Optimising Hepatitis C care in an urban Aboriginal and Torres Strait Islander primary health care clinic

Prabha Lakhan,[1] Deborah Askew,[1,2] Noel Hayman,[1] Leigh-anne Pokino,[1] Cheryl Sendall,[1] Paul J. Clark[1,3,4]

Abstract

Objective: Describe the sociodemographic and clinical characteristics of patients with Hepatitis C Virus (HCV) attending an urban Indigenous primary health clinic (IPHC) in Brisbane, Australia.

Methods: A retrospective chart review of sociodemographic characteristics, presence of liver disease and treatments, lifestyle behaviours and comorbidities in patients with a HCV infection was conducted between October 2015 and March 2016.

Results: One hundred and thirteen patients with confirmed HCV infection were aged between seven and 63 years; 66% were male, and 84% were Indigenous. Sixty-nine per cent had been incarcerated; 41% had experienced conflict or domestic violence; 47% were injecting drugs; 72% had depression; and 61% had anxiety. Cirrhosis was present in 7/95 patients with adequate data and associated with age (p=0.02). Eleven patients had commenced direct acting antiviral (DAA) therapy in the 18 months that it had been available.

Conclusions: The study highlights the opportunities for enhancing treatment of patients with HCV infection. Opportunities to improve treatment rates in an Indigenous primary healthcare include optimising diagnostic pathways, improving patient engagement, and general practitioner and peer worker participation.

Implications for public health: HCV poses a serious threat to public health in Australia and IPHCs are key sites to addressing this for Indigenous people. Optimising care of patients with HCV attending IPHC requires recognition of the complex health needs and social context, to reduce the incidence and consequences of HCV infection.

Key words: Hepatitis C, Aboriginal and Torres Strait Islander, primary health care

An estimated 227,306 Australians were living with chronic Hepatitis C Virus (HCV) in 2015.[1] Untreated HCV infection can result in significant liver disease and early mortality.[1] Significant advances in HCV treatment have been achieved with new direct acting antiviral (DAA) medications. Despite easy accessibility to more efficacious DAA medications, barriers to treatment uptake remain, such as low health literacy, feelings of shame and stigma.[2-6] Extension of DAA prescription eligibility to the primary health care (PHC) setting provides greater opportunities for HCV treatment in the community.[4,7] There is very little research into the care that is needed or provided in this setting.[4]

The health of Aboriginal and Torres Strait Islander people (respectfully referred to as Indigenous hereafter) is improving in some areas, however, the disproportionate burden of illness compared to non-Indigenous Australians remains in a number of areas including chronic diseases and prevalence of HCV infection.[8] Many factors contribute to the poorer health of Indigenous Australians, especially the social determinants of lower levels of education, income, higher rates of incarceration, unemployment, poorer housing and lack of accessibility to culturally appropriate health services. The notification rates of newly diagnosed cases of HCV infection among Indigenous Australians was 173 per 100,000 in 2016, with a 25% increase in rates of HCV infection from 2012 to 2016.[9] This rate was 3.8 times higher than the stable rate of around 45 per 100,000 for non-Indigenous Australians. The social determinants of health play an important role in the high and increasing rates of HCV, especially the disproportionately higher rates of incarceration than non-Indigenous Australians, an important risk factor for HCV transmission.[9]

This study aimed to describe the sociodemographic characteristics, lifestyle behaviours, presence of liver disease and other co-morbidities and treatment of patients with confirmed active HCV infection attending an urban Indigenous PHC clinic.

Methods

Setting

This study was conducted at the Southern Queensland Centre of Excellence (CoE) in Aboriginal and Torres Strait Islander Primary

1. Southern Queensland Centre of Excellence in Aboriginal and Torres Strait Islander Primary Health Care, Queensland
2. The University of Queensland, Primary Care Clinical Unit, Royal Brisbane and Women's Hospital, Queensland
3. Faculty of Medicine, The University of Queensland
4. Department of Gastroenterology, The Princess Alexandra and Mater Hospitals, Queensland
Correspondence to: Dr Paul J. Clark, Southern Queensland Centre of Excellence in Aboriginal and Torres Starit Islander Primary Health Care, 37 Wirraway Parade, Inala, Queensland 4077; e-mail: Drpjclark@gmail.com
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Health Care, which has onsite easily-accessed integrated specialist services such as hepatology clinic, mental health, Alcohol and Other Drugs Services.[10] Since 2012, a hepatologist (PC) and Registered Nurse (CS) have conducted a hepatology clinic (four-hour afternoon session) once every four weeks at the CoE clinic.

Study design

We conducted a retrospective medical chart review of all patients (Indigenous and non-Indigenous) between October 2015 and March 2016 who were attending the CoE, with a diagnosis of HCV in their medical record in November 2014.

Metro South Human Research Ethics Committee exempted the study from requiring ethical review and the Inala Community Jury for Aboriginal and Torres Strait Islander Health Research provided community approval.[11]

Data collection instrument

Data extraction form

A standardised electronic Microsoft Access© data extraction form was developed by PL, PC and CS for recording extracted information for all the variables for each patient. The form was pilot-tested and refined. A pilot test of extracted data was conducted. PL and LP independently extracted data for five patients. The results were compared and any disagreements were clarified prior to commencing formal data extraction for the study. No formal inter-rater reliability test of the extracted data was undertaken. However, a number of strategies were used to increase the reliability and validity of information obtained from medical records.[12,13] To ensure consistency in data extraction, a drop-down menu containing all possible response options was used for recording information for most variables. An accompanying document provided an explanation of each variable, method for entering the data and the response options. Where possible, the results of the laboratory tests (such as the HCV RNA PCR result) were copied directly from the electronic laboratory result and pasted into the data extraction form.

List of variables included in the data extraction form: descriptions and reasons for inclusion

The variables included in the data extraction form reflected the aims of the study. The variables to describe the sociodemographic characteristics of the sample included age, gender and ethnicity (Aboriginal, Torres Strait Islander, Aboriginal and Torres Strait Islander; Non-Aboriginal and Torres Strait Islander) and marital status.

Information was obtained on living arrangement (alone, with spouse and/or children, other family members, friends, in shared accommodation such as hostel); living condition (homelessness and overcrowding); whether patient experienced conflict and/or domestic violence in the home environment; and any history of incarceration.

Patients with chronic HCV infection experience many psycho-social issues including depression, anxiety, irritability and outbursts of anger.[14] In addition, treatment with pegylated interferon and ribavirin medications may cause severe side effects (such as depression, anxiety, irritability and insomnia) and less common side effects of suicidal ideation and acute psychosis.[14-16] For these reasons, patients needed to be living in a stable and supportive home environment to access treatments.

Information was collected on current and past injecting drug use; prescribed and/or illicit opioids use; opioid replacement therapy; current or past tobacco use; and unsafe level of alcohol consumption. The presence of some lifestyle-associated behaviours could influence the accessibility to interferon-based treatments or increase the risk of liver cancer such as tobacco[17-19] and alcohol use. Most HCV infection is acquired through injection drug use and many patients have a history of opiate injection specifically. Opiate substitution therapy (OST) has been found to be protective against HCV infection.[20] However, in the peg-interferon era of HCV treatment, a number of barriers, including clinicians' attitudes and organisational factors, prevented the administration of HCV treatment in the OST setting.[21] In this retrospective chart review it was not possible to characterise these features with sufficient accuracy, however, an attempt was made to document opiate exposure, given historically clinicians have considered this in their decisions to treat.

Information was also obtained on the variables that described the clinical characteristics of patients including presence of mental illness (anxiety, depression, suicidal ideation, psychosis, bipolar disorder, schizophrenia, Borderline Personality Disorder, Post –Traumatic Stress Disorder), liver disease (fatty liver disease, hepatic fibrosis, cirrhosis, hepatocellular carcinoma, elevated prothrombin times, elevated bilirubin, low platelets, low albumin), exposure to Hepatitis B and HIV, and presence of chronic conditions indicating fatty liver metabolic risks (hypertension, diabetes, obesity).

Variables to describe the details of HCV infection included the most recent HCV Ab positive and HCV RNA PCR and genotype results. This audit was conducted between October 2015 and March 2016 for patients with diagnosis of HCV infection in 2014, when interferon-based treatments were being used for treatment. Information obtained included whether the patient was referred for treatment (if referred, the date of referral); reasons for non-referral for treatment; details of treatment commencement (date and name of treatment); reason for not commencing treatment; and details on treatment completion (date of completion, whether SVR was achieved and reason for incomplete treatment).

Interferon-based medications were replaced by DAA therapies in Australia in March 2016. An additional data extraction tool was developed (PL, CS) to obtain information (attendance for appointments, medication, reasons for non-completion of treatment, successful completion and achievement of Sustained Virological Response (SVR)) on the subgroup of patients who had commenced DAA HCV medications from March 2016 to October 2017.

Data sources used to extract information for each variable

Information on each variable was obtained from a review of the patient's medical record, including notes documented by the GP, hepatologist and mental health staff; laboratory, ultrasound and fibroscan test reports; and completed annual health assessments. An annual health assessment (HA) is one of the initiatives to assist in closing the gap in health status between Indigenous and Non-Indigenous Australians.[22] Indigenous patients attending the CoE are encouraged to have a HA conducted annually. Information is collected on a range of topics including social determinants of health; mental and clinical measures of health and lifestyle behaviours influencing health such as injecting drug use; use of prescription and illicit opiates; and tobacco and alcohol

use. A health summary at the end of each health assessment highlights any significant health issues that need to be addressed.[23]

The most recent information available on safe and unsafe levels of alcohol consumption was obtained from review of the completed HA form and the General Practitioner's notes. The National Health and Medical Research Council's definition of levels of alcohol consumption was used in the HA to assess alcohol consumption. The earlier definition of unsafe levels of alcohol consumption of '>4 standard drinks per day on average or drinks 6-7days per week or >28 standard drinks per week; or > 6 standard drinks on any one day'[24] was later replaced to '>2 standard drinks per day'.[25] The HA definitions were revised accordingly. The definition used to record a patient's level of alcohol consumption was dependent on the date of the most recent available information at the time of audit. For patients who did not have a health assessment, level of alcohol consumption was obtained from review of information in the medical notes.

Data collection procedure

All data was extracted by two of the authors (PL, LP) who were trained in the use of the electronic patient medical record software program and the data extraction form. The most recent information available for all variables was extracted from the patients' electronic medical records between October 2015 and March 2016 and entered into the electronic data extraction form. During data extraction for each patient, any information that needed clarification was discussed by both extractors as required.

HCV infection was determined by confirmation with HCV antibodies (Ab) and HCV ribonucleic acid polymerase chain reaction (RNA PCR) results and classified by PC as either: 1) confirmed active infection (HCV Abs and RNA positive); 2) spontaneous clearance (HCV Ab positive but RNA negative without a history of treatment); or 3) SVR if RNA negative with a history of prior treatment. Patients with HCV Ab positive and unconfirmed HCV RNA results were categorised as HCV exposed.

Access to non-invasive transient elastography was limited, thus liver disease severity was estimated using the Aspartate Transaminase (AST) Platelet Ratio Index (APRI), as suggested in the Australian HCV Management Recommendations.[26]. APRI >0.7 and ≤ 1.0 was classified as advanced fibrosis. Cirrhosis was classified as APRI >1, but required hepatologist confirmatory chart review and ultrasonography.

Data analysis

Descriptive statistics were used to describe the sociodemographic and clinical characteristics and lifestyle behaviours. The number of patients who commenced the interferon-based treatments and the new DAA treatments were described. The association between sociodemographic characteristics, presence of mental illness, tobacco use, alcohol use and IDU, and the presence of liver cirrhosis was investigated using univariate logistic regression analysis. STATA® version 14.1 was used for statistical analysis. Data were missing for all variables except for 'age', 'gender', 'ethnicity' and 'regular attendance at the clinic'. Results were reported from analyses of available data, which are shown in the first columns of Tables 1, 2 and 3.

Results

Sociodemographic characteristics and lifestyle behaviours

Of the 210 patients with a diagnosis of HCV infection in their medical records, 185 had PCR confirmation available. Of these, 113 had active HCV with confirmed PCR positive; 72 had prior HCV (PCR negative); and 25 were HCV antibody positive without confirmatory PCR (Figure 1).

The 113 patients with confirmed active HCV infection were aged between seven and 63 years (median 38 years), predominantly male (66%), 84% were Indigenous and 62% were considered as regular attendees (≥3 clinic visits in the previous two years).[27] HCV genotyping was completed in 74 patients with Genotype 3 (37/74; 50%) and Genotype 1 (36/74; 49%) being predominant.

Conflict at home or domestic violence was experienced by 41% (33/81) of patients and 69% (72/105) had a history of incarceration (Table 1). Nearly all patients (96%; 89/93) had a past history of IDU, 47% (36/77) were current IDUs, 31% (25/80) had been using either prescribed or illicit opiates and 24% (20/83) were registered on an opiate substitution program such as buprenorphine or methadone (Table 2). Tobacco was used by 87% (94/108) of patients and 27% (24/89) consumed alcohol at unsafe levels.

Clinical characteristics of patients with HCV

Mental illness

A high number of patients experienced concurrent mental illnesses such as

Figure 1: HCV infection status; treatment (interferon-based only) details for patients with diagnosis of Hepatitis C in patients' medical records in November 2014.

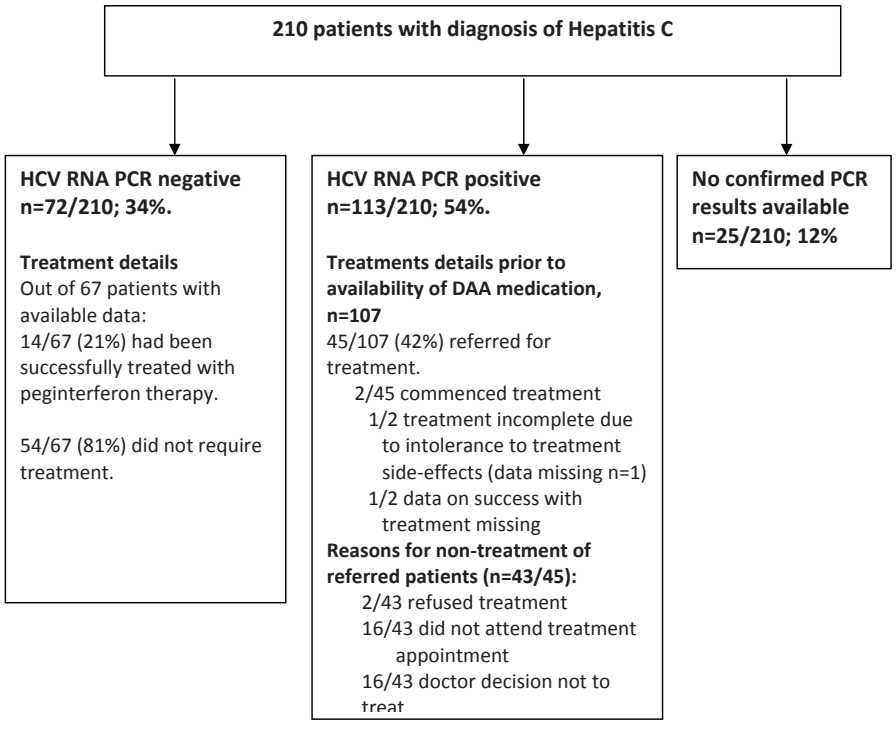

Table 1: Socio-demographic characteristics of 113* patients with HCV RNA PCR positive results.

Characteristic	HCV RNA PCR positive	
Age mean (±SD, min-max), years	39 (±9.7, 7-63)	
Age categories, years, n=113	**n**	**%**
<20	3	2.7
21- 30	15	13.3
31- 40	51	45.1
41-50	30	26.5
51-60	12	10.6
61-70	2	1.8
Gender, n=113		
Male	75	66.4
Ethnicity, n=113		
Aboriginal	90	79.7
Torres Strait Islander	2	1.8
Aboriginal & Torres Strait Islander	3	2.7
Non-Aboriginal/Torres Strait Islander	18	15.9
Regular attendance at clinic (≥3 visits in last two years), n=113	70	61.9
Living condition, n=81		
Homelessness or overcrowding present	6	7.4
Living arrangement, n=54		
Living alone	4	7.4
Living with spouse, or spouse & children	15	27.8
Living with other family members, including own children	25	46.3
Living with friends/shared accommodation, hostel, under care of Department of Children's Services	10	18.5
Other factors		
History of incarceration, n=105	72	68.6
Conflict or domestic violence, n=81	33	40.7

Notes:

** Data were not available for all patients. All analysis was performed with available data.*

Table 2: Comorbidities and relevant lifestyle-associated factors present among 113 patients* with HCV RNA PCR positive.

	HCV RNA PCR positive	
	n	**%**
Comorbidities		
Depression, n=99	71	71.7
Anxiety, n=92	56	60.9
Other current mental illness present,** n=92	28	30.4
History of previous suicide/self- harm attempt, n=65	15	23.1
Hypertension, n=90	10	11.1
Diabetes, n=90	9	10.0
Ischaemic Heart Disease, n=91	4	4.4
Body Mass Index (kg/m2) >25, n=89	43	48.3
Lifestyle-associated behaviours		
Current smoker, n=108	94	87.0
Unsafe levels of alcohol consumption, n=89	24	26.9
Using an opiate, n=80	25	31.3
On replacement opiate, n=83	20	24.1
Self-reported Current Injecting Drug User, n=77	36	46.8
Past Injecting Drug User, n=93	89	95.7

Notes:

**Data were not available for all patients, analysis conducted with available data.*

*** Other current mental illnesses include suicide ideation, psychosis, bipolar disorder, schizophrenia, Borderline Personality Disorder, Post –Traumatic Stress Disorder.*

depression (72%; 71/99) and anxiety (61%; 56/92), with one-third (30%; 28/92) diagnosed with other mental health problems such as bipolar affective disorder or schizophrenia. Nearly one-quarter of participants had a history of prior suicide attempt or self-harm (23%; 15/65), see Table 2.

Liver disease

Table 3 presents clinically important features of patients with active HCV infection. Denominators differ because of incomplete investigations. Six out of 95 (6%) patients with an APRI score had advanced hepatic fibrosis, and 7/95 (7%) had an APRI score >1 and a specialist assessment that confirmed cirrhosis. Active inflammation was present in 64 of 98 (65%) patients, suggested by elevated ALT (>45 U/mL) and 49/98 (50%) had elevated AST (>40 U/mL). Of the 39/113 patients who had prothrombin time tested, two had elevated prothrombin times (>1.2 seconds), 7/98 (7%) had elevated bilirubin (>20 umol/L), 12/97 (12%) had low platelets, and 11/98 (11%) had low albumin (<35 g/L).

Fifteen of 29 (52%) patients had a comorbid diagnosis of fatty liver disease reported on liver ultrasound or liver biopsy and 4/26 (15%) had alcoholic liver disease. Approximately half (43/89; 48%) the patients were overweight or obese (Body Mass Index >25kg/m^2), and some patients had additional fatty liver metabolic risks such as hypertension (10/90) or diabetes (9/90), see Table 2. One patient was diagnosed with hepatocellular carcinoma. With the caveat of a small sample size, age was the only variable significantly associated with presence of cirrhosis in the univariate logistic regression analysis (p=0.02), see Supplementary Table 1.

Presence of other blood-borne virus infections

Seventy (62%) of 113 patients were screened for Hepatitis B Virus (HBV) with two being positive for HB surface antigen, suggesting an active HBV. Fourteen per cent (16/113) were tested for exposure (core antibody), and seven of those were positive to prior exposure to HBV (Table 3). Immunity to HBV (surface antibody) was tested in 48/113 of patients, with 22/48 (46%) being non-immune (HBsAB <10 IU/L) (Table 3). None of the 68% (77/113) HIV screened patients were positive (Table 3).

Treatment of patients with HCV infection

Forty-five (42%) of 107 patients with available data were referred for peginterferon therapy,

with two commencing treatment (Figure 1). Thirty-one of the 113 patients (27%) had been provided scheduled appointments to attend the hepatology clinic for assessment and possible treatment with the new DAA medications from March 2016 to October 2017. Twelve patients (39%) were prescribed treatments, with 10 patients (83%) completing their treatment (six achieving an SVR at 12 weeks, including one with liver cirrhosis and four awaiting SVR results) and two (17%) not completing their treatment either due to loss of medication prescription or medication intolerance. Of the 19/31 patients (61%) not prescribed any treatment, 14/31 (45%) had not attended for the first and/or subsequent scheduled appointments. Of the remaining five patients, one declined treatment, one deferred due to renal toxicity, one was deceased and two relocated.

Table 3: Severity of Liver Disease and co-infection with other blood borne viruses among 113* patients with HCV RNA PCR positive results.

Characteristic	HCV RNA PCR positive	
	n	%
Liver Disease		
Fatty liver disease, n=29	15	51.7
Primary carcinoma of liver, n=29	1	3.5
No liver disease, n=29	13	44.8
Alcoholic Liver Disease, n=26	4	15.4
AST: Platelet Ratio Index (APRI) scores, n=95 min - max, mean (±SD)	0.02-12.25,0.95(1.97)	
Hepatic fibrosis and cirrhosis, n=95		
No significant hepatic fibrosis (APRI <=0.7)	75	78.9
Advanced hepatic fibrosis (1, APRI >0.7 – 1.0)	6	6.3
Cirrhosis (APRI >1 and confirmed by specialist)	7	7.4
No Cirrhosis (APRI >1, and confirmed by specialist)	6	6.3
APRI >1, but presence of cirrhosis unclear	1	1.1
Serum levels for Liver Function tests		
Alanine Transaminase (ALT), min-max; mean (±SD), n=98	11- 425; 72.4 (±60.3)	
Normal ALT (Reference range 7-45 U/L)	34	35
Raised ALT (>45 U/L)	64	65
Aspartate Transaminase (AST), min-max; mean (±SD), n=98	9 - 204; 52.8 (37.3)	
Normal AST (Reference range 10 to 40 U/L)	49	50
Raised AST (>40 U/L)	49	50
Bilirubin, min-max; mean (±SD), n=98	2-63, 11 (7)	
Normal (Reference range: <20 umol/L)	91	92.9
Raised (≥20 umol/L)	7	7.1
Albumin, min-max; mean (±SD), n=98	20 - 48, 39.8 (5)	
Normal (Reference range 35-50 g/L)	87	89
Low (< 35 g/L)	11	11
Gamma Glutamyl Transpeptidase (GGT), min-max; mean (±SD), n=98	9-267, 60.6 (55)	
Normal (Reference range: <55 U/L)	64	65
Raised (>55 U/L)	34	35
Platelet, n=97		
Normal (Reference range: 150-400x10^9/L)	83	85.6
Low (<150x10^9/L)	12	12.4
High (>400x10^9/L)	2	2
International Normalised Ratio (INR), n=39		
Normal (reference range: 0.9-1.2)	37	95
Raised (>1.2)	2	5
Co-infection with Hepatitis B, n=70		
HBsAG		
Negative/ non-reactive	68	97.1
Positive/reactive	2	2.9
HBsAB, n=48		
<10 IU/L	22	45.8
≥ 10 IU/L	26	54.2
HBcAB, n=16		
Positive/reactive	7	44
Negative/non-reactive	9	56
Co-infection with Human Immunodeficiency Virus (HIV), n=77	0	0

Notes:
** Data were not available for all patients, analysis conducted with available data.*

Discussion

This study aimed to gain an understanding of patients with HCV infection attending an urban Aboriginal and Torres Strait Islander PHC clinic. Eighty-six per cent of the patients in the study were Indigenous. The findings related to the sociodemographic characteristics and lifestyle behaviours have identified that many of these patients experienced social vulnerabilities. Descriptions of the clinical characteristics associated with HCV infection has also highlighted the health vulnerabilities experienced by these patients. The study findings indicate that understanding the sociodemographic, clinical and health system factors affecting patients with HCV is critical in increasing the uptake of treatment.

Sociodemographic factors

The high rates of incarceration, tobacco and injecting drug use, exposure to conflict and/or domestic violence, and opiate use observed in our study suggest that patients experienced significant social vulnerability. Incarceration increases the risk of acquiring HCV infection and subsequent transmission in the community following release.[28-34] The presence of inter-related social determinants of health (such as education, employment, housing, discrimination) further influence the high rates of imprisonment experienced by Aboriginal and Torres Strait Islander people,[33] reflecting the complexity of HCV infection occurring within the multiplicity of sociological risks.[2,6,33] A small proportion of

patients were living in insecure or vulnerable living arrangements. Discreetly taking and storing HCV medication may be problematic for those living in shared accommodation, and daily adherence to medications prove challenging when accommodation is uncertain.[35]

Clinical factors

Genotype 3 (G3) HCV comprised nearly half of all infections in our clinic-based sample, compared to the Australia-wide prevalence estimates of 37%.[36] With the limitation of a small sample size, this raises the possibility that transmission may be occurring within the community, given that the genotype frequency is different to that seen more broadly in Australia.[37] This has two implications. First, strategies to combat transmission should be directed at peer-to-peer transmission risk within communities and may differ from strategies for other communities. Second, from a clinical perspective, HCV G3 is associated with higher rates of steatosis, cirrhosis progression and liver cancer.[38] These data are limited, however, and more work needs to be done to better understand the nature of transmission, risk and engagement in care for patients with HCV in Indigenous communities.[6]

The rate of HBV co-infection was higher (3%) in this study compared to the approximately 1% national prevalence.[1] HBV co-infection requires closer monitoring during HCV therapy in case of HBV reactivation, and specialist involvement is recommended.[26] After cure of HCV, Hepatitis B co-infection poses a continuing risk for long-term liver injury and morbidity. High rates of HBV exposure (44% HBV core antibody positive) also reflect a higher population risk of HBV exposure to blood-borne viruses than the surface antigen suggests. The high rate of fatty liver and risk factors (such as obesity, hypertension and diabetes) adds further risk for progressive liver disease, independent of HCV cure, and ongoing morbidity from metabolic risks continues.

The significantly high rates of mental illnesses could prevent patients from seeking HCV treatment, reinforcing the need for a holistic health care approach.[39] Clinically, it is often difficult to distil cause from effect in hepatitis C infection, drug use and mental health. High rates of IDU and depression were observed in our study. In a cohort of injection drug users, higher rates of depression were seen in patients with HCV infection than those non-infected.[40]

Health system related factors

Many patients with HCV infection were not adequately characterised in terms of other blood-borne virus infections, liver disease severity or genotype. Non-invasive liver fibrosis evaluation is a core component of HCV treatment algorithms in Australia[26] and was not available for assessment of all patients in the study. Low rates of HBV screening were undertaken. Testing for HBV infection, exposure and immunity is important, particularly among Indigenous patients, who *a priori* are at higher risk of HBV infection.[41] On many occasions GPs had requested investigations that were not completed by patients.

Opportunities to improve management of patients with HCV infection

The strengths of the health care services provided at our Clinic include a strong community support; holistic patient-centred care model; and GP-specialist partnerships, providing an ideal setting for providing treatment for HCV infection. A HCV-specific care model, including interventions described below and treatment algorithms for patients who are newly-diagnosed or at risk of infection could further strengthen service provision.

The high proportion of patients in our study with a history of IDU and incarceration should not preclude them from receiving treatment.[35,42] A strength identified in this study was that nearly half the patients were living with extended family that could provide support during the assessment and treatment process. Connections within the community and family could also assist with accessing treatment thereby preventing transmission within the community through harmful drug injection. However, it is important to be aware of the factors that may limit accessibility to family support. Stigma related to HCV infection may impact the individual's desire to seek family support but also limit the family support available. Discussion about involvement of family or other community support needs to be individualised to each person's situation. Better collaboration with local pharmacists could assist with administering HCV treatments to patients without supportive family members. Better integration of community education and prison health care would increase treatment uptake either in prison or on release. Better HCV education, opiate substitution programs and access to Needle Syringe Programs for incarcerated people may help reduce transmission risk both in prison and also the subsequent risk of transmission on release into the community.[34]

The attendance rate at this community-centred hepatology clinic remains low. Of patients for whom post treatment data were available, there was 100% cure rate with DAA medications. The true 'intention to treat' from referral is difficult to establish as six of 13 patients did not follow-up with the required testing to determine SVR and the community cure rate for HCV remains limited to the less than the 50% patients who attended the clinic during follow-up. Training GPs and primary healthcare nurses about screening and treatment of HCV and clinical care pathways may also assist in increasing the number of patients being treated.[43] GPs trained and taking a lead role in assessing and treating HCV infection may reduce the loss from the HCV 'cascade of care' from diagnosis to treatment.[7,26,44] Early interventions at the CoE clinic for training to increase capacity and confidence for GP prescribers are under way, including having GPs buddying specialist consultations and educational lectures. The peer-led model of care could be implemented to increase the number of people being screened and treated for HCV, especially among persons who are injecting drugs and may be experiencing many competing priorities.[45,46] The close proximity of our Clinic to the Needle and Syringe Program and recent co-location of the Drug and Alcohol Service within our Clinic also presents opportunities for engaging with persons who may be at risk of HCV infection. The Nurse Navigator model of care is already being practiced in our Clinic to assist patients with attending hospital and other healthcare related appointments, provision of health information and referral to other in-home services. A similar patient navigation model could be investigated for its effectiveness in assisting patients with HCV to attend appointments and access treatments.[47,48]

Some patients in this study did not follow-up for investigations such as confirmatory testing when positive for HCV antibodies. Activation of reminder HCV alerts in the patient's medical record, co-locating local pathology

collection facilities at the Clinic or upskilling staff to collect blood specimens could facilitate timely completion of investigations. Introduction of reflex testing would reduce the required number of blood tests and visits to the Clinic and increase the number of patients being diagnosed.[43,49] Better efforts to engage patients with community health care workers, relatives and clinic staff from the initial visit may be a key part of this process. Audits such as these improve the understanding and awareness of GPs and also more broadly in the communities they serve. Audit review activities can have direct impact through quality improvement activities (such as changing screening or referral processes for patients at risk of HCV infection) and increasing the number of patients being tested and treated.[50] Preventative interventions to reduce new HCV infections and re-infections are important. Understanding the enablers and facilitators of IDU initiation is critical to preventing the increasing rates of HCV transmission in urban Indigenous communities.

Study limitations

The study was conducted at a single outer metropolitan site and findings may not be generalisable to all Indigenous PHC settings. However, similar issues may be experienced in other urban non-Indigenous and rural Indigenous communities, where lower socioeconomic status and higher rates of incarceration pose challenges.

The use of a retrospective chart review study design may have compromised the reliability and validity of the information obtained from the patients' medical records since the primary purpose of medical records information is to document details of the specific health information and healthcare provided to the patient and not for research. Although we used a number of strategies to ensure reliability of data extraction, we did not conduct an inter-rater reliability study to examine reliability of data extraction by the two data extractors.

Reliability and validity of clinical measures was maintained in this study since these were internationally recognised measures such as APRI scores, ALT and AST reference ranges, and other diagnostic procedures such as ultrasound and fibroscan tests. However, use of the retrospective chart review study design may have influenced the validity of the measures recorded for some variables.

Data was missing for a number of variables for some patients or the most recent data was not available resulting in a possible under-estimation of the prevalence of HCV infection, other sociodemographic characteristics, lifestyle behaviours and co-infection with HBV and presence of liver cirrhosis The definition of safe level of alcohol use had undergone changes from being ≤ 4 standard drinks per day, 1-2 alcohol free days per week or < 28 standard drinks per week to more recent definition of ≤ 2 standard drinks per day. It is possible that when using the former definition, patients consuming up to four standard drinks per day could be considered safe. In these cases, if the medical notes did not identify a harmful level of consumption, then it was assumed that these patients were taking safe levels of alcohol.

Conclusion

Early HCV infection detection and treatment uptake will result in a better prognosis. However, HCV infection cannot be addressed without recognising the social and health context in which it occurs, in particular the relative social disadvantage and competing medical and psychological comorbidities, common among people living with HCV infection and especially among Indigenous communities.[5,6,51,52] Addressing these through Indigenous primary care may allow the full benefits of new HCV therapies to be realised.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary Table 1: Univariate logistic regression analysis of predictive factors associated with presence of cirrhosis.