



Retrospective Study

# Hospitalizations for alcoholic liver disease during the COVID-19 pandemic increased more for women, especially young women, compared to men

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## Abstract

### BACKGROUND

Alcoholic liver disease (ALD) remains one of the major indications for liver transplantation in the United States and continues to place a burden on the national healthcare system. There is evidence of increased alcohol consumption during the coronavirus disease 2019 (COVID-19) pandemic, and the effect of this on the already burdened health systems remains unknown.

### AIM

To assess the trends for ALD admissions during the COVID-19 pandemic, and compare it to a similar pre-pandemic period.

### METHODS

This retrospective study analyzed all admissions at a tertiary health care system, which includes four regional hospitals. ALD admissions were identified by querying a multi-hospital health system's electronic database using ICD-10 codes. ALD admissions were compared for two one-year periods; pre-COVID-19 from

April 2019 to March 2020, and during-COVID-19 from April 2020 to March 2021. Data were analyzed using a Poisson regression model and admission rates were compared using the annual quarterly average for the two time periods, with stratification by age and gender. Percent increase or decrease in admissions from the Poisson regression model were reported as incident rate ratios.

## RESULTS

One thousand three hundred and seventy-eight admissions for ALD were included. 80.7% were Caucasian, and 34.3% were female. An increase in the number of admissions for ALD during the COVID-19 pandemic was detected. Among women, a sharp rise (33%) was noted in those below the age of 50 years, and an increase of 22% in those above 50 years. Among men, an increase of 24% was seen for those below 50 years, and a 24% decrease in those above 50 years.

## CONCLUSION

The COVID-19 pandemic has had widespread implications, and an increase in ALD admissions is just one of them. However, given that women are often prone to rapid progression of ALD, this finding has important preventive health implications.

**Key Words:** Alcoholic liver disease; COVID-19; Alcoholic hepatitis; Alcoholic liver cirrhosis; Alcoholism; Pandemic; Young women; Alcohol-related disorders

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**Core Tip:** An increase in alcoholic liver disease admissions was observed in the first year of the pandemic compared to the year prior to the pandemic with various “lock-downs” in place. This trend was most pronounced in the cohort of women below the age of 50.

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## INTRODUCTION

The spectrum of alcoholic liver disease (ALD) includes an array of pathologies, from reversible fatty liver, to alcoholic hepatitis and advanced cirrhosis with portal hypertension[1]. Although women have lower and less active alcohol dehydrogenase in the GI tract and liver compared to men, ALD has traditionally been a disease primarily of middle-aged and older men[2]. A study by Shirazi *et al*[3], analyzing the National Inpatient Sample from 2007-2014 showed significantly higher hospitalization rates in males *vs* females, for alcohol associated hepatitis and cirrhosis.

The coronavirus disease 2019 (COVID-19) pandemic has had deep and far reaching consequences on people across the globe, affecting individuals at personal, economic, and social levels. It is alleged to have provoked more significant financial and emotional hardships on women compared to men[4,5]. During the initial phase of the pandemic, liquor stores in the United States were considered essential businesses, and alcohol sales increased by more than 34%[6]. The current study was designed to evaluate whether increased alcohol consumption during the COVID-19 pandemic was associated with an increase in ALD admissions, particularly in women.

## MATERIALS AND METHODS

An IRB exception was obtained for this study, prior to any data acquisition or analysis. Admissions to a multi-hospital health system for ALD were compared for two one-year periods [April 2019-March 2020 (pre-COVID-19, “PC”) and April 2020-March 2021 (during-COVID-19, “COV”)]. One thousand three hundred and seventy-eight admissions from the four regional hospitals for ALD were identified by querying an electronic database using the International Classification of Diseases (ICD-10) codes (K70 and its sub-categories representing the spectrum of alcoholic fatty liver, hepatitis, cirrhosis, fibrosis). Patients with more than one or overlapping diagnoses were only counted once. Data were analyzed using a Poisson regression model and admission rates were compared using the annual quarterly

average for the two time periods, with stratification by age and gender. Percent increase or decrease in admissions from the Poisson regression model were reported as incident rate ratios. Continuous variables were compared using Student's *t*-test, while categorical variables were compared using chi-square or Fisher's exact test. All data were analyzed using SAS v9.4 software (Cary, NC).

## RESULTS

Comparing admissions for ALD pre-COVID-19 (PC) and during-COVID-19 (COV) periods, an average quarterly increase of 33% was identified in women below 50 years (75 PC *vs* 104 COV,  $P = 0.031$ ), and an increase of 22% in women above 50 years (131 PC *vs* 163 COV,  $P = 0.063$ ). During the same two periods, ALD admissions for men below 50 years increased 24% (131 PC *vs* 166 COV,  $P = 0.043$ ) (Figure 1).

Interestingly, a 24% decrease in admissions for ALD was observed in males above 50 years (341 PC *vs* 267 COV,  $P = 0.003$ ). Although this group had the greatest number of hospitalizations, a significant proportional decline was observed among them, compared to the other groups.

The total number of admissions for ALD in men and women only increased from 678 pre-COVID-19 to 709 during-COVID-19 (Table 1). Strikingly, the proportion of women increased from 30.4% ( $n = 206$ ) to 38.1% ( $n = 267$ ), demonstrating an increase of 29% ( $P = 0.005$ ). Total admissions for males decreased from 69.6% ( $n = 472$ ) to 61.9% ( $n = 433$ ), a 9% decrease ( $P = 0.195$ ).

No significant racial/ethnic difference was identified, with the majority of the patients being Caucasian (80.7%). Approximately 35% of patients in both groups were decompensated with ascites. For patients with ALD, the length of stay during the pandemic was higher than pre-pandemic (110 h *vs* 96 h,  $P = 0.014$ ). Interestingly, during the COVID-19 period, more patients left the hospital prematurely, against medical advice (4.3% *vs* 2.5%,  $P = 0.03$ ). A higher proportion of patients were discharged to a rehabilitation facility during the pandemic as well (2.6% *vs* 1.5%,  $P = 0.03$ ).

## DISCUSSION

The current study, comparing the pre-COVID and during-COVID periods, detected a significant increase in the number of ALD hospital admissions for both women and men below the age of 50 years (33% and 24% increase respectively). With the onset of stressors including those brought by prolonged social isolation and socio-economic instability associated with the pandemic, an increase in substance abuse, not only among the high-risk groups, but also in the general population is not surprising and has been described[7].

Importantly, a significant increase in the number of younger women requiring admission for ALD was identified. To a lesser extent, this trend was observed in women over 50 years of age as well. The contextual, environmental, and social influences impacting alcohol consumption during the COVID-19 pandemic have not been comprehensively evaluated. The current study identified multiple significant trends that are likely related to psychosocial factors and social processes the study was not designed to evaluate. Previous studies have suggested anxiety and depression may be more prevalent in women than men, and the uncertainties during the pandemic may have compounded this[8]. A national survey reported a significant impact of the pandemic on the mental health of women, with 1 in 5 women respondents reporting an increase in alcohol or drug use after the onset of the COVID-19 outbreak[9]. One can speculate the increased consumption of alcohol could be related to stresses in the home added to existing marital responsibilities including: Stresses associated with both partners working remotely, the added stress of having children in the home, and the responsibilities associated with coordinating education for remote learning. The traditional gender gap in alcohol use also tends to be narrowing. A study by Williams *et al*[10] examining heavy drinking trajectories demonstrated an increase in heavy drinking frequency among younger women. These trends are concerning, given that women are not only at a higher risk of developing liver disease with alcohol intake, but are also at increased risk for progression of ALD with increasing alcohol intake compared to men[11]. Differences in gastric alcohol dehydrogenase levels and body fat are thought to be the reason behind this gender difference. A recent study by Bertha *et al*[11], analyzing a national inpatient database, reported that although ALD is seen predominantly in men, there has been a disproportionate increase in ALD mortality among women. Specifically, mortality in women below 34 years has progressed at a significantly high rate[1].

Another trend the current study identified was a decrease in ALD hospitalizations for older males during the COVID-19 pandemic. During the pandemic many individuals made every attempt to avoid hospital visits. Men are especially prone to denial of symptoms and avoidance of healthcare. It is also plausible that the overall consumption of alcoholic beverages by men decreased during the pandemic while increasing in women. Davies *et al*[12] found that drinking in the home with a partner, compared to drinking outside the home, is associated with lower consumption of alcohol. With the temporary closing and restricted capacities of establishments serving alcohol (bars, pubs, and restaurants), males may have consumed less alcohol due to limited access. In addition, social cues may have limited alcohol consumption in the home. Although liquor store sales increased during the pandemic, it is plausible

**Table 1 Trends for alcoholic liver disease admissions pre-COVID and during COVID-19, *n* (%)**

Variable	Total ( <i>n</i> = 1378)	COVID-19 period ( <i>n</i> = 700)	Pre-COVID-19 period ( <i>n</i> = 678)	<i>P</i> value
Age (yr)	53.9 ± 13.1	53.1 ± 12.9	54.7 ± 13.2	0.025
Gender				0.002
Female	473 (34.3%)	267 (38.1%)	206 (30.4%)	
Male	905 (65.7%)	433 (61.9%)	472 (69.6%)	
Race				0.628
Black or African American	168 (12.2%)	91 (13.0%)	77 (11.4%)	
White or Caucasian	1112 (80.7%)	559 (79.9%)	553 (81.6%)	
Diagnosis name				0.274
Alcoholic cirrhosis of liver with ascites	491 (35.6%)	246 (35.1%)	245 (36.1%)	
Alcoholic cirrhosis of liver without ascites	336 (24.4%)	164 (23.4%)	172 (25.4%)	
Alcoholic fatty liver	43 (3.1%)	20 (2.9%)	23 (3.4%)	
Alcoholic fibrosis and sclerosis of liver	1 (0.1%)	0 (0.0%)	1 (0.1%)	
Alcoholic hepatic failure with coma	4 (0.3%)	3 (0.4%)	1 (0.1%)	
Alcoholic hepatic failure without coma	141 (10.2%)	79 (11.3%)	62 (9.1%)	
Alcoholic hepatitis with ascites	85 (6.2%)	52 (7.4%)	33 (4.9%)	
Alcoholic hepatitis without ascites	205 (14.9%)	105 (15.0%)	100 (14.7%)	
Alcoholic liver disease, unspecified	72 (5.2%)	31 (4.4%)	41 (6.0%)	
Discharge disposition				0.034
Expired	57 (4.2%)	34 (4.9%)	23 (3.4%)	
Home or self-care	832 (60.6%)	412 (59.1%)	420 (62.1%)	
Home-health care service	154 (11.2%)	86 (12.3%)	68 (10.1%)	
Hospice/home	30 (2.2%)	16 (2.3%)	14 (2.1%)	
Hospice/medical facility	38 (2.8%)	14 (2.0%)	24 (3.6%)	
Left against medical advice	47 (3.4%)	30 (4.3%)	17 (2.5%)	
Rehab facility	29 (2.1%)	18 (2.6%)	11 (1.6%)	
Short term hospital	58 (4.2%)	34 (4.9%)	24 (3.6%)	
Skilled nursing facility	76 (5.5%)	35 (5.0%)	41 (6.1%)	

COVID: Coronavirus disease.

overall consumption by men decreased due to limited access to previously visited establishments.

Recent studies mirror these findings. Deutsch-Link *et al*[13] reviewed the Centers for Disease Control and Prevention data, and discovered that mortality from ALD rose from 2017 to 2020 in the United States, with females and younger adults having the highest relative increase. Gonzalez *et al*[14] documented an increase in the proportion of female ALD admissions during the pandemic, in their study of 337 patients in the Detroit area. They also found an increase in Black/African American admissions. Sohal *et al*[15] also reported an increase in alcohol-related hepatitis requiring inpatient management, especially in patients under the age of 40 and in women during the pandemic with 329 patients studied in three community hospitals in Fresno, California, United States.

The strength of the current study lies in its longitudinal population-based evaluation of temporal trends for ALD in a large multi-hospital system, reviewing 1378 admissions for ALD. Limitations of the current study include its retrospective design and limited geographical reach. This study definitely underestimates the prevalence of ALD during the COVID-19 era, as only patients with significant ALD would have been admitted. Patient hesitancy to present to hospitals during the pandemic, as well as cessation of elective admissions may have also contributed to underestimating the prevalence of ALD during the pandemic. Further studies are indicated to determine whether these increasing trends of ALD hospitalizations persist, particularly in younger women, and to evaluate the psychosocial factors impacting alcohol consumption during the COVID-19 pandemic.

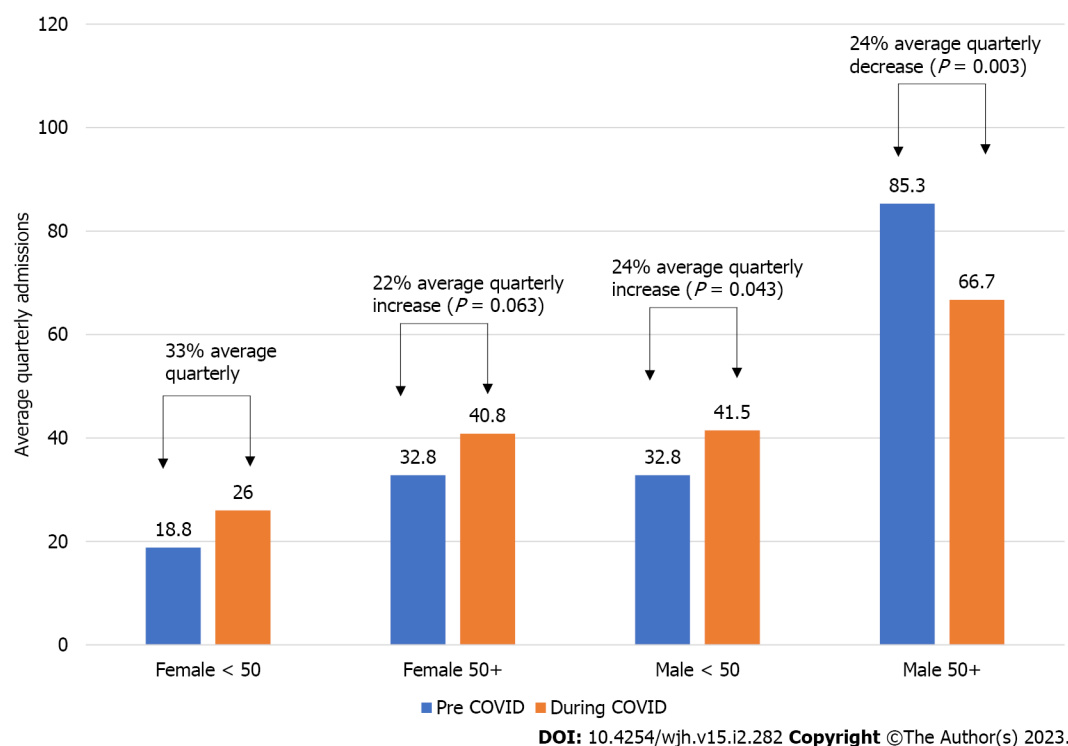


Figure 1 Alcoholic liver disease admissions in a pre-COVID and during-COVID period by age and gender. COVID: Coronavirus disease.

## CONCLUSION

This large multi-hospital analysis demonstrates a concerning gender disparity with women, especially young women, being significantly more likely to be admitted with ALD during the COVID-19 period compared to the twelve months prior to the pandemic. Intensive public health interventions, especially those focused towards women, may help to curb the rising rates of alcoholic liver disease in the United States.

## ARTICLE HIGHLIGHTS

### Research background

Alcoholic liver disease (ALD) has traditionally been a disease of middle-aged and older men, though recent studies indicate an increasing prevalence of women with ALD.

### Research motivation

The coronavirus disease 2019 (COVID-19) pandemic has had widespread consequences affecting many socially and economically. This appears to have resulted in increased alcohol consumption in many individuals.

### Research objectives

To assess the trends for ALD admissions during the COVID-19 pandemic and compare it to a similar pre-pandemic period.

### Research methods

This was a retrospective analysis of hospitalizations for ALD in a large multi-center hospital system in the United States from April 2019 to March 2021.

### Research results

An increase in admissions for ALD in women was noted (33% rise in women < 50 years and 22% rise in women > 50 years). Though ALD admissions for men < 50 years rose 24%, a fall of 24% in those > 50 years was noted.

## Research conclusions

This study found a significant increase in younger women requiring hospital admission for ALD.

## Research perspectives

It is of significant medical interest to gastroenterologists and hepatologists to determine whether the trend of increased ALD hospitalizations in women persist in future years.

## FOOTNOTES

**Author contributions:** Campbell JP, Jahagirdar V, Muhanna A, Kennedy KF, and Helzberg JH contributed equally to this work; Campbell JP contributed to conceptualization, data curation, writing original draft, review and editing, and project administration; Jahagirdar V contributed to writing original draft, review, and editing; Muhanna A contributed to investigation and methodology; Kennedy KF contributed to formal analysis, data curation, validation, and visualization; Helzberg JH contributed to supervision, writing, editing, and project administration; all authors have read and approved the final manuscript.

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**Informed consent statement:** Informed consent was not obtained from each patient evaluated since this project was completely retrospective and performed with an IRB exemption.

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