

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1: Claims-Based Definitions

| | ICD-9-CM | CPT | Laboratory |
|--|--|---|---------------------|
| Alcoholic liver disease | 571.0; 571.1; 571.2; 571.3; 291.x; 303.x; 305.0x | | |
| Any solid organ transplant | 00.91; 00.92; 00.93; 33.5; 33.50; 33.51; 33.52; 33.6; 37.5; 37.51; 46.97; 50.5; 50.51; 50.59; 52.8; 52.80; 52.81; 52.82; 52.83; 55.6; 55.61; 55.69; 996.8; V42; V58.44; E878.0 | 32851; 32852; 32853; 32854; 33935; 33945; 44135; 44136; 47135; 47136; 48554; 50360; 50365 | |
| Ascites | 789.59 | | |
| Autoimmune hepatitis | 571.42 | | |
| Cirrhosis | 456.0; 456.1; 456.2; 456.21; 567.23; 571.2; 571.5; 572.2; 572.3; 572.4 | | |
| Dyslipidemia | 272.0; 272.1; 272.2; 272.4; 272.5; 272.9 | | |
| Hepatic encephalopathy | 572.2 | | |
| Hepatitis B | 070.2; 070.20; 070.21; 070.22; 070.23; 070.30; 070.31; 070.32; 070.33 | | HBsAg |
| Hepatitis C | 070.41; 070.44; 070.51; 070.54; 070.7; 070.70; 070.71 | | Anti-HCV HCV RNA |
| Hepatocellular carcinoma | 155.0 | | |
| Hypertension | 401; 401.0; 401.1; 401.9; 402.0; 402.1; 402.9; 403.0; 403.1; 403.9; 404; 404.0; 404.1; 404.9; 278.0; 278.00; 278.01; 278.02; 278.1; V77.8; 783.1; 278.02 | | |
| Impaired fasting glucose/diabetes mellitus | 250; 790.2; 790.21; 790.22; 790.29 | | |
| Liver transplant | 50.5; 50.51; 50.59 | 47135; 47136 | |
| Nonalcoholic steatohepatitis | 571.8 | | |
| Obesity | 278.0; 278.00; 278.01; 278.1; V77 | | |

| | | | |
|--------------------------------|---------------|--------------|--|
| Paracentesis | 54.91 | 49080; 49081 | |
| Primary biliary cholangitis | 571.6 | | |
| Primary sclerosing cholangitis | 576.1 | | |
| Variceal hemorrhage | 456.0; 456.20 | | |

Abbreviations: ICD-9-CM, International Classification of Diseases, Clinical Modification; CPT, Current Procedural Terminology; HBsAg, hepatitis B surface antigen; anti-HCV, hepatitis C antibody; HCV RNA, hepatitis C ribonucleic acid.

eTable 2. Incidence of Clinical Outcomes Based on Age

| | Person-years | Events | Incidence rate ^a (95% CI) | Crude HR/SHR (95% CI) | Adjusted HR/SHR ^b (95% CI) |
|---|--------------|--------|---|--------------------------|--|
| Mortality | | | | | |
| <40 | 1,975 | 126 | 6.4 (5.4-7.6) | 0.66 (0.55-0.79) | 0.66 (0.55-0.80) |
| 40-64 | 19,435 | 1,924 | 9.9 (9.5-10.4) | Ref | Ref |
| ≥65 | 6,037 | 976 | 16.2 (15.2-17.2) | 1.43 (1.33-1.55) | 1.10 (0.98-1.23) |
| Transplant | | | | | |
| <40 | 1,975 | 6 | 0.3 (0.1-0.7) | 1.06 (0.46-2.45) | 1.21 (0.52-2.82) |
| 40-64 | 19,435 | 61 | 0.3 (0.2-0.4) | Ref | Ref |
| ≥65 | 6,037 | 21 | 0.3 (0.2-0.5) | 0.88 (0.54-1.44) | 1.38 (0.67-2.83) |
| Hepatocellular carcinoma | | | | | |
| <40 | 1,690 | 8 | 0.5 (0.2-0.9) | 0.27 (0.13-0.54) | 0.36 (0.18-0.72) |
| 40-64 | 16,218 | 304 | 1.9 (1.7-2.1) | Ref | Ref |
| ≥65 | 4,691 | 84 | 1.8 (1.4-2.2) | 0.84 (0.66-1.07) | 1.58 (1.13-2.22) |
| Decompensation^c | | | | | |
| <40 | 1,129 | 82 | 7.3 (5.9-9.0) | 0.75 (0.59-0.93) | 0.78 (0.62-0.99) |
| 40-64 | 11,597 | 1,188 | 10.2 (9.7-10.8) | Ref | Ref |
| ≥65 | 3,603 | 402 | 11.2 (10.1-12.3) | 0.92 (0.83-1.03) | 1.08 (0.93-1.26) |
| Ascites^c | | | | | |
| <40 | 1,180 | 68 | 5.8 (4.5-7.3) | 0.79 (0.62-1.01) | 0.86 (0.67-1.10) |
| 40-64 | 12,245 | 950 | 7.8 (7.3-8.3) | Ref | Ref |
| ≥65 | 3,745 | 318 | 8.5 (7.6-9.5) | 0.93 (0.82-1.06) | 1.11 (0.93-1.33) |
| Hepatic encephalopathy^c | | | | | |
| <40 | 1,272 | 29 | 2.3 (1.6-3.3) | 0.55 (0.38-0.79) | 0.53 (0.36-0.78) |
| 40-64 | 12,922 | 577 | 4.5 (4.1-4.8) | Ref | Ref |
| ≥65 | 3,887 | 180 | 4.6 (4.0-5.4) | 0.88 (0.75-1.04) | 1.19 (0.95-1.50) |
| Variceal bleeding^c | | | | | |
| <40 | 1,262 | 19 | 1.5 (1.0-2.4) | 0.81 (0.51-1.29) | 0.82 (0.50-1.33) |
| 40-64 | 13,131 | 267 | 2.0 (1.8-2.3) | Ref | Ref |
| ≥65 | 3,990 | 56 | 1.4 (1.1-1.8) | 0.58 (0.44-0.78) | 0.94 (0.64-1.37) |

^aPer 100 person-years.

^bMultivariable models were adjusted for sex, cause of cirrhosis, decompensation, Charlson comorbidity index, insurance, and year of cohort entry. For the mortality outcomes, hazard ratios (HR) are reported; for other outcomes, subhazard ratios (SHR) are reported.

^cDecompensation outcomes were assessed in only those with compensated cirrhosis at baseline.

Abbreviations: HR, hazard ratio; SHR, subhazard ratio; CI, confidence interval.

eTable 3: Cumulative Survival According to Baseline Decompensation Status, Age, and Cause of Cirrhosis

| | 1-year survival (95% CI) | 2-year survival (95% CI) | 5-year survival (95% CI) |
|-------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Compensated | | | |
| <40 | 94.5 (91.5-96.5) | 92.8 (89.4-95.1) | 85.4 (80.1-89.4) |
| 40-64 | 90.6 (89.6-91.4) | 84.7 (83.4-85.8) | 72.1 (70.4-73.8) |
| ≥65 | 84.1 (82.2-85.8) | 75.9 (73.6-78.0) | 57.6 (54.5-60.6) |
| Decompensated | | | |
| <40 | 73.1 (66.3-78.8) | 64.5 (57.0-71.1) | 55.6 (47.2-63.2) |
| 40-64 | 65.1 (62.9-67.3) | 57.1 (54.7-59.5) | 41.7 (38.8-44.6) |
| ≥65 | 62.6 (59.1-66.0) | 52.4 (48.4-56.2) | 34.1 (28.7-39.5) |
| Compensated | | | |
| Alcohol | 91.4 (90.0-92.6) | 86.5 (84.7-88.0) | 73.9 (71.3-76.3) |
| Viral | 91.5 (90.3-92.5) | 85.2 (83.7-86.5) | 70.8 (68.7-72.9) |
| NASH/other | 80.3 (78.0-82.3) | 71.7 (69.0-74.2) | 58.1 (54.7-61.3) |
| Autoimmune/cholestatic | 92.8 (87.7-95.9) | 88.2 (82.1-92.3) | 75.1 (65.7-82.3) |
| Decompensated | | | |
| Alcohol | 73.1 (70.4-75.6) | 64.9 (61.8-67.7) | 51.1 (47.2-54.8) |
| Viral | 65.5 (62.3-68.6) | 55.5 (52.0-58.9) | 36.8 (32.8-40.9) |
| NASH/other | 52.7 (48.9-56.3) | 46.2 (42.2-50.1) | 33.4 (28.6-38.3) |
| Autoimmune/cholestatic | 59.7 (45.2-71.6) | 38.7 (23.6-53.7) | 27.5 (12.1-45.5) |

Abbreviations: CI, confidence interval; NASH, nonalcoholic steatohepatitis.

eTable 4: Incidence of Clinical Outcomes Based on Cause of Cirrhosis

| | Person-years | Events | Incidence rate ^a (95% CI) | Crude HR/SHR (95% CI) | Adjusted HR/SHR ^b (95% CI) |
|---|--------------|--------|---|--------------------------|--|
| Mortality | | | | | |
| Alcohol | 9,444 | 881 | 9.3 (8.7-10.0) | 0.94 (0.86-1.02) | 0.89 (0.80-0.98) |
| Viral | 12,565 | 1,198 | 9.5 (9.0-10.1) | Ref | Ref |
| NASH/other | 4,722 | 879 | 18.6 (17.4-19.9) | 1.69 (1.55-1.85) | 1.44 (1.30-1.60) |
| Autoimmune/cholestatic | 716 | 68 | 9.5 (7.5-12.1) | 0.94 (0.74-1.20) | 1.01 (0.76-1.33) |
| Transplant | | | | | |
| Alcohol | 9,444 | 35 | 0.4 (0.3-0.5) | 1.13 (0.72-1.79) | 1.10 (0.66-1.82) |
| Viral | 12,565 | 39 | 0.3 (0.2-0.4) | Ref | Ref |
| NASH/other | 4,722 | 6 | 0.1 (0.1-0.3) | 0.29 (0.13-0.69) | 0.32 (0.12-0.82) |
| Autoimmune/cholestatic | 716 | 8 | 1.1 (0.6-2.2) | 3.39 (1.58-7.26) | 3.87 (1.72-8.70) |
| Hepatocellular carcinoma | | | | | |
| Alcohol | 7,881 | 76 | 1.0 (0.8-1.2) | 0.35 (0.27-0.45) | 0.30 (0.23-0.41) |
| Viral | 10,336 | 281 | 2.7 (2.4-3.1) | Ref | Ref |
| NASH/other | 3,792 | 28 | 0.7 (0.5-1.1) | 0.25 (0.17-0.36) | 0.22 (0.15-0.35) |
| Autoimmune/cholestatic | 590 | 11 | 1.9 (1.0-3.4) | 0.67 (0.37-1.24) | 0.59 (0.29-1.19) |
| Decompensation^c | | | | | |
| Alcohol | 5,083 | 541 | 10.6 (9.8-11.6) | 0.92 (0.83-1.03) | 0.97 (0.86-1.09) |
| Viral | 7,776 | 891 | 11.5 (10.7-12.2) | Ref | Ref |
| NASH/other | 2,970 | 195 | 6.6 (5.7-7.6) | 0.50 (0.43-0.59) | 0.51 (0.43-0.60) |
| Autoimmune/cholestatic | 501 | 45 | 9.0 (6.7-12.0) | 0.77 (0.57-1.03) | 0.82 (0.59-1.13) |
| Ascites^c | | | | | |
| Alcohol | 5,406 | 406 | 7.5 (6.8-8.3) | 0.83 (0.73-0.93) | 0.86 (0.75-0.98) |
| Viral | 8,236 | 744 | 9.0 (8.4-9.7) | Ref | Ref |
| NASH/other | 3,010 | 150 | 5.0 (4.2-5.8) | 0.48 (0.40-0.57) | 0.46 (0.37-0.56) |
| Autoimmune/cholestatic | 519 | 36 | 6.9 (5.0-9.6) | 0.75 (0.54-1.04) | 0.83 (0.58-1.19) |
| Hepatic encephalopathy^c | | | | | |
| Alcohol | 5,662 | 281 | 5.0 (4.4-5.6) | 1.04 (0.90-1.21) | 1.12 (0.95-1.31) |
| Viral | 8,790 | 423 | 4.8 (4.4-5.3) | Ref | Ref |
| NASH/other | 3,085 | 62 | 2.0 (1.6-2.6) | 0.36 (0.28-0.48) | 0.38 (0.28-0.50) |

| | | | | | |
|--------------------------------------|-------|-----|---------------|------------------|------------------|
| Autoimmune/cholestatic | 545 | 20 | 3.7 (2.4-5.7) | 0.76 (0.49-1.18) | 0.80 (0.49-1.30) |
| Variceal bleeding^c | | | | | |
| Alcohol | 5,766 | 126 | 2.2 (1.8-2.6) | 1.00 (0.80-1.25) | 1.17 (0.92-1.50) |
| Viral | 8,956 | 195 | 2.2 (1.9-2.5) | Ref | Ref |
| NASH/other | 3,111 | 17 | 0.5 (0.3-0.9) | 0.22 (0.13-0.36) | 0.28 (0.16-0.47) |
| Autoimmune/cholestatic | 550 | 4 | 0.7 (0.3-1.9) | 0.33 (0.12-0.87) | 0.24 (0.06-0.97) |

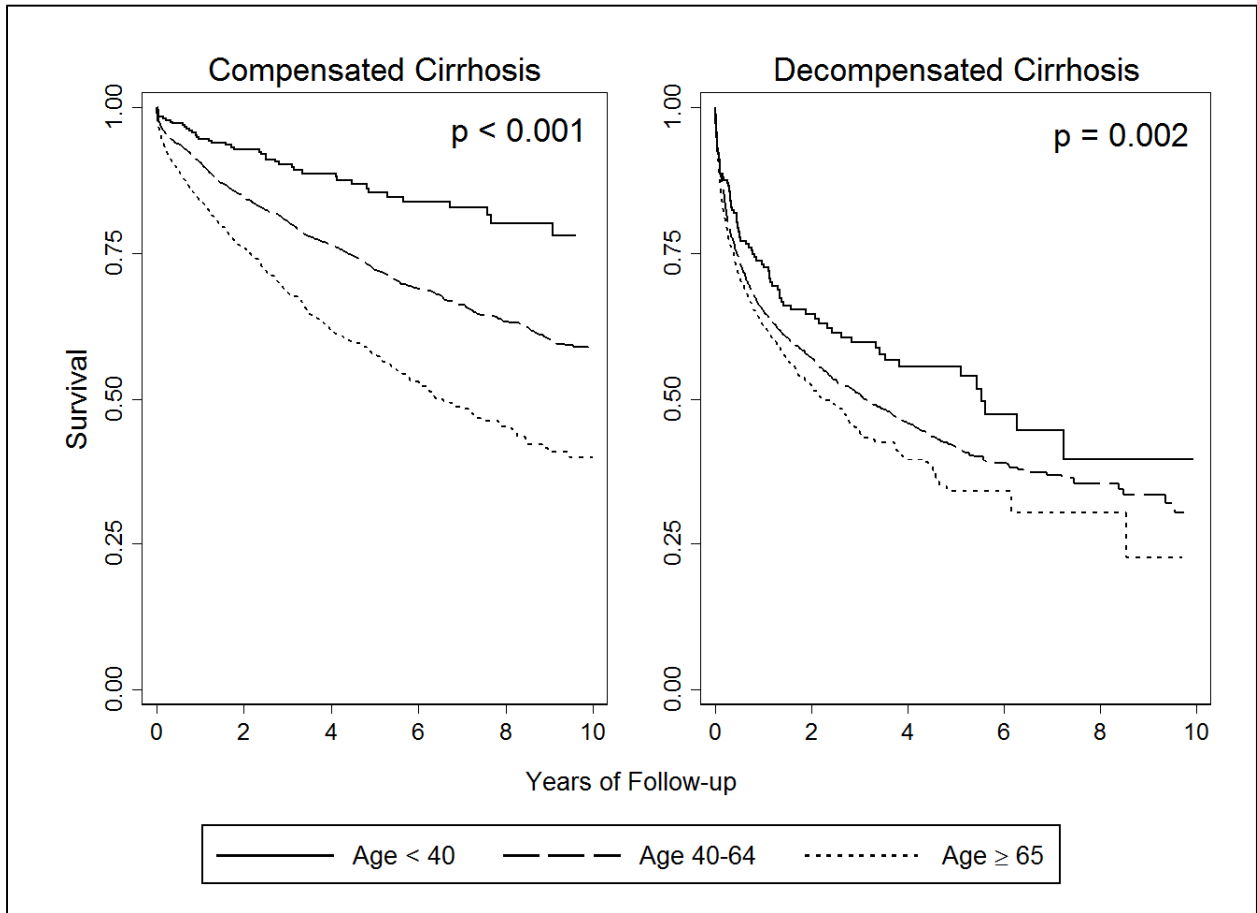
^aPer 100 person-years.

^bMultivariable models were adjusted for sex, cause of cirrhosis, decompensation, Charlson comorbidity index, insurance, and year of cohort entry. For the mortality outcomes, hazard ratios (HR) are reported; for other outcomes, subhazard ratios (SHR) are reported.

^cDecompensation outcomes were assessed in only those with compensated cirrhosis at baseline.

Abbreviations: NASH, nonalcoholic steatohepatitis; HR, hazard ratio; SHR, subhazard ratio; CI, confidence interval.

eFigure 1. Mortality According to Age



eFigure 2. Mortality According to Cause of Cirrhosis

