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Original Article

Inpatient Screening, Brief Intervention, and Referral to Treatment for Alcohol Use Disorder in Patients Admitted with Alcohol-associated Liver Disease Is Not Universally Implemented in Practice, But Can Reduce Readmissions for Alcohol-associated Hepatitis

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Abstract

Introduction: The management of alcohol-related liver disease requires a multidisciplinary approach to treat alcohol use disorder. We aimed to determine the proportion of actively drinking patients admitted for alcohol-associated hepatitis (AAH) or decompensated alcohol-related cirrhosis (DARLC) who were offered or underwent screening, brief intervention, and referral to treatment (SBIRT) for alcohol use disorder during admission and if inpatient SBIRT is associated with reduced readmissions for alcohol-related liver disease.

Methods: We conducted a retrospective cohort study of actively drinking patients admitted to our institution from January 2017 to December 2021 with AAH or DARLC. Logistic regression was used to identify factors, such as conducting SBIRT, that were associated with 30-day and 90-day readmissions for recurrent AAH or DARLC.

Results: There were 120 AAH admissions (mean age 47.7 ± 13.6 years), and 177 DARLC admissions (mean age 58.2 ± 9.5 years). SBIRT was conducted in only 51.7% of AAH admissions, and 23.7% of DARLC admissions. For AAH, conducting SBIRT was associated with significantly reduced 30-day (OR 0.098, $P = 0.001$, 95% CI 0.024–0.408) and 90-day (OR 0.166, $P = 0.003$, 95% CI 0.052–0.534) readmissions. For DARLC, there was no association between conducting SBIRT and 30-day or 90-day readmissions.

Conclusion: SBIRT was conducted with actively drinking patients in only 51.7% of AAH admissions and 23.7% of DARLC admissions. Patients admitted for AAH who received inpatient SBIRT had decreased 30-day and 90-day readmission rates for AAH or DARLC.

Key words: alcohol-related liver cirrhosis; social work; addictions; SBIRT; alcohol-associated hepatitis

Introduction

Alcohol-related liver disease (ALD), which includes alcohol-related liver cirrhosis (ARLC) and alcohol-associated hepatitis (AAH), is a common cause of liver disease worldwide. The prevalence of ALD in the US is approximately 4.7%, with 50% of global cases of cirrhosis attributable to ALD.[1,2] AAH has also become more common over the past few decades, with increasing numbers of admissions and cases documented in the US, Denmark, and Finland.[3–6]

ALD comes with significant morbidity and mortality, accounting for 48% of cirrhosis-related admissions and deaths in the US and 48% of cirrhosis-related deaths worldwide.[7,8] Compared to patients with non-alcohol-related cirrhosis, ARLC patients had more frequent admissions and readmissions.[9] ALD has also been increasing the strain on the healthcare system.[9–12] Studies involving the National Readmissions Database in the US show that from 2010 to 2018, the all-cause readmission rate increased from 18.8% to 24.4% for AAH patients, and from 24.9 to 29.9% for ARLC patients. These same studies showed that the mean total hospital cost per readmission from 2010 to 2018 increased from $14,285 to $17,227 USD for AAH patients and from $13,790 to $171,150 USD for ARLC patients.[11,12]

Alcohol abstinence is key in ALD management, as it is associated with improved survival in cirrhosis.[13,14] Various societies, such as the American Association for the Study of Liver Diseases and the European Association for the Study of the Liver, have adopted the screening and management of concurrent alcohol use disorder (AUD) as a core aspect of managing ALD.[15,16] Even so, many ALD patients do not receive directed management for AUD, such as behavioural therapy or pharmacotherapy.[14,17] Management of AUD typically starts with screening, brief intervention, and referral to treatment (SBIRT). SBIRT has been shown to reduce short-term heavy alcohol drinking and harmful alcohol use.[18–20] Admission for AAH or decompensated ARLC (DARLC) presents an important opportunity to conduct SBIRT to help patients reduce alcohol intake.

The aim of our study was to determine the proportion of actively drinking patients admitted for AAH or DARLC who are either offered SBIRT or have SBIRT conducted during their admission, either by social workers or addictions counsellors, or by physicians alone. We also investigated for associations between either being offered SIBRT or having SBIRT conducted, and 30-day and 90-day readmissions for recurrent AAH or DARLC.

Methods

Patient selection

We conducted a retrospective review of electronic medical records of all patient admissions to tertiary and community hospitals under Hamilton Health Sciences (HHS) from January 2017 to December 2021 with a primary or secondary diagnosis of ARLC or AAH based on the International Classification of Diseases 10th Revision (ICD-10) codes K700, K701, K703, and K704. Patient charts were retrieved with the assistance of HHS Clinical Decision Support. Patients were admitted to the gastroenterology ward, the intensive care unit, or a general ward. The admitting service would need to put in a formal consult with a social worker or addictions counsellor to have their assistance in providing SBIRT.

The inclusion criteria included patients ≥18 years of age, actively drinking alcohol as defined as any alcohol consumption within 1 month of admission, and had either a diagnosis of AAH, or a diagnosis of ARLC with concurrent hepatic decompensation defined as ascites, spontaneous bacterial peritonitis, hepatic hydrothorax, hepatic encephalopathy, or variceal bleed. The criteria from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) were used to corroborate the diagnosis of AAH, and imaging studies were reviewed to corroborate the diagnosis of ARLC.[21] We excluded admissions that were missing one of the inclusion criteria, as well as patients with positive serology for hepatitis B or C virus, and patients with compensated ARLC.

Variables

Data were collected using pre-formed standardized data collection sheets. Variables collected for baseline characteristics included age, gender, length of stay (LOS), same-admission mortality, clinical admitting service (general ward, gastroenterology ward, intensive care unit), and the Model for End-stage Liver Disease (MELD) score on admission. For AAH patients, we also collected the Maddrey discriminant function (MDF) and corticosteroid use during admission. Notes in patient charts, such as admission and discharge summaries, as well as notes from social workers and addictions counsellors, were reviewed to collect data on SBIRT. The index admission was defined as the first admission in the study period.

Primary outcomes were the proportion of admissions in which SBIRT was conducted, as well as the association between conducting SBIRT and 30-day and 90-day readmissions for recurrent AAH or DARLC. Only admissions in which patients did not die in hospital were included in the analysis of 30-day and 90-day readmissions. The 30-day and 90-day readmission events included readmissions where patients were either still actively drinking, or no longer actively drinking alcohol. G*Power version 3.1.9.7 was used to perform a power analysis.[22] To reach power = 0.80 and α = 0.05 for detecting a medium effect of SBIRT reducing 30-day or 90-day readmissions while assessing eight independent variables (age, male gender, admission to GI vs general ward, admission to ICU versus general ward, MELD, SBIRT conductance, MDF, and corticosteroid use), the minimum sample size needed was 109 admissions.

Secondary outcomes included the proportion of admissions in which SBIRT was offered and the type of treatment used if SBIRT was conducted. Types of SBIRT-related treatment included administration of resources such as brochures for community programs, referral to AUD community programs, re-establishment of follow-up with community programs if patients were previously connected, counselling about alcohol cessation, and pharmacotherapy prescription.

Statistics

Categorical variables were compared by Chi-squared test. Continuous variables were assessed for normality using the Shapiro-Wilk test, and if continuous variables deviated from the normal distribution, they were compared by Mann–Whitney *U* test. Multivariable logistic regression was used to determine the relationship between variables (such as age, gender, MELD and MDF on admission, corticosteroid use, clinical admitting service, and inpatient conductance of SBIRT), and outcomes (30-day and 90-day readmissions). *P* values <0.05 were considered statistically significant. Variables were tested for multicollinearity based on the variance inflation factor (VIF), with VIF > 10 indicating multicollinearity. All statistical analyses were performed with SPSS version 26.[23] The study was approved by the Hamilton Integrated Research Ethics Board.

Results

Patient characteristics

There were 120 admissions for AAH (representing 95 patients, 95 index admissions, 18 30-day readmissions, and 26 90-day readmissions) and 177 admissions for DARLC (representing 132 patients, 132 index admissions, 13 30-day readmissions, and 31 90-day readmissions) from January 2017 to December 2021 (Table 1). The sum of the index AAH admissions and 90-day readmissions was found to be greater than the total number of AAH admissions; this is because of the inclusion of readmissions where patients were no longer actively drinking alcohol.

The Shapiro-Wilk test found that the continuous variables of age, MELD, MDF, and LOS significantly deviated from the normal distribution.

The mean age for patients admitted with AAH (47.7 ± 13.6 years) was significantly younger than those admitted with DARLC (58.2 ± 9.5 years, $U = 5945.5$, $P < 0.001$). There were fewer admissions with male patients with AAH (71 male patients, 59.2%) than those admitted with DARLC (130 male patients, 73.4%, $P = 0.010$). There was no significant difference between AAH admissions and DARLC admissions for LOS, MELD on admission, same-admission mortality, and 30-day and 90-day readmissions (Table 1).

According to the NIAAA criteria, 55 (45.8%) of AAH admissions involved probable AAH, and 65 (54.2%) involved possible AAH. For AAH admissions, the mean MDF was 33.2 ± 36.7, and 32.5% of AAH admissions involved corticosteroid use.

Of all DARLC admissions, 77 (38.1%) involved ascites, 12 (5.9%) involved SBP, 3 (1.5%) involved hepatic hydrothorax,

Table 1. Baseline characteristics of admissions with alcohol-associated hepatitis and decompensated alcohol-related liver cirrhosis.

Characteristics	AAH	DARLC	*P* value	*U* Statistic
Number of admissions	120	177		
Number of patients (also the same as number of index admissions)	95	132		
Age (years, mean ± SD)	47.7 ± 13.6	58.2 ± 9.5	<0.001	5,945.5
Male gender (% admissions)	71 (59.2%)	130 (73.4%)	0.010	
MELD (mean ± SD)	19.1 ± 8.3	17.4 ± 7.3	0.079	9,344.5
MDF (mean ± SD)	33.2 ± 36.7	N/A		
Corticosteroid use in admission (%)	39 (32.5%)	N/A		
Length of stay (mean ± SD)	9.2 ± 12.4	13.7 ± 19.9	0.107	9,454
Admitted to general ward	87	90		
Admitted to gastroenterology service	19	51		
Admitted to intensive care unit	14	36		
Same-admission all-cause mortality (%)	15 (12.5%)	34 (19.2%)	0.126	
30-day readmission (%)	18 (15.0%)	13 (7.3%)	0.034	
90-day readmission (%)	26 (21.7%)	31 (17.5%)	0.373	

AAH = alcohol-associated hepatitis; DARLC = decompensated alcohol-related liver cirrhosis; MELD = Model for End-Stage Liver Disease; MDF = Maddrey discriminant function; SD = standard deviation.

Table 2. Proportion of admissions in which SBIRT was conducted during admission for alcohol-associated hepatitis or decompensated alcohol-related liver disease.

ALL admissions	AAH (*n* = 120)	DARLC (*n* = 177)	*P* value
SBIRT conducted by all HCP (% of all admissions)	62 (51.7%)	42 (23.7%)	<0.001
Conducted by SW and AD (% of those conducted)	48 (77.4%)	31 (73.8%)	<0.001
Conducted by physicians only (% of those conducted)	14 (22.6%)	11 (26.2%)	0.097
INDEX admissions	AH (*n* = 95)	DARLC (*n* = 132)	
SBIRT conducted by all HCP (% of all admissions)	51 (53.7%)	35 (26.5%)	<0.001
Conducted by SW and AD (% of those conducted)	39 (76.5%)	28 (80.0%)	0.001
Conducted by physicians only (% of those conducted)	19 (23.5%)	7 (20.0%)	0.049

AD = addictions counsellors; AAH = alcohol-associated hepatitis; DARLC = decompensated alcohol-related liver cirrhosis; HCP = healthcare providers; SBIRT = screening, brief intervention, and referral to treatment; SW = social workers.

68 (33.7%) involved hepatic encephalopathy, and 44 (21.8%) involved variceal bleeding.

Primary outcome: conducting SBIRT during AAH and DARLC admissions

SBIRT was conducted in 62 of 120 (51.7%) AAH admissions, primarily conducted by social workers and addictions counsellors (48/62 [77.4%]) and occasionally by physicians alone (14/62 [22.6%]). SBIRT was conducted in 42 of 177 (23.7%) DARLC admissions, primarily conducted by social workers and addictions counsellors (31/42 [73.8%]) and occasionally by physicians alone (11/42 [26.2%]) (Table 2). When grouping together all healthcare professionals, SBIRT was conducted more frequently in AAH admissions than DARLC admissions (62/120 [51.7%] of AAH admissions vs. 42/177 [23.7%] DARLC admissions, $P < 0.001$).

Primary outcome: readmissions

For AAH admissions, conducting SBIRT by any healthcare provider was associated with significantly decreased 30-day (OR 0.098, $P = 0.001$, 95% CI 0.024–0.408) and 90-day (OR 0.166, $P = 0.003$, 95% CI 0.052–0.534) readmissions for recurrent AAH or DARLC. For DARLC admissions, there was no significant association between conducting SBIRT by any healthcare professional and 30-day (OR 0.695, $P = 0.613$, 95% CI 0.169–2.850) or 90-day readmissions (OR 0.754, $P = 0.572$, 95% CI 0.283–2.010). Age, gender, clinical admitting service, and corticosteroid use were not associated with 30-day or 90-day readmissions (Table 3). No multicollinearity of independent variables was detected based on VIF in the logistic regression for either AAH or DARLC (Supplementary Table S1).

Similarly, offering SBIRT during admissions for AAH was also associated with significantly decreased 30-day (OR 0.239, $P = 0.022$, 95% CI 0.070–0.810) and 90-day (OR 0.241, $P = 0.014$, 95% CI 0.078–0.750) readmissions for recurrent AAH or DARLC. Offering SBIRT during admissions for DARLC did not affect 30-day or 90-day readmissions (Supplementary Table S2).

Secondary outcome: offering SBIRT during AAH and DARLC admissions

SBIRT was offered in 73 of 120 (60.8%) AAH admissions, primarily offered by social workers and addictions counsellors

Table 3. Multivariable logistic regression of variables, including the conducting of SBIRT by any healthcare provider, associated with 30-day or 90-day readmissions for recurrent alcohol-associated hepatitis or decompensated alcohol-related liver cirrhosis.

	AAH			DARLC		
	OR	95% CI	*P*	OR	95% CI	*P*
30-day readmissions						
Age	0.977	0.930–1.026	0.350	0.978	0.916–1.044	0.503
Male gender	1.848	0.538–6.347	0.330	0.927	0.262–3.278	0.906
Admit to GI vs. general ward	1.770	0.438–7.160	0.423	1.923	0.548–6.753	0.307
Admit to ICU vs. general ward	5.496	0.317–95.436	0.242	1.830	0.293–11.445	0.518
MELD	0.849	0.706–1.020	0.080	1.014	0.922–1.114	0.780
SBIRT conducted during admission by any HCP	0.098	0.024–0.408	0.001	0.695	0.169–2.850	0.613
MDF	1.032	0.997–1.068	0.073			
Corticosteroid use	2.309	0.596–8.944	0.226			
90-day readmissions						
Age	0.965	0.924–1.008	0.108	1.001	0.955–1.050	0.958
Male gender	1.473	0.517–4.195	0.469	0.516	0.220–1.207	0.127
Admit to GI vs. general ward	1.282	0.362–4.537	0.700	0.776	0.322–1.867	0.571
Admit to ICU vs. general ward	2.556	0.180–36.303	0.488	0.499	0.098–2.538	0.402
MELD	0.859	0.738–0.999	0.049	0.972	0.903–1.047	0.454
SBIRT conducted during admission by any HCP	0.166	0.052–0.534	0.003	0.754	0.283–2.010	0.572
MDF	1.032	1.001–1.064	0.045			
Corticosteroid use	2.674	0.787–9.083	0.115			

AAH = alcohol-associated hepatitis; CI = confidence interval; DARLC = decompensated alcohol-related liver cirrhosis; GI = gastroenterology; ICU = intensive care unit; HCP = healthcare providers; MELD = Model for End-Stage Liver Disease; MDF = Maddrey discriminant function; OR = odds ratio; SBIRT = screening, brief intervention and referral to treatment.

Table 4. Proportion of admissions in which SBIRT was offered during admission for alcohol-associated hepatitis or decompensated alcohol-related liver disease.

ALL admissions	AAH (*n* = 120)	DARLC (*n* = 177)	*P* value
SBIRT offered by all HCP (% of all admissions)	73 (60.8%)	55 (31.1%)	<0.001
Offered by SW and AD (% of those offered)	59 (80.8%)	44 (80.0%)	<0.001
Offered by physicians only (% of those offered)	14 (19.2%)	11 (20.0%)	0.097
INDEX admissions	AH (*n* = 95)	DARLC (*n* = 132)	
SBIRT offered by all HCP (% of all admissions)	60 (72.2%)	44 (33.3%)	<0.001
Offered by SW and AD (% of those offered)	48 (80.0%)	37 (84.1%)	<0.001
Offered by physicians only (% of those offered)	12 (20.0%)	7 (15.9%)	0.049

AD = addictions counsellors; AAH = alcohol-associated hepatitis; DARLC = decompensated alcohol-related liver cirrhosis; HCP = healthcare providers; SBIRT = screening, brief intervention and referral to treatment; SW = social workers.

(59/73 [80.8%]) and occasionally by physicians alone (14/73 [19.2%]). SBIRT was offered in 55 of 177 (31.1%) DARLC admissions, primarily offered by social workers and addictions counsellors (44/55 [80.0%]) and occasionally by physicians alone (11/55 [20.0%]) (Table 4). When grouping together all healthcare professionals, SBIRT was offered more frequently in AAH admissions than DARLC admissions (73/120 [60.8%] of AAH admissions vs. 55/177 [31.1%] DARLC admissions, $P < 0.001$).

Secondary outcome: type of SBIRT conducted during AAH and DARLC admissions

For all admissions in which SBIRT was implemented, patients were given information resources about AUD community programs in 23 (37.1%) AAH admissions and 20 (47.6%) DARLC admissions, patients were referred directly to community programs in 25 (40.3%) AAH admissions and 9 (21.4%) DARLC admissions, patients were counselled on alcohol cessation in 7 (11.3%) AAH admissions and 13 (31.0%) DARLC admissions, AUD pharmacotherapy was started in 2 (3.2%) AAH admissions and zero DARLC admissions, and patients who were already followed by community programs had follow-up re-established 5 (8.1%) AAH admissions and zero DARLC admissions (Table 5).

Reasons for SBIRT not being conducted in patients offered SBIRT included patients not believing that alcohol use is an issue, wanting to reduce alcohol intake on their own, being too acutely ill to adequately participate in SBIRT, and leaving

Table 5. Types of SBIRT conducted among patients receiving SBIRT.

Type of SBIRT conducted	AAH			DARLC		
	All HCP (*n* = 62)	SW and AD (*n* = 48)	Physicians only (*n* = 14)	All HCP (*n* = 42)	SW and AD (*n* = 31)	Physicians only (*n* = 11)
Given resources (%)	23 (37.1%)	21 (43.8%)	2 (14.3%)	20 (47.6%)	19 (61.3%)	1 (9.1%)
Referred to AUD community programs (%)	25 (40.3%)	20 (41.7%)	5 (35.7%)	9 (21.4%)	9 (29.0%)	0
Counselled about alcohol cessation (%)	7 (11.3%)	0	7 (50.0%)	13 (31.0%)	3 (9.7%)	10 (90.9%)
Prescribed AUD pharmacotherapy (%)	2 (3.2%)	2 (4.2%)	0	0	0	0
Re-established follow-up with AUD community programs (%)	5 (8.1%)	5 (10.4%)	0	0	0	0

AD = addictions counsellors; AAH = alcohol-associated hepatitis; AUD = alcohol use disorder; DARLC = decompensated alcohol-related liver cirrhosis; HCP = healthcare providers; SBIRT = screening, brief intervention and referral to treatment; SW = social workers.

against medical advice before SBIRT could be conducted (Supplementary Table S3).

Discussion

SBIRT was offered in only 60.8% of AAH admissions, and 31.1% of DARLC admissions. HHS does not have a formal process for involving allied health services for SBIRT; typically, the admitting service would consult social work or addictions specialist colleagues. This result reflected similar trends seen in the outpatient management of AUD in ALD patients.[24] In a recent survey of gastroenterology and hepatology providers within and outside the US, only 60% of respondents referred patients for behavioural therapy for AUD, and 71% of providers never prescribed pharmacotherapy for AUD, with the most common reason being low comfort with the medications.[25] Another retrospective review also found that only 64% of cirrhosis patients were offered outpatient AUD treatment.[26] Factors that impede the implementation of SBIRT include gaps in knowledge or comfort about aspects of managing AUD, such as pharmacotherapy, as well as insufficient healthcare resources and system limitations.[24,26,27] Most of the SBIRT in our study was started by social workers and addictions counsellors, which further highlights the importance of a multidisciplinary approach to AUD and ALD.[28]

It is unclear why SBIRT was offered more frequently in AAH admissions compared to DARLC admissions. Our data show that there was still a sizeable proportion of admissions in which AAH or DARLC patients with active alcohol use were not having SBIRT offered or conducted. Given the importance of managing AUD and ALD concurrently, it is reasonable to offer SBIRT to all actively drinking ALD patients on admission.

SBIRT was conducted in only 51.7% of AAH admissions, and 23.7% of DARLC admissions. The majority of SBIRT was conducted by social workers and addictions counsellors. It is important to note that compared to social workers and addictions counsellors, SBIRT provided by physicians was more likely to be counselling about alcohol cessation, which is less resource-intensive and time-intensive than the other forms of SBIRT, such as referring to AUD community programs. Similar results were found in the ADVISe cluster randomized controlled trial, were patients attending primary care clinics were randomized to receive SBIRT from physicians, SBIRT from non-physician providers (NPPs) and medical assistants (MAs), or usual care. Alcohol use screening occurred more frequently with NPPs and MAs, but physicians had higher brief intervention and referral rates.[29]

When grouping together the efforts of physicians, social workers, and addictions counsellors, either offering or conducting SBIRT for patients admitted with AAH was associated with reduced 30-day and 90-day readmissions for recurrent AAH or DARLC. This result was echoed in another retrospective and prospective analysis of patients admitted for AAH, which found that alcohol rehabilitation within 30 days of discharge was associated with reduced 30-day readmission, alcohol relapse, and death.[30]

In contrast to patients admitted for AAH, patients admitted with DARLC had no association between conducting SBIRT and 30-day or 90-day readmissions. The exact reason for this result was unknown. Attempts to reduce readmissions in patients with chronic disease such as decompensated cirrhosis may be limited, compared to more acute processes such as AAH. Identification of AUD during admissions may still have a place in ARLC management, as one study found that diagnosis of AUD at the time of discharge for cirrhosis was associated with decreased 30-day readmission rate.[31]

SBIRT has demonstrated benefits for patients with alcohol or substance use disorders. Various studies show that inpatient administration of SBIRT decreases readmissions or future emergency department visits.[32,33] SBIRT appears to have the greatest effect within the first three months of administration, with reduced heavy drinking days and at-risk alcohol use.[18–20] This protective effect is less consistent beyond three months, with no significant association between SBIRT and alcohol abstinence, use of addiction services, or reduced at-risk alcohol use.[18,34] SBIRT is also cost effective, with one study showing that $2547 USD per patient is saved with SBIRT administration.[35] To our knowledge, this is the first study that investigates the impact of SBIRT, specifically for AAH and DARLC patients. The cost-effectiveness and accessibility of SBIRT make it a valuable asset in reducing readmissions for AAH patients.

While our study looked at offering or starting SBIRT in the inpatient setting, multidisciplinary outpatient clinics for

patients with ALD and AUD have been established to better integrate the expertise of multiple healthcare providers such as physicians, social workers, nurses, addictions specialists, and psychiatrists.[28,36] Early studies have found that ALD patients followed by these multidisciplinary clinics had various improved outcomes, such as reduced ED visits and readmissions, and decreased rates of alcohol relapse post-transplantation for ALD.[37,38] The results of our study suggest that the effects of starting SBIRT during admissions for AAH only extend to 60 days. Establishing long-term regular follow-up at multidisciplinary outpatient clinics can maintain the momentum in managing alcohol use.

Our study has several limitations. Data were collected only at a single centre. We could not confirm the presence of concomitant metabolic-associated steatotic liver disease (MASLD) in these ALD patients as there are no tests that are specific only for MASLD. Although clinical decision support identified patient charts with ICD-10 codes of interest, it is possible that there were other admissions for ALD that did not have these ICD-10 codes and were not included in the study. None of the AAH cases were classified as definite AAH according to the NIAAA criteria, and 54.2% of these admissions were classified as possible AAH. The admissions for both AAH and DARLC had a higher proportion of male compared to female patients. The admissions for AAH had a higher proportion of younger and female patients, compared to admissions for DARLC. These factors limit the generalizability of the results. Information about socioeconomic status or ethnicity was rarely documented in the inpatient chart notes, and the relationship between these variables and readmissions for AAH or DARLC could not be studied. The amount of alcohol used, the type of AUD pharmacotherapy provided, and reasons why SBIRT was not offered could not be retrieved in the chart review. Aside from readmissions, there was no way to retrieve information about post-discharge follow-up, including attendance rates to outpatient addiction programs or medical clinics, adherence to or adverse reactions from pharmacotherapy, and post-discharge rates of alcohol abstinence. Readmissions recorded in other centres could not be captured as the study was only approved to review patient data from HHS.

The exact effects of the COVID-19 pandemic were not accounted for in this study. While pandemic-related social distancing guidelines would have limited the accessibility of AUD community programs or other such outpatient resources, inpatient access to SBIRT would likely be less affected by the pandemic.

Conclusion

SBIRT was conducted with actively drinking patients in only 51.7% of AAH admissions, and 23.7% of DARLC admissions. Conducting SBIRT during admissions for AAH was associated with reduced 30-day and 90-day readmissions for recurrent AAH or DARLC. Physicians, social workers, addiction counsellors, and other allied health providers should collaborate to conduct SBIRT for all actively drinking patients admitted for AAH or DARLC.

Supplementary data

Supplementary data are available at *Journal of the Canadian Association of Gastroenterology* online.

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Conflicts of Interest

Dennis Wang has no conflicts of interest to disclose. Marco Puglia acts as a consultant, clinical trial investigator, speaker, and member of the advisory board for AbbVie, Gilead, Intercept, and NovoNordisk; as a speaker and member of the advisory board for Eisai and Lupin; and as a clinical trial investigator for Madrigal. This manuscript has never been previously published.

Data availability

The data underlying this article cannot be shared publicly due to privacy reasons, as this deals with sensitive topics such as alcohol use. The data will be shared on reasonable request to the corresponding author.

References

1. Wong, Terrence, Katherine Dang, Sanah Ladhani, Ashwani K. Singal, Robert J. Wong. "Prevalence of Alcoholic Fatty Liver Disease Among Adults in the United States, 2001-2016." *JAMA* 321, no. 17 (2019): 1723–5. https://doi.org/10.1001/jama.2019.2276
2. Shah, Neil D., Meritxell Ventura-Cots, Juan G. Abraldes, Mohamed Alboraie, Ahmad Alfadhli, Josepmaria Argemi, Ester Badia-Aranda, et al. "Alcohol-Related Liver Disease Is Rarely Detected at Early Stages Compared With Liver Diseases of Other Etiologies Worldwide." *Clinical Gastroenterology and Hepatology* 17, no. 11 (2019): 2320–2329.e12. https://doi.org/10.1016/j.cgh.2019.01.026
3. Marlowe, Natalie, David Lam, William Krebs, WeiQi Lin, and Suthat Liangpunsakul. "Prevalence, Co-Morbidities, and in-hospital Mortality of Patients Hospitalized with Alcohol-Associated Hepatitis in the United States from 2015 to 2019." *Alcoholism Clinical and Experimental Research* 46, no. 8 (2022): 1472–81. https://doi.org/10.1111/acer.14896
4. Jinjuvadia, Raxitkumar, and Suthat Liangpunsakul; Translational Research and Evolving Alcoholic Hepatitis Treatment Consortium. "Trends in Alcoholic Hepatitis-related Hospitalizations, Financial Burden, and Mortality in the United States." *Journal of Clinical Gastroenterology* 49, no. 6 (2015): 506–11. https://doi.org/10.1097/MCG.0000000000000161
5. Sandahl, Thomas Damgaard, Peter Jepsen, Karen Louise Thomsen, and Hendrik Vilstrup. "Incidence and Mortality of Alcoholic Hepatitis in Denmark 1999-2008: A Nationwide Population Based Cohort Study." *Journal of Hepatology* 54, no. 4 (2011): 760–4. https://doi.org/10.1016/j.jhep.2010.07.016
6. Sahlman, Perttu, Markku Nissinen, Eero Pukkala, and Martti Färkkilä. "Incidence, Survival and Cause-Specific Mortality in Alcoholic Liver Disease: A Population-Based Cohort Study." *Scandinavian Journal of Gastroenterology* 51, no. 8 (2016): 961–6. https://doi.org/10.3109/00365521.2016.1157889
7. Axley, Page D., Crit Taylor Richardson, and Ashwani K. Singal. "Epidemiology of Alcohol Consumption and Societal Burden of Alcoholism and Alcoholic Liver Disease." *Clinics in Liver Disease* 23, no. 1 (2019): 39–50. https://doi.org/10.1016/j.cld.2018.09.011
8. Campollo, Octavio. "Alcohol and the Liver: The Return of the Prodigal Son." *Annals of Hepatology* 18, no. 1 (2019): 6–10. https://doi.org/10.5604/01.3001.0012.7854
9. Mellinger, Jessica L., Kerby Shedden, Gerald Scott Winder, Elliot Tapper, Megan Adams, Robert J. Fontana, Michael L. Volk, Frederic C. Blow, and Anna S.F. Lok. "The High Burden of Alcoholic Cirrhosis in Privately Insured Persons in the United States."

Hepatology 68, no. 3 (2018): 872–82. https://doi.org/10.1002/hep.29887
10. Adejumo, Adeyinka C., George Cholankeril, Umair Iqbal, Eric R. Yoo, Brian C. Boursiquot, Waldo C. Concepcion, Donghee Kim, and Aijaz Ahmed. "Readmission Rates and Associated Outcomes for Alcoholic Hepatitis: A Nationwide Cohort Study." *Digestive Diseases and Sciences* 65, no. 4 (2020): 990–1002. https://doi.org/10.1007/s10620-019-05759-4
11. Kichloo, Asim, Zain El-Amir, Dushyant Singh Dahiya, Farah Wani, Jagmeet Singh, Dhanshree Solanki, Ehizogie Edigin, Precious Eseaton, Asad Mehboob, and Hafeez Shaka. "Trends of Alcoholic Liver Cirrhosis Readmissions from 2010 to 2018: Rates and Healthcare Burden Associated with Readmissions." *World Journal of Hepatology.* 13, no. 12 (2021): 2128–36. https://doi.org/10.4254/wjh.v13.i12.2128
12. Dahiya, Dushyant Singh, Asim Kichloo, Jagmeet Singh, Gurdeep Singh, Farah Wani, and Hafeez Shaka. "Declining Inpatient Mortality Despite Increasing Thirty-Day Readmissions of Alcoholic Hepatitis in the United States From 2010 to 2018." *Gastroenterology Research* 14, no. 6 (2021): 334–9. https://doi.org/10.14740/gr1473
13. Lackner, Carolin, Walter Spindelboeck, Johannes Haybaeck, Philipp Douschan, Florian Rainer, Luigi Terracciano, Josef Haas, Andrea Berghold, Ramon Bataller, and Rudolf E. Stauber. "Histological Parameters and Alcohol Abstinence Determine Long-Term Prognosis in Patients with Alcoholic Liver Disease." *Journal of Hepatology* 66, no. 3 (2017): 610–8. https://doi.org/10.1016/j.jhep.2016.11.011
14. Rogal, Shari, Ada Youk, Hongwei Zhang, Walid F. Gellad, Michael J. Fine, Chester B. Good, Maggie Chartier, et al. "Impact of Alcohol Use Disorder Treatment on Clinical Outcomes Among Patients With Cirrhosis." *Hepatology* 71, no. 6 (2020): 2080–92. https://doi.org/10.1002/hep.31042
15. Crabb, David W., Gene Y. Im, Gyongyi Szabo, Jessica L. Mellinger, and Michael R. Lucey. "Diagnosis and Treatment of Alcohol-Associated Liver Diseases: 2019 Practice Guidance From the American Association for the Study of Liver Diseases." *Hepatology* 71, no. 1 (2020): 306–33. https://doi.org/10.1002/hep.30866
16. Thursz, Mark, Antoni Gual, Caroline Lackner, Philippe Mathurin, Christophe Moreno, Laurent Spahr, and Martina Sterneck. "EASL Clinical Practice Guidelines: Management of Alcohol-Related Liver Disease." *Journal of Hepatology* 69, no. 1 (2018): 154–81. https://doi.org/10.1016/j.jhep.2018.03.018
17. Carvalho, Andre F., Markus Heilig, Augusto Perez, Charlotte Probst, and Jürgen Rehm. "Alcohol use disorders." *Lancet* 394, no. 10200 (2019): 781–92. https://doi.org/10.1016/S0140-6736(19)31775-1
18. Karno, Mitchell P., Richard Rawson, Benjamin Rogers, Suzanne Spear, Christine Grella, Larissa J. Mooney, Richard Saitz, Bruce Kagan, and Suzette Glasner. "Effect of Screening, Brief Intervention and Referral to Treatment for Unhealthy Alcohol and other Drug Use in Mental Health Treatment Settings: A Randomized Controlled Trial." *Addiction* 116, no. 1 (Jan 2021): 159–69. https://doi.org/10.1111/add.15114
19. Zhai, Jing, Wenzheng Wang, Lei Zhang, Rao Fu, Qingzhi Zeng, Leping Huang, Min Zhao, and Jiang Du. "The Effect of SBIRT on Harmful Alcohol Consumption in the Community Health Centers of Shanghai, China: A Randomized Controlled Study." *Alcohol and Alcoholism* 57, no. 6 (Nov 2022): 742–8. https://doi.org/10.1093/alcalc/agac030
20. Bruguera, Pol, Pablo Barrio, Clara Oliveras, Fleur Braddick, Carolina Gavotti, Carla Bruguera, Hugo López-Pelayo, et al. "Effectiveness of a Specialized Brief Intervention for At-risk Drinkers in an Emergency Department: Short-term Results of a Randomized Controlled Trial." *Academic Emergency Medicine* 25, no. 5 (2018): 517–25. https://doi.org/10.1111/acem.13384
21. Crabb, David W., Ramon Bataller, Naga P. Chalasani, Patrick S. Kamath, Michael Lucey, Philippe Mathurin, Craig McClain, et al.; NIAAA Alcoholic Hepatitis Consortia. "Standard Definitions and Common Data Elements for Clinical Trials in Patients With Alcoholic Hepatitis: Recommendation From the NIAAA Alcoholic Hepatitis Consortia." *Gastroenterology* 150, no. 4 (2016): 785–90. https://doi.org/10.1053/j.gastro.2016.02.042
22. Faul, Franz, Edgar Erdfelder, Axel Buchner, and Albert-Georg Lang. "Statistical Power Analyses Using G*Power 31: Tests for Correlation and Regression Analyses." *Behavior Research Methods* 41, no. 4 (2009): 1149–60. https://doi.org/10.3758/BRM.41.4.1149
23. *IBM SPSS Statistics for Windows*. Armonk, NY: IBM Corp; 2022.
24. Johnson, Emily, Sumantra Monty Ghosh, Vijay John Daniels, T. Cameron Wild, Puneeta Tandon, and Ashley Hyde. "Clinicians' Perspectives and Perceived Barriers to Caring for Patients with Alcohol Use Disorder and Cirrhosis." *Addiction Science and Clinical Practice.* 17, no. 1 (2022): 9. https://doi.org/10.1186/s13722-022-00292-8
25. Im, Gene Y., Jessica L. Mellinger, Adam Winters, Elizabeth S. Aby, Zurabi Lominadze, John Rice, and Michael R. Lucey, et al. "Provider Attitudes and Practices for Alcohol Screening, Treatment, and Education in Patients With Liver Disease: A Survey From the American Association for the Study of Liver Diseases Alcohol-Associated Liver Disease Special Interest Group." *Clinical Gastroenterology and Hepatology* 19, no. 11 (2021): 2407–2416.e8. https://doi.org/10.1016/j.cgh.2020.10.026
26. Chaudhari, Rahul B., Nikki Duong, Shreesh Shrestha, Bryan Badal, Neerav Dharia, Gonzaga Ernesto Robalino, Patrick Spoutz, et al. "Patient- and Provider-Level Factors that Underlie Alcohol Use Disorder Treatment Offer and Acceptance in Veterans with Cirrhosis." *Alcoholism Clinical and Experimental Research* 46, no. 5 (2022): 809–14. https://doi.org/10.1111/acer.14809
27. Cotter, Thomas G., Fares Ayoub, Andrea C. King, Kapuluru Gautham Reddy, and Michael Charlton. "Practice Habits, Knowledge, and Attitudes of Hepatologists to Alcohol Use Disorder Medication: Sobering Gaps and Opportunities." *Transplant Direct* 6, no. 10 (2020): e603. https://doi.org/10.1097/TXD.0000000000001054
28. DiMartini, Andrea F., and Ashwani K. Singal. "Barriers to the Management of Alcohol Use Disorder and Alcohol-Associated Liver Disease: Strategies to Implement Integrated Care Models." *Lancet Gastroenterology and Hepatology* 7, no. 2 (2022): 186–95. https://doi.org/10.1016/S2468-1253(21)00191-6
29. Mertens, Jennifer R., Felicia W. Chi, Constance M. Weisner, Derek D. Satre, Thekla B. Ross, Steve Allen, David Pating, Cynthia I. Campbell, Yun Wendy Lu, and Stacy A. Sterling. "Physician Versus Non-Physician Delivery of Alcohol Screening, Brief Intervention and Referral to Treatment in Adult Primary Care: The ADVISe Cluster Randomized Controlled Implementation Trial." *Addiction Science and Clinical Practice.* 10, no. 1 (2015): 26. https://doi.org/10.1186/s13722-015-0047-0
30. Peeraphatdit, Thoetchai Bee, Patrick S. Kamath, Victor M. Karpyak, Brian Davis, Vivek Desai, Suthat Liangpunsakul, Arun Sanyal, Naga Chalasani, Vijay H. Shah, and Douglas A. Simonetto. "Alcohol Rehabilitation Within 30 Days of Hospital Discharge Is Associated With Reduced Readmission, Relapse, and Death in Patients With Alcoholic Hepatitis." *Clinical Gastroenterology and Hepatology* 18, no. 2 (2020): 477–485.e5. https://doi.org/10.1016/j.cgh.2019.04.048
31. Singal, Ashwani K., Andrea DiMartini, Lorenzo Leggio, Juan P. Arab, Yong-Fang Kuo, and Vijay H. Shah. "Identifying Alcohol Use Disorder in Patients With Cirrhosis Reduces 30-Days Readmission Rate." *Alcohol and Alcoholism* 57, no. 5 (2022): 576–80. https://doi.org/10.1093/alcalc/agac015
32. Cooper, Lise, Brooke Donald, Kathryn Osborne, Mark Roffman, Stephanie Chiu, Mildred Ortu Kowalski, Thomas Zaubler. "The Effect of Inpatient Addiction Screening and Intervention on Readmissions." *Applied Nursing Research* 65 (2022): 151573. https://doi.org/10.1016/j.apnr.2022.151573
33. Barata, Isabel A., Jamie R. Shandro, Margaret Montgomery, Robin Polansky, Carolyn J. Sachs, Herbert C. Duber, Lindsay M. Weaver, et al. "Effectiveness of SBIRT for Alcohol Use Disorders in the Emergency Department: A Systematic Review." *The Western*

Journal of Emergency Medicine 18, no. 6 (2017): 1143–52. https://doi.org/10.5811/westjem.2017.7.34373

34. Bruguera, Pol, Pablo Barrio, Jakob Manthey, Clara Oliveras, Hugo López-Pelayo, Laura Nuño, Laia Miquel, et al. "Mid and Long-Term Effects of a SBIRT Program for at-risk Drinkers Attending to an Emergency Department Follow-up Results from a Randomized Controlled Trial." *European Journal of Emergency Medicine* 28, no. 5 (2021): 373–9. https://doi.org/10.1097/MEJ.0000000000000810
35. McCall, Marcia H., Kelly L. Wester, Jeremy W. Bray, Amresh D. Hanchate, Laura J. Veach, Benjamin D. Smart, and Carrie Wachter Morris. "SBIRT Administered by Mental Health Counselors for Hospitalized Adults with Substance Misuse or Disordered Use: Evaluating Hospital Utilization and Costs." *Journal of Substance Abuse Treatment* 132 (2022): 108510. https://doi.org/10.1016/j.jsat.2021.108510
36. Winder, Gerald Scott, Anne C. Fernandez, Kristin Klevering, and Jessica L. Mellinger. "Confronting the Crisis of Comorbid Alcohol Use Disorder and Alcohol-Related Liver Disease With a Novel Multidisciplinary Clinic." *Psychosomatics* 61, no. 3 (2020): 238–53. https://doi.org/10.1016/j.psym.2019.12.004
37. Mellinger, Jessica L., Gerald Scott Winder, Anne C. Fernandez, Kristin Klevering, Amanda Johnson, Haila Asefah, Mary Figueroa, Jack Buchanan, Fred Blow, and Anna S.F. Lok. "Feasibility and early experience of a novel multidisciplinary alcohol-associated liver disease clinic." *Journal of Substance Abuse Treatment* 130 (2021): 108396. https://doi.org/10.1016/j.jsat.2021.108396
38. Carrique, Lauren, Jill Quance, Adrienne Tan, Susan Abbey, Isabel Sales, Les Lilly, Mamatha Bhat, et al. "Results of Early Transplantation for Alcohol-Related Cirrhosis: Integrated Addiction Treatment With Low Rate of Relapse." *Gastroenterology* 161, no. 6 (2021): 1896–1906.e2. https://doi.org/10.1053/j.gastro.2021.08.004