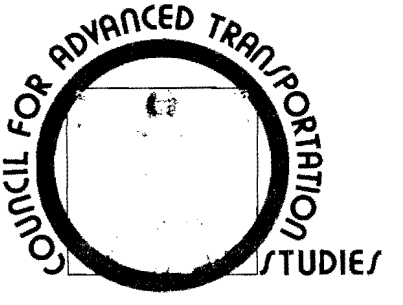
DEMOGRAPHIC VARIABLES AND ACCIDENTS

DEBORAH VALENTINE
MARTHA WILLIAMS
ROBERT K. YOUNG

RESEARCH REPORT 55

JANUARY 1978

TEXAS OFFICE OF TRAFFIC SAFETY



The University of Texas at Austin

RESEARCH REPORTS PUBLISHED BY
THE COUNCIL FOR ADVANCED TRANSPORTATION STUDIES

1 *An Integrated Methodology for Estimating Demand for Essential Services with an Application to Hospital Care.* Ronald Briggs, Wayne T. Enders, James A. Fitzsimmons, and Paul Jenson, April 1975 (DOT-TST-75-81).
2 *Transportation Impact Studies: A Review with Emphasis on Rural Areas.* Lidvard Skorpa, Richard Dodge, C. Michael Walton, and John Huddleston,October 1974 (DOT-TST-75-59).
4 *Inventory of Freight Transportation in the Southwest/Part I: Major Users of Transportation in the Dallas-Fort Worth Area.* Eugene Robinson, December 1973 (DOT-TST-75-29).
5 *Inventory of Freight Transportation in the Southwest/Part II: Motor Common Carrier Service in the Dallas-Fort Worth Area.* J. Bryan Adair and James S. Wilson, December 1973 (DOT-TST-75-30).
6 *Inventory of Freight Transportation in the Southwest/Part III: Air Freight Service in the Dallas-Fort Worth Area.* J. Bryan Adair, June 1974 (DOT-TST-75-31).
7 *Political Decision Processes, Transportation Investment and Changes in Urban Land Use: A Selective Bibliography with Particular Reference to Airports and Highways.* William D. Chipman, Harry P. Wolfe, and Pat Burnett, March 1974 (DOT-TST-75-28).
9 *Dissemination of Information to Increase Use of Austin Mass Transit: A Preliminary Study.* Gene Burd, October 1973.
10 *The University of Texas at Austin: A Campus Transportation Survey.* Sandra Rosenbloom, Jane Sentilles Greig, and Lawrence Sullivan Ross, August 1973.
11 *Carpool and Bus Matching Programs for The University of Texas at Austin.* Sandra Rosenbloom and Nancy J. Shelton, September 1974.
12 *A Pavement Design and Management System for Forest Service Roads–A Conceptual Study.* Final Report—Phase I. Thomas G. McGarragh and W. R. Hudson, July 1974.
13 *Measurement of Roadway Roughness and Automobile Ride Acceleration Spectra.* Anthony J. Healey and R. O. Stearman, July 1974 (DOT-TST-75-140).
14 *Dynamic Modelling for Automobile Acceleration Response and Ride Quality over Rough Roadways.* Anthony J. Healey, Craig C. Smith, Ronald O. Stearman, and Edward Nathman, December 1974 (DOT-TST-75-141).
15 *Survey of Ground Transportation Patterns at the Dallas/Fort Worth Regional Airport,Part I: Description of Study.* William J. Dunlay, Jr., Thomas G. Caffery, Lyndon Henry, and Douglas W.Wiersig, August 1975 (DOT-TST-76-78).
16 *The Prediction of Passenger Riding Comfort from Acceleration Data.* Craig C. Smith, David Y. McGehee, and Anthony J. Healey, March 1976.
17 *The Transportation Problems of the Mentally Retarded.* Shane Davies and John W. Carley, December 1974.
18 *Transportation-Related Constructs of Activity Spaces of Small Town Residents.* Pat Burnett, John Betak, David Chang, Wayne Enders, and Jose Montemayor, December 1974 (DOT-TST-75-135).
19 *The Marketing of Public Transportation: Method and Application.* Mark Alpert and Shane Davies, January 1975 (DOT-TST-75-142).
20 *The Problems of Implementing a 911 Emergency Telephone Number System in a Rural Region.* Ronald T. Matthews, February 1975.
23 *Forecast of Truckload Freight of Class I Motor Carriers of Property in the Southwestern Region to 1990.* Mary Lee Gorse, March 1975 (DOT-TST-75-138).
24 *Forecast of Revenue Freight Carried by Rail in Texas to 1990.* David L. Williams, April 1975 (DOT-TST-75-139).
28 *Pupil Transportation in Texas.* Ronald Briggs, Kelly Hamby, and David Venhuizen, July 1975.
30 *Passenger Response to Random Vibration in Transportation Vehicles–Literature Review.* A. J. Healey, June 1975 (DOT-TST-75-143).
35 *Perceived Environmental Utility Under Alternative Transportation Systems: A Framework for Analysis.* Pat Burnett, March 1976.
36 *Monitoring the Effects of the Dallas/Fort Worth Regional Airport,* Volume I: *Ground Transportation Impacts.* William J. Dunlay, Jr., Lyndon Henry, Thomas G. Caffery, Douglas W. Wiersig, and Waldo A. Zambrano, December 1976.
37 *Monitoring the Effects of the Dallas/Fort Worth Regional Airport,* Volume II: *Land Use and Travel Behavior.* Pat Burnett, David Chang, Carl Gregory, Arthur Friedman, Jose Montemayor, and Donna Prestwood, July 1976.
38 *The Influence on Rural Communities of Interurban Transportation Systems,* Volume II: *Transportation and Community Development: A Manual for Small Communities.* C. Michael Walton, John Huddleston, Richard Dodge, Charles Heimsath, Ron Linehan, and John Betak, August 1977.
39 *An Evaluation of Promotional Tactics and Utility Measurement Methods for Public Transportation Systems.* Mark Alpert, Linda Golden, John Betak, James Story, and C. Shane Davies, March 1977.
40 *A Survey of Longitudinal Acceleration Comfort Studies in Ground Transportation Vehicles.* L. L. Hoberock, July 1976.
41 *A Lateral Steering Dynamics Model for the Dallas/Fort Worth AIRTRANS.* Craig C. Smith and Steven Tsao, December 1976.
42 *Guideway Sidewall Roughness and Guidewheel Spring Compressions of the Dallas/Fort Worth AIRTRANS.* William R. Murray and Craig C. Smith, August 1976.
43 *A Pavement Design and Management System for Forest Service Roads–A Working Model.* Final Report—Phase II. Freddy L. Roberts, B. Frank McCullough, Hugh J. Williamson, and William R. Wallin, February 1977.
44 *A Tandem-Queue Algorithm for Evaluating Overall Airport Capacity.* Chang-Ho Park and William J. Dunlay, Jr., February 1977.
45 *Characteristics of Local Passenger Transportation Providers in Texas.* Ronald Briggs, January 1977.
46 *The Influence on Rural Communities of Interurban Transportation Systems,* Volume I: *The Influence on Rural Communities of Interurban Transportation Systems.* C.Michael Walton, Richard Dodge, John Huddleston, John Betak, Ron Linehan, and Charles Heimsath, August 1977.
47 *Effects of Visual Distraction on Reaction Time in a Simulated Traffic Environment.* C. Josh Holahan, March 1977.
48 *Personality Factors in Accident Causation.* Deborah Valentine, Martha Williams, and Robert K. Young, March 1977.
49 *Alcohol and Accidents.* Robert K. Young, Deborah Valentine, and Martha S. Williams, March 1977.
50 *Alcohol Countermeasures.* Gary D. Hales, Martha S. Williams, and Robert K. Young, July 1977.
51 *Drugs and Their Effect on Driving Performance.* Deborah Valentine, Martha S. Williams, and Robert K. Young, May 1977.
52 *Seat Belts: Safety Ignored.* Gary D. Hales, Robert K. Young, and Martha S. Williams, June 1978.
53 *Age-Related Factors in Driving Safety.* Deborah Valentine, Martha Williams, and Robert K. Young, February 1978.
54 *Relationship Between Roadside Signs and Traffic Accidents: A Field Investigation.* Charles J. Holahan, November 1977.
55 *Demographic Variables and Accidents.* Deborah Valentine, Martha Williams, and Robert K. Young, January 1978.
56 *Feasibility of Multidisciplinary Accident Investigation in Texas.* Hal L. Fitzpatrick, Craig C. Smith, and Walter S. Reed, September 1977.
57 *Modeling the Airport Terminal Building for Capacity Evaluation Under Level-of-Service Criteria.* Nicolau D. Fares Gualda and B. F. McCullough, forthcoming 1979.
58 *An Analysis of Passenger Processing Characteristics in Airport Terminal Buildings.* Tommy Ray Chmores and B. F. McCullough, forthcoming 1979.
59 *A User's Manual for the ACAP Model for Airport Terminal Building Capacity Analysis.* Edward V. Chambers III, B. F. McCullough, and Randy B. Machemehl, forthcoming 1979.
60 *A Pavement Design and Management System for Forest Service Roads–Implementation.* Final Report—Phase III. B. Frank McCullough and David R. Luhr, January 1979.
61 *Multidisciplinary Accident Investigation.* Deborah Valentine, Gary D. Hales, Martha S. Williams, and Robert K.Young, October 1978.
62 *Psychological Analysis of Degree of Safety in Traffic Environment Design.* Charles J. Holahan, February 1979.
63 *Automobile Collision Reconstruction: A Literature Survey.* Barry D. Olson and Craig C. Smith, forthcoming 1979.
64 *An Evaluation of the Utilization of Psychological Knowledge Concerning Potential Roadside Distractors.* Charles J. Holahan, forthcoming 1979.

DEMOGRAPHIC VARIABLES AND ACCIDENTS

Deborah Valentine
Martha Williams
Robert K. Young

RESEARCH REPORT 55

January 1978

Prepared by

Council for Advanced Transportation Studies
The University of Texas at Austin
Austin, Texas 78712

For

Texas Office of Traffic Safety
State Department of Highways and Public Transportation
Austin, Texas

The conclusions and opinions expressed in this document are those of the author and do not necessarily represent those of the State of Texas, the Texas Office of Traffic Safety, State Department of Highways and Public Transportation or any political subdivision of the State or Federal Government.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
DEMOGRAPHIC VARIABLES AND ACCIDENTS	January 1978
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Deborah Valentine, Martha Williams, Robert K. Young	Research Report 55
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Council for Advanced Transportation Studies The University of Texas at Austin Austin, Texas 78712	11. Contract or Grant No. (77) 7200-02-B
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Texas Office of Traffic Safety State Department of Highways and Public Transportation Austin, Texas	Research Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Highway transportation systems are usually designed with the "typical" driver in mind. The "typical" driver is a white male of middle class background. Research is reviewed in this monograph for accident data pertaining to women, minority groups and low economic status members. Although men have more accidents in terms of total numbers than women, accidents are a leading cause of death among women. Literature is scanty with regard to race, occupation and socio-economic status as factors in accidents. Generally, however, accidents occur more often to the less privileged groups. In addition, marital status seems related to driving performance. Married individuals, with certain exceptions, seem to be less often involved in accidents and to receive fewer violations.

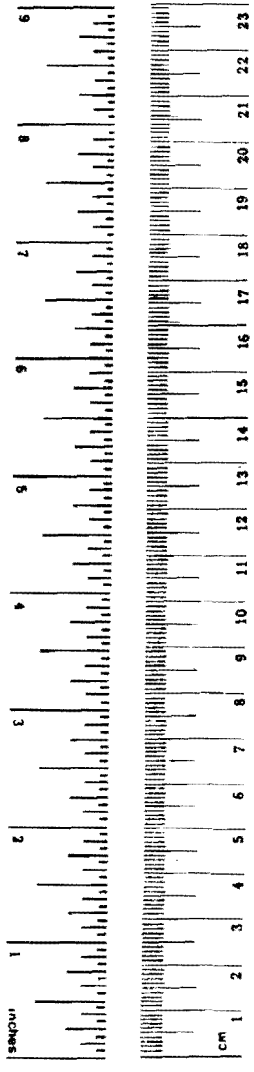
17. Key Words	18. Distribution Statement
Marital status, Occupational status, Social class	This document is available through the Council for Advanced Transportation Studies, U.T.-Austin, Austin, Texas 78712.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	39	

METRIC CONVERSION FACTORS

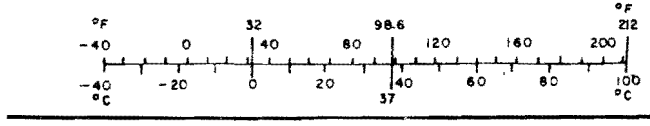
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



EXECUTIVE SUMMARY

Highway transportation systems are usually designed with the "typical" driver in mind. The typical driver is a white male of middle class background. Yet, many drivers are female, members of ethnic minority groups, and/or of upper or lower class background. Do such differences substantially affect driving behavior? If so, should highway designers, engineers, driver training specialists and others concerned with traffic safety take special cognizance of these demographic differences when planning and implementing programs? Do any of the statistical differences reported really make a practical difference?

To answer such questions a number of studies have been implemented over the years. Most have verified statistical differences between various demographic groups. Few have guided us regarding appropriate actions indicated. The general trends in the research to date are summarized in this report.

Although in terms of total numbers men have more accidents than women, accidents are a leading cause of death among women. Between 1960 and 1968 the death rate from motor vehicle accidents among women of various ages and ethnicity rose dramatically.[1] Sheppard, studying accidents in Great Britain in 1968, showed that sex differences in accident rates for men and women are at least partly due to experience, exposure, and type of vehicle driven.[2] More important in terms of prevention strategies is the work of Harrington and McBride showing differences in types of violations committed by males and females.[3] Males were seven times more often cited for inadequate equipment,

---

[1] "Rise in Accidental Deaths Among Women," Metropolitan Life Statistical Bulletin, 56 (October 1972), p. 6.

[2] D. Sheppard, Characteristics of Drivers Obtained from Large Scale Enquiries (Crawthorne, Berkshire, Great Britain: Road Research Laboratory: Department of the Environment, 1971), pp. 1-20.

[3] D.M. Harrington and R.A. McBride, "Traffic Violations by Type, Age, Sex and Marital Status," Accident Analysis and Prevention, 2, No. 1 (May 1970), pp. 67-79.

received major violations five times as often and were twice as often cited for right-of-way violations. However, exposure was not controlled in this study. Robertson and Baker, also in a study not controlling exposure, showed women to be less often involved in fatal crashes and to have fewer convictions prior to fatal accidents.[4] However, Burg collected data and controlled for exposure.[5] He claims that male/female differences disappear when exposure is taken into account. He does verify differences, however, in types of violations committed. Men were more often cited for drunken driving, hit and run, reckless driving and faulty equipment. Women were more often cited for failure to stop, failure to yield the right of way and turning violations. Hagen, in a simulator study of driving performance, showed sex differences in psychomotor performance with males and females making different kinds of driving errors.[6]

Marital status also seems related to driving performance: married individuals with certain exceptions seem to be less often involved in accidents and to receive fewer violations.[7] Hyman reports findings where exposure was controlled and found that married versus separated/divorced men differ primarily at older (over 44) and younger (under 25) ages, whereas for females marital status differences generally decreased with age.[8]

Although the literature is scanty with regard to race, occupation and socio-economic status as factors in accidents, some studies do report differences. Generally, accidents occur more often to the less privileged groups.

---

[4] L.S. Robertson and S.P. Baker, "Prior Violation Records of 1447 Drivers Involved in Fatal Crashes," paper prepared for the Maryland Motor Vehicle Administration, Baltimore, Maryland, September 1974.

[5] A. Burg, Traffic Violations in Relation to Driver Characteristics and Accident Frequency (Los Angeles, California: Institute of Transportation and Traffic Engineering, California Department of Transportation, June 1974).

[6] R.E. Hagen, "Sex Differences in Driving Performance," Human Factors, 17, No. 2 (1975), pp. 165-171.

[7] R.C. Peck, R.S. Coppin and W.C. Marsh, "Driver Record by Age, Sex and Marital Status," Highway Research Record, 163 (1967), pp. 54-67.

[8] M.M. Hyman, "Accident Vulnerability and Blood Alcohol Concentrations of Drivers by Demographic Characteristics," Quarterly Journal of Studies on Alcohol, 4 (1968), pp. 34-57.

For example, Hyman reports Blacks of all educational categories to have more accidents than whites, and the unskilled or semi-skilled to have more accidents than professional or executive groups.[9] Zylman reports that lower class drivers are more often involved in collisions than are those in upper classes but that whites and Blacks matched for age and class show similar collision rates.[10] Racial differences in other words may be primarily a result of class differences and studies should control for this possibility.

Malek suggests that low socio-economic status is coupled with an environment producing accidents (overcrowding, poor attitudes, physical hazards, etc.).[11] Levonian and Case affirm that poor attitudes (lack of caution, expediency and defensiveness) are more characteristic of individuals from the lower social classes.[12]

Finally, one must be careful in accepting the demographic differences reported above. McGuire found biases in the reporting of accidents by police officers.[13] Although there were no age and race differences, accidents involving females, semi-professional and professional groups were underreported in official records. Furthermore, the young, males and non-caucasians were overrepresented in the reporting of traffic violations.

Perhaps the most productive future research in this area would compare the driving skills of different demographic groups in carefully controlled laboratory settings. Complex interaction effects of sex, marital status, attitudes, social class and ethnicity seem likely given the findings reported above. Only well-designed factorial studies controlled for exposure and setting are likely to shed further light in this area of investigation.

---

[9] Ibid.

[10] R. Zylman, "Race and Social Status Discrimination and Police Action in Alcohol-Affected Collisions," Journal of Safety Research, 4, No. 2 (June 1972), pp. 75-84.

[11] L. Malek, "Social Factors in Accidents," Dissertation, The American University (Washington, D.C.), 1968.

[12] E. Levonian and H.W. Case, "Behavioral and Demographic Correlates of Responses to a Driving Questionnaire," Proceedings of the Highway Research Board, 40 (1961), pp. 582-592.

[13] F.L. McGuire, "The Nature of Bias in Official Accident and Violation Records," Journal of Applied Psychology, 57, No. 3 (June 1973), pp. 300-305.

ACKNOWLEDGMENTS

The authors wish to gratefully acknowledge the research assistance of Gary Hales and the secretarial assistance of Nancy Craft, Kay Schauer and Sandy Bannister whose contributions to this report were invaluable. We would also like to commend Del Ervin and Mildred Martin for library assistance and Art Frakes for editorial assistance. We appreciate the efforts and contributions of these talented individuals.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

Driver demographic information (such as the sex of the driver, his/her marital status, occupation, race and socio-economic status) is potentially useful in law enforcement, licensing, and vehicle and highway design. Establishing relationships between driver characteristics and highway safety can provide information necessary to implement insightful and effective safety countermeasure programs, including specialized driver training, education and enforcement procedures, as well as providing general awareness of the most accident vulnerable group of drivers.

The assessment of driving performance is critical to the evaluation and improvement of highway safety. At the present time, highway transportation systems are developed primarily on the basis of information regarding white, middle class male drivers.[1] On the basis of these driver evaluations, highways and automobiles are designed, driver's licenses are issued, laws are passed and enforced and accident countermeasures are implemented. However, several research studies have addressed themselves to women and non-white drivers. Marital status, occupation and socio-economic status also have been studied in relation to highway safety and driving performance.

The etiology of the accident process has generally been studied within the framework of the accident prone personality or the epidemiological approach. Both of these approaches have limitations when an attempt is made to incorporate accident research into a single theoretical framework. Malek considers the limitations of the accident prone model to include:

1. the fact that no stable personality trait or configuration which can be defined as accident proneness has ever been isolated (in other words, accident proneness is usually defined after the fact), and
2. the fact that future accident rates of individuals cannot be predicted accurately on the basis of past accident records.[2]

---

[1] R.E. Hagen, "Sex Differences in Driving Performance," Human Factors, 17, No. 2 (1975), pp. 165-171.

[2] L. Malek, "Social Factors in Accidents," Dissertation, The American University (Washington, D.C.), 1968.

The epidemiological approach (interaction between agent, host and environment) in accident investigation also has serious limitations according to Malek. She states that "the difficulty in applying the approach to accident research is that often the agent cannot be recognized or separated from the environment."[3]

Malek suggests that since accidents and resultant injuries invariably occur in a socio-cultural context, an analysis of socio-cultural variables may provide a relational framework within which accident situations occur and attitudes, motivations and responses to risk and hazard are learned. Group membership and demographic characteristics would thus be very important in the evaluation of accident causation.

In the first section of this report, the sex of drivers is discussed, compared and evaluated in terms of accident occurrence, driving record and driving performance. The subsequent sections deal primarily with the marital status, race, occupation and socio-economic status of drivers as variables important to highway safety.

---

[3]Ibid., p. 271.

II. SEX AS A FACTOR IN ACCIDENTS

Automobile accident research comparing the driving records and performances of women as compared to men is frequently misinterpreted. Women tend to deemphasize the risk of highway accidents due to their lower accident rate as compared to men. Accidents of all kinds, however, are a leading cause of deaths among women.

> Accidental deaths rank second among the causes of death for women in the United States at ages 15 through 44, with only cancer taking a greater number of their lives each year. Among young women in the age range of 15 through 24 fatal accidents are the leading cause of death, and in 1968 accounted for over 40 percent of all deaths.[4]

Figures 1 and 2 and Table 1 show the mortality from accidents among women aged 15 through 64 by age and race in the United States for the years 1960, 1964 and 1968. It is apparent that the accident death rate among women per 100,000 is increasing. Among white women aged 15 through 64 years, the death rate from all types of accidents, adjusted for changes in the age composition of the population, rose from 19.0 per 100,000 in 1960 to 24.2 per 100,000 in 1968, or by more than one-fourth. A smaller increase was experienced by non-white women. Most of these increases were concentrated at the younger ages. The death rate from all types of accidents is rather high among white women at ages 15 through 19, decreases to a minimum at ages 25 through 34, but thereafter rises with advancing age. Among non-white women, on the other hand, the accidental death rate increases progressively with age.

Most of the increase in the accidental death rate among women at ages 15 through 44 is due to a rise in motor vehicle fatalities. Between 1960 and 1968 the death rate from motor vehicle accidents among white women rose by more than two-fifths at ages 15 through 24 and by almost as much at ages 25 through 44. Among non-white women, the motor vehicle accident death rate increased by about one-third at ages 15 through 24 and by about two-thirds at ages 25 through 44.

---

[4] "Rise in Accidental Deaths Among Women," Metropolitan Life Statistical Bulletin, 56 (October 1972), p. 8.

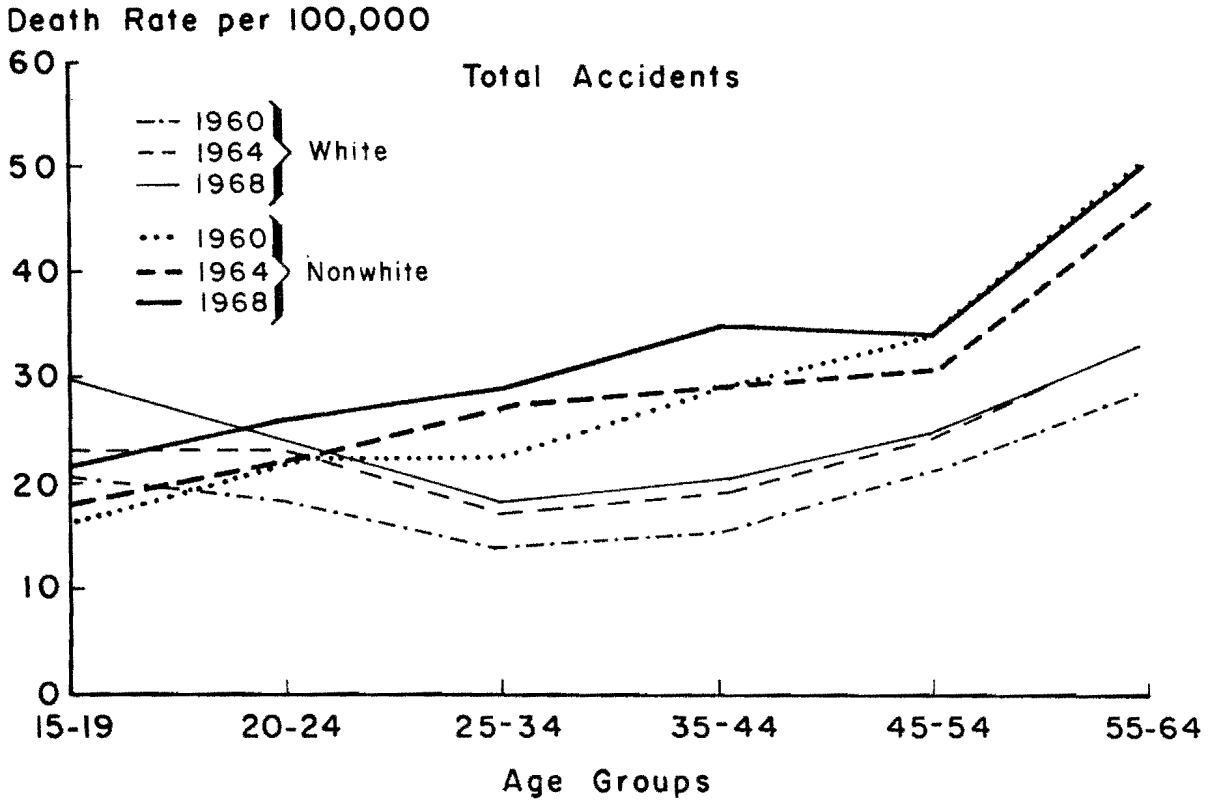


Figure 1. Mortality from total accidents among women, by selected age groups, in the United States, in 1960, 1964 and 1968.[5]

[5]"Rise in Accidental Deaths Among Women," Metropolitan Life Statistical Bulletin, 56 (October 1972), p. 7.

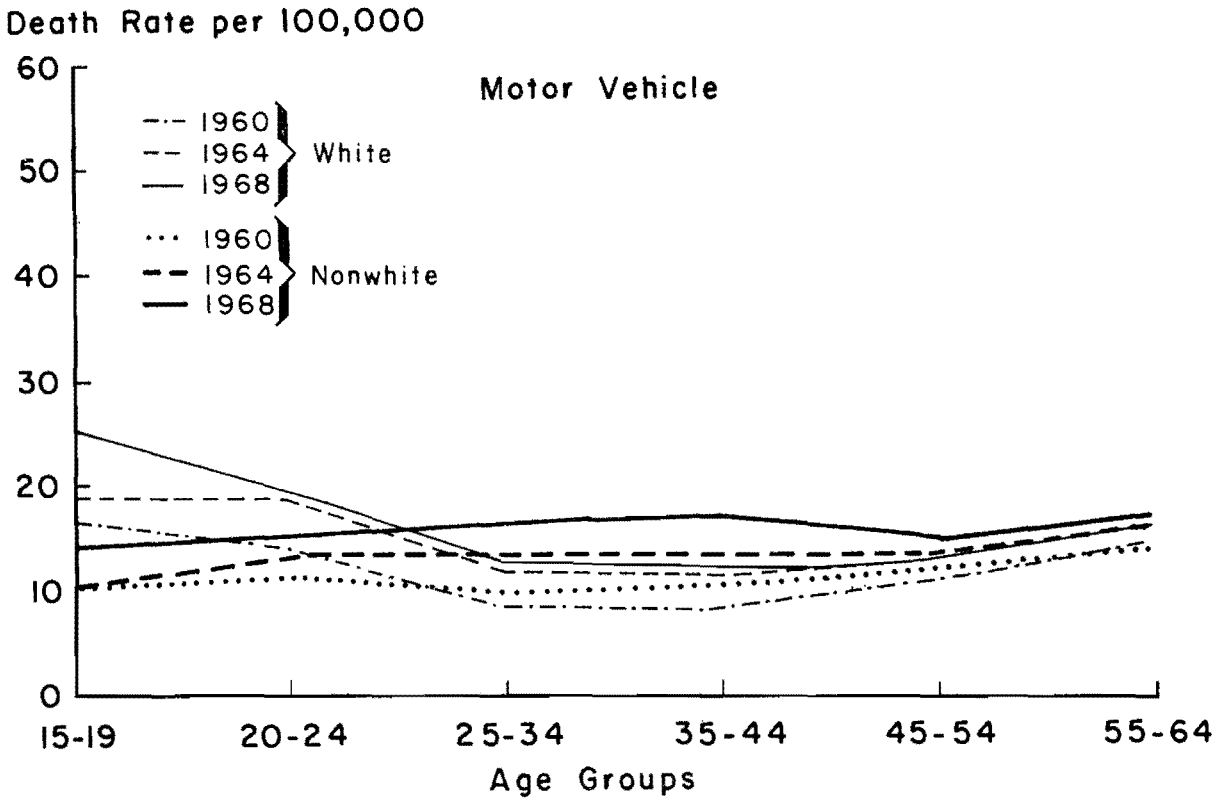


Figure 2. Mortality from motor vehicle accidents among women, by selected age groups, in the United States, in 1960, 1964 and 1968.[6]

[6]"Rise in Accidental Deaths Among Women," Metropolitan Life Statistical Bulletin, 56 (October 1972), p. 7.

TABLE 1. MORTALITY FROM ACCIDENTS AMONG WOMEN, AGES 15-64

By Age and Color, United States, 1960, 1964, 1968.[7]

Death Rate Per 100,000

Age and Color	1960 Total Accidents	1960 Motor Vehicle	1960 All Other	1964 Total Accidents	1964 Motor Vehicle	1964 All Other	1968 Total Accidents	1968 Motor Vehicle	1968 All Other
				White					
15-64*	19.0	11.9	7.1	22.5	14.9	7.6	24.2	16.0	8.2
15-24	19.7	15.6	4.1	23.4	19.3	4.1	27.5	22.7	4.8
25-44	14.9	9.0	5.9	18.3	12.0	6.3	19.3	12.6	6.7
45-64	25.0	13.1	11.9	28.7	15.5	13.2	29.2	15.1	14.1
				Non-white					
15-64*	28.8	11.6	17.2	29.1	13.9	15.2	32.7	16.5	16.2
15-24	19.6	11.2	8.4	20.3	12.4	7.9	24.1	15.2	8.9
25-44	26.1	10.6	15.5	28.8	14.0	14.8	32.4	17.5	14.9
45-64	41.5	13.5	28.0	37.7	15.2	22.5	41.2	16.2	25.0

*Adjusted on Basis of age distribution of United States total population, 1940.
Source of basic data Reports of the Division of Vital Statistics, National Center for Health Statistics.

[7]"Rise in Accidental Deaths Among Women," Metropolitan Life Statistical Bulletin, 56 (October 1972), p. 6.

The high proportion of women fatally injured in highway accidents indicates the urgent need for further research, evaluation and countermeasure techniques to combat this trend. Highway safety research focuses primarily on the comparison between male versus female driving performance. Variables such as exposure and type of vehicle driven must be accounted for before any results can be adequately considered.

Sheppard surveyed 595 male drivers and 179 female drivers randomly sampled from Great Britain.[8] Table 2 shows the mileage driven in 12 months (1968) by both men and women. It is clear that men accumulate higher mileage than women which reflects a higher experience factor as well as a greater exposure to possible accidents among male drivers. Sheppard also reports (Table 3) that although both men and women primarily drive automobiles, men also drive other types of vehicles, e.g., vans, taxi cabs, motorcycles, buses, etc., in greater numbers. This may account for the higher risk factor among men with regard to traffic safety. One must keep in mind, however, that this information was collected in 1968 and the proportion of drivers who are women is increasing.[9] Although comparisons between the driving performances and records of men and women are important, equally essential in evaluating and providing effective drivers education and countermeasure strategies is determining the type of driving violation most frequently committed by women and men.

Harrington and McBride collected data on 147,984 drivers whose licenses ended in 00 or 01 during the period between September 1963 and March 1964.[10] They found that when all types of violations were analyzed together, the male

---

[8] D. Sheppard, Characteristics of Drivers Obtained from Large Scale Enquiries (Crawthorne, Berkshire, Great Britain: Road Research Laboratory: Department of the Environment, 1971), pp. 1-20.

[9] Ibid.; and "Rise in Accidental Deaths Among Women," op.cit., p. 8.

[10] D.M. Harrington and R.A. McBride, "Traffic Violations by Type, Age, Sex and Marital Status," Accident Analysis and Prevention, 2, No. 1 (May 1970), pp. 67-79.

TABLE 2. MILEAGE DRIVEN IN 12 MONTHS (1968) BY 595 MALE AND 179 FEMALE DRIVERS IN GREAT BRITAIN.[11]

Miles driven	Percentage of men drivers	Percentage of women drivers	Percentage of all drivers
None	2	2	2
1000 or less	12	48	20
1001-3000	11	26	15
3001-6000	14	9	13
6001-10,000	24	9	21
10,001-20,000	25	4	20
20,001 or more	13	1	10
Base total	608	182	790

[11] D. Sheppard, Characteristics of Drivers Obtained from Large Scale Enquiries (Crawthorne, Berkshire, Great Britain: Road Research Laboratory: Department of the Environment, 1971), p. 5.

TABLE 3. PERCENTAGES OF MEN AND WOMEN DRIVING DIFFERENT TYPES OF VEHICLES IN GREAT BRITAIN IN 1968.[12]

Vehicle	Percentage of men drivers	Percentage of women drivers	Percentage of all drivers
Car	86	96	89
Van	18	1	15
Lorry	10	0	8
Motor cycle	7	1	5
Scooter/moped	5	2	4
Bus/coach	4	0	3
Other	3	1	2
Base total	595	179	774

[12]D. Sheppard, Characteristics of Drivers Obtained from Large Scale Enquiries (Crawthorne, Berkshire, Great Britain: Road Research Laboratory: Department of the Environment, 1971), p. 6.

rate was approximately three times that of the female.[13] More specifically, the study also indicated that males averaged seven times as many violations related to inadequate equipment maintenance (equipment violations) and five times as many major violations as females, but only two times as many right-of-way violations as women. Exposure (number of miles driven) and experience were not controlled for in this study. The figures do, however, reflect the raw accident and violation rates for men and women.

In another study evaluating 1,447 fatal crashes in Maryland in 1970 and 1971, Robertson and Baker illustrate (Figure 3) that women were involved in fatal crashes at consistently lower rates per 100,000 drivers than men, except among those women with more than two convictions for violations for the three year period before the fatal crash.[14] In addition, they reported that only four percent of women drivers, compared with six percent of men drivers in fatal crashes, had more than two prior convictions. Over 71 percent of female drivers and 48 percent of male drivers in fatal crashes had no convictions in the three years prior to the fatal accident. Exposure was not controlled in this study.

Burg collected data, controlling for exposure, and interviewed 14,831 California drivers, aged 18 to 92, who held driver's licenses for a three year period.[15] From the same sample, he extrapolated data for 7,841 drivers who held driver's licences for the six year period preceding the study. He found that although males have more accidents and convictions per unit time than do females and a smaller percentage are conviction-free drivers during any given time period, the male/female difference in accident and conviction rate tends

---

[13] R.C. Peck, R.S. Coppin and W.C. Marsh, "Driver Record by Age, Sex and Marital Status," Highway Research Record, 163 (1967), pp. 54-67, found similar results indicating that males have approximately two times as many driver record incidents (accidents and citations) as females in their study of 165,843 California drivers during 1961-1963. Exposure was not controlled.

[14] L.S. Robertson and S.P. Baker, "Prior Violation Records of 1,447 Drivers Involved in Fatal Crashes," paper prepared for the Maryland Motor Vehicle Administration, Baltimore, Maryland, September 1974.

[15] A. Burg, Traffic Violations in Relation to Driver Characteristics and Accident Frequency (Los Angeles, California: Institute of Transportation and Traffic Engineering, California Department of Transportation, June 1974).

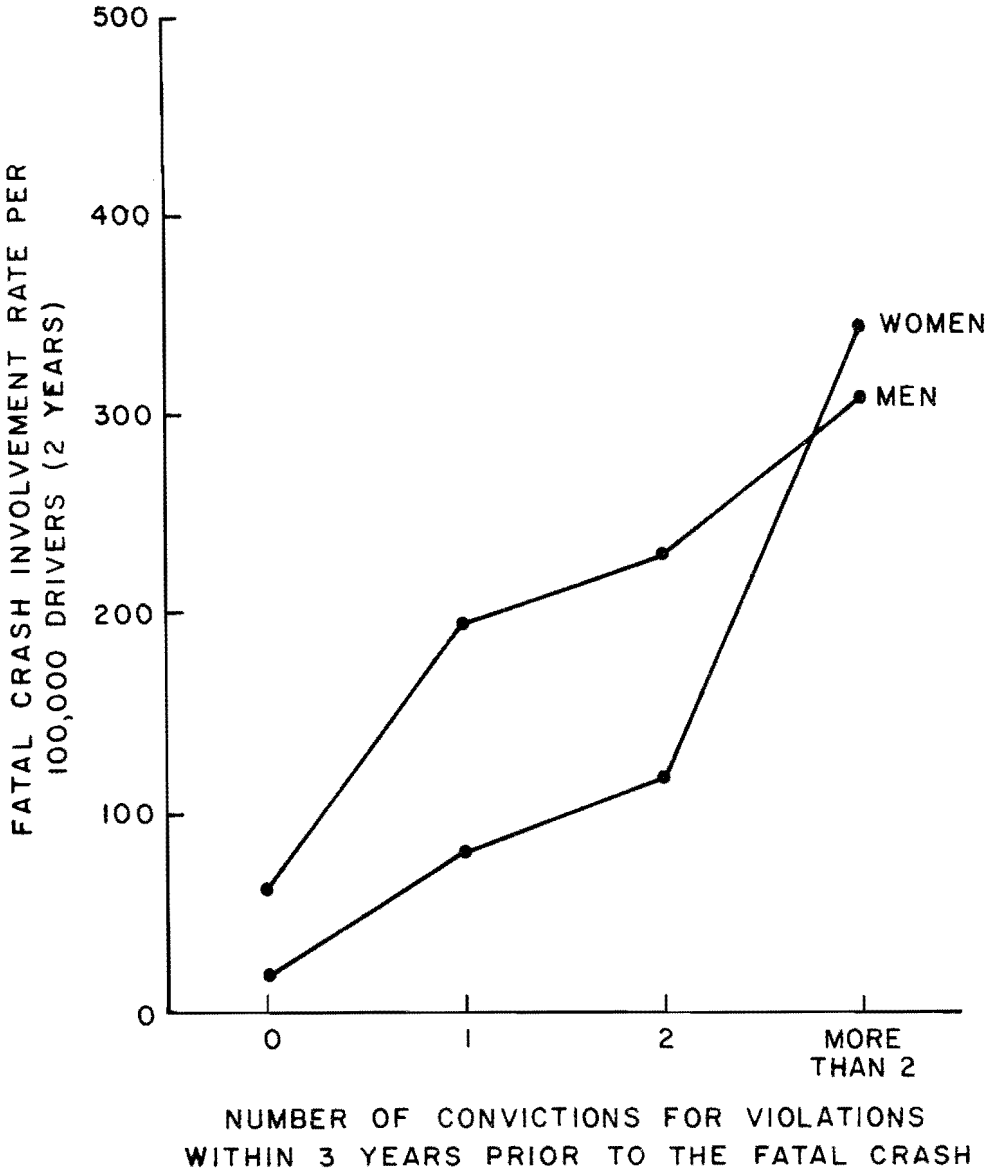


Figure 3. Fatal crash involvement rate per 100,000 drivers in two years by sex and number of convictions for violations within 3 years prior to the fatal crash .[16]

[16] L. S. Robertson and S. P. Baker, "Prior Violation Records of 1447 Drivers involved in Fatal Crashes," paper prepared for the Maryland Motor Vehicle Administration, Baltimore, Maryland, September 1974.

to disappear when exposure is taken into account. The author also reported that, for males, prior accidents are much more highly correlated with subsequent accidents than are prior convictions. The reverse is true for females. Burg's findings also indicate that fewer accidents are significantly associated with women not working outside the home ("housewives"). He speculates that this may be due to an exposure factor, i.e., housewives may drive less overall or less during hazardous times.

Burg's study also found that males have significantly more equipment violations and other violations related to obedience to laws and regulations. Males also experience a disproportionately large number of major violations such as drunken driving, hit and run and reckless driving. Men do not, however, show more excessive speed violations than women. Females, on the other hand, were found to have significantly more violations related to improper or hazardous driving such as failure to stop for traffic control devices, failure to yield right-of-way to other vehicles and turning violations. It is interesting to note that had exposure been controlled in the Harrington and McBride study, the types of violations might have more closely resembled the results of the Burg study.

Hyman used subjects from the Grand Rapids study of 9,353 individuals involved in accidents and an additional 8,008 in a control group.[17] One of the results reported suggested that since women drive less and do not have the same distribution of times and places for driving as men, that "when exposure to driving is taken into account, women are slightly more likely to get into an accident than men."[18] Hagen, on the other hand, found contrary results.[19] He measured driving performance in a simulated driving environment with a car simulator for 89 men and 74 women. Hagen reported that the group means revealed that males had a larger positive constant error and a

---

[17] M.M. Hyman, "Accident Vulnerability and Blood Alcohol Concentrations of Drivers by Demographic Characteristics," Quarterly Journal of Studies on Alcohol, Supplement No. 4 (1968), pp. 34-57.

[18] Ibid., p. 35.

[19] Hagen, op.cit.

higher mean speed and produced more accelerator in-put than females. Also, the group means showed that females were more consistent in their operation of the accelerator than males. He concludes that the "results of this investigation demonstrated that there are sex differences in psychomotor performance found in the execution phase of the driving task."[20]

There appear to exist differences between the driving performances of men and women. At the present time, the results are confused and obscured due to research which does not control for exposure and the variation in measuring performance. Further research and duplication of existing research are undoubtedly needed. Burg suggests that there is a need to conduct a study which will "determine the most common violation patterns or combinations that appear on multiple-violation convictions, and ascertain how these patterns vary as a function of such variables as age and sex."[21]

Hagen recommends a reevaluation of selection, training and countermeasure techniques, which he states have been based primarily on male driving performance data.[22] He suggests, for example, that differential treatment of young male and female drivers might be needed during drivers education. Drivers education courses could use different teaching techniques or materials according to the sex of the driver if differential performance skills were verified by further research.

---

[20] Ibid., p. 170.

[21] Burg, op.cit., p. 48.

[22] Hagen, op.cit.

III. MARITAL STATUS AS A FACTOR IN ACCIDENTS

Relationships between highway safety and marital status have been found in numerous studies. Peck, Coppin and Marsh surveyed 97,281 male California drivers and 68,562 female California drivers during 1961-1963.[23] Although exposure was not controlled, general tendencies can be inferred from the results pertaining to marital status and accident/violation records. Peck, Coppin and Marsh show the mean citation and accident frequency by age, sex and marital status (Figures 4 and 5). As can be seen, married female drivers had driving records that were superior to those of single female drivers for all age groups. Single females, in fact, were found to have approximately twice the accident and violation rate of married females. Similarly, married men had driving records superior to those of single men with the exception of the youngest group of married men. Relative to both citation and accident frequency, the greatest similarity was found between married men and single women. Furthermore, there was a definite tendency for driver record differences between married men and single women to decrease with age. Also, driver record differences with respect to citations were greater than differences with respect to accidents.

In general, Peck, Coppin and Marsh conclude that "for both sexes, marital status was found to have exerted a significant effect on driving record (both accidents and citations). Generally speaking, single drivers had a higher accident and citation frequency than married drivers."[24] In addition, they report that for both accidents and violations, there was a significant interaction between marital status and age, indicating that marital status did not exert a constant effect on driving record throughout the age distribution.

In another study which analyzed the relationship between marital status and driver record, Harrington and McBride surveyed 147,984 licensed drivers.[25] Again, exposure was not controlled and results must be evaluated accordingly.

---

[23] Peck, Coppin and Marsh, op.cit.

[24] Ibid., p. 66.

[25] Harrington and McBride, op.cit.

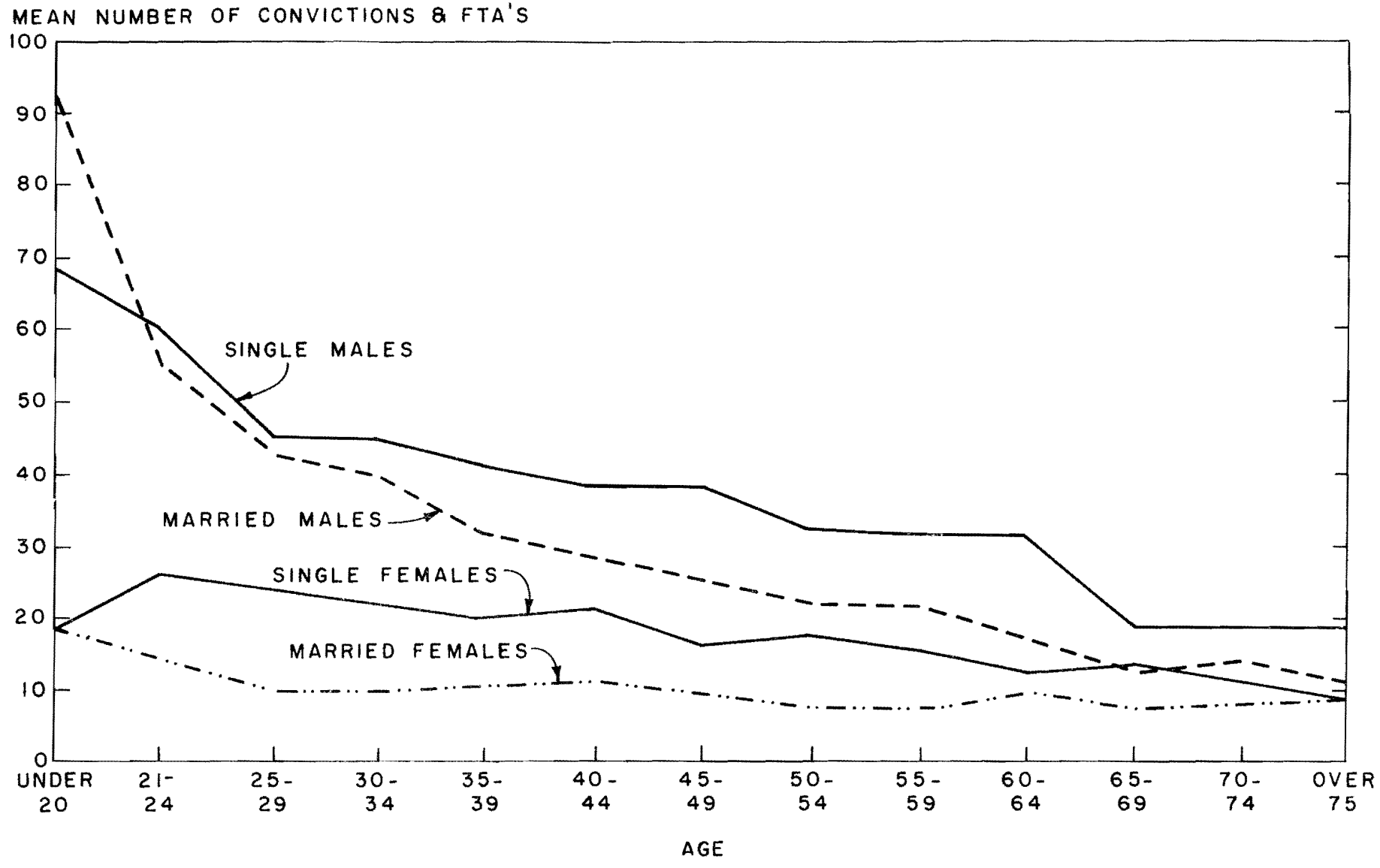


Figure 4. Mean citation frequency by age, sex and marital status (1-year driving record, 1962) for 97,281 male California drivers and 68,562 female California drivers.[26]

[26] R.C. Peck, R.S. Coppin, and W.C. Marsh, "Driver Record by Age, Sex and Marital Status," Highway Research Record, 163 (1967), p.59.

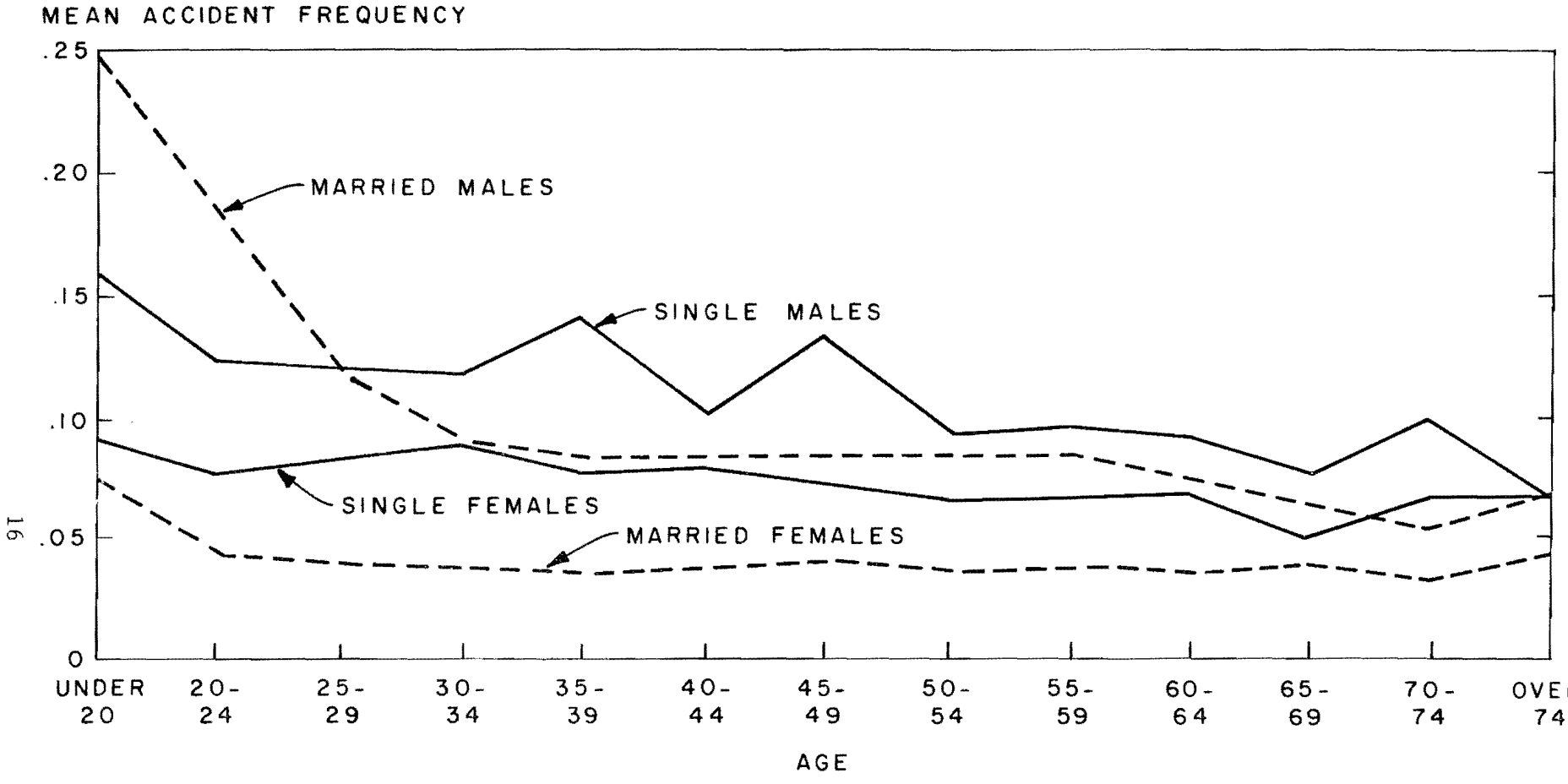


Figure 5. Mean accident frequency by age, sex and marital status (1-year driving record, 1962) for 97,281 male California drivers and 68,562 female California drivers.[27]

[27] R.C. Peck, R.S. Coppin, and W.C. Marsh, "Driver Record by Age, Sex, and Marital Status," Highway Research Record, 163 (1967), p. 60.

They found results similar to those reported previously. Single drivers (male and female) were found to have a greater average number of each type of violation. For example, single males averaged twice as many speed violations as married males (controlling for age). Overall, this study indicated that single males average 1.7 times as many violations as married males and single females average 1.9 times as many violations as married females.

Hyman, in a study cited earlier, also evaluated the relationship between marital status and driving record.[28] Information was accumulated from the Grand Rapids study and driving exposure was controlled. Hyman reports that, although single males over 44 years of age are more than twice as accident vulnerable as married males over 44 years of age, the difference between single males and married males under 45 is slight.[29] Hyman also reported that divorced and separated men who were under 25 and over 44 had higher accident vulnerability ratios. Among women, the divorced and separated manifested a tendency to have a higher accident vulnerability ratio than married females, a difference that decreased with age.

The Hyman study results differ greatly from the previously mentioned research describing the relationship between marital status and driving record. The fact that exposure was controlled in the Hyman study certainly lends more credence to the findings; however, since a duplication of this study is not available at this time, the results cannot be considered conclusive.

---

[28] Hyman, op.cit.

[29] Accident vulnerability is the ratio calculated by dividing the percentage of accident involved drivers by the percentage of control drivers in each category.

IV. OCCUPATION, RACE AND SOCIO-ECONOMIC STATUS AS FACTORS IN ACCIDENTS

Occupational status and race are closely related to socio-economic status. For this reason, race, occupation and socio-economic status as demographic variables related to traffic safety are reviewed together.

For the most part, literature is scanty in this area of research. The studies which have been performed lack needed documentation of variables which might prove more useful in evaluating the effects of race, occupation and socio-economic status on traffic safety. For example, research which has focused on racial differences in driving records uses either a white/non-white dichotomy, which ignores possible differences among Black, Oriental, Spanish-surnamed and Native American drivers, or focuses on white versus Black driver differences. Further investigation in this area may be useful for varying parts of the United States, depending on the predominance of drivers of specific ethnic backgrounds. Occupational status also suffers from the same lack of discrimination for occupational categories. Primarily, professional, skilled, unskilled and semi-skilled categories are utilized for analysis, which ignores differences which may require more refined categorization. Categorizing all "housewives" as a single occupation, also, does not reflect the degrees of status women may feel from such factors as community involvement, financial situation, husband's occupation, etc.

Socio-economic status appears to be most definitive in that yearly income is fairly well described, often reflecting societal status. These factors should be kept in mind when the results of the research are evaluated.

Hyman, using data from the Grand Rapids study of 9,353 drivers involved in accidents and 8,008 control drivers, found that Blacks in all educational categories had a higher accident vulnerability ratio.[30] Among whites, Hyman reports, the accident vulnerability ratio decreases with increased occupational prestige. The combined unskilled or semi-skilled categories were 80 percent more accident vulnerable than the professional or executive group. This research also indicated that Blacks who completed high school and were in low

---

[30] Hyman, op.cit.

prestige occupations were 70 percent more accident vulnerable than whites in the same situation.

Robertson and Baker found similar results in their study of 1,447 Maryland drivers involved in fatal crashes.[31] Figure 6 shows the fatal crash involvement rate per 100,000 drivers by race and number of convictions for violations within three years prior to the fatal crash. Black drivers were somewhat more often involved than white drivers, regardless of prior convictions. Robertson and Baker go on to say, however, that "it was not possible to adjust this data to make comparisons of blacks and whites of equal socio-economic status differences which may have accounted for the result."[32]

The socio-economic status of drivers may be the important variable when driving performance is evaluated. Zylman evaluated data gathered from the Grand Rapids study described earlier and reported that non-white drivers were involved in collisions about one-third more often than would be expected from their representation in the control group ($p<.05$) (see Table 4).[33] Zylman goes on to report that drivers of lower social class also appeared in collisions about one-third more often than their representation in the control group would indicate. Those drivers in other social classes, however, had collisions less often than would be expected ($p<.05$) (see Table 5). Zylman also states that "subsequent tests showed that when unskilled whites were compared with unskilled non-whites in the same age and class, the collision experience was similar."[34]

Zylman continues his analysis by introducing blood alcohol concentration (BAC) as a possible factor related to race, social class and collision involvement. The author reports that both whites and non-whites have greater numbers of high BACs among the two lower classes. The conclusion drawn from

---

[31] Robertson and Baker, op.cit.

[32] Ibid., p. 10.

[33] R. Zylman, "Race and Social Status Discrimination and Police Action in Alcohol-Affected Collisions," Journal of Safety Research, 4, No. 2 (June 1972), pp. 75-84.

[34] Ibid., p. 77.

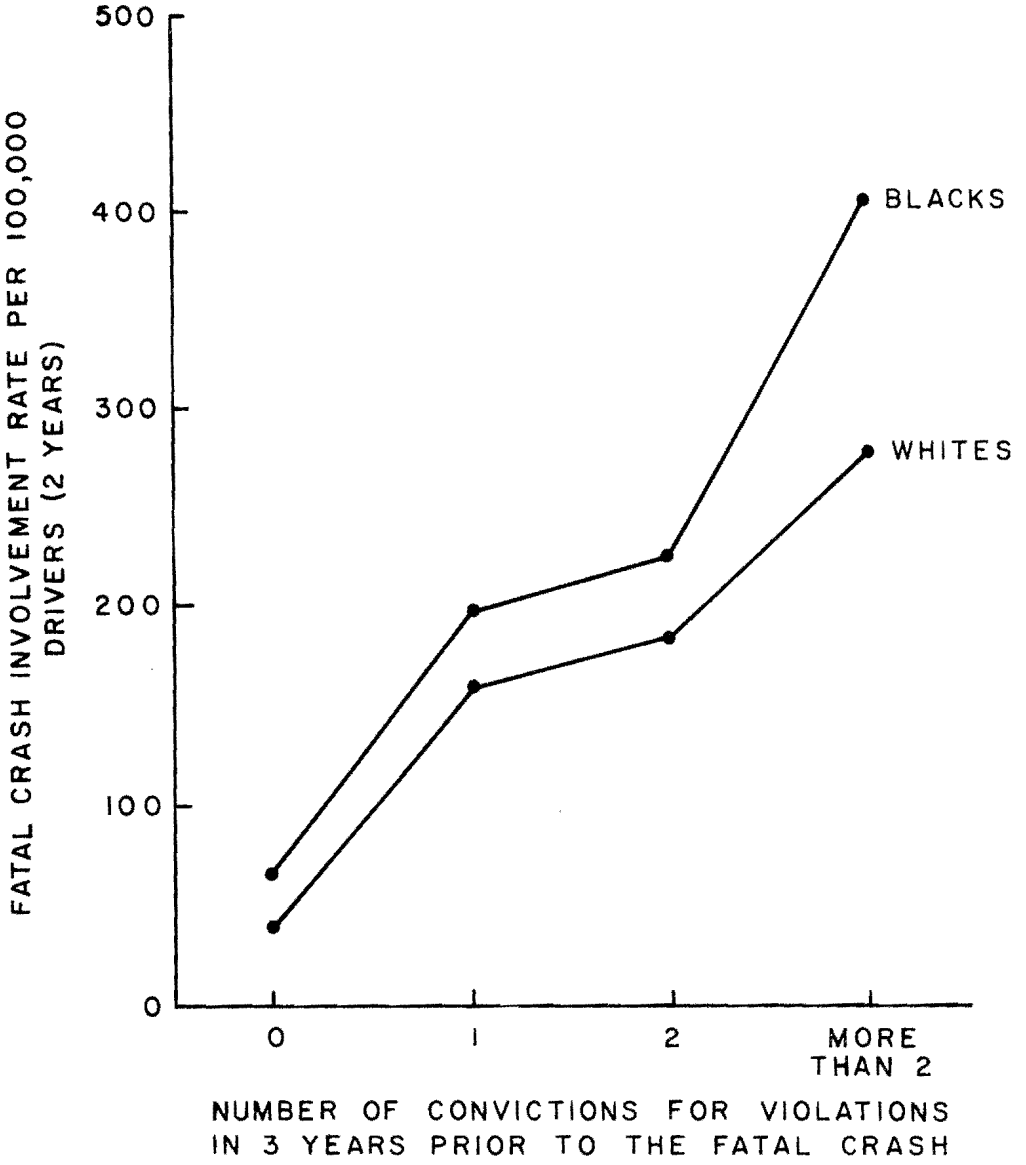


Figure 6. Fatal crash involvement rate per 100,000 drivers by race and number of convictions for violations within 3 years prior to the fatal crash.[35]

[35] L. S. Robertson and S. P. Baker, "Prior Violation Records of 1447 Drivers Involved in Fatal Crashes," paper prepared for the Maryland Motor Vehicle Administration, Baltimore, Maryland, September 1974.

TABLE 4. DISTRIBUTION OF CONTROL AND COLLISION DRIVERS BY RACE (GRAND RAPIDS STUDY).[36]

Race	Driver Category			
	Control		Collision	
	N	%	N	%
White	7272	93.4	6220	90.8
Non-white	517	6.6	633	9.2
Total	7789	100.0	6853	100.0

[36]R. Zylman, "Race and Social Status Discrimination and Police Action in Alcohol-Affected Collisions," Journal of Safety Research, 4, No. 2 (June 1972), p. 77.

TABLE 5. DISTRIBUTION OF CONTROL AND COLLISION DRIVERS BY SOCIAL CLASS (GRAND RAPIDS STUDY).[37]

Social Class	Driver Category			
	Control		Collision	
	N	%	N	%
Lower	2380	32.5	2625	42.4
Skilled	1719	23.5	1354	21.9
Lower White Collar	1646	22.5	1366	22.1
Upper	1569	21.5	844	13.6
Total	7314	100.0	6189	100.0

[37]R. Zylman, "Race and Social Status Discrimination and Police Action in Alcohol-Affected Collisions," Journal of Safety Research, 4, No. 2 (June 1972), p. 78.

this data was that although non-whites were involved in proportionately more collisions and subsequent driving-while-intoxicated arrests, the propensity of the lower class to drive after drinking coupled with the preponderance of non-whites in this class may account for the racial difference. Malek suggests that

> a low socio-economic status contains many elements which are productive of accidents. Some of these are overcrowding, unsafe physical conditions, lack of recreation areas . . . In addition, the attitudes and values associated with low socio-economic status may provide an incentive to the individual to engage in unsafe behavior since such actions are often awarded with prestige and acclaim.[38]

Zylman also contends that congested environmental conditions in which the lower social status group must drive may be partially responsible for their disproportionate involvement in collisions.

Burg interviewed and reviewed the driving records of 14,381 California drivers.[39] He reported that less professional and more unskilled occupations among men were associated with more violations of all types. Burg suggests that this reflects a combination of age, exposure, socio-economic occupations and number of violations.

The research available in this area appears to indicate an intricate interaction between race, occupation, age and social status. If any general conclusions can be extrapolated from the literature, it may be that drivers who have low social status are more likely to be involved in accidents and incur more traffic violations and convictions. Congested driving conditions and attitudes contrary to traffic safety, as mentioned earlier, may account for this difference. Levonian and Case gave questionnaires to 1080 driver education students from varying socio-economic status groups.[40] The authors found that students from higher social areas scored significantly higher on

---

[38] Malek, op.cit., p. 275.

[39] Burg, op.cit., pp. 1-52.

[40] E. Levonian and H.W. Case, "Behavioral and Demographic Correlates of Responses to a Driving Questionnaire," Proceedings of the Highway Research Board, 40 (1961), pp. 582-592.

cautiousness and lower on expediency and defensiveness.[41] Although other driving dimensions were measured, the authors mentioned cautiousness, expediency and defensiveness as being possibly associated with social class.

Further analysis of the socio-economic, racial and occupational factors related to accident and violation rates is certainly warranted. It is too often true that the less prestigious groups of people are ignored in research, evaluation and prevention of problems which significantly affect them. With regard to traffic safety, effectively designed preventative techniques and drivers education courses may be useful in combatting the high incidence of accidents and subsequent fatalities among the lower socio-economic driving population.

---

[41] Levonian and Case define cautiousness, expediency and defensiveness as follows. Cautiousness: a student who scores high on this dimension is more likely to state that he would use his horn to notify other drivers of his actions, slow down whenever he is unsure of the intent of other drivers, wait for a break in traffic before attempting to drive across an intersection, etc. Expediency: a student with a high score in this dimension is more likely to state that he would speed up so that he could pass through an intersection ahead of an oncoming driver, leave his high beam lights on until the oncoming drivers lower theirs, dart across an intersection when traffic hesitates, close the gap ahead of him in order to prevent a passing driver from filling the gap, etc. Defensiveness: a student who scores high on this dimension is more likely to state that he would drive much faster than posted limits, follow closely behind a car which had cut in ahead of him, not stop at an intersection even though other cars are stopping, cut closely in front of another driver who made passing difficult, etc.

V. CONCLUSIONS

When driver records and descriptors such as sex, age, socio-economic status and marital status of many individuals are aggregated, the results are related to probable involvement in motor vehicle accidents. Thus, certain combinations of descriptors can be used to identify groups of drivers more likely to be involved in crashes than other groups. Tentative conclusions can be drawn from the available research.

Although men and women probably do not differ significantly in their rate of accidents if exposure and hazard miles are controlled, males have a much higher proportion of accidents and violations in absolute terms. Thus males predominate in the number of accidents and violations. Accidents among women, on the other hand, also take a significant number of lives each year. Highway deaths among women should not be overlooked as insignificant. One way of investigating this problem is to compare types of violations for males and females in an effort to determine their respective vulnerable areas. Men, for example, tend to have more equipment violations and major violations, such as drunken driving, reckless driving and hit and run. Women, on the other hand, tend to have right-of-way violations and turning violations. Further confirmation of these results may be used as evidence to promote specialized drivers education, for example.

Marital status has also been tentatively shown to be related to accident and violation rates. In general, single drivers have a higher accident and violation frequency than married drivers. However, exposure was not controlled in the majority of the studies.

Non-white drivers and drivers in less prestigious occupational categories (unskilled and semi-skilled) tend to have higher accident and violation rates. These tentative conclusions, however, may be related more to the socio-economic status of the driver than to race or occupational status. There appears to be a fairly clear negative correlation between socio-economic status and accident rate. Since non-whites and unskilled workers tend to be of the lower socio-economic groups, they are overrepresented in accident and violation rates. Controlling for exposure (number of miles driven) should be an essential ingredient of further research in this area.

In addition, McGuire states that "the nature of biases existing in official records should first be established before they are used for research or used to form the basis for action programs."[42] Possible sex, age, race and occupational biases may exist in the reporting of accidents and violations by police officers. McGuire performed confidential interviews with 500 Mississippi subjects. Of all accidents admitted to during the course of the interviews, only 25 percent were in police records, indicating underreporting or bias in reporting of accidents. The author, however, found that there were no age or race biases; any one age group or race was as likely to be reported as any other age group or race. For the occupational category, however, the semi-professional and professional groups were reported proportionately less often than any of the other groups. Females were also reported to a significantly lesser degree than males ($p<.05$). The study also found that with regard to citations, there were significant biases. The young, males and non-caucasians were reported more often than the older drivers, females and caucasians respectively. The possible bias in reporting accidents and violations complicates existing results even further.

When demographic variables are viewed overall, it appears that there is a complicated interaction between age, marital status, race, occupation and socio-economic factors. Additional research may reveal results which may be helpful in instituting effective countermeasure techniques, drivers training and more refined licensing procedures.

---

[42] F.L. McGuire, "The Nature of Bias in Official Accident and Violation Records," Journal of Applied Psychology, 53, No. 7 (June 1973), p. 305.

REFERENCES CITED

Burg, Albert. Traffic Violations in Relation to Driver Characteristics and Accident Frequency. Los Angeles, California: Institute of Transportation and Traffic Engineering, California Department of Transportation, June 1974.

Hagen, R.E. "Sex Differences in Driving Performance." Human Factors, 17, No. 2 (1975), 165-171.

Harrington, D.M. and R.A. McBride. "Traffic Violations by Type, Age, Sex, and Marital Status." Accident Analysis and Prevention, 2, No. 1 (1970), 67-79.

Hyman, M.M. "Accident Vulnerability and Blood Alcohol Concentrations of Drivers by Demographic Characteristics." Quarterly Journal of Studies on Alcohol, Supplement No. 4 (1968), 34-57.

Levonian, E. and H.W. Case. "Behavioral and Demographic Correlates of Responses to a Driving Questionnaire." Proceedings of the Highway Research Board, 40 (1961), 582-592.

Malek, L. "Social Factors in Accidents." Dissertation, The American University (Washington, D.C.), 1968.

McGuire, Frederick L. "The Nature of Bias in Official Accident and Violation Records." Journal of Applied Psychology, 57, No. 3 (1973), 300-305.

Peck, R.C., R.S. Coppin and W.C. Marsh. "Driver Record by Age, Sex and Marital Status." Highway Research Record, 163 (1967), 54-67.

"Rise in Accidental Deaths Among Women." Metropolitan Life Statistical Bulletin, 56 (October 1972), 5-8.

Robertson, L.S. and S.P. Baker. "Prior Violation Records of 1447 Drivers Involved in Fatal Crashes." Paper prepared for the Maryland Motor Vehicle Administration, Baltimore, Maryland, September 1974.

Sheppard, D. Characteristics of Drivers Obtained from Large Scale Enquiries. Crawthorne, Berkshire, Great Britain: Road Research Laboratory: Department of the Environment, 1971.

Zylman, Richard. "Race and Social Status Discrimination and Police Action in Alcohol-Affected Collisions." Journal of Safety Research, 4, No. 2 (1972), 75-84.

SUPPLEMENTARY BIBLIOGRAPHY

Borkenstein, R.F., R.F. Crawther, R.P. Shumate, W.B. Ziel and R. Zylman. The Role of the Drinking Driver in Traffic Accidents (The Grand Rapids Study). Bloomington, Indiana: Department of Police Administration, Indiana University, 1964.

Gutshall, Robert W. "An Exploratory Study of the Interrelations Among Driving Ability, Driving Exposure and Socio-Economic Status of Low, Average, and High Intelligence Males." Dissertation Abstracts, 28, 4-A (1967), 1206.

Kuzma, Jan W., P. William Dysinger, Peter Strutz and David Abbey. "Non-fatal Traffic Accidents in Relation to Biographical, Psychological, and Religious Factors." Accident Analysis and Prevention, 5, No. 1 (1973), 55-65.

Levonian, E. "Prediction of Accidents and Convictions." Traffic Safety Research Review, 11 (1967), 75-79.

Minnesota Department of Public Safety. Minnesota Motor Vehicle Crash Facts -- 1975. St. Paul, Minnesota: Minnesota Department of Public Safety, Traffic Safety Section, 1975.

Sleight, R.B. and K.G. Cook. Problems in Occupational Safety and Health: A Critical Review of Select Worker Physical and Psychological Factors. Vol. 1. Cincinnati, Ohio: U.S. Department of Health, Education, and Welfare, November 1974.

Uhr, Leonard. "Sex as a Determinant of Driving Skills: Women Drivers!" Journal of Applied Psychology, 43 (1959), 35.

Zylman, Richard. "Comparing Collision Drivers with the Driving Population-at-Risk: A Challenge to Conventional Methods." Behavioral Research in Highway Safety, 1, No. 2 (1970), 78-86.

THE AUTHORS

Deborah Valentine is a doctoral student in the Graduate School of Social Work at the University of Texas at Austin. She received her M.S.W. from the University of Texas at Austin (1973) and prior to that her undergraduate training in psychology at the University of Illinois (B.A., 1970).

Valentine was director of Social Services at the Settlement Club of Austin from 1973 to 1976 where she was in charge of intake, therapy, family treatment and discharge planning. The Settlement Club is a treatment center for disturbed adolescents. Previously she had worked in Illinois and Colorado, where she provided clinical services to brain damaged, autistic and emotionally disturbed children and adolescents.

Martha Williams, Professor of Social Work, joined the University of Texas at Austin faculty in 1966. She received her undergraduate training in psychology at the University of Texas (B.A., 1957) and her graduate training in psychology and management at the same university (M.A., 1962; Ph.D., 1963). She was a social science research associate in the Business School and the Law School at UT prior to joining the Social Work faculty. She is a member of the American Psychological Association and is a licensed psychologist in the State of Texas.

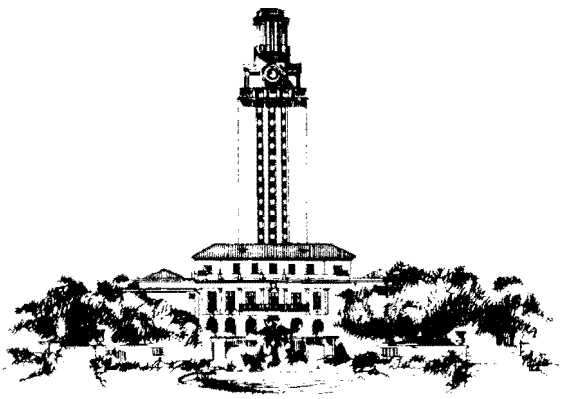
Williams' research and interests lie mainly in the areas of applied research methods, organizational psychology and evaluation research in human services organizations. She has published numerous articles on these topics.

Robert K. Young, Professor of Psychology, joined the faculty of the University of Texas in 1956. He received his B.A. in psychology from Miami University in 1951 and his Ph.D. in psychology from Northwestern University in 1954. While in the U.S. Army from 1954 to 1956 he served as chief of the Psychological Services Branch of the Quartermaster Research and Development Field Evaluation Agency at Fort Lee, Virginia.

Young has authored many articles and books in the areas of learning, experimental design and statistics. He is a member of the American Psychological Association and is a licensed psychologist in the State of Texas. Young's interests lie in the areas of learning strategies, programmed instruction, and the use of statistical techniques in applied research.

RESEARCH MEMORANDA PUBLISHED BY THE COUNCIL FOR ADVANCED TRANSPORTATION STUDIES

1 *Human Response in the Evaluation of Modal Choice Decisions.* Shane Davies, Mark Alpert, and Ronald Hudson, April 1973.
2 *Access to Essential Services.* Ronald Briggs, Charlotte Clarke, James Fitzsimmons, and Paul Jensen, April 1973.
3 *Psychological and Physiological Responses to Stimulation.* D. W. Woolridge, A. J. Healey, and R. O. Stearman, August 1973.
4 *An Intermodal Transportation System for the Southwest: A Preliminary Proposal.* Charles P. Zlatkovich, September 1973.
5 *Passenger Travel Patterns and Mode Selection in Texas: An Evaluation.* Shane Davies, Mark Alpert, Harry Wolfe, and Rebecca Gonzalez, October 1973.
6 *Segmenting a Transportation Market by Determinant Attributes of Modal Choice.* Shane Davies and Mark Alpert, October 1973.
7 *The Interstate Rail System: A Proposal.* Charles P. Zlatkovich, December 1973.
8 *Literature Survey on Passenger and Seat Modeling for the Evaluation of Ride Quality.* Bruce Shanahan, Ronald Stearman, and Anthony Healey, November 1973.
9 *The Definition of Essential Services and the Identification of Key Problem Areas.* Ronald Briggs and James Fitzsimmons, January 1974.
10 *A Procedure for Calculating Great Circle Distances Between Geographic Locations.* J. Bryan Adair and Marilyn Turnbull, March 1974.
11 *MAPRINT: A Computer Program for Analyzing Changing Locations of Non-Residential Activities.* Graham Hunter, Richard Dodge, and C. Michael Walton, March 1974.
12 *A Method for Assessing the Impact of the Energy Crisis on Highway Accidents in Texas.* E. L. Frome and C. M. Walton, February 1975.
13 *State Regulation of Air Transportation in Texas.* Robert C. Means and Barry A. Chasnoff, April 1974.
14 *Transportation Atlas of the Southwest.* Charles P. Zlatkovich, S. Michael Dildine, Eugene Robinson, James S. Wilson, and J. Bryan Adair, June 1974.
15 *Local Governmental Decisions and Land-Use Change: An Introductory Bibliography.* William Dean Chipman, May 1974.
16 *An Analysis of the Truck Inventory and Use Survey Data for the West South Central States.* Michael Dildine, July 1974.
17 *Towards Estimating the Impact of the Dallas-Fort Worth Regional Airport on Ground Transportation Patterns.* William J. Dunlay, Jr., and Lyndon Henry, September 1974.
18 *The Attainment of Riding Comfort for a Tracked Air-Cushion Vehicle Through the Use of an Active Aerodynamic Suspension.* Bruce Gene Shanahan, Ronald O. Stearman, and Anthony J. Healey, September 1974.
19 *Legal Obstacles to the Use of Texas School Buses for Public Transportation.* Robert Means, Ronald Briggs, John E. Nelson, and Alan J. Thiemann, January 1975.
20 *Pupil Transportation: A Cost Analysis and Predictive Model.* Ronald Briggs and David Venhuizen, April 1975.
21 *Variables in Rural Plant Location: A Case Study of Sealy, Texas.* Ronald Linehan, C. Michael Walton, and Richard Dodge, February 1975.
22 *A Description of the Application of Factor Analysis to Land Use Change in Metropolitan Areas.* John Sparks, Carl Gregory, and Jose Montemayor, December 1974.
23 *A Forecast of Air Cargo Originations in Texas to 1990.* Mary Lee Metzger Gorse, November 1974.
24 *A Systems Analysis Procedure for Estimating the Capacity of an Airport: A Selected Bibliography.* Chang-Ho Park, Edward V. Chambers III, and William J. Dunlay, Jr., August 1975.
25 *System 2000–Data Management for Transportation Impact Studies.* Gordon Derr, Richard Dodge, and C. Michael Walton, September 1975.
26 *Regional and Community Transportation Planning Issues–A Selected Annotated Bibliography.* John Huddleston, Ronald Linehan, Abdulla Sayyari, Richard Dodge, C. Michael Walton, and Marsha Hamby, September 1975.
27 *A Systems Analysis Procedure for Estimating the Capacity of an Airport: System Definition, Capacity Definition and Review of Available Models.* Edward V. Chambers III, Tommy Chmores, William J. Dunlay, Jr., Nicolau D. F. Gualda, B. F. McCullough, Chang-Ho Park, and John Zaniewski, October 1975.
28 *The Application of Factor Analysis to Land Use Change in a Metropolitan Area.* John Sparks and Jose Montemayor, November 1975.
29 *Current Status of Motor Vehicle Inspection: A Survey of Available Literature and Information.* John Walter Ehrfurth and David A. Sands, December 1975.
30 *Executive Summary: Short Range Transit Improvement Study for The University of Texas at Austin.* C. Michael Walton, May 1976.
31 *A Preliminary Analysis of the Effects of the Dallas-Fort Worth Regional Airport on Surface Transportation and Land Use.* Harry Wolfe, April 1974.
32 *A Consideration of the Impact of Motor Common Carrier Service on the Development of Rural Central Texas.* James S. Wilson, February 1975.
33 *Modal Choice and the Value of Passenger Travel Time Literature: A Selective Bibliography.* Shane Davies and Mark I. Alpert, March 1975.
34 *Forecast of Air Cargo Originations in Arkansas, Louisiana, and Oklahoma to 1990.* Deborah Goltra, April 1975.
35 *Inventory of Freight Transportation in the Southwest/Part IV: Rail Service in the Dallas-Fort Worth Area.* Charles P. Zlatkovich, Mary L. Gorse, Edward N. Kasparik, and Dianne Y. Priddy, April 1975.
36 *Forecast of Waterborne Commerce Handled by Texas Ports to 1990.* Stuart Metz Dudley, April 1975.
37 *Forecast of Refinery Receipts of Domestic Crude Oil from Pipelines in the West South Central States to 1990.* Mary L. Gorse, Dianne Y. Priddy, and Deborah J. Goltra, April 1975.
38 *A Feasibility Study of Rail Piggyback Service Between Dallas-Fort Worth and San Antonio.* Edward N. Kasparik, April 1975.
39 *Land Value Modeling in Rural Communities.* Lidvard Skorpa, Richard Dodge, and C. Michael Walton, June 1974.
40 *Towards Computer Simulation of Political Models of Urban Land Use Change.* Carl Gregory, August 1975.
41 *A Multivariate Analysis of Transportation Improvements and Manufacturing Growth in a Rural Region.* Ronald Linehan, C. Michael Walton, and Richard Dodge, October 1975.
42 *A Transit Demand Model for Medium-Sized Cities.* John H. Shortreed, December 1975.
43 *Recommended Procedures for Evaluating Medical Services Transportation in Houston, Texas.* Mark Daskin, John F. Betak, Randy Machemehl, and Ronald Briggs, October 1978.



Council for Advanced Transportation Studies
THE UNIVERSITY OF TEXAS AT AUSTIN