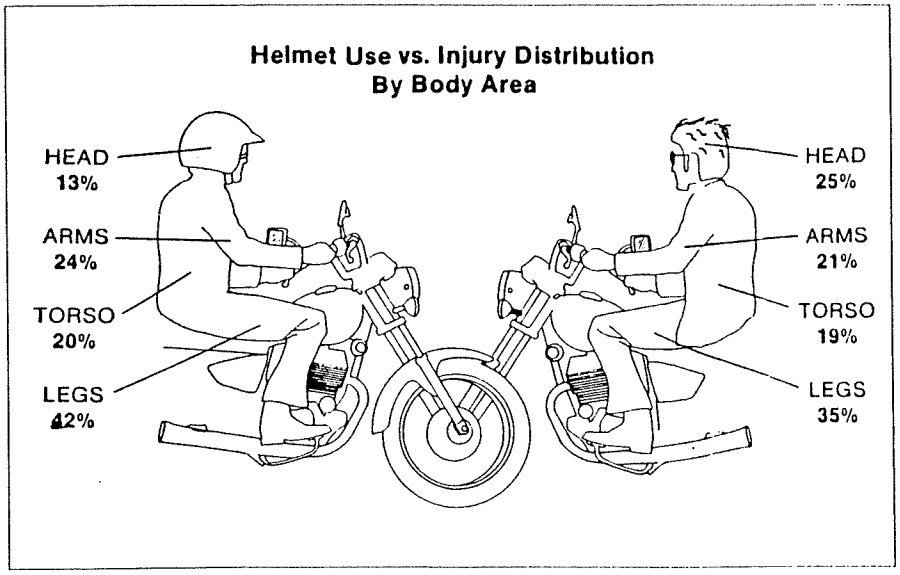

The distribution of injury by body part involved is dependent upon helmet use at the time of crash. For those without helmets, 25% of the injuries are head injuries. For those with helmets,only 13% sustain head injuries (NHTSA, September 1980).

2-14

STATE LEGISLATIVE FACT SHEET

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U.S. Department of Transportation
National Highway Traffic Safety Administration

November 1990

MOTORCYCLE HELMET USE LAWS

The U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) strongly believes that effective, comprehensive programs encompassing motorcycle helmet usage, rider education, motorcycle operator licensing, and the responsible use of alcohol will have the greatest positive effect on motorcycle safety. Motorcycle helmets offer motorcyclists involved in traffic crashes the best protection from head injury. The passage of helmet use laws governing all motorcycle occupants is the most effective method of getting all motorcyclists to wear helmets. NHTSA strongly supports State passage of motorcycle helmet use laws for all riders. This paper highlights the key reasons why motorcycle helmet use laws should be enacted.

Key Facts

o In 1989, 3,143 motorcyclists died and approximately 100,000 were injured in highway crashes in the U.S.

o Per mile, a motorcyclist is 20-30 times more likely to die in a crash than is an automobile operator.

o Head injury is the leading cause of death in motorcycle crashes.

o An unhelmeted motorcyclist is three times more likely to incur a fatal head injury and two times more likely to incur a serious head injury than a helmeted motorcyclist.

o A study conducted at the University of Southern California, which investigated 900 motorcycle crashes and analyzed 3600 traffic accident reports covering motorcycle crashes, concluded that helmet use was the single most important factor governing survival in motorcycle crashes.

o The same study found that helmeted operators and passengers experienced significantly fewer and less severe head and neck injuries than unhelmeted operators and passengers.

o From 1984 through 1989, it is estimated that helmets saved the lives of more than 4,100 motorcyclists. If everyone on a motorcycle (operators and passengers) had worn helmets during those years, it is estimated that approximately 4,182 additional lives would have been saved.

o Numerous studies have proven that helmets do not impair the users' vision or hearing. All helmets provide a field of view greater than 180 degrees and often provide an advantage in hearing warning signals by reducing wind and engine noise.

o All motorcycle helmets sold in the U.S. are required to meet Federal Motor Vehicle Safety Standard 218, the performance standard which establishes the minimum level of protection helmets must afford to each user.

o Helmet use laws governing all motorcycle occupants significantly increase helmet use and are easily enforced because of the occupants high visibility. In NHTSA's latest 19 cities survey (July 1989), helmet use was reported to be essentially 100 percent at sites with helmet use laws governing all motorcycle occupants as compared to a range of 34 to 54 percent at sites with no helmet use laws or laws governing only minors.

o NHTSA estimates that motorcycle helmets reduce the likelihood of a fatality by 29 percent.

o Data on crashes in States where only minors are required to wear helmets show that fewer than 40 percent of the fatally injured minors are wearing helmets even though the law requires them to do so. Helmet laws which govern only minors are extremely difficult to enforce.

o When helmet laws are repealed, fatalities are estimated to increase 20 percent.

Legislative Status

o Currently 23 States, the District of Columbia and Puerto Rico require helmet usage by all motorcycle operators and passengers. In another 23 States, only persons under a specific age, usually 18, are required to wear helmets.

o Data from Louisiana, the first State to repeal and then readopt a full helmet law, shows that Louisiana experienced a 30 percent reduction in fatalities (40 fewer deaths) during 1982, the first year after helmet law re-enactment. This reduction occurred even though motorcycle registrations increased 6 percent during the year. The helmet use rate increased from approximately 50 percent to 96 percent.

o Texas, Oregon and Nebraska have enacted full motorcycle helmet use laws in the past 2 years. Oregon and Nebraska have experienced reductions in motorcycle fatalities of 33 and 32 percent, respectively, in the first year of their helmet use laws' reenactment. Data is not yet available on the lifesaving benefits of the Texas law as it only became effective in late 1989.

Cost Savings

o Failure to use motorcycle helmets places a large financial burden on society. Unhelmeted riders involved in crashes are less likely to have insurance and more likely to have higher hospital costs than helmeted riders involved in similar crashes.

o In Louisiana, the average cost per motorcycle crash decreased by 48 percent from 1981 to 1982, the first year of its helmet use law, and dramatic differences were found in lengths of hospital stay between helmeted and non-helmeted riders.

o Numerous studies comparing hospital costs of helmeted and unhelmeted motorcyclists involved in traffic crashes have found costs for unhelmeted riders to average $3,000 more than for helmeted riders.

o It is estimated that $1.7 billion was saved between 1984 and 1989 because of the use of helmets. An additional $1.8 billion would have been saved if all motorcyclists had worn helmets.

Who Supports Motorcycle Helmet Use Laws

The following organizations have publicly supported motorcycle helmet use laws: Advocates for Highway and Auto Safety; American Academy of Family Physicians; American Academy of Orthopaedic Surgeons; American Academy of Pediatrics; Am. Association of Critical-Care Nurses; Am. Association of Neurological Surgeons; Am. Association of Occupational Health Nurses; Am. Coalition for Traffic Safety, Inc.; Am. College of Emergency Physicians; Am. College of Preventive Medicine; Am. College of Surgeons; Am. Hospital Association; Am. Insurance Association; Am. Medical Association; Am. Nurses' Association; Am. Public Health Association; Am. Trauma Association; Association for the Advancement of Automotive Medicine; Child Welfare League; Congress of Neurological Surgeons; Consumer Federation of Am.; Emergency Nurses Association; Epilepsy Foundation of Am.; GEICO; General Federation of Women's Clubs; Motorcycle Industry Council; Motor Vehicle Manufacturers Association; National Association of Public Hospitals; Nat'l Association of Emergency Medical Technicians; Nat'l Association of State EMS Directors; Nat'l Council on the Handicapped; Nat'l Head Injury Foundation; Nat'l Safety Council; SAFE KIDS; Snell Memorial Foundation; Students Against Drunk Driving; Traffic Safety Now, Inc.

Additional Sources of Information

The Effect of Helmet Law Repeal on Motorcycle Fatalities, A Four Year Update. NHTSA Research Notes, Sept. 1989. This report estimates fatalities increased about 20 percent in States that repealed helmet use laws.

The Effectiveness of Motorcycle Helmets in Preventing Fatalities. U.S. Dept. of Transportation, report no. DOT HS 807 416, March 1989. This publication presents the data and analysis used to estimate that motorcycle helmets are 29 percent effective in preventing fatalities

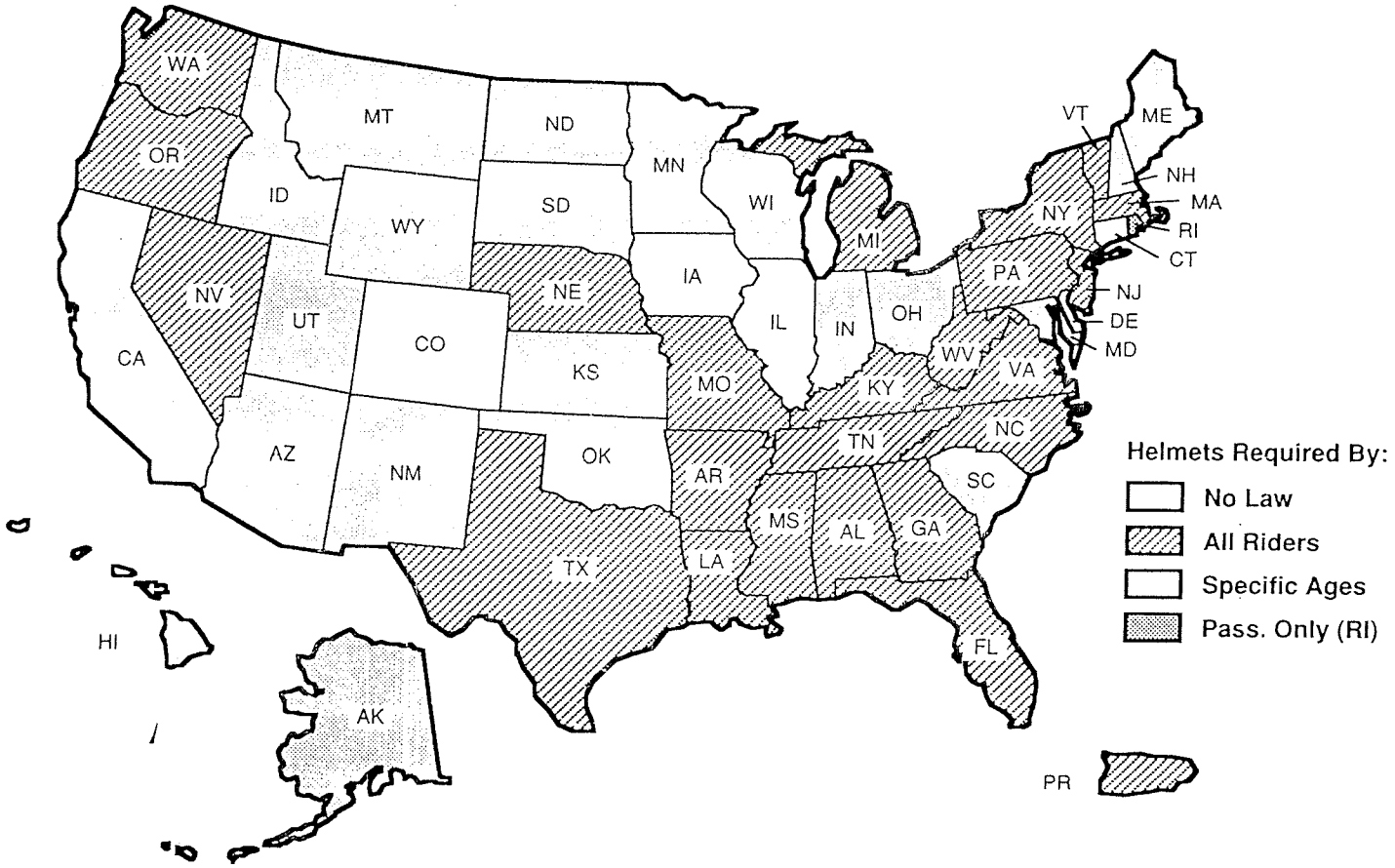
Impact of the Re-Enactment of the Motorcycle Helmet Law in Louisiana. U.S. Dept. of Transportation, report no. DOT HS 806 760, December 1984. This report presents the study and comparison of injury severities, fatalities, and financial impact of helmeted versus non-helmeted motorcycle operators and passengers in Louisiana. The repeal and subsequent re-enactment of Louisiana's helmet use law offered unique and valuable data to conduct this systematic study.

Motorcycle Accident Cause Factors and Identification of Countermeasures, Volume 1: Technical Report. University of Southern California, Los Angeles, U.S. Dept. of Transportation, report no. DOT HS 805 862, January 1981. This report presents the data and findings from the on-scene, in-depth investigations of 900 motorcycle crashes and the analysis of 3600 traffic accident reports of motorcycle crashes in the same study area.

These reports and additional information are available through your State Office of Highway Safety, the NHTSA Regional Office serving your State, or from NHTSA Headquarters, Traffic Safety Programs, NTS-23, 400 7th St., S.W., Washington, D.C. 20590, 202/366-9836.

MOTORCYCLE HELMET USE LAWS

As of September 1, 1990



Motorcycle helmet use, incidence of head injury, and cost of hospitalization

Christine May, RN, MSN, and Diane Morabito, RN, MPH, San Francisco and Oakland, California

Few public safety measures have aroused the controversy generated by mandatory motorcycle helmet legislation. Arguments against the legislation include restriction of hearing and peripheral vision allegedly caused by helmets, the relative lack of cervical spine protection afforded by helmets, and violation of the fundamental notion of freedom of choice for motorcyclists. Prompted by the reintroduction of mandatory helmet legislation in the California State Assembly, data from motorcycle accident casualties cared for at a designated trauma center were reviewed retrospectively.

Trauma clinicians are well aware of the management dilemmas associated with severe head injuries. Despite significant developments in early recognition, rapid transport, and aggressive treatment, mortality from head injuries remains high.[1] Studies have shown that patients with head injuries generally have longer stays in both intensive care units and acute care hospitals.[2] The long-term care needs, limits of rehabilitation, and varying degrees of permanent disability add to the magnitude of this health care problem.

The impact of helmet use on motorcycle casualties has been studied in several states; all studies that compared patients with helmets to those without have reported a higher incidence of head injury among nonhelmeted cyclists. Lloyd and associates[3] reported on 160 patients in Texas and noted a head injury rate 2 to 3 times greater among nonhelmeted cyclists than those wearing helmets. Rivara and associates[4] reviewed 100 patients injured in motorcycle crashes in Arizona; 57% of these patients sustained head injuries. Further, McSwain and Petrocelli's review[5] of motorcycle casualties in four states noted that head injury was more likely to be the most severe injury of the nonhelmeted cyclists.

As expected, the patient groups with longer lengths of stay also have higher charges. When attempting to correlate injury severity with cost, O'Malley and associates[2] demonstrated that cost is largely dependent on length of stay and they concurred with other investigators who have shown longer lengths of stay for head-injured-patients. Most authors focused the attention on acute care costs as represented by charges, but there also have been attempts to estimate long-term costs. Rivara and associates[4] followed patients for a mean time of 20 months and noted that 23% of direct costs were for rehabilitation or readmission. The Arizona study also considered lost productivity and reported a number of patients on subsistence or disability programs after injury, none of whom had required public assistance before their injuries.[4] Using census reports for potential earnings in 1980, Lloyd and associates[3] estimated the "social costs" to be $180 million. Although widely variable, these figures represent a range of total costs for head-injured patients not addressed by initial hospitalization charges.

METHOD Data were reviewed from 225 victims of motorcycle crashes transported according to county triage criteria to the trauma center during a 24-month period in 1987-1988. The population of interest was divided into helmeted and nonhelmeted cyclists. Twelve patients were excluded because their helmet use was unknown. For the remaining 213 patients, data extracted included age, injury severity, length of stay in intensive care unit and acute care hospital, disposition, and aggregate charges.

The tool for data collection was the Bay Area Trauma Registry, a 350-point data set compiled for all patients cared for by the trauma service at the study institution. Information collected included prehospital care, resuscitation, inpatient treatment, outcome, and hospital charges. The body region and severity are listed according to the Abbreviated Injury Scale (AIS) for each injury incurred. The AIS severity code is then used to determine the Injury Severity Score (ISS),

Ms. May is assistant clinical professor in the Department of Physiological Nursing at the University of California, San Francisco. Ms. Morabito is assistant trauma coordinator, Highland General Hospital, Oakland.
18/1/15139

Seven of the eight deaths [in the 213 patient sample] were in the nonhelmeted group.

TABLE 1 Age, length of stay, and disposition

	With helmet	Without helmet
Number of patients	60	153
Average age	29 yr	26 yr
Number of patients admitted to:		
Hospital	47 (78%)	123 (80%)
ICU	9 (15%)	43 (28%)
Average length of stay:		
Hospital	4.2 days	8.2 days
ICU	2.1 days	4.6 days
Average Injury Severity Score:	9	11.5
Hospital admittances	10	13
ICU	17	20
Disposition:		
Home	44 (73%)	118 (77%)
Death	1 (1%)*	7 (4%)
Rehabilitation	0 (0)	5 (3%)
Other hospital	9 (15%)	13 (8%)
HMO	6 (10%)	10 (6%)
Charges per patient	$6,637	$12,108

*In emergency department.

which measures overall severity of injury for each patient. Higher ISS reflects more severe injuries.[6]

Injuries within each subject group were categorized by body region or type of injury, although injury combinations by specific patients were not described. Areas of analysis included ratio of head injuries to all injuries, most frequently occurring injuries, and expected occurrences based on volume differences alone. A simple computation was done using the incidence of injury in the group wearing helmets to estimate the incidence in the nonhelmeted group that could be accounted for solely by increased population size. Average Injury Severity Scores were compared for the two groups. Finally, total charges and payment sources were obtained from the billing department and comparisons were made for helmeted and nonhelmeted patients. Because disposition from the trauma center was the only outcome parameter consistently available, follow-up and long-term disability were not included in this study.

RESULTS Of the 213 patients in the study population, 60 (28%) were wearing helmets and 153 (72%) were not. Age of the sample patients ranged from 14 to 54 years, with a median age of 24 for all patients. Average age of helmeted cyclists was 29, comparable to age 26 for those not wearing helmets. The study population was predominately male (93%). Because nearly all of the subjects were male, no comparison was made of helmet use in male and female subjects.

Eighty percent of the patients were admitted to the hospital. Although nearly equal percentages of both groups were admitted, only 15% of the helmeted group were admitted to the intensive care unit (ICU) as compared with 28% of those patients not wearing helmets. Average length of stay (LOS) for both ICU and total hospitalization was twice as long for nonhelmeted cyclists as for those who wore helmets.

The majority of patients (75%) were discharged home. The remainder were discharged from the emergency department or died. Seven of the eight deaths were in the nonhelmeted group. Other disposition classifications include rehabilitation facility, other acute care hospital (usually patient or family request), and health maintenance plan hospital (usually payer request). All patients transferred to a rehabilitation facility from the trauma center were nonhelmeted. Although this subset included only five patients, final outcome was not known for an additional 38 patients (18%) who were transferred to other acute care facilities. This group of 38 patients included 15 who were wearing helmets and 23 who were not. Age, length of stay, and disposition are detailed in Table 1.

The average ISS for patients wearing helmets was 9, compared to 11.5 for those not wearing helmets. There were 240 separate injuries for the helmeted group and 756 in the nonhelmeted group, indicating that many patients had more than one injury. When external injuries (lacerations, abrasions, and contusions, which were likely to be minor) were excluded, there were 116 injuries in the helmeted group and 380 in the nonhelmeted subjects.

Significant head injuries accounted for 9% of the injuries among helmeted patients as compared with 37% among nonhelmeted patients. Significant head injuries were defined as all injuries to brain tissue and skull. Some patients had more than one head injury diagnosis, such as cerebral contusion and skull fracture. The difference between the two groups in incidence of head injury showed significance at the

2-20

Aggregate charges for the helmeted sample were $398,298, or $6,637/patient. Charges for the nonhelmeted group were $1,852,505, an average of $12,109/patient.

TABLE 2 Injury distribution

	With helmet	Without helmet
Total injuries	240	756
Total injuries excluding surface trauma	116	380
Head:		
Concussion	3	9
Significant injury	10	141
Facial bone	8	24
Eye	1	13
Spinal fracture:		
With cord injury	2	2
Without cord injury	6	10
Pneumothorax	4	8
Lung injury	3	10
Abdominal organ injury	11	10
Pelvic fracture	5	16
Clavicle fracture	3	10
Scapula fracture	1	2
Rib fracture	6	15
Upper extremity	10	36
Lower extremity	36	59
Sprains/dislocations	7	15
Surface trauma (external lacerations, abrasions, contusions)	124	376

TABLE 3 Payment source

	With helmet (N = 60)		Without helmet (N = 153)	
	No.	%	No.	%
Medicare	1	1.7	1	0.7
Medicaid (MediCal)	3	5	15	9.8
Victim of crime (state program)	1	1.7	1	0.7
CMSP (county funds for medically indigent)	2	3.3	11	7.7
Collective (criminal justice)	0		2	1.3
Insurance	15	25	19	12.4
Kaiser	8	13.3	12	7.8
Government payer	8	13.3	5	3.2
Third-party liability	1	1.7	6	3.9
Patient pay	12	20	47	30.7
Other	1	1.7	1	0.7
Information not available	8	13.3	33	21.6

$p < 0.001$ level by means of the chi-square test. Distribution by body region is shown in Table 2.

Comparison of actual incidence of injury with that expected from volume increase alone indicates that injuries to facial bones, eyes, and upper extremities occurred more than expected in the nonhelmeted group. There were fewer lower extremity and abdominal injuries than expected in the nonhelmeted group.

The final area of analysis was fiscal; the findings were based on patient charges generated by the billing department. (Actual cost figures for personnel and resources were not available.) Aggregate charges for the helmeted sample were $398,298 or $6,637/patient. Charges for the nonhelmeted group were $1,852,505, an average of $12,109/patient. Sixty-one percent of the helmeted group had insurance; only 30% of the nonhelmeted group were insured. Payment source is broken down in Table 3.

DISCUSSION The significantly greater incidence of head injury among nonhelmeted motorcyclists in this study ($p < 0.001$) cannot be attributed to volume increase alone. The greater than expected occurrence of facial bone and eye injuries in nonhelmeted patients can be associated logically with lack of protection. However, more information about crash mechanism, including speed, rider ejection, and point of collison, is required to discuss other injuries that occurred more or less frequently than expected on the basis of volume differences.

As noted previously, information was incomplete in this study sample with regard to rehabilitation charges and remaining disability. However, hospital charges for acute care of nonhelmeted patients averaged nearly twice the charges per helmeted patients; this is consistent with other authors' findings.[3, 4, 7, 8]

And who is bearing these costs? As a county facility, the majority of patients cared for at the study institution are publicly supported. Funding sources are detailed in Table 3, and it can be summarized that 57% of these patients listed a government program as the principal payer or were designated "self pay." Previous studies have reported a range of 39% to 75% of uninsured patients.[3, 7, 9]

Although the focus of many studies has been patients who are injured and require hospitalization, fatality rate must not be ignored. It has been shown that severely injured patients with head injury have a higher mortality rate than severely injured patients

2-21

Few persons can afford serious head injury and its aftermath; neither can state governments, local governments, or public agencies.

who are not head injured.[1] It also is clear that head injuries are more likely to occur in nonhelmeted cyclists.[3, 5] In this study seven of eight patients who died were nonhelmeted. The one patient in this study who was wearing a helmet at time of injury died in the emergency department of severe intrathoracic and abdominal injuries. He did not have a significant head injury on autopsy. Perhaps more striking, however, are data from the county Emergency Medical Services agency for all motorcycle accident fatalities during the study period. Of 63 deaths in trauma centers, 52% were nonhelmeted or had unknown helmet use. Of 51 nontrauma-center deaths, 48 were not wearing helmets at the time of injury. All 21 patients pronounced dead at the scene were nonhelmeted, with the remaining 30 patients meeting criteria for transport to the nearest hospital rather than a trauma center (unmanageable airway or cardiac arrest). The three helmeted patients who died at nontrauma centers had major exsanguinating torso injuries. Previously reported comparisons of fatality rates show an increase in serious and fatal head injuries after laws requiring helmets were altered or repealed.[5, 10] Such comparisons cannot be made in California since there is no legislation governing helmet use; but there is the implication that helmet use could not only significantly decrease incidence of severe head injury, but also affect fatality rates.

This study supports the previously demonstrated significance of helmet use in motorcycle crashes. Decreased incidence of head injury, with corresponding shorter lengths of stay and hospitalization costs, are all desired outcomes that can be accomplished, at least in part, by use of appropriate protective devices. The nonuse of helmets in states where there are no laws requiring helmet use, along with the increases in injuries and injury severity when helmet laws were repealed,[5] make a compelling argument for mandatory helmet legislation.

CONCLUSION As health care providers and patient advocates, emergency nurses must not neglect the prevention component of trauma care. It is incumbent on us to address public education needs and support legislation that can be demonstrated to prevent or decrease injury. And finally, in these days of limited health care funds and discussion of resource rationing, the fiscal impact cannot be minimized or overlooked. The cost in pain and human suffering from preventable injuries is tragic. The dollar costs of acute care, rehabilitation, long-term care, and public assistance for the disabled and their families also must be considered. Few persons can afford serious head injury and its aftermath; neither can state governments, local governments, or public agencies.

We wish to thank Gretchen Parker, the trauma program coordinator for Alameda County, for trauma system motorcycle fatality data.

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2-22

Mr. Chairman, committee members, thank you for the opportunity to talk to you today and to urge you to recommend the passage of the proposed helmet law bill.

My name is Andrea Ramsay. I am a practicing attorney from Wichita, Kansas and have represented persons with head injuries.

I am a board member and Vice President for Region VII of the National Head Injury Foundation, including the states of Kansas, Missouri, Iowa and Nebraska.

I am past president and board member and am a member of the Advisory Council of the Head Injury Association of Kansas and greater Kansas City.

I have spoken to civic groups, counseled educators, and have listened to and counseled many dozens of Kansans and persons throughout the United States who have been affected by head injuries.

I am the sister, wife and mother of motorcyclists like those from whom you will hear today, and I have read and heard all the arguments, good and bad, for and against mandatory helmet laws for adults, including those of ABATE of Kansas. Of course, that was when the acronym ABATE stood for American Brotherhoood Against Totalitarian Enactments. They have changed the name to place an emphasis on education. I think that was wise, and I applaud them for the change.

You and they may be surprised to learn that I agree with many of the facts and statistics that ABATE of Kansas and its supporters will undoubtedly quote to you today, although we disagree on the meaning of some of them. I'd like to repeat,

House Transportation
2-21-91
ATTACHMENT 3-1

and comment upon some of the remarks and statistics cited by lobbyists for ABATE of Kansas to this committee in the 1984-1985 session, which will probably be resurrected today.

1. Automobile motorists cause two-thirds of the motorcycle accidents by inattentive driving, so go after car drivers, not motorcycle riders.

Indeed, the study done for the U.S. Department of Commerce indicates some basis for this. The sources I cite are listed in my handout, and I have provided copies of several articles as well. The fact that motorcyclists face great risks on the road is a signal of the need for greater protection, instead of a valid reason to avoid legislating such protection.

2. Increasing the awareness of automobile drivers could reduce motorcycle accidents and injuries.

That sounds logical, and I agree that such education would be a good idea; however, ABATE lobbyist Schlagel testified in 1985 that ABATE planned to conduct such safety education. Despite that, the accident/injury rates have not declined significantly.

3. Helmets obscure vision and hearing, are too hot for safety, and wearing a helmet could actually cause a broken neck in the event of an accident.

That's one of their favorites, on a par with their fear that negligent medical personnel removing a helmet might worsen an already severe injury. Unfortunately, it is based on rank speculation and extremely rare occurrences. For the facts, read the sources in my bibliography, including the October 1, 1983 "Code of Federal Regulations, Parts 400 to 999, Transportation,

concerning motorcycle helmet manufacturing standards, and "Motorcycle Accident Cause Factors and Identification of Countermeasures", the extensive study done for the U.S. Department of Commerce in 1981.

4. Kansas is one of the four safest states in which to ride a motorcycle, and there are fewer accidents and injuries in Kansas since the repeal of the mandatory adult helmet law.

If Kansas is safe, it is only so by comparison to more populous states with more months of warm riding weather, with more cars competing for space on the roads or with worse terrain to ride in. In fact, Kansas is not nearly as safe to ride in now as it was before the repeal. Read the handout, "Impact of Repeal of Motorcycle Helmet Law," the study in which Dr. McSwain found that in Kansas, after the repeal, there was a 333 per cent increase in fatalities per 1000 accidents for those individuals who were not using helmets at the time of their accident compared with those that were using helmets at that time; a 100 per cent increase in head injuries per 1,000 accidents; and a 67 per cent increase in head injury severity.

5. 92 per cent of people involved in motorcycle accidents have been riding less than six months and have not been properly trained.

Based upon the Hurt study, that appears to be accurate. The error is in the conclusion ABATE draws that training and education can reach all of those young, inexperienced riders in time to prevent those accidents and injuries. 88 to 92 percent, varying from year to year, of persons involved in motorcycle accidents in

Kansas are over 18. After many years and even with vigorous legal enforcement increasing the percentages slowly over the years, still only 53 percent of those under age 18, in 1989, were wearing helmets. In 1989, among those ages 18 to 24, only 21% wore helmets; among ages 25-34, only 27%; and among ages 35 and over, only 30%. Following the role model of those older, supposedly more experienced, riders who do not wear helmets because they do not have to, even the minors our statute is supposed to protect are riding unprotected, in noncompliance with the law. It would appear that all of ABATE's attempts at education and encouragement of voluntary helmet usage have not significantly increased helmet usage. When we had a comprehensive helmet law, the usage figures approached 90%.

6. Strict licensing laws contribute to rider education and secondarily to reduction of accidents. Kansas licensing laws are adequate.

ABATE supports strong licensing laws, although they will never eliminate all accidents, but it opposes strong helmet laws, which can significantly reduce fatalities and severe injuries. The illogic of two such opposite views on basically the same issue are insupportable. If the state has a legitimate interest in enacting and enforcing strong licensing, it has an equally strong interest in enacting and enforcing the use of safety equipment by motorcyclists, including helmets.

7. Perhaps most important to bikers, there is the ultimate, "personal freedom" versus "Big Brother" argument. In 1984-85, ABATE's lobbyist even quoted John Stuart Mills to the effect

that government may appropriately act to protect an individual from harming others, but should not have the power to limit the individual's right to harm himself.

Well, John Stuart Mills never drove a car or rode a motorcycle. The right to operate a motorcycle on the streets and roads of the state of Kansas, like the right to drive a car, is not a Constitutionally guaranteed right or personal freedom. It is a privilege granted by the State of Kansas, which has the right to limit or restrict that privilege for legitimate safety ends.

8. In 1984-85, ABATE said that motorcyclists who suffer incapacitating injuries are not a burden to society, that they are adequately insured.

Read the article I've provided on the cost to society of these accidents and then call the office of the Commissioner of Insurance of the State of Kansas, which estimates that 90 per cent of all motorcyclists in Kansas elect minimum liability coverage, that 95% of them reject Personal Injury Protection insurance coverage, and that an extremely high percentage of them allow their insurance coverage to lapse during winter months and do not renew it before they take their bikes out for a ride on those first warm days each Spring.

Then review in your own mind what you know about the rising costs of medical care, particularly for catastrophic trauma care and the controversies that have waged in the legislature in recent years about the inadequate health insurance coverage of all Kansans, which would include motorcyclists. Fewer than twenty

percent of all persons who suffer a severe head injury, including motorcyclists, have insurance which will cover their catastrophic medical and rehabilitation needs. A one-month stay in ICU can cost one hundred thousand dollars or more. A six-month stay in the hospital's rehab unit can cost hundreds of thousands more. Extended rehab can cost in excess of a million dollars. Lifetime care for a person with an incapacitating head injury can cost more than eight million dollars. I have fought battles with insurance companies who try to find ways to limit coverage for rehabilitation in every way they can devise. Find me even one motorcyclist in the state of Kansas who has the kind of insurance that will pay all of the costs of rehabilitation after a severe head injury. I know of none, and least of all those who seem to take the greatest risks with their health and lives and who historically have elected the minimum legal coverage. For those who do not, our already overburdened Medicaid system has to pick up the tab.

9. There is a direct correlation between motorcycle accidents and injuries, including head and spinal cord injuries, but motorcyclists are responsible for only 4.6 per cent of all such injuries, so no such legislation is warranted.

There are some fallacies here. If you check the JAMA articles in my handouts, you will find that motorcycle accidents account for five percent of head injury fatalities and at least that percentage or greater of head injuries without death. Further, there is no logic in saying that you should concentrate only on the areas where the majority of injuries occur and ignore a

proven, partially preventable, although minority cause. In fact, Kansas did address the major causes first by enacting seat belt and child restraint laws. Please read the JAMA handout articles, particularly the "Head Injury-Associated Deaths from Motorcycle Crashes," from the November 14, 1990 issue of the "Journal of the American Medical Association" which states that:

> "A review of US mortality data from 1979 to 1986 identified 15,194 deaths and nearly 600,000 years of potential life lost before age 65 years that were associated with head injuries from motorcycle crashes."

It also recites increases in death and injury rates in states which repealed or weakened their helmet laws and decreases in death and injury rates in states which have enacted stronger laws. And it concludes by saying, as I say to you:

> "Since helmets reduce the severity of nonfatal head injuries in addition to lowering the rate of fatal injuries, we urge the adoption and enforcement of comprehensive motorcycle helmet-use legislation."

By the way, when I told you about my son opposing mandatory motorcycle helmet laws, I didn't tell you that he was only 19 years old at the time, in 1980. I don't know whether his position would be the same today. On September 9, 1980, despite his rider training, the education required to obtain a Kansas license, his wariness of inattentive motorists, and his 19-year old reflexes, he had that accident he thought he would never have. Since then,

he has been unable to sit up alone, to stand, to walk, to go to the bathroom, to feed himself, or to speak. But he is not the only one. Where are those opponents who have suffered similar catastrophic injuries and their families pleading for their continued right of personal freedom to risk further injury and death?

Chairman and committee members, the Kansas Head Injury Association, the National Head Injury Foundation, and I urge you to recommend the adoption of a mandatory helmet law for all motorcyclists in Kansas.

Thank you.

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Title 49, "Transportation," Parts 400 to 999, Rev. 10/1/83, Code of Federal Regulations

ACCIDENT STATS FOR KANSAS

I ALL VEHICLES	1985	1986	1987	1988	1989
Accidents	72585	61984	15245	63256	63642
Persons	190093	163717	166280	1616889	163616
Fatalities	486	500	491	483	428
Incap Injury	5487	45235	5043	5303	5388
Other Injury	27735	26915	27146	26763	27426
No Injuries	156385	131067	133600	129340	130374
Percent Driver	62	64	65	65	65
Percent Passengers	32	34	34	34	34
II MOTORCYCLES					
Accidents	1769	1624	1549	1378	1285
Persons	3794	3598	3228	2894	2686
Percent Driver	75	73	75	74	76
Percent Passengers	23	25	24	25	24
Helmets					
A. NAVAL & Unk (dr/pass)	896	1233	1058	953	472
B. Not Worn (dr/pass)	230	319	334	299	257
C. Worn (all)	351	400	423	645	375
1. Driver	334	360	381	597	333
2. Passenger	27	40	42	48	42
D. Worn & Fatality	10	8	8	4	7
1. Driver	10	7	8	3	6
2. Passenger	0	1	0	1	1
E. Worn & Incap Injury	83	97	89	125	102
1. Driver	79	92	76	105	92
2. Passenger	4	5	13	20	10
F. Total Fatalities	39	42	42	43	27
G. Total Incap Injuries	619	551	528	495	475
Number of Cars Involved w/MC	826	810	748	638	612
Number of Motorcycles	1797	1651	1549	1404	1308

3-10

ACCIDENT STATS FOR KANSAS

III 1985 Data on MOTORCYCLE Accidents by Age

A. Age Groups	Under 18	%	18-24	%	25-34	%	>35	%	Unknown	%	TOTAL	%
Number Persons	228	12.6	742	41	513	14	259	14	55	3	1797	
Number Fatalities/Group	4	2	11	1	14	3	10	4	1	2	1	
Number Incap Injury/Group	66	3	221	3	166	3	99	4	6	1		
B. Helmets												
NAVAL & Unknown	43	19	187	25	138	27	66	25	7		441	24.5
Not Worn	21	9	100	13	73	14	28	10.8			222	12
Worn	68	30	123	16.5	81	15.7	58	22	4		334	18.5

41% of all persons involved in motorcycle accidents are between the ages of 18 and 24; 55% are between 18 and 34. Only 12.6 percent are under 18. The rest are 35 and older.

Only 15 - 16% of the group 18 to 34 were wearing helmets.

ACCIDENT STATS FOR KANSAS

IV 1986 Data on MOTORCYCLE Accidents by Age

A. Age Groups	Under 18	%	18-24	%	25-34	%	>35	%	Unknown	%	TOTAL	%
Number Persons	240	15	664	40	454	27	248	16	45	3	1651	100
Number Fatalities/Group	7	3	12	2	15	3	3	1	0	0	37	
Number Incap Injury/Group	69	18	178	27	155	33	89	36	2	4	491	
B. Helmets												
NAVAL & Unknown	36	15	197	29.6	138	30	50	20	2	4		
Not Worn	22	9	112	16.8	97	8	39	15.9	0	0		
Worn	94	39	116	17	79	17	67	27	4	9		

67% between 18 and 34, with only 17% helmet usage.

1.5% under 18, with 39% helmet usage.

3-12

ACCIDENT STATS FOR KANSAS

V 1987 Data on MOTORCYCLE Accidents by Age

A. Age Groups	Under 18	%	18-24	%	25-34	%	>35	%	Unknown	%	TOTAL	%
Number Persons	216	14	599	39	444	29	247	16	43	2	1549	100
Number Fatalities/Group	3	1	19	3	13	5	5	2	0	0		
Number Incap Injury/Group	65	3	164	27	131	29.5	92	37	0	4		
B. Helmets												
NAVAL & Unknown	45	21	237	39.5	156	12.6	71	28.7	1	2		
Not Worn	20	9	112	18.6	105	23.6	55	22	2	5		
Worn	95	44	121	20	91	20	44	17.8	0	0		

ACCIDENT STATS FOR KANSAS

VI 1988 Data on MOTORCYCLE Accidents by Age

A. Age Groups	Under 18	%	18-24	%	25-34	%	>35	%	Unknown	%	TOTAL	%
Number Persons	178	12.7	597	42.5	352	25	845	60	29	2	1404	100
Number Fatalities/Group	4	2	19	3	12	3	7	0	0	0		
Number Incap Injury/Group	89	50	171	29	120	34	78	9	1	3		
B. Helmets												
NAVAL & Unknown	51	29	249	41	158	45	81	9.5	10	3		
Not Worn	18	10	123	21	67	19	39	4.6	0	0		
Worn	94	53	119	20	72	20	91	10.7	0	0		

ACCIDENT STATS FOR KANSAS

VII 1989 Data on MOTORCYCLE Accidents by Age

A. Age Groups	Under 18	%	18-24	%	25-34	%	>35	%	Unknown	%	TOTAL	%
Number Persons	106	8	515	39	363	27.7	248	18.9	36	27.5	1308	100
Number Fatalities/Group	2	2	10	2	9	2	5	2	0	0		
Number Incap Injury/Group	49	46	157	30	141	39	91	37	1	3		
B. Helmets												
NAVAL & Unknown	34	32	192	37	151	36	74	30	8	22		
Not Worn	15	14	95	18	62	17	42	17	2	5		
Worn	88	83	108	21	97	27	75	30	1	3		

Head Injury–Associated Deaths From Motorcycle Crashes

Relationship to Helmet-Use Laws

Daniel M. Sosin, MD; Jeffrey J. Sacks, MD, MPH; Patricia Holmgreen, MS

A review of US mortality data from 1979 to 1986 identified 15 194 deaths and nearly 600 000 years of potential life lost before age 65 years that were associated with head injuries from motorcycle crashes. White males from 15 to 34 years of age accounted for 69% of the deaths. The rate of motorcycle-related deaths associated with head injury declined modestly between 1979 and 1986 (19% using rates based on resident population and 8% based on motorcycle registrations). Population-based rates adjusted for age, sex, and race in states with partial or no motorcycle helmet–use laws were almost twice those in states with comprehensive helmet-use laws. Two states that weakened their helmet-use laws from comprehensive to partial during the study period had increases in motorcycle-related head injury death rates (184% and 73%), and one state that strengthened its law from partial to comprehensive had a decline in its death rate (44%). Head injury death rates based on motorcycle registrations were also lowest in states with comprehensive helmet-use laws. Since helmets reduce the severity of nonfatal head injuries in addition to lowering the rate of fatal injuries, we urge the adoption and enforcement of comprehensive motorcycle helmet–use legislation.

(*JAMA*. 1990;264:2395-2399)

IN THE United States, motor vehicles are a major cause of premature death and disability. An average of 46 500 motor vehicle–related deaths occurred on public roadways each year from 1979 to 1986 and 12% of those who died were riding motorcycles.[1] Head injuries are a leading cause of death from motorcycle crashes, and there is substantial evidence that motorcycle safety helmets are effective in reducing the incidence and severity of head injuries due to motorcycle crashes.[2] Nonetheless, there has been no national description of head injuries or head injury–associated deaths from motorcycle crashes. Studies of the effectiveness of motorcycle helmet–use laws[2-7] generally use motorcycle-related death as a proxy for the measure of more direct interest, motorcycle-related head injury death. We used death certificate data from the National Center for Health Statistics (NCHS) to examine motorcycle-related head injury–associated deaths in the United States from 1979 to 1986. We report here on the descriptive epidemiology, national time trends, and association between such deaths and motorcycle helmet–use laws.

From the Division of Injury Control, Center for Environmental Health and Injury Control, Centers for Disease Control, Public Health Service, US Department of Health and Human Services, Atlanta, Ga.

Reprint requests to Division of Field Services, Epidemiology Program Office, Centers for Disease Control, Mailstop F-15, Atlanta, GA 30333 (Dr Sosin).

METHODS

We used the Multiple Cause-of-Death Public-Use Data Tapes from the NCHS for the years 1979 to 1986. The underlying cause of death and up to 20 associated medical conditions were coded from death certificates onto these tapes according to the *International Classification of Diseases, Ninth Revision (ICD-9)*.[8] Part I of the death certificate lists the sequence of conditions that resulted in death. Head injury–associated deaths were those that had at least one of the following head-injury diagnoses listed in Part I of the death certificate: fracture of the vault or base of the skull [diagnosis codes 800.0-801.9]; other and unqualified and multiple fractures of the skull [803.0-804.9]; intracranial injury, including concussion, contusion, laceration, and hemorrhage [850.0-854.9]; late effects of fracture of the skull and face [905.0]; and late effects of intracranial injury without skull fracture [907.0].

All deaths among US residents were analyzed when the underlying cause was coded as motor vehicle–related [E810-E825]. Motorcycle-related deaths were those with a fourth digit code for driver [.2] or passenger [.3] on a motorcycle. Motorized scooters and tricycles and mopeds were included as motorcycles. Both drivers and passengers are referred to as motorcyclists. Death certificates did not contain information on helmet use or levels of intoxicants in the blood at the time of death.

To estimate underreporting of head injuries on the death certificates, we studied deaths with nonspecific codes in detail. We collectively labeled the following injury diagnosis codes as "nonspecific codes": internal injury to unspecified or ill-defined organs [869], traumatic shock [958.4], other early complications of trauma [958.8], and injury not otherwise specified [959.8-959.9]. We then reviewed all diagnoses describing the nature of injuries [800-999] for a random sample of 500 motorcyclist deaths with at least one nonspecific code and without a head-injury diagnosis.

Motorcycle-related head injury–associated death rates were calculated per million people by using the residence of the deceased and population estimates for each year from 1979 to 1986.[9,10] All population-based state rates were adjusted for age, sex, and race to the US population[11,12] by the direct method. To adjust for age, we used the age groups 0 to 14, 15 to 19, 20 to 24, 25 to 29, 30 to 34, 35 to 39, 40 to 44, and 45 years of age or older. Five-year spans were chosen for the 15- to 44-year range because most deaths associated with head injury

3-16

that are sustained in motorcycle crashes happen to people in that age range.

Information on motorcycle helmet-use laws was obtained from the Motorcycle Industry Council, Government Relations Office. States with helmet-use laws requiring all motorcyclists to wear safety helmets were designated as having comprehensive or full laws. States with laws limited to young motorcyclists (eg, those younger than 21 years old) were considered to have partial laws. States without a law or with a law restricted to passengers or to drivers younger than 16 years of age were considered to have no law. Two types of motorcycle-related death rates were calculated for states that were grouped by helmet-use law: (1) population-based rates adjusted for age, sex, and race and (2) rates per 10 000 registered motorcycles.[13,14] If a state changed its law during the study period, its mortality was apportioned to the appropriate helmet-use law group for the years with that law.

Public-use tapes from the Fatal Accident Reporting System (FARS) of the National Highway Traffic Safety Administration were used to study the representativeness of the NCHS data by comparing age, sex, and location of motorcyclist fatalities for 1979 to 1986. The FARS gathers data on the circumstances of all motor vehicle crashes that occur on public roads and that involve one or more fatalities within 30 days of the crash; however, data on the anatomic nature of injuries are not obtained. The FARS records are based on the date and location of the crash rather than on the decedent's date of death and place of residence, as in the NCHS records.

We report on all death certificates of motorcycle-related deaths in the United States from 1979 to 1986. As such, we chose not to address sampling error and no statistical tests were applied to our results.

Table 1.—Motorcycle-Related Deaths With Head Injury by Age, Race, and Sex in the United States From 1979 to 1986

	All Motorcyclist Deaths	Motorcyclist Deaths With Head Injury	Head Injury, %
Age group, y			
<15	907	506	55.8
15-24	14 251	7694	54.0
25-34	9037	4790	53.0
35-44	2817	1390	49.3
≥45	1732	812	46.9
Total*	**28 744**	**15 192**	52.9
Race			
W	26 465	14 124	53.4
B	1984	910	45.9
Other	300	160	53.3
Total	**28 749**	**15 194**	52.9
Sex			
M	26 236	13 745	52.4
F	2513	1449	57.7
Total	**28 749**	**15 194**	52.9

*Age at death was not available in five instances; those five were excluded from the age-adjusted rates.

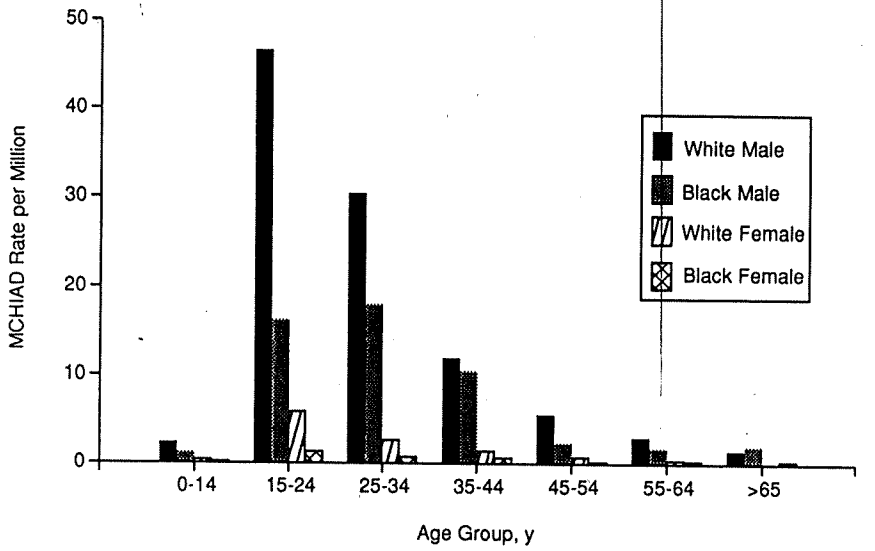

Fig 1.—Motorcycle-related head injury–associated death (MCHIAD) rates, by age, sex, and race, in the United States from 1979 to 1986.

RESULTS

According to death certificates of US residents, 28 749 motorcyclists died from motorcycle-related injuries during the 8 years from 1979 to 1986. On the basis of the age at death, 1 108 733 years of potential life were lost before age 65 years. Head injury was involved in 15 194 (53%) of these deaths, which resulted in 591 977 years of potential life lost. The proportion of motorcycle deaths associated with head injury decreased as the age of the groups increased; however, the proportion varied less than 9% by age group, race, or sex (Table 1). More than 82% (12 484) of the deaths associated with head injury in motorcycle crashes were among persons 15 to 34 years of age (median age, 24 years). Ninety percent (13 745) of the decedents were male and 93% (14 124) were white; 69% (10 541) were white males aged 15 to 34 years.

Of 179 968 head injury–associated deaths due to motor vehicle crashes, the type of vehicle and the decedent's role in the incident (eg, motorcycle driver, driver of a motor vehicle other than a motorcycle, and pedestrian) were not known in 41 900 instances (23%). Motorcyclists accounted for 11% (15 194) of the deaths when the vehicle type was recorded. Loss of control of the motorcycle [E815-E816] was cited specifically for 40% (6004) of motorcyclist deaths associated with head injury. Collision with another motor vehicle [E812] accounted for 52% (7882) of such deaths; nontraffic injuries [E820-E825] for 2% (297); other known circumstances [E810-E811, E813-E814, E817-E818] for 2% (351); and unknown circumstances [E819] for 4% (660). Fourteen percent (2145) of the motorcyclists with head injury–associated deaths were passengers.

Motorcyclists died with head injuries at an average annual rate of 8.2 per million US residents. The rate varied

3-17

Table 2.—Annualized Population-Based (PB) and Registration-Based (RB) Rates of Motorcycle-Related Head Injury–Associated Death (MCHIAD), by State and Helmet-Use Law in the United States From 1979 to 1986.

Full Law				Partial Law				No Law			
State	MCHIAD Deaths	PB Rate*	RB Rate†	State	MCHIAD Deaths	PB Rate*	RB Rate†	State	MCHIAD Deaths	PB Rate*	RB Rate†
Ala	184	6.0	3.3	Alaska	21	5.5	2.7	Calif	2617	12.5	4.6
Ark	29	1.7	1.3	Ariz	320	13.5	4.6	Colo	283	9.6	3.1
DC	10	0.4	2.5	Del	49	9.9	5.5	Conn	294	11.7	5.2
Fla	753	9.9	4.1	Hawaii	73	12.1	8.4	Ill	491	5.4	2.4
Ga	136	3.1	1.5	Idaho	38	6.6	0.9	Ind‡	129	4.7	1.6
Ky	102	3.3	2.3	Ind‡	89	5.4	2.2	Iowa	376	15.4	2.0
La‡	61	3.0	2.0	Kan	246	12.5	3.0	Me	128	12.6	3.4
Mass	332	6.7	3.8	La‡	62	5.4	2.6	Neb	159	11.7	4.3
Mich	449	6.1	2.3	Md	221	6.9	3.6	RI	63	7.8	3.1
Miss	137	8.3	6.3	Minn	324	8.7	2.4	Wash	431	11.4	3.9
Mo	254	6.5	3.4	Mont	98	13.3	3.7				
Nev	76	10.0	4.5	NH	109	12.2	2.5				
NJ	286	5.2	3.2	NM	121	10.0	3.0				
NY	573	4.3	3.5	ND	78	12.1	3.2				
NC	330	6.9	4.3	Ohio	598	6.9	2.7				
Pa	379	4.1	2.1	Okla	274	11.0	2.9				
SC‡	20	5.6	5.3	Ore	318	14.6	4.7				
Tenn	301	8.1	4.1	SC‡	338	15.9	13.3				
Vt	24	4.9	1.4	SD	65	10.6	2.2				
Va	168	3.7	2.6	Tex	1407	10.8	5.7				
WVa	44	2.5	1.5	Utah	166	11.5	3.4				
Wyo‡	13	5.1	1.5	Wis	525	12.9	3.3				
				Wyo‡	22	8.8	2.5				
Total	**4661**	5.5	3.0	**Total**	**5562**	10.2	3.7	**Total**	**4971**	10.4	3.5

*Per million residents.
†Per 10 000 registered motorcycles (No. of registered motorcycles [10 000]: full law = 1530; partial law = 1505; and no law = 1408).
‡States that changed their helmet-use laws included Indiana, no law 1979-1983, partial law 1984-1986; Louisiana, partial law 1979-1981, full law 1982-1986; South Carolina, full law 1979, partial law 1980-1986; and Wyoming, full law 1979-1982, partial law 1983-1986.

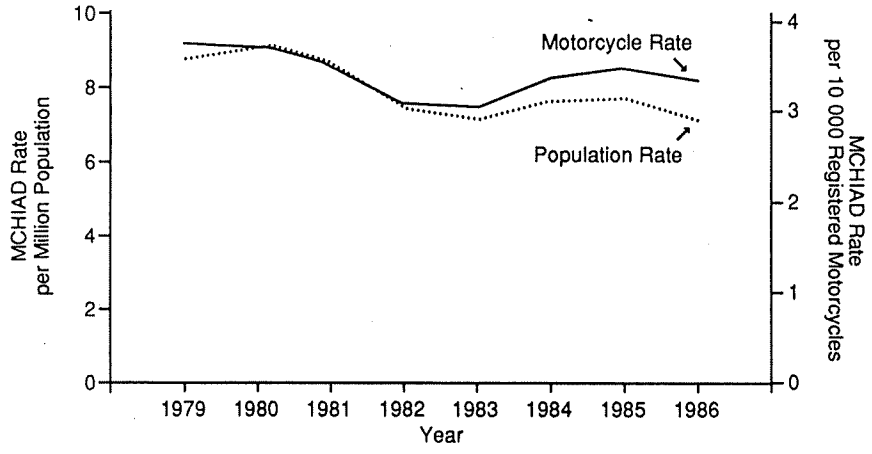

Fig 2.—Motorcycle-related head injury–associated death (MCHIAD) rates, by year, in the United States from 1979 to 1986.

considerably by age group, sex, and race (Fig 1). The rate peaked at 21 years of age (31.5), with the highest rate among 21-year-old white men (63.5). The age-, sex-, and race-adjusted annualized death rate for all motorcycle fatalities was 11.7 per million residents in states with full helmet-use laws, 19.5 in states with partial laws, and 17.6 in states with no law. The relative difference in similarly adjusted death rates between states with full laws and those with partial or no law was even greater for deaths associated with head injury: the rate for states with full helmet-use laws (5.5) was nearly half the rate for states with partial laws (10.2) or no law (10.4) (Table 2). The adjusted annualized rate for those under 20 years of age, for whom the partial laws were designed, remained similarly elevated in states with partial laws (7.4) and states without laws (7.7) compared with states with full laws (4.5).

Overall, the annualized motorcycle registration-based rate of death associated with head injury was 3.4 per 10 000. The rate was 23% higher in states with partial laws (3.7) than in those with full laws (3.0) and was 17% higher in states with no law (3.5) than in those with full laws. These rates could not be adjusted for age, sex, or race because registration data were not available by such categories. Motorcycle registration-based rates of head injury–associated deaths declined from 3.7 in 1979 to 3.4 in 1986, a relative decline of 8%, which was less than half the decline found with population-based rates (9.0 to 7.3 per million residents; 19%) (Fig 2). More striking was the lack of sustained decline in either rate since 1983, a pattern seen in all categories of helmet law (Fig 3).

Three of the four states that changed

3-18

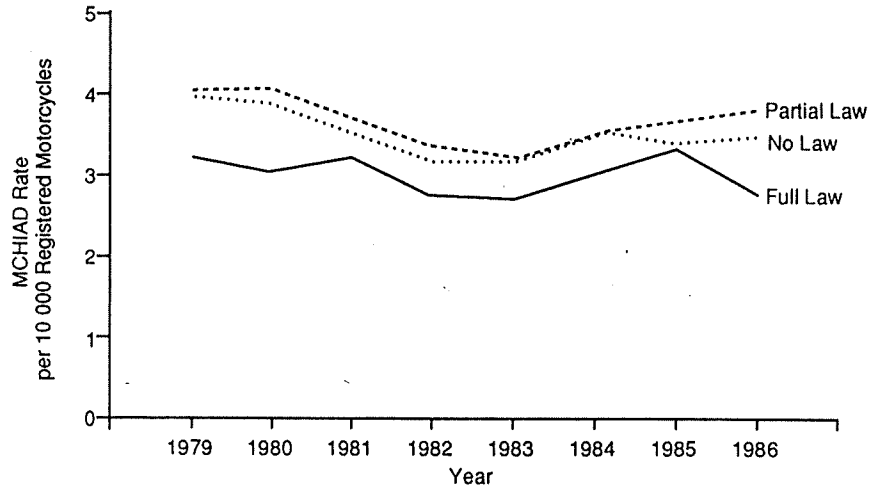

Fig 3.—Motorcycle-related head injury–associated death (MCHIAD) rates, by helmet law and year, in the United States from 1979 to 1986.

helmet-use laws during the study period showed higher adjusted population-based rates of head injury–associated deaths during the period of less comprehensive law. South Carolina and Wyoming changed from full to partial laws and had increases of 184% and 73%, respectively. The rate in Louisiana decreased 44% when the state changed from partial to full law. Indiana, which only changed from no law to partial law, showed a 15% increase after the change, consistent with the national trend (Fig 2). Similar changes were seen using motorcycle registration-based rates (Table 2).

The FARS identified 37 391 motorcyclist fatalities from 1979 to 1986. The distribution of fatalities for both the FARS and the NCHS varied no more than 0.5% within the sex or age groups. The undercount of motorcyclist deaths by the NCHS relative to the FARS ranged from 20% to 25% during each of the 8 years. Compared with the FARS, similar proportions of the NCHS fatalities were from states with full helmet-use laws (35% vs 36%) and states without helmet-use laws (31% vs 30%).

Few death certificates for motorcyclists, less than 1% (147 per 28 749), had no nature-of-injury code [800-999]. Of motorcycle-related deaths without a head injury listed, a nonspecific injury code was listed on the death certificate in 68% of cases (9149 of 13 533). States without helmet-use laws were more likely to use a nonspecific code for motorcycle-related deaths not associated with head injury (75%) than either states with full helmet-use laws (65%) or partial laws (63%). Of a random sample of 500 motorcyclist deaths without a head injury code but with a nonspecific injury code, 17% (83) also had an injury diagnosis specifying an anatomic site.

COMMENT

The 15 000 motorcyclist deaths and nearly 600 000 years of potential life lost associated with head injury during the 8-year study period reflect only a fraction of the head injury problem caused by motorcycles. Death is the outcome for only 1% of motorcyclists injured severely enough to receive medical care.[15] Furthermore, nonuse of motorcycle helmets has been shown to result in a shift in the spectrum of injuries, not only to more fatalities but also to more severe nonfatal injuries.[2] Disability related to the nonfatal injuries is extensive, and much of the cost is borne by the public.[16]

Although the annual rate of head injury–associated deaths from motorcycle crashes (8.2 per million US residents) is substantial, it is an underestimate of the death rate for motorcyclists, since most US residents do not ride motorcycles. Although the risk of injury may be greater for 21-year-old white men than for any other segment of the population, greater motorcycle usage is probably a factor in that high rate. The 40-fold higher national rate of motorcycle-related head injury–associated deaths when rates are based on motorcycle registrations rather than on the US population better reflects the motorcyclist's risk. However, motorcycle registrations are still limited because they do not directly reflect motorcycle usage. Furthermore, motorcycle registration–based rates do not allow adjustment for factors of demonstrated importance such as age, sex, and race. It is for this reason that we present both registration- and population-based rates when comparing states grouped by helmet law status.

Although the FARS and the NCHS tabulate similar numbers of motor vehicle deaths,[17] the NCHS underestimated motorcycle-related deaths by 23%, consistent with the 23% of all motor vehicle crashes for which the crash circumstances, including vehicle type, were unknown. While bias introduced to our helmet law analysis by the undercount of motorcycle deaths cannot be excluded, such bias would be dependent on those not included being different in their injury risk and helmet law distribution from those included in the analysis. We were unable, however, to find substantial differences between the FARS and the NCHS data on motorcyclist fatalities by comparable risk variables (age, sex, or year) or by the geographic distribution that reflected the state groupings for helmet-use laws.

The contribution of head injury to death, when recorded, could not be determined for this study; hence, the designation "head injury–associated death." Conversely, head injuries truly associated with death may not have been recorded on the death certificate. The extent to which head injury is undiagnosed at death has not been studied. Underreporting may also occur when injuries are extensive and the recorder chooses not to provide anatomic detail. While it was rare for motorcycle-related deaths to be reported without any nature-of-injury diagnosis, many of these diagnoses were nonspecific. Even so, we estimate that as many as 73% of the death certificates for motorcycle-related deaths from 1979 to 1986 had some specific anatomic injury information on them. We calculated our estimate by adding the 15 194 head injury–associated deaths, the 4406 non–head injury deaths with a specific nature-of-injury code, and the sample-based estimate of 1519 ([83/500] × 9149) deaths without a head injury code but with some specific anatomic injury information in addition to a nonspecific code. This estimate is similar to one made during a study of all motor vehicle–related deaths in 1978. In that study, a specific body region of injury was identified on 78% of the death certificates.[17] Most of the remaining deaths were attributed to injury complications or massive multiple injuries. While death certificates remain the only source of comprehensive, continuously available national data for head inju-

3-19

ries,[18] more thorough and accurate completion of death certificates is vital to the future study and monitoring of injuries in the United States.

Temporal and geographic trends in death certificate data also need to be interpreted cautiously because of possible differential variations in diagnosis, terminology, and reporting practices by time and place.[19-21] Regional differences in the use of nonspecific codes, for example, could bias rates of motorcycle-related head injury–associated deaths if these codes were used in place of a head injury diagnosis. For this study, such a bias would have minimized the differences between death rates in states with full helmet-use laws and those with no helmet-use law, since nonspecific codes were used more frequently in no-law states.

Despite their limitations, the NCHS multiple cause-of-death data help to evaluate efforts to reduce motorcycle-related head injury–associated deaths in the United States. Numerous studies have already demonstrated that the use of motorcycle helmets can reduce the severity of head injuries,[3,4,7,22-27] and that full helmet-use laws effectively increase the use of motorcycle helmets to nearly 100% from a voluntary level of 50% to 60%.[2,4] An ecological study to assess the impact of helmet-use laws on the collective population is a suitable approach for evaluating the effectiveness of motorcycle helmet-use legislation.[28] Other such studies have shown that the repeal of mandatory helmet-use laws has been associated with increased motorcyclist fatalities.[2-7]

Although all motorcyclist fatalities are a reasonable proxy for those associated with head injury, we were able to describe the association between head injury and helmet-use legislation more directly by comparing motorcycle-related head injury–associated death rates per million US residents (adjusted for age, sex, and race) and per 10 000 registered motorcycles for states with full, partial, or no helmet-use laws from 1979 to 1986. The greatest limitation of these analyses was our inability to control for potential confounding factors associated with both the rate of head injury–associated deaths among motorcyclists and the type of helmet-use law (eg, stricter speed limit laws and greater restrictions on access to alcohol may exist in states with comprehensive helmet-use laws). Nonetheless, in the aggregate we found substantially lower rates of head injury–associated deaths from motorcycle crashes in states with full helmet-use laws. Although based on smaller numbers of deaths, we also found that states that changed from full to partial law or from partial to full law had lower rates during the full-law years. States with partial helmet-use laws (those laws restricted to the youngest motorcyclists) had similar rates as states with no helmet-use law, even for deaths among those under 20 years of age. The ineffectiveness of the partial laws appears to be related to low compliance with them, which arises from difficulties in enforcement of laws targeted to a specific age group.[2] Our findings reinforce the existing scientific data that demonstrate the effectiveness of comprehensive motorcycle helmet-use laws.

To improve voluntary helmet use in the absence of mandatory helmet-use laws, motorcyclists need an increased awareness of their vulnerability. Most injured motorcyclists who do not wear helmets report that they did not expect to be injured[22]; yet 40% of the head injury–associated deaths were ascribed to the motorcyclist's loss of control, not, apparently, to some action of the driver of another motor vehicle. New efforts to improve motorcyclists' ability to maintain control of their vehicles (eg, vehicle or roadway design changes and special training programs) may also prove beneficial.

The reasons for the lack of a sustained decline in motorcycle-related head injury–associated death rates since 1983 are unclear. Changes in speed limit laws, access to alcohol, or vehicle miles traveled do not appear to explain the temporal trend. The nominal reduction in head injury death rates from motorcycle crashes since 1979 highlights the importance of expanding efforts to prevent such injuries. Comprehensive motorcycle helmet-use legislation appears to be a viable and scientifically sound component of those efforts.

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3-20

Head Injury–Associated Deaths in the United States From 1979 to 1986

Daniel M. Sosin, MD; Jeffrey J. Sacks, MD, MPH; Suzanne M. Smith, MD

Review of US mortality data from 1979 to 1986 identified 315 328 deaths associated with head injury, which represented 2% of all deaths, 26% of injury deaths, and an annualized head injury–associated death rate of 16.9 per 100 000 residents. Motor vehicles (57%), firearms (14%), and falls (12%) were the most frequent causes. Death rates peaked at 15 to 24 years of age and at 75 years or older, with the younger group most affected by motor vehicles (77%) and the older group by falls (43%). Although blacks and whites had similar death rates overall, age- and cause-specific rates varied considerably. The rate of head injury–associated death for males was three times that of females. Rates for head injury–associated death plateaued after declining in the early 1980s. Physicians can play an important role in primary prevention of head injury through careful prescribing of medications, patient counseling, and advocacy of proved interventions such as motor vehicle–occupant restraints.

(*JAMA*. 1989;262:2251-2255)

HEAD INJURIES are a major cause of morbidity and mortality,[1] as well as persistent functional disability and psychological impairment.[2] The national incidence of fatal and nonfatal head injuries, however, has not yet been adequately characterized. Only a few studies have estimated the incidence of head injury, and these were mostly in limited geographic areas during 1 year.[3-9] Obtaining national estimates of the incidence of head injury is made more difficult by the different methods of case definition and ascertainment used in these studies. Indeed, head injury researchers have decried the "lack of essential data to estimate levels and secular trends in mortality nationally."[10] We used an existing national database to examine the major causes of head injury–associated death (HIAD), to describe those at greatest risk, and to define the incidence and temporal trends of HIAD in the United States from 1979 to 1986.

From the Division of Injury Epidemiology and Control, Center for Environmental Health and Injury Control, Centers for Disease Control, Atlanta, Ga.

Reprint requests to Division of Field Services, Epidemiology Program Office, Centers for Disease Control, Mailstop C-08, Atlanta, GA 30333 (Dr Sosin).

METHODS

We used the Multiple Cause-of-Death Public Use Data Tapes for the years 1979 to 1986 from the National Center for Health Statistics. The underlying cause of death and up to 20 associated medical conditions were coded from death certificates onto these tapes according to the *International Classification of Diseases, Ninth Revision*.[11] Descriptions of these tapes and the coding process are reported elsewhere.[12,13]

All deaths that had at least one of the following head injury diagnoses anywhere on the death certificate were reviewed: fracture of the vault or base of the skull (diagnosis codes N800.0 through N801.9); other and unqualified and multiple fractures of the skull (N803.0 through N804.9); intracranial injury, including concussion, contusion, laceration, and hemorrhage (N850.0 through N854.9); late effects of fracture of the skull and face (N905.0); and late effects of intracranial injury without skull fracture (N907.0). To meet our criteria of an HIAD, we required that one or more of the previously mentioned head injuries be listed in the sequence of conditions that resulted in death (ie, in part I of the death certificate). We also required a death to have an intentional or unintentional injury condition (E800 through E999) coded as the underlying cause of death, and that the deceased be a US resident.

The following underlying cause-of-death categories were analyzed: motor vehicles (E810 through E825); unintentional falls (E880 through E888); and firearms, both intentional and unintentional (E922, E955.0 through E955.4, E965.0 through E965.4, E970, and E985.0 through E985.4). All other underlying injury causes of death were grouped together because of their infrequent occurrence or nonspecific nature. *Other* causes of injury death included railway and air transport, drowning, natural disasters, and nonspecific causes such as being struck by an object or caused by machinery.

Annual HIAD rates were calculated using population estimates of US residents for individual years 1979 to 1986.[14-17] The annualized HIAD rates for the period 1979 to 1986 used cumulative deaths and population estimates for those years. Race-specific death rates are presented for whites and blacks

3-21

only; other races, however, were included in analyses not stratified by race. The HIAD rates for regions[17] were based on the place of residence of the deceased. The population for metropolitan and nonmetropolitan counties was provided by the US Bureau of the Census for the years 1980 through 1986 using the 1983 definition of standard metropolitan statistical areas. The 1980 estimate was also used for 1979 because no estimate was available for that year. No statistical tests were applied to our results because we analyzed all HIADs and not a sample of HIADs.

RESULTS

A head injury condition was recorded on the death certificates of 335 769 US residents from 1979 to 1986. Excluding 17 663 (5.3%) deaths for which the head injury condition was recorded as contributing to death but not related to the underlying cause of death (ie, the condition was listed on part II of the death certificate), and excluding an additional 2778 (0.8%) deaths for which the underlying cause of death was not an injury, 315 328 deaths met our study definition of an HIAD.

These 315 328 HIADs represented 2.0% of all deaths, 26.1% of all injury deaths, and an annualized HIAD rate of 16.9 per 100 000 US residents during that period. Intracranial injury was reported for 87% of the HIADs and skull fracture was reported for 27%. Skull fracture was reported in the absence of a separate intracranial injury code for only 12% of the HIADs. In the absence of an acute code for intracranial injury or skull fracture, "late effects" contributed only 1% of all HIADs. An autopsy was reported to have been performed for 48% of the HIADs.

Head injury–associated deaths were most often related to motor vehicles (57%), firearms (14%), and unintentional falls (12%). Of all deaths in those categories, head injury was associated with 46%, 17%, and 38%, respectively.

Age-specific HIAD rates showed a bimodal distribution with peaks in the 15- to 24-year age group (26.7 per 100 000 residents) and those 75 years or older (34.1 per 100 000 residents) (Fig 1). Injuries related to motor vehicles accounted for 77.1% of HIADs in the 15- to 24-year age group but only 25.6% in those 75 years or older; unintentional falls were associated with 2.3% and 42.9% of HIADs in these age groups, respectively. The HIAD rate related to firearms peaked in the 25- to 34-year age group (3.4 per 100 000 residents) and showed little decline with advancing age.

The annualized HIAD rate was 17.0 per 100 000 residents for both whites and blacks (Table 1). Other races made up 2.7% of the population during 1979 to 1986, and their HIADs reflected the age, sex, and cause trends of whites, although at lower rates. Motor vehicle–related injuries were the predominant underlying cause of death for both races; however, the motor vehicle–HIAD rate for whites was 39% higher than that for blacks. In contrast, HIAD rates related to firearms were 39% higher for blacks than whites. Blacks had higher HIAD rates than whites in all age groups except those 15- to 24-years old and 75 years or older, the peaks of the white bimodal age distribution. Death rates for blacks showed less variation between age groups, reaching a plateau in those 25 to 34 years old before peaking in the 75-years or older age group. Unintentional falls made a larger contribution at a younger age for blacks relative to whites; however, the highest HIAD rate for unintentional falls was in older whites.

Head injury–associated death rates related to firearms were higher for blacks than whites in all age groups through 54 years of age (Table 1). Sui-

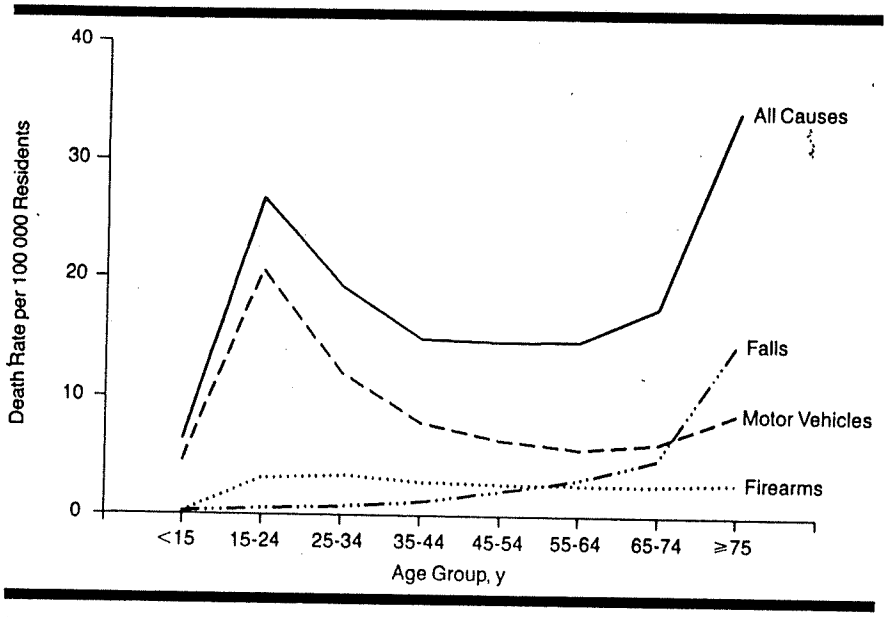

Fig 1.—Age-specific rates for head injury–associated death, by underlying cause, United States, annualized for 1979 to 1986.

Table 1.—Rates for Head Injury–Associated Death (HIAD), by Age, Cause, and Race, in the United States, Annualized for 1979 to 1986

	Rate* of HIAD									
	Motor Vehicle		Fall		Firearm		Other		Total	
Age Group, y	White	Black	White	Black	White	Black	White	Black	White	Black
<15	4.5	4.6	0.3	0.5	0.2	0.3	1.2	2.3	6.2	7.7
15-24	22.7	9.2	0.7	0.3	2.9	5.0	2.3	2.6	28.6	17.1
25-34	12.5	9.7	0.8	1.3	3.0	6.3	2.6	5.5	18.9	22.8
35-44	7.8	7.6	1.0	2.7	2.7	4.3	2.7	6.9	14.2	21.5
45-54	6.3	6.7	1.9	4.2	2.8	2.9	3.1	7.3	14.1	21.1
55-64	5.6	6.5	3.0	4.8	2.6	2.3	3.1	6.6	14.3	20.2
65-74	6.2	6.0	4.8	5.1	2.9	1.5	3.5	6.8	17.4	19.4
≥75	8.8	7.1	15.1	8.8	3.0	1.3	7.4	13.2	34.3	30.4
All ages	10.0	7.2	2.0	1.9	2.3	3.2	2.7	4.7	17.0	17.0

*Per 100 000 US residents.

3-22

cide contributed to 63% of all firearm-related HIADs, with homicide contributing 29%; unintentional firearm injuries, 5%; and the remainder were of unknown intent or legal intervention. For whites, suicide accounted for 72% of the firearm-related HIADs and homicide accounted for 21%. Conversely, for blacks, 21% of the firearm-related HIADs were caused by suicide and 72% were caused by homicide. The firearm-related HIAD rate caused by homicide for blacks was 4.9 times that for whites, and the firearm-related HIAD rate caused by suicide for whites was 2.5 times that for blacks.

Homicide, as a cause of firearm-related HIAD, peaked for blacks and whites in the 25- to 34-year age group (Table 2). Although firearm-related HIAD rates caused by suicide also peaked in the 25- to 34-year age group for blacks, the rates generally increased with age for whites.

The HIAD rates were three times higher for males than females (Table 3). The HIAD rate ratio for males vs females was 5.9 for firearms, 2.8 for motor vehicles, and 2.1 for unintentional falls. The differential between male and female HIAD rates was greatest in the 25- to 34-year age group; males, however, had higher rates of HIADs in all cause and age groups.

The HIAD rates plateaued after declining in the early 1980s (Fig 2). Most of the decline was related to reductions in motor vehicle–related HIADs, with HIAD rates declining 21% for motor vehicles from 1979 to 1985. The contribution that HIADs made to all motor-vehicle fatalities went from 48% to 45%. Little absolute change in HIAD rates was related to firearms or falls during the 8-year period, although HIAD rates declined 18% for firearms and 14% for falls. The proportionate decline in HIAD rates was similar for all age groups except those 75 years or older, where no overall improvement in the rate of HIADs was seen. Temporal trends in HIAD rates of blacks mirrored those of whites. The HIAD rates declined 22% for males during 1979 to 1986; the decline for females was 15%.

The HIAD rates per 100 000 residents varied by region: Northeast, 15.6; Midwest, 16.0; South, 17.8; and West, 18.3. Motor vehicle–related HIAD rates were highest in the South (11.1), firearms were highest in the West (2.6), and falls were highest in the Northeast (2.4). Declines in HIAD rates during 1979 to 1986 also showed geographic variation, with proportionate declines of 26% in the West, 22% in the Midwest, 21% in the Northeast, and 19% in the South. The HIAD rates for nonmetropolitan counties (22.8) were 50% higher than in metropolitan counties (15.0). Most of the difference came from motor vehicle–related HIADs, where rates were 15.0 and 8.0, respectively.

COMMENT

To our knowledge, this is the first reported study of vital statistics data used to describe deaths associated with head injury for the entire United States. Findings from this study include the following: motor vehicles, firearms, or falls were implicated in 83% of HIADs; there was a bimodal age distribution with highest rates in young adults and older persons; HIAD rates were similar between blacks and whites overall, but with considerable variation by age and cause; there were higher HIAD rates in males than females for all age groups; there was regional and temporal variation in HIAD rates, including a plateau in rates after a decline in the early 1980s; and there was a lower HIAD rate than in previous, more localized studies.

While our findings do not necessarily have decisive implications for the design and implementation of prevention measures, they help focus head injury prevention efforts by highlighting the patterns of injury and portraying the national scope of the head injury problem. This is most evident in the area of motor vehicles. Since nearly half of all motor-vehicle fatalities were associated with head injury, and, consistent with previous studies,[3,6,7,8] motor vehicles were associated with 57% of all HIADs, reducing motor-vehicle fatalities should have a substantial impact on HIAD rates. Proved interventions exist for reducing motor vehicle–related injuries. Improvements in vehicle and roadway design, restriction of access to alcohol for young drivers, and reductions in

Table 2.—Rates for Head Injury–Associated Death (HIAD) From Firearms, by Age, Cause, and Race, in the United States, Annualized for 1979 to 1986

	Rate* of HIAD					
	Homicide		Suicide		Unintentional	
Age Group, y	White	Black	White	Black	White	Black
<15	0.07	0.17	0.06	0.02	0.09	0.07
15-24	0.75	3.82	1.77	0.73	0.25	0.25
25-34	0.83	4.72	1.96	1.23	0.14	0.20
35-44	0.67	3.07	1.87	0.94	0.09	0.15
45-54	0.50	1.88	2.12	0.83	0.09	0.11
55-64	0.29	1.44	2.25	0.78	0.06	0.04
65-74	0.21	0.73	2.59	0.65	0.06	0.09
≥75	0.13	0.50	2.78	0.75	0.08	0.05
All ages	0.47	2.28	1.64	0.65	0.12	0.14

*Per 100 000 US residents.

Table 3.—Rates for Head Injury–Associated Death (HIAD), by Age, Cause, and Sex, in the United States, Annualized for 1979 to 1986

	Rate* of HIAD									
	Motor Vehicle		Fall		Firearm		Other		Total	
Age Group, y	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
<15	5.5	3.5	0.4	0.2	0.3	0.1	1.6	1.2	7.8	5.0
15-24	31.1	9.9	1.1	0.2	5.3	1.0	3.6	1.0	41.1	12.1
25-34	19.2	4.9	1.4	0.2	5.7	1.1	4.9	1.2	31.2	7.4
35-44	11.9	3.9	1.9	0.4	4.7	1.0	5.3	1.1	23.8	6.4
45-54	9.6	3.3	3.4	0.9	4.6	1.0	5.8	1.4	23.4	6.6
55-64	8.2	3.5	4.9	1.5	4.6	0.8	5.7	1.4	23.4	7.2
65-74	8.4	4.5	7.3	2.9	5.5	0.6	6.3	2.0	27.5	10.0
≥75	14.7	5.5	20.6	11.3	7.6	0.3	12.6	5.3	55.5	22.4
All ages	14.5	5.1	2.7	1.3	4.1	0.7	4.5	1.4	25.8	8.5

*Per 100 000 US residents.

3-23

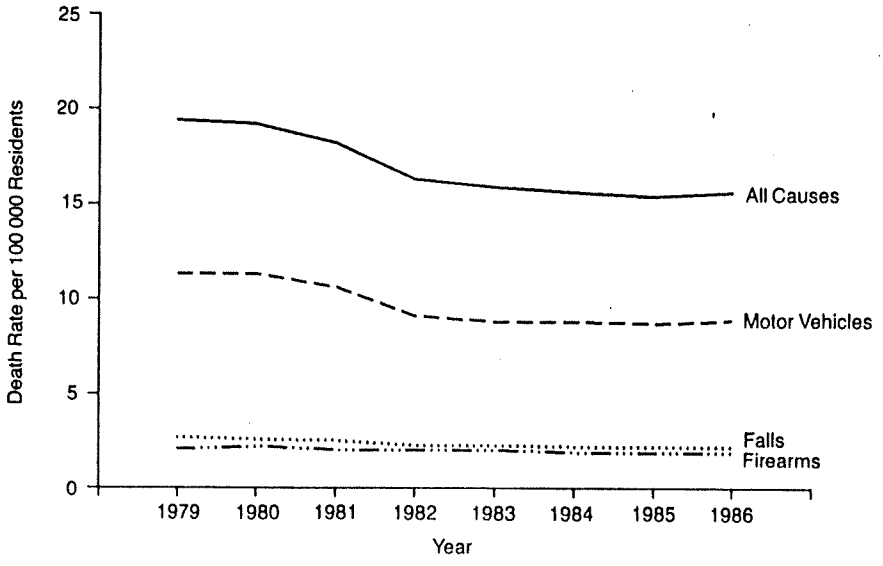

Fig 2.—Rates for head injury–associated death, by underlying cause, United States, 1979 to 1986.

driving speeds have been credited with reductions in the rate of motor-vehicle crashes.[18,19] Improvements in vehicle crashworthiness and the voluntary and automatic use of occupant-restraining systems such as safety belts and air bags also reduce the likelihood of severe head injury when a crash occurs.[18,19] Nonetheless, HIAD rates and total traffic fatality rates per vehicle-mile traveled have plateaued since declines in the early 1980s.[20] This plateau occurred in the face of the adoption of regionalized trauma care in many parts of the country during the early 1980s,[21] continued increases in safety-belt use, and declines in the proportion of traffic fatalities associated with alcohol during those years.[20] Despite the availability of these interventions, some segments of our population carry a disproportionate burden of motor vehicle–related HIADs, such as young, white males and residents of nonmetropolitan counties. Higher motor-vehicle fatality rates have been shown previously for rural as compared with urban residents.[22] While further advances in vehicle and roadway design hold promise, substantial reductions in HIAD could be effected through more widespread use of existing interventions.

The predominant role of the motor vehicle in HIAD does not overshadow the tragedy of firearm-related head injury. With 14% of HIADs directly related to firearms, there is an evident need to develop strategies to prevent firearm injuries. Currently lacking the scientific basis for selecting interventions, we need an objective evaluation of the risk associated with individual firearm possession, and the effectiveness of regulations and other interventions in reducing the likelihood of firearm injury.[23]

Other causes of HIAD are more diverse than motor vehicles and firearms and may be even more challenging to prevent. The mechanisms of injury for unintentional falls are as varied as the environments in which we live and work, requiring a multiplicity of interventions to effect a substantial reduction in such injuries. The difficulty in addressing these diverse causes may explain why those 75 years or older, who have a large proportion of HIADs associated with falls and other causes, were the only age group not to show reductions in HIAD rates since 1979.

Our findings can also help focus head injury prevention efforts by highlighting the patterns of injury within subpopulations of the United States. The use of aggregate rates may lead to interventions that do not address the specific needs of minority populations. Previous studies have suggested that blacks were at increased risk of head injury,[4,5,8] yet this finding may reflect the urban populations studied or instability of the estimates because of small numbers. We found no difference in the overall HIAD rate between blacks and whites. Total HIAD rates, however, mask important age- and cause-specific differences between blacks and whites. Blacks had higher HIAD rates than whites in the middle years of life, raising the question of a greater risk of head injury in the workplace. Aggregating firearm-related HIADs might lead to a focus on suicide, which represented 63% of all firearm-related HIADs and 72% of such deaths in whites. With only 21% of firearm-related HIADs in blacks being attributable to suicide, however, and 72% to homicide, a focus on suicide prevention would have little impact on reducing HIADs caused by firearms in blacks. A focus on homicide prevention is needed to reduce firearm-related HIADs in blacks.

Because multiple cause-of-death data are easily accessible and HIAD rates appear to vary by region, state and local agencies might use these data to describe their local patterns of head injury, set priorities, and allocate injury prevention resources. These surveillance data can also play a role in the critical task of evaluation, as head injury prevention measures can be monitored using the ongoing, standardized collection of multiple cause-of-death data.

The national HIAD rate of 16.9 per 100 000 US residents was lower than rates reported in previous large, community studies where HIAD rates ranged from 22 to 30 per 100 000 residents.[3,4,7,8] Although death certificates are an important source of epidemiological data, they do have limitations. Using the multiple cause-of-death data, we were able to review all deaths for which a head injury condition was recorded on the death certificate. The major limitation, therefore, was the extent to which head injuries associated with death were not entered on the death certificate. Underreporting of alcohol-related conditions on the death certificate have been shown to be as much as 84% for young US Army veterans.[24] In contrast to alcohol-related conditions, the diagnosis of head injury does not require a judgment as to the etiology of the primary condition, ie, cirrhosis of the liver secondary to alcohol. Moreover, recording head injury on the death certificate does not carry the same negative character connotations or legal implications as the recording of alcohol-related conditions. Underreporting of traumatic conditions as the underlying cause of death was found to be 18% when comparing death certificates with a clinicopathologic review of autopsy information[25]; however, this study was unable to address underreporting of head injury as an associated condition. Compared with the HIAD rates from previous large, community studies,[3,4,7,8] our data may have underestimated HIADs by as much as 23% to 44%.

Variations in case definitions may account for some of the differences in HIAD rates. Fractures of only facial bones (N802) were excluded from our study because concomitant brain injury was uncertain. Skull fractures without indication of intracranial injury were included, on the expectation that trauma

3-24

sufficient to fracture the skull is likely to be associated with some degree of brain injury. We included late effects of skull fracture or intracranial injury because these late effects were believed by the certifier to be in the sequence of conditions directly resulting in death (ie, reported in part I of the death certificate). Previous studies included superficial head injuries in the presence of clinical findings (eg, loss of consciousness, posttraumatic seizures, or neurological signs).[3-6,8,9] Because we were restricted to vital statistics data without clinical records, these milder traumatic events may have been missed unless an intracranial injury (N850 to N854) was diagnosed and deemed relevant to be entered on the death certificate.

The HIAD rates from previous studies may not reflect national rates, however, because they evaluated restricted populations and studied less person-time at risk of HIAD. Previous studies were also conducted on or before 1981, and national HIAD rates declined 16% from 1979 to 1982. While these previous studies may provide a better representation of HIAD for the specific time and place in which they were conducted, unless HIADs not reported on the death certificate were different from those that were identified, our study should better reflect the current national patterns of head injury.

Geographic and temporal trends in death certificate data need cautious interpretation because of possible differential variations in diagnosis, terminology, and reporting practices for head injury by place and time.[26-28] It is also possible that persons with numerous comorbid conditions may be less likely to have a head injury recorded as an associated condition, thus, underestimating the role of HIAD in older persons relative to younger ones. Despite limitations, death certificates remain the only source of comprehensive, continuously available national data for head injury. Physicians can play a vital role in our understanding and monitoring of injuries and other diseases through the accurate and thorough completion of death certificates.[29,30] Improving autopsy rates and assuring the inclusion of autopsy results in death certification will also improve these data.

Physicians can also play a role in the primary prevention of head injury by working in concert with legislators, traffic-safety engineers, motor-vehicle manufacturers, and other researchers and public health advocates to further the implementation of proved interventions. More careful prescribing of medications that affect orthostasis, equilibrium, and sensorium could prevent some fall injuries in older patients.[31] While researchers have disputed the relative merits of environmental and behavioral interventions for injury prevention, it is clear that all injury hazards cannot be eliminated from our complex environments. Therefore, patients should be counseled about the importance of restraint use in motor vehicles (both safety belts and air bags),[18] as well as helmet use while riding bicycles[32] or motorcycles,[33] removal of trip and fall hazards in the home,[34] and the use of impact-absorbing surfaces on playgrounds.[35] Given the pervasive role of alcohol in injuries, physicians should identify patients with the potential for alcohol misuse and direct such patients to appropriate therapy. Furthermore, physicians and other health care providers should step forward in public forums as health advocates for their community by supporting scientifically sound efforts to reduce head injuries from all causes, and they can urge their patients to do likewise. Given the severe consequences of head injury, the physician's customary focus on secondary and tertiary prevention through prompt diagnosis, treatment, and provision of rehabilitative services cannot, alone, suffice.

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3-25

IMPACT OF REPEAL OF MOTORCYCLE HELMET LAW

Norman E. McSwain, Jr., M.D., F.A.C.S., *New Orleans, Louisiana, and*
Michael Lummis, M.P.H., *Kansas City, Kansas*

PRIOR to 1974, the Secretary of Transportation was able to influence the states to enforce mandatory motorcycle helmet laws. In that year, Congress removed this prerogative, resulting in the repeal of helmet laws in many states. To date, the repeal of these laws has been seen by some Americans, particularly the American Motorcyclist Association, A Brotherhood Against Totalitarian Enactments, and others as a victory of individual rights. The impact of this repeal, as viewed by the physician interested in the health and well-being of his patients, however, may well be seen as a serious setback to preventative medicine.

To evaluate the actual impact of repeal of the helmet law, to determine any variations in mortality and morbidity rates and to determine the benefit or nonbenefit of helmet usage, a study was undertaken in the state of Kansas by The Emergency Medical Training Program, Kansas University Medical Center. Our intent is not to judge but, rather, to present the facts concerning the effects of the repeal of the mandatory helmet law in Kansas, the third state to repeal its law.

MATERIALS AND METHODS

The repeal of the Kansas mandatory helmet law was effective on 1 July 1976. In this study, comparable periods of stable motorcycle usage before and after repeal of the law are considered and the morbidity and mortality associated with the nonuse of helmets by motorcyclists are compared. Due to the extremes of temperature and the climatic conditions of Kansas, the months of July, August and September offer the most consistent conditions. Therefore, in this study, these three months were considered, for both 1975 and 1976, before and after the repeal.

Kansas law requires a standard accident form, regardless of which law enforcement agency completes the accident investigation. A great deal of training has been conducted in the state to ensure that such forms are consistently used. Each law enforcement officer in the state is required to attend a law enforcement academy, adding to the reliability of these forms. These forms are four pages long. In addition to other information, they define the severity of injury on a numerical scale and identify motorcyle helmet usage, including information about chin strap status and helmet retention. In the form is indicated the ultimate destination of anyone injured, and the mode of transportation to any health care facility is identified. In addition to the state requirement, most local government agencies have ordinances that require an official report to be completed for anyone who presents himself at a health care facility for treatment as a result of trauma involving any form of motor vehicle. This system ensures the completeness of accident report forms, through duplication. Any deviance from the completeness of these records, however, would apply equally to both time periods of the study.

In addition to the completeness of the record system, Kansas Statute KSA 45-201 ensures that any record completed by a public official shall be available to a legitimate research project. Through these provisions, the Kansas Department of Transportation, which is the archivist of these records, was able to provide complete copies on all motorcycle accident report forms for the study periods. A comparison of accident report forms with the logbooks of hospital emergency departments in the study area indicates that, at least, 95 per cent of all motorcycle accidents are investigated and reported by a law enforcement agency in Kansas. This stands in marked contrast with verbal reports received from other states. A cross check of the hospital logbooks identifies those accidents missed in the accident report forms to make the study as complete as possible.

Following identification of the victims of motorcycle accidents, medical records were obtained from the appropriate medical facility for the individuals. To facilitate this process, the study area was limited to the three primary population centers in the state. These consist of Sedgwick

From the Department of Surgery, Tulane University School of Medicine, New Orleans, and the Department of Emergency Medical Training, University of Kansas Medical Center, Kansas City.

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3-26

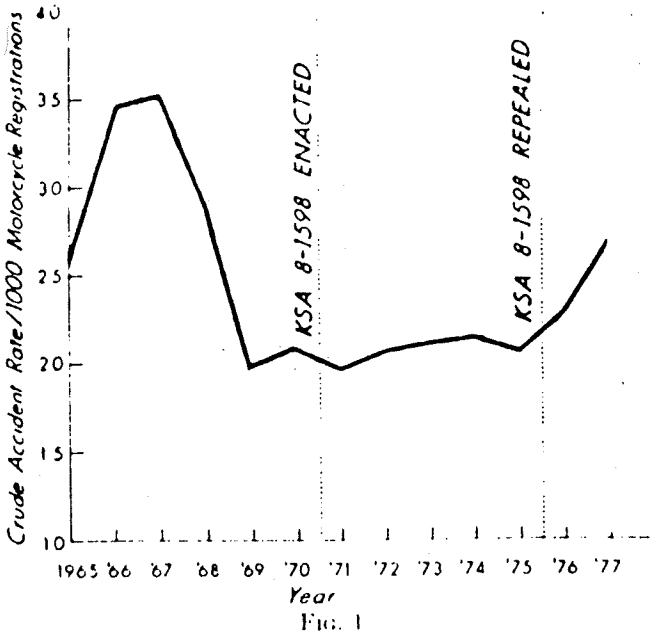

Fig. 1

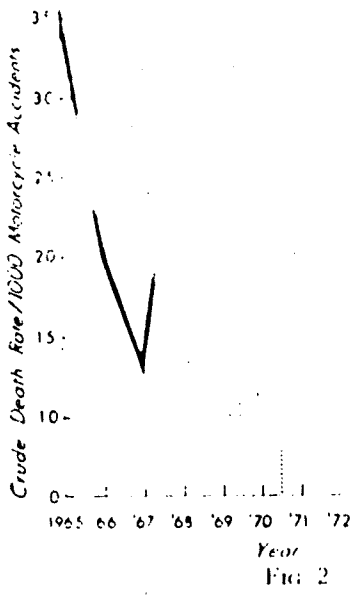

Fig. 2

Fig. 1. Crude accident rate related to motorcycle registration change before, during and after helmet legislation.

Fig. 2. Death rate as it relates to motorcycle accidents before, during and after helmet legislation.

county, which contains the largest city in the state, Wichita; Shawnee county, which contains the state capital, Topeka, and Wyandotte and Johnson counties, which are a part of the metropolitan area in which Kansas City is located.

A review of emergency department and medical records in the health care facilities was carried out with no threat to the integrity of patient records. After identification of individual records, the name of the patient was removed and not used again. In addition to general patient information, the injuries of each victim were scored and recorded. The Abbreviated Injury Scale developed by the American Medical Association was used as the primary scoring system. Classification of specific injuries, using the Abbreviated Injury Scale is carried out using these scores: zero, no injury; 1, minor injury; 2, moderate injury; 3, severe injury—no threat to life; 4, serious injury—life-threatening, survival probable; 5, critical injury—survival uncertain, and 6, maximum injury—not currently treatable.

The Abbreviated Injury Scale is based upon scoring specific injuries in each body region. There are six body regions. Each was scored individually according to the injury rating in the Abbreviated Injury Scale dictionary: general body; head and face; neck; chest; abdomen, and extremities.

In addition to the aforementioned information, the use of motorcycle helmets has been estimated in excess of 95 per cent by law enforcement cies prior to repeal of the law. During the parable months of 1977, a survey consisting 2,000 visual motorcycle observations reveals th less than 50 per cent of the drivers and passenge of motorcycles are using helmets (Table II).

Initially, two population groups were considered, those victims of motorcycle accidents who presented themselves for medical attention during the 1975 study period made up one group and a similar group for 1976 made up the other group. Following initial consideration, the victims were further divided into two groups based upon helmet usage. Final criterion for inclusion in the study was based upon actual arrival at a medical facility for treatment.

To verify that results obtained during this study, as limited by both the geographic and chronologic boundaries, were not biased, the number of accidents, motorcyle registrations and fatalities in the entire state from 1965 through 1977 were obtained and compared (Figs. 1, 2 and 3 and Table I).

In the 26 years between 1950 and 1976, the number of motorcycles in America increased more than 1,300 per cent, from 453,874 in 1950 to more than 6,100,000 in 1976. In the state of Kansas, the increase in the number of registered motorcycles has been less dramatic, but the number still increased by 313 per cent between 1965 and 1975. The number of motorcycles regis-

decreased by 4 per cent between 1975 and 1[illegible], with a continued decrease into 1977. Within the study area, this decrease was slightly more, with a 6 per cent decrease recorded.

The last year for which comparable crude death rates were available for both Kansas and America was 1970. In this year, there were 11.3 deaths per million residents as a result of motorcycle accidents in America and 10.6 deaths per million residents in Kansas. Between 1970 and 1976, the crude death rate nearly doubled in Kansas, where a rate of 20.6 fatalities per million residents was recorded as a result of 1976 motorcycle accidents.

On the basis of most demographic statistics, the population of the study area compares favorably with the national population. An example of this similarity is found in the median age for the state of Kansas, 28.7 years, which is only slightly higher than the figure for the United States, 28.1 years. As of the most recent census, 41 per cent of the population of Kansas resides within the study area.

Within the geographic and chronologic boundaries of the study area, during the three month period under consideration, 400 motorcycle accidents occurred during 1975. Within the same geographic boundaries and study period, 449 motorcycle accidents occurred during 1976, an increase of 12.3 per cent. Motorcycle registrations in the state of Kansas, during the years of 1975 and 1976, actually declined by some 4 per cent from 90,329 in 1975 to 86,789 in 1976. Within the geographic locations of the study area, the decrease in motorcycle registration was slightly more pronounced, 6 per cent from 31,206 in 1975 to 29,334 in 1976. With these statistics, a crude accident rate was computed for both 1975 and

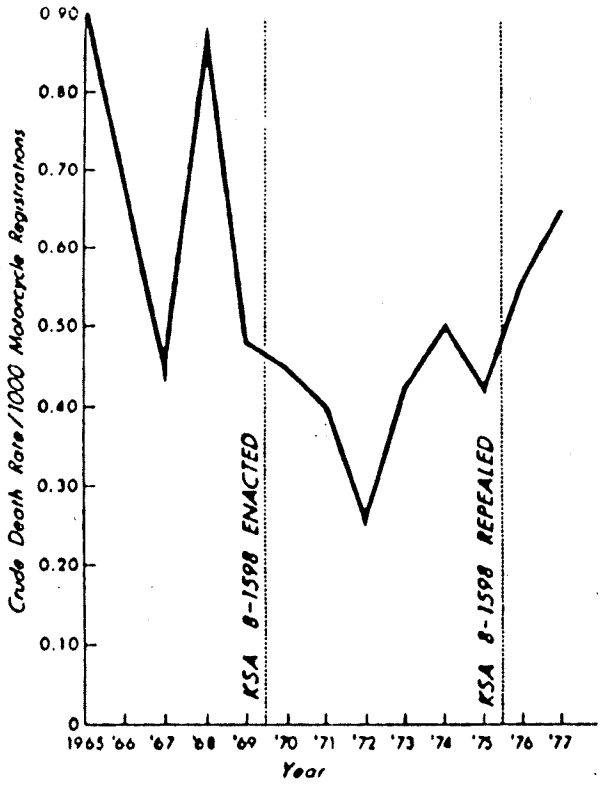

FIG. 3. Death rate as related to motorcycle registrations before, during and after motorcycle helmet legislation.

1976. During 1975, there were 400 accidents per 31,206 registered motorcycles, a crude accident rate of 12.8 per cent accidents per 1,000 registrations. During 1976, there were 449 accidents per 29,334 registered motorcycles, a Kansas accident rate of 15.3 accidents per 1,000 registrations. This represents an increase of 19.4 per cent in this crude accident rate from 1975 to 1976.

The 849 accidents involved 977 individuals. Eight hundred and fifty of those involved in accidents were drivers and 127 passengers. One ac-

TABLE I.—STATE OF KANSAS—RELATIONSHIP OF FATALITIES AND ACCIDENTS TO MOTORCYCLE ACCIDENTS AND MOTORCYCLE REGISTRATIONS TO ACCIDENTS

Yr.	*Motorcycle registrations*	*Fatalities*	*Motorcycle accidents*	*Accident rate per 1,000 registrations*	*Crude death rate per 1,000 accidents*	*Crude death rate per 1,000 registrations*
1965	21,881	20	570	26.0	35.0	0.91
1966	28,015	19	969	34.6	19.6	0.68
1967	31,538	14	1,107	35.1	12.6	0.44
1968	34,336	30	994	28.9	30.1	0.87
1969	39,835	19	788	19.8	24.1	0.48
1970	53,847	24	1,128	20.9	21.3	0.45
1971	74,525	30	1,476	19.8	20.3	0.40
1972	88,894	22	1,829	20.6	12.0	0.25
1973	99,499	42	2,106	21.2	19.9	0.42
1974	92,354	46	1,975	21.4	23.3	0.50
1975	90,329	38	1,876	20.7	20.3	0.42
1976	86,789	48*	1,976	22.8	24.3	0.55
1977	84,502	55	2,261	26.8	24.3	0.65

*During 1976, one fatality occurred in conjunction with a police roadblock and was not included in the Kansas Department of Transportation printout of accidents. It has been included in these figures.

3·28

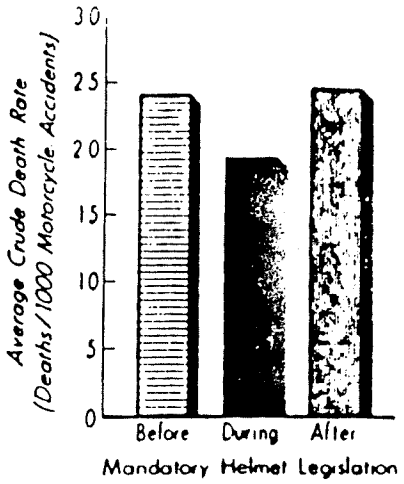

FIG. 4

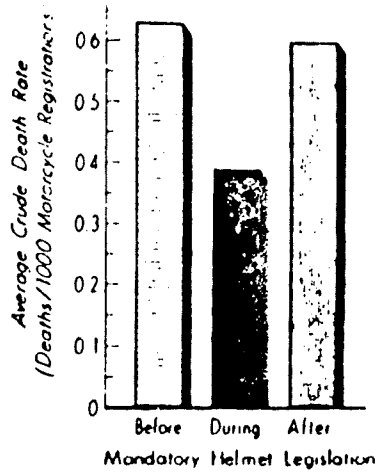

FIG. 5

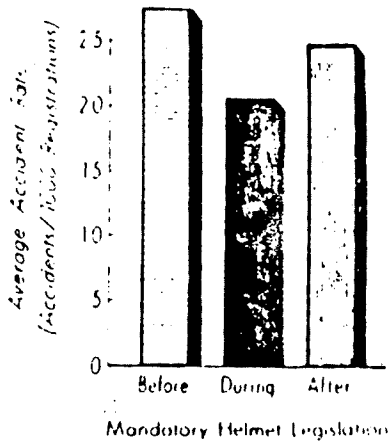

FIG. 6

FIG. 4. Graphic depiction of the average crude death rate before, during and after mandatory helmet legislative period as a function of motorcycle accidents.

FIG. 5. The death rate before, during and after the period of mandatory helmet legislation as it relates to the number of motorcycles registered in the state.

FIG. 6. The accident rate before, during and after the mandatory helmet legislative period as related to the number of registered motorcycles within the state.

cident involved two motorcycles which resulted in the statistic of 850 drivers being involved in 849 accidents.

The information provided on the Kansas uniform accident report form indicated that 456 individuals were injured in the 849 accidents for the entire study period. This accident report form uses five categories for accident severity which range from no injury to fatal on a scale of zero to 4. These report forms are completed in the field and are, sometimes, amended at a later date as additional information becomes available. Due to the conditions under which the forms are completed, this form provided little more than an indication that trauma had occurred. In another category in the form, the manner in which accident victims leave the scene of the accident is described. A careful check was made of the emergency department and the medical records. Upon completion of this portion of the study, it was evident that 47 of those who were indicated as injured on the accident report forms did not actually present themselves at a medical facility for treatment. A review of the forms reveals that each of these individuals was being transported by private vehicle as opposed to public transportation or care by an ambulance team.

During the entire study, 17 victims of motorcycle accidents had fatal injuries. Six of the fatalities occurred during 1975 and 11 during 1976.

The six fatalities for 400 motorcycle accidents during 1975 resulted in a crude fatality rate of 15 deaths per 1,000 accidents. Computation of similar figures for 1976 reveals 11 fatalities for 449 accidents, resulting in a crude fatality rate of 24.5 fatalities per 1,000 accidents. This is an increase of 63.3 per cent from 1975 to 1976 (Fig. 9).

As noted heretofore, however, motorcycle registrations from 1975 to 1976 actually decreased. If the fatality information is related to motorcycle registration, prospective changes occurred. During the 1975 study period, there were six fatal accidents for 31,206 registrations. This represents 19.2 fatalities per 100,000 motorcycle registrations. During the 1976 study period, there were 11 fatalities for 29,334 registered motorcycles. This represents a crude fatality rate of 37.5 deaths per 100,000 registered motorcycles. This is an increase of 95 per cent from during the law to afterward (Fig. 10).

TABLE II.--HELMET USE SURVEY, DRIVERS

	Helmet		No helmet	
	No.	Per cent	No.	Per cent
Urban weekday	242	0.484	258	0.516
Urban weekend	225	0.45	275	0.55
Rural weekday	249	0.498	251	0.502
Rural weekend	239	0.478	261	0.522
Total urban	467	0.467	533	0.533
Total rural	488	0.488	512	0.512
Total weekday	491	0.491	509	0.509
Total weekend	464	0.464	536	0.536
Study total	955	0.4775	1,045	0.5225

TABLE III—ACCIDENT VICTIMS INCLUDED IN STUDY

Yr.	Total accidents	Injury accidents	Persons involved	Persons injured	Injured drivers	Injured passengers
1975	459	139	516	153	139	14
1976	550	193	646	232	193	39

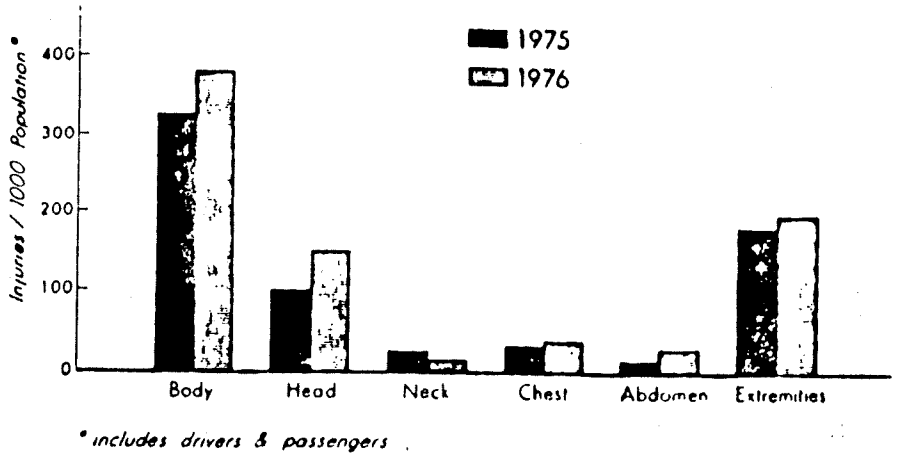

FIG. 7. The number of injuries in the various body systems of both the drivers and riders of motorcycles during the study period.

Further examination of the data from the standpoint of helmet usage reveals that six of the deaths involved victims wearing helmets, while 11 of the deaths involved victims without helmets. Of 977 individuals, who were involved in motorcycle accidents during the study period, complete accident data were unavailable for 91 individuals. The incomplete charts were spread out over both periods of the study. These were discarded. Out of the balance, 572 individuals were wearing helmets at the time of the accident, and 314 individuals were not wearing helmets at the time of the accident. The crude death rate for those wearing helmets at the time of the accident was 10.5 fatalities for 1,000 occupants of motorcycles at the time of the accident. The crude death rate for those not wearing helmets at the time of the accident was 333 per cent greater or 35.0 fatalities per 1,000 individuals involved in motorcycle accidents.

As already stated, 456 individuals were identified on the accident report form as being injured. Forty-seven of the individuals did not seek treatment, 27 of the medical records were unavailable, subpoenaed for legal purposes, and 50 reports did not contain complete data. As a result, 332 complete reports were reviewed, which involved 298 accidents; this involved 298 drivers and 37 passengers. In Figure 8, there is a breakdown of injury by body region for the two years.

The crude injury rate for the 1975 survey period was 297 injuries per 1,000 accident victims compared with 359 injuries per 1,000 accident victims in the 1976 survey period (Fig. 12). This change is significant, $\Delta: p = < 0.05$ (Table III). Between 1975 and 1976, there was an increase of 17 per cent for the crude rate for general body injuries, an 8 per cent increase in the rate of injury to the extremities and a 51 per cent increase in the crude rate of head injuries. The last mentioned increased from 98 head injuries per 1,000 motorcycle accident victims in 1975 to 148 head injuries per 1,000 accident victims during 1976. In Table III, there is a breakdown of the injured drivers and passengers.

The second aspect of the study was an evaluation of the rate of injuries and deaths resulting from the use or nonuse of helmets. The injury rate for the helmeted population was found to be 348 injured persons per 1,000 accident victims, while the rate for the nonhelmeted population was some 25 per cent greater, or 436 injuries per 1,000 accident victims (Fig. 13). Information regarding injuries to specific body areas is tabulated in Figure 6. The crude injury rate for those wearing helmets who received general body injuries was 315 per 1,000 accidents, while the rate of general body injury was 35 per cent greater for those not wearing helmets, or 424 injuries per 1,000 accidents. Injuries of the extremity increased 23 per cent, from 173 to 213 injuries per accident victim. The difference is most striking, however, in the area of head injury, where the helmeted persons received head injuries at a rate of 91 injuries per 1,000 accidents, and the nonhelmeted rates were 106 per cent greater, or 188 injuries per 1,000 accidents.

TABLE IV.—STATE OF KANSAS—RELATIONSHIP OF FATALITIES SUBSEQUENT TO MOTORCYCLE ACCIDENTS COMPARED WITH SELECTED RATES FOR 1975 AND 1977

Type of rate	*1975 rate*	*1977 rate*	*Per cent change*
Total motorcycle registrations	90,329	84,502	−6.4
Fatalities/1,000 registrations	0.42	0.65	+55.0
Fatalities/1,000 accidents	20.30	24.30	+20.0
Accidents/1,000 registrations	20.7	26.8	+29.5

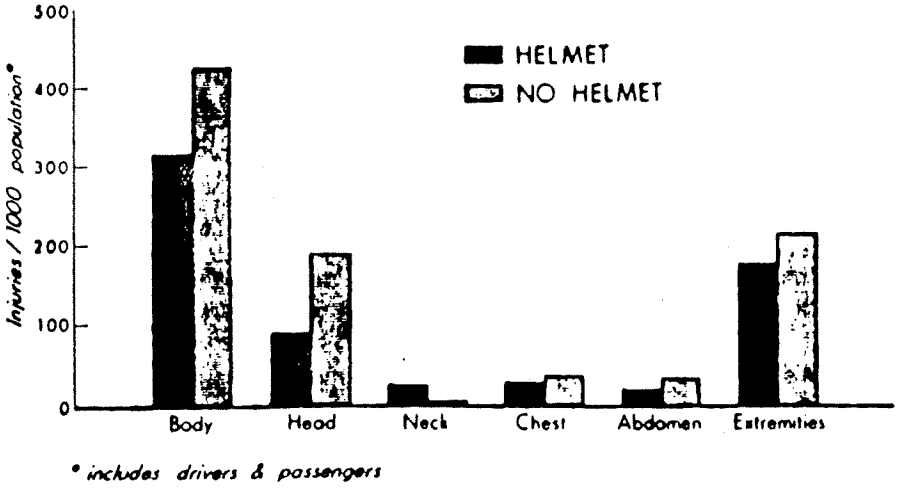

FIG. 8. The injuries of both the drivers and passengers as related to whether or not they were wearing helmets.

In addition to the data presented in Figures 6, 7 and 8, the mean of the severity score for all those involved in accidents was computed. This score, based upon a scale of zero to 6, was computed to be 0.52 for those involved in accidents while wearing helmets and 0.87 for those involved in accidents without the benefit of a helmet, an increase of 67 per cent in injury severity (Fig. 14).

In Tables IV and V, the total number of injuries that occurred during the study periods and a comparison of helmet and no helmet injury data are presented. The numbers indicate a significant difference in head and body injuries. Although there is some difference in the other categories, the differences are not significant.

The data seem to indicate fewer neck injuries numerically with helmets than without helmets. A comparison of the severity of neck injuries, however, in Table V shows that all of these injuries are Abbreviated Injury Scale 1 or minor injuries. The individuals with head injuries of Abbreviated Injury Scale 3 or greater may have had minor neck injuries but were of such less significance to them personally that this was not recorded on the hospital medical record.

In Table V are listed the numbers of persons injured in the various Abbreviated Injury Scale categories. The per cent of those with injuries in the various Abbreviated Injury Scale categories with, and without, the use of helmets is graphically demonstrated in Figures 7 and 8. The differences in Abbreviated Injury Scale 1, 2 and 5 are statistically significant, while those of scale 3 and 4 are not. As can be seen, those individuals using helmets had many more minor injuries, while those not using helmets had many more critical injuries.

An interesting statistic that further validates the investigation involves the number of damaged helmets reported in the study. In 39 motorcyclists, the wearer of a helmet reported no head injury, despite damage to the helmet. When this number is added to those who received a head injury while wearing a helmet, the combined rate is 159 per

TABLE V.—SUMMARY OF INDIVIDUAL ABBREVIATED INJURY SCALE SCORES

	1975						*1976*					
	0	*1*	*2*	*3*	*4*	*5*	*0*	*1*	*2*	*3*	*4*	*5*
General body	275	85	45	1	—	1	298	149	32	—	—	—
Head	367	24	7	3	3	3	408	37	14	5	3	12
Neck	398	7	—	—	2	—	472	7	—	—	—	—
Chest	394	6	1	2	3	1	462	7	4	5	1	—
Abdomen	400	2	—	—	3	2	465	4	1	3	6	—
Extremities	334	25	21	24	3	—	386	33	36	24	—	—
	Helmet						*No helmet*					
	0	*1*	*2*	*3*	*4*	*5*	*0*	*1*	*2*	*3*	*4*	*5*
General body	392	127	51	1	—	1	181	104	29	—	—	—
Head	520	34	7	4	4	3	255	28	14	4	2	11
Neck	558	12	—	—	2	—	312	2	—	—	—	—
Chest	554	6	2	5	3	2	302	6	3	2	1	—
Abdomen	561	4	—	5	2	—	304	2	1	3	4	—
Extremities	473	32	30	34	3	—	247	26	27	14	—	—

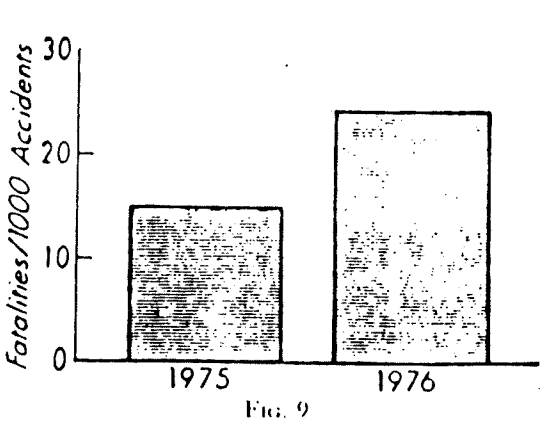

Fig. 9

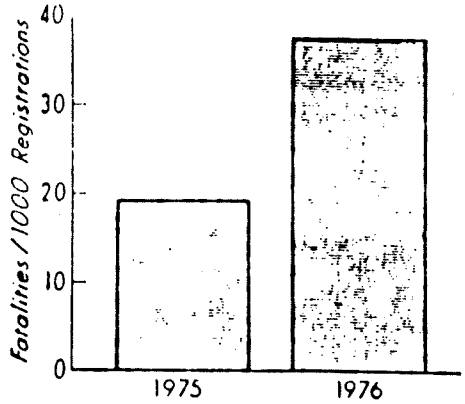

Fig. 10

Fig. 9. The fatalities as a function of the number of accidents in the two study periods.
Fig. 10. The fatalities related to motorcycle registration during the two study periods.

1,000 accidents compared with the injury rate of 187 per 1,000 accidents for those not wearing helmets (Fig. 15).

In Table II is indicated helmet usage after repeal of the law. It was estimated by various Kansas highway patrol officers and supervisors as well as local police personnel that prior to repeal the use of a helmet was greater than 95 per cent.

Of the operators and passengers of motorcycles within the geographic boundaries of the study area, 47.8 per cent were wearing helmets after repeal of the law. The use of the helmets was remarkably consistent across all locations within the study area, ranging from a low of 45 per cent usage for urban weekend operators and passengers of motorcycles to a high of 49.8 per cent usage for rural weekend operators and passengers of motorcycles.

In Figures 4, 5 and 6, the change in the fatality rate as a function of motorcycle accidents and motorcycle registration and the accident rate as a function of motorcycle registration are averaged for the total period.

The enactment of motorcycle helmet legislation and the repeal of the legislation are outlined. It is apparent that the death and accident rates, figured by whatever parameters, were significantly decreased during the time the legislation was in force, and therefore, helmet usage approached greater than 95 per cent.

The crude death rate per 1,000 accidents averaged for 1965 through 1970 was 23.8 before enactment during the period of mandatory helmet usage which dropped to 19.2, rising again after repeal to 24.3 (Table VI and Figure 6).

DISCUSSION

There has been a dramatic increase in motorcycle usage in the United States during the past 27 years. In an effort to control the subsequent increase in motorcycle accident fatalities, most states passed legislation which made the use of motorcycle helmets mandatory. Various organizations, such as A Brotherhood Against Totalitarian Enactments and the American Motorcyclist Association, have lobbied and fought extensively in an effort to force the repeal of such legislation, based upon four contentions: the mandatory use of motorcycle helmets is an infringement of personal freedoms guaranteed to every American; no proof exists that mandatory helmet laws have affected the mortality from motorcycle accidents; helmet use actually increases the rate of accident because of a limitation to visibility and hearing, and the weight of the helmet may contribute to the severity of injury if an accident occurs.

The first of these three contentions cannot be decided by scientific investigation but is rather a matter for the courts and legislative bodies. The second contention has been examined, and the contents of this study may be used for each individual to draw their own conclusions. The third and fourth contention has been widely discussed, including a conference held in May of 1976 by the American Medical Association. At this con-

TABLE VI.—RATE DATA

Crude death rate/1,000 accidents*		
Before	23.8	>23.9 per cent
During	19.2	>26.5 per cent
After	24.3	
Accident rate/1,000 registrations*		
Before	27.5	>32.8 per cent
During	20.7	>19.8 per cent
After	24.8	
Crude death rate/1,000 registrations*		
Before	0.63	>61.5 per cent
During	0.39	>53.8 per cent
After	0.60	

*All percentage changes use during as the denominator for consistency

rence, it was concluded that there was no evidence helmets caused or contributed to either injury or increased risk of accident. The data in Figure 6 seem to indicate an increase in the rate of injury to the neck between helmeted and nonhelmeted victims of motorcycle accidents, and it should be noted that all helmeted drivers who received neck injuries scored Abbreviated Injury Scale 1, which indicates a rather minor injury. It seems extremely likely that injuries to the cervical spine received by nonhelmeted individuals may easily have been overlooked, in light of the more severe head and general body injuries that those in this group received.

One of the most interesting conclusions that might be drawn from this study concerns the contention on the part of A Brotherhood Against Totalitarian Enactments and others that helmets actually contribute to the number and severity of motorcycle accidents. If this were true, one would logically expect the rates in the state of Kansas to decrease following repeal of the mandatory law. The numbers of registered motorcycles decreased during this time period; it is evident that the rate of injury actually increased, as already stated, from 400 accidents in 1975 to 449 in 1976, an increase of 12 per cent. During this same time period, the crude death rate increased by 303 per cent, and the crude injury rate increased by 20 per cent. Based on a comparison of the change in motorcycle registrations, there was a 19 per cent increase in the injury rate after repeal of the helmet law.

It is apparent in reviewing the study that there is a significant difference in the death and injury rates based upon helmet usage. It is also evident that the use of helmets was significantly higher during the period that the mandatory helmet legislation was enforced. It can, therefore, be determined that mandatory helmet legislation significantly reduces death and disability, secondary to motorcycle usage.

It could certainly be an area of criticism if these study periods shown were, in fact, not truly representative of either the effect of helmet usage or the effect of the legislation. In the design of the study, the area and time chosen were believed important because the area represented a significant portion of the urban and suburban population of the state and a time of high motorcycle usage and, therefore, a large portion of the motorcycle riders. If it could be argued, however, that urban riders use helmets less than do rural riders, the study would be invalid as regard to helmet usage and, therefore, the resultant changes in mortality and injury. As can be seen, however, the use of helmets in the urban and rural areas, as identified the survey, demonstrates that usage is quite similar in both areas without mandatory legislation, in a range of 50 per cent

It could also be argued that the study period is not representative of motorcycle usage in the State. The two periods were chosen because the climatic conditions in Kansas are such that the use of motorcycles is much more frequent during these months than other months. It would be only reasonable to assume that the variance in use or nonuse of the helmet would be the same.

A further argument against the validity of this study could be that the time periods are short and that they are limited to only two years. To verify the study from this aspect, the death rate per 1,000 accidents, the death rate per 1,000 motorcycle registrations and the accident rate per 1,000 motorcycle registrations were compared for the period of 1965 to 1977. The averages of the death and accident rates during these periods of time before, during and after the motorcycle helmet legislation indicate that, in fact, the parameters chosen are valid and representative.

Further verification of this study is seen in the comparison of 1975 data with 1977 data (Table IV). The incidence of fatal accidents during the study periods for each year increased by 63.3 per cent from 1975 to 1976. During 1975, the crude fatality rate was 15 deaths per 1,000 motorcycle accidents. During 1976, there were 24.5 fatalities per 1,000 motorcycle accidents. During 1976, there were actually 6 per cent fewer motorcycles registered within the study area than had been registered during 1975. When fatal accidents are compared with motorcycle registrations, we find an incidence of 19.2 fatalities per 100,000 registered motorcycles during 1975 and 37.5 fatalities per 100,000 registered motorcycles during 1976. This represents an increase of 95 per cent from 1975 to 1976. The incidence of fatal injuries is 303 per cent greater for those individuals who do not have the benefit of helmet protection at the time of accident compared with those individuals who are wearing helmets at the time of accidents. The crude death rate for those wearing helmets at the time of accident was 10.5 fatalities per 1,000 occupants of motorcycles involved in accidents. The crude death rate for those not wearing helmets at the time of accident was 31.8 fatalities per 1,000 individuals involved in motorcycle accidents (Fig. 11).

The incidence of head injury for those involved in motorcycle accidents increased by 51 per cent

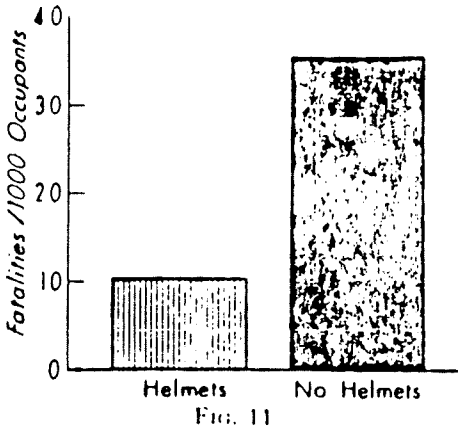

FIG. 11

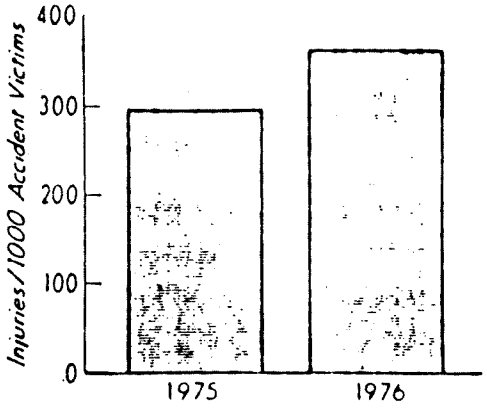

FIG. 12

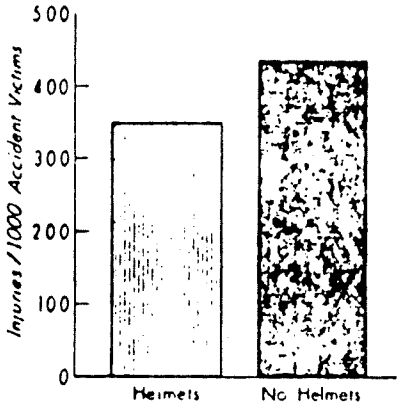

FIG. 13

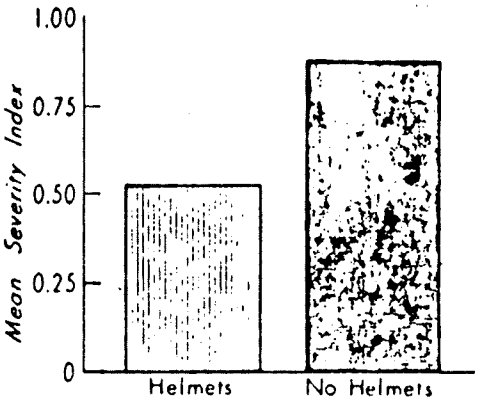

FIG. 14

FIG. 11. The fatalities of those with and without helmets as it relates to the number of occupants riding the motorcycles.

FIG. 12. The injuries in the two study periods before and after helmet legislation as it relates to the number of accidents.

FIG. 13. The injuries of those with and without helmets that were involved in accidents.

FIG. 14. The mean severity index of the occupants of motorcycles in accidents as a function of whether or not they were wearing helmets.

FIG. 15. The amount of head injury with helmet plus helmet damage with no head injury as it relates to not wearing helmets during the two study periods.

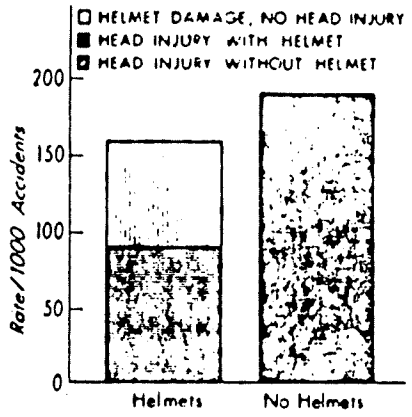

FIG. 15

from the study period for 1975 to the study period for 1976. During the 1975 portion of the study, 98 head injuries occurred for every 1,000 motorcycle accidents. During the 1976 portion of the study, 148 head injuries occurred per 1,000 motorcycle accidents. The crude rate of head injury for those not wearing helmets at the time of motorcycle accident was 106 per cent greater than for those who were wearing helmets at the time of accident. Ninety-one persons received head injuries while involved in motorcycle accidents for each 1,000 motorcycle riders who were wearing helmets at the time of accident. For those not wearing helmets at the time of accident, there were 188 injuries per 1,000 accidents. Based upon a scale from zero to 6, the mathematical mean of the severity score for all of those involved in motorcycle accidents was 67 per cent higher for those not wearing helmets at the time of accident than for those who were provided with the benefit of a motorcycle helmet. The mean mathematical severity score for those who were wearing helmets at the time of accident was 0.52. The mean mathematical severity score for those not wearing helmets at the time of accident was 0.87.

Less than 50 per cent of the motorcycle riders

observed in the study period during July, August and September of 1977 were wearing motorcycle helmets. The crude death rate per 1,000 accidents decreased 23.9 per cent with the enactment of helmet legislation and increased 26.5 per cent with its repeal. The six year average before repeal was 23.8, during repeal was 19.2 and after repeal was 24.3. The crude death rate per 1,000 motorcycle registrations decreased from 0.63 before legislation to an average of 0.39 during legislation and rose to 0.60 in the two years following repeal. The percentage changes are 61.5 and 53.8, respectively. The most unexpected change occurred in the accident rate per 1,000 registrations. Before legislation, it was 27.5, during legislation 20.7 and after repeal 24.8. The percentage changes here are 32.8 and 19.8 per cent.

SUMMARY

With the repeal of motorcycle helmet legislation becoming rampant throughout the country following the congressional decision that the Secretary of Transportation could no longer force the states to have such legislation, the question was raised as to what the impact would be on the death and injury rate in the United States. This study was designed to determine if changes have occurred in the death and injury rates after the repeal of such legislation and, secondarily, to use this opportunity to check the thesis that the use of helmets did, in fact, reduce death and disability from motorcycle accidents.

This study was conducted in Kansas for two, three month periods before and after the legislation was repealed. The number of accidents, the number of motorcycle registrations, the injury severity using the abbreviated injury scale, the rate of injury and the number of deaths were studied. The use of helmets during this period and the use of helmets during accidents was also determined. It is apparent that helmet usage significantly decreased the death and injury rates. The impact of repeal of mandatory motorcycle helmet usage is significant in terms of injuries, fatalities and accident rate, a 63.3 per cent increase in fatalities per 1,000 accidents during study, a per cent increase in fatalities per 1,000 motorcycle registrations during study; a 51 per cent increase in the incidence of head injuries per 1,000 accidents; a 67 per cent increase in the over-all Abbreviated Injury Scale injury per 1,000 accidents during study; a 19.4 per cent increase in the crude accident rate—accidents per 1,000 registrations—during study, and a decrease in helmet usage from 95 to 50 per cent.

The nonusage of helmets by those riding motorcycles significantly increases fatalities and injuries. There is a 333 per cent increase in fatalities per 1,000 accidents; a 106 per cent increase in head injuries per 1,000 accidents; a 67 per cent increase in head injury severity, and the damaged helmet rate plus the head injury rate—helmets—is similar to the head injury rate without helmets.

A significant fact that resulted during the study was related to the accident rate. It has been one of the contingents of the American Motorcyclist Association, A Brotherhood Against Totalitarian Enactments and other antagonists toward the use of helmets and helmet legislation, that helmets, although they are somewhat protective, actually increase the number of accidents because they limit vision, hearing and other factors. This fact was not borne out by the study; as a matter of fact, the exact opposite occurred, in that there was a decrease in the actual number of accidents in the period when helmet usage fell to 50 per cent.

The most definitive statistic determined was that there was a 333 per cent higher fatal injury rate for those individuals who were not using helmets at the time of their accident compared with those that were using helmets at that time.

Based upon this study and a comparison of the years 1965 to 1977, in Kansas, there is no doubt that mandatory helmet legislation effects helmet usage, and helmet usage dramatically reduces the death and injury rates. Although not so dramatic, there is also a reduction in the accident rate associated with helmet usage.

The Public Cost of Motorcycle Trauma

Frederick P. Rivara, MD, MPH; Barbara G. Dicker, MA; Abraham B. Bergman, MD; Ralph Dacey, MD; Clifford Herman, MD

Despite the effectiveness of motorcycle helmet legislation, many states have repealed these laws during the last decade. Aspects often neglected by policymakers are who pays for the care of these victims and how much of this cost is subsidized by public funds. To determine the extent of this subsidy, we studied the cost of care of 105 motorcyclists hospitalized at a major trauma center during a 12-month period. Total direct costs for these 105 patients, followed up for a mean of 20 months, were more than $2.7 million, with an average of $25 764 per patient. Only 60% of the direct costs were accounted for by the initial hospital care; 23% of costs were for rehabilitation care or readmission for treatment of acute problems. The majority (63.4%) of care was paid for by public funds, with Medicaid accounting for more than half of all charges.

(*JAMA* 1988;260:221-223)

MOTORCYCLE trauma is an important cause of mortality and morbidity in the United States.[1] In 1985, four thousand four hundred twenty-three motorcyclists were killed, accounting for nearly one of every ten motor vehicle fatalities.[2] For every motorcyclist killed there are about 90 others who require medical care for the treatment of their injuries.[3] Well known to health professionals are the facts that most deaths and serious disabilities are due to head injuries,[4] that helmets significantly reduce the chances of death and disability,[5-7] and that compulsory helmet laws appreciably increase the proportion of helmeted motorcycle riders.[8] This knowledge led Congress in 1966 to enact legislation to withhold federal funds for highway construction from states without compulsory motorcycle helmet laws. The result was that by 1975 forty-seven states required all motorcyclists to use helmets, leading to a striking diminution in mortality rates.[9] Reacting to strong pressure from motorcycle rider groups, in 1976 Congress withdrew the authority of the Department of Transportation to withhold highway funds from noncompliant states. Twenty-six states promptly repealed or weakened their helmet laws.[9] These actions were associated with a 44% increase in motorcycle fatalities nationally between 1976 and 1979.[9]

In dealing with this issue, policymakers have tended to neglect an important aspect of motorcycle trauma: who pays for the costs of care.[10] Several studies have shown that a high proportion of motorcyclists lack insurance to cover the costs of their medical care, resulting in heavy subsidization by taxpayers.[11-13] These studies, however, have only considered the immediate period of hospitalization and have not explored subsequent costs for rehabilitation and home care, costs for support of dependents when an injured head of the household is not able to work, or indirect costs from lost productivity. We therefore examined all costs generated by injured motorcyclists treated at a major trauma center during a one-year period.

METHODS

Harborview Medical Center (HMC), Seattle, is the only level I trauma center serving the four-state area of Washington, Alaska, Idaho, and Montana. As a level I trauma center, HMC has resources available around the clock to care for any type of trauma emergency, including appropriate medical specialists, support services, and immediate operating room availability. Approximately 80% of the admissions are from King County (population, 1.4 million); an additional 20% are from the rest of the region. All injured motorcyclists admitted for care during 1985 were identified through the Harborview Trauma Registry, a computerized listing of all trauma admissions. Injury Severity Scores (ISSs) were calculated from the Abbreviated Injury Scale-1980[14] using the method of Baker et al.[15] The Glasgow Coma Score (GCS) was calculated by the treating physician as described by Teasdale and Jennett.[16]

Direct costs of care were determined as those incurred by the study group during the follow-up period (mean, 20 months). Although there is a distinction between costs and charges,[17] payer-specific charges were used as a proxy for costs of care. Hospital charges and source of payment for the acute-care hospitalization, rehospitalization at HMC, or rehabilitation care at HMC were obtained from the hospital billing office. Costs for hospital care constitute 93% to 94% of charges. Charges for professional fees were obtained from the billing office of the Harborview physician group practice. For patients who received rehabilitation care elsewhere, after consent was obtained the patient's family, treating physician, and treating facility were contacted to determine charges for care on discharge from HMC. Finally, a search by state personnel was made of records for use of funds from Aid to Families of Dependent Children, Supplemental Security Income, the Division of Vocational Rehabilitation, and Medical Assistance (Medicaid) by the injured motorcyclists during the follow-up period. With the assurance that only aggregate data would be used, the study was approved by the institutional review board of the University of Washington.

Indirect costs were estimated using the human capital approach outlined by Rice et al[17] for a subset of the study population in whom the time lost from work as a result of the injury was known. Costs were based on age- and sex-specific national estimates of mean annual earnings in 1980. The estimates take into account the 1980 employment rates published by the US Bureau of the Census and described by Rice et al.[17] Earnings include the value of housekeeping services for women not in the labor force and for employed men and women. For individuals with fatal or totally incapacitating injuries, indirect costs were estimated as the expected lifetime earnings for age and sex, discounted at the conservative rate of 6%.

RESULTS

One hundred eleven motorcyclists were treated for injuries at HMC during 1985. Medical records were unavailable for four patients, leaving 107 for review.

From the Harborview Injury Prevention and Research Center (Drs Rivara, Bergman, and Herman and Ms Dicker) and the Departments of Pediatrics (Drs Rivara and Bergman), Epidemiology (Dr Rivara and Ms Dicker), Surgery (Dr Herman), and Neurological Surgery (Dr Dacey), University of Washington, Seattle.

Reprint requests to Harborview Injury Prevention and Research Center, 325 Ninth Ave, Seattle, WA 98104 (Dr Rivara).

Table 1.—Selected Characteristics of Motorcyclists Admitted to Harborview Medical Center During 1985

Characteristic	No. of Motorcyclists (N = 107)
Sex	
M	91
F	16
Mean age, y	28.6
Injury Severity Score	
<14	52
14-25	39
25+	16
Glasgow Coma Score	
<9 (severe)	17
9-13 (moderate)	11
13-15 (mild)	72
Unknown	7
Mean length of stay, d	19.6
Outcome	
Death	7
Persistent vegetative state/ severe disability	18
Moderate disability/good recovery	82

Table 2.—Components of Direct Costs

Type of Cost	No. of Motorcyclists	Total Cost, $	Average Cost, $	% of Total
Acute-care hospitalization				
Initial inpatient	105	1 637 217	15 592	60.5
Readmission	26	123 650	4756	4.6
Rehabilitation				
Harborview Medical Center	8	190 977	23 872	7.0
Other inpatient rehabilitation	9	309 211	34 357	11.4
Nonhospital charges				
Skilled nursing care	5	41 099	8220	1.5
Physician fees	105	360 621	3434	13.3
AFDC/SSI*	4	12 972	3243	0.5
Vocational retraining	3	5832	1944	0.2
Equipment	11	16 875	1534	0.6
Transportation	14	4942	353	0.2
Home health care	4	1847	462	0.07
Total	105	2 705 244	25 764	100

*AFDC indicates Aid to Families With Dependent Children; and SSI, Supplemental Security Income.

Table 3.—Sources of Payment (N = 105)

Source	Charges, $	% of Total Charges
Medicaid	1 522 090	56.3
Other state/public funds	192 171	7.1
Federal AFDC/SSI*	12 972	...
Division of vocational rehabilitation	5832	...
Military health care	60 060	...
State reimbursement for indigent care	113 307	...
Commercial	595 165	22.0
Self-pay	19 066	0.7
Other/unknown	367 732	13.9
Total	2 706 244	100.0

*AFDC indicates Aid to Families with Dependent Children; and SSI, Supplemental Security Income.

Table 4.—Harborview Medical Center (HMC) Charges and Injury Severity

Injury Severity Score (No. of Motorcyclists)	HMC Charge, $	Average Charge, $
1-8 (27)	123 189	4563
9-15 (35)	387 812	11 080
16-24 (26)	561 751	21 606
25-34 (13)	506 747	38 981
35-49 (3)	365 322	121 774
50+ (1)	6928	6928
Total (105)	1 951 749	...

Table 5.—Harborview Medical Center Charges and Glasgow Coma Score

Glasgow Coma Score (No. of Motorcyclists)	Total Charge, $	Average Charge, $
<9 (16)	750 976	46 936
≥9 (84)	835 727	9949
Unknown (5)	365 145	73 029
Total (105)	1 951 848	...

Patient Profiles

Characteristics of the injured cyclists are shown in Table 1. The majority of patients were men, with a mean age of 28.6 years. The mean length of stay was 19.6 days (range, one to 258 days). Nearly half of the patients (49%) had an ISS less than 15 while 15% had an ISS greater than 25. There were 61 patients (57%) with head injuries; in 33 patients these were mild, with a GCS between 13 and 15. Eleven patients had moderate head injuries, with a GCS between 9 and 12; head injuries were severe, with a GCS less than 9, in 17 patients. There were seven deaths; 18 patients were severely disabled or in a persistent vegetative state on discharge from the hospital.

Direct Costs

Complete financial information was available on 105 patients (Table 2). Total direct costs for these 105 patients, followed up for a mean of 20 months, were more than $2.7 million, or an average of $25 764 per patient. Sixty percent of these costs were accounted for by charges for initial hospital care. Rehabilitation care accounted for an additional $500 188, or 18.4% of the total direct costs. Twenty-two patients had 26 readmissions for treatment of acute-care problems related to the initial injury, generating an additional $123 650 (4.6% of total) in charges. Non–hospital-related charges accounted for only 1% of all direct costs. The three patients with the most severe injuries accounted for 18% of the total direct costs; patients with severe head injuries had costs almost fivefold higher than those with moderate or minor head trauma.

Sources of Payment

The majority (63.4%) of care of injured motorcyclists was paid for by public funds in one form or another, with Medicaid payments accounting for slightly more than half of all charges (Table 3). None of the victims were receiving public assistance prior to being injured. The patients qualified instead for the "medically indigent" category of Medicaid after admission in anticipation of a long hospital stay because of their serious injuries, resulting in $113 307 in charges reimbursed by the state. Injury-related disability also resulted in direct transfer of payments to three patients with Supplemental Security Income funds and to the dependents of two patients with funds from Aid to Families With Dependent Children. Three patients received state support for vocational rehabilitation training. Finally, one patient received part of his treatment in the military health care system. Commercial insurance plans accounted for 22% of charges, while less than 1% of charges were paid directly by the injured motorcyclist or his family.

Direct Costs and Injury Severity

As expected, average costs for care were directly related to injury severity (Table 4). More than half (59%) of the patients had injuries with ISSs of 15 or less. These patients, however, accounted for only 26.2% of acute-care hospital costs. There were 39 patients (37%) who had ISSs between 16 and 34; these patients accounted for 54.7% of acute-care hospital costs. The three patients with the most severe injuries (ISSs between 35 and 49) had an average direct cost of $121 744 and accounted for 18.7% of hospital costs. The patient with the most severe injuries generated a relatively small hospital charge because he died soon after admission.

The direct costs of care also varied directly with the severity of the head injury (Table 5). Patients with a GCS less than 9 had 4.7-fold higher average costs than did those with scores of 9 or more.

3-37

» 6.—Indirect Costs From Lost Productivity

Cause of Cost	No. of Motorcyclists	Productivity Losses, $	
		Total	Average
Mortality	7	2477 768	353 967
Morbidity	44	1 924 335	43 735
Total	51	4 402 103	...

ndirect Costs

The indirect costs, representing the alue of lost output because of cessation ır reduction of productivity caused by leath or disability are shown in Table 6. The average losses from fatal injuries re somewhat low because of the inclu ion of one 71-year-old man. This indi idual was an unusual motorcycle fatali y by virtue of his age. Only 1.9% of atients with motorcycle injuries were 5 years of age or older and only 0.5% of notorcycle trauma victims dying in the Jnited States in 1985 were aged 65 ears or older.[2] If this individual is ex luded, the average indirect cost from atal injuries is $410 850.

Indirect costs were based on employ nent data available from 44 individuals t the mean follow-up time of 20 months. hese represent minimal estimates of he lost productivity for the entire roup. The total direct and indirect osts are thus conservatively estimated t more than $7 1 million.

OMMENT

At this urban level I regional trauma enter, 64% of the total direct costs for notorcycle trauma victims in 1985 were aid by public funds. The study is onsistent with prior studies. Acute are hospital charges at the Massachusetts General Hospital from 1982 to 1983 or injured motorcyclists averaged 15 114.[11] The authors found that 46% of heir 47 patients had no medical insur nce. A study of charges for orthopedic njuries to motorcyclists in a level I rauma center in California found that 2.3% were paid from public funds.[10]

In addition to supporting these previ us findings, our study extends them by examining charges for care beyond the nitial hospitalization and by estimating he indirect costs of the motorcycle injuies. Follow-up care, rehabilitation are, and physician services accounted or an additional $1 million, or 39.5% of otal charges. Because many insurance olicies do not cover long-term rehabili ation or nursing home needs and be ause they provide limited coverage of utpatient expenses, most of these ad litional charges are paid by public unds.

Although indirect costs accrue mainly o the individual who is injured, they do reflect a societal cost. Society is not only deprived of the individual's contributions, but it may need to provide support to him or his family as well. The indirect costs arrived at in this study are not precise. They may be overestimated because they are based on age- and sex-specific national estimates of annual mean earnings. Since a disproportionate share of the sample lacked health insurance coverage, these individuals may have had jobs with below-average wages. On the other hand, the indirect costs are underestimates of the total since they are based on follow-up data from only a portion of the total group.

As a regional center attracting the most seriously injured patients, our population may not be representative of all motorcycle injury victims. However, these cost estimates, even if only representative of one region, are alarming.

There are many approaches that could be used to decrease the public cost of motorcycle trauma. One relatively easily implemented solution would be to require helmets. Although we did not compare helmeted and unhelmeted motorcycle riders, other studies have shown that motorcycle helmets are clearly effective in decreasing the severity of head injuries and in lowering the rate of fatal injuries. One study that compared the risk of death in a motorcycle crash of an unhelmeted rider with that of a helmeted rider on the same motorcycle found that the unhelmeted rider had a 27% greater chance of dying.[7] Other studies have documented that states with an enforced helmet law maintain a compliance rate of more than 90% while in states without such a law helmet usage remains at the 50% level.[12] Decreasing head injuries through a mandatory helmet law would therefore be expected to significantly reduce the costs of care.

The impact of the cost of motorcycle injuries on society was perhaps best expressed 16 years ago by a Massachusetts court[19]:

> We cannot agree that the consequences of such (motorcycle) injuries are limited to the individual who sustains the injury. From the moment of injury, society picks the person up off the highway; delivers him to a municipal hospital and municipal doctors; provides him with unemployment compensation if, after recovery, he cannot replace his lost job, and, if the injury causes permanent disabi may assume the responsibility for his an family's subsistence.

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3-38

H E L M E T L A W

POSITION PAPER

KANSAS HEAD INJURY ASSOCIATION

NOVEMBER 6, 1984

Dan Lykins

Andrea Ramsay

KANSAS HEAD INJURY ASSOCIATION

POSITION PAPER

HELMET LAW

1. I knew someone who was wearing a helmet and they died. Do helmets really work?

Yes. Because of the exposed position of the motorcycle rider, accidents provide great opportunity for injury to all parts of the body, and there are several kinds of protective equipment available to riders. The one item of protective equipment which is unique to the motorcyclist is the safety helmet; no other vehicle in traffic use has the same associated demand for head protection.

The National Technical Information Service (NTIS) of the U.S. Department of Commerce published a report in 1981, based on studies made on the scene of 900 motorcycle accidents in California. The study assessed the effectiveness of various safety equipment, including helmets. Of the 900 accidents, it was found that 355 riders and 24 passengers wore helmets; 537 riders and 127 passengers did not. The overall usage of helmets on the roads was approximately 50% voluntary usage.

The report found the following incidence of injuries and fatalities:

	No Helmets	Helmets
Riders and Passengers	664	379
Facial Injuries	44	19
Neck Injuries	25	12
Head Injuries	174	26
Fatalities	46	12

No single piece of safety equipment can prevent all accidents or injuries, but it is obvious that helmets reduce facial, neck and head injuries and save lives.

Thus, in Kansas last year, unhelmeted riders were involved in more accidents, were 2.3 times as likely to die, and almost twice as likely to be injured. In a more comprehensive study of motorcyle accidents in Kansas, prepared by Norman E. McSwain, Jr., M.D., F.A.C.S., and Michael Lummis, M.P.H., as part of a larger Department of Transporation study of several states which had repealed or weakened their helmet laws, it was found that nonhelmeted persons were 106% more likely to be head-injured than were helmeted riders. The repeal of the mandatory motorcycle helmet law resulted in increased injuries and fatalities among nonhelmeted riders. Comparing pre-repeal and post-repeal figures, it was found that there had been a 333% increase in fatalities, a 106% increase in head injuries overall, and a 67% increase in head injury severity among nonhelmeted riders. The figures compared were figures for the years 1975 to 1977, and are based on fatalities or injuries per 1000 accidents.

The death rate from head injuries when helmets were not worn versus when helmets were worn was 333%. The total outpatient cost for helmeted motorcyclist was $876.00, whereas the non-helmeted was $2,478.00. Inpatient cost for helmeted motorcyclist was $5,976.00, whereas the non-helmeted was $17,886.00. "presentation for the Louisiana Legislative Committee for Mandatory Helmet Legislation" by Norman E. McSwain, Jr., M.D., Professor of Surgery, Tulane University School of Medicine(from a Kansas Study, 1977).

Obviously, helmets work. However, no single piece of safety equipment can prevent all accidents or injuries, but helmets produce significant reductions in facial, neck and head injuries and fatalities.

2. Helmets cause accidents because hearing and vision is impaired.

Wrong. There is no data indicating that helmet use increases accidents by impairing vision or hearing, or by causing fatigue or over-confidence. No evidence that helmets cause or increase severity of neck injury in motorcycle accidents. In May, 1976, representatives of the American Motorcyclist Association, in conjunction with an American Medical Association Conference, concluded unanimously that helmets impaired neither the vision nor the hearing of a motorcycle rider.

In the California-based NTIS study, it was found that approximately 50% of all motorcycle riders voluntarily wore helmets, but nonhelmeted riders accounted for about tho-thirds of all of the accidents. At best, it appears that people who wear helmets are safer operators and have fewer accidents. At least, it shows that wearing helmets did not cuase more accidents by impairing; helmeted riders accounted for only approximately one-third of all accidents.

3. I have the right to decide if I want to wear a helmet.

States have the authority to require helmets in the public interest. Regulation of use of vehicles on public roads is a valid function of government. Each driver accepts reasonable limitations on how he or she may use the roads, i.e. driver's license, license plates, etc. Death and disablement because of failures of many motorcyclists to wear helmets places substantial burdens on society through insurance, medical care and welfare benefits.

The Supreme Court of the United States answered this question.

As of December 1, 1976, helmet laws had been upheld 30 times by the highest courts in 25 states. At least five times the United States Supreme Court has refused to overturn decisions which sustained the constitutionality of helmet laws.

In 1972, the United States Supreme Court affirmed without opinion the District Court decision in Simon v. Sargent, 346 F. Supp. 279 (Mass. 1972). The three judge Federal panel in Simon v. Sargent unanimously held that a Massachusetts statute requiring protective headgear was constitutional. The court reasoned that although the police power does not extend to overcoming the right of an individual to incur risks that involve only himself, the public has a legitimate interest if public resources are directly involved in those risks. The court noted that it is society that picks a person up off the highway, delivers him to a municipal hospital and municipal doctors, provides him with unemployment compensation and assumes responsibility for the victim's family's continued subsistence.

In earlier cases, the Supreme Court had denied three petitions for certiorari in cases upholding headgear legislation and dismissed an appeal in a fourth case "for want of a substantial federal Question," Bisenius v. Karns, 165 N.W. 2nd 377 (S. Ct. Wisc. 1969), appeal dismissed, 89 S. Ct. 2033 (1969). The appellant had attacked Wisconsin's headgear legislation (347.485(1) (a) stats. as a restriction upon individual liberty and as exceeding the police power of the State, alleging that both violated the due process clause of the Fourteenth Amendment.

The Supreme Court's dismissal of appeal "for want of substantial Federal question" meant that the Court viewed the decision to be correct, and that no substantial question on the merits was raised.

The issues raised in Bisenius were essentially the same as those raised in other suits challenging the constitutionality of headgear legislation, and forecast the Court's affirmation in Simon v. Sargent, supra.

"Head Injury" is a euphemis for brain damage. Once the brain is damaged, the damage is incurable. The consequences are devastating. Only 13% of all head-injured persons are ever able to work again. Those who are able to work again can seldom return to the same job they held before the accident. Most face a lifetime of being handicapped, of living under severe limitations, and of being dependent upon someone else for their care and support. At least 50% of all head injuried persons are between the ages of 16 and 24. Another large group is between the ages of 24 and 35. These people may live a normal lifespan after the accident, although they remain at greater risk of ailments associated with their head injury. Few people have long-term disability insurance which will care for them or their families for life. Social Security and Medicare are inadequate for the task of caring for all their needs. The states do not provide for all their needs, but will probably be responsible for what support and care is provided. There is no way to measure in dollars the suffering of families, friends and loved ones when a normal person suddenly and irreversibly becomes a severely handicapped, possible mentally deficient. No one has the moral or legal right to multiply their risks of injury in such a way as to inflict upon others the suffering and financial burden which head injuries create.

4. Why was the previous law repealed, date and year?

The Highway Safety Act of 1966 (1) granted to the U.S. Secretary of Transportation the authority to withold State Highway Safety of Construction funds for noncompliance with mandatory motorcycle helmet usage.

208 of the Highway Safety Act of 1976 withdrew the authority from the Secretary of Transportation granted under the Highway Safety Act of 1966 to disapprove a state highway safety program which does not require helmet use by a person. Congress interpreted this as helmet usage is not important.

Since 1976, 35 states repealed their helmet laws. Kansas repealed theirs, May 1976.

5. How much money can be saved in reduced health costs?

In "The Economics of Safety Deregulation: Lives and Dollars Lost due to Repeal of Motorcycle Helmet Laws," J. Health Politics, Policy and Law, Volume 8, Number 1, Spring, 1983, a study indicated that 516 excess deaths occurred in 1980 in the 28 states that weakened or repealed their helmet laws, at an increased excess economic cost of $180 million. These figures represent only those costs associated with excess fatalities, that is the increase in fatalities directly due to repeal or weakening of helmet laws.

McSwain, supra #1 indicates the following:

$2,478.00	Outpatient Unhelmeted	- $17,886.00	Inpatient Unhelmeted
- 876.00	Outpatient Helmeted	- -5,976.00	Inpatient Helmeted
$1,602.00	Savings	- $11,910.00	Savings

Combined total Savings: $12,972.00

or $1.5 million per person for a severely head injured person over a lifetime.

6. How many states have a helmet law?

23 states have an unlimited law:

1. Alabama
2. Arkansas
3. Florida
4. Georgia
5. Kentucky
6. Louisanna
7. Mass.
8. Michigan
9. Mississippi
10. Missouri
11. Nevada
12. New Jersey
13. New York
14. North Carolina
15. Pennsylvannia
16. South Carolina
17. Tennessee
18. Vermont
19. Virginia
20. West Virginia
21. Wyoming
22. District of Columbia
23. Puerto Rico

7. What does the present law say?

K.S.A. 8-1598. Operation of motorcycles; equipment required for operators and riders, (a) No person under the age of 18 years shall operate or ride upon a motorcycle or a motorized bicycle, unless wearing a helmet which complies with the minimum performance requirements established by the National Highway Safety Administration pursuant to the National Traffic and Motor Vehicle Safety Act of 1966 for helmets designed for use by motorcyclists and other motor vehicle users.

(b) No person shall operate a motorcycle unless such person is wearing an eye-protective device of a type which complies with the standards established by the Secretary of Transportation, except when the motorcycle is equipped with a windscreen which has a minimum height of 10 inches measured from the center of the handlebars.

(c) This section shall not apply to persons riding within an exclosed cab or a golf cart, nor shall it apply to any person operating or riding any industrial or cargo-type vehicle having three wheels and commonly known as a truckster.

(d) The Secretary of Transportation may approve or disapprove eye-protective devices required by this section, and may adopt rules and regulations establishing standards and specifications for the approval thereof. The Secretary shall publish lists of all eye-protective devices by name and type which the Secretary has approved.

8. What are the standards for helmets? Who controls or regulates the standards?

Federal Motorcycle Safety Standards No. 218:

1. Impact Attenuation
2. Penetration
3. Configuration
4. Retention
5. Projections
6. Labelling:

   Permanent, legible label with manufacturer's name and I.D., precise model designation, month, year of manufacture and DOT sticker.

The United States Department of Transportation Standards regulates the standards for helmets through their National Highway Traffic Safety Administration.

Other helmet labels:

ANSI-Z90.1 is the "Specification for Protective Headgear for Vehicular Users" published by the American National Standards Institute.

The "Snell" label means that the helmet has been tested in accordance with a procedure somewhat more severe than the Z90.1. Snell approved helmets are generally intended for competition use by motorcyclists and auto racers.

DOT MVSS 218 is the federal standard of the United States Department of Transportation and is a refined version of the ANSI-Z90.1 standard, specifically intended for road users.

CSA-D230 is the Canadian Standards Association standard for "Safety Helmets for the Motorcycle Riders".

9. Does the insurance industry support helmets? Why?

Yes. Ronald Cobb, Vice President of S.W. Region of the American Insurance Association, Houston, Texas, which is the National Trade Association for insurance companies, states, yes.

The legal counsel for the assiciation are: Mark Bennett, Sr. (Topeka) and Bud Cornish (Topeka).

One main reason they support helmets is the cost of motorcyclists accidents, nationwide.

BRYAN, LYKINS, HEJTMANEK & WULZ, P.A.
ATTORNEYS AT LAW
222 WEST SEVENTH STREET
P.O. BOX 797
TOPEKA, KANSAS 66601
(913) 235-5678

February 21, 1991

JOHN J. (JIM) BRYAN
DAN LYKINS
DANTON C. HEJTMANEK
DAN L. WULZ
CATHLEEN M. REEDER

FAX
(913) 357-1729

State Representative Herman G. Dillon
Chairman of the House Transportation Committee
Room 519-S
State Capitol Building
Topeka, KS 66612

RE: House Bill 2129

Dear Chairman Dillon:

As a member of the Kansas Head Injury Association, I strongly support House Bill 2129 pertaining to the mandatory use of helmets while operating a motorcycle. As an attorney over the past 19 years, I have represented over 100 individuals injured in motorcycle accidents, and most of these clients not wearing helmets either sustained permanent head injuries or were killed.

One of my clients, Mike Wells, who sustained permanent injuries as a result of a motorcycle accident is with me today. Mike Wells was born on July 5, 1952, and at the time of his motorcycle-car accident on September 29, 1987, in Topeka, Kansas, he was not wearing a helmet. Mike sustained a severe head injury in this accident, plus he lost his eyesight. Mike will never see his wife or four children again as a result of this accident, and thus he hopes the 1991 Legislature will enact a mandatory helmet law to hopefully save other Kansas families from going through the miseries that Mike and his family will endure for the rest of their lives.

I do suggest that a provision be added to the helmet law that would be similar to the seat belt law which would state "evidence of failure of any person to use a helmet while riding on a motorcycle shall not be admissible in any action for purpose of determining any aspect of comparative negligence or mitigation of damages".

Mike Wells and his family pray that the 1991 Legislature will have the courage to pass a mandatory helmet law in order to protect the citizens of our state.

Sincerely,

Dan Lykins

Dan Lykins

DL:gc

House Transportation
2-21-91
ATTACHMENT 4-1

(4) an occupant of a passenger car required to be protected by a safety restraining system under the child passenger safety act.

(c) The secretary of transportation shall initiate an educational program designed to encourage compliance with the safety belt usage provisions of this act.

(d) The secretary shall evaluate the effectiveness of this act and shall include a report of its findings in the annual evaluation report on its highway safety plan that it submits under 23 U.S.C. 402.

(e) Law enforcement officers shall not stop drivers for violations of this act in the absence of another violation of law. A citation for violation of this act shall not be issued without citing the violation that initially caused the officer to effect the enforcement stop.

History: L. 1986, ch. 35, § 3; L. 1989, ch. 40, § 4; July 1.

Research and Practice Aids:
Automobiles ⇐ 5(2), 11.
C.J.S. Motor Vehicles § 20 et seq.

Attorney General's Opinions:
Person involved in vehicular accident may be cited for violation of Kansas safety belt use act even though not cited for any other violation. 87-129.
Child passenger safety act; effect of 1989 House Bill No. 2196. 89-104.

8-2504. Same; warning citations; fines; violation not reported to department of revenue; failure to use belt not admissible to determine negligence or damages. (a) (1) From and after the effective date of this act, and prior to July 1, 1987, a law enforcement officer shall issue a warning citation to anyone violating subsection (a) of K.S.A. 1986 Supp. 8-2503; and

(2) from and after July 1, 1987, persons violating subsection (a) of K.S.A. 1986 Supp. 8-2503 shall be fined not more than $10 including court costs.

(b) No court shall report violation of this act to the department of revenue.

(c) Evidence of failure of any person to use a safety belt shall not be admissible in any action for the purpose of determining any aspect of comparative negligence or mitigation of damages.

History: L. 1986, ch. 35, § 4; July 1.

CASE ANNOTATIONS

1. Evidence of nonuse or misuse of child safety restraining device (8-1344) as inadmissible under 8-1345(d) examined. Watkins v. Hartsock, 245 K. 756, 763, 783 P.2d 1293 (1989).

2. Admissibility of evidence concerning nonuse of child safety restraint in determining comparative negligence or mitigation of damages considered. Barnes v. Robision, 712 F.Supp. 873, 876, 877 (1989).

8-2505. Same; act does not affect requirement of crash protection under federal law. The passage of this act shall not be interpreted to obviate the requirement of occupant crash protection as contained in 49 C.F.R. 571.208, as authorized by 15 U.S.C. 1392.

History: L. 1986, ch. 35, § 5; July 1.

8-2506. Same; severability of act. If any provision of this act or the application thereof to any person or circumstance is held invalid, the invalidity does not affect other provisions or applications of the act which can be given effect without the invalid provision or application, and to this end the provisions of this act are severable.

History: L. 1986, ch. 35, § 6; July 1.

8-2507. Same; manufacturer warranty on safety belts; "motor vehicle" defined. (a) From and after the effective date of this act, a manufacturer of a motor vehicle sold in this state which is equipped with safety belts in compliance with federal motor vehicle safety standard no. 208, shall provide for a ten-year warranty on such safety belts.

(b) As used in this section, "motor vehicle" means a new motor vehicle which is sold in this state, and which is registered for a gross weight of 12,000 pounds or less, and does not include the customized parts of motor vehicles which have been added or modified by second stage manufacturers, first stage converters or second stage converters as defined in K.S.A. 8-2401 and amendments thereto.

History: L. 1986, ch. 35, § 7; July 1.

4-2

CMS
The Kansas Rehabilitation Hospital

I am before you to testify in favor of a motorcycle helmet law in Kansas. I am a clinical social worker with fifteen years of experience as a family counselor. The past five years of my professional life have been spent working with head injury survivors and their families in rehabilitation settings.

I have attached a list containing statistics related to head injury in the United States. On the average, there are 700,000 head injuries each year (in Kansas-Missouri alone there are 30,000 injuries). Of this national total 70 - 90,000 result in coma or extreme debilitation and loss of body function. Each severe head injury survivor requires between $4.1 and $9 million in care over a lifetime. The typical survivor is injured when they are between the ages of 15 and 35.

These statistics suggest that it is not only the survivor of a head injury who is traumatized, but their families as well. For that reason, I would like to focus the remainder of my comments on the impact head injury has on families.

Head injuries are sudden events for which families are ill prepared. It is truly the entire family system that is affected in a way that is distinctly different from other losses. When a person dies as a result of an injury or illness, the family experiences a process of grieving. They redefine roles and expectations and eventually reach a resolution that permits them to establish new relationships and continue with their lives.

Families who experience head injury must meet and cope with a different set of challenges. They have undergone a loss but their is no final resolution. Survivors of severe head injuries will invariably have significant impairment in physical abilities, cognitive-communication skills, and emotional and social behavior. Families frequently report that they must learn to get to know a new person because the survivor's personality is significantly altered. While they struggle with the loss of the person they once knew, they must also deal with taking on responsibility for the care of the person who now has a new role in the family.

Janet Williams, a long time advocate for head injury survivors and their families has recently edited a book entitled "Head Injury: A Family Matter". In a chapter authored by Ms. Williams, she lists the following factors that create the greatest stress for families:

1. Cognitive and social problems - these factors are usually more stressful than adjustment to the survivor's physical impairment.

HOUSE TRANSPORTATION
2-21-91
ATTACHMENT 5-1

1504 S.W. 8th Street, Topeka, Kansas 66606
(913) 235-6600

2. Lack of information - families typically do not receive adequate information on the long term needs of the survivor and the impact on the family.

3. Lack of service - many areas do not have the wide range of services essential for positive adjustment by individual or family.

4. Uncertainty of the future - who will take care of the survivor when parents become too old to continue.

5. Finances - costs range from inpatient care to respite care as well as loss of income and interference with career advancement for survivor and spouse.

6. Role changes - it is unlikely that someone with a severe head injury will be able to function in pre-injury roles of spouse, student, wage earner, and sexual partner.

7. Social isolation - early on friends and relatives will be actively involved and supportive. However, over time contact decreases and isolation begins to set in.

8. Prolonged caretaking - since head injury survivors have an average life expectancy, caregivers are faced with 20-30 years of responsibility.

There is no cure for head injury, but there is prevention. A helmet law would prevent some individuals and families from experiencing the devastation and despair created by head injury. A helmet law has its place in a constellation of preventative measures including educational programs in our schools and the existing seat belt law. Such a law is worthy of your most serious consideration.

2-21-91
Date

Donovan Lee

Donovan Lee, LSCSW
Coordinator Neurobehavioral
Rehabilitation Unit
Kansas Rehabilitation Hospital

The Kansas Rehabilitation Hospital

1504 S.W. 8th Street • Topeka, Kansas 66606
(913) 235-6600)

HEAD INJURY IN THE UNITED STATES

* There are approximately 700,000 head injuries in the United States every year.
* Half of these (350,000) head injuries stem from automobile crashes.
* One out of 80 children born this year will die of a vehicular-induced head injury, probably before reaching 25 years of age.
* Head injuries are responsible for up to 60 percent of auto trauma deaths.
* The most frequent reason for visits to physicians for emergency care is head injury.
* Each year, more than 140,000 Americans die as a result of head injuries.
* There are between 70,000 and 90,000 head injuries in the United States each year that result in coma or extremely debilitation loss of body function.
* Head injury accounts for 500,000 hospital visits every year.
* There are 2,000 cases of persistent vegetative state in the United Stated every year caused by head injury.
* Head injuries require 3.5 million days of hospitalization and cost more than 35,000 man years of working ability each year.
* Each severe head injury survivor requires between $4.1 and $9 million in care over a lifetime.
* Those survivors who have sustained severe head injuries in any one year alone will require a total of up to $630 billion in lifetime care.
* The typical survivor of serious head injury requires between five and 10 years of intensive rehabilitation.
* Head injury kills more Americans under the age of 34 than all other causes combined.

Compiled by National Head Injury Foundation

5-3

State of Kansas
Joan Finney, Governor
Department of Health and Environment
Division of Health
Landon State Office Bldg., Topeka, KS 66612-1290
Acting
Stanley C. Grant, Ph.D., Secretary
Reply to: _____
FAX (913) 296-6231

Testimony presented to

House Transportation Committee

by

The Kansas Department of Health and Environment

House Bill 2129

I am pleased to present testimony today in support of House Bill 2129 which proposes to expand KSA 1598 to require that people of all ages must wear a helmet when operating or riding upon a motorcycle or a motorized bicycle. Kansas law currently requires only motorcyclists under the age of 18 to wear helmets.

Motorcycle helmet laws are an intervention that have been proven effective in preventing unnecessary injuries and fatalities. In 1966 the Highway Safety Act was passed which in effect required that all states pass a helmet use law to qualify for safety and highway funds. By 1975, the District of Columbia and 47 States required all motorcyclists to use helmets. In 1976, despite evidence that nearly all motorcyclists were complying, Congressional pressure was lifted and within 2 years, 26 states had rescinded or weakened their laws. The result was predictable and overwhelming: the repeals or weakening of motorcyclist helmet use laws were typically followed by an almost **40% increase** in the numbers of fatally injured motorcyclists.

The overall number of motorcycle accidents is low, but almost all of these collisions result in injury. Motorcycle crashes accounted for two percent of statewide crashes in Kansas, but those crashes accounted for more than six percent of the statewide fatalities, a disproportionate amount. Of the 1,272 reported motorcycle accidents in Kansas in 1989, there were 27 rider fatalities and 1,128 rider injuries, according to data from the Kansas Department of Transportation. There were no fatalities in the age 1-14 age group and 4 fatalities in the 15-19 age group. Nineteen fatalities (70%) occurred in the over age 19 age group. Similarly, 845 (75%) of the injuries occurred in the over age 19 age group. (The ages of four fatality victims and 11 injured were reported unknown.) Of those killed in 1989, 28% were wearing helmets; 72% were not.

The National Highway Traffic Safety Administration (NHTSA) conducted a helmet survey in 1986 which compared helmet usage in seven cities with mandatory helmet laws to helmet usage in 12 cities with no or limited helmet use laws. Surveyors observed a helmet usage rate of 99.5% in the cities with mandatory use laws and 48.2% in cities with no or limited helmet use laws.

In 1974, Kansas legislation was passed that required helmets to be worn by

HOUSE TRANSPORTATION
1-21-91
ATTACHMENT 6-1

Charles Konigsberg, Jr., M.D., M.P.H.
Director of Health
(913) 296-1343

James Power, P.E.
Director of Environment
(913) 296-1535

Lorne Phillips, Ph.D.
Director of Information Systems
(913) 296-1415

Roger Carlson, Ph.D.
Director of the Kansas Health and Environment Laboratory
(913) 296-1619

all motorcycle drivers and passengers. In 1976, the requirement as it applied to those 16 years and over was repealed. In 1979, the mandate was reinstated for 16 and 17 year olds. Kansas accident data mirrored the national experience. The number of motorcycle fatalities increased by 58% from 1975 to 1980 (see attachment 1) The decrease in number of fatalities and injuries since 1980 can be explained in part by the concomitant decrease in the number of motorcycle registrations: There were 92,218 registrations in 1980 compared to 61,419 registrations in 1989.

If motorcyclists who choose to not wear helmets were only hurting themselves, the question of mandatory helmet laws might not be such an issue for public concern. However, helmet use is an economic issue as well as a personal safety issue. Nationwide, at least $61 million could be saved annually if all motorcyclists were to use helmets. Helmet laws are effective in encouraging helmet use among motorcyclists and, thus, prevent unnecessary medical expenditures as well as unnecessary pain and suffering among injured motorcyclists. The experience of the state of Louisiana is an example of the benefits to be gained by reenacting a universal helmet law. This state reenacted a mandatory helmet use law in 1981. An analysis revealed that following reenactment fatalities fell from 3.63 per 100 collisions to 1.07 per 100 collisions. Crashes resulting in reportable, serious injuries fell from 84% to 74%. They also benefitted by a substantial reduction in the average medical cost per injury: $2,071.00 before reenactment, $835.00 after reenactment.

The National Center for Statistics and Analysis estimated costs resulting from non-use of motorcycle helmets for each state based on 1984-88 fatality data. According to their estimations, Kansas saved $8,632,304 and 18 lives by virtue of the current law which requires helmet use for those under age 18. Kansas could have experienced an additional savings of $31,610,127 and 46 lives if **all** operators had worn helmets.

The Kansas Department of Health and Environment supports House Bill 2129. Motorcycle helmet use saves lives, prevents unnecessary disabilities and saves the taxpayers money. Mandatory helmet use laws double compliance to the recommendation to wear helmets.

Testimony presented by: Paula F. Marmet, MS, RD
Director
Office of Chronic Disease and Health Promotion
February 21, 1991

OCTOBER 25, 1990

OFFICE OF TRAFFIC SAFETY
KANSAS DEPARTMENT OF TRANSPORTATION
TOPEKA, KANSAS

MOTORCYCLE FATALITIES AND INJURIES BY HELMET USE

	Killed			Injured		
Year of 1975	Operator	Passenger	Total	Operator	Passenger	Total
Helmet - worn	27	2	29	1225	186	1411
Helmet - not worn	5	1	6	35	10	45
Unknown if worn	3	0	3	328	66	394
Total	35	3	38	1588	262	1850
Year of 1976						
Helmet - worn	17	5	22	971	135	1106
Helmet - not worn	10	3	13	478	82	560
Unknown if worn	8	2	10	268	61	329
Total	35	10	45	1717	278	1995
Year of 1977						
Helmet - worn	9	1	10	595	77	672
Helmet - not worn	29	7	36	920	195	1115
Unknown if worn	8	1	9	415	103	518
Total	46	9	55	1930	375	2305
Year of 1978						
Helmet - worn	5	1	6	490	67	557
Helmet - not worn	31	1	32	862	167	1029
Unknown if worn	12	2	14	438	105	543
Total	48	4	52	1790	339	2129
Year of 1979						
Helmet - worn	7	1	8	495	70	565
Helmet - not worn	26	11	37	802	151	953
Unknown if worn	8	1	9	621	146	767
Total	41	13	54	1918	367	2285
Year of 1980						
Helmet - worn	10	0	10	496	77	573
Helmet - not worn	24	5	29	750	153	903
Unknown if worn	17	4	21	721	132	853
Total	51	9	60	1967	362	2329

MOTORCYCLE FATALITIES AND INJURIES BY HELMET USE

	Killed			Injured		
Year of 1981	Operator	Passenger	Total	Operator	Passenger	Total
Helmet - worn	30	2	32	504	65	569
Helmet - not worn	11	5	16	533	97	630
Unknown if worn	21	2	23	810	178	988
Total	62	9	71	1847	340	2187
Year of 1982						
Helmet - worn	8	1	9	358	39	397
Helmet - not worn	14	0	14	262	50	312
Unknown if worn	22	3	25	875	189	1064
Total	44	4	48	1495	278	1773
Year of 1983						
Helmet - worn	5	1	6	319	36	355
Helmet - not worn	13	1	14	209	34	243
Unknown if worn	20	2	22	797	143	940
Total	38	4	42	1325	213	1538
Year of 1984						
Helmet - worn	12	1	13	335	36	371
Helmet - not worn	12	1	13	263	27	290
Unknown if worn	19	2	21	901	146	1047
Total	43	4	47	1499	209	1708
Year of 1985						
Helmet - worn	10	0	10	254	19	273
Helmet - not worn	6	1	7	188	33	221
Unknown if worn	13	2	15	927	158	1085
Total	29	3	32	1369	210	1579
Year of 1986						
Helmet - worn	7	1	8	269	28	297
Helmet - not worn	9	1	10	231	40	271
Unknown if worn	13	4	17	768	168	936
Total	29	6	35	1268	236	1504

MOTORCYCLE FATALITIES AND INJURIES BY HELMET USE

	Killed			Injured		
Year of 1987	Operator	Passenger	Total	Operator	Passenger	Total
Helmet - worn	8	0	8	345	35	380
Helmet - not worn	8	2	10	257	34	291
Unknown if worn	19	3	22	720	137	857
Total	35	5	40	1322	206	1528
Year of 1988						
Helmet - worn	3	0	3	312	38	350
Helmet - not worn	5	1	6	219	42	261
Unknown if worn	23	10	33	658	112	770
Total	31	11	42	1189	192	1381
Year of 1989						
Helmet - worn	6	1	7	296	35	331
Helmet - not worn	4	2	6	192	36	228
Unknown if worn	13	1	14	643	113	756
Total	23	4	27	1131	184	1315

JTS:dkr

Mr. Chairman and members of the committee. I am Sgt. Charles Walker with the Topeka Police Department. I am here to speak in support of House Bill No. 2129 concerning mandatory use of safety helmets.

At the present time I am the Officer in charge of the Motorcycle Unit of the Topeka Police Department and the instructor for the program. I am certified as a Motorcycle Instructor / rider by the Institute of Police Technology and Management as well as Central Missouri State University. Prior to joining the Topeka Police Department I was a professional motorcycle racer as well as being employed in the motorcycle industry. I have had extensive connections with safety helmets in use, sales and development. During my racing carrier I was employed by the BUCO helmet mfg. Co. to aid in development of safety helmets.

Members of the Committee I am here to tell you that safety helmets do work. I am speaking from first hand, personal experience that impacting the ground at speed may be survived if you are properly prepared. In 1987 the City of Topeka experienced seventeen fatality accidents. Of these seventeen five, almost 1/3, were involving motorcycles. Death in all cases were directly related to head injuries. One, which I became involved by checking the condition of the motorcycle, occurred on 07/24/87. Attached you will find a copy of the autopsy report as well as a statement by the coroner "The nature of the injuries also indicate the likelihood that he would have survived with little harm, had he been wearing a helmet." Another Coroner's report from 1988 is attached with the same conclusion, head injuries.

By 1966 the United States were experiencing approx. thirteen death's per. 10,000 registered motorcycles. Between 1966 and 1969 forty States enacted helmet laws and by 1969 that number had dropped to approx. eight fatalities per 10,000. With these laws in effect that number continued to drop until in 1975 we were experiencing less that seven deaths per 10,000. Then between 1976 and 1979 twenty seven States repealed or weakened helmet laws and by 1979 the fatalities again had risen to 9.7 per. 10,000. This obvious correlation between death's and helmet's cannot be ignored.

The individual actions of motorcycle riders are beyond our control, but there ability to legally ride on the street is not. If by requiring the use of helmets we are able to decrease the number of death's and injuries the effort is well spent.

Attached you will find four copies of articles and pictures of motorcycle crashes that the riders survived and in all but one got up and walked away. Attachment number five is entitled "Facts not myths about motorcycle helmets" and attachment number six "How much protection does a standard helmet offer." Both of these articles offer excellent insight on helmets . Also attached fatality facts from 1980 to 1989.

House Transportation
2-21-91
ATTACHMENT 7-1

AUTOPSY REPORT

NAME:		DATE OF DEATH:	7/25/87
AGE:		DATE OF AUTOPSY:	7/26/87
CORONERS CASE NO:		FORENSIC AUTOPSY NO:	FA87-77

SUMMARY OF FINDINGS:

1. Major closed head injury, with/including:
   a. Subcutaneous and subgaleal hemorrhage, most prominently on right side.
   b. Non-depressed right temporal skull fracture.
   c. Right anterior fossa basilar skull fracture, with right periorbital ecchymosis.
   d. Right frontal lobe brain contusion.
   e. Subdural hematoma, large, base of brain and around brainstem.
   f. Mild diffuse subarachnoid and intraventricular hemorrhage.
   g. Cerebral edema.
   h. Herniation of cerebellar tonsils and uncal gyri.
   i. Secondary pulmonary edema.
   j. Acute bronchopneumonia, patchy, lower lobes.

2. Multiple cutaneous abrasions (see diagrams).

3. Multiple superficial contusions.

CONCLUSIONS: It is our opinion that a 22 year old white male died as a result of a closed head injury sustained when his head struck a curb after he slid across the pavement following a motor vehicle accident, in which he lost control of his motorcycle. This resulted in a skull fracture, intracranial bleeding, brain contusion, swelling of the brain, and herniation of the cerebellum. As is common in these situations, there was reflex edema of the lungs, resulting in early acute bronchopneumonia. It is obvious that the subject struck the right side of his head against the curb. There were no other significant injuries, except for major cutaneous abrasions and some small contusions. His blood alcohol level at the time of admission to the emergency room was 0.178 g %, so that it is likely that significant intoxication contributed to or caused the accident. The nature of the injuries also indicates the likelihood that he would have survived with little harm, had he been wearing a helmet. There were no other significant findings.

7-2

Statements of witnesses (their names) (Accident, Suicide, Homicide, Natural.)

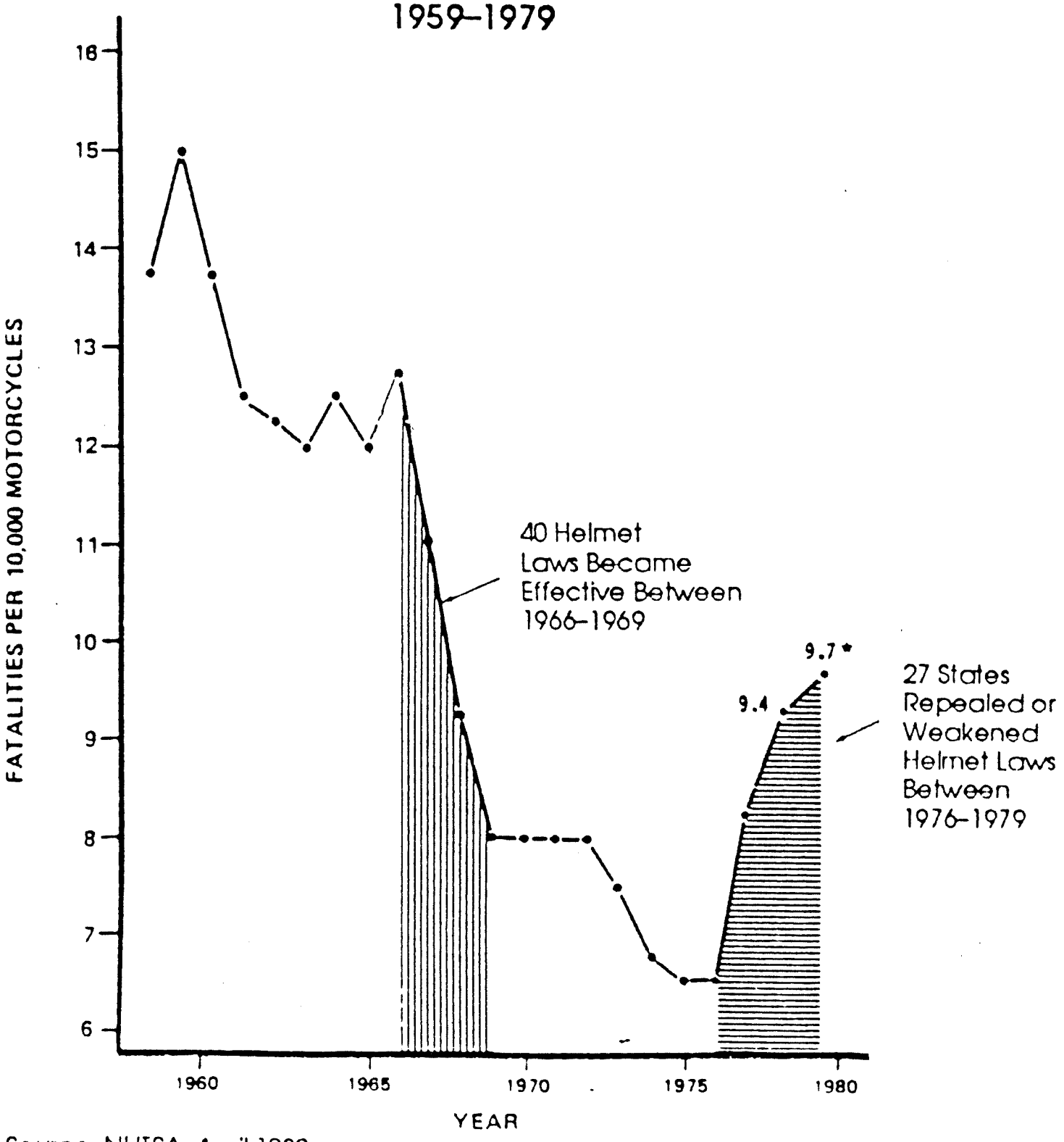
The Deputy District Coroner (R. Jensen, M.D.) was contacted at 1814 hour regarding a death in the Intensive Care Unit at Stormont-Vail Regio Medical Center. The subject is a 37 year old Caucasian male who was involved in a motorcycle-motor vehicle accident on 1988 at approximately 4 PM. The accident occurred in the . According to Patrolman Mark Finley of the Topeka Police Department, the motor vehicle involved in the accident was driving south in the right hand lane when it apparently turned in front of the subject's motorcycle which was traveling in the left lane of southbound traffic. The motorcycle apparently struck the left rear wheel well of the vehicle causing the motorcycle to fall and skid along the pavement. The subject was allegedly thrown from the motorcycle, landing on his head on the hard pavement. The subject was not wearing a helmet according to police. The subject was attended to immediately after the accident then transferred to the

Emergency Room at Stormont-Vail Regional Medical Center where he was found to be comatose due to a severe closed head injury. A large left posterior scalp laceration and a few bruises were apparent upon examination. At the time of admission, blood was identified draining from the subject's nose. After initial examination, he was felt to have a subdural hematoma and severe brain swelling. His condition remained unstable due to cardiac arrhythmias and severe cerebral edema. Electroencephalograms performed on were isoelectric. After the second flat EEG, the subject was pronounced brain dead at hours on . The subject subsequently underwent organ transplantation of the corneas, heart, pancreas, spleen, and kidneys.

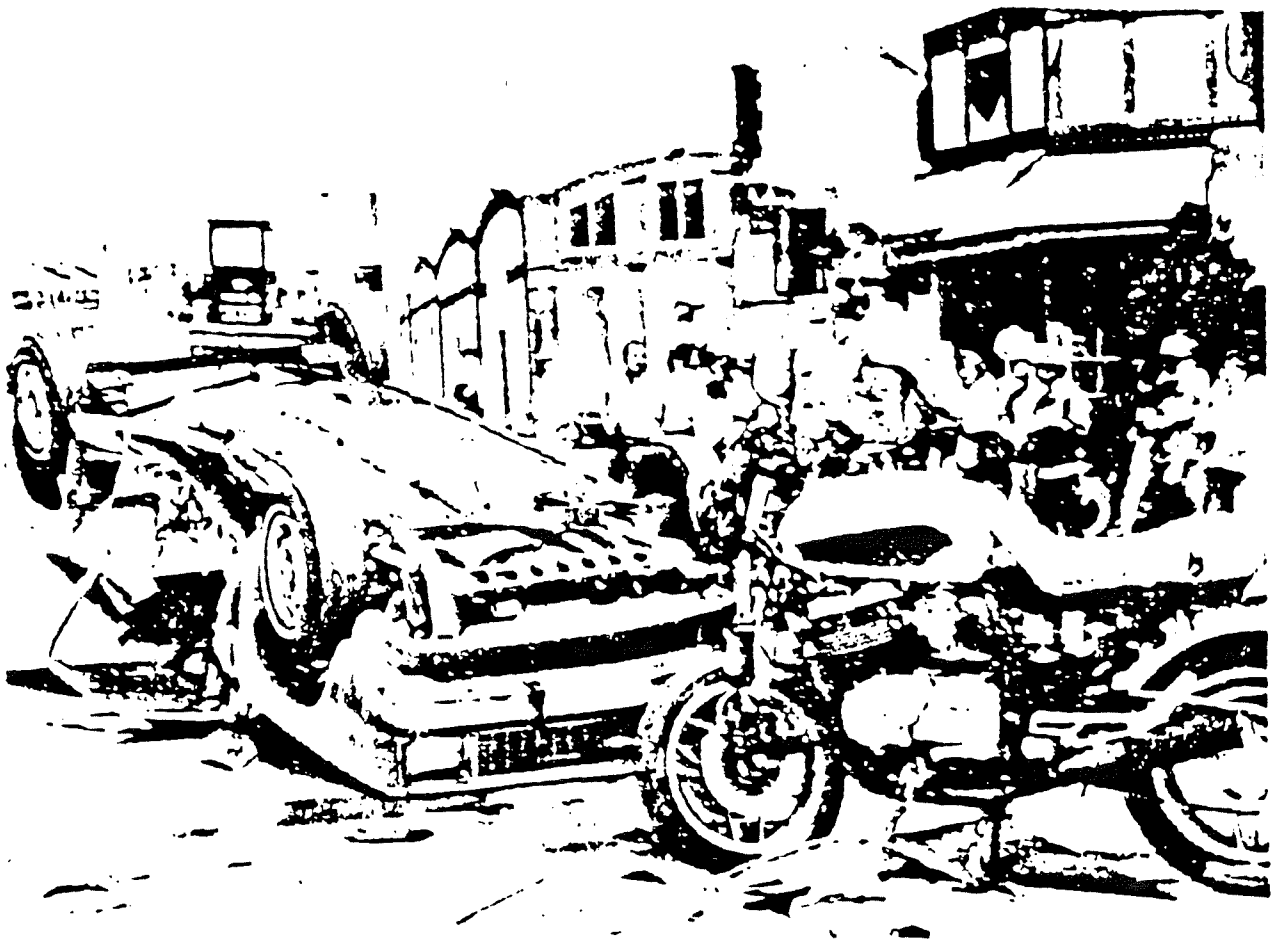
Robert D Jensen MD

Robert D. Jensen, M.D.
Deputy District Coroner
Third Judicial District
Shawnee County Kansas
1500 W. 10th Street
Topeka, Kansas 66604-1353
(913) 233-3074

MOTORCYCLE FATALITIES PER 10,000 MOTORCYCLES 1959–1979

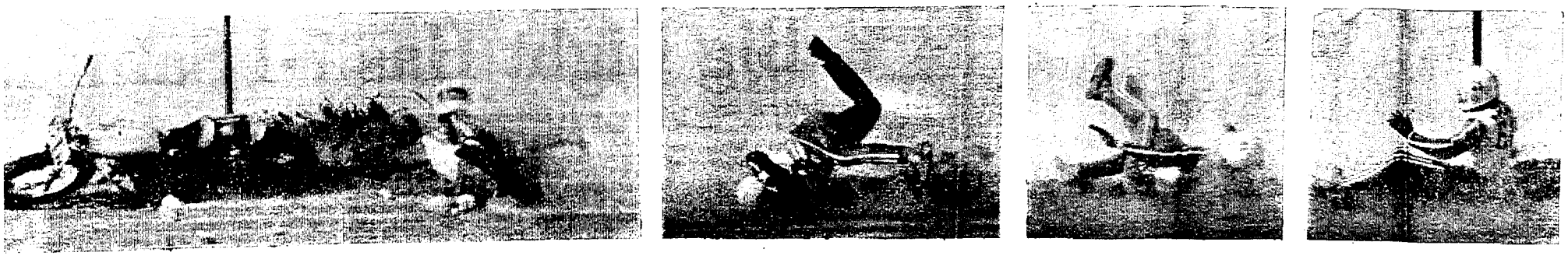


Source: NHTSA, April 1980.



California Highway Patrol

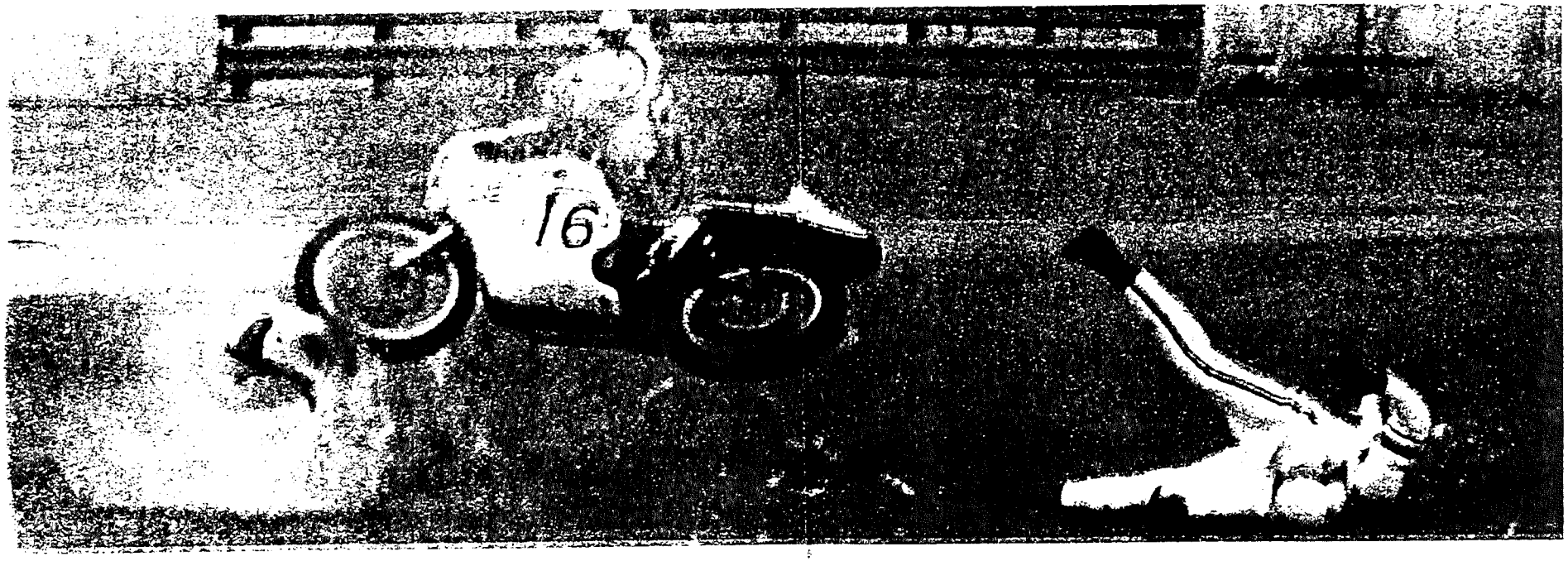
In 1983, a 21 year old male motorcyclist, traveling about 70-80 miles per hour, broadsided a car. The impact overturned the car and killed its driver instantly. The motorcyclist hit the edge of the roof at top of driver's door, then flew over the car and landed on the pavement. The motorcyclist was wearing a helmet. He suffered major injuries to the chest, shoulders, arms and face, but he survived and recovered partially at San Francisco General Hospital.



(News Photos by Jim Morris)

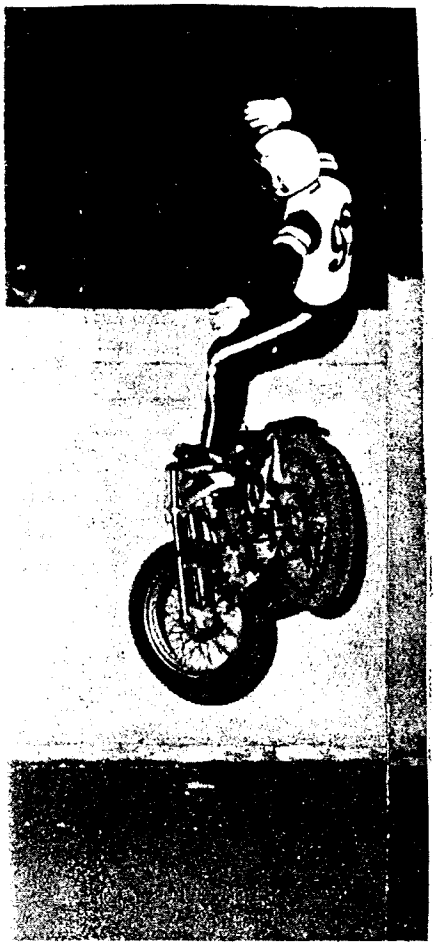
HNG TO A HALT — THE HARD WAY. Charles Walker, Topeka, falls from his cycle as it hits the wall, and comes to a halt when he lands in up-right position during motorcycle races Sunday at the State Fair oval.

7-6



HOW TO LOSE A HARLEY — John Porter of Kensington, Md., takes a slide as his Harley-Davidson comes apart at the seams during a spectacular spill during Friday's 100 mile race for amateurs at Daytona International Speedway. NJ Photo by John Gontner

L-4



UP, UP, AWAY
. . . Mark Brelsford flys through the air in a tussle with the wall at Memorial Stadium Friday night. He was only slightly injured

FACTS, NOT MYTHS, ABOUT MOTORCYCLE HELMETS

FACT ONE: *HELMETS DO NOT OBSTRUCT CRITICAL VISION.*

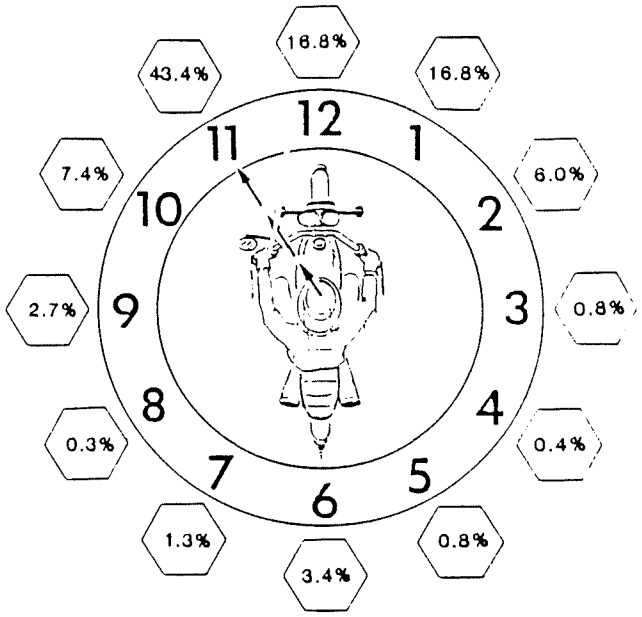
The figure at right shows where the crash hazards were located *from the rider's point of view* during the pre-crash phase in the 900 motorcycle crashes investigated by the USC Traffic Safety Center. For example, a car straight ahead would be at the 12 o'clock location. Seventy-seven per cent of the hazards were at the 11, 12 and 1 o'clock positions. Over 90 per cent fell within the 10 to 2 o'clock locations. The DOT standard requires no restriction of peripheral vision as far back as the 4 and 8 o'clock positions. The visual problem is not restriction of peripheral vision. Instead, it is a matter of watching what is directly in front of the motorcycle and protecting one's eyes to assure full visual acuity (Ouellet, 1987).

FACT TWO: *HELMETS DO NOT INTERFERE WITH CRITICAL HEARING.*

Any sound loud enough to be heard over the noise of the motorcycle and the wind will be loud enough to be heard inside the helmet. Motorcycles create noise in the range of 85-95 decibels. Helmets reduce the loudness of both the sound of interest (*e.g.*, a car's horn) and the motorcycle noise by an equal amount, but do not alter the ability to hear one over the other. No case of the 900 on-scene, in-depth investigations in the USC study revealed a failure to detect critical traffic sounds, for helmeted or unhelmeted riders (Hurt, 1981).

FACT THREE: *HELMETS DO NOT CAUSE NECK INJURIES.*

In the USC investigation (Hurt, 1981) of 900 motorcycle crashes, spinal cord injuries occurred only in very severe, high energy crashes. In these high-speed crashes the riders died of multiple injuries of which spinal cord injury was only one. In the 846 nonfatal crashes, no rider suffered a spinal cord injury. Helmeted riders get fewer neck injuries at most levels of severity. Helmets may help to REDUCE neck injuries (which are usually the result of head impact). They certainly have NOT been found to pose any increased hazard (Ouellet, 1987).



11+12+1: 77.0%

10+11+12+1+2: 90.4%

5+7: 2.1%

FACT FOUR: *HELMETS DO NOT BUILD UP DANGEROUS TEMPERATURES INSIDE THE HELMET.*

Motorcyclists are less likely to wear helmets voluntarily in very hot weather. However, the USC researcher testified that temperature readings inside helmets show that temperatures stabilize slightly above body temperature. The insulation of the helmet makes its interior more subject to body heat than to outside temperatures (Ouellet, 1987).

FACT FIVE: *HELMETS DO NOT CAUSE FATIGUE WHICH CAUSE CRASHES.*

The USC study of 900 motorcycle crashes found that 50% of the crashes occurred within six minutes from the start of the trip and over 90 per cent occurred in less than one hour of the start of the trip (Hurt, 1981). ■

"The only significant protective equipment is the qualified safety helmet, and it is capable of spectacular reduction of head injury frequency and severity. This research shows no reasons for a motorcycle rider to be without a safety helmet; qualified helmets do not limit vision or hearing in traffic or cause injury."

—Hurt HH, Ouellet JV, Thom DR. 1981. Motorcycle Accident Cause Factors and Identification of Countermeasures. (NHTSA, 1981)

7-9

HOW MUCH PROTECTION DOES A STANDARD HELMET OFFER?

Most state helmet use laws require the wearing of helmets which meet existing standards. Below in extremely simplified form are the basic requirements of the DOT standard.

Department of Transportation Motorcycle Helmet Standard:

from the Code of Federal Regulations: Transportation (49): Section #571.218.

THE HELMET MUST "CUSHION" THE BLOW TO THE RIDER'S HEAD WHEN THE HELMET STRIKES A BARRIER.

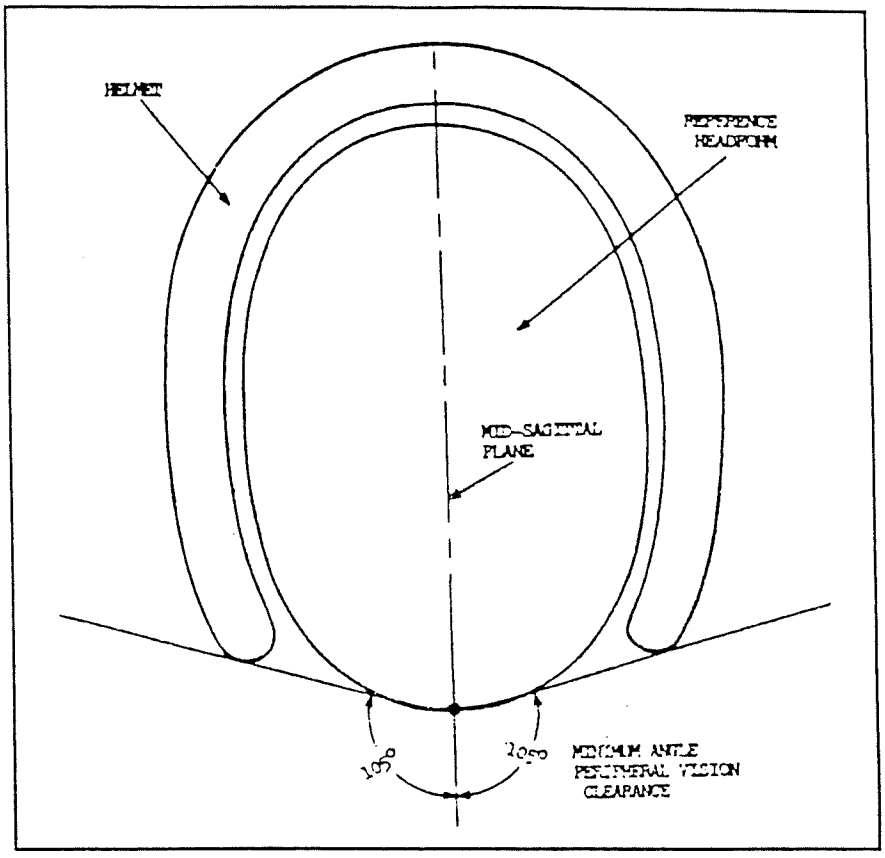
The tests use an instrumented headform as a proxy. In a series of tests, the helmet is dropped in a guided free fall upon fixed hemispherical and flat steel anvils from the heights of 54.5 inches and 72 inches. Measurements on the headform must meet the following requirements:
"(a) Peak accelerations shall not exceed 400g;
(b) Accelerations in excess of 200g shall not exceed a cumulative duration of 2.0 milliseconds; and
(c) Accelerations in excess of 150g shall not exceed a cumulative duration of 4.0 milliseconds."

FOREIGN OBJECTS MUST NOT PENETRATE THROUGH THE HELMET TO THE RIDER'S HEAD.

The "foreign object" in the test is a 6 pound, 10 ounce pointed "striker" (point has included angle of 60 , a cone height of 1.5 inches, a tip radius of 0.5 millimeter radius). The "striker" is twice dropped in a guided free fall of 118.1 inches, and "the striker shall not contact the surface of the test headform."

THE HELMET'S STRAPS MUST STAY FASTENED WHEN STRESSED.

The test applies static tensile load to the straps, or "retention assembly." First, a 50-pound load is applied for 30 seconds, then an additional 250-pound load is applied for 120 seconds. The straps must not separate, and the adjustable portion cannot move more than one inch when the additional load is applied.



THE HELMET MUST NOT OBSTRUCT VISION.

Each helmet must provide "peripheral vision clearance of at least 105° to each side of the midsagittal plane," or in other words, provide 210° angle of vision for the wearer (see above).

THE HELMET MUST BE LABELED.

Each helmet must be permanently and legibly labeled with several items of information, including the symbol "DOT," the manufacturer's certification that the helmet conforms to the standard.

THE SNELL STANDARD

There are two major motorcycle helmet standards recognized in the United States, The U.S. Department of Transportation (DOT) standard and the "1985 Standard for Protective headgear, For Use with Motorcycles and Other Motorized Vehicles" developed by the Snell Memorial Foundation. The Snell standard, first proposed in 1959 for racing crash helmets and revised five times since then, is the more demanding of the two. Information about this standard can be obtained from the Snell Memorial Foundation, P.O. Box 733, Wakefield, RI 02880. ■

7-10

Motorcycles

Motorcycles typically have high performance capabilities, including especially rapid acceleration and high top speeds. In emergency braking, motorcycles are less stable than cars. They're less visible than cars, too. Motorcycles are thus more likely than cars to be in crashes. And, when cyclists do crash, they lack the protection of an enclosed vehicle. It isn't surprising, then, that motorcycles are especially dangerous. This edition of Fatality Facts addresses the problem.

- 3,036 motorcyclists died in crashes in 1989. This represents a 13 percent decline since 1988.
- The number of deaths in 1988 per 100,000 registered motorcycles was 76 compared to 18 for registered passenger cars. Per vehicle mile traveled, the number of deaths on motorcycles is about 19 times the number in cars.[1]
- The problem of motorcyclist deaths largely affects young males — 55 percent of all deaths occur among 16-29-year-old males. The number of deaths per 100,000 people is 12 times as high for males (2.3) as for females (0.2).
- Forty-six percent of all motorcyclist deaths occur in single-vehicle crashes, 54 percent in multiple-vehicle crashes. About 1/3 of multiple-vehicle crashes involve cars turning left into the paths of oncoming motorcycles.[2]
- More than half of all crashes involving motorcycles and other vehicles involve drivers who say they either did not see the motorcycle at all or not until it was too late.[2]
- More than half (56 percent) of all motorcyclist deaths occur on weekends (Friday, Saturday, and Sunday). Fifty-seven percent occur between 6 pm and 3 am.
- Forty-two percent of all fatally injured motorcycle drivers either don't have a valid license to operate a cycle or it has been suspended or revoked.
- According to a 1985-86 California study of motorcycle drivers who were killed or severely injured, only 33 percent had valid motorcycle licenses. On borrowed cycles, only 20 percent were licensed.[3]
- More than half (57 percent) of all motorcycle drivers 16 years and older who are killed in single-vehicle crashes have very high blood alcohol concentrations (0.10 percent or more).

Motorcyclist Deaths as a Percent of All Motor Vehicle Deaths

	Total Motorcyclist Deaths	Percent
1980	4,961	10
1981	4,746	10
1982	4,270	10
1983	4,104	10
1984	4,431	10
1985	4,417	10
1986	4,309	9
1987	3,831	8
1988	3,486	7
1989	3,036	7

Motorcyclist Deaths, 1989

Age	Male	Female	Total
to 16	56	8	64
16-19	393	38	431
20-24	712	39	751
25-29	575	54	629
30-34	412	38	450
35-39	259	27	286
40-44	176	9	185
45-49	88	12	100
50-54	57	6	63
55-59	22	4	26
60-64	27	1	28
65+	17	2	19
Unk	2	2	4

Fatality Facts 1990
Published by the Insurance Institute for Highway Safety

More than half of all motorcycle drivers 16 years and older who are killed in single-vehicle crashes have very high BACs.

Distribution of Motorcyclist Deaths by Time of Day, 1989

	Percent
Midnight - 3 am	15
3am - 6 am	5
6 am - 9 am	5
9 am - Noon	5
Noon - 3 pm	11
3 pm - 6 pm	18
6 pm - 9 pm	22
9 pm - Midnight	21

Distribution of Motorcyclist Deaths by Day of Week, 1989

	Percent
Sunday	19
Monday	11
Tuesday	10
Wednesday	11
Thursday	13
Friday	15
Saturday	22

Distribution of Motorcyclist Deaths by Month, 1989

	Percent
January	3
February	3
March	6
April	7
May	12
June	12
July	14
August	14
September	10
October	10
November	5
December	3

- Motorcycles with large and powerful engines are much lighter than they used to be, so they have higher power:weight ratios and can accelerate faster. Many models can go from 0 to 60 mph in less than 2-1/2 seconds. This means the fastest cycles can reach 60 mph from a complete stop in about 100 feet. In comparison, a Porsche 911 Turbo, one of the fastest cars, takes 5 seconds to reach 60 mph from a standing start.
- The rates of fatal and severe injuries are twice as high among drivers of racing-design cycles as they are among drivers of street cycles (128 vs. 66 per 10,000 registered motorcycle years). This is based on analysis of nearly 2,000 motorcycle crashes resulting in severe injury or death in California in 1985.[4]
- Improved testing and licensing programs for motorcyclists in California have not reduced crash or violation rates. Nor have tougher licensing standards and increased education programs in New York State.[5]
- Virtually all states enacted helmet use laws between 1966 and 1973. Illinois repealed its law in 1970 and, by 1980, 28 more states had abandoned or substantially weakened theirs. A number of states later reenacted helmet laws (see page 3). As a result, helmet use rates are uneven — nearly 100 percent in states with helmet laws for all riders and about 50 percent in states without such laws or with weak helmet use laws applying only to young cyclists.[6,7]
- The benefits of helmets are proven. Analyzing monthly counts of motorcycle deaths across the United States, researchers estimated that in the 28 states where use laws were repealed or weakened

Percent of Fatally Injured Motorcycle Drivers 16 Years and Older with BACs ≥ 0.10 Percent, by Type of Crash

	Single Vehicle	Multiple Vehicle
1980	58	31
1981	61	32
1982	62	29
1983	63	31
1984	64	25
1985	57	29
1986	57	29
1987	54	26
1988	54	27
1989	57	28

The rates of fatal and severe injuries are twice as high among drivers of racing-design cycles as they are among drivers of street cycles.

Helmet Law Applies to All Riders

Alabama
Arkansas
District of Columbia
Florida
Georgia
Kentucky
Louisiana
Massachusetts
Michigan
Mississippi
Missouri
Nebraska
Nevada
New Jersey
New York
North Carolina
Oregon
Pennsylvania
Tennessee
Texas
Vermont
Virginia
Washington
West Virginia

Helmet Law Applies to Some Riders

Alaska
Arizona
California
Connecticut
Delaware
Hawaii
Idaho
Indiana
Kansas
Maine
Maryland
Minnesota
Montana
New Hampshire
New Mexico
North Dakota
Ohio
Oklahoma
South Carolina
South Dakota
Utah
Wisconsin
Wyoming

No Helmet Law

Colorado
Illinois
Iowa
Rhode Island*

*law applies to passengers only

between 1976 and 1980 more than 500 excess deaths (amounting to 1/4 of the total number of motorcycle deaths in these states) occurred in 1980.[8,9,10]

- When helmet use laws are reinstated, the benefits return. Louisiana reenacted its law in 1981 (it was enacted in 1968, then repealed in 1976), and the use rate increased from about 50 percent to 96 percent. The death rate among cyclists declined immediately from 38 to 29 per 1,000 crashes.[11,12] When Texas amended its helmet law in 1989 to apply to all motorcyclists (not just those younger than 18 years), helmet use immediately increased from less than 50 percent to more than 90 percent. A few months later, helmet use in Texas was more than 95 percent.[6]
- There's no evidence that weak helmet use laws (i.e., those that apply only to young riders) reduce deaths and injuries. In states that mandate helmet use for those 18 years or younger, 12 percent of motorcyclists killed in crashes are from that age group. The same percentage holds for this age group in states without helmet laws.
- Do mandatory helmet laws violate the rights of individuals? In 1972, a federal court in Massachusetts told a cyclist who objected to the law, "The public has an interest in minimizing the resources directly involved. From the moment of injury, society picks the person up off the highway; delivers him to a municipal hospital and municipal doctors; provides him with unemployment compensation if, after recovery, he cannot replace his lost job; and, if the injury causes permanent disability, may assume responsibility for his and his family's subsistence. We do not understand a state of mind that permits plaintiff to think that only he himself is concerned." This decision was affirmed by the U.S. Supreme Court.[13]
- Public funds paid for 63 percent of the $26,276 average per-patient cost of caring for injured motorcyclists at Harborview Medical Center in Seattle, Washington during 1985.[14]

THE INFORMATION IN THIS FACT SHEET IS BASED LARGELY ON ANALYSIS OF DATA FROM THE U.S. DEPARTMENT OF TRANSPORTATION'S FATAL ACCIDENT REPORTING SYSTEM. FOR FURTHER INFORMATION, SEE THE FOLLOWING REPORTS:

[1]Federal Highway Administration. 1988. Highway statistics 1988. Washington, DC: Federal Highway Administration.

[2]Hurt, H.H. Jr. 1981. Motorcycle accident cause factors and identification of countermeasures. Washington, DC: U.S. Department of Transportation DOT-HS-805-862-3.

There's no evidence that weak helmet use laws reduce deaths and injuries.

[3]Kraus, J.F.; Zador, P.L.; Anderson, C.; Williams, A.F.; Arzemenian, S.; Li, W.; and Salatka, M. 1989. Motorcycle licensure, ownership, and crash involvement. Arlington, VA: Insurance Institute for Highway Safety.

[4]Kraus, J.F.; Zador, P.; Arzemanian, S.; Anderson, C.L.; and Harrington, S. 1987. Motorcycle design and crash injuries in California, 1985. Bulletin of the New York Academy of Medicine 64:788-803.

[5]Insurance Institute for Highway Safety. 1988. Two studies question value of motorcycle licensing program. Status Report 23:8.

[6]Lund, A.K; Williams, A.F.; and Womack, K.N. 1989. Motorcycle helmet use in Texas. Arlington, VA: Insurance Institute for Highway Safety.

[7]Williams, A.F.; Ginsburg, M.J.; and Burchman, P.F. 1979. Motorcycle helmet use in relation to legal requirements. Accident Analysis and Prevention 11:271-73.

[8]Hartunian, N.S.; Smart, C.N.; Willemain, T.R.; and Zador, P.L. 1983. The economics of safety deregulation: lives and dollars lost due to repeal of motorcycle helmet laws. Journal of Health Politics, Policy and Law 8:76-98.

[9]Watson, G.S.; Zador, P.L.; and Wilks, A. 1980. The repeal of helmet use laws and increased motorcyclist mortality in the USA: 1975-1978. American Journal of Public Health 70:579-85.

[10]Watson, G.S.; Zador, P.L.; and Wilks, A. 1981. Helmet use, helmet use laws, and motorcyclist fatalities. American Journal of Public Health 71:297-300.

[11]McSwain, N.E.; Willey, A.; and Janke, T.H. 1985. The impact of re-enactment of the motorcycle helmet law in Louisiana. Twenty-ninth Proceedings of the American Association for Automotive Medicine. Arlington Heights, IL: American Association for Automotive Medicine.

[12]National Highway Traffic Safety Administration. 1984. Impact of the re-enactment of the motorcycle helmet law in Louisiana. Washington, DC: U.S. Department of Transportation DOT-HS-806-760.

[13]Simon v. Sargent, 346 F. Supp. 277, 279 (D. Mass. 1972), affirmed 409 U.S. 1020 (1972).

[14]Rivara, F.P.; Dicker, B.G.; Bergman, A.B. Dacey, R.; and Herman, C. 1988. The public cost of motorcycle trauma. Journal of the American Medical Association 260:221-23.

Deaths per 100,000 Registered Vehicles

	Motor-cycles	Passenger Cars
1979	90	23
1980	90	23
1981	84	22
1982	77	19
1983	76	18
1984	84	18
1985	84	18
1986	82	18
1987	79	18
1988	76	18

INSURANCE INSTITUTE FOR HIGHWAY SAFETY

July 1990. Editor Anne Fleming

Insurance Institute for Highway Safety
1005 North Glebe Road, Arlington, VA 22201
(703) 247-1500

The Insurance Institute for Highway Safety is an independent, nonprofit public service organization that develops and evaluates ways to reduce motor vehicle losses. The Institute's work is wholly supported by the nation's property and casualty insurers, individually and through their trade associations.

7-14

MRF

MOTORCYCLE RIDERS FOUNDATION, INC.

Testimony of Wayne T. Curtin
Vice President of Government Relations
Motorcycle Riders Foundation

Before The Kansas House Of Representatives
Committee On Transportation

Concerning H.B. 2129

February 21, 1991

HOUSE TRANSPORTATION
2-21-91
ATTACHMENT 8-1

P.O. Box 1808, Washington, D.C. 20013-1808 • (202) 944-4920

MRF

MOTORCYCLE RIDERS FOUNDATION, INC.

Mr. Chairman, and members of the committee, I thank-you for this opportunity to testify before the Kansas House of Representatives Committee on Transportation. I am Wayne T. Curtin, Vice President of Government for the Motorcycle Riders Foundation (MRF). MRF is a national motorcyclist organization, based in Washington, D.C., which is comprised of a coalition of motorcycle organizations from all 50 states, including ABATE of Kansas. The total membership of these organizations is in excess of 110,000. I am here today to speak in opposition to H.B. 2129.

Much of the argument for mandatory helmet laws is based on a perceived "social burden" as a result of motorcycle accident victims. I question the validity of the conclusion that mandatory helmet laws will result in a positive economic manner and have concerns that such a law will have negative implications for the motorcycle industry.

Attached are the results of a review by Dr. Jonathan Goldstein, Ph.D. of one of the major studies being used to support the social burden theory. Dr. Goldstein reveals that the author of this study failed to control for two very relevant factors -- alcohol use and speed. By not controlling for these variables the author has drastically skewed the results. Dr. Goldstein's paper contains adjusted figures based on controlling for the factors of speed and alcohol impairment. By using these corrected data you can see the data is not there to support the author's conclusion on the effectiveness of helmet laws.

Also, I would like to bring your attention to one factor that is showing up in several of these shock trauma unit studies on the medical costs of motorcycle accident victims. The most publicized study is Dr. Rivara's 1988 paper out of Harborview Medical Center in Washington State. In his paper it is reported that those accident victims who paid for their medical bills either with private funds or insurance had an average stay of 9.8 days at an average cost of $10,295. Yet, those individuals whose medical bill were paid for with public funds had an average stay of 25 days at an average cost of $31,125. The question is raised: Are the extent of one's injuries related to one's soci-economic status, or could it be possible that medical facilities themselves are part of the "social burden" problem by keeping those on public funds longer, thereby raising the costs?

8-2

P.O. Box 1808, Washington, D.C. 20013-1808 • (202) 944-4920

But, even if the social burden theory is to be considered as a basis for a helmet law all economic impacts must be considered. The biggest impact will be to the motorcycle industry. Please consider the following facts:

1.) Since passage of a full mandatory helmet law in 1988, motorcycle registrations in Nebraska have fallen 26%. And, according to a July 4, 1990, Lincoln Star article new motorcycle sales have fallen 40%. As well, Oregon and Texas, both of which enacted mandatory helmet laws in 1988 and 1989, have seen registration drops of 17%. During the same time period nationally motorcycle registrations were only down about 10%.

2.) Comparing 1990 census population figures with the most recent state motorcycle registrations show that the national average is 1.7 motorcycles per 100 persons. A further look at these data show a much lower average for states with mandatory helmet laws. In states with no helmet law of any kind have an average motorcycle ownership of 2.5 motorcycles per 100 residents. In states with helmet laws for minors only the average is 2 motorcycles per 100 residents. While states with full mandatory helmet laws only have an average motorcycle ownership of 1.2 motorcycles per 100 residents.

If the true concern on this issue is the economic impact on the state of Kansas, then this committee and the Kansas Legislature must consider all possible economic impacts. Will the questionable savings helmet law advocates proport such a law will bring about off set the loss of sales, business and income taxes the state will lose as a result of motorcycle businesses losing sales, laying off employees and going out of business?

Lastly I would like to raise the question of the effectiveness of mandatory helmet laws. Comparing 1989 state motorcycle registration figures with 1989 motorcycle accident fatality numbers clearly show states with full mandatory helmet laws have higher fatality rates than states with helmet laws for only minors, and the states with no helmet law of any kind have the lowest fatality rates. The figures are as follows:

1.) The 22 states (plus the District of Columbia) that had helmet laws in 1989, had an average fatality rate of 8.18 per 10,000 registrations.

2.) The 23 states that had helmet laws applying to minors only in 1989, had an average fatality rate of 6.74 per 10,000 registrations.

3.) The 5 states that no helmet law in 1989, had an average fatality rate of 6.16 per 10,000 registrations.

Considering the questionable credibility of the supporters of mandatory helmet laws "social burden" theory, the potential for a dramatic negative impact on the motorcycle industry in Kansas, the lower fatality rates in states without helmet laws and the basic fact that in a free society, like The United States of America, a free people must be allowed to decide their own fate I strongly encourage this committee to report unfavorably on H.B. 2129.

REVIEW OF THE CDC STUDY ON HEAD INJURY DEATHS AND HELMET LAWS

WHAT THE STUDY DOES

In "head inury- associates deaths from motorcycle crashes: relationship to helmet-uses laws" by D.M. Sosin, et.al. (Jama, nov. 14, 1990 - Vol 264, no.18), the authors estimate rate of motorcycle-related deaths associate with head injury for states with comprehensive(full) helmet use laws, states with partial youth helmet-use laws, and state with no laws. Two different rates are caculated for each state , a population based rate -- motorcycle death associated with head injuries divided by state population and a regstration based rate -- deaths associated with head injuries divided by the number of state motorcycle registrations. The end result is an average population based rate and an average registration based rate of motocycle deaths associated with head injuries for each of the three groupings of states during the entire 1979-1986 period.

The authors find that the population based rate in states with partial laws (10.2 fatalities per million residents) no helmet use laws (11.4) were almost twice those in states with comprehensive helmet use laws(5.5).

The registration based rates show dramatically less contrast between the three groupings: partial law (3.7 per 10,000 registered motocycles), no law (3.5) and comprehesive law(3.0).

Comparisons of these rates particularly the population rates across groups of states with different helmet law coverage on the basis of the author concludes that comprehensive helmet use laws are an extremely effective mechanism for reducing the severity of nonfatal head inuries and the rate fatal injuries. Their policy perscription is the adopton of comprehensive motorcycle use legislation.

The contribution of this study is the creation of an alternative data set on motorcycle fatalities. In particular, the authors are able to seprate out motorcycle related head injury deaths from all motocycle related deaths. Thus, isolating a fatality variable which can more directly be used to test propositions on motorcycle helmet effectiveness. Unfortunately, the statistical methodology employed comparing rates of head injury related deaths for states with different helmet use law coverage in order to infer how effective such helmet legislation is -- is fundamentally flawed. In summary, the authors should be praised for their data collection technique/innovations, but criticized for the inappropiated statistical methods and thus invalid conclusions.

THE MAJOR WEAKNESS OF THE STUDY

The main conclusion of the study (helmet use laws) is that helmet laws are effective for reducing the rate of fatal injuries associated with with head injuries from a statistical technique know as correlation analysis. The authors simply observe that states with comprehensive laws have lower fatality rates than states without comprehensive laws and they conclude that if that comprehensive helmet laws are the sole cause of these differences in ratality rates. Bust as all beginning statistic students know, correlation does not enjoy causelity. The method employed in the CDC study fails to control for differences (across comprehensive and non comprehensive

helmet law states) in other factors-- speed, alcohol, registrations or motorcycle useage-- that can dramatical impact the population based fatality rates used to arrive at the CDC study's concusion. Thus the higher fatality rates in the CDC study observed in non comprehensive law states could be explained by higher average driving speeds, more alcohol consumption, and more motorcycle useage per person. The data in Table 1 clearly establishs that states without comprehensive helmet laws have these characteristics. Thus the CDC study fails to determine what percent of higher speeds, more alcohol consumption, more of motorcycles person, and the lack of a comprehensive helmet law are responsible for the higher fatality rates, by not controlling for the impact of these other factors, the CDC study erroneously assigns their impact to the one factor that is considered in the analysis-- nonexistence of a comprehesive helmet use law-- the CDC study clearly and dramaticly over state the effectiveness of helmet use laws by assuming that higher fatality rates in comprehensive law states are are determined by the lack of it. The level of distortion could be large enough that if it is corrected, the end result would show that helmet use laws do not have a statistically significant effect on head injury related fatalities. Other studies that enjoy the correct statistical methods - - Goldstein(1983-1988)- - by controlling for the impact of speed, alcohol, ect. find that helmets and helmet use laws have no statistically significant effect on the fatality rates.

TABLE I
DIFFERENCES IN OTHER KEY DETERMINATES OF FATALITY RATES ACROSS STATES GROUPED BY TYPE OF HELMET USE LAWS

FACTOR	COMPREHENSIVE		NONE		PARTIAL		NONCOMPREHENSIVE	
	1979-82	1982	1979-82	1982	1979-82	1982	1979-82	1982
Average m/c per 1000 pop.	23.8	20.8	36.1	36.3	34.4	36.6	35.5	36.5
Average per capita alcohol consumption	2..96	2.84	3.04	2.95	3.17	3.15	3.14	3.09
Average driving speed	55.6	54.8	56.0	55.6	55.7	55.4	55.7	55.5
N = # of states		20		8		22		30

Referring to Table I, the heart of the problem in the CDC study can de addressed. The number of m/c registrations per 1000 population is dramatically higher in states without a comprhensive law -- in these states people are more likely to own/register/ride a motorcyle, thus, motorcyle useage percentage is higher as will be accident rates, and fatality rates. In particular, in states with comprehensive laws there are 23.8 registrations per 1000 population during 1979-82, in states with no laws these are 36.1, in states with partial laws 34.4 and in states without comprehensive law (states with no laws or partial laws) these 35.5.

This implies that part, if not all of the difference in the population based rates of the CDC study could be explained by the existence of high motorcycle rates per capita, rather than the nonexistence of a helmet law. One way to correct for the influence of higher registration rates is to calculate a registration based fatality rate associated with head injuries. The CDC study does this and finds that the differences between comprehensive law rates and other states all but disappears. In particular, the comprehensive states have 3.0 fatalities per 10,000 registrations while partial law states and no law states have 3.7 and 3.5 respectively. Yet the CDC study ignores that the difference between states with comprehensive laws and without laws have been dramatically reduced and continues to rely on the distorted population rates. The 3.0 and 3.5 rates are different by more than one would expect to occur by these sampling errors. Thus, there may not exist any significant statistical difference in fatality rates between comprehensive law states and other states. (unfortunately not enough information is provided in the article to calculate the approprate statistical tests). Another disturbing aspect associated with the registration based rates is that the CDC study ignores the fact that partial law states have a higher fatality rate than states with no laws, Using the flawed logic used in the CDC study, one could conclude from this result that helmet laws do work because they result in higher fatality rates. Yet the study just ignores this finding. Of course, the contridictory result supports more the notion that the CDC study has produced distorted estimates of helmet law effectiveness than it supports the notion that helmets cause fatalities.

We have just seen that when the CDC study controls for registrations, the differnces between comprehenseve and non comprehensive law states virtually diappear (in a statistical sense they may totally be eliminated). If the CDC study controlled not only for registration/useage differences across states but also the speed and alcohol differences. exhibited in table I, the differences in fatality rates would be reduced further. The higher average driving speed and alcohol consumption found in the non comprehensive law states certainly explains some if not all of the remaining difference in fatality rates between state with and without comprehensive laws. Other studies, Goldstein I1985, 1986) have shown that speed and alcohol are the major determinants of death in motorcycle accidents. In addition, it is also a well know fact that excessive apeed and alcohol cojungtion are a primary cause of accidents. Thus, once all reluvant factors are controlled for, it is highly likely that no statistically significan impact of helmet law on fatality rates will exist. In order to control for all relavant factors and thus sort out the unbiased(undistorted) effect of helmet laws on fatality rates requires the appilacation of multiple regression analysis. The CDC study does not employ this statistical methodology. Studies that have used this technique (Goldstein 1985,1986) generated on undistorted estimate of helmet use law effectiveness which shows that these laws have no statistically significant effect.

In conclusion, the CDC study dramatically overstates the effectiveness of helmet use laws on fatality rates related to head injuries because it fails to control for all of the relevant factors (m/c useage, speed and alcohol) that affect fatality rates. When all factors are controlled for , the difference between conprehensive helmet-use law states, fatality rates and all other states fatality rates disappear implying that helmet use laws are ineffective in reducing fatality rates.

HOUSE BILL 2129

Transportation Committee

February 21, 1991

Mr. Chairman and Members of the Committee:

Probably the first control I learned was how to get my way with my Daddy. Since then I have developed some control of my temper, basic control of my budget, weight, life, what I do and where I go. One factor of my life that I can't control is the deterioration of my heart. After bypass surgery 16 months ago, I developed congestive heart disease...I just get weaker and weaker. I continue to work and manage my employees and the care of my patients. If I can just keep from smoking, I could live forever!

I am still mostly in control of me and I still LOVE to ride on the back of a motorcycle. Who I ride behind is under my control--knowing that inexperience, alcohol and drugs are the biggest killers of motorcyclists, I know when to say "no." Extensive research my past few riding years has led me to know that I don't want my driver's senses diminished by wearing a helmet either!!

Until this day, I have had control of that possibility also! Now, not only can you restrict my choice in the "safety mode" I choose, but according to my physician, I might get by with wearing a helmet from Garden City to Holcomb (6 miles), but because of my heart--no further--I can't take the weight. Isn't that a new one for begging legislators not to pass a helmet law?

I've given you statistics; you'll hear more; I've heard case after case in the past week where a helmet would only have further injured a biker. One tiny "triker" told me of a HOT day in Oklahoma when she stopped to wipe the sweat out of her eyes so she could see; she accidentally dropped her helmet. From her height of about 5', the helmet broke in three pieces when it hit the concrete. I'm glad she was wearing it because of "the law"--not because she depended on it to protect her pretty little head!!

I like to say I'm not scared of anything. Right now I'm afraid -- afraid that you will not only take away bikers' choice of safety precautions, but take away my days "in the wind."

Please don't. Believe that we know best when to wear and when not to wear a helmet. Let us retain that right -- I do respectfully request that you vote "NO" on House Bill 2129. Kansas motorcyclists thank you for consideration of this personal choice. Yes, I do have hospitalization!!

JACQUE SUE

2002 Downing, Garden City, America

HOUSE TRANSPORTATION
2-21-91
ATTACHMENT 9-1

I believe that laws are passed by elected officials to protect the rights of the majority--and to exact punishment upon those who infringe upon the rights of others....and how to spend whose former money.

I realize that some legislative bodies believe that they must protect people also from themselves...and some law may be passed justly for that reason. HB 2129 may be one that you feel would protect the few who ride from the danger of head injury--but I understand it has more to do with the expense you have been led to believe it would cost the State to care for the victims of motorcycle accidents.

First, I work in home health, medical equipment, supplies and care of the terminally ill. In the past almost 8 years, my companies have been paid more than $3 million for medical care. $9,000 of that was for a motorcycle accident victim. This young man lost his nose, broke an arm and some ribs--and had some internal injuries. His passenger injured his back and was paralyzed a while. The passenger had another injury that might have been avoided had he had on leather pants rather than cut-offs, but who knows? Helmets would not have stopped any of their injuries. Who paid this $9,000? The insurance company that covered the on-coming pickup that turned left in front of the kids.

That's a key to our argument that motorcycle accidents don't cost the public money--most accidents are caused by a second vehicle that didn't see the motorcycle...keep mandating that all vehicles have liability insurance--and there's not going to be public costs for motorcycle accidents.

Secondly, do you know how much it costs to buy and keep a motorcycle running? Show me a person who owns a Harley that runs and you have a working man or woman who does maintain hospitalization insurance. There are NO inexpensive motorcycles that run! Now and then a kid can get one cheap, but his parents probably have insurance. The last motorcycle I bought only Cost $2700, but in some three years, another $7,000 was invested to keep it beautiful and running perfectly. Granted one $3,000 expenditure was after an accident--my husband knew how to stop the bike when a lady pulled out in front of him--demolished his bike, but didn't scratch her car or his body! We had to pay 10% of the expense because of contributory negligenoe--his black leather made him "difficult to see" at dusk.

Thirdly, it is understood by the responsible adults who ride motorcycles, that it is dangerous. Accidents in town may involve a broken bone or two and some roadrash if they're not properly clothed in leather...accidents on the highway more often cause funeral expenses than do they medical expense. In my few years of being aware of motorcycles, I know of no one who ended up a vegetable; I know of a dozen who died. Two friends lost teen-aged sons last year; they had on helmets, as is the law. Their parents would have, however, gladly accepted brain damage or paralysis. Both of their accidents were because of inexperience and the "blindness" of a car-driver. Two adult, working male-biking brothers in Garden City have died in the past four months. One's estranged wife shot him...it will cost taxpayers a bunch--we must pay for her attorney and court-time, as well as possibly prison

time. The other one had a stupid accident--it was his fault--he was drunk with a new love and with alcohol. He crossed the center line and hit an on-coming car. His passenger was decapitated; he lost the left side of his head, his left arm and leg. IF he'd had a helmet on, perhaps we could have had an open casket! I still grieve for that sweet guy, but riding was his first love, and most of those I deal with have not chosen their cause of death.

People who know me and my work ask how I can deal with the patients and families of those with terminal illnesses. It is pure pain, but I know I make a difference. How do I clear my head--I get the wind in my hair--before I discovered motorcycles, I found that peace in a convertible. Many of my biker friends are veterans who fought for our freedom; who watched others die by their hands. They, too, let the wind suck the blood from their eyes and find peace again and again "in the wind."

I've attempted in previous contact with you-all to convince you that helmets cause at least as much injury as they could possibly stop. (In my job, I probably shouldn't attempt to stop this bill, believing as I do--physical therapy is my most expensive service--why should I care whether Medicaid or private car insurance pays??) I've spoken of "rights" of individuals, "control" of the people's safety...all are reasons against this bill.

If the reason is public funds--can you tell me how many persons Kansas is presently caring for who were injured in motorcycle accidents--THAT WEARING A HELMET WOULD HAVE SAVED?? Are there any?

If the reason for the bill is "safety" can you tell me why you have not mandated motorcycle safety education before licensing, or educational material for driver's education on the rights of bikers on the road, or materials in the state booklets given out when you're studying for a driver's license test--or the wearing of leather pants, jackets, gloves and lace-up boots for all motorcycle riders? Can you tell me why Kansas is the ONLY state in the union whose motorcycle instruction does NOT meet the standards of the Motorcycle Safety Foundation? Can you tell me why our Motorcycle Safety Funds cannot go or should not go to MSF certified instructors for training courses? MOST motorcycle accidents involve our Kansas youth--who ride in cut-offs and tennis shoes--who have less than 1,000 miles on their bikes?

ABATE OF KANSAS has MSF certified instructors--if you want to save lives, let us teach the inexperienced rider...if you want to pass legislation to save lives (and money), defeat this bill and let's do something definitive that will save lives and money.

PLEASE...

JACQUE SUE
2002 Downing
Garden City, KS 67846

9-3