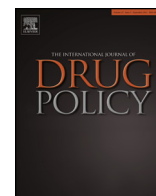




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## Research paper

# The effect of social functioning and living arrangement on treatment intent, specialist assessment and treatment uptake for hepatitis C virus infection among people with a history of injecting drug use: The ETHOS study



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## ARTICLE INFO

## Article history:

Received 12 February 2015

Received in revised form 11 May 2015

Accepted 2 June 2015

## Keywords:

HCV

Drug users

PWID

Treatment

Education

Therapy

Barriers

## ABSTRACT

**Background:** The objective was to assess social functioning and its association with treatment intent, specialist assessment and treatment uptake for hepatitis C virus (HCV) infection among people with a history of injecting drug use.

**Methods:** ETHOS is a prospective observational cohort evaluating the provision of HCV assessment and treatment among people with chronic HCV and a history of injecting drug use, recruited from nine community health centres and opioid substitution treatment clinics (NSW, Australia). Social functioning was assessed using a short form of the *Opioid Treatment Index* social functioning scale. Those classified in the highest quartile (score >6) were considered having lower social functioning. Analyses were performed using logistic regression.

**Results:** Among 415 participants (mean age 41 years, 71% male), 24% were considered having lower social functioning, 70% had early HCV treatment intent (intention to be treated in the next 12 months), 53% were assessed by a specialist and 27% initiated treatment. Lower social functioning was independently associated with unemployment, unstable housing, recent injecting drug use and moderate to extremely severe symptoms of depression, anxiety and stress. Lower social functioning was independently associated with reduced early HCV treatment intent (aOR 0.51, 95% CI 0.30–0.84) and lower specialist assessment (aOR 0.48, 95% CI 0.29–0.79), but not HCV treatment uptake (aOR 0.76, 95% CI 0.40–1.43). Living with someone was independently associated with HCV treatment uptake (with someone and children: aOR 2.28, 95% CI 1.01–5.14; with someone and no children: aOR 2.36, 95% CI 1.30–4.31), but not early HCV treatment intent or specialist assessment.

**Conclusions:** This study highlights the need for the development and implementation of strategies targeting people who inject drugs with lower social functioning to enhance HCV treatment intent and specialist assessment. Further, strategies to enhance social support may play a role in increasing HCV treatment uptake.

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## Introduction

The majority of new and existing cases of hepatitis C virus (HCV) infection in many high- and middle-income countries occur among people who inject drugs (PWID) (Hajarizadeh, Grebely, & Dore, 2013; Nelson et al., 2011). Although HCV treatment is safe and effective among PWID (Aspinall et al., 2013; Dimova et al., 2013), antiviral therapy uptake remains suboptimal in this population (Alavi et al., 2014; Grebely & Dore, 2014; Grebely et al., 2009; Iversen et al., 2014; Mehta et al., 2008). Strategies to enhance HCV care requires addressing several elements, including increased HCV testing, linkage to HCV care, improved liver fibrosis assessment, enhanced HCV treatment uptake, improved adherence and cure of HCV, collectively termed the “HCV cascade of care” (Yehia, Schranz, Umscheid, & Lo Re, 2014). Barriers to HCV care include those at the levels of the system, provider, and patient (Grebely, Oser, Taylor, & Dore, 2013; Morrill, Shrestha, & Grant, 2005). Multiple patient-level barriers have been identified (Fraenkel, McGraw, Wongcharatrawee, & Garcia-Tsao, 2005; Grebely et al., 2008, 2013; Grebely & Tyndall, 2011; Morrill et al., 2005; Osilla et al., 2009; Swan et al., 2010; Treloar, Newland, Rance, & Hopwood, 2010), including many factors related to social functioning. Social functioning encompasses employment, income, housing, interpersonal relationship and conflicts, and living arrangements issues (Darke, Ward, Hall, Heather, & Wodak, 1991; Richardson, Wood, Li, & Kerr, 2010). Understanding social functioning and its role in various steps of the HCV care cascade has important implications for the design and implementation of programs to enhance access to HCV care and treatment.

HCV treatment intent, specialist assessment and treatment uptake have been shown to be associated with one or several components related to social functioning (Darke et al., 1991; Richardson et al., 2010), including housing (Charlebois, Lee, Cooper, Mason, & Powis, 2012; Harris & Rhodes, 2013; Strathdee et al., 2005), living arrangement, employment and income (Kanwal et al., 2007; Moirand, Bilodeau, Brissette, & Bruneau, 2007), social support (Gidding et al., 2011; Grebely et al., 2010; Moirand et al., 2007) and interpersonal conflicts (Harris & Rhodes, 2013). When scales specifically designed to measure social functioning have been used, higher social functioning has been associated with improved response to HCV therapy (Dore et al., 2010). However, the majority of studies are retrospective or cross-sectional, have limited sample sizes and have not considered the association between social functioning across multiple components of the HCV care cascade.

The specific aims of this study were: (1) to assess factors associated with lower social functioning; and (2) to evaluate the association of social functioning and living arrangement with specific components of the HCV care cascade (treatment intent, specialist assessment and treatment uptake for HCV infection) among participants with chronic HCV infection and a history of injecting drug use in the Enhancing Treatment for Hepatitis C in Opioid Substitution Settings (ETHOS) study.

## Methods

### *Study population, sites and design*

ETHOS was an observational cohort study evaluating the provision of HCV assessment and treatment among people with a history of injecting drug use attending opioid substitution therapy (OST) and community health clinics in New South Wales (NSW), Australia. Study recruitment occurred between February 2009 and December 2012, with follow-up until June 2014. This study was performed through a collaborative network of nine clinics with existing infrastructure for drug and alcohol care, where

on-site HCV nursing and physician assessment, treatment and monitoring were provided. The majority of services had limited previous experience in providing HCV care.

ETHOS study sites have been previously described (Alavi et al., 2013), and included four public sector OST clinics, two private sector for-profit OST clinics, two community health centres and one Aboriginal community controlled health organisation; one was rural, one was regional and seven were urban clinics. At study enrolment, participants were assessed for HCV infection by a clinical nurse or general practitioner. HCV nursing services were available at eight of nine clinics, with one clinic only providing general practitioner services. Following assessment by a nurse or general practitioner, all participants were considered for referral to a specialist (including infectious disease specialist, hepatologist, gastroenterologist, or a general practitioner with HCV training and prescribing rights) for HCV assessment. HCV specialist medical services were provided on-site at five clinics, on-site and off-site at two clinics, and off-site at one clinic. Two clinics offered HCV peer-support services.

Inclusion criteria in the ETHOS cohort included age being  $\geq 18$  years, a history of injecting drug use and chronic HCV infection (HCV antibody and RNA positive). Exclusion criteria included acute HCV infection, negative or unknown HCV antibody status and current HCV treatment. People attending one of the study sites who satisfied these inclusion and exclusion study criteria were invited to participate in ETHOS and receive HCV assessment (and treatment, if required). All study participants provided written informed consent and were reimbursed for their time with a \$20 gift card voucher at each study visit. The study was approved by local research ethics committees.

### *Data collection*

All patients enrolled in the study were asked to return for six-monthly follow-up visits. At enrolment and each six-monthly visit, forms were completed comprising of a practitioner-administered questionnaire, standard clinical assessment and structured case note review. The practitioner-administered questionnaire included demographics, drug use behaviours, receipt of OST, social functioning, mental health (DASS-21) and history of HCV treatment. The clinical assessment and case note review collected information on demographics, HCV, HBV and HIV testing, liver function tests, assessment for HCV treatment initiation, and medical and psychiatric history. Participants were withdrawn from the study if they had not attended the HCV clinic for  $\geq 18$  months.

### *Study assessments and end points*

At enrolment, all participants completed a short form of *The Opiate Treatment Index (OTI)* social functioning scale (Darke et al., 1991; Lawrinson, Copeland, & Indig, 2003). The social functioning short form consists of six questions pertaining to money problems, conflict with partner/spouse, relatives or employer, and living with/time spent with people who use/do not use heroin or other illicit opioids. It has been validated among people recently commencing OST (past three months) recruited from metropolitan and rural drug and alcohol clinics in NSW, Australia (Lawrinson, Copeland, & Indig, 2005). Social functioning scores range from 0 to 18 with higher scores indicating lower social functioning. In unadjusted and adjusted analyses, participants were stratified into higher (score  $\leq 6.0$ ) and lower (score  $> 6.0$ ) social functioning based on the cut-off for the fourth quartile of social functioning scores (score of 6.0).

At enrolment, all participants were asked the following question about their HCV treatment intent; “Do you plan to go onto treatment for hepatitis C in the future?” HCV treatment intent

was described using a five point Likert scale as follows: yes, in the next 12 months; yes, in the next 1–2 years; yes, in the next 2–5 years; yes, but not at least for another 5 years; no, never. In unadjusted and adjusted analyses, participants were stratified into early treatment intent (intent to be treated in the next 12 months) and no early treatment intent (other levels of treatment intent). Participants who were referred to a specialist and attended their appointment were considered assessed for HCV treatment. Participants with a defined date of HCV treatment initiation were considered having received treatment.

### Statistical analysis

Factors hypothesised to be associated with lower social functioning were assessed, and included: age and gender (Richardson et al., 2010; Topp, Iversen, Baldry, & Maher, 2013), current employment status (part-time or full-time employment vs. other) (Aubry, Klodawsky, & Coulombe, 2012), education level (completed high school or higher levels vs. not) (Neale, 2008), housing (stable vs. unstable) (Richardson et al., 2010), living arrangement (living with someone and children vs. living alone, living alone with children, and living with someone and no children) (Blasiolo, Shinkunas, Labrecque, Arnold, & Zickmund, 2006; Kemp, Neale, & Robertson, 2006), OST status (never vs. currently and before but not currently) (Stevens, Radcliffe, Sanders, & Hunt, 2008), injecting drug use (Adlaf, Begin, & Sawka, 2005; Kemp et al., 2006; Richardson et al., 2010), level of risk of alcohol consumption (Fazel, Khosla, Doll, & Geddes, 2008; Kemp et al., 2006; Thompson, Wall, Greenstein, Grant, & Hasin, 2013), and mental health parameters (symptoms of depression, anxiety or stress) (Alavi et al., 2012; Blasiolo et al., 2006; Fazel et al., 2008; Neale, 2001, 2008; Santos, Amorim, Santos, & Barreto, 2015; Stephens, Alpass, Towers, & Stevenson, 2011).

Housing status and injecting drug use were described over the six months prior to study enrolment. Stable housing was defined among people who spent the majority of their nights in a house or flat they rented or owned, in prison/detention centre, or in a psychiatric home/hospital. Unstable housing was defined among people who spent the majority of their nights in other types of housing; including boarding house, hostel/supported accommodation services, alcohol/other drug treatment residence, shelter/refuge, caravan on serviced site, no usual residence/homeless or squat. Injecting drug use was defined by injecting either heroin, morphine (or other opiates), methamphetamine (including all forms), cocaine, and/or benzodiazepine. Additionally, all drugs were analysed separately in unadjusted analyses. High risk alcohol consumption was determined by the *Alcohol Use Disorders Identification Test-Consumption* (AUDIT-C), derived from the first three questions of the full AUDIT (scores higher than three and four indicate high-risk consumption among women and men, respectively) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). Mental health parameters were assessed using the *Depression, Anxiety and Stress Scale* (DASS-21) (Henry & Crawford, 2005). DASS-21 is a 21 item survey consisting of three scales (seven questions each) assessing the severity of the core symptoms of depression, anxiety and stress in the past week. The score ranges from 0 to 42, with increasing score indicating increasing severity. It also categorizes depression, anxiety and stress symptoms into five levels: normal, mild, moderate, severe and extremely severe. Participants with moderate, severe and extremely severe symptoms were compared to those with normal or mild symptoms, for each of the mental health parameters.

Unadjusted and adjusted analyses were performed using logistic regression to evaluate factors independently associated with lower social functioning. Multivariable models were evaluated considering all variables hypothesized to be associated with

social functioning. Depression, anxiety and stress symptoms were evaluated in separate multivariate models. Sensitivity analyses were also performed to include: (1) models adjusted for study site (OST and site could not be included in the same models, given that some sites were specifically OST sites); and (2) most parsimonious models, using a stepwise backwards elimination subject to a likelihood ratio test (with factors considered significant at the 0.20 level in unadjusted analyses). Sociodemographic variables were assessed for collinearity, and for interactions when appropriate.

Unadjusted and adjusted analyses were also performed using logistic regression to evaluate whether housing status, living arrangement and social functioning were independently associated with HCV treatment intent, HCV specialist assessment and HCV treatment uptake. Factors previously shown to be associated with HCV treatment intent, HCV specialist assessment and HCV treatment uptake in the ETHOS study were also assessed, including age, employment, education, OST treatment, benzodiazepine use and HCV genotype (Alavi et al., 2013, 2015). Given that living arrangement was previously shown to be associated with HCV treatment uptake, the associations between living with people and/or children vs. living alone and the outcomes of interest were assessed.

For all analyses, statistically significant differences were assessed at  $P < 0.05$ ;  $P$ -values were two-sided. All analyses were performed using the statistical package *Stata v12.0* (College Station, TX, USA).

## Results

### Study participants

Between 2009 and 2012, 415 patients were enrolled in the ETHOS study. At enrolment, mean age was 41 years-old, 71% ( $n = 295$ ) were male, 91% (378) were unemployed, 18% ( $n = 75$ ) finished high-school, 14% (60) were in unstable housing, 49% ( $n = 202$ ) used injecting drugs in the prior 6 months, 80% ( $n = 332$ ) were currently receiving OST and 42% ( $n = 173$ ) had HCV genotype 1 (Table 1).

### Social functioning

Overall, 24% ( $n = 100$ ) of participants demonstrated lower social functioning (defined by the highest quartile, score  $>6.0$ ). The mean and median social functioning scores were 4.4 (SD, 3.7), and 3.6 (IQR, 1.2–6.0), respectively.

In unadjusted analysis, lower social functioning (score  $>6.0$ ) was associated with unemployment, unstable housing, living alone, recent injecting drug use, moderate to extremely severe levels of depression, anxiety and stress symptoms (Table 2). There was no collinearity or interactions observed between the variables of interest. In model adjusting for age, gender, employment, education, housing, living arrangement, recent injecting drug use, risky alcohol consumption, OST and depression symptoms (Table 2), lower social functioning was associated with unemployment (adjusted odds ratio [aOR] 8.00, 95% CI 1.04–61.68), unstable housing (aOR 2.04, 95% CI 1.07–3.88), recent injecting drug use (aOR 1.97, 95% CI 1.16–3.32) and moderate to extremely severe symptoms of depression (aOR 2.46, 95% CI 1.47–4.12). Similarly, in separate adjusted models, lower social functioning was also associated with moderate to extremely severe symptoms of anxiety (aOR 2.56, 95% CI 1.51–4.36) and stress (aOR 2.65, 95% CI 1.60–4.41). Sensitivity analyses performed using models adjusting for study sites (Supplementary Table 1) and the most parsimonious models (Supplementary Table 2) produced similar results.

**Table 1**Demographic and clinical characteristics of participants with chronic HCV infection and a history of injecting drug use, stratified by social functioning level, in the ETHOS study ( $n=415$ ).

Characteristics, $n$ (%)	Overall ( $n=415$ )	Higher social functioning (score $\leq 6$ , $n=315$ )	Lower social functioning (score $>6.0$ , $n=100$ )
Age, mean ( $\pm$ SD)	40.96 ( $\pm 8.87$ )	41.30 ( $\pm 9.05$ )	39.87 ( $\pm 8.23$ )
Male gender	295 (71)	223 (71)	72 (72)
No part- or full-time employment	378 (91)	279 (89)	99 (99)
Finished high school or higher education	75 (18)	59 (19)	16 (16)
Unstable housing <sup>a</sup>	60 (14)	35 (11)	25 (25)
Living arrangement			
Alone	144 (35)	99 (31)	45 (45)
Alone with children	28 (7)	27 (9)	1 (1)
With someone and children	58 (14)	48 (15)	10 (10)
With someone and no children	184 (44)	141 (45)	43 (43)
Recent drug use (injecting or not) <sup>a</sup>	266 (64)	186 (59)	80 (80)
Heroin use	138 (52)	90 (48)	48 (60)
Morphine use	68 (26)	40 (22)	28 (35)
Methamphetamine use	106 (40)	67 (36)	39 (49)
Cocaine use	24 (9)	12 (6)	12 (15)
Benzodiazepine use	144 (54)	100 (54)	44 (55)
Recent injecting drug use <sup>a</sup>	202 (49)	136 (43)	66 (66)
Heroin injection	137 (68)	91 (67)	46 (70)
Morphine injection	56 (28)	33 (24)	23 (35)
Methamphetamine injected	99 (49)	62 (46)	37 (56)
Cocaine injection	23 (11)	12 (9)	11 (17)
Benzodiazepine injection	14 (7)	8 (6)	6 (9)
High risk alcohol consumption (AUDIT-C)	138 (33)	103 (33)	35 (35)
OST			
Never	57 (14)	49 (16)	8 (8)
Previous, not current	26 (6)	19 (6)	7 (7)
Current	332 (80)	247 (78)	85 (85)
History of treated mental illness			
No	203 (49)	161 (51)	42 (42)
Yes	198 (48)	143 (45)	55 (55)
Unknown	14 (3)	11 (3)	3 (3)
Mental health status (DASS-21) <sup>b</sup>			
Depression symptoms, median (IQR)	12 (4–24)	10 (4–19)	20 (10–30)
Moderate to extremely severe (vs. normal to mild)	195 (47)	128 (41)	67 (67)
Anxiety symptoms, median (IQR)	10 (2–20)	8 (2–18)	16 (8–24)
Moderate to extremely severe (vs. normal to mild)	215 (52)	144 (46)	71 (71)
Stress symptoms, median (IQR)	14 (6–24)	12 (4–22)	22 (12–28)
Moderate to extremely severe (vs. normal to mild)	148 (36)	91 (29)	57 (57)
HCV genotype			
1	173 (42)	130 (41)	43 (43)
2, 3, 4, 6, mixed	202 (49)	156 (50)	46 (46)
Unknown	40 (10)	29 (9)	11 (11)
Early HCV treatment intent	290 (70)	234 (74)	56 (56)
Assessed by a specialist	222 (53)	184 (58)	38 (38)
HCV treatment uptake	111 (27)	94 (30)	17 (17)

<sup>a</sup> In the six months prior to study enrolment.<sup>b</sup> 401 participants answered the DASS-21 questionnaire.

### HCV treatment intent, specialist assessment and treatment uptake

Among the 415 participants enrolled and assessed by a clinic nurse or a general practitioner (Table 1), 70% ( $n=290$ ) had early treatment intent (in the next 12 months), 53% ( $n=222$ ) were assessed by a HCV specialist and 27% ( $n=111$ ) initiated treatment (Table 1).

In unadjusted analysis (Table 3), compared to participants living alone, participants living with someone (both with and without children) were more likely to have early HCV treatment intent and to receive HCV treatment. However, there was no difference between participants living with someone and/or children and those living alone with respect to receiving HCV specialist assessment. Participants with lower social functioning were less likely to have early treatment intent, to be assessed by a specialist and to receive HCV treatment. There was no difference in terms of HCV treatment intent, specialist assessment or treatment uptake between those with unstable and those with stable housing (Table 3). Thus, housing status was not included in adjusted analysis (Table 4).

In adjusted analysis, lower social functioning was associated with reduced early HCV treatment intent (aOR 0.51, 95% CI 0.30–0.84, Table 4) and lower HCV specialist assessment (aOR 0.48, 95% CI 0.29–0.79), but not HCV treatment uptake (aOR 0.76, 95% CI 0.40–1.43). In adjusted analyses, living with someone was associated with HCV treatment uptake (with someone and children: aOR 2.28, 95% CI 1.01–5.14; with someone and no children: aOR 2.36, 95% CI 1.30–4.31), but not early HCV treatment intent. Sensitivity analyses performed using models adjusting for study sites (Supplementary Table 3) and the most parsimonious models (Supplementary Table 4) produced similar results.

### Discussion

This study assessed the role of social functioning and living arrangement on treatment intent, specialist assessment and treatment uptake for HCV infection among a cohort of people who inject drugs (PWID) with HCV infection, recruited from OST and community health clinics between 2009 and 2014 in New South Wales, Australia. Factors independently associated with



**Table 2**

Factors associated with lower social functioning among participants with chronic HCV infection and a history of injecting drug use in the ETHOS study, adjusting for all variables in the final model ( $n=415$ ).

Characteristics	Unadjusted	Model 1 <sup>c</sup>	Model 2 <sup>d</sup>	Model 3 <sup>e</sup>
	OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Age				
Per 10 year increase	0.83 (0.64–1.07)	0.95 (0.70–1.28)	0.97 (0.72–1.31)	0.98 (0.72–1.32)
Gender				
Male (vs. female)	1.05 (0.64–1.73)	0.80 (0.45–1.42)	0.78 (0.44–1.38)	0.78 (0.44–1.38)
Part- or full-time employment				
No (vs. yes)	12.77 (1.73–94.41)	8.00 (1.04–61.68)	7.73 (1.00–59.63)	7.65 (0.97–60.10)
Finished high school or higher education				
No (vs. yes)	1.21 (0.66–2.22)	1.30 (0.67–2.51)	1.29 (0.66–2.51)	1.26 (0.65–2.45)
Housing status <sup>a</sup>				
Unstable (vs. stable)	2.69 (1.52–4.78)	2.04 (1.07–3.88)	2.05 (1.08–3.87)	1.99 (1.05–3.79)
Living arrangement				
With someone and children	1.00	1.00	1.00	1.00
Alone	2.18 (1.01–4.70)	1.50 (0.65–3.46)	1.49 (0.64–3.45)	1.48 (0.64–3.43)
Alone with children	0.18 (0.02–1.46)	0.15 (0.02–1.36)	0.14 (0.02–1.26)	0.17 (0.02–1.54)
With someone and no children	1.46 (0.68–3.14)	1.09 (0.48–2.48)	1.12 (0.49–2.57)	1.18 (0.51–2.70)
Recent injecting drug use <sup>a</sup>				
Yes (vs. no)	2.55 (1.60–4.09) <sup>b</sup>	1.97 (1.16–3.32)	2.12 (1.25–3.58)	2.04 (1.21–3.45)
High risk alcohol consumption (AUDIT-C)				
Yes (vs. no)	1.11 (0.69–1.78)	1.07 (0.62–1.84)	1.08 (0.63–1.84)	1.09 (0.63–1.87)
OST				
Never	1.00	1.00	1.00	1.00
Previous, not current	2.26 (0.72–7.09)	1.85 (0.48–7.16)	1.92 (0.49–7.41)	1.99 (0.51–7.77)
Current	2.11 (0.96–4.63)	1.70 (0.63–4.60)	1.74 (0.65–4.67)	1.65 (0.61–4.46)
Mental health status (DASS-21)				
Depression symptoms				
Moderate to extremely severe (vs. normal to mild)	3.07 (1.89–5.00)	2.46 (1.47–4.12)	–	–
Anxiety symptoms				
Moderate to extremely severe (vs. normal to mild)	3.03 (1.84–5.02)	–	2.56 (1.51–4.36)	–
Stress symptoms				
Moderate to extremely severe (vs. normal to mild)	3.34 (2.08–5.35)	–	–	2.65 (1.60–4.41)

<sup>a</sup> In the six months prior to study enrolment.

<sup>b</sup> Individual ORs (95% CI): heroin, 2.10 (1.32–3.33); morphine, 2.56 (1.42–4.61); methamphetamine, 2.39 (1.46–3.91); cocaine, 3.08 (1.31–7.22); benzodiazepine, 2.41 (0.82–7.12).

<sup>c</sup> Model 1: adjusted for depression symptoms.

<sup>d</sup> Model 2: adjusted for anxiety symptoms.

<sup>e</sup> Model 3: adjusted for stress symptoms.

lower social functioning included unemployment, unstable housing, recent injecting drug use and moderate to extremely severe symptoms of depression, anxiety and stress. Lower social functioning was independently associated with reduced early HCV treatment intent and lower specialist assessment, but not HCV treatment uptake. Living with someone was independently associated with HCV treatment uptake. This study highlights the need for development and implementation of strategies targeting PWID with lower social functioning to enhance HCV treatment intent and specialist assessment, and strategies to ensure appropriate social support when it comes to receiving treatment for HCV. These findings may have important implications in the design and implementation of public health and social programs to enhance access to HCV care and treatment.

Overall, the mean social functioning score in this study was 4.4, with one-quarter of participants having a score >6 (lower social functioning). These results are consistent with a previous validation study of this social functioning score within people receiving OST (mean social functioning score, 5.1) (Lawrinson et al., 2005).

Lower social functioning (score >6.0) was independently associated with unemployment, unstable housing, recent injecting drug use and moderate to extremely severe symptoms of depression, anxiety and stress. These results are not surprising, given that this social functioning scale addresses questions pertaining to money problems, conflict with partner/spouse, relatives or employer, and living with/time spent with people who use/do not use heroin or other illicit opioids (Darke et al., 1991; Richardson et al., 2010). Injecting drug use can have major

consequences on social integration and social functioning among some PWID. Drug use may dictate the lifestyle of some PWID by promoting drug-seeking behaviours, impacting social networks (drug-using networks, and interpersonal conflicts with family and friends), housing, income and employment (Adlaf et al., 2005; Kemp et al., 2006; Richardson et al., 2010). Unemployment is a barrier to housing stability (Aubry et al., 2012; Richardson et al., 2010). In turn, housing instability has been shown to be associated with riskier drug-injecting behaviour and may impact social networks (Johnson & Chamberlain, 2008; Topp et al., 2013). Unstable housing, unemployment, low income and injecting drug use may contribute to an unstable lifestyle, affect mental health status and result in developing symptoms of depression, anxiety and/or stress (Alavi et al., 2012; Boscarino et al., 2015; Braitstein et al., 2005; Golden, O'Dwyer, & Conroy, 2005; Mackesy-Amity, Donenberg, & Ouellet, 2014; Whittaker et al., 2015; Yamini et al., 2011). Further, these factors all contribute to the disadvantage, marginalization and vulnerability among people with lower social functioning.

Lower social functioning was independently associated with reduced early HCV treatment intent and lower specialist assessment. It has been demonstrated that disadvantaged sub-groups of PWID are less likely to seek health care by fear of stigma, discrimination, judgemental attitudes, and misunderstanding of their needs and their lifestyle by healthcare providers (Neale, Tompkins, & Sheard, 2008; Ostertag, Wright, Broadhead, & Altice, 2006). However, when adjusted for other factors, lower social functioning in the current study was not associated with HCV treatment uptake. It is well documented that the quality of the

**Table 3**

Unadjusted analysis of factors associated with early HCV treatment intent, specialist assessment and HCV treatment uptake among participants with chronic HCV infection and a history of injecting drug use in the ETHOS study ( $n=415$ ).

Characteristics	Early HCV treatment intent	Assessed by specialist	HCV treatment uptake
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age			
<35	1.00	1.00	1.00
35–45	2.04 (1.20–3.48)	1.42 (0.88–2.28)	1.79 (1.01–3.16)
≥45	1.13 (0.67–1.90)	2.28 (1.37–3.80)	1.78 (0.98–3.22)
Employment status			
No part- or full-time employment	1.00	1.00	1.00
Part- or full-time employment	1.83 (0.78–4.29)	2.19 (1.05–4.57)	4.20 (2.10–8.39)
Finished high school or higher education			
No	1.00	1.00	1.00
Yes	1.02 (0.59–1.76)	1.95 (1.16–3.30)	2.13 (1.26–3.60)
Benzodiazepine use <sup>a</sup>			
Yes	1.00	1.00	1.00
No	1.34 (0.87–2.08)	1.67 (1.11–2.51)	2.07 (1.26–3.41)
OST			
Current	1.00	1.00	1.00
Previous, not current	1.58 (0.61–4.08)	2.42 (1.02–5.72)	1.98 (0.85–4.64)
Never	4.25 (1.77–10.21)	3.64 (1.89–7.01)	4.79 (2.67–8.61)
HCV genotype			
1	1.00	1.00	1.00
2, 3, 4, 6, mixed	2.00 (1.27–3.16)	1.75 (1.16–2.65)	2.47 (1.54–3.95)
Unknown	0.85 (0.42–1.71)	0.25 (0.11–0.58)	0.10 (0.01–0.79)
Housing status <sup>a</sup>			
Unstable	1.00	1.00	1.00
Stable	1.13 (0.63–2.04)	1.02 (0.59–1.77)	1.56 (0.79–3.06)
Living arrangement			
Alone	1.00	1.00	1.00
Alone with children	1.50 (0.62–3.64)	1.33 (0.59–3.02)	1.67 (0.64–4.36)
With someone and children	2.20 (1.07–4.53)	1.15 (0.62–2.11)	2.25 (1.11–4.57)
With someone and no children	1.74 (1.08–2.79)	1.27 (0.82–1.97)	2.54 (1.49–4.34)
Social functioning			
Higher (score ≤6.0)	1.00	1.00	1.00
Lower (score >6.0)	0.44 (0.27–0.71)	0.44 (0.27–0.69)	0.48 (0.27–0.86)

<sup>a</sup> In the six months prior to study enrolment.

relationship between patient and health professional has a direct impact on engagement in care, including HCV care (Osilla et al., 2009; Swan et al., 2010; Treloar et al., 2010; Treloar, Rance, & Backmund, 2013). As such, a trusted HCV peer-support worker, nurse, or specialist may facilitate addressing patient barriers to HCV care related to social functioning that might be present at the time of treatment contemplation or prior to engagement with an HCV specialist (Treloar, Rance, Dore, & Grebely, 2014). In addition, this interaction might improve knowledge of HCV, and enhance patient trust in the health care system and in their provider. Therefore, a patient with lower social functioning may become more confident in commencing HCV treatment following interaction with a HCV peer-support worker, nurse or specialist. This perhaps explains why lower social functioning was associated with treatment intent and specialist assessment, but not treatment uptake.

Living with someone (both with and without children) was independently associated with HCV treatment uptake. These data are consistent with previous qualitative literature demonstrating that social support is an important factor in facilitating entry into HCV care and treatment (Hopwood & Treloar, 2007). In order to deal with competing priorities, social support is essential throughout the treatment process, either for moral support or technical help. As such, living with someone likely provides important social support that facilitates entry into HCV treatment and assists in addressing issues that may arise during HCV treatment. However, it appears that various steps of the HCV treatment cascade have their own barriers/facilitators, which are important to understand. It should not be assumed that addressing barriers to HCV treatment intent and specialist assessment will necessarily sort out issues later in the cascade (or vice versa).

There are a number of limitations to this study. First, all participants were recruited among PWID attending drug and alcohol clinics and community health centres. Therefore, the study population may be more engaged in health services, resulting in an underestimation of lower social functioning in this population and an overestimation of the proportions with HCV treatment intent, specialist assessment and HCV treatment uptake. That being said, the mean social functioning score was similar to that observed among people currently receiving OST in the original validation study of the social functioning score. Second, several socio-demographic factors were included in the statistical models for this analysis and it is acknowledged that factors not statistically collinear may be clinically correlated. Finally, these findings may not be generalizable to other populations of people with HCV infection, particularly those less engaged in health services.

In summary, we have demonstrated that unemployment, unstable housing, recent injecting drug use and moderate to extremely severe symptoms of depression, anxiety and stress were independently associated with lower social functioning. Further, lower social functioning was associated with reduced early HCV treatment intent and lower specialist assessment, but not HCV treatment uptake. Living with someone (both with and without children) was independently associated with HCV treatment uptake.

This study suggests that variables related to social functioning (e.g. housing, income, social support) are important for influencing decisions around treatment intent and whether to see a specialist, but can be overcome following specialist assessment. However, treatment initiation may require enhanced social support (in this study, living with someone was associated with HCV treatment uptake). As such, practitioners should be educated about the

**Table 4**  
Adjusted analysis of factors associated with early HCV treatment intent, specialist assessment and HCV treatment among participants with chronic HCV infection and a history of injecting drug use in the ETHOS study, adjusting for all variables in the final models ( $n=415$ ).

Characteristics	Early HCV treatment intent	Assessed by specialist	HCV treatment uptake
	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Age			
<35	1.00	1.00	1.00
35–45	2.09 (1.19–3.68)	1.30 (0.77–2.20)	1.79 (0.93–3.43)
≥45	0.96 (0.53–1.73)	1.92 (1.08–3.41)	1.45 (0.72–2.92)
Employment status			
No part- or full-time employment	1.00	1.00	1.00
Part- or full-time employment	1.20 (0.47–3.09)	1.01 (0.45–2.29)	2.52 (1.12–5.68)
Finished high school or higher education			
No	1.00	1.00	1.00
Yes	1.08 (0.60–1.95)	2.11 (1.18–3.77)	2.62 (1.40–4.90)
Benzodiazepine use <sup>a</sup>			
Yes	1.00	1.00	1.00
No	1.16 (0.72–1.87)	1.44 (0.92–2.26)	1.68 (0.97–2.92)
OST			
Current	1.00	1.00	1.00
Previous, not current	1.63 (0.60–4.44)	2.92 (1.14–7.47)	2.06 (0.80–5.33)
Never	4.55 (1.68–12.32)	2.64 (1.29–5.39)	3.46 (1.77–6.75)
HCV genotype			
1	1.00	1.00	1.00
2, 3, 4, 6, mixed	2.01 (1.24–3.27)	1.73 (1.11–2.69)	2.54 (1.51–4.28)
Unknown	1.02 (0.48–2.17)	0.28 (0.11–0.68)	0.10 (0.01–0.86)
Living arrangement			
Alone	1.00	1.00	1.00
Alone with children	1.06 (0.41–2.79)	0.99 (0.39–2.48)	1.22 (0.41–3.68)
With someone and children	1.92 (0.89–4.14)	1.16 (0.58–2.30)	2.28 (1.01–5.14)
With someone and no children	1.44 (0.86–2.39)	1.22 (0.75–1.99)	2.36 (1.30–4.31)
Social functioning			
Higher (score ≤6.0)	1.00	1.00	1.00
Lower (score >6.0)	0.51 (0.30–0.84)	0.48 (0.29–0.79)	0.76 (0.40–1.43)

<sup>a</sup> In the six months prior to study enrolment.

sociodemographic challenges faced by PWID (such as lower social functioning, risky injecting behaviour, employment and housing instability, and stress), and about specific help they can and should provide, such as direct interventions or referrals to appropriate resources that can efficiently address these complex issues. The short form of the OTI social functioning scale seems to be an easy-to-use, efficient tool that could be utilized by practitioners to address social functioning issues and to screen patients receiving OST in need for specific interventions. Peer-support programs (provider-led or peer-led) have also been successful in providing the social support necessary to enhance engagement in HCV care (Crawford & Bath, 2013; Keats et al., 2015; Treloar et al., 2015). They have also been shown to reduce patients' mistrust in the health care system, address barriers to HCV treatment through discussions with workers and peers, and improve knowledge about HCV and treatment (Crawford & Bath, 2013; Keats et al., 2015; Treloar et al., 2015). As such, peer-support models should be further evaluated as a strategy to enhance engagement in HCV care.

An evaluation of various strategies to enhance social functioning and social support prior to and during treatment for HCV infection may be warranted, given their importance in the HCV care cascade.

#### Disclaimer

The findings and views expressed in this publication are those of the authors and do not represent the position of the Australian Government.

#### Financial support

This work was supported by the National Health and Medical Research Council (NHMRC, 568985) and New South Wales Health. The Centre for Social Research in Health is supported by

a grant from the Australian Government Australian Government Department of Health and Ageing. This publication was funded by the Australian Government Department of Health and Ageing. GD and PH are supported through NHMRC Practitioner Fellowships. JG is supported through a NHMRC Career Development Fellowship.

#### Role of the funding source

The corresponding author had full access to all data in the study and had final responsibility for the decision to submit for publication.

#### Conflicts of interest

None of the authors has commercial relationships that might pose a conflict of interest in connection with this manuscript.

#### Acknowledgements

The authors would like to thank the study participants for their contribution to the research, as well as current and past researchers and staff. They would like to acknowledge members of the study group:

*Protocol Steering Committee* – Paul Haber (Chair, University of Sydney), Nicky Bath (New South Wales Users and AIDS Association), Carolyn Day (University of Sydney), Gregory Dore (University of New South Wales), Jason Grebely (University of New South Wales), Claire Honey (NSW Health Department), Murray Krahn (University of Toronto), Mike Lodge (NSW Health Department), Stuart Loveday (Hepatitis C Council of New South Wales, Inc.), Michelle Micallef (University of New South Wales), Hla-Hla Thein (University of Toronto), Carla Treloar (University of New South Wales).

Coordinating Centre – Michelle Micallef (Study Co-ordinator), Maryam Alavi (PhD Student), Gregory Dore (Principal Investigator), Jason Grebely (Co-investigator), Pip Marks (Clinical Trials Manager), Ineke Shaw (Systems Manager), Sharmila Siriragavan (Data Manager) and Mahshid Tamaddon (Data Manager).

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## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.drugpo.2015.06.001>.

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