

Fitting health care to people: understanding and adapting to the epidemiology and health literacy of people affected by viral hepatitis from culturally and linguistically diverse migrant backgrounds

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Abstract

Background This study explored the epidemiology and health literacy of people affected by viral hepatitis (VH) from migrant culturally and linguistically diverse (CALD) backgrounds attending a community-based general practitioner and specialty hepatology shared-care (HEPREACH) clinic in Brisbane, Australia.

Methods Self-reported data on health literacy and clinical information from adult patients (n=66) of CALD background recruited from the liver clinic were analyzed. Health literacy was assessed using a 5-question, 12-point scale. Variance weighted multiple linear regression was used to identify factors associated with knowledge about VH.

Results About three-quarters of patients (74.2%) were diagnosed with hepatitis B. The median knowledge score was 7.8 (interquartile range(IQR) 6–9). One in five patients did not understand the infective nature of VH, 30.3% did not understand mother-to-child transmission risk, and 30%–40% of patients thought activities such as kissing, sharing food or mosquito bites could spread VH. Only 6% of patients understood the risk of liver cancer and the need for regular screening. Higher educational level (secondary, $\beta=4.8$, $p<0.0001$ or tertiary, $\beta=8.1$, $p<0.0001$ vs. primary) was associated with better knowledge, and transition through a refugee camp (vs. not, $\beta= -1.2$, $p=0.028$) and country of diagnosis (overseas vs. Australia, $\beta=-1.9$, $p=0.016$) were associated with poorer knowledge.

Discussion Country of origin, refugee status and opportunities for tertiary education impact patients' understanding of VH. Ensuring delivery of culturally appropriate care and education is critical to improve knowledge, reduce misconceptions to improve care and outcomes for viral hepatitis in CALD migrant communities.

Introduction

In Australia, the majority of hepatitis B virus (HBV) burden is borne from immigrants born in intermediate and high HBV prevalence countries[1, 2]. People born outside Australia such as in Asia (57%) and Africa (35%) contribute to a significant portion of referrals due to HBV[3]. The highest prevalence rates of HBV are observed in migrants born in Cambodia(8.6%), Taiwan (8.1%), Vietnam(7.5%), China (6.8%), and Tonga (6.5%)[4]. Immigrants from high HCV prevalence countries have a higher prevalence rate of hepatitis C virus(HCV) infection compared with persons born in Australia, reflecting the contribution of the country of origin[5–7].

Health literacy is the ability of persons to obtain, understand, and use health information in a way that benefits their health[8]. Health literacy of people from culturally and linguistically diverse (CALD) backgrounds may be influenced by language barriers, access to health information including digital media, and their healthcare uptakes[9, 10]. Difficulties in access and processing health information may lead to poorer engagement in health systems and poorer health outcomes[11]. Australia has a universal health care system that allows for subsidized HBV assessment and treatment, though barriers still exist for migrant CALD peoples.

The World Health Organization has identified viral hepatitis (VH) elimination targets, which include a 65% reduction in hepatitis-related mortality and a 90% reduction in new infections by 2030[12–14]. Without a firm understanding of how VH impacts and is understood by people from CALD backgrounds - including risks of transmission and need for follow-up, successful control of VH will be unattainable. Ensuring health systems meet patients' needs rather than patients "fitted" into the health system, is critical to engaging these vulnerable migrant CALD people. The success of such an effort depends partly on patients' knowledge of VH and their healthcare uptake.

The genotypic distribution of HBV and HCV reflects the epidemiology of both the countries of origin and country of residence, genotypes common in Asian and African regions are reflected in the migration of persons with chronic HBV. In Australia, the commonest HBV genotype is genotype C[15], reflecting the preponderance of Asian migrants with CHB. HBV genotype can impact the likelihood of treatment response using peginterferon[16].

Few studies describe the knowledge of VH in persons with chronic HBV, particularly health literacy about VH in people from CALD backgrounds. We reported the epidemiology of HBV and HCV in migrant communities in Australia and determined their knowledge of viral hepatitis.

Methods

Study design and setting

The Hepatology Research Education and Clinical Outreach (HEPREACH) study is a prospective cohort study of patients of CALD backgrounds diagnosed with VH. The study took place in two clinics in Brisbane, Beaudesert Road Surgery and Inala Primary Care, where migrant communities with a high prevalence of HBV and HCV live. HEPREACH is an innovative model of care for liver disease that reorients the tertiary specialist hepatology services into the community and offers an opportunity for CALD communities to overcome barriers to access to tertiary hospital-based care, integrating general practitioner and specialty nurses into the teams caring for patients[17]. This baseline survey is conducted on the first HEPREACH clinic appointment of patients. Patients were recruited during January 2018 and February 2020.

Study participants

The study included adults of CALD backgrounds including refugees ≥ 18 years) with a diagnosis of HBV, HCV or both. Patients were identified through a General Practitioner (GP) clinic audit. We excluded patients with decompensated liver cirrhosis and those either assessed for or undergone liver transplantation. Eligible patients were offered appointments to the HEPREACH clinics within the GP practice and written informed consent was obtained. The clinical care of patients at the HEPREACH clinic continued irrespective of participation in the study.

Data collection

Eligible patients attended a liver clinic where they were seen by a multidisciplinary team including a hepatologist (liver specialist), a specialist hepatitis nurse and a GP with a special interest in VH. Information on the date of birth, gender, country of birth, and ethnicity was collected using a structured questionnaire on the date of the first HEPREACH clinic visit. Viral hepatitis literacy data were gathered using a questionnaire using a 5-question 12-point scale.

Liver disease status data were gathered using hematologic laboratory (creatinine, alanine aminotransferase (ALT), aspartate aminotransferase (AST), gamma-glutamyl transpeptidase (GGT), estimated glomerular filtration rate (eGFR) and international normalization ratio (INR)) and transient elastography test using Fibroscan, performed as part of the HEPREACH clinical care.

HBV status was determined by HBV virology test including HBsAg, HBcAg, HBsAb, HBeAg, HBeAb, and HBV viral load. HCV status, genotypes, subtypes, and viral load were determined using the HCV genotype test.

Statistical analyses

Data were entered into the Research Electronic Data Capture (REDCap) database at the Mater Research Institute and exported to Stata version 15.1 for coding and analysis (Stata Corporation, College Station, Texas, USA). Descriptive statistics were used to present patient demographics, clinical profile and genotypic epidemiology of HBV and HCV.

Patient knowledge regarding VH was computed from 5 knowledge questions adapted from a similar study in Australia by Dahl and colleagues[9], which included understanding and utilization of health information. The knowledge scores range from 0 to 12 points with higher scores indicating better knowledge. The instrument and scoring system are shown in **Supplementary Table 1**.

Following Dahl, we gave one point if a patient answered either of HCV, HBV or cirrhosis for a question asking why the patient comes to the clinic, and one point each for mentioning the liver and cirrhosis, liver damage or hepatocellular carcinoma (HCC) on answering how the liver affects the body. For the prompted modes of transmission, we gave 0.5 points for each of the risk factors if the participant answered yes and another 0.5 points if the patient answered no to the misconceptions. Regarding the reasons for being monitored or treated 1 point was assigned for mentioning low viral load and another one point for mentioning the absence or presence of liver damage. Two points were assigned if a participant mentioned reducing alcohol or eating a healthy diet to improve hepatitis or liver disease. Multivariable linear regression reported in terms of coefficients with associated 95% confidence intervals (CIs) was used to identify factors associated with patient literacy about VH. The variance-weighted least squares method was used as it gives a more precise estimate when the sample is small, and the independent variables are categorical.

Results

Characteristics of the HEPREACH cohort

The baseline characteristics of the cohort are presented in Table 1. The cohort was predominantly female, (41.5% male and 58.5% females), and the median age was 40.2 years (IQR 32.9–47.6). Most of the cohort (83.3%) members were born overseas such as in Vietnam, Taiwan, China, and African countries. Educational status was very variable,–14% of respondents had only primary education, while nearly half (47.6%) had tertiary qualifications. Many of the patients had arrived as refugees, with twenty–four (40.0%) patients transiting through a refugee camp, spending a median of 5 years in refugee camps. For more than three–quarters(77.8%) of patients, English was the preferred language.

Table 1
Baseline characteristics of the HEPREACH cohort

	Number of participants, n = 66	Percentage
Gender		
Male	27	41.5
Female	38	58.5
Age (years); median = 40.2(IQR 32.9–47.6)		
20–30	11	16.7
31–40	21	31.8
>40	34	51.5
Body mass index (median = 25.4, IQR 23.8–29.6.0), n = 60		
Ideal weight	27	45.0
Overweight	19	31.7
Obese	14	23.3
Education level		
Primary	9	14.3
Secondary	24	38.1
Tertiary	30	47.6
Country of birth		
Australia	11	16.7
Vietnam	14	21.2
Liberia	5	7.6
Taiwan	5	7.6
Other countries	31	46.9
Time spent in Australia		
< 2 years	6	10.2
2–5 years	6	10.2
5–10 years	12	20.3
> 10 years	35	59.3

	Number of participants, n = 66	Percentage
Ever been in a refugee camp (n = 60)	24	40.0
Years spent in a refugee camp (median = 5, IQR 3–13), n = 21		
≤ 5 years	12	57.1
6–10 Years	1	4.8
> 10 years	8	38.1
Preferred language, n = 63		
English	49	77.8
Other languages	14	22.2
Need for interpreter		
Patient needs interpreter	13	20.3
No need for interpreter	53	79.7

Epidemiology of hepatitis B virus infection

Forty–nine (74.2%) patients had HBV infection and most of them reported longstanding infection. Vertical transmission (39.1%) was the most prevalent mode of acquisition (18 patients, 39%). Most patients were in the immune control phase (57%) or had resolved infection (13%). Of the 49 patients reviewed, 9 (18.4%) were on treatment (Table 2).

Table 2
Epidemiology of hepatitis B and C viruses and modes of acquisition in people of culturally and linguistically diverse backgrounds, Australia.

	Number of patients (N = 66) ^a	Percentage
Hepatitis B positive, n = 66	49	74.2
HBsAg, n = 54	49	90.7
HBsAb, n = 54	7	13.0
HBeAg, n = 54		
Negative	39	73.6
Positive	9	17.0
Unknown	5	9.4
New HBV diagnosis, n = 50	2	4.0
Duration of HBV infection (Years), n = 46		
2–5	4	8.7
6–10	8	17.4
11–20	16	34.8
> 20	16	34.8
Unknown	2	4.4
Mode of HBV acquisition		
Vertical	18	39.1
Tattoo	2	4.3
IDU	1	2.2
Medical procedure	1	2.2
Other (unknown/unsure)	27	58.7
HBV ^b treatment status		
On treatment	9	18.4
^a sample size in each compartment may vary due to missing values and applicability		
^b Hepatitis B virus; ^c hepatitis C virus; ^d injecting drug use; ^e Other- <i>tattoo, medical procedure, sexual contact</i>		

	Number of patients (N = 66) ^a	Percentage
Not on treatment	40	61.6
HCV ^c status (positive)	18	27.3
HCV genotype, n = 16		
G1	3	18.8
G3	7	43.8
G4	2	12.5
Unknown	4	25.0
HCV subtype, n = 8		
3a	5	62.5
1a	2	25.0
1b	1	12.5
Duration of HCV infection (years) (median = 11, IQR 6.5–24.5), n = 16		
2–10 years	8	50.0
11–20 years	1	6.3
20–30 years	7	43.7
Mode of HCV acquisition, n = 18		
IDU ^d	10	55.6
Other ^e	4	22.2
Unknown	4	22.2
HCV treatment status		
Not treated	15	83.3
On treatment	2	11.1

^a sample size in each compartment may vary due to missing values and applicability

^bHepatitis B virus; ^chepatitis C virus; ^d injecting drug use; ^eOther-*tattoo, medical procedure, sexual contact*

	Number of patients (N = 66) ^a	Percentage
Treatment completed	1	5.6
^a sample size in each compartment may vary due to missing values and applicability		
^b Hepatitis B virus; ^c hepatitis C virus; ^d injecting drug use; ^e Other- <i>tattoo, medical procedure, sexual contact</i>		

Epidemiology of hepatitis C virus infection

Eighteen (27.3%) patients were diagnosed with HCV infection. The commonest HCV genotype was genotype 3 (63.6%) and the most prevalent HCV subtype was 3a (62.5%). All patients with G4 HCV infection were born outside of Australia (Fig. 1). Patients had a median of 11 years (IQR 6.5–24.5) of HCV infection. Over half of patients (55%) with HCV infection acquired this through injection drug use (IDU). The majority of persons diagnosed with HCV infection were not treated, and two patients were on treatment (Table 2).

Prevalence of liver fibrosis and cirrhosis

Six (12.5%) patients had a fibrosis score consistent with advanced liver fibrosis (TE 10–14kPa and another 6 had cirrhosis based on elastography (TE > 14 kPa) fibrosis score. None of the patients with cirrhosis (TE score > 14 kPa) was on treatment (despite this being an approved and subsidized treatment indication). Most patients had active liver inflammation—63.6% males and 38.1% females diagnosed with HBV or HCV had elevated ALT while 50.0% male and 19.0% female patients had elevated AST (Supplementary Table 2).

Health literacy about viral hepatitis

The overall median score for VH knowledge of patients was 7.8 (IQR 6–9) on a 12- point scale. Two patients had a maximum score of 11.5 points and the other two had a score of 2 points(Fig. 2).

One-fifth of patients (21.2%) were unsure of what HBV or HCV was and did not understand the concept of it as an infective agent. Forty percent understood the concept of the virus, and over half perceived it as an external infectious-like entity affecting the liver. Seven (10.8%) patients interviewed thought VH is not transmittable to other persons. Despite most patients having acquired hepatitis vertically, even after prompting, 30% did not recognize perinatal transmission as a risk factor. Most patients were aware of risk factors for the transmission of HBV or HCV such as sexual contact (77.3%), contact with infected blood (86.4%), unclean needles (84.9%), and blood transfusion (83.3%). Many patients felt VH infections could be transmitted by sharing food (21.2.0%), kissing (31.8%), breathing (9.1%), and mosquitoes (37.9%). Importantly, only 6% were aware of the purpose of regular liver cancer surveillance(Table 3).

Table 3

Patient literacy about viral hepatitis in culturally and linguistically diverse populations, Australia

	Responses	Number of patients, n = 66	Percentage
Why are you coming to the clinic?	Hepatitis B	46	69.7
	Hepatitis C	14	21.2
	Unsure/incorrect	5	7.6
What causes hepatitis B or C or cirrhosis?	Concept of virus	27	40.9
	Concept of something attacking the liver	36	54.6
	Viral hepatitis	2	3.0
	Incorrect/unsure	14	21.2
How can hepatitis B or C or cirrhosis affect your body	Affects liver	44	66.7
	Jaundice	11	16.7
	Fatigue	14	21.2
	Liver cancer	16	24.2
	Liver damage/cirrhosis	13	19.7
	Asymptomatic	10	15.2
	Stigma	4	6.1
	Unsure/incorrect	10	15.2
Can hepatitis B or C be spread to someone else	Yes	55	84.62
	No	7	10.8
	Unsure	3	4.6
How can hepatitis B or C be spread to someone else (unprompted)	Sexual contact	34	51.5
	Blood contact	44	66.7
	Needle contamination	12	18.2
	Perinatal	5	7.6
	Medical procedures	3	4.6

	Responses	Number of patients, n = 66	Percentage
	Body fluids, nail clipping or saliva	17	25.8
	Incorrect/unsure	3	4.6
How can hepatitis B or C be spread to someone else(prompted)	Sharing food	14	21.2
	Sexual contact	51	77.3
	Contact with infected blood	57	86.4
	Kissing	21	31.8
	Unclean needles	56	84.9
	Mother to child during birth	46	69.7
	Breathing	6	9.1
	Unclean medical equipment	53	80.3
	Mosquitoes	25	37.9
	Blood transfusion	55	83.3
Why are you being monitored/ treated?	Virus monitoring	14	21.2
	Liver damage monitoring	10	15.2
	Viral and liver damage monitoring	3	4.6
	Liver cancer monitoring	4	6.1
	Unsure/incorrect	10	15.2
Patients on treatment; Do you know the name of the treatment? (n = 12; 9 HBV cases & 3 HCV cases)	Correctly named medication	10	83.3
Those not on treatment; Do you know why you are not being treated for hepatitis? (n = 54)	Mentioned virus	16	29.6
	Liver damage	4	7.4
	Mentioned potential liver cancer risks	1	1.9
	Unsure/incorrect	9	16.7

	Responses	Number of patients, n = 66	Percentage
Is there anything you can do to improve your hepatitis or cirrhosis?	Reduce alcohol	24	36.4
	Stop smoking	9	13.6
	Lose weight/exercise	20	30.3
	Treatment	12	18.2
	Iron, vitamins supplement	37	56.1
	Incorrect	2	3.0

Table 4
Multiple linear regression for determinants of viral hepatitis knowledge in people from culturally and linguistically diverse backgrounds in Australia^a

	Coefficient	95% Confidence interval	P value
Educational level			
Primary (ref)			
Secondary	4.8	2.91 — 6.68	< 0.0001*
Tertiary	8.1	6.13 — 10.03	< 0.0001*
Preferred language			
English (ref)			
Other languages	3.5	2.19 — 4.89	< 0.0001*
Ever been in a refugee camp			
No (ref)			
Yes	-1.2	-2.27 — -0.13	0.028*
Country of hepatitis diagnosis			
Australia (ref)			
Other countries	-1.9	-3.40 — -0.35	0.016*
Attendance at primary Care			
No (ref)			
Yes	-0.6	-1.89 — 0.60	0.312
^a Goodness-of-fit chi-square = 10.4, p = 0.066			
*Statistically significant			

Factors associated with health literacy

Table 5 presents the factors associated with viral hepatitis knowledge score. The higher level of educational attainment was associated with better literacy on hepatitis; compared to patients with primary school, for those with secondary education level the knowledge score was increased by 4.8 ($p < 0.0001$) and for tertiary education level the score increased by 8.1 ($p < 0.0001$). Forty percent of patients had been in a refugee camp, and this was significantly associated with lower knowledge scores than

those who had not ($\beta = -1.2$, $p = 0.028$). A diagnosis of VH made outside of Australia had a lower knowledge score by nearly 2 points ($\beta = -1.9$, $p = 0.016$).

Discussion

Most patients in the HEPREACH cohort were overseas-born, and two-fifths of patients transitioned through a refugee camp. Patients held many misconceptions related to VH transmission including sharing food, kissing, breathing and mosquitoes as potential transmission risk factors, but many did not realize the risks of transmission from identified risks. Country of hepatitis diagnosis, patient educational level, preferred language of communication, and having stayed in a refugee camp were associated with knowledge of VH.

While three-fourths of patients were diagnosed with HBV, less than one-in-five were on treatment. Similarly, only 3 of the 18 persons diagnosed with HCV were treated. All patients with G4 HCV genotype were born outside Australia. Low treatment rates for both HCV and HBV represent a major deficiency of the health system's ability to serve this community.

The ethnic diversity and casemix of HBV and HCV is representative of Australia's VH epidemiology, which is strongly influenced by immigration from high-to intermediate-prevalence countries[4, 18]. Most migrant patients living with HBV or HCV were born in Vietnam, Liberia, Taiwan, and other countries in the Pacific and African regions, which were known to have a high prevalence of HBV[7]. The longer duration since HBV infection could be due to transitioning through the refugee camp, or other barriers to healthcare such as culture and language. Low levels of understanding of the risks of HCC and the need for regular screening may underlie the higher prevalence of HCC in migrant Australians with HBV, which can occur without progression to cirrhosis [Taye et al, 2019, unpublished].

The country of birth for patients with HCV G4 being outside of Australia (one case each from DR Congo and Sudan) is in line with studies that reported the genotypic distribution of HCV is markedly contributed to by immigration[5, 19]. The finding suggests the need for different treatment regimens that cover the varying genotypes, to achieve a high rate of treatment success and elimination targets[5, 20]. Social and cultural stigma in many migrant communities needs to be breached to better understand injection drug use as a major risk factor for HCV transmission. The presence of stigma and discrimination in the community harms the utilization of needle and syringe programs and the uptake of antiviral prophylaxis for the prevention of HBV mother to child transmission[21, 22]. Stigma and discrimination in persons with VH affect the possibility of early diagnosis, and treatment adherence, which may be associated with a presentation with advanced liver disease, increased hospital re-admissions, increased healthcare costs and higher mortality rates[23]. The low HCV treatment rate in this population may reflect access to care could be influenced by socio-economic, cultural and linguistic factors. A high treatment coverage and success rate in CALD populations is essential to reach HCV elimination targets, given the significant burden of HCV in people from CALD backgrounds[24].

This study is one of the few that investigated the health literacy of CALD communities about VH. We found the health literacy of migrant people with VH was limited by their educational level, having a history of being a refugee and with non-English speaking language preference. Patients whose diagnosis had been provided before their migration—either in their country of origin or a transit camp, had a significantly poorer understanding of VH. This may reflect more limited health care resources and expertise in their country of diagnosis, which itself may have been a transit country for the 40% of patients who were refugees.

Our study participants had a low median knowledge score and only two-thirds of patients were able to describe that VH affects the liver. Without knowledge of the implications of VH, particularly hepatocellular carcinoma (HCC) in people of CALD backgrounds is limited and could have an impact on the screening for HCC and HBV treatment uptake[25]. Laboratory and radiologic evidence of cirrhosis and liver damage in these patients were common, indicating the need for early diagnosis and monitoring.

Although most patients acquired HBV vertically, a third of patients did not recognize perinatal transmission as a risk factor. This wide gap in knowledge of vertical transmission has a significant contribution to mother to child transmission of HBV to children born in Australia, making HBV a major health problem in people of CALD background. Expanding knowledge of VH is, therefore, a key element of the approaches to prevent transmission and accelerate elimination[24].

Many patients felt that sharing food, kissing, breathing, and mosquitoes transmit VH. The higher rate of misconceptions held by CALD populations reflects the presence of a wider knowledge gap that must be addressed during follow up visits to prevent the transmission of VH to other family members[9, 26, 27]. The high proportion of misconceptions in VH patients could contribute to poor diagnosis and treatment uptake rates and may increase patient lost-to-follow-up.

Societal perspectives about viral hepatitis are variable depending on the education from healthcare providers[28]. Social networks determine the dynamics of transmission for VH and the related perceptions of having VH infections are related to differential treatment-seeking and health outcomes[29]. The disconnection between patient perspectives and experience and assumptions of healthcare providers has implications on the engagement of people living with VH[30]. The social attribution to having hepatitis among the community themselves is crucial to design the type and level of medical and psychosocial support for patients[28].

The knowledge of VH was associated with educational level, staying in a refugee camp and the country of diagnosis. Better access to information about VH and delivering patient education contributes to the positive behavior that prepares patients to contribute towards the prevention of hepatitis through vaccination, preventing vertical transmission or unsafe injections[31]. In the refugee camps, migrants may not have access to health information and were more likely to have lower health literacy scores, this implies the importance of viral hepatitis education and provision of access to health information in refugee camps to prevent infection in migrants and transmission to other communities at the destination

country. Migrant people are at-risk group, targeted strategies need to include focused patient education about VH transmission and misconceptions.

While this is the largest study that assessed patient literacy to VH in people from CALD backgrounds in Australia, the generalizability of our findings could be limited by the small sample size and the fact that the study population was recruited from two clinics located in areas overpopulated with migrants. The study assessed health literacy in the context of Australia and different ways of understanding and terminologies that might have existed in the countries of birth were not included in the assessment. The duration of stay in Australia before VH diagnosis could not be established because of the variable country of diagnosis for participants. Despite what appear to be significant weaknesses in health literacy and poor treatment rates, it is likely that selection bias from this group of engaged patients understates the situation for many migrant people with viral hepatitis in the community. Nevertheless, this study identified a clear health literacy gap particularly in the areas of transmission and natural history, which can be used to design CALD-focused patient education strategies to reduce the number of new cases, increase treatment uptake, and reduce stigma and discrimination, pivotal to achieving the VH elimination targets.

Conclusions

A significant health literacy gap exists for migrant CALD people affected by viral hepatitis. Low rates of viral hepatitis treatment and relatively high rates of cirrhosis and liver fibrosis were also observed. Such disparities can only be addressed by being targeted and tailored to the needs of migrant people, a group at high risk of viral hepatitis and vulnerable to poorer health outcomes. In order to meet the needs of these patients and public health elimination objectives, it is critical that health systems adapt to the needs of the people they care for, rather than anticipating equivalent outcomes by forcing CALD migrant patients with viral hepatitis into a health system that is not designed to fit this purpose.

Declarations

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Data availability All data generated or analysed during this study are included in this published article and its supplementary information files.

Author contributions All the authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Burglind Liddle, Paul Clark, Gary Chang, Suzanne Williams, and Belaynew Taye. The first draft of the manuscript was written by Belaynew Taye and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Conflict of interest All the authors declare that they have no potential conflicts of interest.

Ethical approval The study was approved by the Mater Misericordiae Human Research Ethics Committee (MHREC, decision HREC/17/MHS/150).

Informed consent Written consent was obtained from all participants included in the study.

Research Involving Human and Animal Participants All study procedures performed in the study were following the ethical standards of the Mater MHREC and the national Human Ethics Committee and with the Helsinki declaration.

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Figures

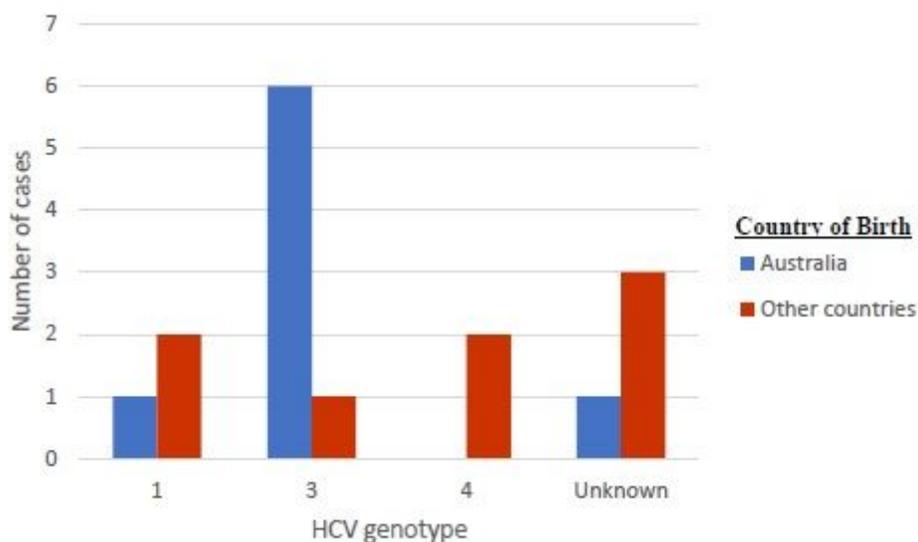


Figure 1

Genotypic distribution of HCV in culturally and linguistically diverse populations. Genotype 4, common in Africa and the Middle East, was identified only in patients born in Africa. Unknown HCV genotype is due to the genotyping not done for these patients.

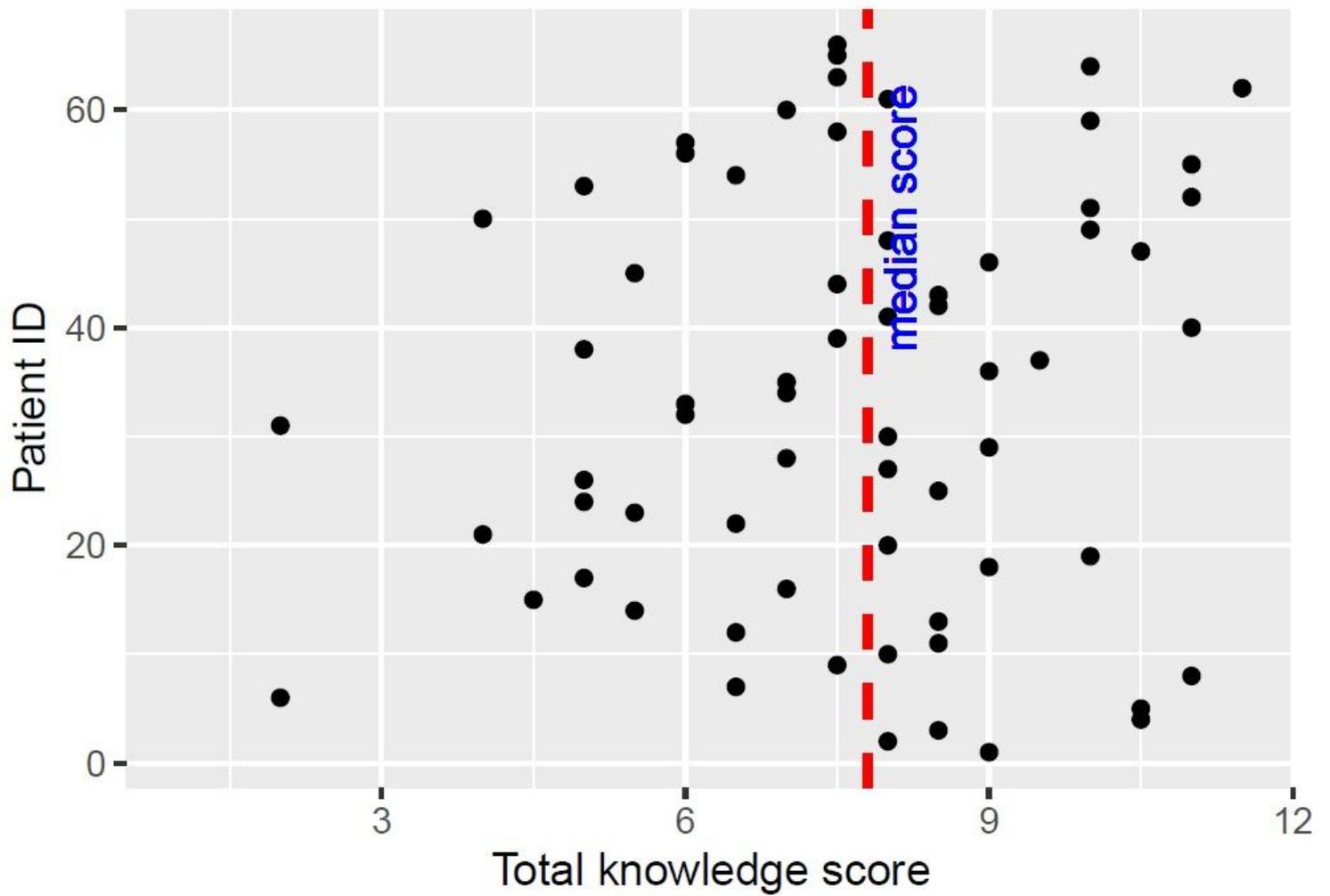


Figure 2

Scatter plot of the knowledge score of patients in the HEPREACH cohort. The median line represents the median knowledge score of all participants.

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