

Alcohol-Related Deaths in Wisconsin: The Impact of Alcohol on Mortality

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Abstract: Analysis of the impact of alcohol as an underlying and non-underlying cause of death in Wisconsin showed a marked increase between 1963 and 1977 in the frequency of deaths reported with mention of alcohol. The rate of deaths for which alcohol was a non-underlying cause rose more sharply during this period (2.4 per 100,000 to 9.3) than that of alcohol-related causes (4.6/100,000 to 9.0). Nearly 90 per cent of alcohol-related deaths at ages 15–24 reported alcohol as a non-underlying cause, compared to 40.7 per cent at ages 45–54 and 57 per cent at ages 75+. This proportion was higher (50.8 per cent) among males than among females (32.8 per cent). Deaths related to alcohol are attributed to a number of underlying causes in addition to alcohol. In 1975–77, nearly half of

the reported alcohol-related deaths were attributed to other causes, including accidents (14.8 per cent), heart disease (14.3 per cent), respiratory diseases (4.9 per cent), suicide (3.7 per cent), and cancer (31 per cent). These percentages may reflect substantial underreporting.

Comparison of motor vehicle driver death certificates with blood alcohol test reports for these drivers shows 90 per cent underreporting of alcohol on death certificates. This fact, along with other information on underreporting, shows that the approximately 650 deaths now being reported with mention of alcohol annually in Wisconsin, represent only a portion of such deaths. (*Am J Public Health* 1981;71:1237–1241.)

Introduction

Alcohol is receiving increasing attention as a leading public health problem and an important cause of death. Comparative data for 1976 show that Wisconsin ranked sixth among the states in per capita consumption of ethanol.¹ Over the 15-year period from 1963–1977, state per capita consumption of beer increased 21 per cent, liquor 68 per cent, and wine 140 per cent.² These statistics emphasize the need for a realistic measure of the overall impact of alcohol on mortality in the state.

A growing proportion of death certificates in Wisconsin mention alcohol, either as the underlying cause of death—that is “the disease or injury which initiated the train of morbid events leading directly to death”³—or as an immediate, secondary, or contributory cause. It is likely that alcohol has an even greater role as an ancillary cause, related to the death or contributing to it, than it does as the underlying cause.

However, it is difficult to evaluate the true impact of alcohol on mortality. Most systems for tabulating and sum-

marizing information reported on death certificates are equipped to deal only with the cause coded as the underlying cause of death. In addition, accurate information on alcohol involvement may be difficult to obtain. Autopsy data can provide only part of the picture; since alcohol is metabolized within a few hours, its presence at the time of the event “which initiated the train of morbid events leading . . . to death” may not be detectable by the time of death. Further, the reporting of alcohol involvement on a death certificate may be considered to be stigmatizing to the decedent and therefore not recorded even when known. Thus, both the ancillary (non-underlying) nature of much alcohol involvement and actual underreporting lead to a substantial underreporting of the impact of alcohol as a cause of death.

Unique resources are available in Wisconsin for evaluating the relative importance and effect of these two sources of underestimation of alcohol-related deaths. A special file of all death certificates reporting alcohol involvement in any context provides information on the importance of alcohol as an ancillary cause. In addition, data on blood alcohol levels of traffic fatalities provide an opportunity for assessing the completeness with which alcohol as a non-underlying cause is reported on the death certificate for deaths from this cause.

Materials and Methods

Three data sources were used in this analysis. First, a supplement to the traditional death record file was used to

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TABLE 1—Deaths Related to Alcohol, Wisconsin, 1963–1977 (Resident data)

Year	Alcohol-Underlying Cause		Non-Underlying Cause		All Alcohol-Related	
	Number	Rate*	Number	Rate*	Number	Rate*
1963	126	4.6	65	2.4	191	6.9
1964	141	5.1	132	4.8	273	9.8
1965	149	5.3	111	4.0	260	9.3
1966	160	5.5	158	5.4	318	10.9
1967	187	6.4	140	4.8	327	11.3
1968	216	7.2	145	4.8	361	12.0
1969	213	7.0	172	5.6	385	12.6
1970	231	7.5	180	5.8	411	13.3
1971	249	7.8	178	5.6	427	13.4
1972	257	8.3	229	7.1	496	15.4
1973	262	8.1	226	7.0	488	15.1
1974	296	8.8	286	8.5	582	17.3
1975	362	10.6	274	8.0	636	18.6
1976	359	10.3	291	8.3	650	18.7
1977	318	9.0	331	9.3	649	18.3

*Rates per 100,000 estimated population age 15 and over.

determine the magnitude and distribution of all alcohol-related deaths in Wisconsin. The standard death certificate in use in Wisconsin and other states gathers information on the immediate cause of death and conditions antecedent to and relating to this cause. In addition, an opportunity is provided for reporting other significant conditions which contributed to death but were not related to the cause. From this list, the underlying cause is selected.⁴ All death records of Wisconsin residents which bear mention of alcohol in any of these contexts are segregated for further study. This group includes two categories of deaths:

- *Alcohol-underlying*: deaths for which the underlying cause involved alcohol, e.g., alcoholic cirrhosis, alcoholism, alcoholic psychosis and alcohol poisoning. (ICDA-8: 541.0, 303, 291.0, 860);
- *Alcohol-non-underlying*: deaths for which the underlying cause did not involve alcohol but alcohol was mentioned on the certificate.

Although information on non-underlying causes is not generally coded and entered on the standard death record file, deaths in the second category have been tabulated manually in Wisconsin since 1963.

The second source of data is also derived from death certificates. In 1973, Wisconsin began using the Automated Classification of Medical Entities (ACME) which tabulates non-underlying causes as well as underlying causes. A five-year work tape and summary tabulations are available for analysis.⁵ Although ACME does not overcome the fundamental problems of underreporting, it does provide an automated method for obtaining information on reported alcohol-related deaths which is easier to manipulate than the manual file. Its use will permit more detailed study of the role of alcohol as a non-underlying cause of death.

A third source of information was used to estimate the completeness with which known alcohol involvement is recorded on death certificates: since 1968, Wisconsin has

maintained a mandatory program for blood alcohol testing of all motor vehicle accident fatalities in which the decedent was a driver, motorcyclist, or pedestrian, aged 16 and over, and died within six hours of the accident. Blood alcohol concentrations (% by weight) of 0.05 per cent or higher are considered relevant legal evidence of intoxication.⁶ Testing program reports for deceased auto and motorcycle drivers and pedestrians with findings of 0.05 per cent or higher were matched with the death certificates for the same individuals.⁷ It could then be determined whether the death certificates for these persons with definite evidence of alcohol involvement recorded this fact.

Results

Throughout most of the 15-year period for which there are data, there has been a steady and marked increase in the frequency of deaths in Wisconsin reported with mention of alcohol (Table 1). The death rate from alcohol-related underlying causes rose from 4.6 per 100,000 population aged 15 and over in 1963 to 9.0 per 100,000 in 1977. The rate of deaths for which alcohol was mentioned as a non-underlying cause rose somewhat more sharply, from 2.4/100,000 in 1963 to 9.3 in 1977.

The reporting of alcohol as a non-underlying cause compared to its reporting as an underlying cause varies according to the age and sex of the decedent (Table 2). As shown in Figure 1, the proportion of all alcohol-related deaths for which alcohol was not the underlying cause was largest at the younger ages. Among decedents aged 35–64, on the other hand, the majority of alcohol-related deaths were due to underlying causes involving alcohol. Among males, 50.8 per cent of all alcohol-related deaths were attributed to underlying causes not involving alcohol; this

TABLE 2—Deaths Related to Alcohol by Sex and Age, Three-Year Average; Wisconsin, 1975–1977 (Resident data)

Age	Alcohol-Underlying		Alcohol Non-Underlying		All Alcohol-Related	
	Number	Rate*	Number	Rate*	Number	Rate*
TOTAL						
All Ages	326.3	9.4	298.6	8.6	624.9	18.0
15–24	4.7	0.5	30.3	3.3	35.0	3.8
25–34	13.7	2.1	20.3	3.2	34.0	5.3
35–44	41.0	8.5	29.3	6.1	70.3	14.6
45–54	88.6	18.1	60.7	12.4	149.3	30.5
55–64	99.0	23.5	72.7	17.2	171.7	40.7
65–74	66.0	21.9	67.3	22.4	133.3	44.3
75+	13.3	6.5	18.0	8.8	31.3	15.3
MALES						
All Ages	233.8	13.9	241.2	14.3	475.0	28.2
15–24	3.7	0.8	25.3	5.4	29.0	6.2
25–34	9.7	3.0	14.0	4.3	23.7	7.4
35–44	26.7	11.3	22.3	9.4	49.0	20.7
45–54	58.7	24.6	45.3	19.0	104.0	43.5
55–64	70.6	35.0	62.0	30.7	132.6	65.6
65–74	54.7	39.9	57.0	41.6	111.7	81.5
75+	9.7	12.1	15.3	19.1	25.0	31.1
FEMALES						
All Ages	92.6	5.2	57.3	3.2	149.9	8.4
15–24	1.0	0.2	5.0	1.1	6.0	1.3
25–34	4.0	1.3	6.3	2.0	10.3	3.3
35–44	14.3	5.9	7.0	2.9	21.3	8.8
45–54	30.0	12.0	15.3	6.1	45.3	18.0
55–64	28.3	12.9	10.7	4.9	39.0	17.7
65–74	11.3	6.9	10.3	6.3	21.6	13.2
75+	3.7	3.0	2.7	2.2	6.4	5.2

*Rates per 100,000 estimated population age 15 and over. 1976 Estimated Population from *Public Health Statistics* (Table 4) Wisconsin Population by Age and Sex, White and Nonwhite 1970 Census and 1976 Estimate.

Note: Average annual figures are calculated for the three-year period. The sum of the age groups may not equal the total of all ages due to rounding.

proportion was lower (38.2 per cent) among females. This pattern was true in most age groups.

Deaths related to alcohol are attributed to a number of underlying causes in addition to alcohol, as indicated above. As shown in Table 3, 36 per cent of all deaths in the years 1975–1977 which were related to alcohol were due to alcoholic cirrhosis of the liver, and 16 per cent were due to alcoholism. On the other hand, for 14.8 per cent of alcohol-related deaths, the underlying cause was accidents, in large part motor vehicle accidents; for another 14.3 per cent, it was heart disease. Stroke, cancer, and suicide also accounted for significant proportions of the total group of alcohol-related deaths.

In order to further assess the impact of alcohol as a non-underlying cause of death, the proportions of deaths attributed to various underlying causes which were reported as related to alcohol are shown in Figure 2. Thus, although 14.3 per cent of all alcohol-related deaths were due to heart disease, this number constituted only 0.6 per cent of all heart disease deaths. In contrast, reported alcohol involvement emerged as a significant factor in motor vehicle accidents (2.7 per cent), other accidental causes (6.5 per cent), and suicide (3.9 per cent).

Additional information on the contribution of alcohol to mortality is derived from the ACME file which includes information on all causes of death, underlying and non-

underlying, as well as other characteristics of the decedent. The mean age of death for all deaths mentioning alcohol, calculated from this file, was approximately 55.6 years whereas the mean age of death for deaths not mentioning alcohol was 70.1. This suggests the loss of life years due to the abuse of alcohol. Comparison of the relative impact of the various leading causes of death as underlying and non-underlying cause underscores the importance of alcohol as a contributory cause.⁸

As noted above, data from the traffic fatality blood alcohol testing program were matched to death certificates to determine the completeness with which alcohol as a non-underlying cause is reported on the certificate for deaths from motor vehicle accidents. During the three-year period 1975–1977, alcohol was mentioned on the death certificate for only 9.7 per cent of the motor vehicle accident victims (drivers and pedestrians) whose test reports indicated relevant evidence of intoxication (Table 4).

Discussion

As mentioned earlier, the extent to which alcohol-related deaths are underreported is unknown, although it is believed to be very substantial. It is likely that the degree of

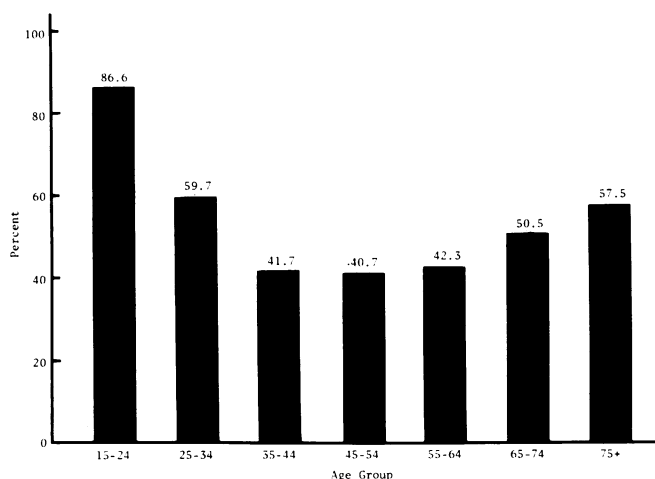


FIGURE 1—Alcohol-Non-Underlying Cause as a Per Cent of All Alcohol-Related Deaths, Three-Year Average: Wisconsin, 1975–1977

underreporting has changed over the years, in keeping with the growing recognition of alcohol as a public health problem. This in itself would cause at least part of the rise in incidence of alcohol-related deaths.

Comparisons with data from the traffic fatality testing programs show that at least for one specific cause of death involving alcohol, an analysis based on death certificates alone reveals only the tip of the iceberg. Clearly, the impact of alcohol as a cause of death is grossly underestimated as far as motor vehicle drivers and pedestrians are concerned. Out of every ten such fatalities in which relevant evidence of alcohol involvement was documented, the death certificate mentioned this fact for only one. Blood alcohol reports are likely to be relatively complete because there is a specific statutory requirement to perform blood alcohol tests on drivers and pedestrians who are accidentally killed. However, the requirement to mention alcohol on the death certi-

TABLE 3—Leading Causes of Death Related to Alcohol, Three-Year Average: Wisconsin, 1975–1977 (Resident data)

Cause (ICDA 8)	Number	Per Cent
All Alcohol-Related	632.3	100.0
Alcohol-Underlying		
571.0 Cirrhosis of Liver	227.0	35.9
303 Alcoholism	101.7	16.1
291 Alcoholic Psychosis	6.7	1.1
860 Alcoholic Poisoning	1.7	0.3
Alcohol—Non-Underlying		
800–949 Accidents	93.3	14.8
Heart Disease*	90.3	14.3
460–519 Respiratory	31.3	4.9
950–959 Suicide	23.6	3.7
140–209 Cancer	19.7	3.1
430–438 Stroke	12.7	2.0
All Other Non-Underlying	11.6	1.8
520–577 Digestive System	8.7	1.4
250 Diabetes	4.0	0.6

* 390–458 except 430–438

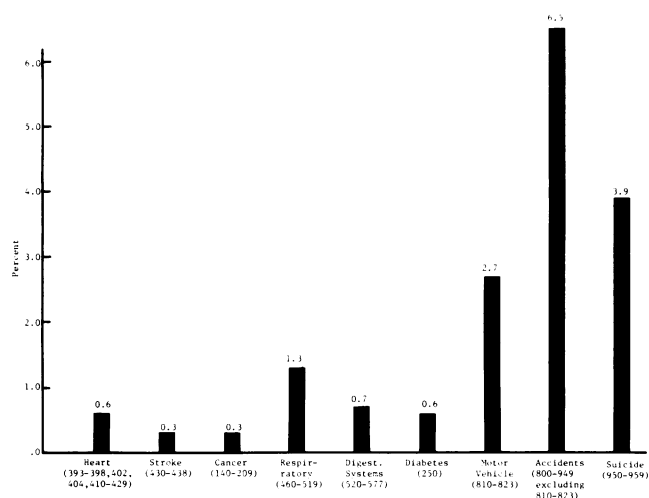


FIGURE 2—Deaths Related to Alcohol as a Per Cent of All Deaths from Selected Causes, Three-Year Average: Wisconsin, 1975–1977

cate when it is a related factor may be less well known; in addition, the information may not be available when the certificate is filled out or it may simply be ignored for social reasons. The death certificate is considered a public document in Wisconsin, whereas the blood alcohol report is held confidential by statute.

If, for purposes of speculation, the ratio of 10 to 1 were taken as a rough indicator of the extent of underreporting for all causes of death in which alcohol is mentioned as a non-underlying cause, then the proportion of deaths in Wisconsin that involve alcohol would be over nine per cent. This approaches the national estimate that 11 per cent of deaths either directly or indirectly involve alcohol.⁹ However, it must be pointed out that the national estimate is also based on partial data and is subject to considerable variation.

The effects of alcohol on mortality are far broader than readily available tabulations in underlying causes of death

TABLE 4—Motor Vehicle Accident Victims*: Comparison of Blood Alcohol Testing Program Reports and Death Certificates, Wisconsin: 1975–1977 (Resident data)

Aged	Blood Alcohol Testing Program Reports	Motor Vehicle Death Certificates with Alcohol-Mention	
	3-Year Av. No.**	3-Yr. Av. No.	Per Cent***
Total	246.4	24.0	9.7
16–19	56.0	5.7	10.2
20–24	67.0	6.4	9.6
25–44	85.7	5.3	6.2
45–64	27.0	5.3	19.6
65+	10.7	1.3	12.2

*Blood Alcohol testing is required by statute for drivers, motorcyclists, and pedestrians.

**Blood alcohol testing program reports indicating blood alcohol concentrations (% by weight) of 0.05% or higher.

***Motor vehicle death certificates with alcohol-mention as percentage of blood alcohol fatalities tested, in same age group, with 0.05% alcohol or over. Note: Average annual figures are calculated for the three-year period.

would suggest. This analysis shows that alcohol is even more important as an immediate, secondary, or contributory cause than it is as an underlying cause. Its relative importance as underlying or non-underlying cause varies by age, sex, and associated causes; these patterns suggest that study of underlying causes alone results in substantial distortions and inhibits understanding of the impact of alcohol on mortality.

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Preventive Medicine Circa 1300

*The Salerne School doth by these lines impart
All Health to England's King and doth advise
From care his head to keep, from wrath his heart,
Drink not much wine, sup light, and soon arise,
When meate is gone, long sitting breedeth smart:
And after-noone still waking keepe your eyes.
When mov'd you find yourself to Nature's Needs,
Forbear them not, for that much danger breeds,
Use three physicians still: Doctor Quiet,
Next Doctor Merry-man, and Doctor Dyet.*

Quoted from Packard ER: The School of Salerno. New York: Paul B. Hoeber, 1920.