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IOWA MOTORCYCLE CRASH STUDY 1974-1976



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SUMMARY

I. Trends in Motorcycle Registrations, Crashes, and Fatalities

- A. Iowa motorcycle registrations in 1976 increased 1,200% when compared to 1960 (11,668 in 1960 and 151,131 in 1976). This increase was characterized by a rapid rate of growth from 1964 through 1974, and a diminishing growth rate from 1975 through 1976.
- B. The motorcycle fatalities growth trend followed a similar behavior with registrations during the three year period of 1974-1976.
- C. Motorcycle registrations chalked up 6.5% of the total vehicle registrations in 1974-1976, while motorcycle fatalities accounted for 9.1% of the total traffic fatalities, indicating a problem area.

II. Motorcycle Crash Facts

- A. Motorcycle drivers were predominantly young. Sixty-eight and two-tenths percent of the drivers in fatal crashes were 24 years of age or younger, and 98.4% were male.
- B. Forty-five percent of the licensed motorcycle operators were 24 years of age or under compared to 68.2% of the motorcycle operators involved in fatal crashes, indicating an overrepresentation of drivers involved in fatal motorcycle crashes.
- C. The collision of a motorcycle with another vehicle accounted for 67% of the fatal crashes, while single motorcycle crashes chalked up 28%.
- D. The motorcycle season in Iowa seemed to be April through September. These months accounted for 85.3% of all motorcycle crashes during the three year period under review.
- E. June and July were peak months, accounting for one-half of the total motorcycle fatalities.
- F. Roughly three-fourths of the fatal crashes occurred between 5:00 p.m. and 3:00 a.m., which would seem to indicate that motorcycles involved in fatal crashes were being used primarily for recreational trips.
- G. One day of the week, Saturday, recorded the highest percentage of fatal motorcycle crashes or 24.6% of the total, suggesting an increased usage of motorcycles for recreational trips.
- H. The motorcycle driver, when involved in a collision, is at fault 62% of the time as compared to 53% of the other motor vehicle drivers involved in crashes.
- I. Drinking was found to be a major contributing factor in fatal motorcycle crashes (32.1% of the total).
- J. About 52% of all multivehicle fatal crashes occurred at intersections.
- K. Half of the fatal single vehicle crashes occurred on curves.
- L. A study of driver actions showed that the most dangerous traffic situation involved an operator of a car attempting to make a left turn, ultimately pulling into the path of a motorcycle.
- M. Environmental conditions relevant to crash situations strongly suggested that a large proportion of the fatal motorcycle crashes occurred on good roads (cement, asphalt bituminous), with vision not obscured, in clear weather, and on dry, level surfaces.
- N. More than half of the crashes occurred on roads without traffic controls, and out in the open country.
- O. About half of the crashes occurred during daytime and half during darkness.
- P. Approximately half of the drivers had at least one crash within three years prior to the fatal crash.

- Q. Two-thirds of all motorcycle drivers had at least one conviction and one-third had clear records as of three years prior to the crash.
- R. About half of the fatal cycle crashes occurred in rural areas and the other half in urban areas.
- S. Crashes and convictions count per driver showed a positive, straight line relationship with each other.
- T. Thirty-one percent of the motorcycle operators did not have a valid motorcycle license while 13% indicated a lack of said license as they were 15 years of age or under.
- U. A comparison of fatality rates (per 10,000 registrations) "before", "during" the helmet law, and "after" the repeal of the helmet law showed a significant decrease in the fatality rate "during", the period when helmet usage was required.
- V. A comparison of the types of injuries incurred showed a decrease in the proportion of head injuries — 62.1% in 1974 compared to 40.1% in 1975-1976. This was probably due to the enforcement of the helmet law.

IOWA MOTORCYCLE CRASH STUDY 1974-1976

1.0 Introduction

This report is a continuous study of motorcycle crashes in the state of Iowa, updated every three years. The main objectives are to study trends, to analyze, and to determine the causes of and circumstances surrounding motorcycle crashes. Hopefully, on the basis of this analysis, countermeasures will be planned in order to reduce motorcycle deaths.

1.1 Collection of Data

Data used in this study were collected from fatal and nonfatal motorcycle crash reports. The number of licensed motorcycle drivers as well as motorcycles registered was gathered from the driver license files and vehicle registration files.

2.0 Trends in Motorcycle Registrations, Crashes, and Fatalities: Iowa, 1970-1976

Motorcycle registrations in Iowa, spanning a period of 17 years, increased tremendously from a mere 11,668 in 1960 to 151,131 in 1976. The graph in Figure 1 shows the growth curve in three stages characterized by stagnation from 1960-1963, a rapid rate of growth from 1964 through 1974, and a diminishing rate of growth from 1975 through 1976. Table 1 details the actual figures.

The motorcycle fatalities growth trend imitated the trends established by the registrations for the period under review. The same behavior was also observed for all motorcycle crashes. Please refer to Figures 1 and 2. Motorcycle registrations chalked up 6.5% of the total motor vehicle registrations in 1974-1976 while motorcycle fatalities accounted for 9.1% of the total traffic fatalities for the same period. The difference between the two proportions were significant¹, clearly pinpointing a problem. The following table shows the details:

YEAR	TOTAL REGISTRATIONS	MOTORCYCLE REGISTRATIONS	%	TRAFFIC FATALITIES	MOTORCYCLE FATALITIES	%
1974	2,178,530	138,021	6.3	685	66	9.6
1975	2,250,417	148,669	6.6	674	62	9.2
1976	2,300,721	151,131	6.6	785	68	8.7
Total	6,729,668	437,821	6.5%	2,144	196	9.1%

¹ $\chi^2 = 24.493264$ P < .001

3.0 Drivers Involved in Motorcycle Crashes by Age

Records show that motorcycle drivers were predominantly young. In 1974-1976, 68.2% of the drivers involved in fatal crashes were 24 years old or younger. This distribution was slightly higher for drivers involved in all motorcycle crashes (71.9% in 1974-1975). Table 2 shows that young motorcycle drivers were over-represented when compared with other motor vehicle drivers involved in fatal motorcycle crashes.

When this proportion was compared with driver licenses in the same age group, it was found that only 45% of the licensed motorcycle drivers were 24 years old or under compared to 68.2% of the cycle drivers involved in fatal crashes or 71.9% involved in all motorcycle crashes for the same age group. This indicates an over representation of this age group in motorcycle crashes. Table A below and Table 3 shows further details.

TABLE A
PERCENT DISTRIBUTION OF LICENSED MOTORCYCLE DRIVERS,
DRIVERS IN FATAL CRASHES, AND ALL MOTORCYCLE CRASHES:
IOWA, 1974-1976

Age	Licensed Motorcycle Drivers	Motorcycle Drivers in Fatal Crashes	Motorcycle Drivers in All Crashes
15	—	7.2	3.0
16	1.8	2.0	6.4
17	3.8	7.2	10.4
18-19	10.6	14.9	20.9
20-24	28.8	36.9	31.2
25-34	31.8	22.1	18.4
35-44	13.2	5.1	5.5
45-54	7.3	2.0	1.6
55-64	2.3	2.0	0.6
65 & up	0.4	—	0.1
Not Stated	—	0.5	2.1
Total	100.0%	100.0%¹	100.0%¹

¹Totals do not always add up to 100% due to rounding.

4.0 Distribution of Motorcycle Crashes by Type of Crash

About two-thirds of all motorcycle crashes were multivehicle crashes. Single vehicle crashes such as running off of the road, overturning, or other noncollision incidents chalked up 23%, while the remaining 9% constituted collisions with trains, animals, bicyclists, or fixed objects.

In terms of fatal crashes, collisions with another vehicle in traffic totaled approximately 52%, single vehicle crashes chalked up 28%, and the remainder involved collisions of motorcycles with trains. Table B shows the details.

TABLE B
PERCENT DISTRIBUTION OF FATAL AND ALL
MOTORCYCLE CRASHES BY TYPE OF CRASH:
IOWA, 1974-1976 and 1971-1973

Type of Crash	Fatal Motorcycle Crashes		All Motorcycle Crashes	
	1974-1976	1971-1973	1974-1976	1971-1973
Collision w/other motor vehicle in traffic	49.7	64.1	62.8	60.2
Collision w/other motorcycle in traffic	2.7	5.9	5.0	7.0
Ran off road, overturned, & other noncollision	27.8	24.1	23.0	21.1
Collision w/train, fixed object, bicyclist, animal	19.8	5.9	9.2	11.7
Total	100.0%	100.0%	100.0%	100.0%

x²_{05,3} = 7.815, x²₀ = 21.11

The above table indicates a significant reduction in the proportion of multivehicle crashes in 1974-1976 when compared with the previous three years. However, an increase in motorcycle collisions with trains, fixed objects, bicyclists, animals, and similar objects was noted.

5.0 Motorcycle Season in Iowa: 1974-1976

Fatal and nonfatal motorcycle crashes are charted and shown in Figure 3. The motorcycle season in Iowa seemed to include the months of April through September. These months accounted for 85.32% of all motorcycle crashes. June and July were peak months accounting for half of all motorcycle fatalities during the period under review. Table 4 and Table 6 show fatal motorcycle crashes and all crashes by month.

6.0 Distribution of Fatal Motorcycle Crashes by Time of Day: 1974-1976

The majority or roughly three-fourths of the fatal crashes in 1974 through 1976 occurred between 5:00 p.m. and 3:00 a.m., which would seem to indicate that the motorcycles which were involved in fatal crashes were being used primarily for recreational trips. No peaks were noted during the morning rush hour or at noon, suggesting less usage of motorcycles for work or educational trips. Please see Figure 4.

7.0 Distribution of Motorcycle Crashes by Day of Week

Saturday had the highest percentage of fatal motorcycle crashes for each of the three years studied, with an overall rate of 46 out of 187 fatal motorcycle crashes or 24.6% of the total occurring on this day. This again suggests an increased usage of motorcycles for recreational trips. Table 7 shows the distribution by day of week.

A comparison of the time distribution of fatal motorcycle crashes and other motor vehicle crashes is shown in Figure 5. The graph suggests that fatal motorcycle crashes follow the same time period distribution of other motor vehicles, from midnight to 5:00 in the evening. However, from 6:00 p.m. to 12:00, motorcycle fatal crashes are over-represented.

8.0 Motorcycle Driver Violations and Other Vehicle Driver Violations

An analysis of driver violations or contributing factors by crash type is as follows:

FATAL SINGLE MOTORCYCLE CRASHES	
1. Drinking	33.3
2. Not under Control	29.9
3. Speed	19.5
4. Disregard Sign	3.4
5. Vehicle Defect	3.4
6. Defective Road (lost control)	3.4
7. Others	7.1
Total	100.0%

8.1 Collision of Motorcycles with Other Motor Vehicles in Traffic

A collision involving another motor vehicle, as stated earlier, made up 52% of all fatal motorcycle crashes. An analysis of the motorcycle driver as well as the other motor vehicle driver was made, the results of which indicated that 38% of the motorcycle drivers were not at fault. By reviewing the driving record of drivers excluding motorcyclists, it was observed that the motor vehicle driver was not at fault in 47% of the total reported crashes.

In summary, it could be said that the motorcycle driver was at fault 62% of the time compared to 53% for the other driver. This information is shown in Table 5.

9.0 Number of Alcohol-Related Fatal Motorcycle Crashes: 1974-1976

Drinking was found to be a major contributing factor in fatal motorcycle crashes. The percentage of alcohol-related fatal motorcycle crashes was 32.1%. This percentage was not significantly different from the overall percentage of alcohol-related fatal crashes which was at the 35.6% level in 1976. The following table supports these facts:

Year	Motorcycle vs. Other Motor Vehicle			Single MC Crash MC Drinking	Total A-R Fatal Crashes	Fatal MC Crashes	% Alcohol- Related	Total Fatal Crashes		
	MC & MV Both Drinking	Other MV Drinking	MC Drinking					Alcohol- Related	Fatal Crashes	%
1974	1	2	6	10	19	64	29.7	187	583	32.1
1975	—	4	5	12	21	61	34.4	221	578	38.2
1976	1	2	3	14	20	62	32.3	242	663	36.5
Total	2	8	14	36	60	187	32.1%	650	1,824	35.6%

10.0 Fatal Motorcycle Crashes by Character of Roadway

An attempt was made to identify the character of roadway where fatal crashes occurred during the three year period. Of the four types of roadway characters indicated below, intersections had the highest frequency of crashes. The frequency of fatal crashes could be summarized as follows:

- 33.2% Intersections
- 31.6% Straight Roads
- 26.8% Curves
- 8.5% Driveways and Others

The following list shows the distribution for single vehicle fatal crashes and for multivehicle fatal crashes by character of roadway:

SINGLE VEHICLE FATAL CRASHES	MULTIVEHICLE FATAL CRASHES
11.6% Intersections	51.5% Intersections
37.2% Straight Roads	27.7% Straight Roads
50.0% Curves	6.9% Curves
1.2% Others	13.9% Others

11.0 Intersection Crashes

A study of driver actions in fatal motorcycle crashes that occurred at intersections showed that the most dangerous driver action was a car driver attempting to make a left turn, ultimately pulling into the path of a motorcycle. This action accounted for approximately 32% of the total.

The following list summarizes driver actions:

DRIVER ACTION	#	%
Car attempted to make a left turn and pulled into path of motorcycle	20	32.2
Car pulled away from stop sign in front of motorcycle	13	21.0
Motorcycle went through stop sign	12	19.4
Motorcycle not under control	17	27.4
Total	62	100.0%

12.0 Facts Describing the Fatal Crash Scene

Environmental conditions describing the crash scene were:

SURFACE TYPE

Portland Cement	51.9
Asphalt Bituminous	35.8
Gravel	9.6
Dirt	1.1
Not Stated	1.6
Total	100.0%

TRAFFIC CONTROL

None	59.4
Stop Sign	16.6
Warning Sign	9.6
Traffic Signal	4.8
Other Control	7.0
No Passing Zone	2.1
Not Stated	0.5
Total	100.0%

KIND OF LOCALITY

Open Country	48.1
Residential	24.1
Business	18.7
Manufacturer & Industry	5.3
Not Stated and Others	3.7
Total	100.0%

VISION OBSCURED

Not Obscured	78.6
Embankment	1.1
Fog/Smoke/Dust	1.1
Trees/Crops	0.5
Other	7.5
Unknown	11.2
Total	100.0%

ROADWAY GEOMETRICS

Straight Level	30.5
Straight, Up/Downgrade	12.3
Straight, Hillcrest	1.6
Curve, Level	12.8
Curve, Up/Downgrade	11.8
Curve, Hillcrest	1.1
Intersection, Level	18.2
Intersection, Up/Downgrade	8.6
Intersection, Hillcrest	1.6
Unknown/Not Stated	1.6
Total	100.0%

13.0 Occupation of Motorcyclists: 1976

The occupations of motorcyclists involved in fatal crashes were as follows:

Student	18	28.6
Laborer	9	14.3
Skilled/Semi-Skilled	15	23.8
Unknown	5	7.9
All Others ¹	16	25.4
Total	63	100.0%

¹Includes those in business (4), commercial drivers (4), farm (4) and others not elsewhere classified (4).

14.0 Distribution of Fatal Motorcycle Crashes by Rural-Urban Classification

The distribution of fatal motorcycle crashes by land use classification revealed that approximately 54% were rural and 45% were urban. The following table identifies the distribution:

YEAR	TOTAL FATAL MOTORCYCLE CRASHES			MULTIPLE FATAL MOTORCYCLE CRASHES			SINGLE FATAL MOTORCYCLE CRASHES		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
1974	36	28	64	21	17	38	15	11	26
1975	31	30	61	10	15	25	21	15	36
1976	35	27	62	22	13	35	13	14	27
Total	102	85	187	53	45	98	49	40	89
% Distrib.	54.6%	45.4%	100.0%	54.1%	45.9%	100.0%	55.1%	44.9%	100.0%

15.0 Driving Record of Motorcycle Operators: 1976

To determine the relationship between crashes and convictions of motorcycle drivers involved in fatal crashes, their 1976 records were searched for convictions and crashes three years prior to the fatal crash.

A total of 63 drivers were involved in fatal crashes in 1976. Out of these, only 49 or 78% had records available, eight had no driver license, and six were out-of-state drivers, hence their records were not readily accessible.

The table below gives the number of motorcycle drivers with zero, one, two, three, and four or more crashes three years prior to the fatal crash:

# OF CRASHES (3-YEARS PRIOR RECORDS)	# MOTORCYCLE DRIVERS	%
0	22	44.9
1	14	28.6
2	8	16.3
3	3	6.1
4	2	4.1
Total	49	100.0%

On the other hand, the number of motorcycle drivers by convictions count, based upon a three year prior record, is as follows:

# CONVICTIONS	# DRIVERS	%
0	16	32.6
1	11	22.5
2	10	20.4
3	2	4.1
4 or more	10	20.4
Total	49	100.0%

The preceding tabulations reflect that of the 49 motorcycle drivers involved in fatal crashes maintaining available records in 1976, approximately half had at least one crash three years prior to the fatal crash.

On the other hand, two-thirds of the drivers had at least one conviction and one-third had clear records.

By combining the two tables, the percentage of drivers who were crash and conviction free could be obtained. This information is shown below:

<u>CRASHES</u> <u>CONVICTIONS</u>	0	1	2	3 OR MORE	TOTAL	%
0	12	4	—	—	16	32.6
1	6	2	3	—	11	22.5
2	1	5	2	2	10	20.4
3	1	—	1	—	2	4.1
4	2	3	2	3	10	20.4
Total	22	14	8	5	49	
%	44.9%	28.6%	16.3%	10.2%	100.0%	100.0%

The results indicated that 12 drivers or 24.5% were crash or conviction free.

DIFFERENTIAL CRASH RATES BY CONVICTION COUNT: 1976				
Convictions	Crashes	Drivers	Crashes Driver	"Times As Many"
0	4	16	0.25	1.00
1	8	11	0.73	2.92
2	12	10	1.20	4.80
3	2	2	1.00	4.00
4 or more	13	10	1.33	5.20
Total	39	49	0.80	

15.1 Differential Crash Rates by Convictions Count, Three Years Prior: 1976

Calculated differential crash rates by convictions count showed that the motorcycle operator who had no convictions three years prior had 0.25 crashes per driver, while those with one conviction had 0.73 crashes per driver. This was about three times that of the motorcycle operator having no conviction rate. Thus, the number of crashes for those drivers with four or more convictions were five times as many as those with clear conviction records.

16.0 Motorcycle Drivers Involved in Fatal Crashes by Type of License: 1976

A search of drivers records was made according to the type of license for each motorcycle driver, and their ages were recorded. It is interesting to note that out of 63 motorcycle drivers, eight did not have a license, seven of the drivers were 15 years of age or younger, and 13 or 21% had a license not valid for motorcycles. Only 36 or 57% had a license valid to operate a motorcycle. The following table shows the distribution:

AGE	VALID FOR MOTORCYCLES	NOT VALID FOR MOTORCYCLES	NO LICENSE	OUT-OF-STATE OR UNKNOWN
15 & below	—	—	7	—
16-20	12	5	—	—
21-24	10	6	1	—
25-34	8	2	—	—
35-44	3	—	—	5
45-54	1	—	—	1
55-64	2	—	—	—
65 & Over	—	—	—	—
Total	36	13	8	6
% Distribution	57%	21%	13%	9%

This may strongly suggest that a lack of training (evident in 21% of the drivers not having a valid motorcycle license) and experience (seven were too young to drive a motorcycle) affected the safe handling and operation of motorcycles.

17.0 Motorcycle Drivers and Passengers in Fatal Crashes: 1976

In 1976, there were 68 motorcycle fatalities of which 51 or 75% were drivers and 15 or 22% were passengers.

18.0 Motorcycle Death Rate (Deaths Per 10,000 Registrations) and Trend: Iowa, 1960-1976

Shown in Table C are death rates per 10,000 motorcycle registrations, and trends for the past 16 years. The trend was determined by applying a five-year moving average to the data. Through this system, the amount of variation tended to reduce, thus smoothing out extreme fluctuations and leaving the trend movement.

The graph of the five-year moving average for the years 1960 through 1976 is shown in Figure 6. The graph indicates a steady decline in the death rate. This does not mean, however, that motorcycle crashes are not a serious problem.

TABLE C
ACTUAL NUMBER OF MOTORCYCLE DEATHS,
REGISTRATIONS, AND DEATH RATE:
IOWA, 1960-1976

Year	Deaths	Registrations	Death Rate ¹	Trend: Five-Year Moving Average
1960	7	11,668	6.00	—
1961	7	11,959	5.85	—
1962	7	12,552	5.58	6.46
1963	11	13,962	7.88	6.74
1964	12	17,141	7.00	7.59
1965	19	25,778	7.37	7.85
1966	33	32,643	10.11	7.95
1967	26	37,646	6.91	7.71
1968	35	41,982	8.34	7.65
1969	28	48,293	5.80	6.66
1970	43	60,835	7.07	6.64
1971	41	78,902	5.20	6.18
1972	66	97,354	6.78	5.98
1973	72	118,545	6.07	5.40
1974	66	138,021	4.78	5.26
1975	62	148,663	4.17	—
1976	68	151,131	4.50	—

¹Motorcycle deaths per 10,000 registrations.

19.0 Helmet Usage

The helmet law was passed by the Legislature and implemented on September 1, 1975, but was repealed on July 1, 1976. These events created an opportunity to present data on the effects of the motorcycle helmet law on fatalities. Data on all motorcycle crashes and injuries during the period are not available, hence it is not possible to evaluate the effects on motorcycle injuries. The following data show the details:

MONTH	BEFORE HELMET LAW (9/74-6/75)	DURING HELMET LAW (9/75-6/76)	AFTER REPEAL OF LAW (9/76-6/77)
September	12	2	8
October	1	5	5
November	3	2	1
December	—	—	1
January	—	—	—
February	1	—	1
March	—	4	1
April	2	2	8
May	7	8	13
June	19	11	9
Total	45	34	47
Fatality Rate	3.4	2.2	3.14

(Motorcycle Deaths Per 10,000 Registrations)

The preceding data indicate a decrease in fatalities or fatality rate during the implementation of the law when compared to before the actual implementation and after the repeal of the law. The data seem to indicate that helmets are effective in reducing motorcycle deaths.

20.0 Number of Fatalities by Type of Injury

Causes of death were studied in terms of the type of injuries incurred. The following table shows this distribution for the years 1974-1976:

NUMBER OF MOTORCYCLE FATALITIES BY TYPE OF INJURY: IOWA, 1974-1976						
Types of Injury	1974		1975		1976	
	#	%	#	%	#	%
Head	41	62.1	21	33.9	31	45.6
Multiple	10	15.2	31	50.0	24	35.3
Upper Torso	7	10.6	6	9.7	7	10.3
Legs	—	—	2	3.2	—	—
Internal	2	3.0	1	1.6	4	5.9
Lower Torso	1	1.5	—	—	1	1.5
Unknown	5	7.6	1	1.6	1	1.5
Total	66	100.0%	62	100.0%	68	100.0%

21.0 Effect of the Helmet Law on Injury

During the 10-month period that the helmet law was implemented, the effect of that law on types of injury incurred was investigated. The table below depicts the number of fatalities by type of injury incurred during the three comparable time periods.

The data strongly suggest that there was a reduction in head injuries during the implementation of the helmet law, but said injuries increased after the helmet law was repealed.

Type of Injury	BEFORE HELMET LAW SEPTEMBER, 1974 JUNE, 1975		DURING HELMET LAW SEPTEMBER, 1975 JUNE, 1976		AFTER REPEAL OF HELMET LAW SEPTEMBER, 1976 JUNE, 1977	
	#	%	#	%	#	%
Head	22	48.9	8	23.5	19	40.4
Multiple	18	40.0	16	47.1	21	44.7
Upper Torso	1	2.2	7	20.6	3	6.4
Legs	—	—	—	—	—	—
Internal	1	2.2	2	5.9	3	6.4
Lower Torso	—	—	1	2.9	—	—
Unknown	3	6.7	—	—	1	2.1
Total	45	100.0%	34	100.0%	47	100.0%

$\chi^2_{0.05, 2} = 5.991$ $\chi^2_0 = 6.506$

22.0 Discussion

The number of motorcycle registrations has been on the increase for the most part. However, the increase in registrations and fatalities was leveling off or decreasing during the last two years.

Multivehicle crashes in which motorcyclists were at fault usually involved violations of the road. Speeding too fast accounted for the largest portion of the violations. This implies that motorcyclists must become more aware of speed laws and following distances. Next to speeding was drinking, totaling 14% of the violations.

On the other hand, a large portion of the other motor vehicle driver's fault was failure to yield to the motorcycle driver, followed by drinking, and improper turns.

The data also indicated an increasing incidence of passenger fatalities. In 1976, 20% of the fatalities were passengers compared to 8.5% in 1974 and 1975. This strongly suggests that motorcycle drivers should be discouraged or prohibited from carrying passengers.

The relationship of helmet usage to motorcycle crashes has been noticed to have an effect on the number of fatalities or motorcycle death rate. This was evident in the "before", "during", and "after" data which showed a decrease of fatalities during the helmet usage period and an increase in motorcycle fatalities within the "after" period.

This suggests that motorcycle helmets are effective in reducing fatalities, probably at a relatively low cost. This also suggests that further research should be conducted in terms of utilizing cost-effectiveness studies of crash helmets.

TABLE 1
NUMBER OF MOTORCYCLE REGISTRATIONS, FATAL CRASHES,
FATALITIES, AND TOTAL CRASHES:
IOWA, 1960-1976

Year	Motorcycle Registrations	Fatal Crashes		Total Crashes
		Number	Fatalities	
1960	11,668	7	7	269
1961	11,959	7	7	257
1962	12,552	7	7	302
1963	13,962	11	11	418
1964	17,141	12	12	579
1965	25,778	19	19	1,041
1966	32,643	33	33	1,227
1967	37,645	26	26	1,181
1968	41,982	33	35	1,194
1969	48,293	26	28	1,176
1970	60,835	40	43	1,512
1971	78,902	41	42	1,835
1972	97,354	61	66	2,287
1973	118,545	68	72	2,925
1974	138,021	64	66	3,008
1975	148,669	61	62	2,669
1976	151,131	62	68	N.A.

TABLE 2
DISTRIBUTION OF MOTORCYCLE DRIVERS AND OTHER MOTOR
VEHICLE DRIVERS INVOLVED IN FATAL MOTORCYCLE CRASHES
BY AGE GROUP:
IOWA, 1974-1976

Age	Motorcycle Drivers		Other Motor Vehicle Drivers	
	#	%	#	%
16 & Under	18	9.3	2	1.9
17-19	42	21.6	17	16.3
20-24	72	37.1	19	18.3
25-34	43	22.2	27	26.0
35-44	10	5.1	17	16.3
45-54	4	2.1	8	7.7
55-64	4	2.1	5	4.8
65 & Over	—	—	8	7.7
Unknown	1	0.5	1	1.0
Total	194	100.0%	104	100.0%

$\chi^2 (7 \text{ d.f.}) = 46.07 \quad (p < .001)$

TABLE 3
DISTRIBUTION OF LICENSED DRIVERS QUALIFIED
TO OPERATE A MOTORCYCLE:
IOWA, 1976

Age Group	#	%
16	2,740	1.3
17	6,141	3.0
18	8,588	4.2
19	10,423	5.1
20	11,172	5.4
21	11,933	5.8
22	11,845	5.7
23	11,782	5.7
24	11,612	5.6
25-29	45,096	21.8
30-34	24,994	12.1
35-39	16,176	7.8
40-44	12,106	5.9
45-49	9,310	4.5
50-54	6,343	3.1
55-59	3,478	1.7
60-64	1,753	0.9
65-69	722	0.3
70-74	247	0.1
75 & Over	74	*
Total	206,535	100.0%

* Less than 0.1%

TABLE 4
FATAL MOTORCYCLE CRASHES BY MONTH:
IOWA, 1974-1976

Month	1974	1975	1976	1974-1976	%
January	—	—	—	—	—
February	1	1	—	2	1.1
March	3	—	3	6	3.2
April	2	2	2	6	3.2
May	7	7	8	22	11.8
June	13	18	10	41	21.9
July	15	19	19	53	28.3
August	8	5	7	20	10.7
September	11	2	7	20	10.7
October	1	5	4	10	5.3
November	3	2	1	6	3.2
December	—	—	1	1	0.5
Total	64	61	62	187	100.0%

TABLE 5
VIOLATIONS OF MOTORCYCLE DRIVERS AND OTHER MOTOR VEHICLE DRIVERS
INVOLVED IN FATAL CRASHES:
IOWA, 1974-1976

Motorcycle Driver			Other Motor Vehicle Driver													
			No Violations		Alcohol		Speed		Failed to Yield		Improper Turn		Improper Passing		Other	
Violations	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
No violations	38	38.0	—	—	5	13.2	6	15.8	17	44.7	5	13.2	—	—	5	13.2
Speed too fast	17	17.0	10	58.8	1	5.9	—	—	2	11.8	3	17.6	—	—	1	5.9
Failed to yield	6	6.0	6	100.0	—	—	—	—	—	—	—	—	—	—	—	—
Drove left of Center	5	5.0	5	100.0	—	—	—	—	—	—	—	—	—	—	—	—
Improper Passing	3	3.0	3	100.0	—	—	—	—	—	—	—	—	—	—	—	—
Had been Drinking	14	14.0	9	64.2	3	21.4	—	—	1	7.1	1	7.1	—	—	—	—
Not under Control	5	5.0	5	100.0	—	—	—	—	—	—	—	—	—	—	—	—
Ran Stop Sign	5	5.0	5	100.0	—	—	—	—	—	—	—	—	—	—	—	—
Others not Stated	7	7.0	4	57.1	1	14.3	—	—	—	—	—	—	—	—	2	28.6
Total	100	100.0%	47	47.0%	10	10.0%	6	6.0%	20	20.0%	9	9.0%	—	—	8	8.0%

TABLE 6
TOTAL MOTORCYCLE CRASHES BY MONTH:
IOWA, 1974-1975

Month	1974	1975	1974-1975	%
January	15	8	23	0.4
February	49	15	64	1.1
March	113	65	178	3.1
April	313	206	519	9.1
May	377	473	850	15.0
June	531	479	1,010	17.8
July	570	517	1,087	19.1
August	444	412	856	15.1
September	310	212	522	9.2
October	198	199	397	7.0
November	73	65	138	2.4
December	15	18	33	0.6
Total	3,008	2,669	5,677	100.0%

TABLE 9
MOTORCYCLE REGISTRATIONS:
IOWA, 1974-1976

County	1974	1975	1976
Adair	582	586	610
Adams	319	356	365
Allamakee	644	746	843
Appanoose	842	800	762
Audubon	335	388	405
Benton	992	1,098	1,159
Black Hawk	6,568	7,100	7,396
Boone	1,526	1,665	1,635
Bremer	1,152	1,266	1,384
Buchanan	1,035	1,168	1,230
Buena Vista	1,280	1,352	1,329
Butler	989	1,099	1,149
Calhoun	701	779	835
Carroll	832	961	1,020
Cass	937	1,044	1,047
Cedar	748	871	893
Cerro Gordo	1,844	2,040	2,138
Cherokee	1,063	1,178	1,228
Chickasaw	664	762	836
Clarke	351	346	354
Clay	1,137	1,230	1,248
Clayton	987	1,142	1,260
Clinton	1,930	2,145	2,260
Crawford	869	1,028	1,090
Dallas	1,734	1,920	1,949
Davis	379	391	377
Decatur	297	381	493
Delaware	997	1,035	1,015
Des Moines	2,681	2,873	2,856
Dickinson	764	804	861
Dubuque	3,716	3,881	3,754
Emmet	1,029	1,082	1,089
Fayette	1,107	1,209	1,293

Continued on Page 21

TABLE 9
MOTORCYCLE REGISTRATIONS:
IOWA, 1974-1976

County	1974	1975	1976
Floyd	1,139	1,285	1,354
Franklin	898	1,010	999
Fremont	485	521	525
Greene	741	752	745
Grundy	842	909	992
Guthrie	649	727	809
Hamilton	1,201	1,264	1,284
Hancock	844	867	864
Hardin	1,050	1,158	1,282
Harrison	723	806	847
Henry	995	1,094	1,119
Howard	428	489	572
Humboldt	824	954	973
Ida	502	551	582
Iowa	819	902	992
Jackson	1,023	1,144	1,132
Jasper	2,542	2,588	2,572
Jefferson	812	788	786
Johnson	2,632	2,855	2,916
Jones	1,020	1,078	1,083
Keokuk	688	732	755
Kossuth	1,367	1,570	1,650
Lee	2,083	2,176	2,123
Linn	6,550	7,105	7,305
Louisa	560	619	636
Lucas	584	630	631
Lyon	733	803	795
Madison	729	743	775
Mahaska	1,508	1,535	1,605
Marion	1,959	1,988	1,914
Marshall	2,284	2,524	2,513
Mills	549	546	575
Mitchell	678	729	766
Monona	654	686	753
Monroe	439	466	488
Montgomery	686	784	770
Muscatine	2,286	2,325	2,292
O'Brien	857	971	1,007

Continued on Page 22

TABLE 9
MOTORCYCLE REGISTRATIONS:
IOWA, 1974-1976

County	1974	1975	1976
Osceola	419	478	537
Page	754	823	858
Palo Alto	837	850	902
Plymouth	1,201	1,241	1,324
Pocahontas	824	908	923
Polk	12,952	13,628	13,204
Pottawattamie	3,782	4,081	4,034
Poweshiek	886	977	996
Ringgold	378	424	455
Sac	820	856	930
Scott	5,595	6,188	6,069
Shelby	627	712	765
Sioux	1,355	1,513	1,614
Story	3,223	3,456	3,394
Tama	1,196	1,292	1,306
Taylor	439	524	536
Union	666	683	670
Van Buren	459	483	497
Wapello	1,847	1,917	1,918
Warren	2,158	2,199	2,199
Washington	987	1,049	1,087
Wayne	378	399	408
Webster	2,614	2,805	2,719
Winnebago	800	875	898
Winneshiek	772	878	993
Woodbury	4,132	4,380	4,279
Worth	542	598	593
Wright	969	1,046	1,073
Total	138,006	148,663	151,125
Official	13	6	6
Grand Total	138,019	148,669	151,131

TABLE 10
MOTORCYCLE FATALITIES BY COUNTY:
IOWA, 1974-1976

County	1974	1975	1976	1974-1976
Adair	—	—	—	—
Adams	1	1	—	2
Allamakee	—	—	—	—
Appanoose	1	2	—	3
Audubon	—	—	1	1
Benton	—	1	1	2
Black Hawk	2	—	1	3
Boone	3	2	1	6
Bremer	—	—	—	—
Buchanan	—	—	—	—
Buena Vista	—	1	—	1
Butler	—	1	—	1
Calhoun	1	1	—	2
Carroll	—	1	1	2
Cass	—	—	—	—
Cedar	—	—	1	1
Cerro Gordo	1	2	1	4
Cherokee	—	—	—	—
Chickasaw	—	1	1	2
Clarke	—	—	—	—
Clay	—	—	—	—
Clayton	—	—	1	1
Clinton	3	—	1	4
Crawford	—	—	—	—
Dallas	—	—	3	3
Davis	1	—	1	2
Decatur	—	—	—	—
Delaware	—	—	1	1
Des Moines	—	1	1	2
Dickinson	1	1	1	3
Dubuque	1	2	1	4
Emmet	1	—	—	1
Fayette	—	1	—	1

Continued on Page 24

TABLE 10
MOTORCYCLE FATALITIES BY COUNTY:
IOWA, 1974-1976

County	1974	1975	1976	1974-1976
Floyd	1	—	2	3
Franklin	—	—	—	—
Fremont	—	—	—	—
Greene	—	—	—	—
Grundy	—	—	1	1
Guthrie	—	—	—	—
Hamilton	—	—	—	—
Hancock	3	—	2	5
Hardin	1	—	—	1
Harrison	—	1	—	1
Henry	—	2	—	2
Howard	—	—	1	1
Humboldt	—	—	—	—
Ida	—	—	1	1
Iowa	2	1	1	4
Jackson	1	1	—	2
Jasper	—	1	2	3
Jefferson	—	1	—	1
Johnson	3	3	—	6

Continued on Page 25

TABLE 10
MOTORCYCLE FATALITIES BY COUNTY:
IOWA, 1974-1976

County	1974	1975	1976	1974-1976
Jones	—	2	—	2
Keokuk	1	—	—	1
Kossuth	—	—	1	1
Lee	—	4	4	8
Linn	7	5	4	16
Louisa	—	—	—	—
Lucas	—	—	—	—
Lyon	—	1	1	2
Madison	—	—	—	—
Mahaska	—	—	1	1
Marion	—	—	—	—
Marshall	—	1	1	2
Mills	—	—	1	1
Mitchell	—	—	1	1
Monona	—	—	—	—
Monroe	—	—	—	—
Montgomery	1	—	—	1
Muscatine	3	—	1	4
O'Brien	—	—	—	—

Continued on Page 26

TABLE 10
MOTORCYCLE FATALITIES BY COUNTY:
IOWA, 1974-1976

County	1974	1975	1976	1974-1976
Osceola	—	—	—	—
Page	1	—	—	1
Palo Alto	1	—	—	1
Plymouth	—	—	—	—
Pocahontas	1	1	—	2
Polk	6	5	3	14
Pottawattamie	6	—	5	11
Poweshiek	1	1	—	2
Ringgold	—	1	—	1
Sac	—	—	—	—
Scott	2	3	4	9
Shelby	—	—	—	—
Sioux	—	—	—	—
Story	1	1	1	3
Tama	—	1	1	2
Taylor	—	—	—	—
Union	1	—	—	1
Van Buren	1	—	—	1
Wapello	1	2	—	3
Warren	1	—	3	4
Washington	—	—	1	1
Wayne	—	—	—	—
Webster	—	1	1	2
Winnebago	1	—	—	1
Winneshiek	2	1	—	3
Woodbury	1	4	6	11
Worth	—	—	—	—
Wright	—	—	—	—
Total	66	62	68	196

TABLE 11
MOTORCYCLE FATALITIES RANKED BY COUNTY:
IOWA, 1974-1976

Name of County	Number of Fatalities
Linn	16
Polk	14
Pottawattamie	11
Woodbury	11
Scott	9
Lee	8
Boone	6
Johnson	6
Hancock	5
Cerro Gordo	4
Clinton	4
Dubuque	4
Iowa	4
Muscatine	4
Warren	4
Appanoose	3
Black Hawk	3
Dallas	3
Dickinson	3
Floyd	3
Jasper	3
Story	3

Continued on Page 28

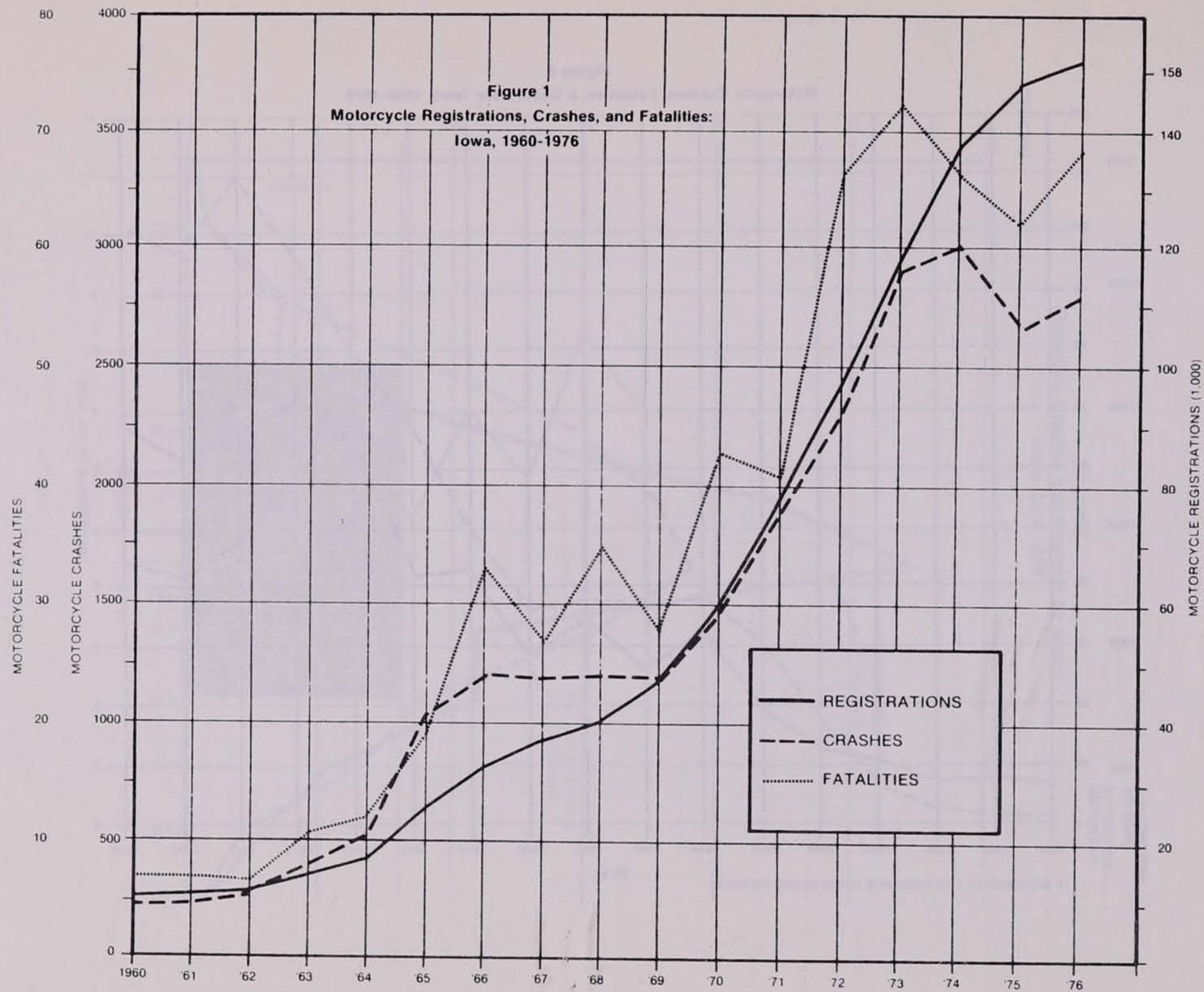


Figure 2
 Motorcycle Crashes, Fatalities, & Death Rate: Iowa, 1960-1976

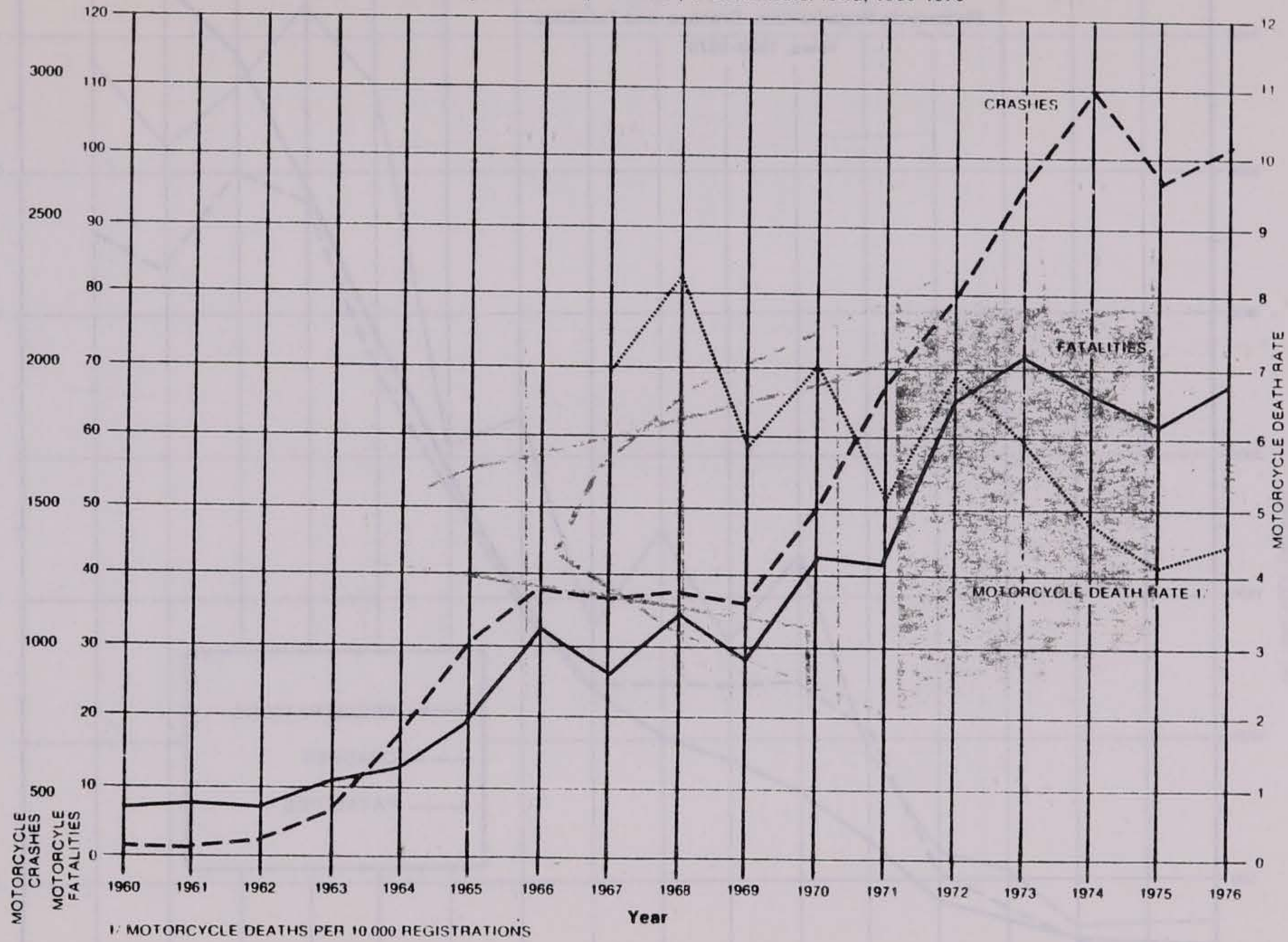


Figure 3
Motorcycle Crashes and Fatalities by Month:
Iowa, 1974-1976

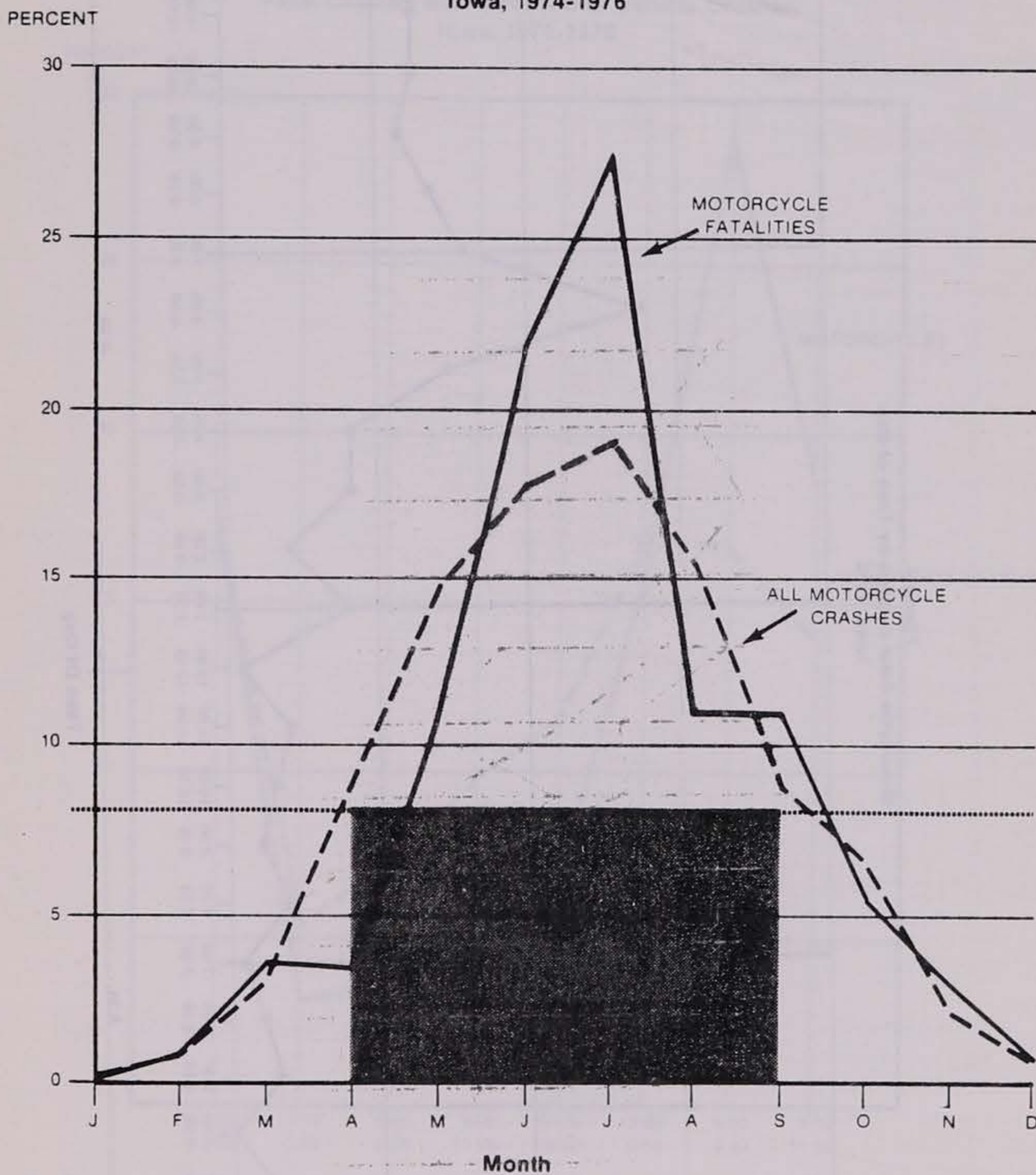


Figure 4
Motorcycle Fatal Crashes by Time of Day
Iowa, 1976

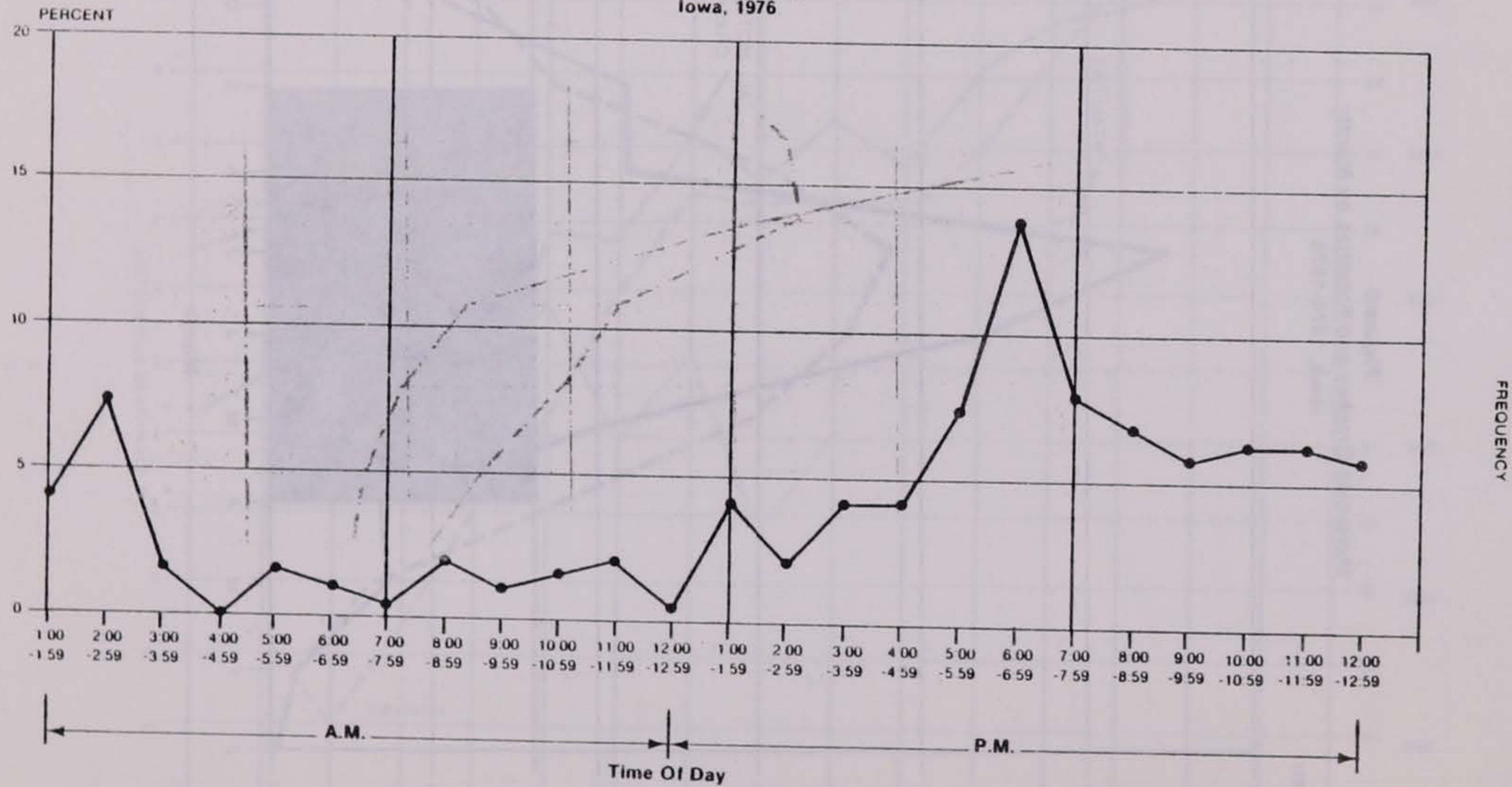


Figure 5
 Tri-Hourly Percent Distribution of Motorcycle
 Fatal Crashes and Other Motor Vehicle Crashes:
 Iowa, 1974-1976

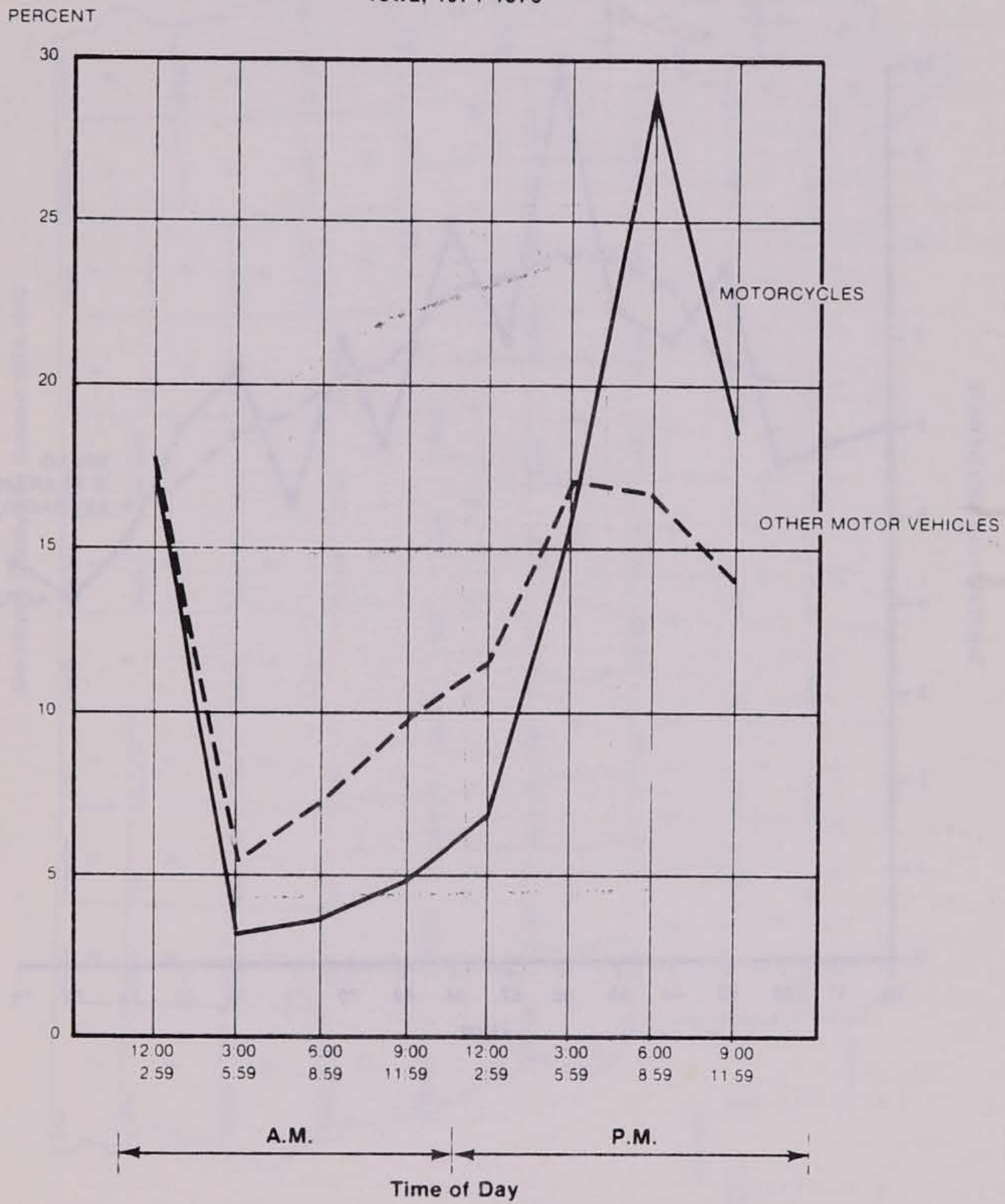


Figure 6
Motorcycle Death Rate (Deaths Per 10,000 Registrations):
Iowa, 1960-1976

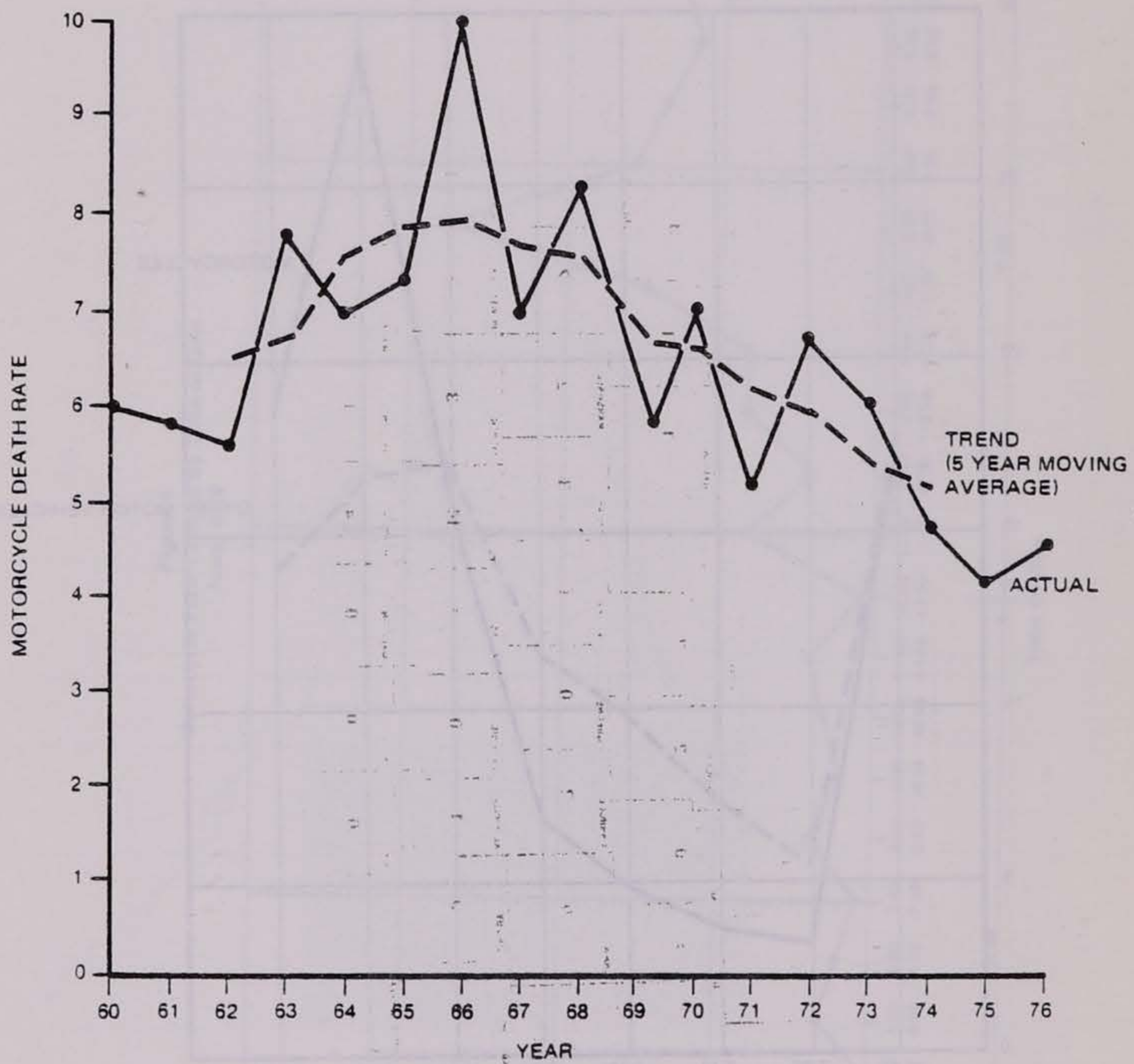
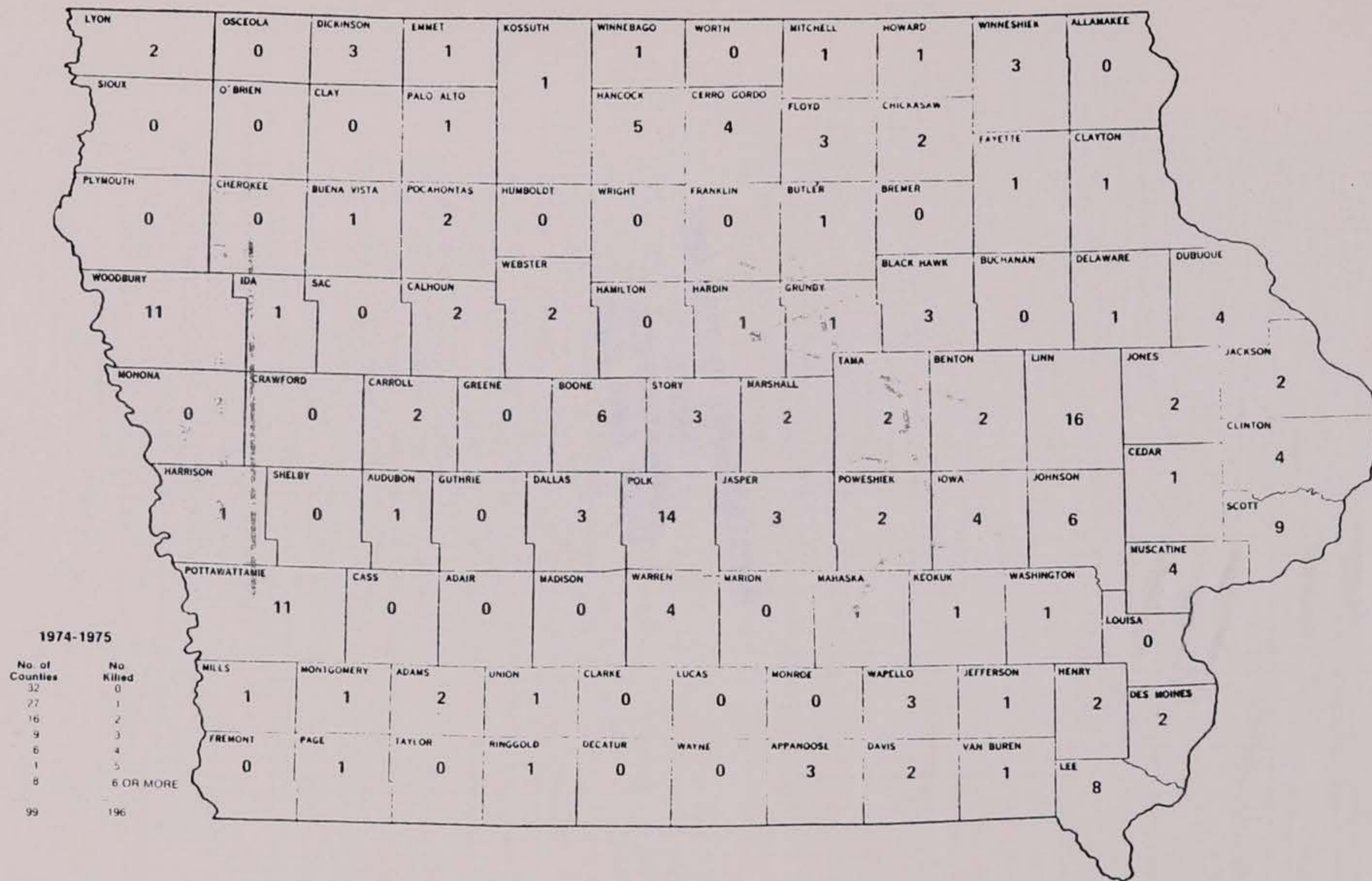


Figure 7
Motorcycle Crashes by County: 1974-1976



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