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Epidemiology of Alcohol Use and Alcoholic Liver Disease

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Abbreviations:

ALD: alcoholic liver disease

AUD: alcohol use disorder

HCV: hepatitis C

NESARC: National Epidemiologic Survey on Alcohol and Related Conditions

NIAAA: National Institute on Alcohol Abuse and Alcoholism

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Alcohol use is an intrinsic part of the pathophysiology of alcoholic liver disease (ALD). Understanding the epidemiology and changing trends in alcohol use in the United States and worldwide is important for those who care for ALD patients. ALD is a spectrum of disease, which starts with steatosis and progresses to fibrosis and ultimately cirrhosis in approximately 20 to 25% of patients who have heavy drinking over many years(1). Chronic alcohol use of approximately 20 to 50 g per day for women or 60 to 80 g per day for men increases the risk of alcoholic cirrhosis(2).

Defining Alcohol Use

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Understanding the epidemiology of alcohol use requires understanding definitions of alcohol use and misuse as well as understanding variation in what is considered a standard drink(3). In the United States, a standard drink contains 14 grams of alcohol and is the equivalent of a 12 ounce can of beer, 8 to 9 fluid ounces of malt liquor, a 1/2 ounce shot of 80 proof spirits, or 5 ounces of wine (see Figure 1). While the definition of a standard drink varies by country, a standard drink typically contains approximately 10-14 grams of alcohol.(4) Recommendations for safe limits for men and women in terms of drinking also vary worldwide, but in general, women are advised to drink less than men, typically about half as much.

Defining how much alcohol is too much is also critically important. Moderate alcohol use has been defined in the dietary guidelines for the United States as up to one drink a day for women or two standard drinks a day for men(5). Binge drinking is defined as drinking more than four standard drinks for women or more than five standard drinks for men in a single occasion. Heavy alcohol use has been defined as binge drinking five or more days in the past month(3). Alcohol use disorder (AUD) is defined by the use of large and escalating amounts of alcohol over a period of time with unsuccessful efforts to cut down, much time spent recovering, obtaining or using alcohol, recurrent alcohol use when is physically hazardous, and craving and withdrawal(6). The accumulation of more symptoms results in a more severe AUD.

Global Alcohol Use Patterns: Who, What and How Much

Globally, the average per capita alcohol consumption per year is approximately 6.4 Liters, having risen from 5.5 Liters in 2005(7). There is geographic variation in this amount, with the lowest amount of per capita alcohol consumption occurring in the Middle East and northern Africa, while Russia and Europe, particularly Eastern Europe, have some of the highest rates of per capita alcohol consumption though encouragingly, those rates seem to be declining (7,8). In Europe, the overall per capita consumption of alcohol declined from 12.1 to 9.8 liters per person from 2000 to 2016, and in countries such as Russia, which were among the highest consumers of alcohol, per capita consumption declined from 18.7 liters to 11.7 over the same timeframe (7). By contrast, the Western Pacific Region and Southeast Asian Regions saw increases in overall per capita alcohol consumption. Importantly, however, amongst *drinkers*, per capita consumption increased in nearly all regions of the world except Europe, indicating that those who do drink at all are drinking more heavily (see **Figure 2**) (7). The types of alcohol consumed vary according to geography. Beer consumption

made up 34% of total alcohol consumption and was the most commonly consumed alcoholic beverage in North and South America and Europe. Overall, however, spirits made up 45% of global alcohol consumption and were highest in the Southeast Asia region (88% of total consumption), the Western Pacific (59%) and the Middle East/Eastern Mediterranean Region (48%)(7). Reasons for these global variations are complex and include demographic, religious and cultural factors as well as economic development level.

Drinking patterns varied, and binge drinking prevalence was reported to be highest in Europe overall with Eastern European countries as well as France and England reporting some of the highest rates of binge drinking. Encouragingly, however, prevalence of binge drinking *declined* in Europe from 2000 to 2016, decreased 10-12% in both the total population and the population of active drinkers (7). With respect to gender, unsurprisingly, more men than women drink and drink more heavily. Worldwide, the proportion of current drinkers was 54% of men and 32% of women. The ratio of male-to-female was 3.8. Importantly, these prevalence estimates mask the fact that the absolute numbers of drinkers has increased given that the population has increased over time as well. The absolute numbers of currently-drinking women have increased worldwide, despite the fact that, compared to men, women drink less often and lower amounts of alcohol overall.

Alcohol Use in the United States and Elsewhere

National estimates of alcohol use in the United States have recently shown alarming figures. Data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a large comprehensive survey conducted in the United States since 2001, recently showed that across all categories of alcohol use and all demographics, alcohol use has risen in the United States from 2001 to 2012(9). The prevalence of any alcohol use in 12 months rose from approximately 65% to just over 72%. This rise was more pronounced in women, rural citizens, and those with lower socioeconomic status. In addition, minorities showed stronger increases across all categories(9). High-risk drinking, defined as drinking 4 to 5 drinks per day, increased by 30%, with more marked increases amongst women and minorities. Amongst the youngest age group (18 to 29), prevalence of high-risk drinking was 19%. The most alarming findings however show that AUDs, the most severe form of alcohol misuse, increased by 50% across the 10 year timeframe, and this increase was more pronounced in women, rising 80% over the timeframe(9). In addition, AUD rates for the youngest age group aged 18 to 29 also rose sharply to nearly 25% by 2012. Similar trends for alcohol use in other countries have been shown. For example, in the United Kingdom, consumption of cider, wine, and spirits

increased by 150 to 400% over a 30-year timeframe from 1980 to 2013. Alongside these increases were an increase in liver related mortality in England and Wales(10).

An important feature of alcohol use epidemiology is the comorbid association with both other substance use disorders and other mood disorders. Comorbid alcohol use and substance use disorders have been well described, with large population level surveys in the United States showing an odds ratio of comorbid substance use disorders ranging from 2.2 to 6.4 over a lifetime(11). Tobacco use is an important comorbid disorder that commonly occurs alongside alcohol use and is known to be a factor in relapse to alcohol use(11,12). Mood disorders, such as depression and anxiety, are also common comorbid mental illnesses in the AUD population(11). Maintaining awareness of the common comorbid substance use and mental health disorders which may impact patients with AUDs is critical for effective long-term management and mandates a multidisciplinary approach to management of ALD patients.

Health Consequences of Alcohol use

Death and disability from alcohol use worldwide is high and has risen. In 2016, worldwide alcohol-attributable mortality was 38.8 per 100,000 people, and 1,759 disability adjusted life years (DALYs) per 100,000 people (7). The highest percentage of overall deaths attributable to alcohol consumption was in Europe at 10.1%. Digestive diseases, including liver disease, made up a substantial portion of these trends, resulting in 8.3 deaths and 307 DALYs per 100,000 people (7).

Importantly for hepatologists, half of all cirrhosis related deaths worldwide were attributable to alcohol use, in whole or in part(7). Alcohol use does have a dose-response effect on risk of liver cirrhosis. In a meta-analysis, rising alcohol consumption, measured in grams per day, was associated with an increased relative risk of cirrhosis in both men and women. However, at the same level of alcohol, women had an increased risk of cirrhosis. For example, at an alcohol consumption level of 48 g per day (approximately four standard drinks in the United States), the relative risk of cirrhosis for women was double that for a man (RR 10.1 (CI 7.5-13.5) for women, RR 5.6 (CI 4.5-7.0)) (13). While it has been suggested that low to moderate doses of alcohol may be beneficial to health, particularly cardiovascular health, this data has been called into question recently, with a large-scale study showing that current thresholds for “safe” drinking may be too high(14). For those with comorbid liver disease, including non-alcoholic fatty liver disease or hepatitis C, alcohol use appears to accelerate liver damage and hepatic decompensation in those with existing cirrhosis (15,16).

Unsurprisingly, given these trends, alcoholic cirrhosis prevalence has been shown to be increasing. In a privately insured population, alcoholic cirrhosis prevalence rose by 43% over the course of a seven-year period, with prevalence in women rising by 50% compared to 30% in men(17). In addition, ALD mortality increased in persons aged 25 to 34, rising 15% over a ten-year period(18). AUDs are common in comorbid liver disease, particularly hepatitis C, where the presence of an AUD increased the risk of decompensation by nearly four-fold (15,19). Furthermore, comorbid AUD with hepatitis C results in an earlier age for decompensated cirrhosis. In a study comparing the population attributable fraction of decompensation in hepatitis C-related cirrhosis, alcohol use was responsible for 13 to 40% of decompensating events in geographically diverse areas(15). These alarming trends suggest that the rising tide of AUDs in the United States may undo the benefits of direct acting antiviral therapy for hepatitis C in many patients.

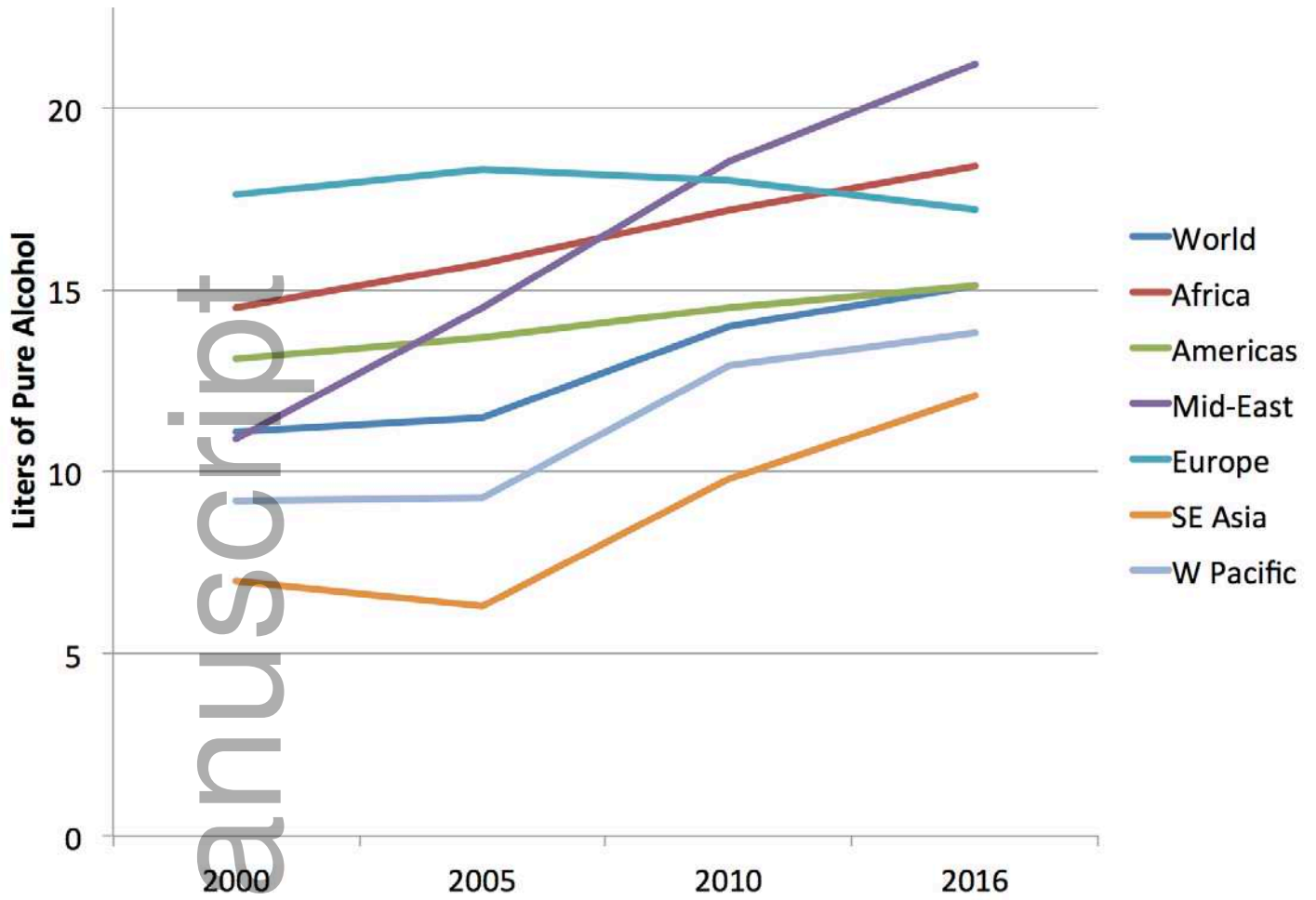
In conclusion, global alcohol trends for some populations are decreasing, but for others, particularly women, appear to be worsening, especially amongst active drinkers. In the US, alcohol consumption trends are moving in an unfavorable direction, particularly amongst women, minorities, and those living in rural areas. These trends threaten to worsen the burden of ALD as well, a burden that is also rising in tandem with rises in alcohol use. Efforts to decrease problem alcohol use at the policy and patient level are urgently needed.

Figure 1. National Institute on Alcohol Abuse and Alcoholism (NIAAA) Guidance on United States Standard Drink sizes.



Each beverage portrayed above represents one standard drink of "pure" alcohol, defined in the United States as 0.6 fl oz or 14 grams. The percent of pure alcohol, expressed here as alcohol by volume (alc/vol), varies within and across beverage types. Although the standard drink amounts are helpful for following health guidelines, they may not reflect customary serving sizes.

Figure 2. Trends in per capita consumption of alcohol (in liters of pure alcohol per year) amongst active drinkers. Data from the World Health Organization 2018 Global Report on Alcohol and Health.



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References

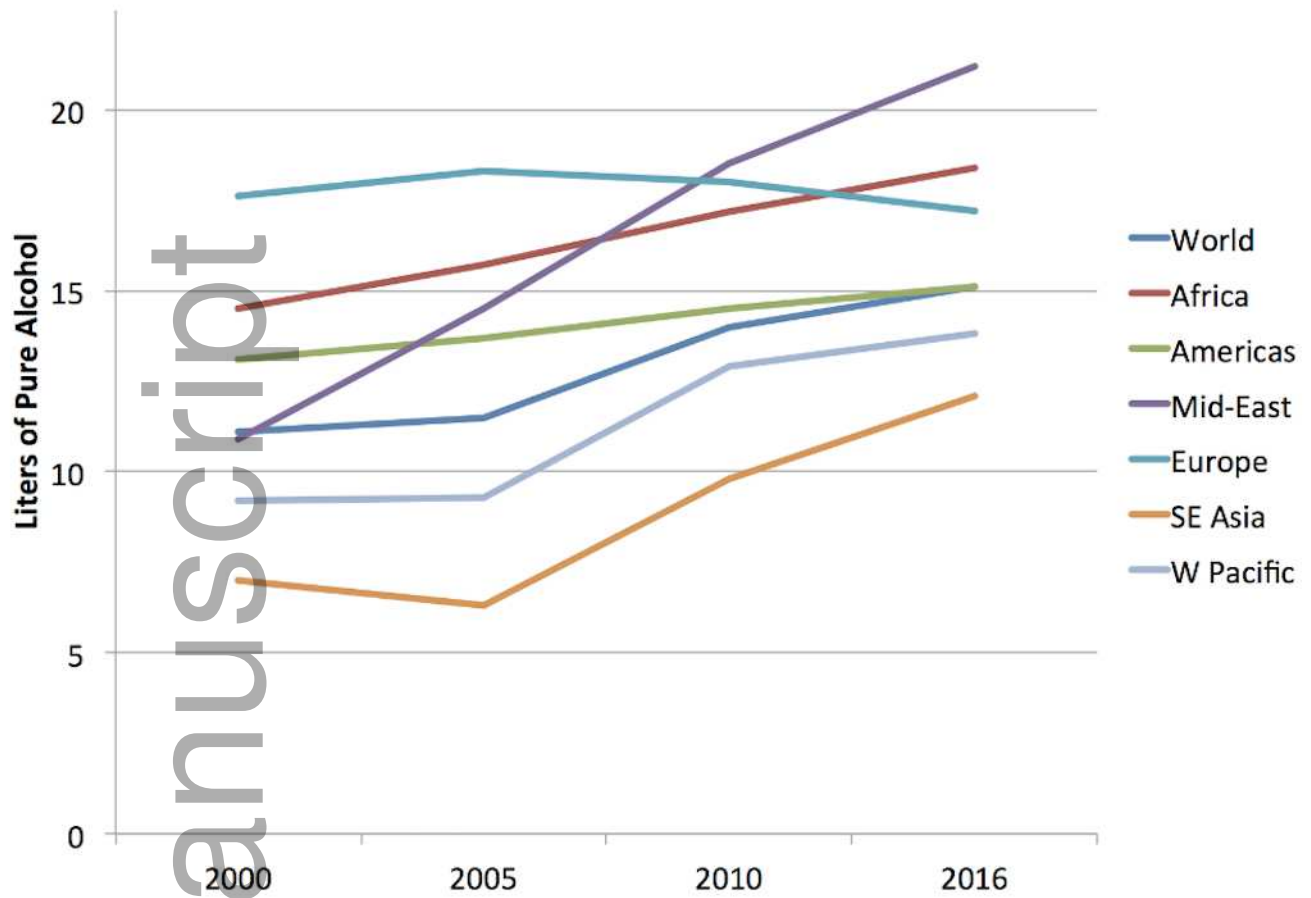
1. O'Shea RS, Dasarathy S, McCullough AJ, Practice Guideline Committee of the American Association for the Study of Liver Diseases, Practice Parameters Committee of the American College of Gastroenterology. Alcoholic liver disease. *Hepatology*. 2010;51:307–328.
2. Mathurin P, Bataller R. Trends in the management and burden of alcoholic liver disease. *J. Hepatol*. 2015;62:S38–46.
3. Kranzler HR, Soyka M. Diagnosis and Pharmacotherapy of Alcohol Use Disorder: A Review. *JAMA*. 2018;320:815–824.
4. International Alliance on Responsible Drinking- Drinking Guidelines. www.iard.org/policy-tablesdrinking-guidelines-general-population.
5. Agriculture USDO, Services USDOHH. Dietary Guidelines for Americans: 2015-2020. <https://health.gov/dietaryguidelines>.
6. Association AP. Diagnostic and Statistical Manual of Mental Disorders (DSM-5®). American Psychiatric Pub; 2013.
7. World Health Organization.... Global Status Report on Alcohol and Health 2018. Geneva:
8. Rehm J, Samokhvalov AV, Shield KD. Global burden of alcoholic liver diseases. *J. Hepatol*. 2013;59:160–168.
9. Grant BF, Chou SP, Saha TD, Pickering RP, Kerridge BT, Ruan WJ, et al. Prevalence of 12-Month Alcohol Use, High-Risk Drinking, and DSM-IV Alcohol Use Disorder in the United States, 2001-2002 to 2012-2013: Results From the National Epidemiologic Survey on Alcohol and Related Conditions. *JAMA Psychiatry*. 2017;
10. Williams R, Aspinall R, Bellis M, Camps-Walsh G, Cramp M, Dhawan A, et al. Addressing liver disease in the UK: a blueprint for attaining excellence in health care and reducing premature mortality from lifestyle issues of excess consumption of alcohol, obesity, and viral hepatitis.

Lancet. 2014;384:1953–1997.

11. Grant BF, Goldstein RB, Saha TD, Chou SP, Jung J, Zhang H, et al. Epidemiology of DSM-5 Alcohol Use Disorder: Results From the National Epidemiologic Survey on Alcohol and Related Conditions III. *JAMA Psychiatry*. 2015;72:757–766.
12. Weinberger AH, Platt J, Esan H, Galea S, Erlich D, Goodwin RD. Cigarette smoking is associated with increased risk of substance use disorder relapse: A nationally representative, prospective longitudinal investigation. *The Journal of clinical psychiatry*. 2017;78:e152–e160.
13. Rehm J, Taylor B, Mohapatra S, Irving H, Baliunas D, Patra J, et al. Alcohol as a risk factor for liver cirrhosis: a systematic review and meta-analysis. *Drug Alcohol Rev*. 2010;29:437–445.
14. Wood AM, Kaptoge S, Butterworth AS, Willeit P, Warnakula S, Bolton T, et al. Risk thresholds for alcohol consumption: combined analysis of individual-participant data for 599 912 current drinkers in 83 prospective studies. *Lancet*. 2018;391:1513–1523.
15. Alavi M, Janjua NZ, Chong M, Grebely J, Aspinall EJ, Innes H, et al. The contribution of alcohol use disorder to decompensated cirrhosis among people with hepatitis C: An international study. *J. Hepatol*. 2018;68:393–401.
16. Åberg F, Helenius-Hietala J, Puukka P, Färkkilä M, Jula A. Interaction between alcohol consumption and metabolic syndrome in predicting severe liver disease in the general population. *Hepatology*. 2018;67:2141–2149.
17. Mellinger JL, Shedden K, Winder GS, Tapper E, Adams M, Fontana RJ, et al. The High Burden of Alcoholic Cirrhosis in Privately Insured Persons in the United States. *Hepatology*. 2018;68(3): 872-882.
18. Tapper EB, Parikh ND. Mortality due to cirrhosis and liver cancer in the United States, 1999-2016: observational study. *BMJ*. 2018;362:k2817.
19. Beste LA, LePERTZ SL, Green PK, Dornitz JA, Ross D, Ioannou GN. Trends in Burden of Cirrhosis and Hepatocellular Carcinoma by Underlying Liver Disease in US Veterans, 2001–2013. *Gastroenterology*. 2015;149:1471–1482.



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