

# Chronic Liver Disease Mortality in the United States, 1979 through 1989

## ABSTRACT

**Objectives.** Rates and trends for chronic liver disease mortality in the United States were examined.

**Methods.** National Center for Health Statistics data on underlying cause of death for chronic liver disease for the United States from 1979 through 1989 were analyzed. Four groups of diseases and conditions included under the *International Classification of Diseases*, 9th Revision, code for chronic liver disease were assessed separately.

**Results.** From 1979 through 1989, there were 303 875 deaths from chronic liver disease; 48% were in the cirrhosis without alcohol group, 42% in the alcohol-related liver disease group, 8% in the liver disease without alcohol group, and 1.5% in the biliary cirrhosis group. Chronic liver disease death rates for Blacks were more than 1.5 times greater than those for Whites and for other races. Chronic liver disease mortality declined 22% overall among both sexes. The largest decreases were for liver disease without alcohol (42%) and cirrhosis without alcohol (25%), followed by alcohol-related liver disease (14%) and biliary cirrhosis (12%).

**Conclusion.** Although declines in US chronic liver disease deaths have been attributed to declining alcohol consumption, these analyses suggest that greater declines have occurred in deaths not coded as alcohol related. (*Am J Public Health*. 1995;85:1256-1260)

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## Introduction

Chronic liver disease is a major cause of morbidity and mortality in the United States. Recent reports have indicated that since 1979 there has been a decline in the death rate for chronic liver disease and cirrhosis.<sup>1</sup> The reason for this decline is unclear; however, some reports have suggested that it may be related to a decline in alcohol use in the United States.<sup>2</sup> Despite this decline, chronic liver disease remains an important cause both of death and of years of potential life lost.<sup>3</sup>

Analyses of chronic liver disease mortality frequently combine all deaths listed as being from chronic liver disease for which the *International Classification of Diseases* code is 571.<sup>4</sup> Many etiologically unrelated diseases or conditions are listed under *International Classification of Diseases*, 9th edition (ICD-9) code 571, including alcohol-related liver disease and cirrhosis, cirrhosis without mention of alcohol, chronic active and chronic persistent hepatitis, and biliary cirrhosis. In view of the possible diverse etiologies of these categories, examination of rates and trends among groups of diseases and conditions that are likely to share similar etiologies, such as all chronic liver disease entities or conditions with an ICD-9 code that specifically mentions alcohol, may provide further insights into chronic liver disease mortality trends.

In this report, we describe chronic liver disease mortality and analyses of recent trends in the United States, focusing on four disease groups of chronic liver disease with ICD-9 codes that suggest that they may share common characteristics or etiologies. These groups include alcohol-related liver disease, cirrhosis without alcohol, chronic hepatitis or liver disease without alcohol, and biliary cirrhosis.

## Methods

Underlying cause of death data for chronic liver disease for the United States from 1979 through 1989 were obtained from the National Center for Health Statistics, Centers for Disease Control and Prevention (CDC).<sup>5</sup> We used ICD-9 codes on death certificates to identify deaths with chronic liver disease as the underlying cause.<sup>6,7</sup> The following chronic liver diseases with corresponding ICD-9 codes were categorized into one of four disease groups: biliary cirrhosis (code 571.6), alcoholic-related liver disease (codes 571.0-571.3), cirrhosis without alcohol (code 571.5), and liver disease without alcohol (codes 571.4 and 571.8-571.9).

Annual death rates for the United States were calculated as the number of deaths per 100 000 persons, based on estimates of the US resident population. The rates were standardized by the direct method with the 1980 census population.<sup>8</sup> Age-adjusted annual death rates were calculated by race, gender, and region. Risk ratios with 95% confidence intervals were calculated to compare age-specific death rates.<sup>9</sup>

To examine age differences, we used the following age groups: 0 through 29, 30

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through 39, 40 through 49, 50 through 59, 60 through 69, and over 70 years. Because chronic liver disease occurs primarily in the older population, we further analyzed data on age groups over 39 years. To study racial differences and trends, we used the categories of White, Black, and other races as provided in the mortality data. Geographic comparisons were analyzed by standard US census regions: North-east, North Central, West, and South.

## Results

From 1979 through 1989, there were 303 875 deaths for which one of the nine chronic liver disease ICD-9 codes was listed as the underlying cause of death (Table 1). Overall, the largest percentages of all chronic liver disease deaths were in the disease groups coded as cirrhosis without alcohol (48.2%) and alcohol-related liver disease (42.4%). Only 9.5% of deaths were in the disease groups coded as liver disease without alcohol (8.0%) and biliary cirrhosis (1.5%). The percentages of all chronic liver disease deaths in each disease group remained similar during the 11-year period of the study.

Age-adjusted death rates decreased from 1979 through 1989 for chronic liver disease overall and for each disease group (Table 2). The largest decreases from 1979 through 1989 were for liver disease without alcohol (42%) and cirrhosis without alcohol (25.2%). The age-adjusted decreases for each of these disease groups were greater than that for alcohol-related liver disease (13.9%).

Age-adjusted death rates for males were higher than those for females overall and in each disease group during the study period, with the exception of biliary cirrhosis (Table 2). Decreases from 1979 through 1989 were observed for both males and females overall and in each disease group, with the exception of females with biliary cirrhosis. Overall, the decreases for males and females were similar; however, within disease groups there were some gender-related differences. The decrease for alcohol-related liver disease among females (22.5%) was twice that among males (10%); for cirrhosis without alcohol the decrease for males (28.2%) was somewhat higher than that for females (20%).

Overall age-adjusted death rates for Blacks were more than 1.5 times greater than those for both Whites and other races. Death rates for alcohol-related liver disease and liver disease without

**TABLE 1—Proportion of Chronic Liver Disease Deaths by Diagnosis, United States, 1979 through 1989**

Type of Chronic Liver Disease	1979 (n = 29 720), %	1989 (n = 26 694), %	1979–1989 (n = 303 875), %
Biliary cirrhosis	1.3	1.5	1.5
Alcohol-related liver disease	42.2	46.1	42.4
Cirrhosis without alcohol	48.1	46.1	48.2
Liver disease without alcohol	8.4	6.3	8.0

**TABLE 2—Gender- and Race-Specific Age-Adjusted Death Rates (per 100 000 Persons) for Chronic Liver Disease, by Diagnosis, United States, 1979 and 1989**

Diagnosis/Gender and Racial Groups	1979		1989		% Change	RR (95% CI)
	Rate	No.	Rate	No.		
Biliary cirrhosis	0.17	376	0.15	394	-11.8	0.9 (0.8, 1.0)
Male	0.09	86	0.05	58	-44.4	0.6 (0.4, 0.8)
Female	0.23	290	0.23	336	0.0	1.0 (0.9, 1.2)
White	0.18	358	0.16	380	-11.1	0.9 (0.8, 1.1)
Black	0.09	17	0.04	10	-55.6	0.5 (0.2, 1.1)
Other	0.03	1	0.08	4	166.7	2.1 (0.2, 18.6)
Cirrhosis without alcohol	6.39	14 298	4.82	12 307	-25.2	0.8 (0.7, 0.8)
Male	9.03	9 057	6.48	7 326	-28.2	0.7 (0.7, 0.7)
Female	4.25	5 241	3.40	4 981	-20.0	0.8 (0.8, 0.9)
White	6.24	12 501	4.73	10 789	-24.2	0.8 (0.7, 0.8)
Black	7.65	1 609	5.38	1 312	-29.7	0.7 (0.6, 0.7)
Other	5.32	188	3.38	206	-36.5	0.6 (0.5, 0.7)
Alcohol-related liver disease	5.60	12 547	4.82	12 308	-13.9	0.9 (0.8, 0.9)
Male	8.47	8 793	7.62	9 012	-10.0	0.9 (0.9, 0.9)
Female	3.15	3 754	2.44	3 296	-22.5	0.8 (0.7, 0.8)
White	5.00	9 967	4.37	9 689	-12.6	0.9 (0.9, 0.9)
Black	10.58	2 295	8.61	2 254	-18.6	0.8 (0.8, 0.9)
Other	6.68	285	4.55	365	-31.9	0.6 (0.5, 0.7)
Liver disease without alcohol	1.12	2 499	0.65	1 685	-42.0	0.6 (0.5, 0.6)
Male	1.38	1 433	0.76	914	-44.9	0.5 (0.5, 0.6)
Female	0.89	1 066	0.54	771	-39.3	0.6 (0.6, 0.7)
White	0.91	1 813	0.59	1 353	-35.2	0.7 (0.6, 0.7)
Black	2.94	646	1.02	275	-65.3	0.3 (0.3, 0.4)
Other	1.00	40	0.87	57	-13.0	0.7 (0.5, 1.1)
Total chronic liver disease	13.28	29 720	10.40	26 694	-21.7	0.8 (0.8, 0.8)
Male	18.97	19 369	14.90	17 310	-21.5	0.8 (0.8, 0.8)
Female	8.52	10 351	6.60	9 384	-22.5	0.8 (0.8, 0.8)
White	12.33	24 639	9.85	22 211	-20.1	0.8 (0.8, 0.8)
Black	21.25	4 567	15.05	3 851	-29.2	0.7 (0.7, 0.7)
Other	13.03	514	8.87	632	-31.9	0.6 (0.5, 0.7)

Note. RR = risk ratio; CI = confidence interval.

alcohol were higher for Blacks. Death rates for cirrhosis without alcohol were similar among racial groups; for biliary cirrhosis the highest rates were among Whites. Significant decreases in rates

were observed among all races for each disease group, except for the biliary cirrhosis group and for persons classified as other race for liver disease without alcohol. Among disease groups there was

**TABLE 3—Age Group–Specific Death Rates (per 100 000 Persons) for Chronic Liver Disease, by Diagnosis, United States, 1979 and 1989**

Diagnosis/Age Group, y	1979		1989		RR (95% CI)
	Rate	No.	Rate	No.	
<b>Biliary cirrhosis</b>					
0–29	<0.1	6	<0.1	3	0.5 (0.1, 2.0)
30–39	<0.1	11	<0.1	8	0.5 (0.2, 1.3)
40–49	0.2	41	0.1	16	0.3 (0.2, 0.5)
50–59	0.3	74	0.2	49	0.7 (0.5, 1.0)
60–69	0.6	102	0.6	120	1.1 (0.8, 1.4)
70+	0.9	142	1.0	198	1.1 (0.9, 1.4)
<b>Cirrhosis without alcohol<sup>a</sup></b>					
0–29	0.1	153	0.1	79	0.5 (0.4, 0.7)
30–39	2.2	677	1.5	596	0.7 (0.6, 0.7)
40–49	8.4	1919	4.1	1243	0.5 (0.5, 0.6)
50–59	16.7	3863	9.8	2139	0.6 (0.6, 0.6)
60–69	23.0	4278	17.6	3628	0.8 (0.7, 0.8)
70+	20.7	3406	22.3	4620	1.1 (1.0, 1.1)
<b>Alcohol-related liver disease<sup>b</sup></b>					
0–29	0.2	239	0.1	155	0.7 (0.5, 0.8)
30–39	4.0	1211	3.8	1560	1.0 (0.9, 1.0)
40–49	11.5	2610	8.7	2643	0.8 (0.7, 0.8)
50–59	17.7	4105	14.5	3160	0.8 (0.8, 0.9)
60–69	17.2	3200	15.2	3141	0.9 (0.8, 0.9)
70+	7.2	1178	7.9	1643	1.1 (1.0, 1.2)
<b>Liver disease without alcohol<sup>c</sup></b>					
0–29	0.1	164	0.1	62	0.4 (0.3, 0.5)
30–39	1.1	328	0.5	192	0.4 (0.4, 0.5)
40–49	2.1	467	1.0	317	0.5 (0.4, 0.6)
50–59	2.3	609	1.3	272	0.5 (0.4, 0.6)
60–69	2.9	544	1.8	381	0.6 (0.6, 0.7)
70+	2.3	383	2.2	460	1.0 (0.8, 1.1)
<b>Total chronic liver disease</b>					
0–29	0.5	562	0.3	299	0.5 (0.5, 0.6)
30–39	7.3	2227	5.7	2356	0.8 (0.7, 0.8)
40–49	22.1	5037	13.9	4219	0.6 (0.6, 0.7)
50–59	37.3	8651	25.9	5620	0.7 (0.7, 0.7)
60–69	43.6	8124	35.2	7270	0.8 (0.8, 0.8)
70+	31.1	5109	33.4	6921	1.1 (0.1, 1.1)

Note. RR = risk ratio; CI = confidence interval.

<sup>a</sup>Two deaths with unknown age for cirrhosis without alcohol in 1979 and 1989.

<sup>b</sup>Four deaths with unknown age for alcohol-related liver disease in 1979 and six in 1989.

<sup>c</sup>Four deaths with unknown age for liver disease without alcohol and one in 1989.

a tendency for decreases to be greater among Blacks and other races than among Whites.

In both 1979 and 1989, the highest age-specific rates overall were among those 40 years old and over; age-specific rates increased with advancing age through ages 60 through 69 years, and then decreased among those over 69 years of age (Table 3). Similar age-specific trends were observed for alcohol-related liver disease and liver disease without alcohol. Biliary cirrhosis deaths rates increased with advancing age throughout all age groups. Death rates from cirrhosis without alcohol among persons over 69 years old decreased slightly in 1979 and increased slightly in 1989 compared with those among persons 60 through 69 years

of age. For persons over 39 years old, overall and for each disease group, the greatest decreases in chronic liver disease death rates occurred in the younger age groups (i.e., 40–49 and 50–59 years) compared with those over 59 years old (Figure 1).

The highest rates overall for chronic liver disease mortality during the 11-year period of the study were in the West and the Northeast (Table 4). This pattern was observed for alcohol-related liver disease, but not for the other disease groups. Cirrhosis without alcohol rates were highest in the Northeast and lowest in the West. Mortality from liver disease without alcohol was highest in the West and lowest in the Northeast and North Central regions.

Similar decreases in overall chronic liver disease mortality occurred in all regions. Decreases in death rates from cirrhosis without alcohol and from liver disease without alcohol did not differ by region. However, significant decreases in alcohol-related liver disease deaths occurred only in the Northeast and West.

## Discussion

These results confirm recent reports concerning decreases in chronic liver disease mortality and provide additional information concerning the reasons. Recent decreases in chronic liver disease deaths are generally attributed to declining alcohol consumption in the United States.<sup>2</sup> Our analyses suggest that although decreases in death rates for alcohol-related liver disease occurred in the past decade, there have been even greater decreases in rates of chronic liver disease-associated deaths with no mention of alcohol on the death certificate, and the latter may be responsible for a larger percentage of the overall decrease in chronic liver disease death rates. The largest decreases in death rates occurred in the groups with liver disease without alcohol and cirrhosis without alcohol; these may reflect a decrease in cirrhosis from causes other than alcohol. It could also reflect increased willingness of physicians to report chronic liver disease deaths as alcohol related.<sup>10</sup>

Death certificate data must be interpreted with great caution when attempting to assign etiologic factors such as alcohol. Studies of chronic liver disease deaths suggested that substantial underreporting of alcohol-related conditions on death certificates may occur.<sup>11</sup> Among deaths coded as being from chronic liver disease with no mention of alcohol, approximately 50% are thought to be due to alcohol use on the basis of studies involving retrospective chart reviews of such deaths.<sup>12</sup> In addition, physicians may differentially underreport alcohol misuse as a cause of death based on sociodemographic status, race, or gender of the deceased. Consequently, population-based studies involving chart and medical-record review would be useful to confirm these observations. Data from the National Hospital Discharge Survey are consistent with the mortality data and trends presented here, including a 44% decrease in the age-adjusted chronic liver disease hospitalization rate from 1980 through 1989; 38% higher chronic liver disease hospitalization rates among men

than among women; 27% higher rates among Blacks than among Whites; and increasing age-specific rates with advancing age, with a sharp decrease after age 64 years.<sup>3</sup>

A number of other factors may affect the validity of our observations, including temporal changes in reporting underlying causes of death on death certificates, especially the reporting of alcohol abuse or other possible causes of chronic liver disease as primary or associated conditions. It is unclear whether there have been such temporal changes. However, analyses of multiple-cause-of-death data to assess trends for deaths with chronic liver disease listed as the underlying cause or as a comorbid condition (not presented here) demonstrate similar trends overall and among each chronic liver disease group. This suggests that our observations are not simply the result of a decrease in coding chronic liver disease as the underlying cause of death and an increase in coding chronic liver disease as a comorbid condition.

The greater decrease in the age-specific death rates among younger individuals may provide an important clue concerning the reasons for the overall decline in chronic liver disease mortality that was observed. Despite the fact that death rates were higher in older individuals (over 59 years old) during the 11-year period, the greatest decreases in chronic liver disease-associated death rates were observed among the 40 through 49 and 50 through 59 age groups. One possible explanation for this observation is that there has been a greater decrease in exposure to chronic liver disease risk factors such as alcohol among younger compared with older individuals. In addition, in view of the fact that chronic consumption of alcohol may lead to irreversible cirrhosis after 15 to 20 years, it is possible that older individuals, particularly those over 60 years of age, would be less likely to benefit from reduced alcohol consumption. It is also possible that recent improvements in therapy and management of chronic liver disease have been more likely to benefit younger rather than older individuals.

In 1989, state-specific age-adjusted chronic liver disease death rates varied from 6.1 per 100 000 persons in Idaho to 31.5 per 100 000 in the District of Columbia.<sup>2</sup> The geographic differences observed in this study suggest that chronic liver disease rates in the United States vary by region overall and for specific groups. Perhaps the most striking geographic

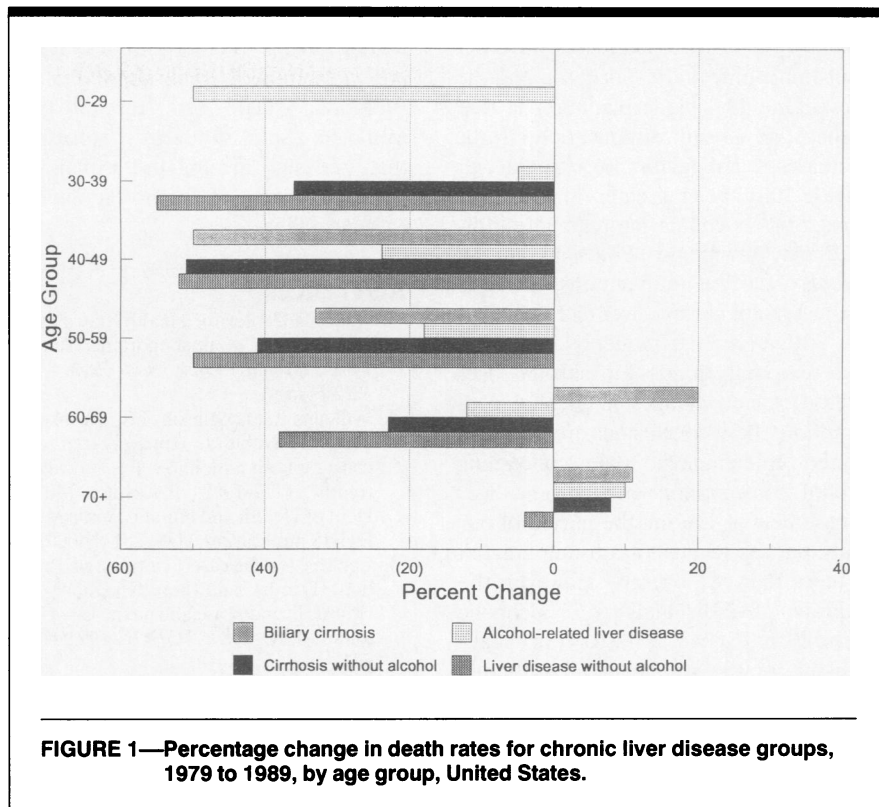


FIGURE 1—Percentage change in death rates for chronic liver disease groups, 1979 to 1989, by age group, United States.

TABLE 4—Region-Specific Death Rates (per 100 000 Persons) for Chronic Liver Disease, by Diagnosis, United States, 1979 and 1989

Diagnosis/Regional Group	1979		1989		RR (95% CI)
	Rate	No.	Rate	No.	
<b>Biliary cirrhosis</b>					
Northeast	0.2	107	0.2	88	0.8 (0.6, 1.0)
North Central	0.2	97	0.2	116	1.1 (0.8, 1.4)
South	0.1	103	0.1	109	0.9 (0.7, 1.1)
West	0.2	69	0.2	81	0.9 (0.7, 1.3)
<b>Cirrhosis without alcohol</b>					
Northeast	7.0	3773	5.5	3129	0.8 (0.8, 0.8)
North Central	6.5	3759	4.4	2764	0.7 (0.8, 0.8)
South	6.3	4593	5.0	4374	0.7 (0.7, 0.8)
West	5.6	2213	4.1	2040	0.7 (0.6, 0.7)
<b>Alcohol-related liver disease</b>					
Northeast	6.8	3569	4.6	2546	0.7 (0.6, 0.7)
North Central	4.0	2332	4.0	2472	1.0 (0.9, 1.1)
South	4.2	3098	4.2	3653	1.0 (0.9, 1.0)
West	8.8	3548	7.2	3637	0.8 (0.8, 0.9)
<b>Liver disease without alcohol</b>					
Northeast	1.0	497	0.5	299	0.6 (0.5, 0.6)
North Central	0.9	545	0.5	297	0.5 (0.4, 0.6)
South	1.2	854	0.7	642	0.6 (0.6, 0.7)
West	1.5	603	0.9	447	0.6 (0.5, 0.7)
<b>Total chronic liver disease</b>					
Northeast	15.0	7906	10.8	6062	0.7 (0.7, 0.7)
North Central	11.6	6733	9.0	5649	0.8 (0.8, 0.8)
South	11.8	8648	10.0	8778	0.8 (0.8, 0.9)
West	16.1	6433	12.4	6205	0.8 (0.7, 0.8)

Note. RR = risk ratio; CI = confidence interval.

observation was the fact that for alcohol-related liver disease, decreases were demonstrable only in the Northeast and the West. One possible explanation is that perhaps, as a result of education efforts, decreases in risk factors for chronic liver disease have been greater in these regions. Studies comparing regional differences may provide further insight into the success of current interventions, as well as risk factors for chronic liver disease.

Although it is frequently suggested that temporal trends for chronic liver disease reflect changes in alcohol consumption, these conclusions are based on limited epidemiologic data concerning alcohol consumption and chronic liver disease deaths. During the period of our study, per capita alcohol consumption fell by more than 8% overall.<sup>2</sup> However, the majority of individuals with alcoholic cirrhosis have had a history of heavy drinking for 10 to 20 years.<sup>13,14</sup> Although there is little information concerning age-, race-, and gender-specific temporal trends that would allow further assessment of chronic liver disease mortality as it relates to declining alcohol use, data from CDC's Behavioral Risk Factor Surveillance System showed a greater percentage of heavy

drinkers among men than among women and an inverse relationship between age and self-reported levels of alcohol consumption.<sup>15</sup> Data on temporal trends would be useful to assess the possibility that declining alcohol use explains the observed decreases in chronic liver disease mortality. □

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