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ORIGINAL ARTICLE

Chronic hepatitis B care in regional Australia: implications for clinical practice and public health policy

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Key words
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Abstract

Background: Australia is struggling to meet its National Hepatitis B Strategy care targets, particularly in nonmetropolitan settings. It is vital to engage priority populations and improve their access to recommended care to reach these targets.

Aims: This retrospective study examined people living with chronic hepatitis B (CHB) in regional North Queensland, Australia, and determined whether their care adhered to current national CHB management guidelines. The analysis aimed to identify gaps in care that might be addressed to improve future outcomes.

Methods: All individuals referred to the gastroenterology clinic at the Townsville University Hospital in regional North Queensland, Australia, for CHB care between January 2015 and December 2020 were identified. Their linkage to care, engagement in care and receipt of guideline-recommended CHB care were determined.

Results: Of 255 individuals, 245 (96%) were linked to care; 108 (42%) remained engaged in care and 86 (38%) were receiving guideline-recommended care in 2021. There were 91/255 (36%) who identified as Indigenous Australians. Indigenous status was the only independent predictor of not being linked to care (odds ratio (OR): 0.13 (95% confidence interval (CI): 0.03–0.60), $P = 0.01$), not being engaged in care (OR: 0.19 (95% CI: 0.10–0.36), $P < 0.0001$), not receiving guideline-recommended CHB care (OR: 0.16 (95% CI: 0.08–0.31), $P < 0.0001$) or not being engaged in a hepatocellular carcinoma surveillance programme (OR: 0.08 (95% CI: 0.02–0.27), $P < 0.0001$).

Conclusion: Current approaches are failing to deliver optimal CHB care to Indigenous Australians in regional North Queensland. Targeted strategies to ensure that Indigenous Australians in the region receive equitable care are urgently needed.

Introduction

Hepatitis B virus (HBV) infection kills 820 000 people annually worldwide.[1] Although childhood vaccination has resulted in a significant decline in the incidence of new HBV infections in Australia, HBV remains the country's most common blood-borne virus, with an estimated 200 385 Australians living with chronic hepatitis B (CHB) in 2021.[2] Australia is recognised as one of the world leaders in treating blood-borne viruses, but it is presently struggling to deliver optimal care to Australians living with CHB.[3]

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The Australian National Hepatitis B Strategy has defined treatment and care targets which include ensuring that at least 80% of individuals living with CHB are diagnosed, at least 50% are engaged in care and at least 20% are receiving antiviral treatment.[4] However, Australia is currently not on track to reach these targets.[2–4] It is estimated that 72.5% of affected individuals have been diagnosed, but, in 2021, only 26% were engaged in care. Meanwhile, it is estimated that although up to 30% require treatment, in 2021, only 12.7% were receiving it.[2] An unforeseen outcome of the global COVID-19 pandemic was a decline in the proportion of Australian patients with CHB engaged in care, particularly in regional parts of the country.[2]

The National Strategy also emphasises meaningful engagement with priority populations to ensure

equitable access to care.[4] This includes populations in regional and remote areas where there is frequently reduced access to health services.[4] Aboriginal and Torres Strait Islander Australians (hereafter respectfully referred to as Indigenous Australians) are an important priority population as the prevalence of CHB among Indigenous Australians is almost twice the rate in the general population.[2] This partly explains the four to six times greater incidence of hepatocellular carcinoma (HCC) among Indigenous Australians.[5] Liver disease is the third most common condition, explaining the ongoing mortality gap between Indigenous and non-Indigenous Australians.[6] Migration from high-prevalence countries has also changed the epidemiology of CHB in Australia.[7] It is estimated that 70% of people living with CHB in Australia are born overseas.[2] Although the CHB prevalence in the Australian-born population is 0.33%, the prevalence in overseas-born Australians is much higher at 1.9%.[2]

However, delivering comprehensive, longitudinal, culturally appropriate care to a geographically dispersed patient population who may have very different backgrounds is challenging.[8] The current centralised model of CHB care is unlikely to serve this diverse population equitably, particularly in regional and remote locations where access to relevant health and community services is often limited.[9,10]

This study was performed to create a snapshot of CHB care in regional North Queensland. It was hoped that this might both identify the successes of the current service and the challenges that remain to be addressed. It was anticipated that these data might be used to inform optimal and equitable care for people living with CHB in the region.

Methods

Study population

This retrospective audit was performed at the Townsville University Hospital (TUH), a teaching hospital and the only tertiary referral centre in outer regional North Queensland. It serves a population of 258 300 dispersed across an area of 80 000 km^2 that includes the city of Townsville and surrounds, and remote North and Western Queensland (Fig. S1).[11] The 2021 Australian Bureau of Statistics census estimates that 9% of this population identify as Indigenous Australians, compared to 3.6% of the Australian general population.[12] Overseas-born residents comprise 20% of the local population. Individuals with CHB (positive hepatitis B surface antigen (HbsAg) on two occasions, at least 6 months apart) who had been referred to the TUH gastroenterology liver clinic between January 2015 and December 2020 were eligible for inclusion in the study.

Study variables

Demographic, laboratory, clinical and radiological data were collected from patient medical records. Patients were identified as 'linked to care' if they were reviewed in clinic between January 2015 and December 2020. The patients were defined as 'engaged in care' if they were reviewed in the clinic in the 2021 calendar year. Patients eligible for antiviral therapy included those with cirrhosis or those in the immune clearance or immune escape phases with a raised alanine aminotransferase (ALT) (serum ALT >30 IU/L if male and >19 IU/L if female) as per current Australian consensus guidelines.[13] Cirrhosis was determined using clinical, biochemical (aspartate aminotransferase to platelet ratio index (APRI) score was >2), and imaging modalities (including cirrhosis on imaging or transient elastography using FibroScan with readings >12.5 kPa). Australian consensus guidelines were used to define patients who were recommended to be receiving HCC surveillance.[13] Patients receiving 'guideline-recommended care' were those who remained engaged in care with annual HBV DNA testing, who were prescribed antiviral therapy if eligible (or a shared decision-making decision not to treat) and who were participating in an HCC surveillance programme (biannual liver ultrasound and serum alpha foetoprotein measurement) if this was indicated.

Additional risk factors for liver disease were specifically sought, including risk factors for metabolic dysfunction–associated fatty liver disease (MAFLD), past or present hazardous alcohol use (defined by current national guidelines as a regular consumption of >10 units of alcohol per week or regular binges of >4 units per day[14]), and a history of coinfection with hepatitis C virus (HCV). The recorded clinical outcomes included a diagnosis of cirrhosis, a diagnosis of HCC and CHB-attributable death (decompensated cirrhosis or HCC).

All individuals receiving care in Queensland's public health system are asked whether they identify as an Aboriginal Australian, a Torres Strait Islander Australian, both or neither; this was recorded. A remote residential address was defined using the Australian Bureau of Statistics definitions.[15]

Statistical analysis

Data were entered into an electronic database (Microsoft Excel) and analysed using statistical software (Stata version 14.2, StataCorp LLC). Demographic data were aggregated and presented using the median and interquartile range (IQR) as several variables had a nonparametric distribution. Groups were compared using chi-square and Fisher exact tests, where appropriate. Logistic

regression was used to determine whether linkage to care, engagement in care and guideline-recommended care were related to predefined characteristics of the cohort (sex, age older than 40 years, Indigenous status, overseas-born, requirment for an interpreter and prisoners). Independent associations were determined using multivariable analysis. Variables were selected for the multivariable model if they were significant in univariate analysis ($P < 0.05$).

Ethical statement

The Townsville University Hospital's Human Research Ethics Committee provided ethical approval for the study (reference: 16/QTHS/234). As the data were retrospective and deidentified, the committee waived the requirement for informed consent.

Results

Demographics

There were 255 patients included in the analysis, their median age was 45 years (IQR, 38–58 years) and 91 of 255 (36%) identified as Indigenous Australians. There were 27 of 255 (11%) individuals with cirrhosis and 19 of 255 (7%) who required an interpreter. Other patient demographics are presented in Table 1.

The largest proportion of referrals originated from a general practitioner (119 of 255, 47%) or other departments within the TUH (56 of 255, 22%), although there was a significant number (45 of 255 (18%)) from the Townsville Correctional Facility. Indigenous Australians were overrepresented in the prisoner population: 38 of /47 (81%) prisoners were Indigenous Australians versus nine of 47 (19%) who were not ($P < 0.0001$) (Table 2). A minority of patients in the cohort resided in a remote region (six of 255, 2.4%).

Cascade of care

Of the 255 referred patients, 245 (96%) were linked to care. Every cirrhotic patient and every patient requiring an interpreter was linked to care. Excluding 29 patients who subsequently died or were discharged to the care of their general practitioner, 108 of 226 (48%) remained engaged in care in the TUH gastroenterology clinic in 2021. Of these 226, 99 (44%) were receiving guideline-recommended care; 36 of 51 (71%) meeting national criteria for antiviral therapy were receiving this therapy with four of 51 (8%) not receiving therapy but under close observation (Fig. 1). Almost half (60 of 121 (50%))

Table 1 Characteristics of the patients and their association with the delivery of care during the 2021 calendar year

Subgroups	Referred to liver clinic	Initially linked to care	Engaged in care in 2021†	Received guideline-recommended care in 2021†‡	Prescribed antiviral therapy if eligible in 2021†	Undergoing HCC surveillance if eligible in 2021†
Entire cohort	255	245 (96%)	108/226 (48%)	99/226 (44%)	36/51 (71%)	60/121 (50%)
Male	130	125 (96%)	51/114 (45%)	46/114 (40%)	19/28 (68%)	31/67 (46%)
Female	125	120 (96%)	57/112 (51%)	53/112 (47%)	17/23 (74%)	29/54 (54%)
Indigenous	91	83 (91%)	18/78 (23%)	14/78 (18%)	2/9 (22%)	3/28 (11%)
Non-Indigenous	164	162 (99%)	90/148 (61%)	85/148 (57%)	34/42 (81%)	57/93 (61%)
Overseas born	143	141 (99%)	83/132 (64%)	78/132 (59%)	31/36 (86%)	51/81 (61%)
Born in Australia	112	104 (93%)	25/94 (27%)	21/94 (22%)	5/15 (33%)	9/40 (24%)
Interpreter required	19	19 (100%)	14/18 (78%)	14/18 (78%)	7/8 (88%)	9/13 (69%)
No interpreter required	236	226 (96%)	94/208 (45%)	85/208 (41%)	29/43 (67%)	51/108 (47%)
Referred from correctional facility	47	46 (98%)	12/40 (30%)	9/40 (23%)	1/6 (17%)	0/6 (0%)
Not referred from correctional facility	208	199 (96%)	96/186 (52%)	90/186 (48%)	35/45 (78%)	60/115 (52%)
Age >40 years	175	170 (97%)	79/151 (52%)	74/151 (49%)	30/36 (83%)	56/109 (51%)
Age <40 years	80	75 (94%)	29/75 (39%)	25/75 (33%)	6/15 (40%)	4/12 (33%)
Cirrhotic	27	27 (100%)	9/16 (56%)	9/16 (56%)	8/13 (62%)	9/16 (56%)
Non-cirrhotic	228	218 (96%)	99/210 (47%)	90/210 (43%)	28/38 (74%)	51/105 (49%)

†Excludes 16 patients who died and 13 discharged from the clinic prior to 2021.

‡Guideline-recommended care includes the following: annual hepatitis B virus DNA testing, antiviral therapy if eligible (or a shared decision not to treat) and participation in hepatocellular carcinoma (HCC) surveillance (biannual liver ultrasound and α-fetoprotein), if recommended in Australian Consensus Guidelines.[13]

All numbers are the absolute number (percentage of the total number in the subgroup).

Table 2 Comparison of the demographics and clinical findings of the Indigenous and non-Indigenous patients in the cohort

	Indigenous Australians, $n = 91$	Non-Indigenous individuals, $n = 164$	*P* value
Median age (years)	43 (36–56)	47 (38–58)	0.03
Male sex	52 (58%)	76 (46%)	0.07
Remote residence	15 (17%)	6 (4%)	0.001
Referred from a correctional facility	38 (42%)	9 (5%)	<0.0001
Hazardous alcohol use	24 (27%)	16 (10%)	<0.0001
Hepatitis C coinfection	4 (4%)	10 (6%)	0.78
MAFLD	13 (14%)	21 (13%)	0.71
Additional risk factor for cirrhosis	37 (41%)	38 (23%)	0.003
Cirrhosis diagnosis	9 (10%)	18 (11%)	0.84
Hepatocellular carcinoma diagnosis	2 (2%)	8 (5%)	0.50

MAFLD, metabolic dysfunction–associated fatty liver disease.

of those meeting national criteria for HCC surveillance, participated in HCC surveillance during 2021.

In univariate analysis, Indigenous patients were less likely – and overseas-born patients more likely – to be linked to care, to be engaged in care, to participate in HCC surveillance and to receive guideline-recommended care in 2021 (Table 1). In multivariate analysis, only Indigenous status was independently associated with linkage to care (odds ratio (OR), 0.13 (95% confidence interval (CI), 0.03–0.62), $P = 0.01$), engagement in care (OR, 0.19 (95% CI, 0.10–0.36), $P < 0.0001$), engagement in HCC surveillance (OR, 0.08 (95% CI, 0.02–0.27), $P < 0.0001$) and the receipt of guideline-recommended care (OR, 0.16 (95% CI, 0.08–0.31), $P < 0.0001$).

Comorbidities and CHB-related complications

Additional risk factors for liver disease were present in 75 of 255 (29%). This proportion rose to 15 of 27 (56%) among individuals with cirrhosis and five of eight (63%) of those with liver-related death (Table 3). An additional risk factor for liver disease was more common in Indigenous than non-Indigenous individuals (37 of 91 (41%) vs 38 of 164 (23%), $P = 0.003$).

Hepatocellular carcinoma

The median age of the 10 individuals with an HCC diagnosis was 59 years (IQR, 49–70 years); all 10 of these individuals were cirrhotic and seven of 10 (70%) had additional risk factors for liver disease. Of the 10 HCCs, two (20%) occurred in Indigenous patients and seven (70%) were overseas-born (Table 4). The calculated HCC incidence in the cohort was 3.5 per 1000 patient-years of follow-up.

Both Indigenous patients (aged 38 and 49 years respectively) with HCC had compensated cirrhosis and had concomitant hazardous alcohol use. Both had been lost to follow-up before the HCC diagnosis, and neither had been prescribed antiviral therapy or had regular HCC surveillance before the HCC diagnosis.

Among 10 patients with HCC diagnoses, seven (70%) died; their median survival after diagnosis was 5 months (IQR, 2–10 months). All three survivors had been prescribed antiviral therapy and were enrolled in HCC surveillance before HCC diagnosis. In comparison, of those who died, only one of seven (14%) had been prescribed antiviral therapy, and only two of seven (28%) were enrolled in HCC surveillance before diagnosis.

Discussion

This real-world study in regional Australia demonstrates that, of the factors examined, the only independent predictor of not being linked to care, of not being engaged in care and of not receiving recommended care is an individual's Indigenous status. These findings highlight the significant challenges in achieving Australia's National Hepatitis B strategy goals for Indigenous Australians and the National Agreement to Close the Gap in Indigenous healthcare.[4,16] As the median age of Indigenous Australians in the cohort was only 43 years – and more than a third had significant hepatic comorbidity – it might be expected that their liver-related morbidity and mortality will only continue to rise.

More than 40% of the Indigenous Australians in the cohort were currently serving custodial sentences; this speaks to a national incarceration rate among Indigenous Australians that is 10 times higher than the general population and highlights the ongoing socioeconomic disadvantage that many Indigenous Australians continue to experience. It also suggests that – at least in this region – Indigenous Australians living with CHB in the general community are currently not accessing tertiary services. Specific strategies to improve the delivery of

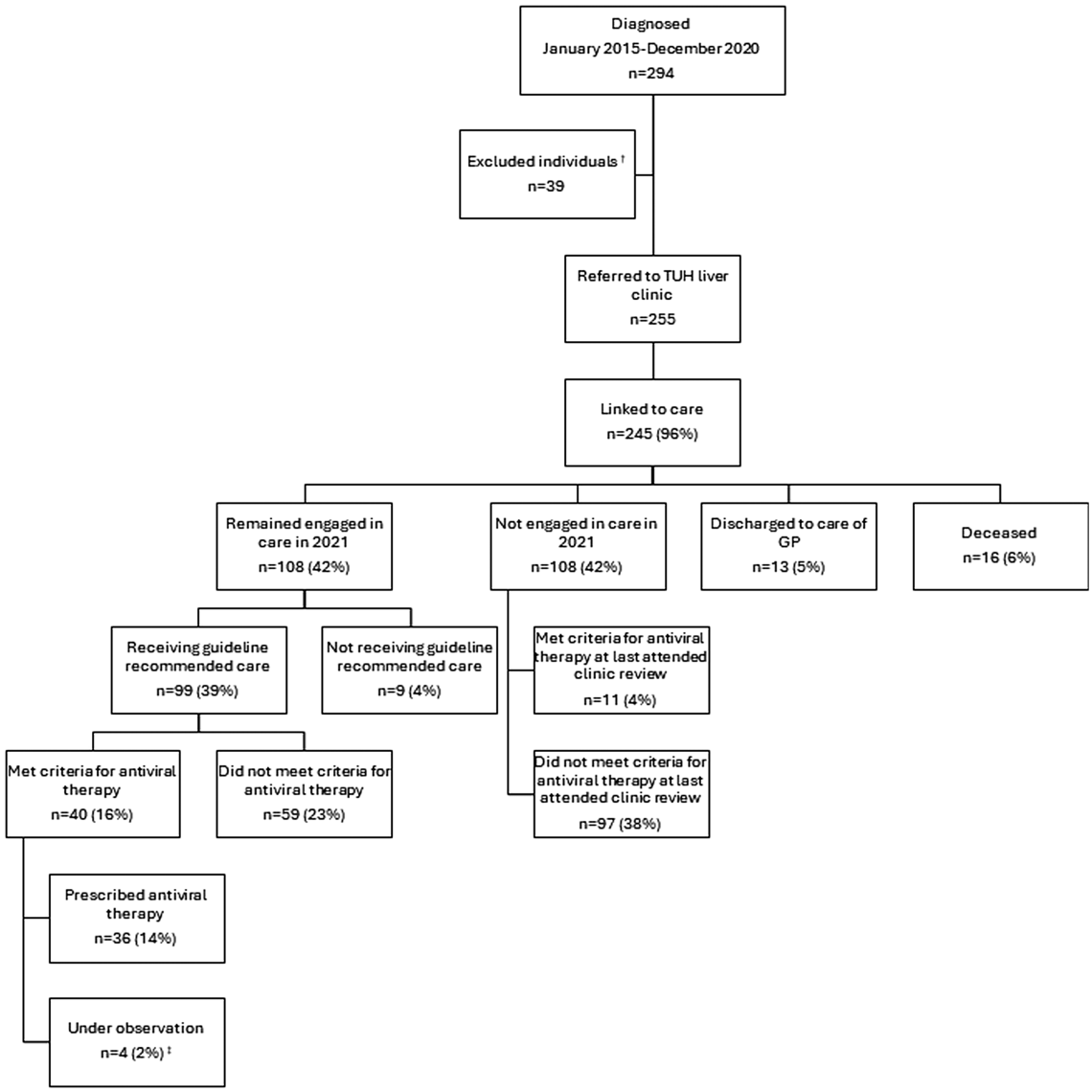

Figure 1 Flow diagram showing the cascade of care of individuals living with chronic hepatitis B referred to the Townsville University Hospital (TUH) gastroenterology service between January 2015 and December 2020. (%) refers to a proportion of all patients referred to the TUH gastroenterology clinic. †Excluded patients who did not have a corresponding identifiable electronic medical record at the TUH. ‡These patients who met the criteria for therapy remained under observation without therapy in shared decision-making with the treating gastroenterologist.

CHB care to the local Indigenous population are essential if we are to provide equitable access to high-quality care in Australia's universal health system.

Our findings are consistent with previous studies that identified barriers to delivering optimal CHB care in Indigenous populations.[3,17] A qualitative study using semistructured interviews at a remote Indigenous community in the Northern Territory explored the community's hepatitis B–related knowledge, perceptions and experiences.[18] The study identified limited biomedical understanding, different world views and even some fatalistic views regarding CHB infection, which negatively influenced healthcare-seeking behaviour. A similar study identified that some Indigenous patients believed that healthcare workers deliberately withhold information, which contributed to a lack of trust in the health system and feelings of disempowerment.[7] Many individuals reported a desire for increased knowledge and insights explained in their first Aboriginal Australian language, not in English. Communication using lay terminology translated to the patient's first language, visual aids and electronic formats have been implemented

Table 3 Proportion of patients who developed CHB-attributable morbidity and mortality with an identified additional risk factor for liver disease

	Number (%)	≥1 additional risk factor for liver disease	Hazardous alcohol consumption	Chronic hepatitis C infection	MAFLD	Other liver disease
Entire cohort	255 (100%)	75 (29%)	40 (16%)	14 (5%)	34 (13%)	2 (1%)†
Cirrhosis diagnosis	27/255 (11%)	15 (56%)	12 (44%)	8 (30%)	2 (7%)	0
Decompensated cirrhosis	11/255 (4%)	7 (64%)	7 (64%)	2 (18%)	1 (10%)	0
HCC diagnosis	10/255 (4%)	7 (70%)	6 (60%)	2 (20%)	2 (20%)	0
CHB-attributable death	8/255 (3%)	5 (63%)	4 (50%)	2 (25%)	1 (13%)	0

†There were two patients with additional liver diseases: one with haemochromatosis and one with hepatitis D infection.
CHB, chronic hepatitis B; HCC, hepatocellular carcinoma; MAFLD, metabolic dysfunction–associated fatty liver disease.

Table 4 Characteristics of the patients diagnosed with HCC during the study period

Case	Age	Sex	Indigenous	Overseas born	Additional risk factor for liver disease	Cirrhotic	Enrolled into HCC surveillance programme	HBV antiviral treatment prior to HCC diagnosis	HCC treatment offered	Outcome following diagnosis
1	38	Male	Yes	No	Alcohol	Yes	No	N/A	Palliative	Died 24 months later
2	49	Female	Yes	No	Alcohol	Yes	No	No	Palliative	Died 2 months later
3	47	Male	No	Yes	Alcohol	Yes	No	No	Palliative	Died 2 months later
4	48	Female	No	Yes	No	Yes	No	No	Palliative	Died 2 months later
7	58	Male	No	Yes	No	Yes	Yes	Yes	Surgical resection	Died 10 months later
5	59	Male	No	Yes	Alcohol, HCV	Yes	No	No	Locoregional therapy	Died 3 months later
8	64	Male	No	No	Alcohol, HCV	Yes	Yes	Yes	Locoregional therapy	Survived
6	69	Female	No	Yes	Alcohol, MAFLD	Yes	Yes	N/A	Palliative	Died 3 months later
9	74	Male	No	Yes	No	Yes	Yes	Yes	Surgical resection	Survived
10	77	Male	No	Yes	MAFLD	Yes	Yes	Yes	Locoregional therapy	Survived

HCC, hepatocellular carcinoma; HCV, hepatitis C virus; MAFLD, metabolic dysfunction–associated fatty liver disease; N/A, not available.

successfully in the Northern Territory but not yet in Queensland.[18,19]

In our analysis, high rates of continued engagement among overseas-born patients who were reviewed with interpreters highlight the importance of communicating with patients using their first language. In contrast to the experience of Indigenous Australians, the proportion of overseas-born individuals engaged in care was 64%, above the target of 50% proposed in The Australian National Hepatitis B Strategy. In patients requiring an interpreter, this figure rose to almost 80%. This is encouraging as it demonstrates the potential to overcome known barriers to care – including health literacy, language, and fear about accessing healthcare – among priority populations.

The involvement of an Indigenous Health Worker might also be expected to have utility. Indigenous Health Workers are Indigenous health professionals who work as a key component of the treating team to enhance patient engagement and deliver culturally safe care. By applying Indigenous ways of knowing, being and doing, their focus is the person rather than the disease.[20] Their front-line role is crucial to adapting conventional biomedically driven practices and is essential to address a lack of cultural or self-awareness that may be present among some non-Indigenous health professionals. Indigenous Health Workers are presently not routinely involved during clinic reviews with Indigenous patients with CHB at present at the TUH. However, their future contributions may be valuable, and our data provide a compelling argument for their involvement.

The Hepatitis B National Strategy suggests targeting settings where priority groups may be reached, including

primary healthcare and dedicated Indigenous health services. Indeed, a novel decentralised, community-based approach to CHB has improved the cascade of care for Indigenous Australians residing in a remote community in the Northern Territory.[10] In this model, the CHB healthcare team travels regularly to the community to deliver care. Adopting a similar model in North Queensland may improve access and increase retention, although adequate resourcing will be essential. It is also crucial that clinicians engage with people living with CHB to identify what they see as the barriers and enablers of ideal longitudinal care. This will ensure greater engagement and facilitate optimal monitoring and treatment and ultimately better outcomes.[21]

Although most CHB monitoring in Australia is performed in the primary care setting (nearly 60% as determined by viral load testing), only a minority of general practitioners have received additional training on the modern management of CHB.[2,22] Less than 11% of patients receiving antiviral therapy for their CHB – many of whom have stable, uncomplicated disease – are receiving scripts for this medication exclusively from their general practitioner. It is clearly not possible – nor desirable – for all Australians living with CHB to be managed in the tertiary setting. CHB care is more cost-effective in primary care, as patients require monitoring over decades and individuals' CHB care can be integrated into the management of other comorbidities, with specialist involvement limited to complex cases, such as HBV occurring in pregnancy and in patients with cirrhosis, immunocompromise or blood-borne virus coinfection.[7,23] Recently updated Australian treatment consensus guidelines propose the development of a shared care framework involving specialists, general practitioners and nurses.[13]

The impact of comorbidity was clearly apparent in the study, with more than half of the patients with cirrhosis having at least one additional risk factor for liver disease, as did three-quarters of the patients who died. After blood-borne virus coinfection is excluded, the management of comorbidity is not strongly emphasised in current national guidelines – receiving only a C1 GRADE recommendation – however, it is essential to integrate the management of comorbidities – such as MAFLD and hazardous alcohol use – into CHB care to reduce liver complications and improve long-term general health outcomes.[24–27] A recent cross-sectional study performed in remote Queensland of all individuals living with CHB identified a significant burden of MAFLD and hazardous alcohol use, which increases their risk of cirrhosis, HCC and premature death.[23] Indeed, it was notable that another recent retrospective multijurisdictional cohort study of Australians diagnosed with HCC identified that after controlling for remote location and comorbidity, Indigenous status did not predict HCC-related outcomes.[26]

However, despite the suboptimal CHB care – and higher rates of comorbidity – Indigenous patients in this cohort had a relatively low incidence of HCC during the study period. Current national HCC surveillance guidelines for Indigenous Australians are based predominantly on data linkage from the Northern Territory of Australia, where a review of local cancer registry data collected between 1991 and 2010 showed that Indigenous individuals had a relative risk of HCC that was six times higher than that of non-Indigenous individuals.[13,28] However, every Aboriginal Australian in the Northern Territory to have had a genotype tested has had the HBV/C4 genotype, which carries a higher risk of progression to cirrhosis and HCC.[29–31] In contrast, over 80% of Aboriginal Australians in a recent study from the neighbouring Far North Queensland region had the less oncogenic HBV/D genotype.[32] The study's investigators hypothesised that this may explain why there had been only a single CHB-related HCC in an Aboriginal Australian in the Far North Queensland region between 2000 and 2020 and might be used to inform care.[31,33,34] A similarly lower-than-anticipated rate of HCC among Aboriginal Australians in our study – despite a significant burden of comorbidity – may suggest that less oncogenic genotypes are prevalent in Aboriginal Australians in this region as well, although this hypothesis requires confirmation in prospective studies.

This study's retrospective nature precluded comprehensive data collection in all cases. This was compounded by limited access to private pathology and radiology providers. The study was based in a tertiary hospital specialist clinic and may not necessarily represent the general population living with CHB in the region. Indeed, residents of remote locations in the catchment area living with CHB are less likely to be seen in the TUH clinic and are underrepresented in this cohort. The relatively limited duration of follow-up is likely to have resulted in an underestimation of the incidence of CHB-related complications. Difficulty in retaining Aboriginal Australians in care and limited HCC surveillance may be responsible for the low rates of cirrhosis and HCC identified in the Indigenous patients in this cohort. However, similarly low rates are also seen in the neighbouring region of Far North Queensland.[9,32] Although differences in prevailing genotype may explain the disparity in HCC rates between Aboriginal Australians in Queensland and the Northern Territory, this remains a hypothesis until more systematic genotyping of the local population is performed. Although Indigenous status was the only factor that was independently associated with suboptimal care in the

study, there was no examination of the social determinants of health that have been linked to health outcomes in the region and which are likely to explain our findings[35,36]. Finally, there is enormous diversity of Indigenous individuals and cultural groups across the region and their circumstances differ substantially. There is unlikely to be a single effective remedy that will improve the care of all the Aboriginal and Torres Strait Islander Australians living with CHB in the region.

Conclusion

This retrospective study found Indigenous status to be the sole independent predictor of suboptimal CHB care. Local prospective studies that examine the contribution of different socioeconomic and sociocultural factors – and the impact of health literacy and health-seeking behaviours – will be crucial if we are to identify specific strategies to enhance the delivery of CHB care to this priority population, improve health outcomes and achieve the targets outlined in Australia's National Hepatitis B Strategy.

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Data Availability Statement

Data cannot be shared publicly because of the Queensland Public Health Act 2005. Data are available from the Townsville University Hospital's Human Research Ethics Committee (contact through email tsv-ethics-committee@health.qld.gov.au) for researchers who meet the criteria for access to confidential data.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web-site:

Figure S1. Map of Queensland illustrating the Townsville University Hospital catchment area, which includes the Townsville and the North-West Queensland regions.