

RECENT TRENDS IN FATAL MOTORCYCLE CRASHES

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ABSTRACT

According to the National Highway Traffic Safety Administration's (NHTSA) 2001 data, while total traffic deaths in the United States increased by four tenths of a percent (+0.4%) from previous year, motorcycle deaths were up by 10 percent. Motorcyclist fatalities increased for the fourth year in a row since reaching a historic low of 2,116 fatalities in 1997. In 2001, 3,181 motorcyclists were killed, an increase of 1,065 fatalities (or over 50 percent) between 1997 and 2001. Without this substantial increase in motorcyclist fatalities between 1997 and 2001, overall highway fatalities would have experienced a marked reduction of about 2.5 percent over this same time frame.

This paper presents information from NHTSA's Fatality Analysis Reporting System (FARS) on fatal motorcycle crashes relating to trends between 1990-2001. The paper also looks at the gain in popularity of motorcycles by comparing the sales data, demographic changes relating to the shifting trends in the age of ownership and engine size of motorcycles. The analysis focuses on how the demographic changes in the age of ownership and engine size of motorcycles have affected the motorcycle crashes. Fatality rates are calculated using exposure data based on vehicle miles traveled, and registered motorcycles.

INTRODUCTION

More than 100,000 motorcyclists have died in traffic crashes since the enactment of the Highway Safety Act of 1966 and The National Traffic and Motor Vehicle Safety Act of 1966. This paper examines data on motorcyclist fatalities from 1990-2001. In 2001, motorcycles made up 2.2 percent of all registered vehicles in the United States compared to 1.8 percent in 1997 and accounted for only 0.34 percent of all vehicle miles traveled compared to 0.39 percent in 1997. However, in the same year motorcyclists accounted for 7.6 percent of total traffic fatalities compared to 5.0 percent in 1997. In

2001, the fatality rate per 100,000 registered vehicles for motorcyclists (64.87) was 4.1 times the fatality rate for passenger car occupants (15.72) compared to 3.1 times in 1997. In 2001, per vehicle mile traveled motorcyclists (33.4) were about 26 times as likely as passenger car occupants (1.3) compared to 14.5 times in 1997 to die in motor vehicle traffic crashes. The purpose of this paper is to:

- Combine NHTSA's motor vehicle crash data from FARS with data from the Motorcycle Industry Council (MIC), and the Federal Highway Administration (FHWA); and,
- Analyze combined data within specific problem areas by looking for trends and calculating rates.

In order to better understand the reasons for the increase in fatalities, FARS data can be analyzed in various cross tabulations of more than 100 data elements. These analyses among the different variables provide better insight into the specific problem areas relating to the increase in fatalities. The following sections detail data used in the analysis, describe the methodology used to analyze crash and exposure data, highlight the findings, and summarize the implications for crash prevention programs.

DATA SOURCES

Three data sources were used in this analysis:

- Fatality Analysis Reporting System (FARS) relating to fatal traffic crashes;
- 2001 Motorcycle Statistical Annual from Motorcycle Industry Council (MIC) relating to ownership, retail sales, and motorcycle population; and,
- Federal Highway Administration (FHWA) relating to registration and vehicle miles traveled (VMT).

Fatality Analysis Reporting System

The National Center for Statistics and Analysis (NCSA) collects and analyzes data, conducts research, and disseminates statistical information to support efforts by NHTSA and the highway safety community aimed at reducing deaths, injuries and economic losses resulting from motor vehicle crashes.

NCSA designed and developed the Fatality Analysis Reporting System (FARS) database, a national census of police-reported motor vehicle crashes resulting in fatal injuries. FARS compiles data from various sources on the location and circumstances of the crash, types of vehicles, and people involved. This system generates overall measures of highway safety, helps identify traffic safety problems, and provides a basis to evaluate the effectiveness of motor vehicle safety standards and highway safety programs. FARS system became operational in 1975. It contains a census of fatal motor vehicle traffic crashes within the 50 states and the District of Columbia and Puerto Rico.

To be included in FARS, a crash must involve a motor vehicle traveling on a traffic way customarily open to the public, and result in the death of a person (either an occupant of a vehicle or a non-motorist) within 30 days of the crash. Data elements contain specific information including the age of the person, license status of the driver, roadway type, motorcycle engine size, and land use (urban/rural). These data elements can be used in determining trends relating to fatal crashes.

Motorcycle Industry Council

The Motorcycle Industry Council (MIC) is a nonprofit, national trade association representing the motorcycle industry. The MIC's purpose is to preserve and promote motorcycling and the motorcycle industry. This is accomplished through activities in government relations, statistics, communications, technical, and aftermarket programs. MIC has two offices, Executive Office in Irvine, California and Government Relations Office in the Washington, D.C. area.

More than 300 members represent manufacturers and distributors of motorcycles, scooters, parts and accessories, and members of allied trades, such as publishing companies, advertising agencies, insurance companies, and consultants. While dealers, clubs and individuals are not eligible

for membership, MIC works with these groups on issues of mutual interest.

Federal Highway Administration

FHWA is part of the U.S. Department of Transportation and is headquartered in Washington, D.C., with field offices across the United States. FHWA performs its mission through these main programs:

The Federal Highway Program provides federal financial assistance to States to construct and improve the National Highway System, urban and rural roads, and bridges. The program provides funds for general improvements and development of safe highways and roads.

The Federal Lands Highway Program provides access to and within national forests, national parks, Indian reservations and other public lands by preparing plans, letting contracts, supervising construction facilities, and conducting bridge inspections and surveys.

To support all of these program areas, FHWA conducts and manages a comprehensive research, development, and technology program.

ANALYTICAL APPROACH

The analytical approach involved the following steps:

- Reviewing the data sources, FARS, MIC, and FHWA, to determine the data elements of interest in FARS and how these data elements could be combined with data from the other sources;
- Formulating hypotheses about factors in fatal motorcycle crashes that may vary with different data elements and from year to year;
- Calculating percentages and rates to analyze 11 years of trend data and within specific data elements; and,
- Summarizing data that focus on increases in motorcyclist fatalities.

Additional information on traffic safety facts, FARS and other publications can be obtained from the NHTSA's website at:

www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/

HISTORIC FARS DATA

A review of historical FARS data from 1975 through 2001 shows motorcyclist fatalities reached an all time high of 5,144 fatalities in 1980, which was 10 percent of the 51,091 fatalities from all motor vehicle crashes. Eleven years later (1990), the number of motorcyclist fatalities was 3,244, only 63

percent of the high for motorcyclist fatalities reached in 1980. In 2001, there were 3,181 fatalities, 98 percent of the motorcyclist fatalities in 1990. In fact, the motorcyclist fatality count in 2001 was just 62 percent of the count in 1980. Table 1 and Figure 1 show the fatalities from motor vehicle crashes from 1975 to 2001.

Table 1.
Fatalities from Motor Vehicle Crashes by Year and Person Type

Year	Person Type				Total Fatalities
	Occupants by Vehicle Type			Non Motorists	
	Passenger Vehicles (1)	Motorcycles	Large Trucks and Others (2)		
1975	30,785	3,189	1,951	8,600	44,525
1976	31,604	3,312	2,186	8,421	45,523
1977	32,758	4,104	2,288	8,728	47,878
1978	34,898	4,577	2,058	8,798	50,331
1979	34,986	4,894	2,050	9,163	51,093
1980	34,935	5,144	1,848	9,164	51,091
1981	33,726	4,906	1,792	8,877	49,301
1982	29,689	4,453	1,504	8,299	43,945
1983	29,181	4,265	1,397	7,746	42,589
1984	30,116	4,608	1,560	7,793	44,257
1985	29,901	4,564	1,578	7,782	43,825
1986	32,261	4,566	1,407	7,853	46,087
1987	33,190	4,036	1,339	7,825	46,390
1988	34,114	3,662	1,394	7,917	47,087
1989	33,614	3,141	1,332	7,495	45,582
1990	32,693	3,244	1,197	7,465	44,599
1991	30,776	2,806	1,158	6,768	41,508
1992	29,485	2,395	1,000	6,370	39,250
1993	30,077	2,449	1,048	6,576	40,150
1994	30,901	2,320	1,097	6,398	40,716
1995	31,991	2,227	1,073	6,526	41,817
1996	32,437	2,161	1,097	6,368	42,065
1997	32,448	2,116	1,161	6,288	42,013
1998	31,899	2,294	1,189	6,119	41,501
1999	32,127	2,483	1,265	5,842	41,717
2000	32,225	2,897	1,226	5,597	41,945
2001	31,910	3,181	1,295	5,730	42,116

Source: NCSA, FARS

Note: (1) Passenger vehicles include passenger cars and light trucks (vans, pickups, sport utility vehicles, and other light trucks).
 (2) Includes large trucks, buses and other type of vehicles and unknown type of vehicle.

The number of passenger vehicle occupant fatalities has ranged from a high of 34,986 in 1979 to a low of 29,181 in 1983. However, between 1997 and 2001 the occupant fatalities in passenger vehicles has been fairly steady. Most of the increases in occupant fatalities between 1997 and 2001 have been

accounted by the increase in motorcyclist fatalities. The overall fatalities would have declined further in 1998, 1999, 2000 and 2001 if motorcyclist fatalities had also decreased in the same four years. Table 2 shows a comparison of the total vs. motorcyclist fatalities from 1997 to 2001.

Table 2.
Total vs. Motorcyclist Fatalities by Year

Fatalities	Year				
	1997	1998	1999	2000	2001
Total	42,013	41,501	41,717	41,945	42,116
Change from Previous Year	---	-512	+216	+228	+171
Motorcyclists	2,116	2,294	2,483	2,897	3,181
Change from Previous Year	---	+178	+189	+414	+284
Percent of Total Fatalities	5.0	5.5	6.0	6.9	7.6

Source: NCSA, FARS

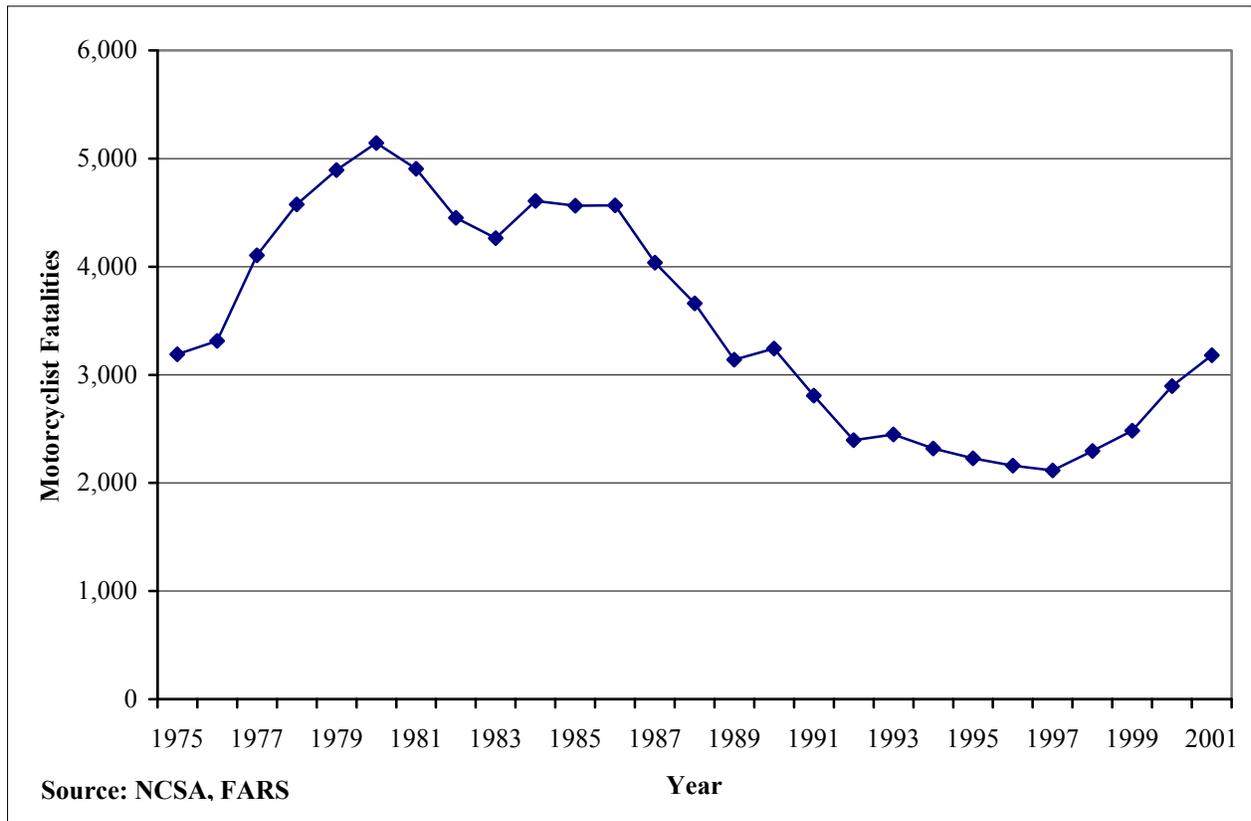


Figure 1. Motorcyclist Fatalities by Year.

**MOTORCYCLE INDUSTRY COUNCIL (MIC)
DATA**

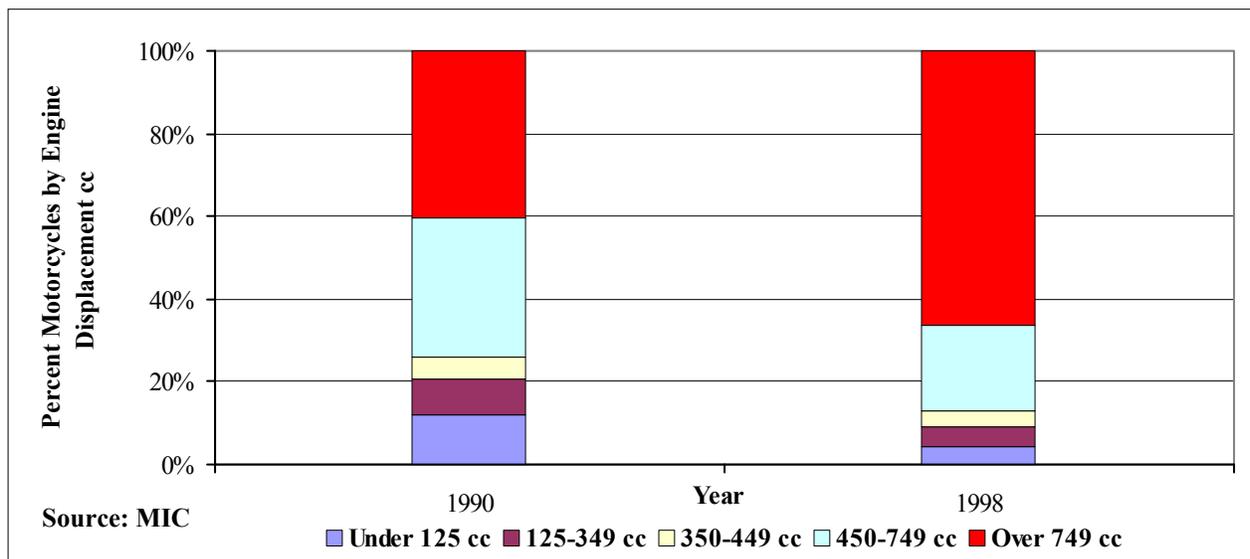
According to the *2001 Motorcycle Industry Council Statistics*, there were 2.5 motorcycles in use for every 100 persons living in U.S. in 1998. California, Florida, Texas, New York and Ohio represented over one-third (34 percent) of the motorcycles in use in 1998. By region, the South had the highest motorcycle population in 1998 with 28 percent of the total motorcycles in use. The West showed the highest motorcycle penetration, at 2.8 vehicles per 100 persons. The Midwest had 2.7 motorcycles per 100 persons, the East had 2.4 motorcycles per 100 persons and the South had the least motorcycle penetration compared to all the regions with 2.1 motorcycles per 100 persons.

An estimated 4,809,000 “on-highway” motorcycles were in use in 1998 compared to 3,650,000 motorcycles in 1990, an increase of 32 percent between 1990 and 1998. On-highway motorcycles are certified by the manufacturer as being in compliance with the Federal Motor Vehicle Safety Standards (FMVSS), and designed for use on public roads. Table 3 and Figure 2 show the distribution of motorcycles by engine size in cubic centimeters (cc) for these years. Two thirds (66 percent) of the motorcycles in 1998 had an engine displacement of over 749 cc compared to 40 percent in 1990. The percentage of motorcycles for all other engine sizes has decreased from 1990 to 1998. These data indicate that motorcycles with engines over 749 cc are becoming more prevalent.

**Table 3.
On-highway Motorcycles by Engine Displacement in cc and Year**

Engine Displacement	1990		1998	
	Num.	%	Num.	%
Under 125 cc	430,700	11.8%	202,000	4.2%
125-349 cc	328,500	9.0%	240,400	5.0%
350-449 cc	197,100	5.4%	187,600	3.9%
450-749 cc	1,215,500	33.3%	995,500	20.7%
Over 749 cc	1,478,200	40.5%	3,183,500	66.2%
Total	3,650,000	100.0%	4,809,000	100.0%

Source: MIC



Source: MIC

Figure 2. On-Highway Motorcycles (Percent) by Engine Displacement cc and Year.

Table 4 shows the number of new on-highway motorcycle units sold between 1990-2000. Starting in 1992, there has been an increase each year in the number of units sold. An estimated 471,000 new on-highway motorcycle units were sold in 2000, almost 20 percent over the previous year and an increase of over 90 percent from the 247,000 units sold in 1997. The average number of units sold between 1990 and 2000 was 257,400 units per year.

Table 4.
New On-Highway Motorcycle Units Sold by Year and Percent Change

Year	Units Sold	Percent Increase from Previous Year
1990	208,000	N/A
1991	190,000	-8.7
1992	186,000	-2.1
1993	201,000	+8.1
1994	210,000	+4.5
1995	214,000	+1.9
1996	228,000	+6.5
1997	247,000	+9.2
1998	298,000	+20.6
1999	379,000	+27.2
2000	471,000	+24.3
Source: MIC		

The mean age of a motorcycle owner in 1998 was 38.1 years compared to 33.1 years in 1990, 28.5 years in 1985 and 26.9 years in 1980. Table 5 and Figure 3 show the proportion of ownership of motorcycles by age groups for these years. The percent of ownership for those age 50 years and over in 1998 was 19.1 percent compared to 10.1 percent in

1990, 8.1 percent in 1985 and 5.7 percent in 1980. Similar increases are also seen in the 35-39 and 40-49 age groups. Under 18, 18-24 and 25-29 age groups showed corresponding decreases. The largest decrease was in the under 18-age group and the greatest increase was in the 40-49 age group.

Table 5.
Ownership of Motorcycles by Age Group and Year

Age	Year			
	1980	1985	1990	1998
Under 18	24.6%	14.9%	8.3%	4.1%
18-24	24.3%	20.7%	15.5%	10.6%
25-29	14.2%	18.7%	17.1%	10.9%
30-34	10.2%	13.8%	16.4%	11.5%
35-39	8.8%	8.7%	14.3%	16.0%
40-49	9.4%	13.2%	16.3%	24.6%
50 and Over	5.7%	8.1%	10.1%	19.1%
Not Stated	2.8%	1.9%	2.0%	3.2%
Median Age	24.0 Years	27.1 Years	32.0 Years	38.0 Years
Mean Age	26.9 Years	28.5 Years	33.1 Years	38.1 Years
Source: MIC				

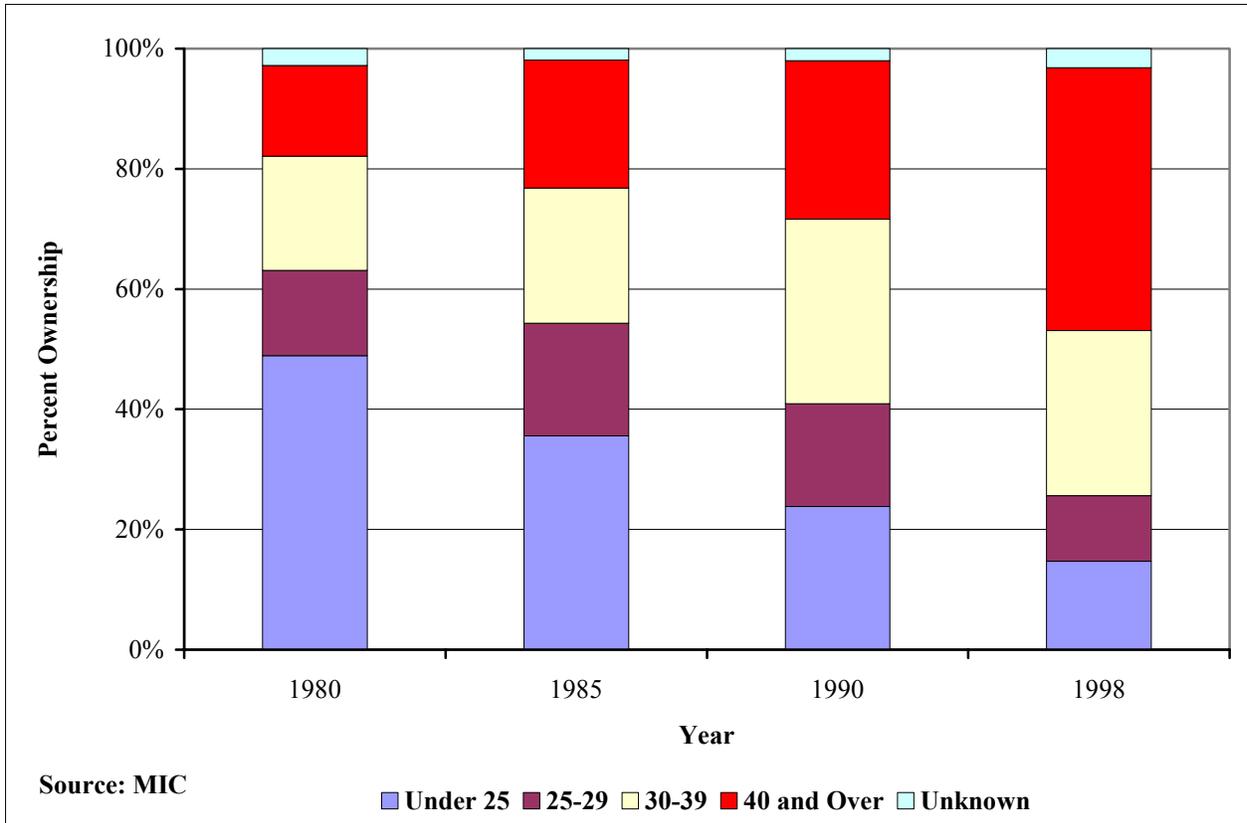


Figure 3. Motorcycle Ownership Percentage by Age Group and Year.

FEDERAL HIGHWAY ADMINISTRATION (FHWA) EXPOSURE DATA

Table 6 shows motorcycle registrations and vehicle miles traveled (VMT) from 1990 to 2001. The data show that motorcycle registrations have increased from 1997 to 2001 by 28.1 percent. The VMT for motorcycles reached the highest level in 1999, an increase of 8.0 percent since 1995. The data indicate increased exposure in terms of both motorcycle registrations from 1997 to 2001 and vehicle miles traveled from 1995 to 1999. In 2000 and 2001 the VMT actually decreased even though the number of registered vehicles increased.

Table 6. Motorcycle Registrations and Vehicle Miles Traveled (VMT) by Year

Year	Motorcycle Registrations		VMT (Millions)	
	Number	Percent Change	Number	Percent Change
1990	4,259,462	N/A	9,557	N/A
1991	4,177,365	-1.93%	9,178	-3.97%
1992	4,065,118	-2.69%	9,557	+4.12%
1993	3,977,856	-2.15%	9,906	+3.65%
1994	3,756,555	-5.56%	10,240	+3.37%
1995	3,897,191	+3.74%	9,797	-4.33%
1996	3,871,599	-0.66%	9,920	+1.26%
1997	3,826,373	-1.17%	10,081	+1.62%
1998	3,879,450	+1.39%	10,283	+2.00%
1999	4,152,433	+7.04%	10,584	+2.93%
2000	4,346,068	+4.66%	10,469	-1.09%
2001	4,903,056	+12.82%	9,529	-8.98%

Source: FHWA

FINDINGS

Results of the findings based on fatalities, ownership and exposure data are presented. Results are also based on the fatality rates calculated using exposure and ownership data.

Motorcyclist Fatalities by Year and Age Group

Table 7 and Figure 4 show the number and percent of motorcyclist fatalities from 1990 to 2001 by age group. As seen in the table the number of motorcyclist fatalities among age 40 and over has been increasing, especially from 1997 to 2001. Even though the number of motorcyclist fatalities declined each year between 1993 and 1997, the number of fatalities in the 40 and over age group increased during the same period. The number of fatalities for motorcyclists ages 40 and over has increased from 699 in 1997 to 1,254 in 2001, an increase of 79 percent. Motorcyclist fatalities have increased between 1990 and 2001 only in the 40-49 and over 49 age groups whereas the number of fatalities has decreased for all other age groups. The fatalities in

40-49 age group have increased from 278 in 1990 to 722 in 2001 and in the over 49 age group from 188 in 1990 to 532 in 2001. Still, the 20-29-age group accounts for the largest number of motorcyclist fatalities from 1990 to 2001 for any age group.

After reaching the historic low in 1997 motorcyclist fatalities increased 8.4 percent between 1997 and 1998, 7.8 percent between 1998 and 1999, 16.7 percent between 1999 and 2000 and 9.8 percent between 2000 and 2001. These increases have been observed, for the most part, in the 40 and over age group. The number of under 20 and 20-29 age group fatalities has declined considerably between 1990 and 2001 and the 30-39 age group has maintained the same percentage of fatalities. But the 40-49 and over 49 age groups show a steady increase each year between 1990 and 2001. The proportion of motorcyclist fatalities in the 40-49 age group has increased from 8.6 percent in 1990 to 22.7 percent in 2001, a factor of 2.6. The over 49 age group fatality proportion for the same years has increased from 5.8 in 1990 to 16.7 in 2001, a factor of 2.9.

Table 7.
Motorcyclist Fatalities by Year and Age Group

Year	Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	
1990	504	16	1,457	45	816	25	278	9	188	6	1	0	3,244
1991	411	15	1,219	43	728	26	296	11	151	5	1	0	2,806
1992	318	13	981	41	652	27	280	12	164	7	0	0	2,395
1993	262	11	1,005	41	666	27	338	14	176	7	2	0	2,449
1994	260	11	910	39	608	26	346	15	195	7	1	0	2,320
1995	195	9	909	41	576	26	359	16	188	8	0	0	2,227
1996	202	9	763	35	555	26	420	19	221	8	0	0	2,161
1997	166	8	694	33	556	26	405	19	294	14	1	0	2,116
1998	201	9	720	31	612	27	475	21	285	12	1	0	2,294
1999	137	6	761	31	612	25	570	23	403	16	0	0	2,483
2000	189	7	818	28	707	24	677	23	501	17	5	0	2,897
2001	209	7	919	29	797	25	722	23	532	17	2	0	3,181

Source: NCSA, FARS

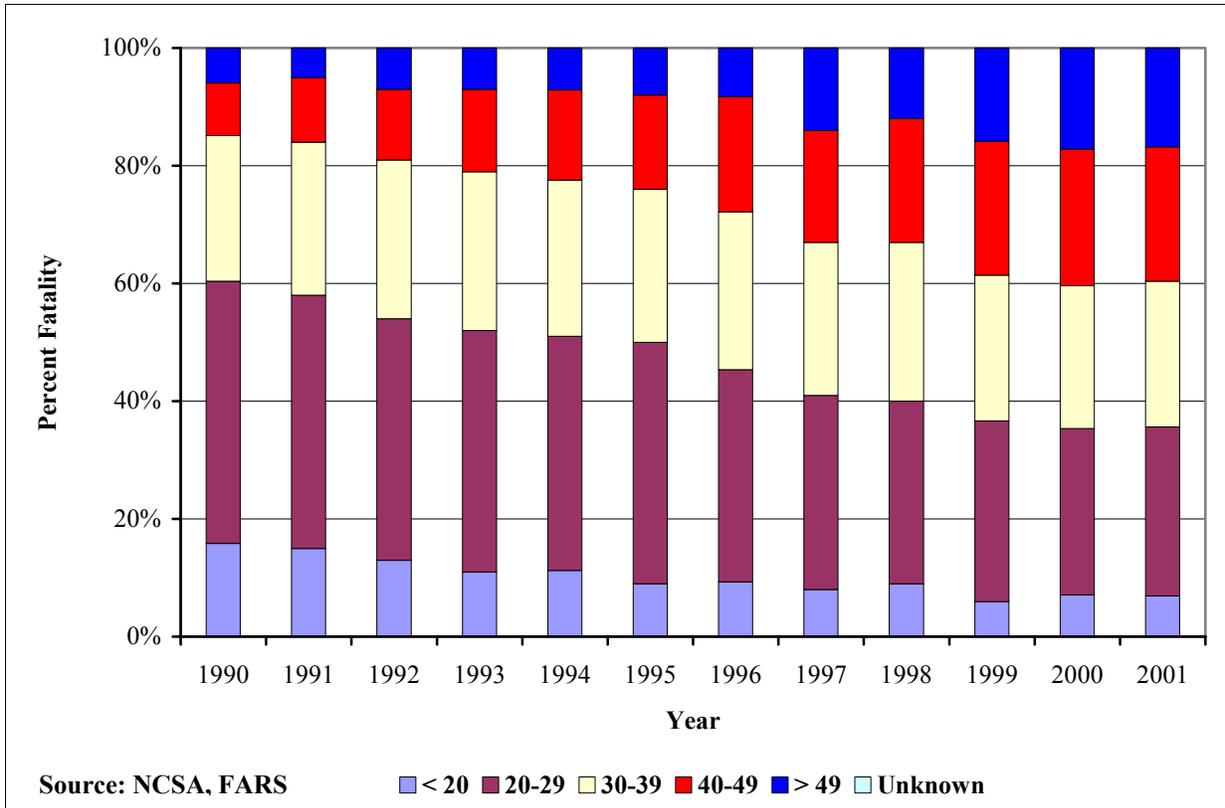


Figure 4. Motorcyclist Fatalities by Age Group (Percent) and Year.

Motorcyclist Fatalities by Year and Engine Displacement in Cubic Centimeters (cc)

In addition to the overall increase in motorcyclist fatalities in recent years, there has been a noticeable increase in fatalities among motorcyclists riding 1,001-1,500 cc engine size motorcycles. The number of motorcyclist fatalities in the 1,001-1,500 cc engine group rose from 702 in 1990 to 1,177 in 2001, an increase of 67.7 percent, the only group to show an increase of fatalities between 1990 and 2001. While the largest number of

motorcyclist fatalities is still in the 501-1,000 cc engine group, the fatality count among motorcyclists in the 1,001-1,500 cc group is fast approaching the 501-1,000 cc level. Motorcyclist fatalities in the 500 cc and less engine group declined by 64.5 percent between 1990 and 2001. Similarly, fatalities in the 501-1,000 cc group have declined by 8.6 percent during the same time period. Starting in 1996, a very small number of all motorcyclist fatalities have been reported involving motorcycles with engine displacements greater than 1,500 cc. Table 8 shows fatalities from 1990 to 2001 by engine displacement.

Table 8.
Motorcyclist Fatalities by Year and Engine Displacement

Year	Engine Displacement (cc)										Total
	Up to 500		501-1,000		1,001-1,500		> 1,500		Unknown		
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	
1990	639	20	1,526	47	702	21	0	0	377	12	3,244
1991	497	18	1,365	49	654	23	0	0	290	10	2,806
1992	411	17	1,107	46	590	25	0	0	287	12	2,395
1993	388	16	1,111	45	683	28	0	0	267	11	2,449
1994	311	13	1,038	45	633	27	0	0	338	15	2,320
1995	310	14	1,009	45	666	30	0	0	242	11	2,227
1996	243	11	1,001	46	654	30	8	0	255	12	2,161
1997	194	9	957	45	729	34	11	1	225	11	2,116
1998	213	9	1,040	45	781	34	16	1	244	11	2,294
1999	185	7	982	40	818	33	23	1	475	19	2,483
2000	203	7	1,261	44	1,092	38	46	2	288	10	2,897
2001	227	7	1,395	44	1,177	37	48	2	324	10	3,181

Source: NCSA, FARS

Motorcyclist Fatalities on 1,001-1,500 cc Engine by Year and Age Group

Between 1990 and 2001, Table 8 (above) showed that motorcyclist fatalities increased only in the 1,001-1,500 cc engine size motorcycles. Analysis of data from Table 9 and Figure 5 show that the number of motorcyclist fatalities in the 1,001-1,500 cc engine size category has increased only in the 40-49 and over 49 age groups between 1990 and 2001. The motorcyclist fatalities in the 40-49 age group have been steadily increasing each year since 1992. Similarly, motorcyclist fatalities in the over 49-age group have been steadily increasing each year since 1993.

The motorcyclist fatalities in the 40 and over age group in the 1,001-1,500 cc engine size have been increasing even though overall motorcyclist fatalities have reduced from 1990 to 1997. The

number of motorcyclist fatalities in the 40-49 age group has increased by a factor of 3.6 between 1990 and 2001. Similarly motorcyclist fatalities in the over 49-age group have increased by a factor of 4.4 between 1990 and 2001. These numbers indicate the involvement of larger motorcycles like 1,001-1,500 cc engine size group by age groups 40 and over in fatal crashes.

The percentage of motorcyclist fatalities in the 40 and over age group has increased from 27 percent in 1990 to 62 percent in 2001 in the 1,001-1,500 cc engine size category. Almost two thirds (62 percent) of the motorcyclist fatalities in 2001 were in the 40 and over age group and the remaining one third in under 40-age group. In 1990, three fourths (74 percent) of motorcyclist fatalities were in the under 40-age group compared to 27 percent in the 40 and over age group.

Table 9.
Motorcyclist Fatalities on 1,001-1,500 cc Engine Size by Year and Age Group

Year	Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	
1990	22	3	236	34	258	37	116	17	70	10	0	0	702
1991	19	3	202	31	246	38	126	19	60	9	1	0	654
1992	17	3	146	25	231	39	125	21	71	12	0	0	590
1993	13	2	191	28	253	37	167	24	59	9	0	0	683
1994	12	2	137	22	215	34	176	28	93	15	0	0	633
1995	12	2	135	20	233	35	182	27	104	16	0	0	666
1996	15	2	119	18	211	32	198	30	111	17	0	0	654
1997	8	1	99	14	232	32	225	31	165	23	0	0	729
1998	17	2	91	12	252	32	267	34	153	20	1	0	781
1999	3	0	79	10	205	25	294	36	237	29	0	0	818
2000	9	1	92	8	282	26	416	38	290	27	3	0	1,092
2001	12	1	125	11	311	26	420	36	308	26	1	0	1,177

Source: NCSA, FARS

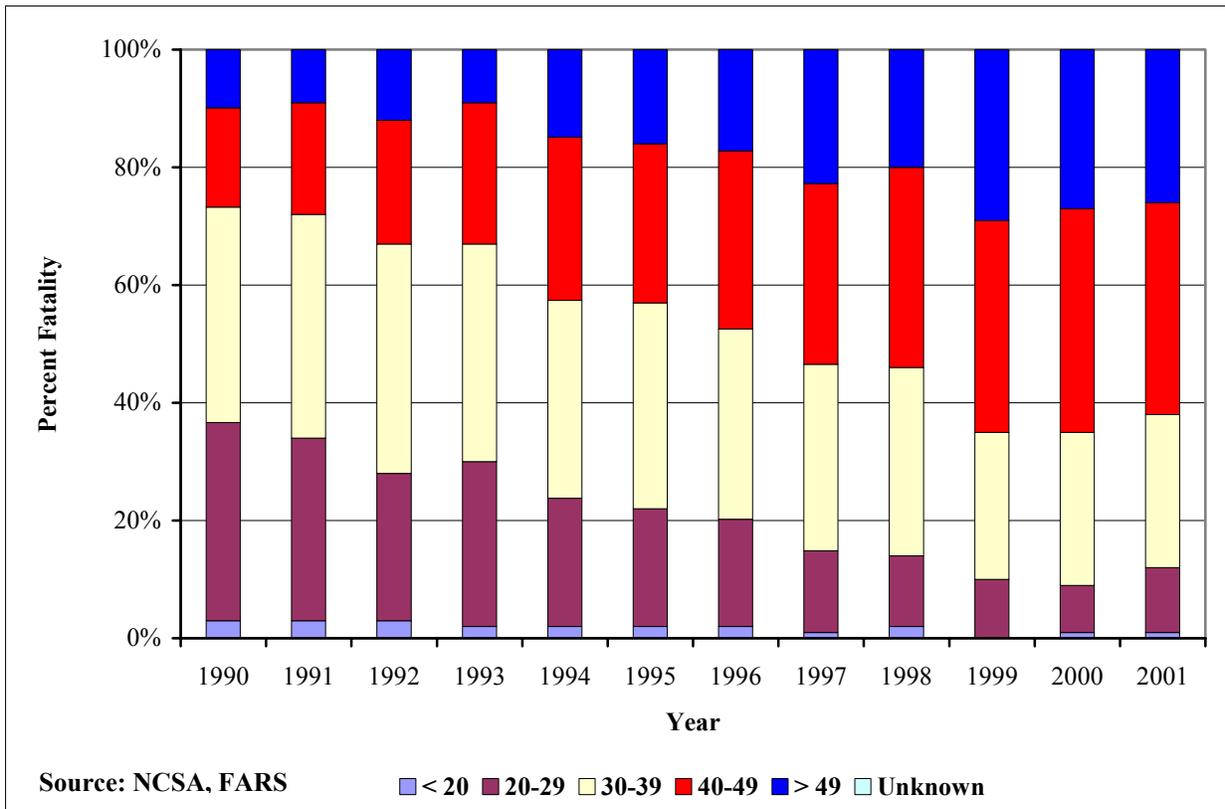


Figure 5. Motorcyclist Fatalities on 1,001-1,500 cc Engine Size by Age Group (Percent) and Year.

Motorcyclist Fatalities by Year and Land Use (Rural/Urban)

Between 1990 and 1997 the majority of motorcyclist fatalities occurred on urban roadways but it was generally decreasing. This trend has changed in the recent years with more fatalities occurring on rural roadways. Motorcyclist fatalities on rural roadways increased from 45 percent in 1990 to 52 percent in 1999 an increase of 7 percentage

points. In 1997, 1,047 motorcyclists were killed on rural roadways compared to 1,557 in 2001, an increase of 49 percent. The increase in motorcyclist fatalities for the same years on urban roadways was 33 percent. Table 10 shows the breakdown of the fatalities by land use for the years 1990 through 2001. The change in proportions from 1999 to 2001 is partially due to the increase in the number of unknowns. The number of unknowns in 2001 could change with release of the Final FARS 2001 file.

**Table 10.
Motorcyclist Fatalities by Year and Land Use**

Year	Motorcyclist Fatalities by Land Use						Total
	Rural		Urban		Unknown		
	Num.	%	Num.	%	Num.	%	
1990	1,445	45	1,798	55	1	0	3,244
1991	1,337	48	1,465	52	4	0	2,806
1992	1,091	46	1,285	54	19	1	2,395
1993	1,177	48	1,256	51	16	1	2,449
1994	1,070	46	1,244	54	6	0	2,320
1995	1,070	48	1,144	51	13	1	2,227
1996	1,027	48	1,126	52	8	0	2,161
1997	1,047	49	1,064	50	5	0	2,116
1998	1,166	51	1,119	49	9	0	2,294
1999	1,290	52	1,175	47	18	1	2,483
2000	1,428	49	1,385	48	84	3	2,897
2001	1,557	49	1,411	44	213	7	3,181

Source: NCSA, FARS

Mean Age of Motorcyclist Killed and Mean Engine Displacement in Fatal Crash

From 1990 to 2001 the average age of motorcyclists killed increased. The mean age of the motorcyclist killed in 1990 was 29.3 years. It increased to 36.3 years in 2001, an increase of 24 percent. Similarly the mean engine displacement of the motorcycles involved in fatal crashes has increased from 769 cc in 1990 to 959 cc in 2001, an increase of 25 percent. The analysis indicates a rise in the average age of motorcyclist killed and greater involvement of motorcycles with larger engines in fatal crashes. Table 11 shows the mean age of motorcyclists killed and mean engine displacement in fatal crashes from 1990 to 2001.

Table 11.
Mean Age of Motorcyclists Killed and Mean Engine Displacement in Fatal Crashes by Year

Year	Mean Age in Year (1)		Mean Engine Size in cc (1)	
	Number	Change	Number	Change
1990	29.3	N/A	769	N/A
1991	29.6	+0.3	786	+17
1992	30.5	+0.9	799	+13
1993	31.3	+0.8	820	+21
1994	31.8	+0.5	837	+17
1995	32.1	+0.3	842	+5
1996	33.4	+1.3	865	+23
1997	34.8	+1.4	899	+34
1998	34.6	-0.2	904	+5
1999	36.5	+1.9	922	+18
2000	36.8	+0.3	957	+35
2001	36.3	-0.5	959	+2

Source: NCSA, FARS

Note: (1) Excludes unknowns

Motorcyclist Fatality Rate by Registered Motorcycles and VMT

Fatality rates for motorcyclists declined between 1990 and 1997 when measured per 100,000 registered motorcycles and per 100 million motorcycle VMT. However, between 1997 and 2001 fatality rates per 100,000 registered motorcycles increased by 17.3 percent and per 100 million VMT by 59.1 percent. The number of fatalities has increased more sharply for these years than the increase in the VMT between 1997 and 2001. Table 12 gives the fatality rates for registered motorcycles and VMT from 1990 to 2001.

The fatality rate per 100,000 registered vehicles actually declined between 2000 and 2001 since the increase in the number of registered motorcycles was higher than the increase in fatalities.

Table 12.
Motorcyclist Fatality Rates by Year and Registered Motorcycles and VMT

Year	Rate per 100,000 Registered Vehicles		Rate per 100M VMT	
	Number	Percent Change	Number	Percent Change
1990	76.16	N/A	33.9	N/A
1991	67.17	-11.8%	30.6	-9.7%
1992	58.92	-12.3%	25.1	-18%
1993	61.57	+4.5%	24.7	-1.6%
1994	61.76	+0.3%	22.7	-8.1%
1995	57.14	-7.5%	22.7	0.0%
1996	55.82	-2.3%	21.8	-4.0%
1997	55.30	-0.9%	21.0	-3.7%
1998	59.13	+6.9%	22.3	+6.2%
1999	59.80	+1.1%	23.5	+5.4%
2000	66.66	+11.5%	27.7	+17.9%
2001	64.88	-2.7%	33.4	+20.6%

Source: NCSA, FARS and FHWA

CONCLUSIONS

The analysis described in this paper supports a variety of conclusions about the targets for motorcycle crash prevention programs and could aid in the design of countermeasure programs. The analysis also demonstrates the utility of using different data sources to cross verify the results from one data source with another. Since one of the major foci of this paper and analysis is based on age groups and engine size, use of the FARS data in conjunction with MIC data permitted conclusions that could not have been drawn by using FARS data alone. The use of MIC data supports the observations of the FARS data relative to the involvement of 40 and over age groups and motorcycles with engine sizes of 1,001-1,500 cc in fatal motorcycle crashes in recent years.

Motorcycle Exposure Rates

Data from FHWA relating to registered motorcycles and motorcycle VMT show an increase in the number of registered motorcycles in the past two years and also an increase in VMT in the past five years. MIC data show that number of new on-highway motorcycle units sold has increased each year since 1992 with most of the increase seen between 1997 and 2001. The motorcyclist fatality

rates based on registered motorcycles and VMT have also increased between 1997 and 2001. These exposure data indicate more motorcycles on the roads with more vehicle miles traveled in the recent years.

Motorcyclist Age

Results from 1990-2001 FARS data show that there has been an increase in the number of motorcyclist fatalities in 40 and over age group. MIC data also suggests more people age 40 and over are buying and riding motorcycles thereby increasing their exposure. If these patterns continue as seen from the combination of data sources, there is the likelihood that there will continue to be an increase in the number of motorcyclists age 40 and over involved in fatal crashes.

Motorcycle Engine Displacement in Cubic Centimeters

Analysis of FARS and MIC data shows that there is an increase in the average engine size of motorcycles involved in fatal crashes. Further data from FARS indicate that more motorcyclists in the 40 and over age group are getting killed on motorcycles with 1,001-1,500 cc engines.

Motorcyclist Fatalities by Land Use (Urban/Rural)

Even though the shift of motorcyclist fatalities on urban roadways to rural roadways has been very gradual, it is possible that this trend will continue. This is important since 42 percent of all motorcyclist fatalities occur on rural undivided roadways. Also, helmet use, license status, alcohol use and speeding vary between urban and rural roadways. Hence more attention should be focused towards rural roadways for better education, enforcement, communication and other safety messages.

Other Conclusions

Following conclusions are based on the report and research notes referenced (references 6-8) in this paper.

- Undivided roadways particularly rural roads account for a majority of motorcyclist fatalities;
- Speeding is still one of the major factors in motorcycle crashes especially among riders under the age of 30;

- High BAC levels continue to be a major problem among motorcycle operators;
- Helmet use is just 50 percent among fatally injured motorcyclists with a 10 percentage point increase from 1990 (43 percent) to 2001 (50 percent); and,
- Motorcycle operators, especially in the under 20 and 20-29 age groups, are often improperly licensed to operate motorcycles.

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