INJURY CONTROL CASE STUDY

ASSESSING THE IMPACT OF INCREASING THE DRINKING AGE ON MOTOR VEHICLE INJURIES

Prepared for

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and
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INJURY CONTROL CASE STUDY:

ASSESSING THE IMPACT OF INCREASING THE DRINKING AGE ON MOTOR VEHICLE INJURIES

I. Introduction

This case study has been prepared to assist health students and professionals in learning more about how state data may be used to evaluate legislative changes. Although the case study focuses on the impact on motor vehicle injuries of raising the legal age of drinking alcoholic beverages, the basic principles involved in formulating questions and analyzing data to address them should have broad application.

Questions are interspersed throughout the materials and should be considered as they arise.

A. Scenario. You have been contacted by your state legislative staff concerning proposed legislation to increase the age of purchase of beverage alcohol to 21. Prior to enactment of such legislation, beer and wine are available to persons age 18 and older. The proponents of the legislation include two major groups. First, there are legislators who are concerned about Federal legislation that threatens to withhold federal funds for highways from any state that fails to raise the age of purchase of alcohol to 21 by 1987. Appendix A provides more information on the Federal legislation, as well as a summary of current state laws. The second group of legislators (and there is some overlap between the two groups) is primarily concerned with whatever life saving and injury reduction potential such legislation might have for the State.

The legislature is already well versed in the Federal legislation. However, they need facts and figures for your state concerning the second issue, namely, <u>the anticipated reductions in death and injury.</u>

QUESTION

1. What questions would you have about the proposed legislative solution to the problem of drinking-driving injuries and deaths among young people in your state? What would you anticipate as some of the arguments for and against raising the legal age of purchase?

B. Background. Although it has been known for decades that alcohol is greatly overrepresented in serious and fatal crashes and that young people are disproportionately represented in these figures, it was not until the advent of citizen action groups (e.g., RID [Remove Intoxicated Drivers], MADD [Mothers Against Drunk Driving]) that the problem was taken seriously. A Presidential Commission on Drunk Driving was appointed and, among other things, endorsed a minimum age of 21 for purchasing beverage alcohol. Some states followed this recommendation, but others did not. As a result, young people often drove much farther than they would have otherwise to cross a state line where the age of purchase was lower, thus increasing the amount of drunk driving.

In 1984 Congress enacted legislation requiring states to pass a minimum drinking age of 21 by 1987 or lose a substantial portion of highway funds. Appendix B lists the funds that states would stand to lose in the first and second years of noncompliance. As of July 1985, 37 states had passed such laws.

Although you have never really thought much about injury as a health problem, you begin to compile data for the nation and for your own state. You discover, much to your surprise, that beyond infancy injury is the leading cause of death for the first half of life. In fact, if viewed in terms of potential years of life lost, injury is the major cause, accounting for greater loss than cancer and heart disease combined (National Research Council, 1985)! Injuries, and motor vehicle injuries in particular, strike the young disproportionately (Baker, O'Neill, and Karpf, 1984). If viewed in terms of potentially productive years of life lost (PPYLL), defined as ages fifteen to seventy, motor vehicle crashes account for 61 percent of PPYLL due to accidents (Perloff et al., 1984).

The Surgeon General's report, Healthy People, points out that life expectancy increased for all age groups with the exception of those age 15 through 24, and for this age group it actually decreased (U.S. Department of Health, Education, and Welfare, 1979). Motor vehicle injuries are by far the leading cause of death. Nationally, it is estimated that alcohol is involved in over half of fatal crashes, which resulted in approximately 22,500 deaths in 1983. In addition, alcohol is implicated in at least 17 percent of injury-producing crashes and 8 percent of noninjury crashes (Fell, 1983). (It should be noted that these latter crash types are much greater in number, so that the numbers of alcohol-related crashes are much higher even though the percentages are lower.)

QUESTION

2. What kinds of information would you need to document the magnitude of the problem of adolescent drunk driving in your state and the anticipated impact of a change in the drinking age?

B. Background (Continued). Drivers age 16 though 24 have the highest rates of alcohol-related fatal crashes based on number of miles driven. There is also evidence that teenagers are more likely to be impaired and involved in crashes at lower levels of alcohol (Fell, 1982).

Drinking is more likely to occur at night and on weekends, and indeed the crash data show that alcohol is more likely to be involved at these times. Drunk driving is also more likely to involve male drivers and result in single vehicle crashes. Epidemiological studies show that as blood alcohol concentration (BAC) rises, the risk of causing a crash also rises. At a blood alcohol concentration of 0.08 percent that risk is four times as high as at zero level BAC; at 0.10 percent, seven times; and at 0.15 percent, 25 times! (Borkenstein, et al., 1964; Perrine, et al., 1971). Appendix C discusses BAC and other measures of alcohol impairment.

QUESTION

3. Where would you go to find the data specific to your state?

II. Data Sources

As is true for the nation as a whole, motor vehicle crashes are the leading cause of death for young people in North Carolina (National Safety Council, 1985; Runyan, et al., 1985). This case study will focus on North Carolina data from 1982. They are characteristic of data from elsewhere in the U.S., however.

The major data source is the state crash file, based on the crash reports completed by state and local police who investigate traffic crashes. Appendix D shows a copy of the North Carolina accident report form. This file includes a wealth of information, from which the following variables were selected:

1. Driver age (see data tables)
2. Driver sex (male, female)
3. Driver race (white, nonwhite)
4. Driver injury (see Table 1)
5. Driver sobriety (see Table 2)
6. Time of crash (day, evening, night)

Every state has a crash file including data similar to those presented in this case study.

The second data set consists of a table of the number of licensed drivers in the state, by age, race, and sex (Licensed Driver Table). Such data, at least in summary form, should be available in all states.

A third state file used is from the Office of the Chief Medical Examiner and includes the blood alcohol test results from deceased crash victims. In this case study we will use only the data pertaining to deceased drivers. Many states can provide similar information.

Every state also has U.S. Census data that can be used to calculate population rates for crash and alcohol involvement.

QUESTIONS

4. What problems, if any, are you likely to encounter in gaining access to these data in your own state?

5. What kinds of legal and ethical considerations should you take into account in requesting and analyzing these data?

Table 1. Definitions and Frequency of Occurrence for Levels of Driver Injury (KABCO Injury Scale) in North Carolina, Based on 1979-1983 Crashes

Scale Level	Description	Percent in N.C. Accidents (N = 1,136,507)
K	Killed	0.5
A	Incapacitating (serious enough to prevent carrying on normal activities for at least 24 hours, e.g., massive loss of blood, broken bone)	4.0
B	Nonincapacitating (injury other than K or A evident at the scene)	8.0
C	No visible sign of injury but complaint of pain or momentary loss of consciousness	9.5
O	No injury	76.0
Unknown		2.0

Table 2. Classifications of Officer's Judgment of Driver Sobriety Prior to Any Arrest or Testing for Blood Alcohol Content, in North Carolina, Based on 1979-1983 Crashes

Classification	Percent in N.C. Accidents (N = 1,136,507)
Not Stated	5.0
No Drinking or Drugs	81.0
Drinking--Impaired	5.0
Drinking--Impairment Unknown	4.0
Unknown	5.0

The actual data from your state may vary from the data presented here. For example, the definition of injury may be somewhat different, although many states use a similar categorization.

QUESTIONS

6. In calculating the anticipated impact of the law, what problems might you encounter as a result of limiting your data base(s) to a single year?

7. Look at Tables 1 and 2. What are potential sources of bias in these data? What other sources of bias may there be in the data bases?

III. Descriptive Data

A. Frequencies. The crash data are compiled in Table 3 to show crash frequencies by driver age, sex, and alcohol involvement as defined by the investigating officer.

QUESTIONS

8. What does this table tell you about the drunk driving problem?
9. What other information do you need to interpret these data?

Table 3. Crash Frequencies by Driver, Age, Sex and Alcohol Involvement North Carolina, 1982

	No Alcohol			Alcohol			
Age	Male	Female	Total	Male	Female	Total	Total
16	4,614	2,765	7,379	321	70	391	7,770
17	5,365	2,967	8,332	622	115	737	9,069
18	5,637	3,037	8,674	1,060	192	1,252	9,926
19	5,583	2,922	8,505	1,223	185	1,408	9,913
20	5,145	2,869	8,014	1,271	212	1,483	9,497
21	5,089	2,875	7,964	1,304	181	1,485	9,449
22-24	13,116	7,923	21,039	3,095	460	3,555	24,594
25+	81,491	49,148	130,639	10,168	1,603	11,771	142,410
Total	126,040	74,506	200,546	19,064	3,018	22,082	222,628

B. Rates. As you can see, the raw numbers of adolescent crashes are not sufficient to understand fully the extent and characteristics of the problem. The crash data provide only numerator information. We now need denominator information to calculate rates. Table 4 provides information on North Carolina population by age and sex, while Table 5 shows the same information for licensed drivers in 1982.

QUESTION

10. Using these tables, calculate the rates of alcohol-involved crashes for 18-year-old drivers versus drivers over age 24. What other denominators might you use other than the ones given? What effect does the choice of denominator have on your rates?

Table 4. Population in North Carolina by Age and Sex, 1980 Census

Age	Males	Female	Total
16	55,272	53,343	108,615
17	55,808	53,645	109,453
18	60,357	56,323	116,600
19	65,822	60,077	125,899
20	65,917	59,358	125,275
21	63,116	57,280	120,396
22-24	169,597	164,244	333,841
25+	1,584,072	1,817,868	3,401,940
Total	2,119,961	2,322,138	4,442,099

Table 5. Numbers of Licensed Drivers by Age and Sex, North Carolina, 1982

Age	Male	Female	Total
16	30,390	25,774	56,164
17	38,948	32,977	71,925
18	46,728	40,735	87,463
19	50,404	43,894	94,298
20	49,531	45,314	94,845
21	53,263	48,236	101,499
22-24	164,303	151,582	315,885
25+	1,582,924	1,497,878	3,080,802
Total	2,016,491	1,886,390	3,902,881

Table 6 shows the alcohol crash rates by age, using population and licensed driver data. Table 7 compares rates of driver alcohol involvement in fatal crashes by age using population, licensed drivers, and mileage driven as denominators. See Appendix E for a discussion of how alcohol involvement in crashes is defined.

QUESTION

11. Based on these rates, what conclusions can you reach about drinking and driving among the 18, 19, and 20-year-olds from whom alcohol purchase privileges will be removed?

Table 8 shows the blood test results from deceased drivers by driver age.

QUESTION

12. How do the proportions of deceased drivers who have been drinking vary by age, sex, and amount of alcohol? What are the limitations of data based solely on fatally injured drivers?

Table 6. Crash Rates Per 1,000 Population (N.C. 1980) versus Per 1,000 Licensed Drivers (N.C. 1982) By Driver Age and Alcohol Involvement, North Carolina, 1982

	No Alcohol		Alcohol	
Age	Population Rates	Licensed Driver Rates	Population Rates	Licensed Driver Rates
16	67.9	131.4	3.6	7.0
17	76.1	115.8	6.7	10.2
18	74.3	99.2	10.7	14.3
19	67.6	90.2	11.2	14.9
20	64.0	84.5	11.8	15.6
21	66.1	78.5	12.3	14.6
22-24	63.0	66.6	10.6	11.3
25+	38.4	42.4	3.5	3.8
Total	35.7	53.8	3.8	5.7

Table 7. Fatal Crash Rates Per Capita, Numbers of Licensed Drivers and Mileage Driven Involving Alcohol Classified by Driver Age, North Carolina, 1982 and U.S., 1984

Age	Per 1,000 Population,N.C.[a]	Per 1,000 Licensed Drivers,N.C.[a]	Per 100,000,000 Miles Driven, U.S.[b]
16	3.6	7.0	4.58
17	6.7	10.2	
18	10.7	14.3	4.61
19	11.2	14.9	4.44
20	11.8	15.6	3.38
21	12.3	14.6	4.08
22-24	10.6	11.3	3.10
25-44	3.5	3.8	1.50
45-54			0.66
55-64			0.68
65+			--
Total	3.8	5.7	--

[a]Highway Safety Research Center, University of North Carolina at Chapel Hill, 1985.

[b]National Highway Traffic Safety Administration, Alcohol and Highway Safety 1984: A Review of the State of Knowledge. US DOT-HS-806-569, February 1985, p. 30.

Table 8. Percentages of Fatally Injured Drivers Classified by Blood Alcohol Concentrations, Age and Sex, North Carolina, 1982

	Male (Blood Alcohol Concentrations)						Female (Blood Alcohol Concentrations)					
Age	0	.01-.07	.08-.13	>.13	Not Tested	N	0	.01-.07	.08-.13	>.13	Not Tested	N
≤15	64	9	9	0	18	11	100	0	0	0	0	1
16	80	7	7	0	7	15	0	0	67	33	0	3
17	44	7	19	11	19	27	83	0	17	0	0	6
18	29	10	26	23	13	31	40	0	20	40	0	10
19	16	13	23	29	19	31	33	17	0	33	16	6
20	21	13	13	37	16	38	17	0	50	17	17	6
21	18	15	18	36	12	33	50	0	0	0	50	2
22-24	18	6	21	46	9	66	56	0	6	11	28	18
25+	37	6	7	34	16	379	62	1	9	14	14	93
Total	33	8	11	33	15	631	57	1	12	16	15	145

To describe the importance of this problem, it is not enough to document the numbers and rates of crashes and fatalities involving young drivers. The total injury outcome of these crashes is also of importance. Table 9 shows the driver injury severity distribution for alcohol and nonalcohol crashes by driver age in North Carolina.

QUESTION

13. How is driver injury severity related to alcohol involvement and age?

Table 9. Percentage of Drivers by Injury Severity[a], Age and Alcohol Involvement, North Carolina, 1982

	No Alcohol				Alcohol			
	Injury Severity				Injury Severity			
Age	None	Mild/ Moderate	Severe/ Fatal	N	None	Mild/ Moderate	Severe/ Fatal	N
≤15	67.0	21.6	11.3	652	40.9	42.4	16.7	66
16	80.3	17.2	3.3	7,379	51.9	37.6	10.5	391
17	80.3	16.5	3.2	8,332	56.9	32.3	10.9	737
18	80.9	16.0	3.1	8,674	56.7	30.8	12.5	1,252
19	79.8	16.7	3.5	8,505	58.2	29.7	12.1	1,408
20	81.3	16.1	2.6	8,014	57.5	30.1	12.3	1,483
21	80.4	16.6	3.0	7,964	56.2	32.9	11.0	1,485
22-24	80.7	16.3	3.0	21,039	57.9	29.3	12.8	3,555
25+	80.7	16.3	3.0	130,639	61.2	27.3	11.4	11,771
Total	80.6	16.4	3.1	201,198	59.3	28.9	11.8	22,148

[a] Severity as defined by KABCO scale (See Table 1).

IV. Anticipated Impact of Legislation

To summarize thus far, you want to estimate the reductions in death and injury that may be anticipated from an increase in the drinking age. Ideally, you would like to have good information on the extent to which young drivers are combining drinking and driving and the extent to which this activity results in injury and death. You would also like to know the degree of compliance that may be anticipated from legislation increasing the drinking age. However, the data you have available are much more limited.

You have demonstrated that drivers age 18 through 21 have higher alcohol-related crash rates (Table 6), and that based on mileage driven young drivers have higher fatal crash involvement rates (Table 7). You have also shown that for all ages alcohol-related crashes are much more likely to result in severe or fatal injuries (Table 9).

Table 10 shows the number and percent of daytime and nighttime crashes involving young drivers who are judged to have been drinking, by injury level. Note that this table differs from Table 9 in that Table 9 shows driver injury. Table 10 shows the severity of the total crash as measured by the most serious injury in the crash. Thus an 18-year-old drinking driver who is not fatally injured but whose crash results in fatal injury to someone else would be listed in the fatal crash category. Note also that Table 10 does not show total fatalities but rather shows fatal crashes. Thus, a crash with one fatality and a crash with three fatalities would be presented in the same way, i.e., as a fatal crash.

Because it is not always clear whether a driver has been drinking, and not all state data systems have high quality data on this variable, you need to consider surrogate measures of alcohol-related crashes.

QUESTION

14. Looking back at the information available on the crash report form, what are some of the variables that you might want to consider and/or use as proxy measures for alcohol-related crashes? What types of crashes are likely to be more affected by the law?

Table 10. Alcohol-Involved Crashes (%) by Day/Night by Injury Level by Driver Age, North Carolina, 1982.

Driver Age	Fatal		Serious		Total	
	Day	Night	Day	Night	Day	Night
16	2 (29)	5 (71)	16 (27)	43 (73)	18 (27)	48 (73)
17	1 (11)	8 (89)	31 (27)	84 (73)	32 (26)	92 (74)
18	6 (33)	12 (67)	43 (22)	155 (72)	49 (23)	167 (77)
19	5 (25)	15 (75)	59 (25)	181 (75)	64 (25)	196 (75)
20	5 (25)	15 (75)	74 (31)	165 (69)	79 (31)	180 (69)
21	15 (50)	15 (50)	62 (30)	145 (70)	77 (32)	160 (68)
22-24	10 (23)	34 (77)	168 (29)	408 (71)	178 (29)	442 (71)
> 24	85 (43)	111 (57)	753 (44)	955 (56)	838 (44)	1066 (56)
Total	129 (38)	215 (62)	1206 (36)	2136 (64)	1335 (36)	2351 (64)

Many states have already raised their legal age of drinking alcoholic beverages, and there is information available on their experience. Appendix F provides a list of relevant references. Two studies have examined the combined experience of some of these states. The first, based on nine states, concluded that raising the legal minimum drinking age to 21 would reduce nighttime fatal crashes involving young drivers affected by the law by approximately 28 percent (Williams, et al., 1983). A more recent study, taking into account a complex array of variables, concludes that the reduction is closer to 13 percent (DuMouchel, Williams, and Zador, 1985).

Table 11 shows fatal crashes by day/night by driver age.

QUESTION

15. Based on the information you now have, how would you calculate the anticipated impact of the proposed legislation?

Table 11. Fatal Crashes by Day/Night by Driver Age, North Carolina, 1982

Driver Age	Day	Night
16	7	17
17	9	26
18	18	36
19	20	37
20	20	34
21	30	27
22-24	44	82
>24	196	338
Total	344	597

Source: UNC Highway Safety Research Center, 1986.

Certain members of the legislature have expressed concern that raising the drinking age from 18 to 21 will result in four and a half million dollars annually in lost revenue. They are unwilling to suggest higher taxes to make up for this loss.

In calculating the costs of deaths, you find that there is no clear agreement on the dollar amounts assigned to morbidity and mortality. A recent report quotes "conservative estimates" of costs per motor vehicle fatality, ranging from a low of $490,050 to a high of $1,470,150 in 1982 dollars (Miller et al., 1985). Values calculated by other economists range even higher (Blomquist, 1982). However, much lower estimates have generally been used in the highway safety field (National Highway Traffic Safety Administration, 1983; Hartunian, Smart, and Thompson, 1981).

Although you are not entirely comfortable assigning dollar values to deaths, you are requested by the legislature to arrive at dollar estimates of savings anticipated in reduced deaths that may be expected from the law.

QUESTIONS

16. How would you calculate the estimated economic savings in avoided deaths?

17. How would you prepare your report to the legislature describing the anticipated impact of the law and what questions and criticisms should you be prepared to answer?

V. Evaluation Plan

Your data show convincing evidence that there is a drinking driving problem among young drivers, and your legislature is favorably disposed to enact legislation to increase the drinking age. However, there is still a minority group of legislators who are not convinced. The proponents of the legislation, being unusually enlightened, have suggested that the bill be enacted only for a specified period of time, that is, with a built-in sunset clause. They also want to include a requirement that an evaluation be conducted and a report delivered to the legislature in time to consider continuation of the law should the evidence warrant it. Such a bill is more difficult to oppose because it does not entail a permanent commitment to an unproven program.

You have been asked to prepare for the legislature an appropriate evaluation plan. In dealing with the legislature you have already learned that such materials must be brief but specific and that you should be prepared to provide more detailed information upon request.

QUESTIONS

18. What are the specific questions you will try to answer with your evaluation?

19. Will you base your evaluation on the kinds of data currently collected, or will you try to get additional data collected? If the latter, what kinds of information would you ask for?

VI. Analysis Issues

Based on your effective analysis and intepretation of the state data, the legislature enacted the Safe Roads Act (SRA). This law increased the legal age of purchase for beer and wine, but only from age 18 to age 19. The same legislation also provided for much more severe consequences for underage drivers found with any blood alcohol concentration whatsoever and increased the penalties for any driver found to be at or above the legal limit for alcohol. Appendix G provides more information on the SRA. The legislature also accepted your recommendation that an evaluation be conducted.

Figure 1 shows the percentage of alcohol-related crashes for the years immediately preceding and following the implementation of the legislation that increased the age of purchase of alcohol from 18 to 19.

QUESTIONS

20. What interpretation can be made of this figure?
21. What additional information would you want to have?

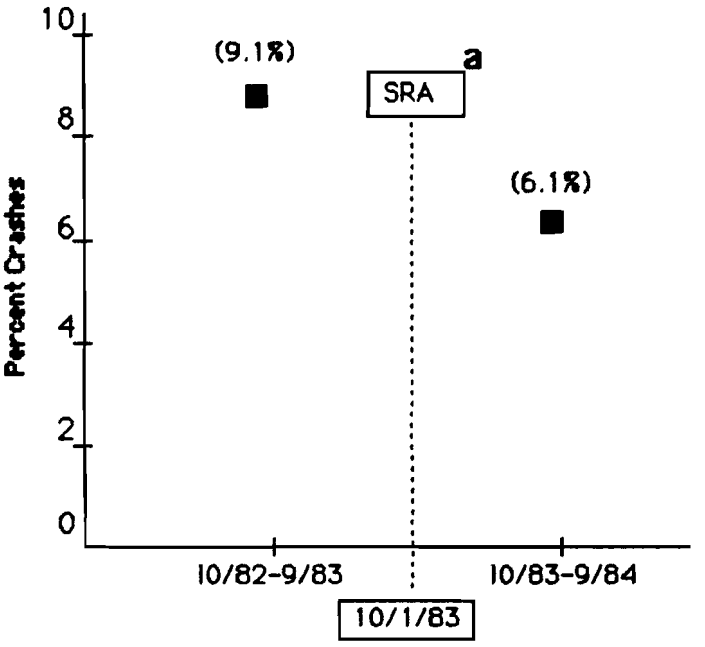


Figure 1. Percentage of Alcohol-Related Crashes by Year for 18-Year-Old Drivers, North Carolina, 1982-1984

a. Implementation of Safe Roads Act

Source: UNC Highway Safety Research Center, 1985

The need was identified for data depicting more points over time. You went back and calculated multiple time data to determine whether there were any trends.

Figure 2 shows the same information but extended for almost four years prior to the new legislation and for more than a year following it.

QUESTION

22. Now what conclusions can you draw about the impact of the law and what are the implications of this figure for the design of your evaluation?

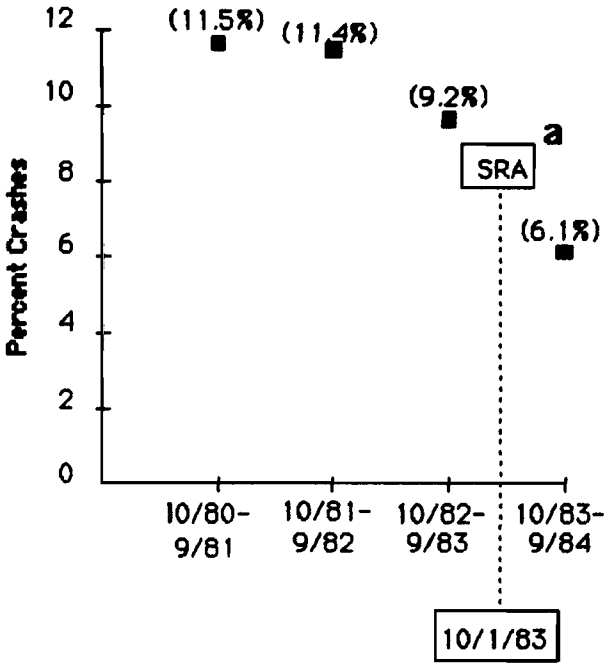


Figure 2. Percentage of Alcohol-Related Crashes by Year for 18-Year-Old Drivers, North Carolina, 1981-1984

a. Implementation of the Safe Roads Act

Source: UNC Highway Safety Research Center

Figure 3 shows the percentage decrease in the proportion of alcohol-involved crashes by driver age preceding and following the implementation of the Safe Roads Act. For example, for those under age 18, the proportion of all crashes involving alcohol declined by about 50 percent.

QUESTION

23. Based on this figure, what can you add to your interpretation of the effect of the law?

24. What kinds of contemporaneous changes, e.g., other safety legislation or social changes, might affect the findings?

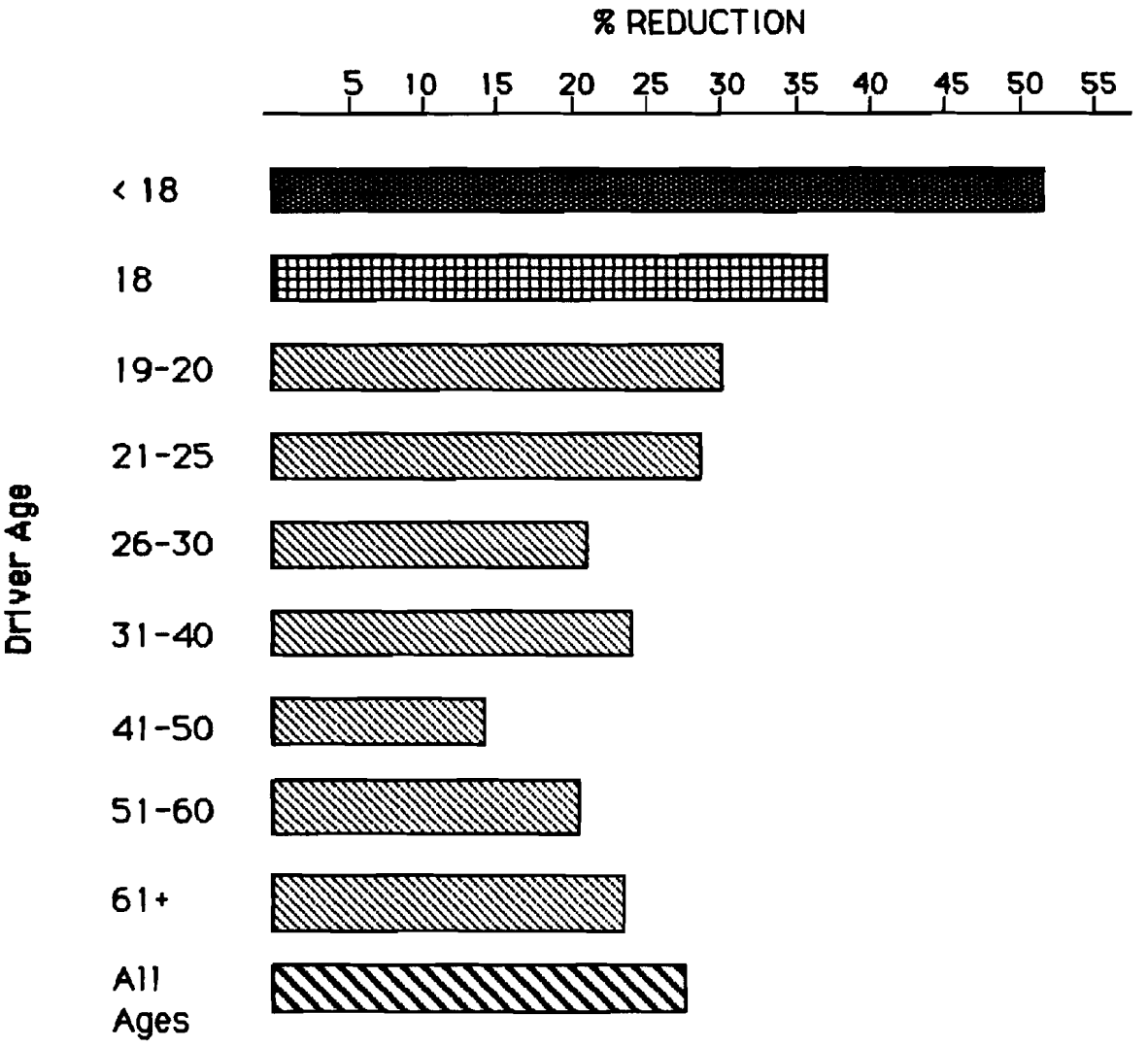


Figure 3. Percent Decrease in the Proportion of Alcohol-Involved Crashes October 82 - Mar 83 Compared to Oct 83 - Mar 84 Before and After SRA

Source: UNC Highway Safety Research Center, 1985

VII. Communicating Findings

Now the time has come for you to prepare your report to the legislature.

QUESTIONS

25. What questions and criticisms might you anticipate and how would you propose to handle them? What unintended consequences might occur?

26. What further questions could you pursue through the use of these data sources?

REFERENCES

1. Baker, S.P., O'Neill, B. and Karpf, R.S. The Injury Fact Book. Lexington, MA: D.C. Heath & Co., 1984.

2. Blomquist, G. Estimating the value of life and safety: Recent developments, In The Value of Life and Safety. Ed. Jones-Lee, M.W. New York: North-Holland Publishing Co., 1982.

3. Borkenstein, R.F., Crowther, R.F., Shumate, R.P., Ziel, W.B., and Zylman, R. The Role of the Drinking Driver in Traffic Accidents. Bloomington, IN: Indiana University, Dept. of Police Administration, 1964.

4. DuMouchel, W., Williams, A.F., and Zador, P. Raising the Alcohol Prchase Age: Its Effects on Fatal Motor Vehicle Crashes in 26 States. Washington, DC: Insurance Institute for Highway Safety, December, 1985.

5. Fell, J.C. Alcohol Involvement in Traffic Accidents: Recent Estimates from the National Center for Statistics and Analysis. Washington, DC: National Highway Traffic Safety Administration, May, 1982.

6. Fell, J.C. Alcohol Involvement in United States Traffic Accidents: Where it is Changing. Washington, DC: National Highway Traffic Safety Administration, November, 1983.

7. Fell, J.C. Tracking the alcohol involvement problem in U.S. highway crashes. In 27th Annual Proceedings, American Association for Automotive Medicine. Morton Grove, IL: American Association for Automotive Medicine, 1983.

8. Hartunian, N.S., Smart, C.N., and Thompson. M.S. The Incidence and Economic Costs of Major Health Impairments. Lexington, MA: D.C. Heath and Co., 1981.

9. Miller, T. R., Hunter, W. W., Waller, P. F., Whitman, R. D., and Whiting, B. E. Development of a Value Criteria Methodology for Assessing Highway Systems Cost-Effectiveness. Washington, DC: Federal Highway Administration, 1985.

10. National Research Council. Injury in America. Washington, DC: National Academy Press, 1985.

11. National Safety Council. Accident Facts 1985 Edition. Chicago,IL: National Safety Council, 1985.

12. Perrine, M.W., Waller, J.A., and Harris, L.S. Alcohol and Highway Safety: Behavioral and Medical Aspects. Burlington, VT: University of Vermont Dept. of Psych. Sept. 1971.

13. Runyan, C.W., Kotch, J.B., Margolis, L.H., and Buescher, P.A. Childhood injuries in north Carolina: A statewide analysis of hospitalizations and deaths. American J. of Public Health, 1985;75:1429-1432.

14. U.S. Department of Health, Education, and Welfare. Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention. DHEW Pub. No. (PHS) 79-55071. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1979.

15. Wass, C. Indirect determination of exposure and liability. Accident Analysis and Prevention, 1982;14:365-369.

16. Williams, A.F., Zador, P.L., Harris, S.S., and Karpf, R.S. The effect of raising the legal minimum drinking age on involvement in fatal crashes, Journal of Legal Studies, 1983;12:169-179.

Appendix A

Federal and State Legislation

Recent legislative changes have resulted from increasing awareness and growing concern about the link between lowered legal drinking age laws and rising teenage fatalities in motor vehicle crashes. In 1983 and early 1984, several bills were proposed in both the House and Senate to encourage individual states to adopt 21 year old drinking age legislation. The bill's sponsors argued that 1,000+ teenage traffic deaths each year could be prevented by such legislation. Uniform laws across states would also help reduce the "blood border" problem arising when teens from one state with a higher age of drinking drive to a neighboring state with a lower age to obtain alcohol (Highway and Vehicle Safety Report, July, 1985).

Congressional support and intensive lobbying efforts by concerned citizen groups helped reverse President Reagan's initial opposition to the legislation. After passing in both houses, Public Law 98-363 was signed by the President on July 17, 1984. PL 98-363, also known as The Federal Drinking Age/Highway Fund Law, mandates that any state not adopting a minimum drinking age of 21 by October 1, 1986, will lose 5% of its federal highway funds in Fiscal Year '87. If such legislation is not adopted by October 1, 1987, an additional 10% of those funds will be withheld in Fiscal Year '88.[a]

First year losses could range from $2,486,000 for the District of Columbia to $33,247,000 for Texas (Loeb, 1985). (See Appendix B for estimates for each state.) Though the law

provides that, subject to availability, these monies would be returned to any state adopting the 21 year old drinking age at a later date, recent proposed amendments would make the withholding of these funds permanent (National Safety Council, 1985). Also included in the legislation are incentives to curb drunk driving, e.g. a 5% increase in federal highway safety funds to states that enact minimum sanctions for drunk driving, including mandatory loss of license and jail terms.

During their 1985 sessions, 13 State Legislatures raised the minimum drinking ages from their states, many in response to the federal legislation. This brought the total to 37 states with 21 as the legal age for drinking (National Safety Council, 1985). In 10 other states such legislation was introduced and defeated.

[a]See specifically PL 98-363, section 1288.4 "Adoption of National Minimum Drinking Age," (Federal Register 50: 188.)

Table A-1 Minimum Drinking Ages
by State

State	Previous Ages[a]	Current Age[a]	Date of Legislation
Alabama	21,19	21	1985
Alaska	21,19	21	1983
Arizona	21,19	21	1984
Arkansas	21	21	1957
California	21	21	1933[b]
Colorado	18/21[a]	18/21	1945[b]
Connecticut	21,18,19,20	21	1985
Delaware	21,20	21	1983[c]
Dist. of Col.	18/21	18/21	1934
Florida	21,18,19	21	1985
Georgia	21,18,19	21	1985[b]
Hawaii	20	18	1972[b]
Idaho	20/21	19	1972[b]
Illinois	21,19/21	21	1980
Indiana	21	21	1934[b]
Iowa	21,19,18	19	1978[b]
Kansas	18/21	21	1985
Kentucky	21	21	1938[b]
Louisiana	18	18	1948
Maine	20,18,20	21	1985
Maryland	21,18/21	21	1982
Massachusetts	21,18,20	21	1984
Michigan	21,18	21	1978[b]
Minnesota	21,18	19	1976[b]
Mississippi	18/21	21	1985
Missouri	21	21	1945
Montana	21,19,18	19	1979
Nebraska	20,19,20	21	1984
Nevada	21	21	1933
New Hampshire	21,18,20	21	1985
New Jersey	21,18,19	21	1982
New Mexico	21	21	1934
New York	18,19	21	1985
North Carolina	18/21,19/21	21	1985
North Dakota	21	21	1936
Ohio	18/21	19/21	1982
Oklahoma	18/21	21	1983
Oregon	21	21	1935
Pennsylvania	21	21	1935
Rhode Island	21,18,19,20	21	1984
South Carolina	18/21	21	1985[b]
South Dakota	19/21,18/21	19/21	1984

(continued)

Tennessee	21,18,19	21	1984
Texas	21,18,19	21	1985
Utah	21	21	1935[b]
Vermont	21	18	1971[b]
Virginia	21,18/21,19/21	21	1985
Washington	21	21	1934[b]
West Virginia	18/21,18	19/21[d]	1983[b]
Wisconsin	18/21,18	19	1983[b]
Wyoming	21	19	1973[b]

[a]Age splits (e.g. 18/21) denote different legal ages for consumption and/or purchase of beer and wine versus distilled spirits.

[b]Legislation to raise the legal age of drinking to 21 was introduced in these states in 1985, and defeated.

[c]1985 legislation introduced; pending.

[d]This age split is for residents/nonresidents.

Sources: R.J. Bonnie. (1985). Regulating Conditions of Alcohol Availability: Possible Effects on Highway Safety. Journal of Studies on Alcohol, (Supplement #10), page 133.

Appendix B

Potential Losses in Federal Highway Funds to States that do not Pass Legislation for a Minimum Drinking Age of 21.

	First Year 5% Loss	Second Year 10% Loss
Alabama	$11,816,000	$23,632,000
Colorado	9,178,000	18,306,000
Connecticut	7,589,000	15,178,000
District of Columbia	2,486,000	4,972,000
Florida	24,253,000	48,506,000
Georgia	17,187,000	34,374,000
Hawaii	5,839,000	11,678,000
Idaho	4,387,000	8,774,000
Iowa	6,103,000	12,206,000
Kansas	5,527,000	11,054,000
Louisiana	14,398,000	28,796,000
Maine	2,939,000	5,878,000
Massachusetts	9,881,000	19,762,000
Minnesota	10,558,000	21,116,000
Mississippi	5,424,000	10,848,000
Montana	5,584,000	11,168,000
New Hampshire	2,646,000	5,292,000
New York	30,101,000	60,202,000
North Carolina	9,970,000	19,940,000
Ohio	17,862,000	35,724,000
South Carolina	7,616,000	15,232,000
South Dakota	4,156,000	8,312,000
Texas	33,247,000	66,494,000
Vermont	2,650,000	5,300,000
Virginia	15,560,000	31,120,000
West Virginia	6,178,000	12,356,000
Wisconsin	7,250,000	14,500,000
Wyoming	4,531,000	9,062,000

Source: CONG. REC., S 8222, June 6, 1984

Source: Loeb, B.F, Jr. "North Carolina's New Drinking Age," Popular Government, Institute of Government, UNC - Chapel Hill, Fall 1985, p.14.

Appendix C

Measures of Alcohol Impairment

In order to calculate any statistics on alcohol related accidents, a reliable indicator of alcohol involvement is needed. Blood alcohol concentration (BAC) measures provide the most reliable information on whether or not a person has been drinking alcohol. The BAC describes a chemical state of the body in contrast to psychomotor tests which describe a behavior. The latter have been shown to be inaccurate as often as 50% of the time, however. Though a BAC measure is far more accurate, it requires a sample of blood or expired air, whereas psychomotor tests require only that the subject perform some physical activity.

To reach a BAC of .10%, the legal definition for "under the influence" in most states, a 150 lb. person would have to consume five shots (7.5 oz.) of 80 proof liquor or a six-pack (72 oz.) of beer, which is typically 4% alcohol, within one hour (Waller, 1985). BAC is affected by many other factors besides the amount consumed and strength of the drink. Body weight, specifically muscle versus fat content, is important as well as the amount of food consumed and time of eating in relation to the time of drinking.

In fact, a BAC as low as .02% may affect performance (Voas, 1985), and at .05% there may be a significant alteration of judgment (Waller, 1985). Three levels of alcohol use have been described: BAC $\geq$ .01% for "drinking," BAC $\geq$ .05% for "impaired," and BAC $\geq$ .10% for "intoxicated" (Voas, 1985). But different people behave differently at the same BAC level; much has to do with how practiced the individual is at the drinking behavior.

Appendix D - Accident Report Form

DMV-349 (Rev. 10/85)

TRAFFIC ACCIDENT REPORT—Send To: N. C. Division of Motor Vehicles Raleigh, N. C. 27697

LOCATION

Date: ____ 19__ Day of Week: ____ Time: __ __ __ __ (24 Hour Clock)
Month Day Year

Accident Occurred in ____ County ☐ In ☐ Near Incorporated City or Town of ____

Outside City or Town ____ Miles ☐ N ☐ E ☐ S ☐ W of City or Town Limits

on ____

Highway Number (I., U.S., N.C., R.P., R.U.). If within corporate limit or no highway number, identify by street name. If ramp or service road, indicate on line.

RR. Crossing No.: ____

__•__ Miles ☐ N ☐ E ☐ S ☐ W At or from ____ Toward ____

____ Feet (0 ft. if intersec.)

Use Highway Number, Street Name, or Adjacent County or State Line

Use Highway Number, Street Name, Incorporated Town, or Adjacent County or State Line

Local Use

Patrol Area

Do not write in these spaces
DMV Report No.:

Date Received by DMV:

ACCIDENT SEQUENCE

1. VEHICLE MANEUVER/ PEDESTRIAN ACTION		2. ACCIDENT TYPE		3. OBJECT STRUCK AND 4. DISTANCE			
				Vehicle 1		Vehicle 2	
Veh. 1	Veh. 2 or Ped.	FIRST HARMFUL EVENT	MOST HARMFUL EVENT: **Repeat Code** if same as for FIRST HARMFUL EVENT Veh. 1 / Veh. 2 or Ped.	Object	Distance	Object	Distance

VEHICLE NO. 1

No. of Units Involved

Driver: ____
First Middle Last Name

Address: ____

City: ____ State: ____ Zip Code: ____

Same Address as on Driver's License? ☐ Yes ☐ No Driver's Phone No.: ____

Race/ Sex: ____ Driver's Lic. No.: ____ State: ____

Date of Birth: ____ Specify Restriction: ____
Month Day Year

Veh. Year: ____ Veh. Make: ____ Veh. Type: ____ Tlr. Type: ____

S-Tlr.: 1. Length ____ Width ____ Axles ____ 2. Length ____ Width ____ Axles ____

Hazardous Material DOT I.D. No. __ __ __ __ Spilled? ☐ Yes ☐ No

Lic. Plate No.: ____ State: ____ Year: ____

VIN: ____

Owner: ____

Address: ____

City: ____ State: ____ Zip Code: ____

(Parts TAD Damaged): ____ Estimated Damage: $ ____

Vehicle Drivable? ☐ Yes ☐ No Post Crash Fire? ☐ Yes ☐ No

Removed to: ____

Address: ____

By: ____ Authority: ____

☐ **VEHICLE NO. 2** ☐ **PEDESTRIAN** ☐ **OTHER**

Driver ____
First Middle Last Name

Address: ____

City: ____ State: ____ Zip Code: ____

Same Address as on Driver's License? ☐ Yes ☐ No Driver's Phone No.: ____

Race/ Sex: ____ Driver's Lic. No.: ____ State: ____

Date of Birth: ____ Specify Restriction: ____
Month Day Year

Veh. Year: ____ Veh. Make: ____ Veh. Type: ____ Tlr. Type: ____

S-Tlr.: 1. Length ____ Width ____ Axles ____ 2. Length ____ Width ____ Axles ____

Hazardous Material DOT I.D. No. __ __ __ __ Spilled? ☐ Yes ☐ No

Lic. Plate No.: ____ State: ____ Year: ____

VIN: ____

Owner: ____

Address: ____

City: ____ State: ____ Zip Code: ____

(Parts TAD Damaged): ____ Estimated Damage: $ ____

Vehicle Drivable? ☐ Yes ☐ No Post Crash Fire? ☐ Yes ☐ No

Removed to: ____

Address: ____

By: ____ Authority: ____

Other Property Damaged: ____

Estimated Damage: $ ____

Owner Name: ____

Address: ____

INJURY SECTION INSTRUCTIONS: Give Injury Class, Belt/Helmet Usage, Race/Sex and Age of ***all occupants*** in the space corrresponding to the seat occupied (see codes at bottom). Names and addresses are necessary for persons who were ***injured.***

Seat	Inj. Cl.	Belt/ Hel.	Race Sex	Age	Injured Names and Addresses First Name Last Name
Left Front					**DRIVER 1**
Center Front					
Right Front					
Left Rear					
Center Rear					
Right Rear					

Total Number Occupants: Total Number Injured:

Seat	Inj. Cl.	Belt/ Hel.	Race Sex	Age	Injured Names and Addresses First Name Last Name
Left Front					**DRIVER 2, PEDESTRIAN, OTHER**
Center Front					
Right Front					
Left Rear					
Center Rear					
Right Rear					

Total Number Occupants: Total Number Injured:

Ambulance Requested? ☐ Yes ☐ No If Yes, Ambulance Arrived At: __ __ __ __ (24 Hour Clock)

Injured Taken To: ____
(Treatment Facility ***and*** City or Town)

MARKS <**ADDED BY** ____ (Initial)>

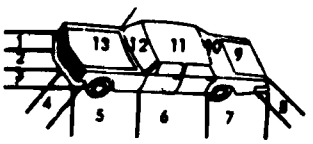
Injury Class

K—Killed
A—Incapacitating (injury obviously serious enough to prevent carrying on normal activities for at least 24 hours; e. g., massive loss of blood, broken bone)
B—Nonincapacitating (injury other than K or A evident at the scene)
C—No visible sign of injury but complaint of pain or momentary unconsciousness
O—No injury

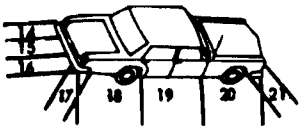
Belt/Helmet

1. None or not used
2. Lap only
3. Lap ***and*** shoulder
4. Child restraint system
7. Helmet
9. Unable to determine

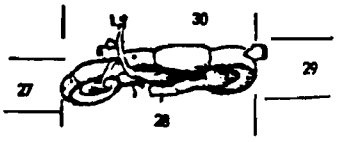
POINT(S) OF INITIAL CONTACT Write In Codes	
VEH. 1	VEH. 2



O. No Contact



Underneath:
22. Front
23. Center
24. Rear
25. Rollover
26. Unknown



Motorcycle
Bicycle or
Moped

ROADWAY INFORMATION					DRIVER 1	DRIVER 2 OR PED.		VEH. 1	VEH. 2
1. Locality		8. Road Surface							
2. Development Type		9. Road Defects		14. Vision Obstruction			18. Vehicle Defects		
3. Road Feature		10. Road Condition		15. Physical Condition			19. Speed Limit (for each vehicle)		
4. Road Character		11. Light Condition		16. Intoxication			20. Estimated Original Traveling Speed		
5. Road Class		12. Weather		17. Chemical Test Given	☐ Yes ☐ No ☐ Refused	☐ Yes ☐ No ☐ Refused	21. Estimated Speed at Impact		
6. Number of Lanes		13. Traffic Control					22. Tire Impressions Before Impact (ft.)		
7. Road Configuration		Operating ☐ Yes ☐ No	Visible ☐ Yes ☐ NO				23. Distance Traveled After Impact (ft.)		

INDICATE NORTH

Vehicle 1 was Traveling ☐ N ☐ E ☐ S ☐ W on

Vehicle 2 was Traveling ☐ N ☐ E ☐ S ☐ W on

DESCRIBE WHAT HAPPENED:

WIT- Name _____ Address _____ Phone No. _____

NESSES: Name _____ Address _____ Phone No. _____

ARRESTS: Name _____ Charge(s) _____ (Cit. No.) _____

Name _____ Charge(s) _____ (Cit. No.) _____

Sign Here _____

Officer's Rank and Name | Number | Department | Date of Report

VIOLATION INDICATED *(Check as many violations as apply)*

Driver 1	Driver 2		Driver 1	Driver 2		Driver 1	Driver 2	
☐	☐	1. No violation indicated	☐	☐	10. Pass stopped school bus	☐	☐	19. Safe movement violation
☐	☐	2. Alcohol use	☐	☐	11. Passing on hill	☐	☐	20. Following too closely
☐	☐	3. Drug use	☐	☐	12. Passing on curve	☐	☐	21. Improper backing
☐	☐	4. Yield	☐	☐	13. Other improper passing	☐	☐	22. Improper parking
☐	☐	5. Stop sign	☐	☐	14. Improper lane change	☐	☐	23. Unable to determine
☐	☐	6. Traffic signal	☐	☐	15. Use of improper lane	☐	☐	24. Left of center
☐	☐	7. Exceeding speed limit	☐	☐	16. Improper turn	☐	☐	25. Right turn on red
☐	☐	8. Exceeding safe speed	☐	☐	17. Improper or no signal	☐	☐	26. Other _____
☐	☐	9. Minimum speed law	☐	☐	18. Improper vehicle equipment			_____

RESERVED FOR CITY OR OTHER USE

RESERVED FOR STATE USE

	Driver 1	Driver 2
24. Direction		
25. Violation		
26. Misc. Action		
27. Charges		

28. Investigating Agency:

Appendix E

Alcohol-Related Crashes

Information collected on alcohol-related accidents differs state by state. Most states legally define a driver as "under the influence" when he/she has a BAC of .10% or more (Voas, 1985). Whether or not .10% is appropriate to label a driver drunk is debatable (see Appendix F, "Measures of Alcohol Impairment"). Regardless of the state's legal definition of what a specific BAC level means, many states legally allow drivers to refuse to submit to a BAC test, unless already arrested for driving under the influence (Voas, 1985). Thus some pre-arrest screening tests (e.g. breath tests) have been introduced recently to help police identify those drivers and arrest them.

After an accident has taken place, a blood sample must be taken from a live victim within four hours for an accurate reading. For victims admitted to a hospital, a sample may be taken without their permission, but this is not always done. Information collected for dead victims is often less complete. If there is a substantial delay between the time of crash and time of death, a BAC taken after death will not necessarily accurately reflect the BAC at the time of the crash because alcohol will continue to be metabolized (Voas, 1985).

Without any systematic data collection requirements nationwide, the information used to measure alcohol-related accidents may differ widely. Police reports are often used, but are not required in all states. Plus, if no BAC reading has been taken, determination of whether the accident is alcohol-related is left to the judgment of the investigating officer.

To compare data from several states, numerous definitions of alcohol involvement may have to be used. Fell, using data from 15 states, has described alcohol-related crashes as those in which "...any driver has a positive BAC or when there is an indication in the police accident report that the driver had been drinking" (Fell, 1984). Wagenaar, in a review of research on alcohol and driving in the 1970's, pointed out that sometimes a surrogate measure is used to indicate alcohol involvement, for instance the number of nighttime accidents involving a single vehicle and a male driver. These are common characteristics of alcohol-related accidents (Wagenaar, 1982).

Appendix F

REFERENCE ARTICLES

I. Background:

Baker, S.P., O'Neill, B. and R.S. Karpf. The Injury Fact Book, Lexington: D.C. Heath & Co., 1984. pp. 238 - 242.

Fell, J.C. "Drinking Age 21: Facts, Myths and Fictions", American Association for Automotive Medicine, The Quarterly Journal, 1985, pp. 21 - 26.

Insurance Institute for Highway Safety. The Highway loss reduction Status Report, Vol. 16, No. 14, September 23, 1981, pp. 1 - 12.

National Highway Traffic Safety Administration. Alcohol and Highway Safety 1984: A Review of the State of the Knowledge, U.S. DOT-HS-806-569, February, 1985, Chapter 3, pp. 7 - 40.

Wagenaar, A.C., Alcohol, Young Drivers, and Traffic Accidents, Lexington: D.C. Heath & Co., 1983. Chapter 2.

Waller, J.A. Injury Control, Lexington: D.C. Heath and Co., 1985, pp. 115 - 118.

II. Legislative Changes/Impact of:

Bonnie, R.J. "Regulating Conditions of Alcohol Availability: Possible Effects on Highway Safety", Journal of Studies on Alcohol, Supplement No. 10, July, 1985, pp. 129 - 143.

Klein, T.M. The Effect of Raising the Minimum Legal Drinking Age on Traffic Accidents in the State of Maine, U.S. DOT-HS-806-149, Washington Office of Program and Demonstration Evaluation, National Highway Traffic Safety Administration.

Lynn, C. The Effects of Raising and Lowering the Minimum Drinking Age in Virginia, Virginia Highway and Transportation Council, Charlottesville, Virginia, 1984.

Smith, R.A., Hingson, R.W., Morelock, S., Heeren, T., Mucatel, M., Mangione, T., Scotch, N., "Legislation raising the Legal Drinking Age in Massachusetts From 18 to 20: Effect on 16 and 17 year olds." Journal of Studies on Alcohol, Vol. 45, No. 6, 1985, pp. 534 - 539.

Wagenaar, A.C. "Youth Drinking and Driving: One Effective Countermeasure," Summary sheet from text: Alcohol, Young Drivers and Traffic Accidents, Lexington: D.C. Heath & Co., 1983.

Wagenaar, A.C. "Legal Minimum Drinking Age Changes in The U.S.: 1970-1981," Alcohol Health and Research World (NIAAA), Vol. 6, No. 2, Winter 1981-82. pp. 21 - 26.

Appendix G

North Carolina Legislation

In North Carolina, the legal age for drinking has always been split -- 18 for "malt beverages and unfortified wine" and 21 for "spirituous liquors and fortified wine." Passage of the 1983 Safe Roads Act (GS 18), among other things, raised the first age limit from 18 to 19. In response to the 1984 Federal legislation (PL 98-363), the 1985 General Assembly of N.C. raised the 19 year old limit to 21, thereby complying with PL 98-363.[a] Noncompliance would have meant a loss in highway funds of $9+ million in Fiscal Year '87 and nearly $20 million in Fiscal Year '88.

However, rather than label a violation of the new law by a 19 or 20 year old a "misdemeanor," such a violation is considered an "infraction" (unlawful act that is not a crime) and is punishable by no more than a $25 fine (Loeb, 1985). This new law becomes effective in N.C. September 1, 1986, in time to meet the federal deadline.

[a]See specifically Chapter 141-H101, amending GS 18B-300 and 302.

INSTRUCTOR'S NOTES

INJURY CONTROL CASE STUDY

ASSESSING THE IMPACT OF INCREASING THE DRINKING AGE ON MOTOR VEHICLE INJURIES

Prepared for

Association of Schools of Public Health
and
Centers for Disease Control

by

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TO THE INSTRUCTOR

This case study is designed to be used as a tool to teach practicing health professionals and graduate students to use existing data to understand an injury problem and to anticipate and monitor the effects of preventive interventions. It introduces some basic concepts in epidemiology and public health practice. For those using this exercise in a classroom setting, adaptations could easily be made to focus attention on the methodological aspects of estimating risks including computations of relative and attributable risk or on considering issues of statistical significance, regression to the mean, and various measurement concerns. A policy class might focus on the valuative and pragmatic issues underlying police change and considerations of how epidemiologic information is best used in the policy making arena. A class studying major contemporary health problems might examine the motor vehicle injury problem itself in more detail with particular attention to comparisons of motor vehicle injuries with other injury problems or other health concerns during adolescence, or between adolescents and younger children or adults.

Included with these materials is a set of templates for making transparencies or slides to assist in presenting the case. They are ordered to correspond to the sequence of the case study.

We welcome comments, addition or criticisms about the exercise as it is used in various contexts and hope that you will modify it according to your needs.

TEACHING OBJECTIVES

1. To familiarize participants with the content and use of state motor vehicle records and medical examiner data as tools for injury surveillance and evaluation of injury prevention efforts.

2. To consider the epidemiology of adolescent motor vehicle injury, particularly with regard to the role of alcohol.

3. To develop a realistic plan for evaluating the impact of raising the drinking age as a statewide strategy for reducing adolescent motor vehicle injury and death.

4. To explore the process of working with state law makers.

QUESTIONS

1. What questions would you have about the proposed legislative solution to the problem of drinking-driving injuries and deaths among young people in your state? What would you anticipate as some of the arguments for and against raising the legal age of purchase?

The arguments against raising the legal age of purchase include three major points. First, it is argued that at age 18 a person is legally an adult. Young men are at least theoretically subject to the draft, and if they are old enough to fight they should be old enough to drink.

Second, there is real concern about the potential loss of revenue. The sale of beer and wine to persons under 21, especially in college communities, represents a major source of revenue to both state and local communities. Officials in one state calculated that their potential losses in direct revenues were greater than what they stood to lose in highway funds. These arguments do not usually consider the costs to society of the premature injury and death that could be averted if the age of purchase were increased. However, these costs are not usually borne directly by the state, but rather represent losses from a wide range of sources, e.g., increases in life, health, disability, and automotive insurance; increases in worker's compensation costs; losses in future productivity. Many state legislators are much more concerned about direct losses to the state in the immediate future. Appendix B lists the funds that states would stand to lose in the first and second years of noncompliance.

Finally, other legislators object strenuously on ideological grounds to the Federal government dictating such policy to the states.

2. What kinds of information would you need to document the magnitude of the problem of adolescent drunk driving in your state and the anticipated impact of a change in the drinking age?

You would first need information on the number of deaths and injuries in crashes involving teenage drivers who had been drinking. It is usually assumed that if the driver has been drinking, then alcohol contributed to the crash. Of course, this is not necessarily the case. For example, a drunk driver could be stopped at a red light and hit from behind by a sober driver who fails to stop. Nevertheless, on the whole it is generally accepted that drinking drivers have contributed to their crashes. For our purposes, injuries and deaths in crashes involving young drivers who have been drinking will be considered the target for the proposed legislation.

3. Where would you go to find the data specific to your state?

Information on crashes can be obtained from the state agency responsible for these data, often the Department of Motor Vehicles or the Department of Public Safety.

Information on licensed drivers can also be obtained through the agency responsible for licensing drivers, usually the Department of Motor Vehicles, but possibly the Department of Public Safety or even the Office of the Secretary of State.

Many states have an Office of the Chief Medical Examiner or Coroner that compiles data on alcohol involvement of deceased motor vehicle crash victims.

Census data can be obtained through the public library, local university, or health department.

Moreover, there are a number of research institutions, as well as the U.S. Department of Transportation, that can provide good information on the relationship between alcohol and motor vehicle crash injury and death. Some of the resources are listed in Appendix 1.

The two major journals in the field of highway safety are:

JOURNAL OF SAFETY RESEARCH
ACCIDENT ANALYSIS AND PREVENTION

In addition, the AMERICAN JOURNAL OF PUBLIC HEALTH includes relevant articles from time to time. Other reports may be obtained from the sources listed in Appendix 1.

You would first compute the number of deaths and injuries currently occurring in conjunction with young drinking drivers. This number is the maximum potential reduction. However, realistically no law will result in 100 percent compliance. Therefore some estimate must be made as to the anticipated compliance rate, and the maximum number of averted deaths and injuries reduced accordingly.

Another approach would be to consider the experience of other states that have increased the legal age for drinking and apply their percentage reduction to your state.

4. What problems are you likely to encounter in gaining access to these data in your own state?

You are likely to find that recent information is not yet available in usable form. There is virtually always a considerable backlog in getting information compiled. Hence you will have to manage with information that is somewhat out of date.

Probably the greatest obstacle to overcome is that of inertia. Providing information other than that which is regularly compiled requires a change in the routine. It also may place an added burden on already overworked personnel. Furthermore, some of the data requested may require special programming, a skill that is usually in short supply. Data banks are often large, and the cost of analyzing them may run into several hundreds of dollars. If you request special analyses, you should make sure that you have appropriate authority and funding to back you up.

5. What kinds of legal and ethical considerations should you take into account in requesting and analyzing these data?

Although in most states crash reports and medical examiner reports are considered public information, in using the data it is essential that every

precaution be taken to protect the identity of individuals. It should not be necessary to obtain identifying information, but there may be instances in which the circumstances of a particular crash would reveal identities, especially in states with low populations. Also, you should be sensitive to any political concerns that may be present and be sure that anything you do does not create embarassment for anyone. It is important to recognize that in dealing with legislators (as well as other state officials), even if you are right it may be wise to remain silent in certain situations.

6. In calculating the anticipated impact of the law, what problems might you encounter as a result of limiting your data base(s) to a single year?

A single year's data could be misleading, particularly in a small state that does not experience high absolute numbers of motor vehicle fatalites. When we focus only on fatalities involving young impaired drivers, the numbers may be so small that year to year fluctuations are larger than any anticipated effects of the legislation.

A single year's data also do not allow the evaluation of any ongoing trends. For example, if there is a general downward trend in alcohol-related deaths and only one year's data are considered, then subsequent decreases in alcohol-related deaths may be attributed to an intervention rather than recognized for the trend they actually depict.

7. Look at Tables 1 and 2. What are potential sources of bias in these data? What other sources of bias may there be in the data bases that are available for use?

The crash report is completed by a police officer who may have had little or no training or may be highly trained. The judgment of injury (Table 1) is made in the field, and, although the injury scale describes the different levels of injury, ultimately the judgment is subjective.

The sobriety judgment (Table 2) is also made by the investigating officer. Once again, the judgment is subjective and may or may not be made by a trained officer. Drinking behavior may be more likely to be attributed to certain kinds of persons, e.g., male, poorly dressed, driving more dilapidated cars, etc., rather than based on concrete evidence of alcohol use.

Other data sources are likewise subject to bias. For example, regarding the medical examiner data, not all states routinely test all deceased drivers. If a test for alcohol is conducted only when alcohol is suspected, then the rates of alcohol involvement will be inflated because the tested group has been selected for a high probability of alcohol involvement.

There are differences among states in the criteria for reporting crashes. Many states now require a police investigation only if there is an injury or fatality, while crashes that do not involve injuries are reported by the drivers themselves. Biases may result from such self-reports because of underreporting of crashes where alcohol is involved or failure to indicate alcohol involvement in those crashes that are reported. In either case, an underestimate of alcohol involvement in

non-injury crashes would result. As a results, the true costs of alcohol involvement in motor vehicle crashes would be underestimated.

Likewise, alcohol impairment may be determined in a number of ways. Traditionally it was measured by observation of driving performance and of performance on psychomotor tasks, such as walking a straight line. The advent of objective chemical measures greatly increased the accuracy of identifying alcohol involvement. While blood tests are the most accurate measure, breath tests can provide a close approximation of the blood alcohol level. See Appendix C for a discussion of this issue.

If different criteria are used for defining alcohol involvement, then different results will be obtained. Because there are wide variations in state practices in this regard, interstate comparisons are often invalid. Many states use one crash report form for the state police or highway patrol, while each municipality has its own version. Often the municipalities do not send all their reports to the state. Many states can provide information on the number of alcohol arrests made by the state-level enforcement personnel but have no figures for cities. Likewise, different state agencies may use different criteria for reporting motor vehicle casualties. Motor vehicle departments may focus on crashes occurring on public highways, while state health departments may include off-road crashes as well. If interstate or interagency comparisons are to be made, be sure to be aware of whatever differences may exist in reporting criteria.

8. What does this table tell you about the drunk driving problem?

This table tells only the absolute numbers of crashes by driver age, sex, and alcohol involvement. It is possible with these data to calculate the proportion of crashes involving alcohol for each age-sex group. Doing this, it can be seen that alcohol-related crashes are predominantly a male phenomenon. Why might this be?

Males drive more than females, and they are more likely to be driving at the times and places where alcohol is being used. Males are also probably more likely to use alcohol and to engage in risk taking behavior.

The table also shows that most crashes do not involve alcohol. Given that that is the case, are there interventions other than alcohol-related ones that might have greater impact on reducing motor vehicle injury and death among adolescents, and if so, what are they?

Occupant restraint laws, curfew laws, increased public transportation all should reduce motor vehicle injury and death. Anything that can be done to improve crash survivability should benefit occupants in both alcohol and nonalcohol crashes, e.g., improvements in the vehicle to minimize the effects of a crash on an occupant or increasing the use of restraint devices.

9. What other information do you need to interpret these data?

The crash figures give you numerator data. You need denominator data to calculate rates and to get an idea of whether drinking teenagers are overrepresented in crashes. Ideally you would want information on the age

and alcohol use of non-crash involved drivers using the same roads at the same times as the crash-involved drivers. Unfortunately such information is next to impossible to obtain. There are some fairly sophisticated techniques that can be used to estimate from the crash data themselves exposure to risk of crash, but these techniques require more expertise and money than is likely to be readily available (Wass, 1982).

In place of such precise exposure data, you can use other information for your denominator, e.g., population data, data on the number of licensed drivers by age.

10. Using these tables, calculate the rates of alcohol-involved crashes for 18-year old drivers versus drivers over age 24. What other denominators might you use other than the ones given? What effect does the choice of denominator have on your rates?

Population Rates
(Ratio to Lowest Rate)

Age	Male	Female	Total
18	.0175621* (19.9)**	.0034089 (3.9)	.0107302 (12.2)
>24	.0064189 (7.3)	.0008818 (1.0)	.0034600 (3.9)
Total	.0068279 (7.7)	.0009577 (1.1)	.0037011 (4.2)

*Number of alcohol-related crashes of 18-year-old males divided by population of 18-year-old males, 1060/60357 = .0175621.

**Ratio of rate among 18-year-old males to rate among females over age 24 (lowest rate group).

Licensed Driver Rates
(Ratio to Lowest Rate)

Age	Male	Female	Total
18	.0226844* (21.2)**	.0047133 (4.4)	.0143146 (13.4)
>24	.0064235 (6.0)	.0010701 (1.0)	.0038207 (3.6)
Total	.0068898 (6.4)	.0011666 (1.1)	.0041104 (3.8)

*Number of alcohol-related crashes of 18-year-old males divided by number of licensed 18-year-old males, 1060/46,728 = .0226844.

**Ratio of rate among 18-year-old male licensed drivers to rate among female licensed drivers over age 24 (lowest rate group).

a. Population figures from Census data - While these data give population rates, they fail to take into consideration the amount of exposure (i.e., being a licensed driver, amount of driving time or mileage) to the risk. This has social as well as statistical implications in that, unlike many other health problems, motor vehicle injuries are a by-product of a desired commodity, namely, transportation. If mileage is reduced to zero, then motor vehicle injuries should likewise be reduced to zero. However, mobility is highly desired, so there is a need for a reasonable tradeoff between mobility and injury.

b. Licensed population - These data are usually readily obtained and are frequently used in calculating rates. They provide a better approximation of the population at risk than merely the total population denominator. However, there are problems in using this denominator, as well. What problems do they pose? All licensed driver groups do not drive comparable distances. Those with low mileage have lower exposure to risk of being in a crash and suffering injury. In addition, not all persons who drive obtain licenses, so there is likely to be an inherent bias in the risk. Furthermore, unless one limits the analysis only to drivers, the licensed driver denominator has little usefulness in estimating risks for the adolescent passenger.

c. Mileage driven - This information is extremely difficult to obtain and is of dubious quality when it is available. Furthermore, mileage driven does not say what kind of mileage. Miles driven at night on two-lane paved rural roads at high speed are much more hazardous than miles driven in good weather in daylight in town.

If mileage driven is used, it will appear that the injury rate has improved dramatically over time, because mileage has increased proportionately more than injuries. If population figures are used, it will appear that the motor vehicle injury problem is showing no improvement whatsoever because larger proportions of the teen population are driving and driving more miles. Thus the choice of a denominator makes a big difference in the conclusions reached.

11. Based on these rates, what conclusions can you reach about drinking and driving among the 18, 19, and 20-year-olds from whom alcohol purchase privileges will be removed?

Table 6 shows that the rates for these young drivers (under age 25) are higher than for drivers age 25 and older.

If the instructor has the students calculate sex specific rates, it will be seen that the rates for the females are much lower than those for the males. In fact, the rates for the young females are well below the rates for the older males.

Based on such empirical evidence, it has been proposed that females be allowed to drink at a younger age than males. What are the pros and cons of such a proposal?

12. How do the proportions of deceased drivers who have been drinking vary by age and amount of alcohol? What are the limitations of data based solely on fatally injured drivers?

It can be seen that younger male drivers on the whole are less likely to have alcohol in them at autopsy than older drivers and that older drivers are more likely to be at the higher alcohol levels. The data on female drivers are almost too sparse to draw any conclusions.

The medical examiner data are the best alcohol data because all victims age 15 and over are tested unless there is a reason the test would not be valid (e.g., too much time elapsed between injury and death). However, only deceased victims are tested. In addition, the medical examiner data do not usually report driver culpability. Consequently, if a culpable drunk 18-year-old driver survives a crash in which a 45-year-old sober driver is killed, the medical examiner data will not show that the death is related to teenage drinking.

13. How is driver injury severity related to alcohol involvement and age?

Table 9 shows that alcohol-involved crashes are much more likely to result in serious or fatal injury to the driver than are crashes with no alcohol involvement. A much higher proportion of nonalcohol crashes involve no driver injuries. These relationships hold true at all ages.

Because alcohol crashes are more severe at all ages, should consideration be given to prohibiting alcohol and driving at any age? (Not intoxication, but alcohol in any amount?) Are there alternative prevention strategies that may prove more effective than legislative restrictions on young drivers? Give examples (e.g., passive restraints).

14. Looking back at the information available on the crash report form, what are some of the variables that you might want to consider and/or use as proxy measures for alcohol-related crashes? What types of crashes are likely to be more affected by the law?

Variables on the crash report form that may be of interest include:

a. Driver sex
b. Driver sobriety
c. Time of day (day versus night)
d. Day of week (week-day vs. weekend)
e. Crash type (single versus multiple vehicle)
f. Speeding (yes versus no)

Alcohol crashes are more likely to involve a male driver in a single vehicle accident, at night, on a weekend. Consequently, to assess the impact of a legislative change, some studies have used nighttime crashes as a proxy measure, while others have used nighttime single vehicle crashes or nighttime single vehicle crashes involving male drivers. In other words, they have examined the drinking and driving problem in the group for which it is most serious and for which an observed change is most likely to indicate real change. If the data bank is large enough, your analysis can focus on fatal crashes. However, in smaller states the numbers are too small to conduct a valid analysis limited to fatal crashes.

15. Based on the information you now have, how would you calculate the anticipated impact of the proposed legislation?

You can now take the number of nighttime fatal crashes involving drivers age 18 through 20 prior to the law and apply the anticipated reduction, either 28 percent or 13 percent, depending on which figure you choose to use. Or you could give both figures and estimate that the reduction should lie somewhere in between.

16. How would you calculate the estimated savings in avoided deaths?

You would first calculate the anticipated reductions in fatalities. Table 10 shows the number of deaths and serious injuries to drivers judged by the investigating officer to have been drinking. However, these estimates are probably conservative. That is, if the officer says the driver has been drinking, the probability is very high that alcohol was involved. For some drivers the officer is not able to make the judgment, so that alcohol cases may be missed. Thus data in Table 10 should be considered the minimum number of cases that potentially could be affected by the law.

Table 11 shows all fatal crashes occurring at night. Assuming only one fatality per fatal crash results in 107 nighttime fatal crashes involving 18, 19, and 20-year-old drivers, i.e., those drivers affected by the proposed legislation. Applying the percent reductions reported in the studies cited, namely, 13 percent and 28 percent, the anticipated reduction in deaths would be between 14 and 30 annually.

Applying a very low value of $250,000 per life (see Blomquist, 1982; Miller et al., 1985), the reduction in fatal injuries would be valued between $3,500,000 and $7,500,000. If the higher value of life calculated by Miller et al. (1985) is applied, then the savings from avoided deaths alone would be between 20 and 44 million dollars.

17. How would you prepare your report to the legislature describing the anticipated impact of the law and what questions and criticisms should you be prepared to answer?

Your report should be brief, preferably no more than one page in length, although you may supplement it with tables or figures. You may have questions about extrapolating from the experience of other states. Someone may ask you about other ways to reduce motor vehicle injuries among young people, e.g., through safety belt usage laws or curfews.

Almost certainly you will encounter the issue of individual freedom and Big Brother telling us what to do. This latter point can be countered by explaining how citizens are currently forced to pay the costs of the motor vehicle injuries and deaths through increased insurance premiums (life, health, disability, and motor vehicle insurance), social security, Medicare, Medicaid, worker's compensation, and so forth.

18. What are the specific questions you will try to answer with your evaluation?

Your evaluation should document the amount of reduction, if any, in deaths and serious injuries associated with crashes involving drinking drivers age 18 through 20. Your evaluation should also address other factors that may affect your findings.

Specifically, your evaluation should answer:

a. Was the implementaion of the law associated with a change in the number of deaths and serious injuries attributable to drinking drivers age 18-20?
b. Is the change, if any, statistically significant?
c. What change, if any, occurred among drivers below age 18?
d. What change, if any, occurred among drivers age 21 and older?
e. What factors other than the legislation might account for any observed changes?
f. Given this information, how might the impact of the legislation best be described?

19. Will you base your evaluation on the kinds of data currently collected, or will you try to get additional data collected? If the latter, what kinds of information would you ask for?

Realistically you will probably have to base your evaluation on the kinds of data currently collected. However, if you had your druthers, what information would you like to have?

Ideally it would be desirable to have a blood alcohol reading on every driver involved in a fatal or injury-producing crash. A very few states currently have legislation providing for the collection of this information, but such information is not generally available. To obtain such information for research purposes only would require legislative action. At the present time an official alcohol test is not administered unless an arrest is made for driving under the influence. Consequently many drinking drivers are not officially detected.

20. What interpretation can be made of this figure?

Although it appears at first glance that the implementation of the legislation led to a decrease in alcohol-related crashes, this interpretation cannot be made without further information.

21. What additional information would you want to have?

You would want more time data to determine whether there was a trend going on prior to the implementation of the law. A simple before-after design as depicted in this figure will not give you this information.

22. Now what conclusions can you draw about the impact of the law and what are the implications of this figure for the design of your evaluation?

This figure suggests that there was a drop in alcohol-related crashes over a period of several months preceding the change in law and that the actual change in law does not appear to have a major impact in and of itself. Nevertheless, the publicity surrounding the passage of the law

very likely contributed to the public awareness which in turn contributed to the observed decrease in alcohol-related crashes.

23. Based on this figure, what can you add to your interpretation of the effect of the law?

This figure shows that there has been an impact on drivers of all ages, that is, all ages show substantial decreases in the proportion of their crashes that are alcohol-involved. However, there seems to be a differential impact on younger drivers, that is, younger drivers show a greater decrease in alcohol-involved crashes. To what extent this differential impact can be attributed to the increase in age of purchase is not clear.

The law increased the age of purchase only one year, to age 19, so technically the 18-year-old drivers are the only ones directly affected by the change in age of purchase provision of the law. If it is assumed that without the change in age of purchase, the behavior of 18-year-olds would be most like the age 19-20 group, then it may be surmised that the difference between the reduction found for 18-year-olds and that seen for 19-20-year-olds is the amount of change that may be attributed to the change in age of purchase.

More information on what else was occurring during this same time period would also be useful. The Safe Roads Act provided much stiffer penalties for underage drivers found to have been drinking. This provision may have had more to do with the differential decrease in crashes at the younger ages than the change in age of purchase.

Furthermore, whatever the legal age for purchase of beverage alcohol, it is likely that there will be a "spillover" effect, that is, a certain proportion of slightly younger drivers will also be drinking. Thus, if the drinking age is 18, a certain proportion of 17-year-olds and a smaller proportion of 16-year-oldS and even 15-year-olds may be expected to drink. If the drinking age is raised from 18 to 21, the spillover effect would show in the 20 and 19-year-olds but would be less prominent in the younger drivers.

There will be some 17-year-olds already drinking while the legal age is 18, and these young drivers may be unlikely to discontinue drinking. However, even younger drivers that have not begun to drink may be less likely to drink at 17 if the drinking age is 21.

For this reason, a single year's data will not be sufficient. Raising the drinking age may be an example of a law that could be expected to have a greater impact several years in the future than it has immediately. Thus, a longer time period for the evaluation is important because there may be long term trends that need to be taken into consideration in assessing the law's impact (see Figure 3).

24. What kinds of contemporaneous changes, e.g., other safety legislation or social changes, might affect the findings?

When there is a heightened awareness of a problem such as traffic injuries, there may be several measures enacted at the same time, e.g.,

safety belt usage laws and stronger drunk driving laws. Evaluators must take such contemporaneous events into account when interpreting findings.

Although these figures do not suggest it, regression to the mean is another phenomenon that must be considered in evaluating changes in health and safety-related laws. Regression to the mean refers to the tendency for extreme values to be followed by values closer to the overall average performance. For example, if there is a marked increase in traffic fatalities in one year, there is a tendency for the number to fall closer to the overall average in the next year. However, if the increase in the first year led to changes in policy, the decrease in the next year is likely to be attributed solely to the new policy, when in fact the decrease might have occurred anyway. In this way, ineffective programs may become entrenched.

25. What questions and criticisms might you anticipate and how would you propose to handle them? What unintended consequences might occur?

The question may be raised as to whether the length of time considered is long enough to arrive at firm conclusions regarding the impact of the law. Indeed, you would want to monitor the evidence for an extended period of time to determine whether any effect increases, decreases, or remains steady.

There may also be a question as to whether any observed changes are attributable to the law or to other factors, e.g., increased awareness of the problem.

Some legislators may still argue that the costs in individual freedom to choose are too great and that it is worth it to sacrifice a few lives in order to retain such freedom.

It is not unusual for legislation to have consequences, good or bad, that were not anticipated. Because it is well known that alcohol is heavily involved in violent death, raising the drinking age might be associated with a decrease in teenage suicides and homocides or even in teenage crime. Even though the focus of your charge was to demonstrate the impact of changing the law on motor vehicle injury, you might strengthen your case by showing other benefits as well.

26. What further questions could you pursue through the use of these data sources?

The data sources used in this evaluation are available to answer other questions as well. The crash and injury data may be used to evaluate the impact of safety belt usage laws or curfew laws, as well as changes in licensing programs, e.g., introducing special licensing for drivers of heavy trucks. The medical examiner files include information on all types of unnatural death and, depending on the quality of the data in your state, can provide a rich source of data for answering questions and evaluating a variety of programs, e.g., gun control laws.

Appendix 1

Sources of Information on Highway Safety Data and Studies

Insurance Institute for Highway Safety (IIHS)
Watergate 600
Washington, DC 20037
(202) 333-0770

The IIHS publishes a free newsletter called STATUS REPORT that provides up-to-the minute news on legislative and other developments in highway safety. It also reports on recent studies in highway safety and usually offers a free copy of the complete report for interested readers.

National Highway Traffic Safety Administration (NHTSA)
400 Seventh Street, S.W.
Washington, DC 20590

and

Federal Highway Administration (FHWA)
400 Seventh Street, S.W.
Washington, DC 20590

NHTSA and FHWA are part of the U.S. Department of Transportation. NHTSA is more likely to have the kind of information you want, particularly the NHTSA Center for Statistics and Analysis. However, some information, like mileage driven by vehicle type, is compiled by FHWA. Any inquiries you make will be directed to the appropriate office.

National Safety Council (NSC)
444 N. Michigan Ave.
Chicago, IL 60611
1-800-621-7619

NSC compiles data provided by the states on motor vehicle as well as other types of accidents and injuries. These data are summarized in their annual publication, ACCIDENT FACTS, which is a valuable reference.

AAA Foundation for Traffic Safety
8111 Gatehouse Road
Falls Church, VA 22047

AAA sponsors studies concerned with highway safety, as well as developing materials for traffic safety education. A list of their publications may be of interest to you.

American Association for Automotive Medicine (AAAM)
40 Second Avenue
Arlington Heights, IL 60005
(312) 640-8440

AAAM membership consists of physicians, engineers, human factors specialists, other health professionals, and others concerned with improving traffic safety. An annual meeting includes presentations of original research on a wide variety of highway safety topics. It is the only highway safety organization that has always focused on the health aspects of motor vehicle crashes. The proceedings of the annual meeting are published. In addition, AAAM publishes a quarterly journal that includes both news and scientific reports.

Transportation Research Board (TRB)
2101 Constitution Avenue
Washington, DC 20418
1-800-424-9818

TRB is the largest operating unit in the National Research Council of the National Academy of Sciences. While most of its activities are probably not of direct interest to you, they have the capability of conducting literature searches on any facet of transportation. There may be occasions when such a service would be of interest to you.

University of Michigan
Transportation Research Institute (UMTRI)
2901 Baxter Road
Ann Arbor, MI 48109

UMTRI is one of the best highway research centers in the world. They have published hundreds of reports, and each year they publish a summary of on-going research. You might ask if your agency could get on their mailing list.

The University of North Carolina
Highway Safety Research Center (HSRC)
CTP 197A
Chapel Hill, NC 27514
(919) 962-2202

The UNC HSRC is also a university research center that focuses on highway safety (as opposed to transportation research generally). Much of the research conducted by HSRC would be of interest to you. A list of their publications is available upon request.

Research and Development Office
Department of Motor Vehicles
P. O. Box 1828
Sacramento, CA 95809

California is unique among state departments of motor vehicles in the amount and quality of research they conduct on highway safety. They have produced many studies on drunk driving countermeasures, driver improvement,

driver licensing incentives, and so forth. If you have questions in these areas, you may want to contact them.

Many other states have some kind of research program in highway safety, but much of the work that is produced in this field is not well conceived or implemented. Much of the good work focuses on roads and vehicles and is probably not of great interest to you. However, you should check in your own state to find out whether your state agencies and/or universities are conducting research that would be helpful to your efforts. In turn, you may be able to work out some collaborative arrangements with these agencies and universites on questions of mutual interest.