IMPACT of Chronic Liver Disease on Healthcare Systems

Supported by an educational grant from Mallinckrodt Pharmaceuticals and Grifols, S.A.

CLDF
Chronic Liver Disease Foundation

Clinical and Economic Impact of Chronic Liver Disease and Cirrhosis on the U.S. Healthcare System

Robert J. Wong, MD, MS
Clinical Associate Professor (Affiliated)
Division of Gastroenterology and Hepatology
Stanford University School of Medicine

Disclosures

- Research grants (to my institution), consulting, advisory board – Gilead Sciences
- Consulting – Intercept

Objectives

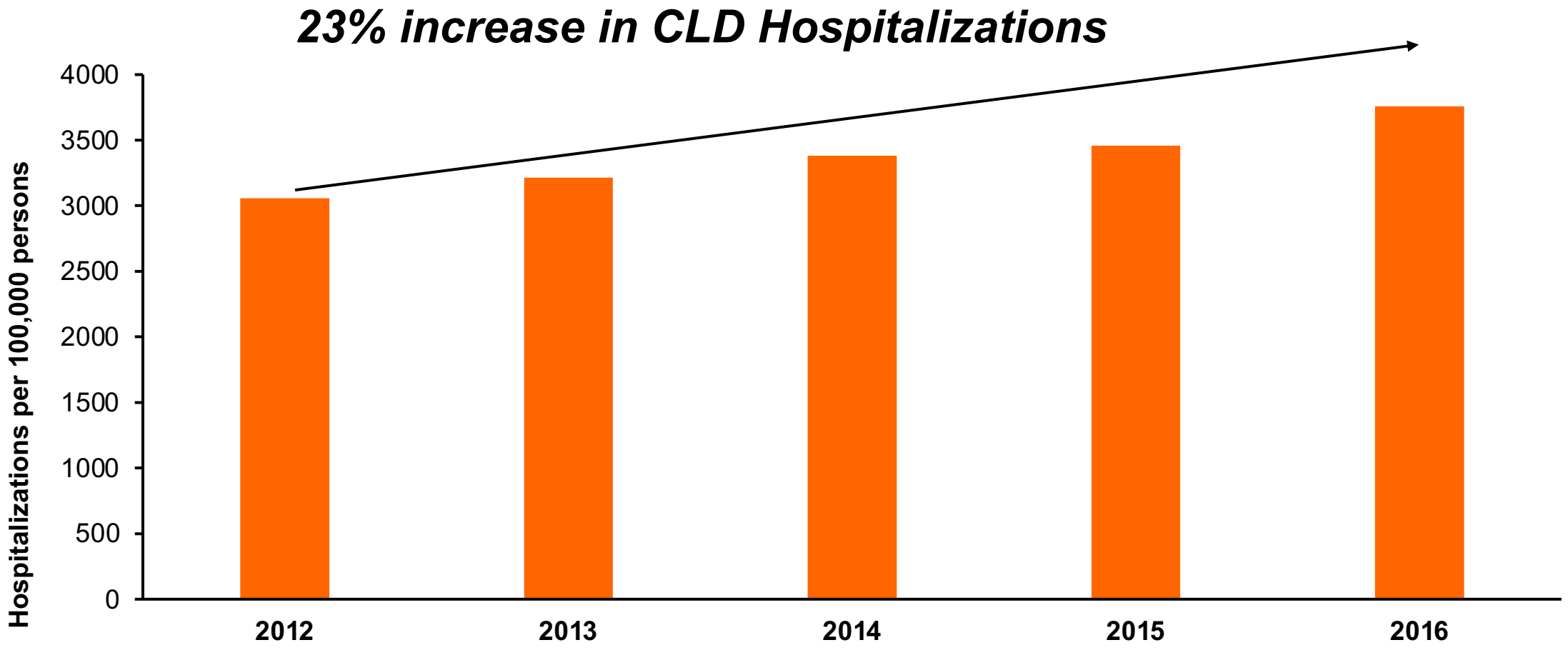
- Review overall trends in the clinical burden of chronic liver disease and cirrhosis in the U.S.
- Understand the current and future economic burden of chronic liver disease and cirrhosis in the U.S.
- Understand the impact of continued disease progression to cirrhosis and cirrhosis-related complications on the U.S. healthcare system.

Background

- Chronic liver disease and cirrhosis is the 11th leading cause of death in the U.S.
- In 2020, CDC reported 51,642 deaths (15.7 per 100,000 population) attributed to chronic liver disease and cirrhosis
- The advent of direct acting antivirals have led to declines in HCV-related cirrhosis and HCC
- NAFLD/NASH emerging as leading cause of chronic liver disease and cirrhosis
- Increasing burden of alcohol associated liver disease (ALD), which has been worsened during the COVID-19 pandemic

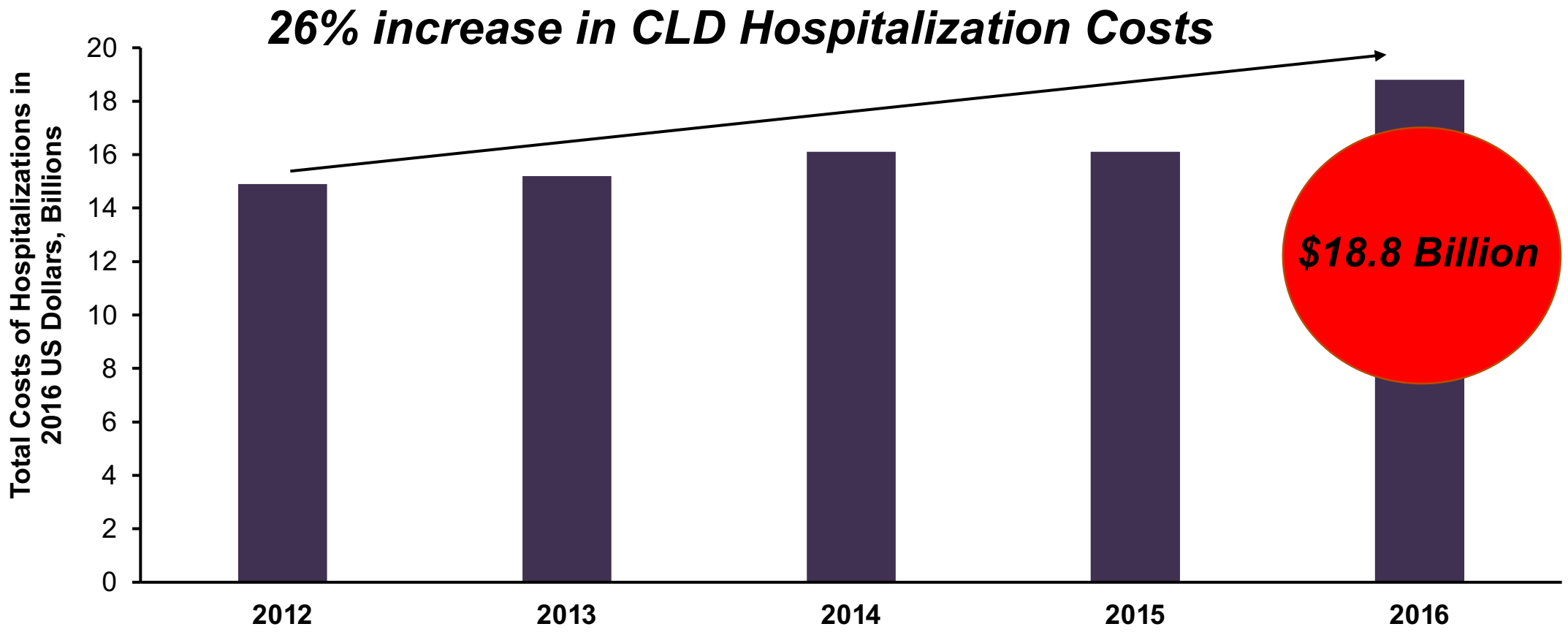
CDC. National Center for Health Statistics.

Chronic Liver Disease Hospitalizations in the U.S.

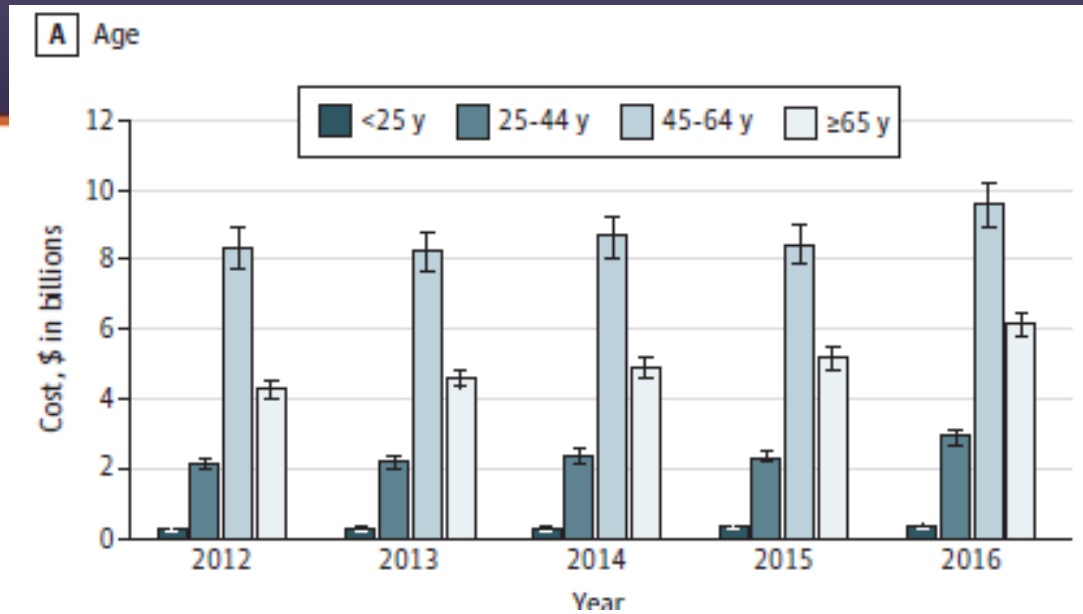


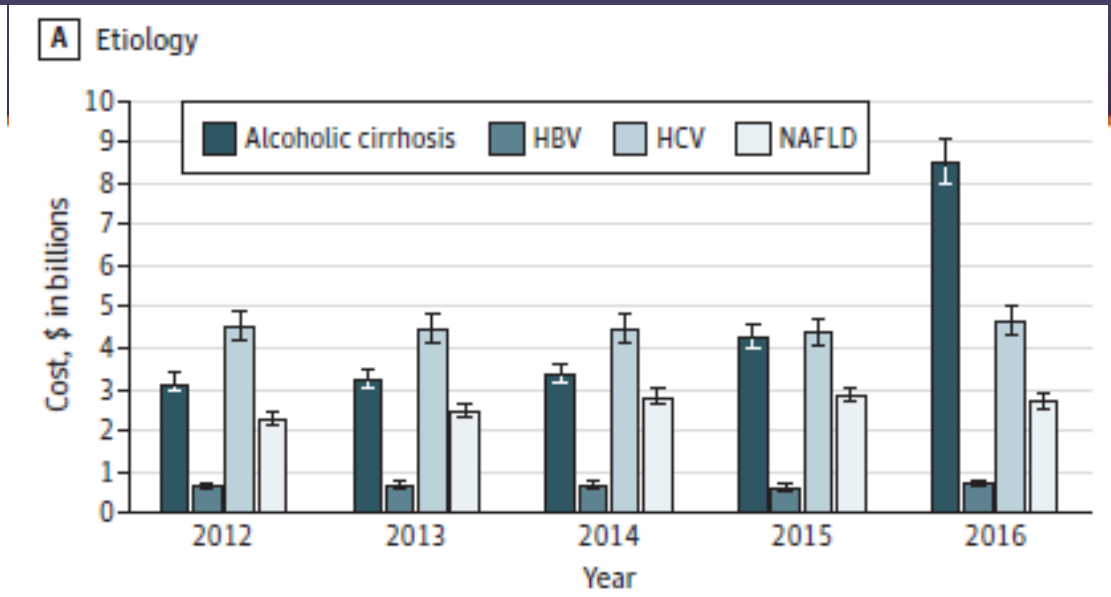
Hirode et al *JAMA*. Net Open 2020.

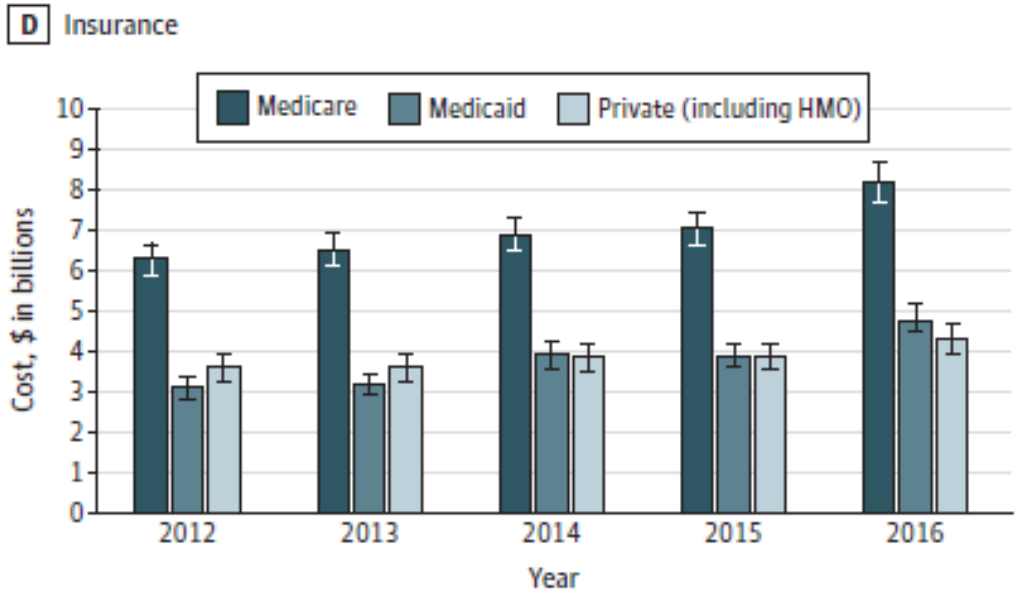
Total Hospitalization Costs for CLD in the U.S.

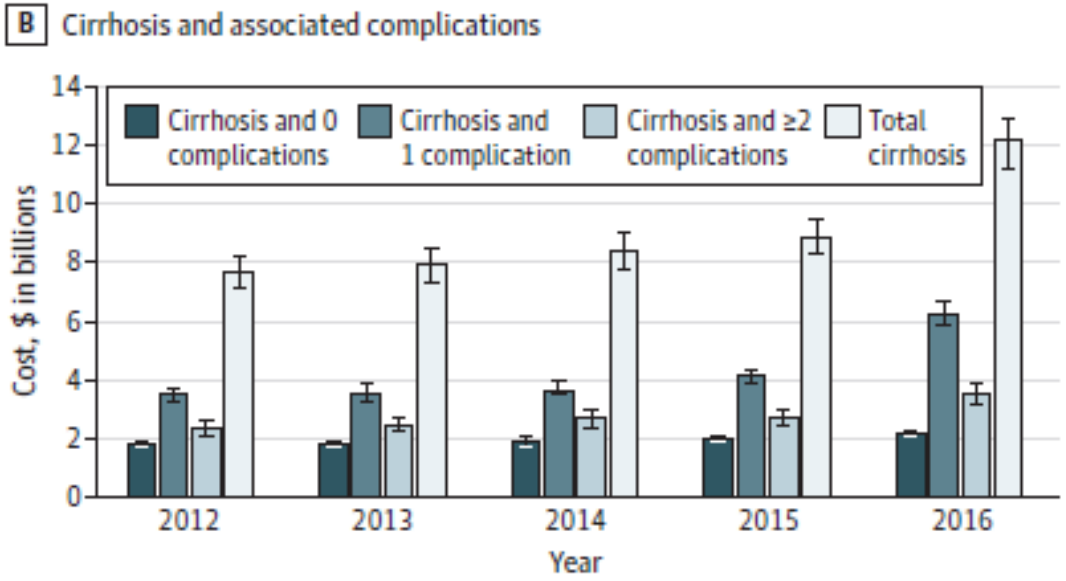


Hirode et al *JAMA*. Net Open 2020.





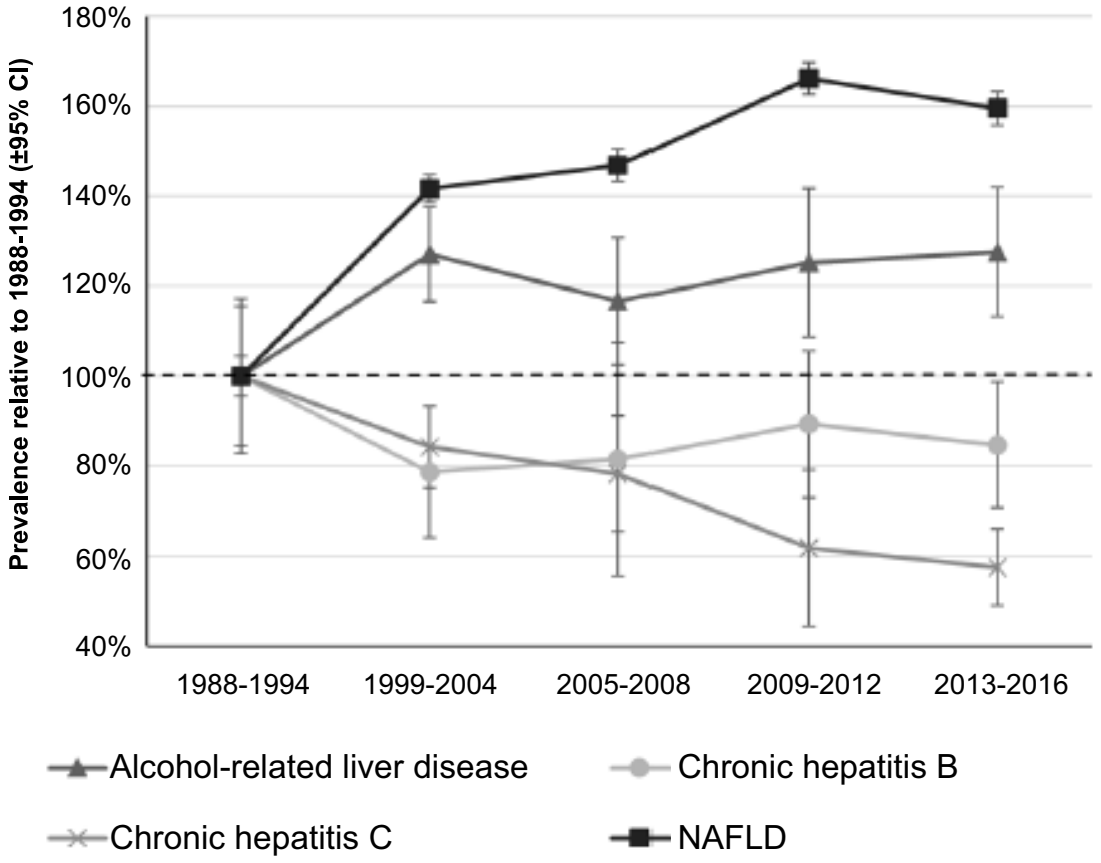




Hirode et al *JAMA*. Net Open 2020.

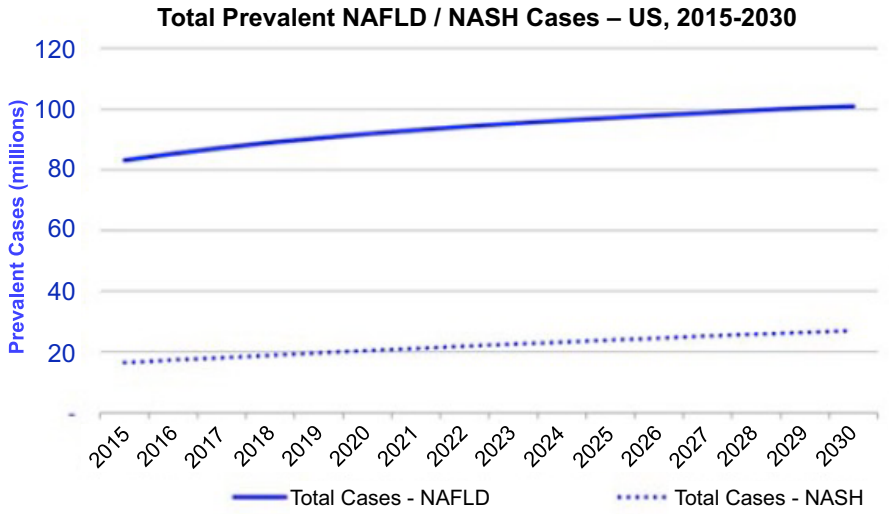
NAFLD/NASH and ALD Are Major Drivers of CLD

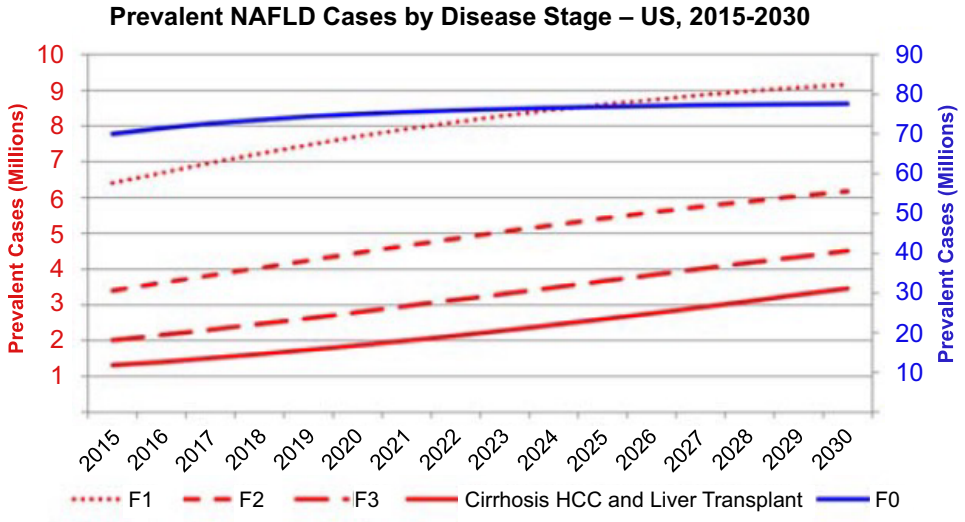
- U.S. NHANES data evaluating the changing prevalence of CLD.
- Compared to 1988-94, in 2013-2016, prevalence of NAFLD increase by 60%, ALD increased by 27%, HCV decreased by 42%.
- In 2013-2016, prevalence of NAFLD was 31.9%, HCV was 1.75%, ALD was 1.03%, HBV was 0.35%.

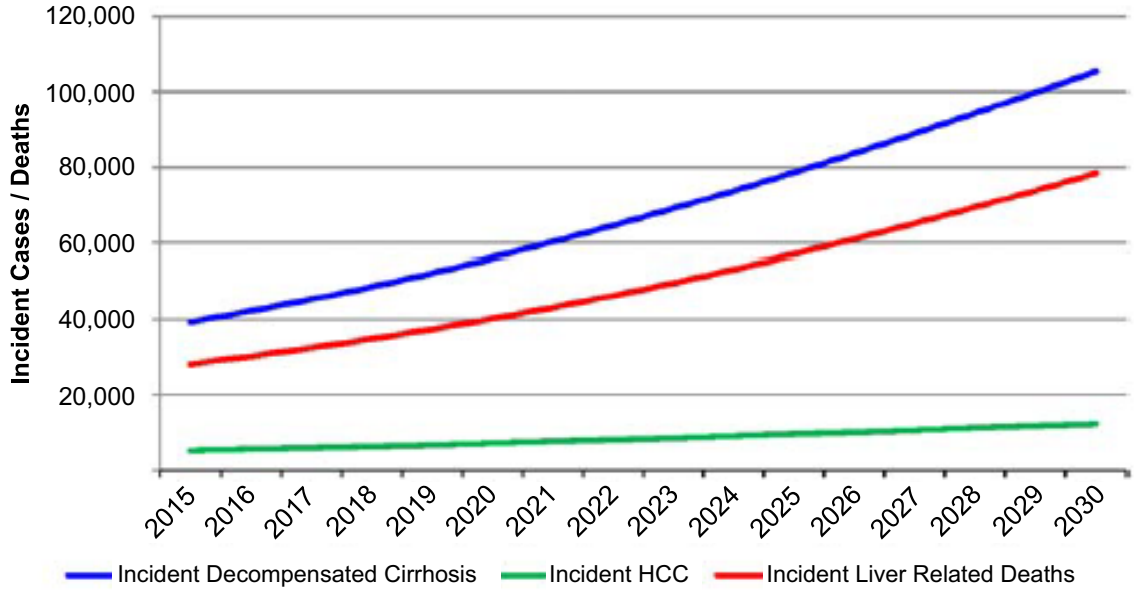


Younossi ZM et al. *Gut*. 2020;69:564–568

NAFLD/NASH Trends – A Modeling Study



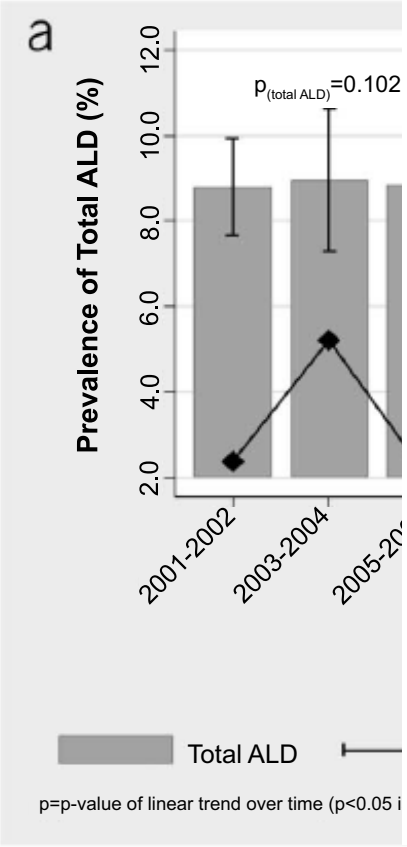




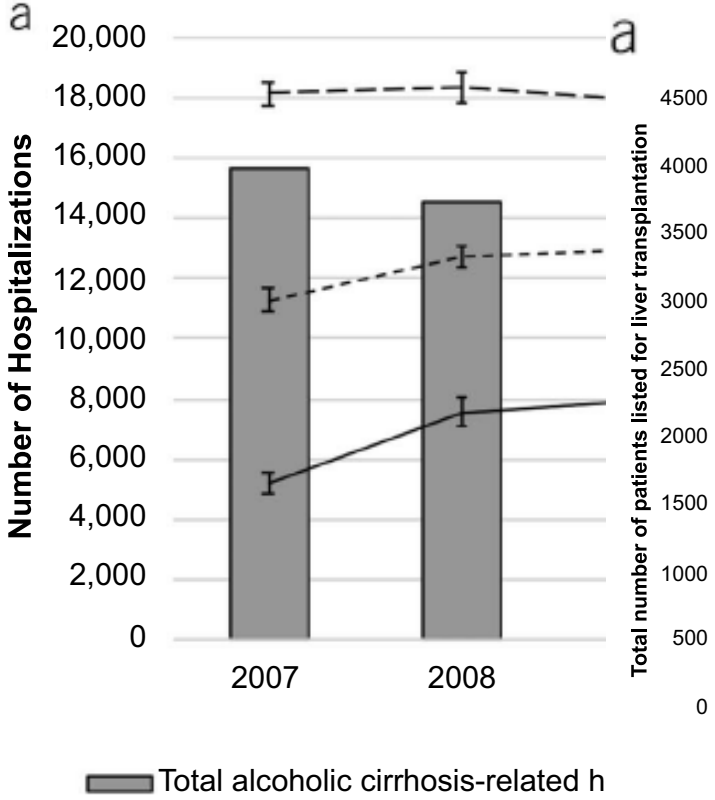
Estes et al. *HEPATOLOGY*. 2018;67:123-133).

ALD Trends Across Three U.S. Datasets

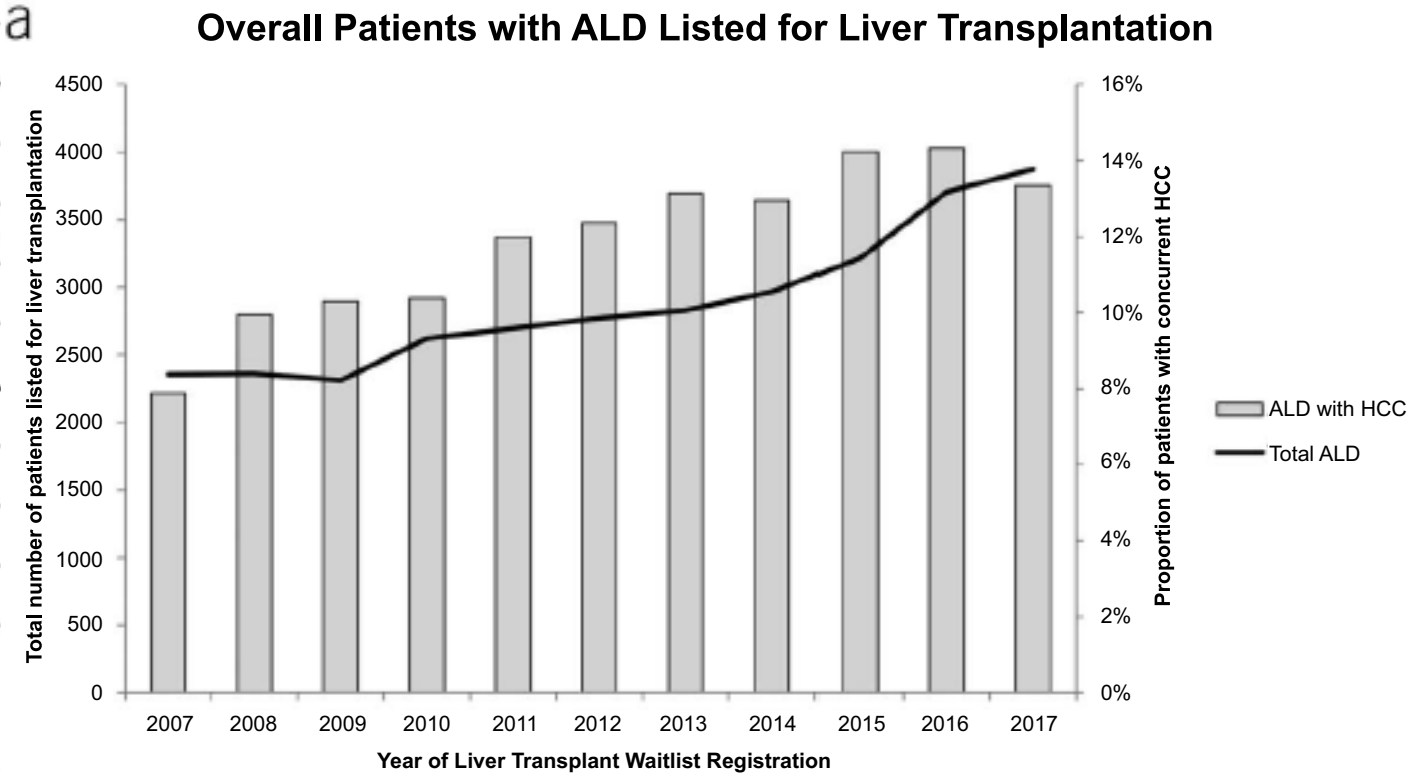
NHANES



NIS

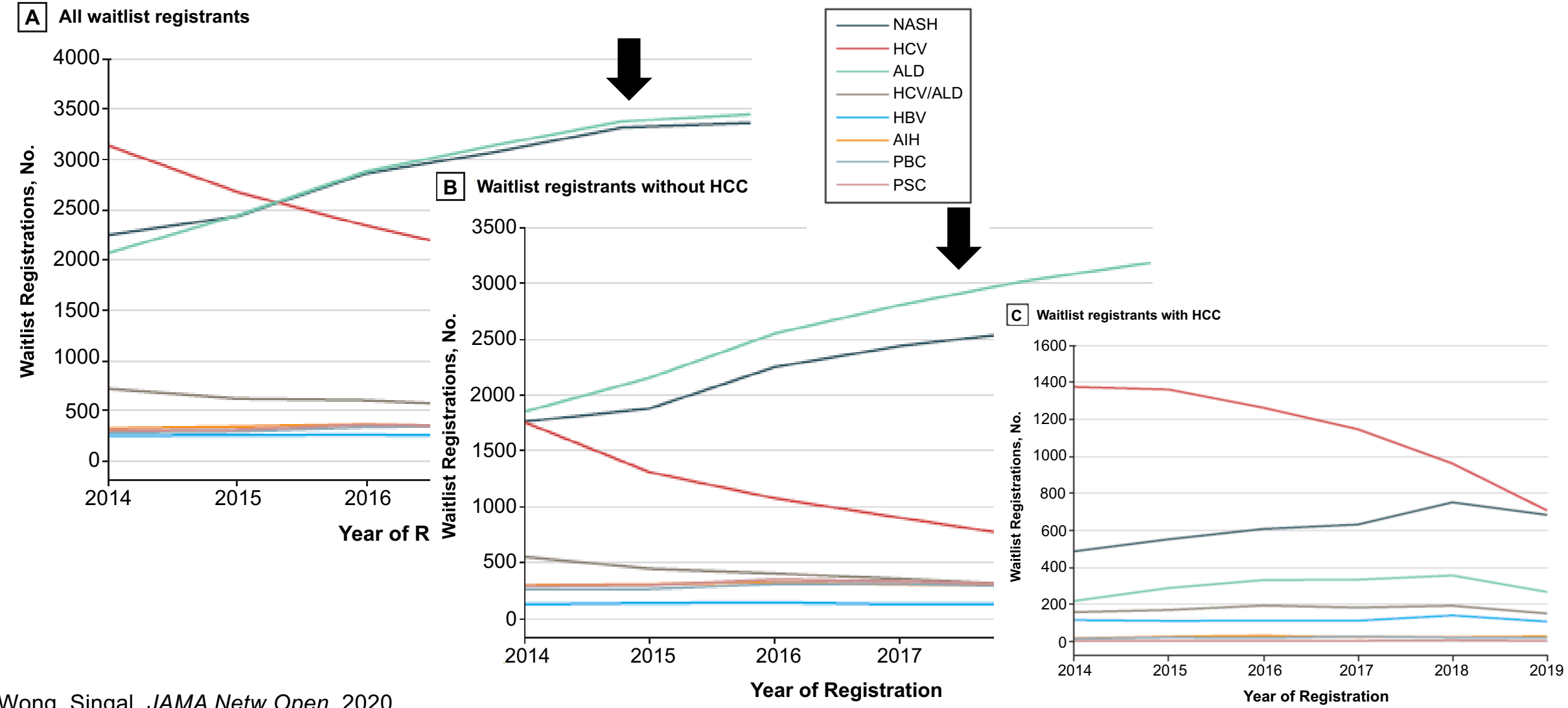


UNOS



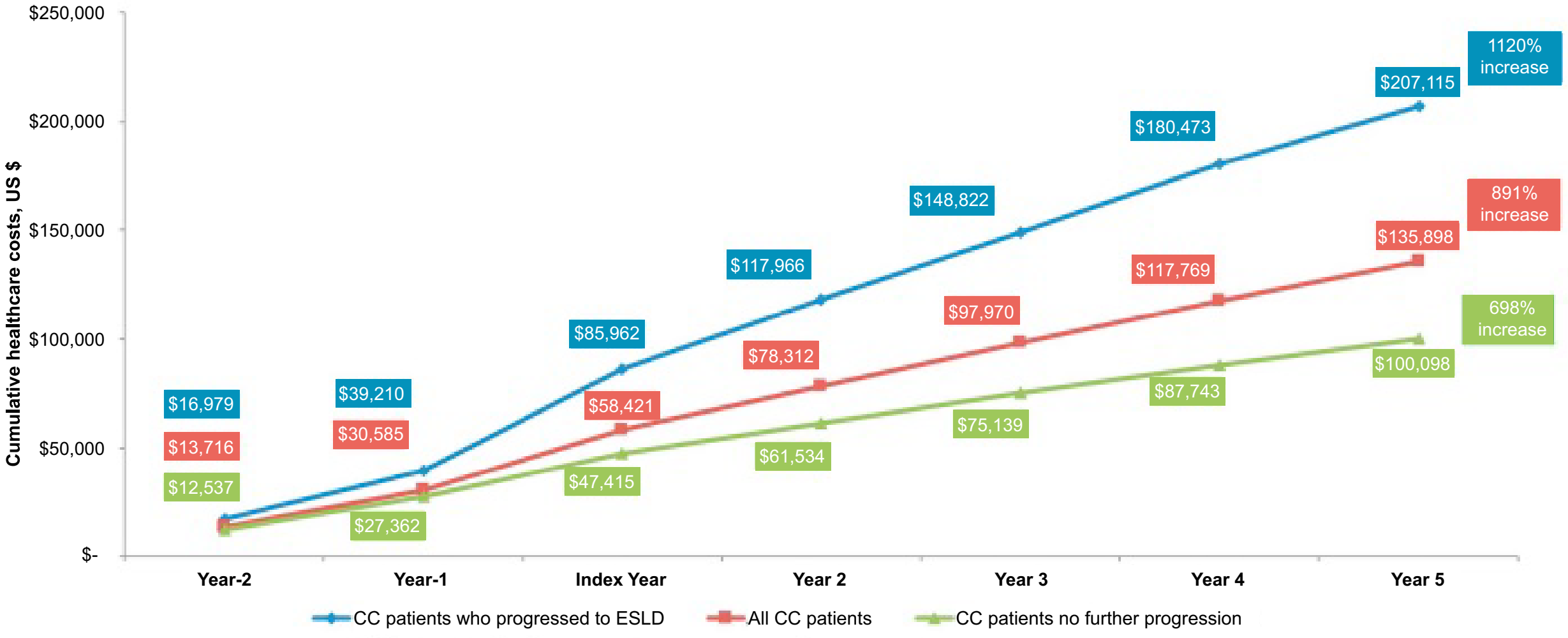
Dang et al. *Am J Gastroenterol.* 2020; Wong et al. *JAMA.* 2019.

NAFLD/NASH and ALD Are Major Drivers of CLD



Wong, Singal. *JAMA Netw Open*. 2020.

NAFLD Economic Burden in the U.S. (Medicare)



Gordon et al. *Am J Gastroenterol*. 2020;115:562–574.

Modeling the Economic Burden of NAFLD in the U.S.

- Markov model to evaluate clinical and economic burden of NAFLD in the U.S.
- Total direct costs estimated at over $103 billion per year.
- Societal costs due to annual quality adjusted life years lost estimated at $189 billion per year.

	United States
Total costs (in billions)	
Direct costs	$103.31
Societal costs	$188.88
Total costs	$292.19
Total costs (per patient)	
Direct costs	$1,612.18
Societal costs	$2,947.36
Total costs	$4,559.54
Costs (in millions) due to	
NAFL	$86,564.2
NASH no FB	$5,483.6
NASH FB	$1,866.3
CC	$6,573.3
DCC	$1,765.5
HCC	$522.7
LT	$161.6
PLT	$375.7

Younossi et al. *HEPATOLOGY.* 2016;64:1577-1586).

Direct and Indirect Economic Impact of CLD

Table 2. Quality of Life and Employment Status in Participants With and Without CLD

	All CLD	No CLD	*P*
Physical limitations, %	34.0 ± 1.6	12.2 ± 0.2	<.0001
Activity limitations, %	34.6 ± 1.7	9.3 ± 0.2	<.0001
Social limitations, %	19.7 ± 1.3	5.2 ± 0.1	<.0001
Cognitive limitations, %	17.6 ± 1.2	4.6 ± 0.1	<.0001
PCS of SF-12	39.6 ± 0.5	49.5 ± 0.1	<.0001
MCS of SF-12	45.4 ± 0.4	51.0 ± 0.1	<.0001
SF-6D utility	0.666 ± 0.006	0.787 ± 0.001	<.0001
K6 (Kessler index)	6.46 ± 0.21	3.40 ± 0.02	<.0001
PHQ-2 score	1.59 ± 0.07	0.71 ± 0.01	<.0001
Employed, %	44.7 ± 1.7	69.6 ± 0.3	<.0001
Total income, $1000	33.2 ± 1.4	41.5 ± 0.3	<.0001
Not working because of illness or disability, %	30.5 ± 1.5	6.6 ± 0.1	<.0001
Disability days in 1 year	10.2 ± 1.1	3.4 ± 0.1	<.0001

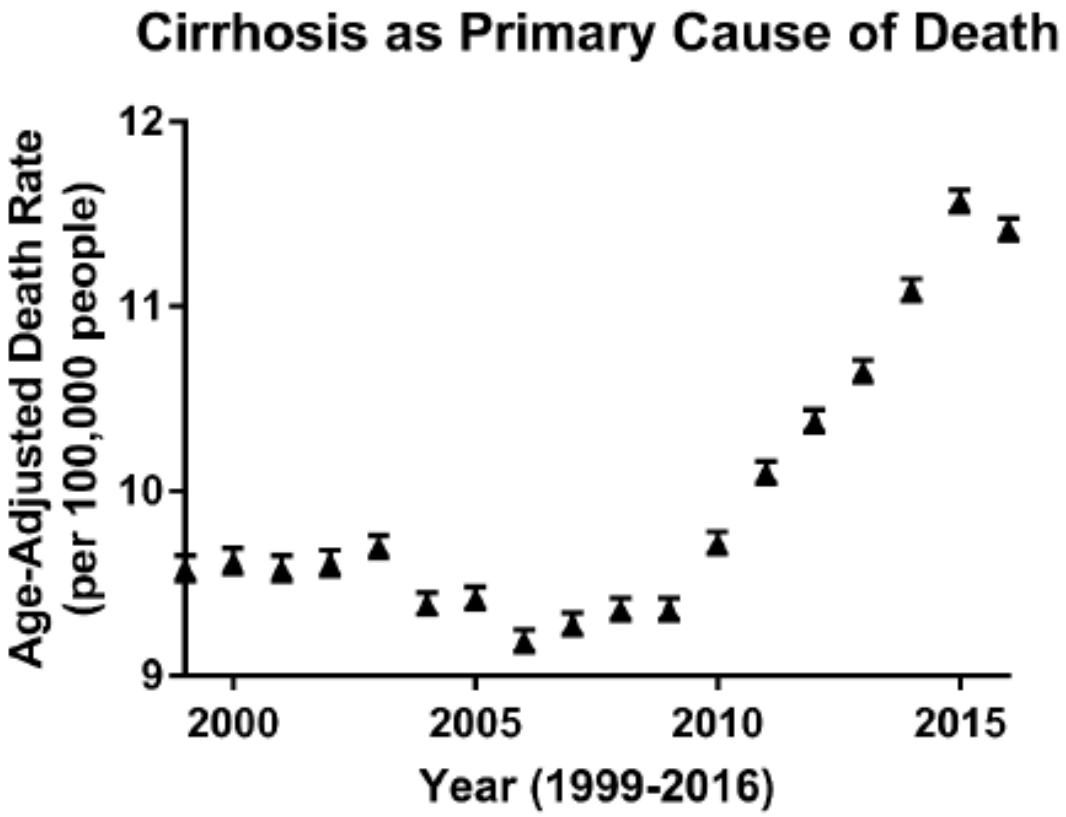
Table 5. Health Care Utilization and Expenses in Participants With and Without CLD

	All CLD	No CLD	*P*
Total health care expenses, $	19,391 ± 1581	5567 ± 56	<.0001
Provider office visits, n	12.61 ± 0.50	5.81 ± 0.05	<.0001
Office visit expenses, $	3284 ± 230	1304 ± 15	<.0001
Hospital o/p visits, n	1.65 ± 0.14	0.52 ± 0.01	<.0001
O/p expenses: facility, $	1521 ± 245	411 ± 10	<.0001
O/p expenses: provider, $	308 ± 82	88 ± 2	.0074
ER visits, n	0.52 ± 0.04	0.19 ± 0.01	<.0001
ER expenses: facility, $	511 ± 67	170 ± 3	<.0001
ER expenses: provider, $	104 ± 14	35 ± 1	<.0001
Inpatient discharges, n	0.42 ± 0.03	0.12 ± 0.01	<.0001
Inpatient nights, n	3.10 ± 0.35	0.59 ± 0.01	<.0001
I/p expenses: facility, $	7490 ± 1216	1464 ± 29	<.0001
I/p expenses: provider, $	696 ± 90	225 ± 4	<.0001
Prescriptions, n	33.44 ± 1.33	12.90 ± 0.14	<.0001
Pharmacy expenses, $	4218 ± 261	1227 ± 18	<.0001

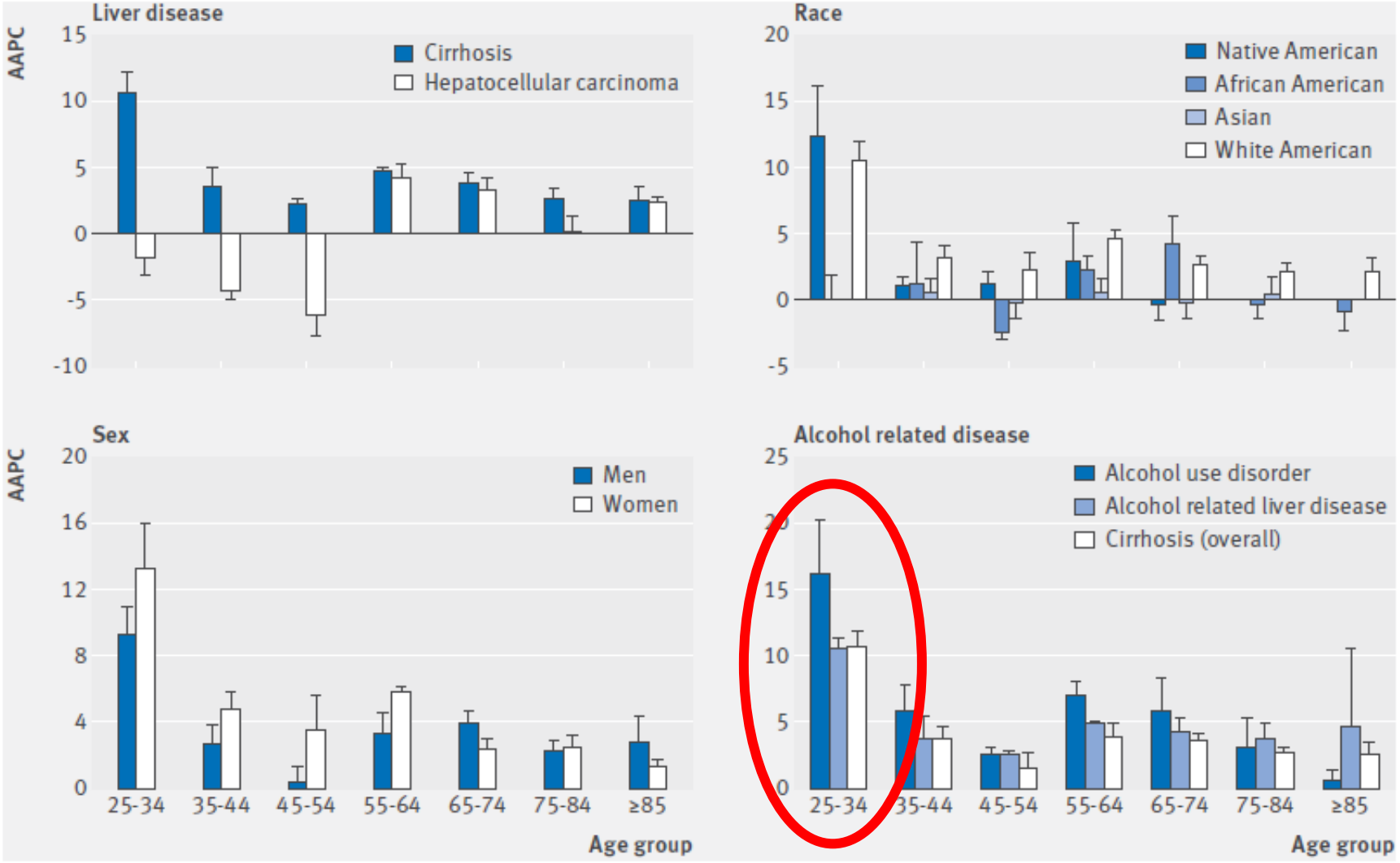
MCS, mental component summary.
NOTE. Means ± standard error shown.
ER, emergency room, i/n, inpatient; o/p, outpatient.
Stepanova et al. *CGH*. 2017;15:759-66.

Cirrhosis Related Mortality Trends in the U.S.

- Data from CDC WONDR (1999 to 2016) demonstrated a 65% increase in annual deaths from cirrhosis and doubling of deaths related to HCC
- From 2008-2016, annual percent increase in deaths of 3.4% for cirrhosis and 3.0% for HCC
- From 2009-16, people aged 25-34 years experienced the highest average annual increase in cirrhosis related mortality (10.5%, 8.9% to 12.2%, P<0.001), driven by alcohol related liver disease



Tapper and Parikh. *BMJ*. 2018;362:k2817.



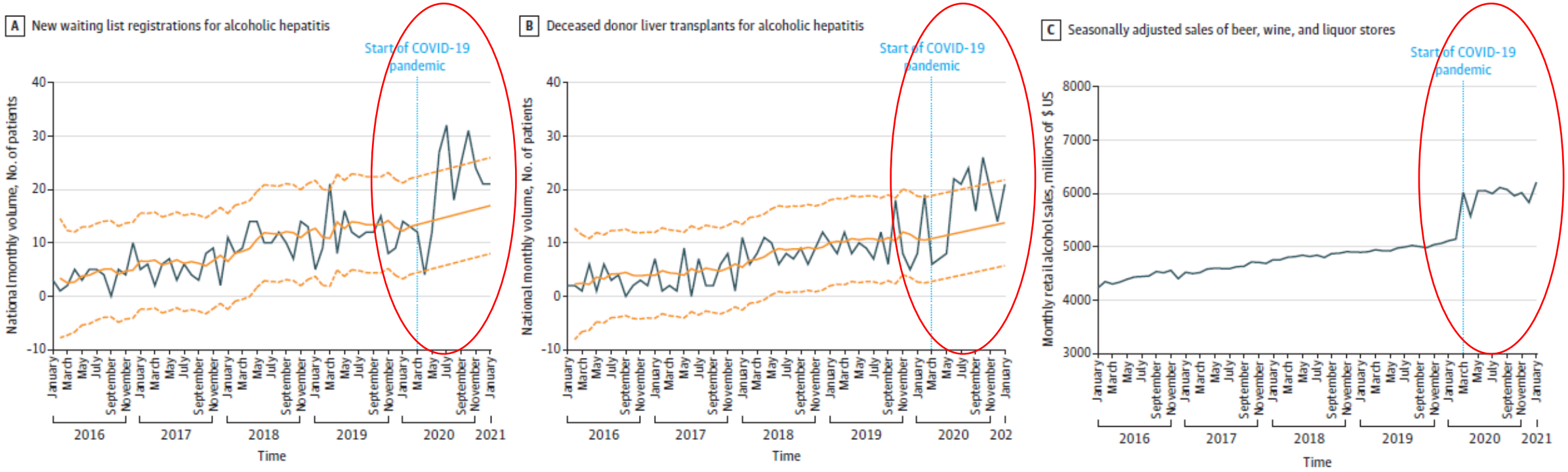
Tapper and Parikh. *BMJ*. 2018;362:k2817.

JAMA Network Open

Research Letter | Gastroenterology and Hepatology

Association of COVID-19 With New Waiting List Registrations and Liver Transplantation for Alcoholic Hepatitis in the United States

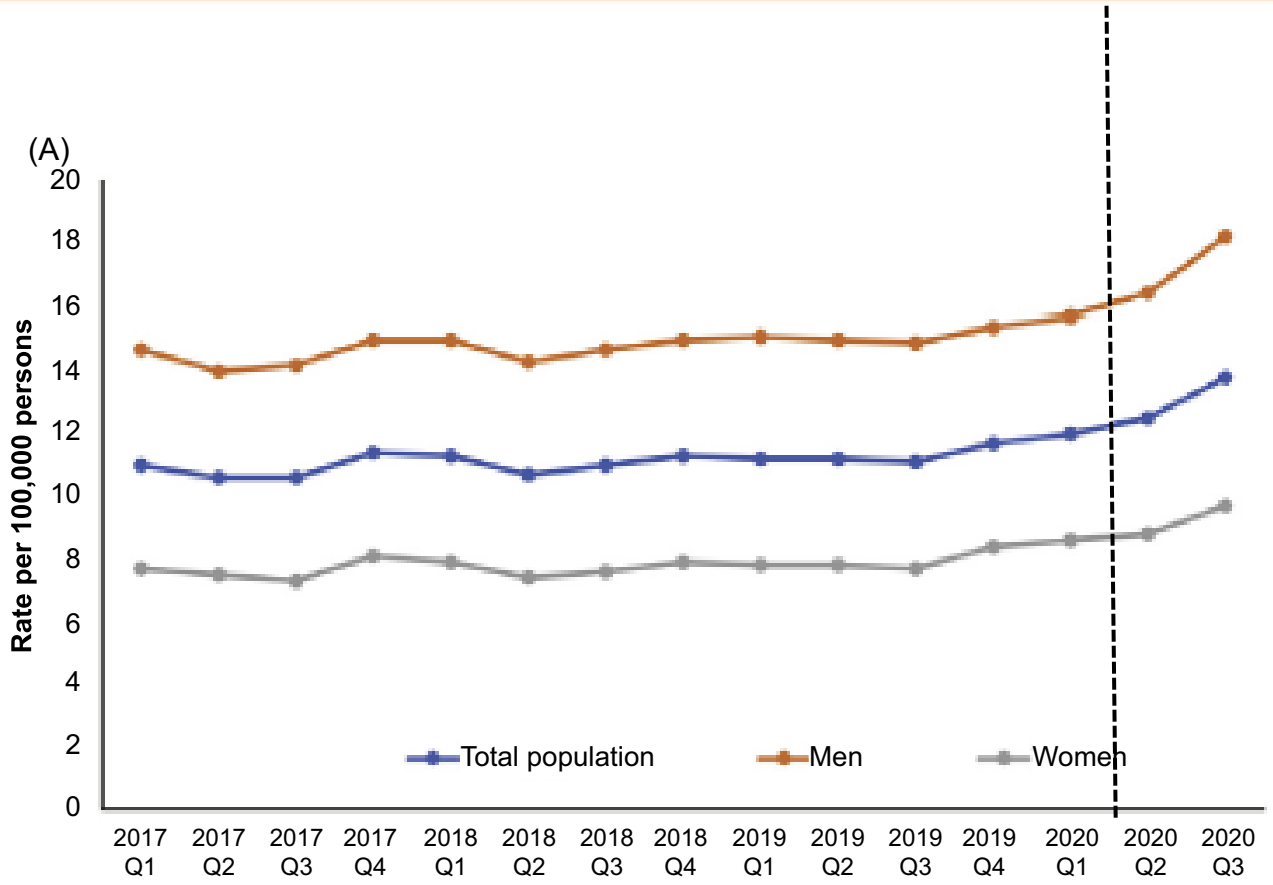
Maia S. Anderson, MD; Valeria S. M. Valbuena, MD; Craig S. Brown, MD, MSc; Seth A. Waits, MD; Christopher J. Sonnenday, MD, MHS; Michael Englesbe, MD; Jessica L. Mellinger, MD, MSc



Anderson et al. *JAMA Netw Open*. 2021.

Chronic Liver Disease and Cirrhosis Mortality

- Data from National Vital Statistics System to evaluate CLD and cirrhosis mortality before and after onset of pandemic.
- Quarterly percent increase in CLD mortality increased from 0.5% (Q1-2017 to Q4-2019) to 6.1% (Q4-2019 to Q3-2020).
- This increase was most pronounced among men (QPC, 0.6% to 8.4% vs. women: 0.3% to 5.1%) and among yound adults ages 35 to 44 years (QPC 1.5% to 15.2%).



Kim et al. *Clinical Gastroenterology and Hepatology.* 2021;19:2664–2666.

Effect of Increased Alcohol Consumption During COVID-19 Pandemic on Alcohol-Related Liver Disease: A Modeling Study

- Validated microsimulation model that estimated the short- and long-term effect of increased drinking during the COVID-19 pandemic compared with a counter-factual scenario wherein no COVID-19 occurs and drinking patterns do not change
- One-year increase in alcohol consumption during the COVID-19 pandemic is estimated to result in the following between 2020 and 2040:
  - **8,000** [95% UI 7,500-8,600] additional ALD-related deaths
  - **18,700** [95% UI 17,600-19,900] cases of decompensated cirrhosis
  - **1,000** [95% UI 1,000-1,100] cases of HCC
  - **8.9 million** disability-adjusted life-years
- ***A sustained increase in alcohol consumption for more than 1 year could result in additional morbidity and mortality***

Julien et al. *Hepatology.* 2021.

Take Home Points

- The clinical burden of CLD continues to rise in the U.S., driven predominantly by NAFLD/NASH and ALD
- Disease progression to cirrhosis and cirrhosis-related complications are major drivers of the significant economic burden associated with CLD
- Rising prevalence of obesity, insulin resistance, and metabolic syndrome further contributes to these concerning trends
- Pandemic fueled increases in unhealthy alcohol use is driving recent spikes of ALD

Thank You

- Chronic Liver Disease Foundation
- Cirrhosis Health Outcomes Coalition Summit Planning Committee

- Contact: Rwong123@Stanford.edu