International Journal of Drug Policy 47 (2017) 51–60

Contents lists available at ScienceDirect

International Journal of Drug Policy

journal homepage: www.elsevier.com/locate/drugpo

Commentary

Research priorities to achieve universal access to hepatitis C prevention, management and direct-acting antiviral treatment among people who inject drugs

Jason Grebely[a,*], Julie Bruneau[b,c], Jeffrey V. Lazarus[d,e], Olav Dalgard[f,E], Philip Bruggmann[g], Carla Treloar[h], Matthew Hickman[i], Margaret Hellard[j], Teri Roberts[k], Levinia Crooks[h,l], Håvard Midgard[f,m,n], Sarah Larney[o], Louisa Degenhardt[o], Hannu Alho[p,q,F], Jude Byrne[r], John F. Dillon[s], Jordan J. Feld[t], Graham Foster[u], David Goldberg[v,w], Andrew R. Lloyd[a], Jens Reimer[x], Geert Robaeys[y,z,A], Marta Torrens[B], Nat Wright[C], Icro Maremmani[G], Brianna L. Norton[D], Alain H. Litwin[D], Gregory J. Dore[a], on behalf of the International Network on Hepatitis in Substance Users

[a] The Kirby Institute, UNSW Sydney, Sydney, Australia
[b] CHUM Research Centre (CRCHUM), Centre Hospitalier de l'Université de Montréal, Montréal, Canada
[c] Department of Family and Emergency Medicine, Faculty of Medicine, Université de Montréal, Montréal, Canada
[d] CHIP, Rigshospitalet, University of Copenhagen, Denmark
[e] Barcelona Institute of Global Health (ISGlobal), Hospital Clínic, Barcelona, Spain
[f] Department of Infectious Diseases, Akershus University Hospital, Lørenskog, Norway
[g] Arud Centres of Addiction Medicine, Zurich, Switzerland
[h] Centre for Social Research in Health, UNSW Sydney, Sydney, Australia
[i] School of Social & Community Medicine, University of Bristol, Bristol, United Kingdom
[j] Disease Elimination Program, Burnet Institute, Melbourne, Australia
[k] Médecins sans Frontières, Geneva, Switzerland
[l] Australasian Society for HIV, Viral Hepatitis and Sexual Health Medicine, Sydney, Australia
[m] Institute for Clinical Medicine, University of Oslo, Norway
[n] Department of Gastroenterology, Oslo University Hospital, Norway
[o] National Drug and Alcohol Research Centre, UNSW Australia, Sydney, Australia
[p] University of Helsinki, Helsinki, Finland
[q] National Institute for Health and Welfare, Helsinki, Finland
[r] Australian Injecting & Illicit Drug Users League, Canberra, Australia
[s] Ninewells Hospital and Medical School, Dundee, United Kingdom
[t] Toronto Centre for Liver Disease, Sandra Rotman Centre for Global Health, University of Toronto, Toronto, Canada
[u] The Liver Unit, Queen Mary University of London, London, United Kingdom
[v] School of Health and Life Sciences, Glasgow Caledonian University, Glasgow, United Kingdom
[w] Health Protection Scotland, Glasgow, United Kingdom
[x] Centre for Interdisciplinary Addiction Research, University Medical Centre Hamburg-Eppendorf, Hamburg, Germany
[y] Department of Gastroenterology and Hepatology, Ziekenhuis Oost Limburg, Genk, Belgium
[z] Department of Hepatology, UZ Leuven, Leuven, Belgium
[A] Faculty of Medicine and Life Sciences, Hasselt University, Hasselt, Belgium
[B] Institute of Neuropsychiatry & Addictions-Hospital del Mar, IMIM (Hospital del Mar Medical Research Institute), Universitat Autònoma de Barcelona, Barcelona, Spain
[C] Spectrum CIC, Wakefield, United Kingdom
[D] Division of General Internal Medicine, Department of Medicine, Albert Einstein College of Medicine and Montefiore Medical Center, Bronx, New York, United States
[E] University of Oslo, Oslo, Norway
[F] Abdominal Center, Helsinki University Hospital, Helsinki, Finland
[G] Santa Chiara University Hospital, University of Pisa, Italy

* Corresponding author at: Viral Hepatitis Clinical Research Program, The Kirby Institute, UNSW Sydney, Australia. Fax: +61 2 9385 0876.
E-mail address: jgrebely@kirby.unsw.edu.au (J. Grebely).

http://dx.doi.org/10.1016/j.drugpo.2017.05.019

ARTICLE INFO

Article history:
Received 11 February 2017
Received in revised form 11 April 2017
Accepted 5 May 2017

Keywords:
HCV
Drug users
Injecting
IFN-free
PWID
DAA

ABSTRACT

Globally, it is estimated that 71.1 million people have chronic hepatitis C virus (HCV) infection, including an estimated 7.5 million people who have recently injected drugs (PWID). There is an additional large, but unquantified, burden among those PWID who have ceased injecting. The incidence of HCV infection among current PWID also remains high in many settings. Morbidity and mortality due to liver disease among PWID with HCV infection continues to increase, despite the advent of well-tolerated, simple interferon-free direct-acting antiviral (DAA) HCV regimens with cure rates >95%. As a result of this important clinical breakthrough, there is potential to reverse the rising burden of advanced liver disease with increased treatment and strive for HCV elimination among PWID. Unfortunately, there are many gaps in knowledge that represent barriers to effective prevention and management of HCV among PWID. The Kirby Institute, UNSW Sydney and the International Network on Hepatitis in Substance Users (INHSU) established an expert round table panel to assess current research gaps and establish futureresearch priorities for the prevention and management of HCV among PWID. This round table consisted of a one-day workshop held on 6 September, 2016, in Oslo, Norway, prior to the International Symposium on Hepatitis in Substance Users (INHSU 2016). International experts in drug and alcohol, infectious diseases, and hepatology were brought together to discuss the available scientific evidence, gaps in research, and develop research priorities. Topics for discussion included the epidemiology of injecting drug use, HCV, and HIV among PWID, HCV prevention, HCV testing, linkage to HCV care and treatment, DAA treatment for HCV infection, and reinfection following successful treatment. This paper highlights the outcomes of the roundtable discussion focused on future research priorities for enhancing HCV prevention, testing, linkage to care and DAA treatment for PWID as we strive for global elimination of HCV infection.

Introduction

Globally, it is estimated that 71.1 million people have chronic hepatitis C virus (HCV) infection (The Polaris Observatory, 2017), including an estimated 7.5 million people who have recently injected drugs (PWID) (Nelson et al., 2011). There is an additional large, but unquantified, burden among those PWID who have ceased injecting (Hajarizadeh, Grebely, & Dore, 2013; Nelson et al., 2011). The incidence of HCV infection among current PWID also remains high in many settings (Morris et al., 2017a; Page, Morris, Hahn, Maher, & Prins, 2013). Morbidity and mortality due to liver disease among PWID with HCV infection continues to increase (Hajarizadeh et al., 2013), despite the advent of well-tolerated, simple interferon-free direct-acting antiviral (DAA) HCV regimens with cure rates >95% (Dore & Feld, 2015). As a result of this important clinical breakthrough, there is potential to reverse the rising burden of advanced liver disease with increased treatment and strive for HCV elimination among PWID and those who have ceased injecting.

Unfortunately, there are many gaps in knowledge that represent barriers to effective prevention and management of HCV among PWID. The Kirby Institute, UNSW Sydney and the International Network of Hepatitis in Substance Users (INHSU) established an expert round table panel to assess current research gaps and establish future research priorities for the epidemiology, prevention, and management of HCV among PWID. This round table consisted of a one-day workshop held on 6 September, 2016, in Oslo, Norway, prior to the International Symposium on Hepatitis in Substance Users (INHSU 2016). International experts in drug and alcohol, infectious diseases, and hepatology were brought together to discuss the available scientific evidence, gaps in research, and develop research priorities. Topics for discussion included the epidemiology of injecting drug use, HCV, and HIV among PWID, HCV prevention, HCV testing, linkage to HCV care and treatment, DAA treatment for HCV infection, and reinfection following successful treatment.

Epidemiology of injecting drug use, HCV, and HIV among PWID

People with a history of injecting drug use include those who report injecting an illicit drug at least once in their life. This population includes people who have permanently ceased injecting; “current” or “recent” injectors (with definitions for “recent” varying in the literature from one month to one year); as well as people who may be considered “occasional” injectors (including people in treatment for drug use disorders, some may be receiving opioid substitution therapy (OST), who have reduced their frequency of, but not entirely ceased, injecting) (Larney et al., 2015). Understanding the size and characteristics of different populations of people who use drugs is crucial for setting research priorities for HCV among PWID.

In 2007, it was estimated that there were 16 million people globally who had injected drugs in the last year (i.e. recent PWID), of whom 3 million were living with HIV infection (Mathers et al., 2008). It was also estimated that 10 million recent PWID have been exposed to HCV infection, 75% of whom have chronic HCV (7.5 million), with an additional large, but unquantified, reservoir of infection among people who have ceased injecting (Nelson et al., 2011). The Global Burden of Disease project attempted to estimate the total burden of HCV due to injecting drug use (including recent and former PWID) (Degenhardt et al., 2016). This modelling estimated that 39% (95% uncertainty interval 31%–43%) of all HCV burden in 2013 was due to HCV acquired via injecting drug use, with global variations that may impact research prioritization. Although these estimates have considerably strengthened epidemiological evidence on HIV and HCV among people who inject drugs, the population estimates are almost a decade old and require updating. The syndemic nature of HCV and HIV infections require approaches which consider both infections. Additionally, there is a need for better data on basic demographic characteristics of people who inject drugs; the prevalence of chronic HCV infection among people who have ceased injecting; and contact of people who inject drugs with systems and settings that may provide opportunities for HCV testing and treatment (e.g. opioid substitution therapy;

amphetamine treatment; drug consumption rooms, and correctional institutions).

Future research priorities on the epidemiology of injecting drug use, HCV, and HIV among PWID include:

1) Updated national, regional and global estimates for the prevalence and numbers of people with a history of injecting drug use, people with recent injecting drug use, and characteristics of these populations (e.g. age; sex; age of injecting initiation and duration of injecting; drugs injected and frequency of injecting; engagement with opioid substitution therapy and the criminal justice system).
2) Updated national, regional and global estimates for the incidence, prevalence, and numbers of people with HCV infection among people with a history of injecting drug use, people with recent injecting drug use, and people with a history of injecting drug use who are receiving opioid substitution therapy or in prison;
3) Updated national, regional and global estimates for the incidence, prevalence, and numbers of people with HIV infection among people with a history of injecting drug use, people with recent injecting drug use, and people receiving opioid substitution therapy or in prison;
4) Evaluate novel methods for improving population estimates of injecting drug use, HIV, and HCV.

Prevention of primary HCV infection

HCV incidence remains high in many settings (Hagan, Pouget, Des Jarlais, & Lelutiu-Weinberger, 2008; Morris et al., 2017a; Page et al., 2013; Wiessing et al., 2014), particularly in the first several years of injecting (Hagan et al., 2008; Roy, Boudreau, & Boivin, 2009), and ongoing HCV transmission is a major issue among PWID, with variations globally.

There is no HCV vaccine, either currently or readily foreseeable. A mathematical model recently suggested that a partially effective vaccine, used as primary prevention or after HCV treatment, could have a substantial effect on reducing HCV prevalence in recent PWID with high baseline HCV prevalence (Scott et al., 2015). Combined OST and high-coverage needle and syringe programs (NSP, often defined as >100% of total injections performed using a sterile needle/syringe) can reduce HCV incidence by up to 80% (Degenhardt et al., 2010; Hagan, Pouget, & Des Jarlais, 2011; MacArthur et al., 2014; Turner et al., 2011; van den Berg et al., 2007), with data suggesting that OST alone can also reduce HCV transmission (Aspinall et al., 2014; Grebely et al., 2015; Nolan et al., 2014; Tsui, Evans, Lum, Hahn, & Page, 2014; White, Dore, Lloyd, Rawlinson, & Maher, 2014). Less than 1% of prisons globally provide NSP and given the over-representation of people living with hepatitis C and PWID (Dolan, et al., 2016), makesthis setting a priority for prevention activities. Data from mathematical modelling studies suggest that HCV treatment for PWID can lead to substantial reductions in HCV prevalence and reduce transmission (de Vos, Prins, & Kretzschmar, 2015; Hellard et al., 2014; Martin, Hickman, Hutchinson, Goldberg, & Vickerman, 2013; Martin et al., 2011; Martin, Vickerman et al., 2013), particularly when combined with OST and NSP (Martin, Hickman, et al., 2013). However, global coverage of OST and NSP interventions is low (Mathers et al., 2010). Further, given the potential prevention benefits, both interferon-based and interferon-free HCV treatment among PWID is cost-effective (Martin et al., 2016, 2012; Williams et al., 2014). As per international guidelines, given PWID are at a high risk of HCV transmission and HCV treatment resulting in cure eliminates infectiousness and may yield transmission reduction benefits, PWID are a high priority for treatment (AASLD/IDSA, 2015; EASL, 2016; Grebely, et al., 2015; WHO, 2014).

Future research priorities on the prevention of HCV infection among PWID include:

1) Improved national, regional and global data on provision of HCV prevention interventions for PWID including NSPs, OST, and other drug treatments;
2) Evaluation of the effectiveness and cost-effectiveness of HCV prevention intervention scale-up for PWID (including NSP, OST, HCV treatment);
3) Evaluation of novel interventions for HCV prevention among PWID, particularly among people who are not opioid dependent (e.g. stimulant users), recent initiates to injecting and females, and including peer-led interventions;
4) Implementation research to evaluate the implementation, effectiveness and scale-up of existing HCV prevention interventions for PWID, including OST, needle exchange programs and treatment as prevention, and factors associated with favorable outcomes;
5) Evaluation of HCV vaccine candidates among PWID, and their potential effect on HCV prevention;
6) Identifying successful and unsuccessful implementation and policy frameworks for harm reduction.

HCV testing

Simple, tolerable, and effective DAA HCV therapies have eliminated interferon as a major barrier to HCV scale-up in PWID and dramatically simplified diagnostic and monitoring needs (Cohn, Roberts, Amorosa, Lemoine, & Hill, 2015). However, in order for these therapies to have an effect at a population level (Grebely & Dore, 2014), targeted interventions to enhance HCV testing, linkage to care, and treatment ("the HCV care cascade") are needed.

Globally, HCV testing and diagnosis remains inadequate (Bruggmann et al., 2014; Lazarus, Sperle, Spina, & Rockstroh, 2016; Liakina et al., 2015; Saraswat et al., 2015). Potential strategies to improve HCV testing include education and counseling by health professionals with on-site HCV testing (Cullen et al., 2006; Lacey, Ellen, Devlin, Wright, & Mijch, 2007; Meyer et al., 2015; Rosenberg et al., 2010; Sahajian et al., 2011; Zhou et al., 2016), physical and electronic medical chart reminders to prompt targeted risk-based assessment and testing (Drainoni et al., 2012; Krauskopf et al., 2014; Litwin et al., 2012; Meyer et al., 2015; Zhou et al., 2016), and simplified testing, including dried blood spot testing (Abou-Saleh, Rice, & Foley, 2013; Coats & Dillon, 2015; Craine, O'Toole, D'Arcy, & Lyons, 2009; Hickman et al., 2008; McLeod et al., 2014; Meyer et al., 2015; Tait, Stephens, McIntyre, Evans, & Dillon, 2013; Zhou et al., 2016), and point-of-care HCV testing (Beckwith et al., 2016; Bottero et al., 2015; Morano et al., 2014).

Benefits of finger-stick capillary dried blood spot testing are that: 1) serological testing can be linked to reflex virological testing for HCV confirmation using additional spots from the same filter paper, thus enabling a definitive diagnosis without the need for the person to return for re-sampling; 2) capillary blood sampling avoids the need for phlebotomy, a major advantage where venous access is difficult or where phlebotomy services are unavailable, and 3) dried blood spots are stable once dried and easy to transport, thus providing a convenient sampling solution in resource limited settings with long transport times and high temperatures. Poor venous access is a major barrier for obtaining phlebotomy among PWID (Day et al., 2008) and is often a reason why PWID do not present for testing. However, finger-stick dried blood spot HCV testing has been shown to be highly acceptable among PWID (White et al., 2008).

Although finger-stick dried blood spot testing enhances HCV testing (Abou-Saleh, et al., 2013; Coats & Dillon, 2015; Craine et al., 2009; Hickman et al., 2008; McLeod et al., 2014; Meyer et al., 2015; Tait et al., 2013; Zhou et al., 2016), collection cards need to be sent somewhere for testing at centralized diagnostic laboratories requiring people to come back for a second visit to receive their result. Among HIV-infected gay and bisexual men, innovative approaches using on-line ordering with self-collected dried blood spot testing simplifies testing and improves access to marginalized populations (Terrence Higgins Trust, 2016).

Finger-stick (Jewett et al., 2012; Smith, Drobeniuc et al., 2011; Smith, Teshale et al., 2011; Wong et al., 2014) or oral saliva (Drobnik et al., 2011; Jewett et al., 2012; Smith, Drobeniuc et al., 2011; Smith, Teshale et al., 2011) point-of-care HCV tests are available, but currently these tests only measure HCV antibody (previous exposure), few have received WHO prequalification and do not measure HCV RNA (active infection) although capillary blood-based virological tests are in development. A major advantage of point-of-care testing is the ability to provide an immediate result, education about HCV prevention, and linkage to care for drug user health (e.g. needle and syringe programs) and HCV, thus reducing loss to follow-up — especially in higher risk groups. Given that 25% of people spontaneously clear HCV infection (Grebely et al., 2014), it is crucial to move towards testing for active HCV infection. Novel point-of-care HCV RNA platforms are under development which would enable HCV RNA confirmation and diagnosis in a single visit (UNITAID, 2015); it is hoped that the first of these (Xpert HCV Viral Load) received WHO prequalification in 2017. In one study, a good sensitivity and specificity of the Xpert HCV Viral Load test for HCV RNA detection in finger-stick samples was observed among people attending drug health and homelessness services in Australia (Grebely et al., 2017a; McHugh et al., 2017). Point-of-care HCV RNA assays might provide an important tool to enhance HCV testing, but further studies are needed to evaluate the performance of novel assays in different settings and populations.

In addition to existing high-throughput, laboratory-based platforms, simplified HCV diagnostics using HCV core antigen are also under development and may serve as an alternative to HCV RNA testing, particularly in low- and middle-income settings, and as a one-step diagnostic for high prevalence contexts, such as testing services for PWIDs (Cohn et al., 2015; Duchesne et al., 2017; Freiman et al., 2016; Lamoury et al., 2017; UNITAID, 2015). Obviating the need for serological screening will also benefit HIV-coinfected people, where the accuracy of HCV serology can be significantly compromised. Thus, moving forward, the key will be to have a low-cost, rapid (results in <60 min) point-of-care test to detect active infection (either through core antigen or HCV RNA) facilitating linkage to HCV care in a single visit.

HCV genotyping may also represent a potential barrier in many settings. As we move into the era of pan-genotypic DAA therapies, HCV genotyping may become less important, but it remains a critical barrier in countries where less expensive drug options are likely to require such testing for the foreseeable future.

Another key issue that needs to be addressed is whether increasing HCV testing translates into increased treatment uptake and the circumstances, be the type of test or the locations and circumstances in which testing occurs. To date, the evidence that links increased testing to increased treatment is very limited and of poor quality.

Future research priorities for HCV testing among PWID include:

1) Identification of barriers and facilitators associated with HCV antibody and RNA testing at the levels of the patient, provider and system;
2) Scale-up and evaluation of strategies that have previously been demonstrated to be effective in increasing HCV testing, including the assessment of whether increased testing translates into increased uptake of HCV treatment;
3) Evaluation of HCV testing coverage and testing frequency;
4) Evaluation of novel strategies to enhance HCV testing and subsequent treatment uptake;
5) Evaluation of commercial serological and virological tests using dried blood spot collection (including publishing instructions for use and application for regulatory approval and WHO prequalification for this sample type);
6) Evaluation of novel point-of-care assays (e.g. core antigen and HCV RNA, APRI) that are highly sensitive, highly specific, simple, quick, and inexpensive on testing and treatment uptake.

Linkage to HCV care and treatment

Linkage to HCV care and treatment also remains inadequate internationally (Bruggmann et al., 2014; Liakina et al., 2015; Saraswat et al., 2015). Simplified HCV testing, including dried blood spot testing (McAllister et al., 2014) and point-of-care HCV testing (Bottero et al., 2015; Morano et al., 2014) has been shown to facilitate linkage to HCV care. Other strategies that have been demonstrated to facilitate linkage to HCV care and treatment include, non-invasive liver disease screening using transient elastography (FibroScan®) with facilitated referral to care (Foucher et al., 2009; Marshall et al., 2015; Moessner et al., 2011), integrated HCV care (Cullen et al., 2006; Evon et al., 2011; Ho et al., 2015; Knott et al., 2006; Masson et al., 2013; Zhou et al., 2016), patient navigation programs (Falade-Nwulia et al., 2016; Trooskin et al., 2015), and telemedicine (Arora et al., 2011; Lloyd et al., 2013; Mashru, Kirlew, Saginur, & Schreiber, 2017; Tahan, Almashhrawi, Kahveci, Mutrux, & Ibdah, 2016).

There is evidence that different models of care are effective for linkage of PWID to HCV care and treatment including in hospital-based specialist clinics, community health centres, drug and alcohol clinics, prisons, needle and syringe programs, and primary care (Bruggmann & Litwin, 2013). The common theme from this spectrum of HCV care models is that “one size does not fit all”. Models of care which provide on-site HCV care in venues where PWID are already accessing services are important (Bruggmann & Litwin, 2013). When barriers are systematically addressed within a supportive environment, HCV assessment and treatment among PWID can be very successful. Furthermore, given the high prevalence of HIV/HCV co-infection among PWID with HCV (Platt, Easterbrook et al., 2016), there is an important opportunity for linkage to both HIV and HCV care. Lastly, with the availability of simple, well-tolerated DAA therapies, the expansion of HCV care to general practitioners and other non-hospital settings will be essential for achieving broad access to HCV care and treatment for PWID.

Future research priorities on linkage to HCV care and treatment among PWID include:

1) Determine national, regional and global estimates for HCV testing, linkage to care, and treatment (e.g. cascades of care) among populations of PWID;
2) Enhanced surveillance of HCV testing, linkage to care, and treatment among populations of PWID in order to monitor the progress of targeted interventions;
3) Evaluation of PWID sub-populations (e.g. sex, recent injectors, etc.) and co-morbidities (e.g. HIV) where there are gaps in HCV testing, linkage to care and treatment;

4) Evaluation of DAA treatment access and reimbursement restrictions (e.g. fibrosis stage, drug/alcohol use, and prescriber type);
5) Identification of barriers and facilitators associated with linkage to HCV care and treatment at the levels of the patient, provider and system;
6) Identifying health care provider attitudes to taking on HCV prevention, treatment and care;
7) Evaluation of the scale-up of strategies that have been demonstrated to be effective in improving linkage to HCV care and treatment;
8) Evaluation of novel strategies and models of care (including primary care, prisons, harm reduction services, peer-based services, and other existing settings where PWID are already accessing services) to enhance HCV care and treatment.

DAA treatment for HCV infection

The availability of tolerable, highly effective all-oral DAA regimens has overcome the barrier posed by poor tolerability of interferon-based therapy, providing an important tool to achieve scale-up of HCV therapy in PWID.

Among people receiving OST with no recent illicit drug use, post-hoc analyses of phase II and III trials of DAA therapy have demonstrated that treatment completion, adherence, and sustained virological response (SVR) are similar to those not receiving OST (Dore et al., 2016; Feld et al., 2014; Grebely et al., 2016a,b; Grebely et al., 2017b,c; Lalezari et al., 2015; Puoti et al., 2014; Zeuzem et al., 2015).

Data on DAA treatment outcomes among people receiving OST with recent illicit drug use are now available from the Co-STAR study (Dore, Altice et al., 2016). Treatment-naïve individuals with HCV genotype 1/4/6 infection receiving "stable" OST (>80% adherence to OST appointments in the last three months) were enrolled (recent drug use did not exclude study participation) and treated with elbasvir/grazoprevir for 12 weeks. Overall, 96% completed therapy, and >96.5% were >95% adherent (Dore, Altice et al., 2016), comparable to trials in non-drug users. Importantly, drug use at baseline (62% all, 47% non-cannabinoids) and during treatment (60% all, 47% non-cannabinoids) did not impact SVR (Dore, Altice et al., 2016), however, several cases of early post-treatment HCV reinfection reduced the SVR12 rate from 95% (without counting reinfection as treatment failure) to 91%. HCV reinfection follow-up is ongoing (for three years), but preliminary evidence indicates a declining HCV reinfection incidence (Dore, Grebely et al., 2016).

Among people with a history of injecting drug use with and without recent drug use, real-world studies of DAA therapy have demonstrated treatment completion of 93-100% and SVR of 80-96% (Bouscaillou et al., 2017; Conway et al., 2016; Mason et al., 2017; Morris et al., 2017b; Norton et al., 2016; Read et al., 2017; Sulkowski et al., 2017). Although some studies have demonstrated lower SVR in intent-to-treat analyses than observed in phase III clinical trials, the majority of non-response has occurred as a result of lost to follow-up between ETR and SVR12 and not virological failure or relapse (Mason et al., 2017; Morris et al., 2017b; Read et al., 2017). In modified intent-to-treat analyses excluding individuals lost to follow-up between ETR and SVR, SVR12 of 91% have been observed (Mason et al., 2017; Morris et al., 2017b; Read et al., 2017). These data suggest that the period between ETR and SVR12 is an important time for maintaining engagement in post-treatment care and follow-up. Importantly, drug use prior to or during therapy does not have an impact on SVR (Mason et al., 2017; Norton et al., 2016; Read et al., 2017). However, study populations vary with respect to the proportion with recent drug use or injecting drug use, the definitions used to define recent drug use (vary from 1-12 months), and some studies do not report information on recent drug use.

Among people with recent injecting drug use, there are now several studies evaluating outcomes following DAA therapy. In a study of 174 participants with injecting drug use in the last year (63% with cirrhosis, 37% with previous treatment experience, 58% genotype 1), 95% completed therapy and 93% achieved SVR (Boglione et al., 2017). The SIMPLIFY study was the first international trial that evaluated DAA therapy in people with recent injecting drug use (Grebely et al., 2017d). People with HCV genotypes 1-6 with injecting drug use in the last six months received sofosbuvir and velpatasvir for 12 weeks. Overall, among 103 participants (58% receiving OST and 74% with injecting drug use in the last 30 days at screening), 96% (99 of 103) completed treatment and all persons who completed treatment had an end of treatment response (100%, 99 of 99). In an intent-to-treat analysis including all people due for follow-up, 96% had an ETR (99/103) and 94% had an SVR (96/102), with no virological failures, and one virological relapse/reinfection (sequencing ongoing). These data provide strong support for DAA treatment among people with recent injecting drug use..

Future research priorities on DAA HCV treatment among PWID include:

1) Evaluation of outcomes following DAA therapy among PWID (clinical trials and "real-world") and factors associated with non-response (including ongoing drug and alcohol use);
2) Evaluation of outcomes in specific PWID populations (e.g. recent injectors, methamphetamine users, HIV/HCV co-infection);
3) Evaluation of completion and adherence to therapy ("real-world");
4) Evaluation of strategies to enhance completion, adherence, and response to therapy;
5) Evaluation of HCV resistance and impact on subsequent response to therapy;
6) Evaluation of post-treatment care (including drug user health and other medical co-morbidities);
7) Evaluation of the impact of DAA therapy on alcohol and drug use behaviours;
8) Evaluation of interventions to enhance education and training for practitioners to enhance competencies in HCV testing, linkage to care and treatment and the field of drug and alcohol.

Reinfection following successful treatment

Ongoing risk behaviours following successful HCV therapy and lack of adequate coverage of harm reduction interventions (e.g. NSP and OST) may lead to reinfection and compromised treatment outcomes (Cunningham, Applegate, Lloyd, Dore, & Grebely, 2015; Midgard et al., 2016). The incidence of HCV reinfection following successful interferon-based treatment among PWID ranges from 0.0 to 5.3/100 person-years (Aspinall et al., 2013; Cunningham et al., 2015; Midgard et al., 2016; Pineda et al., 2015; Simmons, Saleem, Hill, Riley, & Cooke, 2016; Weir et al., 2016; Young et al., 2017). These differences mainly reflect heterogeneity in study populations with regards to sample size, risk behaviours definitions, study designs, and applied virological methods (Cunningham et al., 2015; Midgard et al., 2016). In one recent study of HIV/HCV co-infected PWID, high frequency injection drug use (cocaine and methamphetamines) were at greatest risk of becoming reinfected (Young et al., 2017). In a systematic review and meta-analysis of HCV reinfection among PWID following interferon-based therapy, the pooled estimate of reinfection was 2.2/100 person-years (95% CI, 0.9–6.1) overall and 6.4/100 person-years (95% CI, 2.5–16.7) among individuals who reported injection

drug use after treatment-induced HCV clearance (Aspinall et al., 2013). In a further meta-analysis performed by Simmons et al. (2016) in settings of interferon-based therapy, the HCV reinfection rate was 0.0 per 100 person-years (95% CI, 0.0–0.0) in "low-risk" populations with HCV mono-infection, 1.9 (1.1–2.8) per 100 person-years in PWID or prisoners with HCV mono-infection and 3.2 (0.0–12.3) per 100 person-years in those with HIV/HCV co-infection (Simmons et al., 2016). In the only study of reinfection post-DAA therapy, spontaneous clearance of HCV reinfection was observed in three of six cases, suggesting some degree of partial immunity against reinfection (Dore, Grebely et al., 2016). With the advent of new tolerable DAA treatments and the increasing number of current and recent PWIDs actively seeking and getting treatment, the incidence of HCV reinfection and natural history of reinfection has to be further documented. Also, studies are needed to assess the appropriate frequency of HCV monitoring post-treatment among PWID.

Future research priorities on reinfection following successful treatment among PWID include:

1) Evaluation of the long-term rate of HCV reinfection following successful HCV therapy among recent PWID and factors associated with reinfection (including the frequency of injecting drug use and type of drugs used);
2) Evaluation of the optimal frequency of HCV monitoring for detection of reinfection following treatment completion;
3) Understanding the immunological, genetic and behavioural factors which provide protection against infection and/or reinfection;
4) Evaluation of the effects of harm reduction interventions developed for the prevention of primary infection on the rate of HCV reinfection;
5) Evaluation of patient attitudes towards reinfection and risk avoidance following during and following successful DAA therapy;
6) Evaluation of novel interventions for the prevention of HCV reinfection and strategies for intervention scale-up.

Approach to these research priorities

A further consideration is the methods chosen to address these identified research priorities. This expert panel identified that a multi-disciplinary and multi-method approach is appropriate for these research priorities. In particular, the expertise and insight that can be drawn from social science and from direct involvement of the affected communities was highlighted as best and appropriate practice to optimise investment in HCV research.

Each of the research priorities posed across topics benefits from the involvement of social science expertise and methods. There is a rich tradition of qualitative social science work in HCV that has helped to shape the sector's understandings of the ways in which people who inject drugs understand the virus (Rhodes & Treloar, 2008), negotiate HCV (Mateu-Gelabert et al., 2007) and other risks and make decisions about care and treatment (Brener, Horwitz, von Hippel, Bryant, & Treloar, 2015). Further, qualitative social research has helped to unpack the ways in which new models of care are implemented and experienced by consumers and providers (Harris, Rhodes, & Martin, 2013; Treloar & Rance, 2014). A key theme across this work has been the stigma associated with HCV and the impact of this on all aspects of the HCV care and treatment cascade (Hopwood, Treloar, & Bryant, 2006; Paterson, Hirsch, & Andres, 2013), as well as on the everyday lives of people living with HCV (Zickmund, Ho, Masuda, Ippolito, & LaBrecque, 2003). A key issues in the stigma literature is to ensure that we engage, including within our research, with the structural elements that shape perceptions of HCV and people who inject drugs and avoid individualising these factors to an issue of knowledge, attitude or practice (Harris & Rhodes, 2013; Paterson, Backmund, Hirsch, & Yim, 2007). With DAAs, additional new questions arise around people's expectations of treatment (Harris, 2017), supporting people to avoid reinfection as well as the impact of HCV cure on individual's sense of self and identity (Rance & Treloar, 2014).

INHSU supports the position of the International Network of People who Use Drugs (INPUD) in requiring genuine engagement of affected communities in research and care provision: "nothing about us without us" (Canadian HIV/AIDS Legal Network, 2005). The experience of injecting drug use and living with HCV are significantly impacted by prohibition and criminalisation mistrust of health systems and fear of discrimination, among other things. These are experiences which would typically not be shared by those who design and deliver HCV services or those who undertake research. It is essential that affected communities are closely involved in all phases of research so that the questions posed, methods used and interpretations drawn are authentic to their experiences and not at the mercy of researchers' assumptions or misconceptions. Besides the impact on research quality, INHSU recognises that close involvement of affected communities is also aligned with ethical and human rights frameworks (Fry, Madden, Brogan, & Loff, 2006; Harris, Albers, & Swan, 2015).

INHSU has strived to meaningfully involve the community in scientific dissemination, and education efforts. Examples of effective community involvement include the coordination of a community day led by community-based drug user organizations preceding the INHSU Symposium, and active inclusion of the community in program development, invited plenaries and the chairing of sessions. INHSU has also partnered with community-based organizations on community-led projects focused on HCV education and training and health promotion materials for PWID. The involvement of community members early in research design (through involvement in grant applications) and governance (through involvement on protocol steering committees) are concrete examples of how PWID can be meaningfully involved in research.

Conclusion

The high burden of HCV infection among populations of PWID poses challenges for the implementation of evidence-based, best practice guidelines to shape the priorities that are identified for research. A key underpinning to research in each area of epidemiology, prevention, testing, linkage to care, treatment outcomes and reinfection is the prohibition that surrounds injecting drug use around the globe. Hence, a research question that is relevant to each area is the impact of policies and regulations from the health or other sector that impact on the implementation or achievement of scale of any program. Understanding successful and unsuccessful implementation efforts and the policy context in which these occur is necessary as policies related to PWID are subject to political and other influences (Fischer et al., 2007; Nutt, King, & Phillips, 2010; Wodak, Ritter, & Watson, 2002).

Achieving the HCV elimination targets set forth by the World Health Organization (WHO, 2016) among people who inject drugs will require continued research to inform policy and clinical practice. This paper highlights future research priorities to achieve universal access to hepatitis C prevention, management and direct-acting antiviral treatment among people who inject drugs. Despite the opinions of some people that the problem of HCV has been "solved", DAA therapies only provide us the tools to work towards HCV elimination and our job is far from over.

Financial support

The Kirby Institute is funded by the Australian Government Department of Health. The National Drug and Alcohol Research Centre at UNSW Australia is supported by funding from the Australian Government under the Substance Misuse Prevention and Service Improvements Grant Fund. The views expressed in this publication do not necessarily represent the position of the Australian Government. JG is supported by a National Health and Medical Research Council Career Development Fellowship. LD is supported by an NHMRC Principal Research Fellowship (1041742). MaHe is supported by a National Health and Medical Research Council Principal Researcher Fellowship. GD is supported by a National Health and Medical Research Council Practitioner Research Fellowship. MaHi has received funding from NIHR Health Protection Research Unit in Evaluation.

Disclosures

JG is a consultant/advisor and has received research grants from Abbvie, Bristol Myers Squibb, Cepheid, Gilead Sciences and Merck. PB has served as advisor and speaker for, and has received project and research grants from AbbVie, BMS, Gilead, Merck, and Mundipharma. JVL is a consultant/advisor for Gilead Sciences and MSD and has received research grants from AbbVie and Gilead Sciences. MaHe received investigator initiated research grant support from Abbvie, Bristol Myers Squibb, and Gilead Sciences. MaHi is a consultant /adviser for AbbVie, Gilead, and MSD. OD is a consultant/advisor and has received research grants from Abbvie, Gilead Sciences and Merck. GD is a consultant/advisor and has received research grants from Abbvie, Bristol Myers Squibb, Cepheid, Gilead, Janssen, Merck, and Roche. MT is a consultant/advisor for Gilead Sciences and MSD. AHL has served as an advisor to Abbvie, BMS, Gilead, Janssen, and Merck and has received research grants from Gilead and Merck. JR is a consultant/adviser and/or received research grants from AbbVie, Bristol Myers Squibb, Gilead, Janssen Cilag and MSD. MT, is a consultant/advisor for Gilead Sciences and MSD. JD has recieved honoraria for lectures and research grants from Roche, Janssen, Gilead, BMS and Merck. LD has received untied educational grant funding from Mundipharma, Indivior and Reckitt Benckiser. SL has received untied educational grant funding from Indivior. JB is a consultant/advisor for Gilead Sciences and MSD. HM has been a advisor and speaker for Gilead, Abbvie and Merck.

References

AASLD/IDSA (2015). *Recommendations for testing, managing, and treating hepatitis C*. Retrieved January 18 2015 www.hcvguidelines.org.

Abou-Saleh, M. T., Rice, P., & Foley, S. (2013). Hepatitis C testing in drug users using the dried blood spot test and the uptake of an innovative self-administered DBS test. *Addictive Disorders & Their Treatment*, *12*, 40–49.

Arora, S., Thornton, K., Murata, G., Deming, P., Kalishman, S., Dion, D., et al. (2011). Outcomes of treatment for hepatitis C virus infection by primary care providers. *The New England Journal of Medicine*, *364*, 2199–2207.

Aspinall, E. J., Corson, S., Doyle, J. S., Grebely, J., Hutchinson, S. J., Dore, G. J., et al. (2013). Treatment of hepatitis C virus infection among people who are actively injecting drugs: A systematic review and meta-analysis. *Clinical Infectious Diseases*, *57*(Suppl. 2), S80–S89.

Aspinall, E. J., Weir, A., Sacks-Davis, R., Spelman, T., Grebely, J., Higgs, P., et al. (2014). Does informing people who inject drugs of their hepatitis C status influence their injecting behaviour? Analysis of the Networks II study. *International Journal of Drug Policy*, *25*, 179–182.

Beckwith, C. G., Kurth, A. E., Bazerman, L. B., Patry, E. J., Cates, A., Tran, L., et al. (2016). A pilot study of rapid hepatitis C virus testing in the Rhode Island Department of Corrections. *Journal of Public Health*, *38*, 130–137.

Boglione, L., Mornese Pinna, S., De Nicolo, A., Cusato, J., Cariti, G., Di Perri, G., & D'Avolio, A. (2017). Treatment with direct-acting antiviral agents of hepatitis C virus infection in injecting drug users: A prospective study. *Journal of Viral Hepatitis*. http://dx.doi.org/10.1111/jvh.12711[Epub ahead of print].

Bottero, J., Boyd, A., Gozlan, J., Carrat, F., Nau, J., Pauti, M. D., et al. (2015). Simultaneous human immunodeficiency virus-hepatitis B-hepatitis C point-of-care tests improve outcomes in linkage-to-care: Results of a randomized control trial in persons without healthcare coverage. *Open Forum Infectious Diseases*, *2*, ofv162. http://dx.doi.org/10.1093/ofid/ofv162. eCollection.

Bouscaillou, J., Kikvidze, T., Butsashvili, M., Labartkava, K., Inaridze, I., Etienne, A., Kamkamidze, G., Gamezardashvili, A., Avril, E., & Luhmann, N. (2017). Effectiveness of DAA-based treatment of HCV in active people who inject drugs living in middle income countries (MIC): the results of a prospective cohort study in Tbilisi, Georgia. *Journal of Hepatology*, *66*, S409.

Brener, L., Horwitz, R., von Hippel, C., Bryant, J., & Treloar, C. (2015). Discrimination by health care workers versus discrimination by others: Countervailing forces on HCV treatment intentions. *Psychology, Health & Medicine*, *20*, 148–153.

Bruggmann, P., Berg, T., Ovrehus, A. L., Moreno, C., Brandao Mello, C. E., Roudot-Thoraval, F., et al. (2014). Historical epidemiology of hepatitis C virus (HCV) in selected countries. *Journal of Viral Hepatitis*, *21*(Suppl. 1), 5–33.

Bruggmann, P., & Litwin, A. H. (2013). Models of care for the management of hepatitis C virus among people who inject drugs: One size does not fit all. *Clinical Infectious Diseases*, *57*(Suppl. 2), S56–S61.

Canadian HIV/AIDS Legal Network (2005). *Nothing about us without us, greater, meaningful involvement of people who use illegal drugs: A public health, ethical, and human rights imperative*. Toronto: Canadian HIV/AIDS Legal Network.

Coats, J. T., & Dillon, J. F. (2015). The effect of introducing point-of-care or dried blood spot analysis on the uptake of hepatitis C virus testing in high-risk populations: A systematic review of the literature. *International Journal on Drug Policy*, *26*, 1050–1055.

Cohn, J., Roberts, T., Amorosa, V., Lemoine, M., & Hill, A. (2015). Simplified diagnostic monitoring for hepatitis C, in the new era of direct-acting antiviral treatment. *Current Opinion in HIV and AIDS*, *10*, 369–373.

Conway, B., Raycraft, T., Bhutani, Y., Kiani, G., Shahi, R., Singh, A., & Alimohammadi, A. (2016). Efficacy of all-oral HCV therapy in people who inject drugs. *Hepatology*.

Craine, N., Parry, J., O'Toole, J., D'Arcy, S., & Lyons, M. (2009). Improving blood-borne viral diagnosis; clinical audit of the uptake of dried blood spot testing offered by a substance misuse service. *Journal of Viral Hepatitis*, *16*, 219–222.

Cullen, W., Stanley, J., Langton, D., Kelly, Y., Staines, A., & Bury, G. (2006). Hepatitis C infection among injecting drug users in general practice: A cluster randomised controlled trial of clinical guidelines' implementation. *British Journal of General Practice*, *56*, 848–856.

Cunningham, E. B., Applegate, T. L., Lloyd, A. R., Dore, G. J., & Grebely, J. (2015). Mixed HCV infection and reinfection in people who inject drugs—impact on therapy. *Nature Reviews Gastroenterology & Hepatology*, *12*, 218–230.

Day, C. A., White, B., Thein, H. H., Doab, A., Dore, G. J., Bates, A., et al. (2008). Experience of hepatitis C testing among injecting drug users in Sydney, Australia. *AIDS Care*, *20*, 116–123.

de Vos, A. S., Prins, M., & Kretzschmar, M. E. (2015). Hepatitis C virus treatment as prevention among injecting drug users: Who should we cure first? *Addiction*, *110*(6), 975–983. http://dx.doi.org/10.1111/add.12842. Epub 2015 Feb 8.

Degenhardt, L., Charlson, F., Stanaway, J., Larney, S., Alexander, L. T., Hickman, M., et al. (2016). Estimating the burden of disease attributable to injecting drug use as a risk factor for HIV, hepatitis C, and hepatitis B: Findings from the Global Burden of Disease Study 2013. *Lancet Infectious Diseases*, *16*, 1385–1398.

Degenhardt, L., Mathers, B., Vickerman, P., Rhodes, T., Latkin, C., & Hickman, M. (2010). Prevention of HIV infection for people who inject drugs: Why individual, structural, and combination approaches are needed. *The Lancet*, *376*, 285–301.

Dolan, K., Wirtz, A. L., Moazen, B., Ndeffo-Mbah, M., Galvani, A., Kinner, S. A., et al. (2016). Global burden of HIV, viral hepatitis, and tuberculosis in prisoners and detainees. *The Lancet*, *388*, 1089–1102.

Dore, G. J., Altice, F., Litwin, A. H., Dalgard, O., Gane, E. J., Shibolet, O., et al. (2016). Elbasvir/grazoprevir to treat HCV infection in persons receiving opioid agonist therapy: A randomized controlled trial (C-EDGE CO-STAR). *Annals of Internal Medicine*, *165*(9), 625–634. http://dx.doi.org/10.7326/M16-0816. Epub 2016 Aug 9.

Dore, G. J., & Feld, J. J. (2015). Hepatitis C virus therapeutic development: In pursuit of perfectovir. *Clinical Infectious Diseases*, *60*, 1829–1836.

Dore, G. J., Grebely, J., Altice, F., Litwin, A. H., Dalgard, O., Gane, E. J., et al. (2016). HCV reinfection and injecting risk behavior following elbasvir/grazoprevir treatment in patients on opioid agonist therapy: Co-STAR Three Year Follow-up Study. *Hepatology*, *64*, 431A.

Dore, G. J., Altice, F., Litwin, A. H., Dalgard, O., Gane, E. J., Shibolet, O., Luetkemeyer, A., Nahass, R., Peng, C. Y., Conway, B., Grebely, J., Howe, A. Y., Gendrano, I. N., Chen, E., Huang, H. C., Dutko, F. J., Nickle, D. C., Nguyen, B. Y., Wahl, J., Barr, E., Robertson, M. N., Platt, H. L., & Group, C. E. C.-S. S. (2016). Elbasvir-grazoprevir to treat hepatitis c virus infection in persons receiving opioid agonist therapy: a randomized trial. *Annals of Internal Medicine*, *165*, 625–634.

Drainoni, M. L., Litwin, A. H., Smith, B. D., Koppelman, E. A., McKee, M. D., Christiansen, C. L., et al. (2012). Effectiveness of a risk screener in identifying hepatitis C virus in a primary care setting. *American Journal of Public Health*, *102*, e115–121.

Drobnik, A., Judd, C., Banach, D., Egger, J., Konty, K., & Rude, E. (2011). Public health implications of rapid hepatitis C screening with an oral swab for community-based organizations serving high-risk populations. *American Journal of Public Health*, *101*, 2151–2155.

Duchesne, L., Njouom, R., Lissock, F., Tamko-Mella, G. F., Rallier, S., Poiteau, L., Soulier, A., Chevaliez, S., Vernet, G., Rouveau, N., Pawlotsky, J. M., Girard, P. M., & Lacombe, K. (2017). HCV Ag quantification as a one-step procedure in

diagnosing chronic hepatitis C infection in Cameroon: the ANRS 12336 study. *Journal of the International AIDS Society*, *20*(1), 1–8. http://dx.doi.org/10.7448/IAS.20.1.21446.

EASL (2016). EASL recommendations on treatment of hepatitis C 2016. *Journal of Hepatology*.

Evon, D. M., Simpson, K., Kixmiller, S., Galanko, J., Dougherty, K., Golin, C., et al. (2011). A randomized controlled trial of an integrated care intervention to increase eligibility for chronic hepatitis C treatment. *American Journal of Gastroenterology*, *106*, 1777–1786.

Falade-Nwulia, O., Mehta, S. H., Lasola, J., Latkin, C., Niculescu, A., O'Connor, C., et al. (2016). Public health clinic-based hepatitis C testing and linkage to care in baltimore. *Journal of Viral Hepatitis*, *23*, 366–374.

Feld, J. J., Kowdley, K. V., Coakley, E., Sigal, S., Nelson, D. R., Crawford, D., Weiland, O., Aguilar, H., Xiong, J., Pilot-Matias, T., DaSilva-Tillmann, B., Larsen, L., Podsadecki, T., & Bernstein, B. (2014). Treatment of HCV with ABT-450/r-ombitasvir and dasabuvir with ribavirin. *The New England Journal of Medicine*, *370*, 1594–1603.

Fischer, B., Oviedo-Joekes, E., Blanken, P., Haasen, C., Rehm, J., Schechter, M. T., et al. (2007). Heroin-assisted treatment (HAT) a decade later: A brief update on science and politics. *Journal of Urban Health*, *84*, 552–562.

Foucher, J., Reiller, B., Jullien, V., Leal, F., di Cesare, E. S., Merrouche, W., et al. (2009). FibroScan used in street-based outreach for drug users is useful for hepatitis C virus screening and management: A prospective study. *Journal of Viral Hepatitis*, *16*, 121–131.

Freiman, J. M., Tran, T. M., Schumacher, S. G., White, L. F., Ongarello, S., Cohn, J., et al. (2016). Hepatitis C core antigen testing for diagnosis of hepatitis C virus infection: A systematic review and meta-analysis. *Annals of Internal Medicine*, *165*(5), 345–355. http://dx.doi.org/10.7326/M16-0065. Epub.

Fry, C. L., Madden, A., Brogan, D., & Loff, B. (2006). Australian resources for ethical participatory processes in public health research. *Journal of Medical Ethics*, *32*, 186.

Grebely, J., & Dore, G. J. (2014). Can hepatitis C virus infection be eradicated in people who inject drugs? *Antiviral Research*, *104*, 62–72.

Grebely, J., Dore, G. J., Zeuzem, S., Aspinall, R. J., Fox, R., Han, L., McNally, J., Osinusi, A., Brainard, D. M., Subramanian, G. M., Natha, M., Foster, G. R., Mangia, A., Sulkowski, M., & Feld, J. J. (2016a). Efficacy and Safety of Sofosbuvir/Velpatasvir in Patients With Chronic Hepatitis C Virus Infection Receiving Opioid Substitution Therapy: Analysis of Phase 3 ASTRAL Trials. *Clinical Infectious Diseases*, *63*, 1479–1481.

Grebely, J., Mauss, S., Brown, A., Bronowicki, J. P., Puoti, M., Wyles, D., Natha, M., Zhu, Y., Yang, J., Kreter, B., Brainard, D. M., Yun, C., Carr, V., & Dore, G. J. (2016b). Efficacy and safety of ledipasvir/sofosbuvir with and without ribavirin in patients with chronic hcv genotype 1 infection receiving opioid substitution therapy: analysis of phase 3 ION trials. *Clinical Infectious Diseases*, *63*, 1405–1411.

Grebely, J., Lamoury, F. M. J., Hajarizadeh, B., Mowat, Y., Marshall, A. D., Bajis, S., Marks, P., Amin, J., Smith, J., Edwards, M., Gorton, C., Ezard, N., Persing, D., Kleman, M., Cunningham, P., Catlett, B., Dore, G. J., & Applegate, T. L. (2017a). Evaluation of the Xpert® HCV Viral Load point-of-care assay from venipuncture-collected and finger-stick capillary whole-blood samples: A prospective study. *Lancet Gastro Hepatol*, *2*(7), 514–520. http://dx.doi.org/10.1016/S2468-1253(17)30075-4. Epub.

Grebely, J., Jacobson, I. M., Kayali, Z., Verna, E. C., Shiffman, M. L., Hyland, R. H., Stamm, L. M., Huang, K. C., Brainard, D. M., McHutchison, J. G., Pol, S., Chung, R. T., Bernstein, D. E., & Dore, G. J. (2017b). SOF/VEL/VOX for 8 or 12 weeks is well tolerated and results in high svr12 rates in patients receiving opioid substitution therapy. *Journal of Hepatology*, *66*, S513.

Grebely, J., Puoti, M., Wedemeyer, H., Cooper, C. S., Sulkowski, M. S., Foster, G. F., Berg, T., Villa, E., Rodriguez-Perez, F., Wyles, D. L., Alami, N. N., Zhang, Z., Dumas, E., & Dore, G. J. (2017c). Safety and efficacy of ombitasvir, paritaprevir/ritonavir and dasabuvir with or without ribavirin in chronic hepati ti s c pati ents receiving opioid substi tuti on therapy: a pooled analysis across 12 clinical trials. *Journal of Hepatology*, *66*, S514.

Grebely, J., Dalgard, O., Conway, B., Cunningham, E., Bruggmann, P., Hajarizadeh, B., Amin, J., Marks, P., Quiene, S., Applegate, T. A., Swan, T., Byrne, J., Lacalamita, M., Dunlop, A. J., Bruneau, J., Hellard, M. E., Matthews, G. V., Powis, J., Shaw, D., Thurnheer, C. M., Weltman, M., Kronborg, I., Cooper, C., Feld, J. J., Fraser, C., Litwin, A., Dillon, J., Read, P., Gane, E., & Dore, G. J. (2017d). Efficacy and safety of sofosbuvir/velpatasvir in people with chronic hepatitis C virus infection and recent injecting drug use: the SIMPLIFY study. *Journal of Hepatology*, *66*, S513.

Grebely, J., Page, K., Sacks-Davis, R., van der Loeff, M. S., Rice, T. M., Bruneau, J., et al. (2014). The effects of female sex, viral genotype, and IL28B genotype on spontaneous clearance of acute hepatitis C virus infection. *Hepatology*, *59*, 109–120.

Grebely, J., Robaeys, G., Bruggmann, P., Aghemo, A., Backmund, M., Bruneau, J., et al. (2015). Recommendations for the management of hepatitis C virus infection among people who inject drugs. *International Journal on Drug Policy*, *26*, 1028–1038.

Hagan, H., Pouget, E. R., & Des Jarlais, D. C. (2011). A systematic review and meta-analysis of interventions to prevent hepatitis C virus infection in people who inject drugs. *Journal of Infectious Diseases*, *204*, 74–83.

Hagan, H., Pouget, E. R., Des Jarlais, D. C., & Lelutiu-Weinberger, C. (2008). Meta-regression of hepatitis C virus infection in relation to time since onset of illicit drug injection: The influence of time and place. *American Journal of Epidemiology*, *168*, 1099–1109.

Hajarizadeh, B., Grebely, J., & Dore, G. J. (2013). Epidemiology and natural history of HCV infection. *Nature Reviews Gastroenterology & Hepatology*, *10*, 553–562.

Harris, M. (2017). Managing expense and expectation in a treatment revolution: Problematizing prioritisation through an exploration of hepatitis C treatment 'benefit'. *International Journal of Drug Policy*, *47*, 161–168. http://dx.doi.org/10.1016/j.drugpo.2017.03.015. pii: S0955-3959(17)30089-0..

Harris, M., Albers, E., & Swan, T. (2015). The promise of treatment as prevention for hepatitis C: Meeting the needs of people who inject drugs? *International Journal of Drug Policy*, *26*, 963–969.

Harris, M., & Rhodes, T. (2013). Hepatitis C treatment access and uptake for people who inject drugs: A review mapping the role of social factors. *Harm Reduction Journal*, *10*, 7.

Harris, M., Rhodes, T., & Martin, A. (2013). Taming systems to create enabling environments for HCV treatment: Negotiating trust in the drug and alcohol setting. *Social Science and Medicine*, *83*, 19–26.

Hellard, M., Rolls, D. A., Sacks-Davis, R., Robins, G., Pattison, P., Higgs, P., et al. (2014). The impact of injecting networks on hepatitis C transmission and treatment in people who inject drugs. *Hepatology*, *60*, 1861–1870.

Hickman, M., McDonald, T., Judd, A., Nichols, T., Hope, V., Skidmore, S., et al. (2008). Increasing the uptake of hepatitis C virus testing among injecting drug users in specialist drug treatment and prison settings by using dried blood spots for diagnostic testing: A cluster randomized controlled trial. *Journal of Viral Hepatitis*, *15*, 250–254.

Ho, S. B., Brau, N., Cheung, R., Liu, L., Sanchez, C., Sklar, M., et al. (2015). Integrated care increases treatment and improves outcomes of patients with chronic hepatitis C virus infection and psychiatric illness or substance abuse. *Clinical Gastroenterology and Hepatology*, *13*, 2005–2014. e2001–e2003.

Hopwood, M., Treloar, C., & Bryant, J. (2006). Hepatitis C and injecting-related discrimination within healthcare in New South Wales, Australia. *Drugs: Education, Prevention and Policy*, *13*, 61–75.

Jewett, A., Smith, B. D., Garfein, R. S., Cuevas-Mota, J., Teshale, E. H., & Weinbaum, C. M. (2012). Field-based performance of three pre-market rapid hepatitis C virus antibody assays in STAHR (Study to Assess Hepatitis C Risk) among young adults who inject drugs in San Diego, CA. *Journal of Clinical Virology*, *54*, 213–217.

Knott, A., Dieperink, E., Willenbring, M. L., Heit, S., Durfee, J. M., Wingert, M., et al. (2006). Integrated psychiatric/medical care in a chronic hepatitis C clinic: Effect on antiviral treatment evaluation and outcomes. *American Journal of Gastroenterology*, *101*, 2254–2262.

Krauskopf, K., Kil, N., Sofianou, A., Toribio, W., Lyons, J., Singer, J., et al. (2014). Evaluation of an electronic health record prompt for hepatitis c antibody screening of baby boomers in primary care-a cluster randomized control trial. *Journal of General Internal Medicine*, *29*, S88–S89.

Lacey, C., Ellen, S., Devlin, H., Wright, E., & Mijch, A. (2007). Hepatitis C in psychiatry inpatients: Testing rates, prevalence and risk behaviours. *Australasian Psychiatry*, *15*, 315–319.

Lalezari, J., Sullivan, J. G., Varunok, P., Galen, E., Kowdley, K. V., Rustgi, V., et al. (2015). Ombitasvir/paritaprevir/r and dasabuvir plus ribavirin in HCV genotype 1-infected patients on methadone or buprenorphine. *Journal of Hepatology*, *63*, 364–369.

Lamoury, F. M. J., Soker, A., Martinez, D., Hajarizadeh, B., Cunningham, E. B., Cunningham, P., Bruggmann, P., Foster, G. R., Dalgard, O., Backmund, M., Conway, B., Robaeys, G., Swan, T., Cloherty, G., Marks, P., Grebely, J., Dore, G. J., & Applegate, T. L. (2017). Hepatitis C virus core antigen: A simplified treatment monitoring tool, including for post-treatment relapse. *Journal of Clinical Virology*, *92*, 32–38. http://dx.doi.org/10.1016/j.jcv.2017.05.007. Epub 2017 May 11.

Larney, S., Grebely, J., Hickman, M., De Angelis, D., Dore, G. J., & Degenhardt, L. (2015). Defining populations and injecting parameters among people who inject drugs: Implications for the assessment of hepatitis C treatment programs. *International Journal on Drug Policy*, *26*, 950–957.

Lazarus, J. V., Sperle, I., Spina, A., & Rockstroh, J. K. (2016). Are the testing needs of key European populations affected by hepatitis B and hepatitis C being addressed? A scoping review of testing studies in Europe. *Croatian Medical Journal*, *57*, 442–456.

Liakina, V., Hamid, S., Tanaka, J., Olafsson, S., Sharara, A. I., Alavian, S. M., et al. (2015). Historical epidemiology of hepatitis C virus (HCV) in select countries—Volume 3. *Journal of Viral Hepatitis*, *22*(Suppl. 4), 4–20.

Litwin, A. H., Smith, B. D., Drainoni, M. L., McKee, D., Gifford, A. L., Koppelman, E., et al. (2012). Primary care-based interventions are associated with increases in hepatitis C virus testing for patients at risk. *Digestive and Liver Disease*, *44*, 497–503.

Lloyd, A. R., Clegg, J., Lange, J., Stevenson, A., Post, J. J., Lloyd, D., et al. (2013). Safety and effectiveness of a nurse-led outreach program for assessment and treatment of chronic hepatitis C in the custodial setting. *Clinical Infectious Diseases*, *56*, 1078–1084.

MacArthur, G. J., van Velzen, E., Palmateer, N., Kimber, J., Pharris, A., Hope, V., et al. (2014). Interventions to prevent HIV and hepatitis C in people who inject drugs: A review of reviews to assess evidence of effectiveness. *International Journal on Drug Policy*, *25*, 34–52.

Marshall, A. D., Micallef, M., Erratt, A., Telenta, J., Treloar, C., Everingham, H., et al. (2015). Liver disease knowledge and acceptability of non-invasive liver fibrosis assessment among people who inject drugs in the drug and alcohol setting: The LiveRLife study. *International Journal on Drug Policy*, *26*, 984–991.

Martin, N. K., Hickman, M., Hutchinson, S. J., Goldberg, D. J., & Vickerman, P. (2013). Combination interventions to prevent HCV transmission among people who inject drugs: Modeling the impact of antiviral treatment, needle and syringe programs, and opiate substitution therapy. *Clinical Infectious Diseases*, *57*(Suppl. 2), S39–S45.

Martin, N. K., Vickerman, P., Dore, G. J., Grebely, J., Miners, A., Cairns, J., et al. (2016). Prioritization of HCV treatment in the direct-acting antiviral era: An economic evaluation. *Journal of Hepatology*, *65*, 17–25.
Martin, N. K., Vickerman, P., Foster, G. R., Hutchinson, S. J., Goldberg, D. J., & Hickman, M. (2011). Can antiviral therapy for hepatitis C reduce the prevalence of HCV among injecting drug user populations? A modeling analysis of its prevention utility. *Journal of Hepatology*, *54*, 1137–1144.
Martin, N. K., Vickerman, P., Grebely, J., Hellard, M., Hutchinson, S. J., Lima, V. D., et al. (2013). Hepatitis C virus treatment for prevention among people who inject drugs: Modeling treatment scale-up in the age of direct-acting antivirals. *Hepatology*, *58*, 1598–1609.
Martin, N. K., Vickerman, P., Miners, A., Foster, G. R., Hutchinson, S. J., Goldberg, D. J., et al. (2012). Cost-effectiveness of hepatitis C virus antiviral treatment for injection drug user populations. *Hepatology*, *55*, 49–57.
Mason, K., Dodd, Z., Guyton, M., Tookey, P., Lettner, B., Matelski, J., Sockalingam, S., Altenberg, J., & Powis, J. (2017). Understanding Real-World Adherence in the Directly Acting Antiviral Era: a prospective evaluation of adherence amongst people with a history of drug use at a community-based program in Toronto, Canada. *International Journal of Drug Policy*, *47*, 202–208.
Mashru, J., Kirlew, M., Saginur, R., & Schreiber, Y. S. (2017). Management of infectious diseases in remote northwestern Ontario with telemedicine videoconference consultations. *Journal of Telemedicine and Telecare*, *23*, 83–87.
Masson, C. L., Delucchi, K. L., McKnight, C., Hettema, J., Khalili, M., Min, A., et al. (2013). A randomized trial of a hepatitis care coordination model in methadone maintenance treatment. *American Journal of Public Health*, *103*, E81–E88.
Mateu-Gelabert, P., Treloar, C., Agullo, V., Sandoval, M., Valderrama, J., Maher, L., et al. (2007). How can hepatitis C be prevented in the long-term? *International Journal of Drug Policy*, *18*, 338–340.
Mathers, B. M., Degenhardt, L., Ali, H., Wiessing, L., Hickman, M., Mattick, R. P., et al. (2010). HIV prevention, treatment, and care services for people who inject drugs: A systematic review of global, regional and national coverage. *The Lancet*, *375*, 1014–1028.
Mathers, B. M., Degenhardt, L., Phillips, B., Wiessing, L., Hickman, M., Strathdee, S. A., et al. (2008). Global epidemiology of injecting drug use and HIV among people who inject drugs: A systematic review. *The Lancet*, *372*, 1733–1745.
McAllister, G., Innes, H., McLeod, A., Dillon, J. F., Hayes, P. C., Fox, R., et al. (2014). Uptake of hepatitis C specialist services and treatment following diagnosis by dried blood spot in Scotland. *Journal of Clinical Virology*, *61*, 359–364.
McHugh, M. P., Wu, A. H. B., Chevaliez, S., Pawlotsky, J. M., Hallin, M., & Templeton, K. E. (2017). Multicenter evaluation of the cepheid xpert hepatitis c virus viral load assay. *Journal of Clinical Microbiology*, *55*(5), 1550–1556. http://dx.doi.org/10.1128/JCM.02460-16. Epub 2017 Mar 8.
McLeod, A., Weir, A., Aitken, C., Gunson, R., Templeton, K., Molyneaux, P., et al. (2014). Rise in testing and diagnosis associated with Scotland's Action Plan on Hepatitis C and introduction of dried blood spot testing. *Journal of Epidemiology and Community Health*, *68*, 1182–1188.
Meyer, J. P., Moghimi, Y., Marcus, R., Lim, J. K., Litwin, A. H., & Altice, F. L. (2015). Evidence-based interventions to enhance assessment, treatment, and adherence in the chronic hepatitis C care continuum. *International Journal on Drug Policy*, *26*, 922–935.
Midgard, H., Bjoro, B., Maeland, A., Konopski, Z., Kileng, H., Damas, J. K., et al. (2016). Hepatitis C reinfection after sustained virological response. *Journal of Hepatology*, *64*, 1020–1026.
Moessner, B. K., Jorgensen, T. R., Skamling, M., Vyberg, M., Junker, P., Pedersen, C., et al. (2011). Outreach screening of drug users for cirrhosis with transient elastography. *Addiction*, *106*, 970–976.
Morano, J. P., Zelenev, A., Lombard, A., Marcus, R., Gibson, B. A., & Altice, F. L. (2014). Strategies for hepatitis C testing and linkage to care for vulnerable populations: Point-of-care and standard HCV testing in a mobile medical clinic. *Journal of Community Health*, *39*, 922–934.
Morris, M. D., Shiboski, S., Bruneau, J., Hahn, J. A., Hellard, M., Prins, M., Cox, A. L., Dore, G., Grebely, J., Kim, A. Y., Lauer, G. M., Lloyd, A., Rice, T., Shoukry, N., Maher, L., & Page, K. (2017a). International collaboration of incident hiv and hcv in injecting cohorts (inc3). geographic differences in temporal incidence trends of hepatitis c virus infection among people who inject drugs: the inc3 collaboration. *Clinical Infectious Diseases*, *64*(7), 860–869. http://dx.doi.org/10.1093/cid/ciw869.
Morris, L., Smirnov, A., Kvassay, A., Leslie, E., Kavanagh, R., Alexander, N., Davey, G., Williams, O., Gilks, C., & Najman, J. (2017b). Initial outcomes of integrated community-based hepatitis C treatment for people who inject drugs: findings from the Queensland Injectors#xp# Health Network. *International Journal of Drug Policy*, *47*, 216–220.
Nelson, P. K., Mathers, B. M., Cowie, B., Hagan, H., Des Jarlais, D., Horyniak, D., et al. (2011). Global epidemiology of hepatitis B and hepatitis C in people who inject drugs: Results of systematic reviews. *The Lancet*, *378*, 571–583.
Nolan, S., Dias Lima, V., Fairbairn, N., Kerr, T., Montaner, J., Grebely, J., et al. (2014). The impact of methadone maintenance therapy on hepatitis C incidence among illicit drug users. *Addiction*, *109*, 2053–2059.
Norton, B. L., Fleming, J., Steinman, M., Yu, K., Deluca, J., Cunningham, C. O., & Litwin, A. H. (2016). *High HCV Cure Rates for Drug Users Treated with DAAs at an Urban Primary Care Clinic. In Conference on Retroviruses and Opportunistic Infections*. United States: Boston.
Nutt, D. J., King, L. A., & Phillips, L. D. (2010). Drug harms in the UK: A multicriteria decision analysis. *The Lancet*, *376*, 1558–1565.
Page, K., Morris, M. D., Hahn, J. A., Maher, L., & Prins, M. (2013). Injection drug use and hepatitis C virus infection in young adult injectors: Using evidence to inform comprehensive prevention. *Clinical Infectious Diseases*, *57*(Suppl. 2), S32–S38.
Paterson, B., Backmund, M., Hirsch, G., & Yim, C. (2007). The depiction of stigmatization in research about hepatitis C. *International Journal of Drug Policy*, *18*, 364–373.
Paterson, B., Hirsch, G., & Andres, K. (2013). Structural factors that promote stigmatization of drug users with hepatitis C in hospital emergency departments. *International Journal of Drug Policy*, *24*, 471–478.
Pineda, J. A., Nunez-Torres, R., Tellez, F., Mancebo, M., Garcia, F., Merchante, N., et al. (2015). Hepatitis C virus reinfection after sustained virological response in HIV-infected patients with chronic hepatitis C. *Journal of Infection*, *71*, 571–577.
Platt, L., Easterbrook, P., Gower, E., McDonald, B., Sabin, K., McGowan, C., et al. (2016). Prevalence and burden of HCV co-infection in people living with HIV: A global systematic review and meta-analysis. *Lancet Infectious Diseases*, *16*, 797–808.
Puoti, M., Cooper, C., Sulkowski, M. S., Foster, G. R., Berg, T., Villa, E., Rodriguez-Perez, F., Rustgi, V., Wyles, D. L., King, M., McGovern, B. H., & Wedemeyer, H. (2014). Abt-450/r/ombitasvir plus dasabuvir with or without ribavirin in hcv genotype 1-infected patients receiving stable opioid substitution treatment: pooled analysis of efficacy and safety in phase 2 and phase 3 trials. *Hepatology*, *60*, 1135a–1136a.
Rance, J., & Treloar, C. (2014). 'Not just Methadone Tracy': Transformations in service-user identity following the introduction of hepatitis C treatment into Australian opiate substitution settings. *Addiction*, *109*, 452–459.
Read, P., Lothian, R., Chronister, K., Gilliver, R., Kearley, J., Dore, G. J., & van Beek, I. (2017). Delivering direct acting antiviral therapy for hepatitis C to highly marginalised and current drug injecting populations in a targeted primary health care setting. *International Journal of Drug Policy*, *47*, 209–215. http://dx.doi.org/10.1016/j.drugpo.2017.05.032. pii: S0955-3959(17)30136-6.
Rhodes, T., & Treloar, C. (2008). The social production of hepatitis C risk among injecting drug users: A qualitative synthesis. *Addiction*, *103*, 1593–1603.
Rosenberg, S. D., Goldberg, R. W., Dixon, L. B., Wolford, G. L., Slade, E. P., Himelhoch, S., et al. (2010). Assessing the STIRR model of best practices for blood-borne infections of clients with severe mental illness. *Psychiatric Services*, *61*, 885–891.
Roy, E., Boudreau, J. F., & Boivin, J. F. (2009). Hepatitis C virus incidence among young street-involved IDUs in relation to injection experience. *Drug and Alcohol Dependence*, *102*, 158–161.
Sahajian, F., Bailly, F., Vanhems, P., Fantino, B., Vannier-Nitenberg, C., Fabry, J., et al. (2011). A randomized trial of viral hepatitis prevention among underprivileged people in the Lyon area of France. *Journal of Public Health*, *33*, 182–192.
Saraswat, V., Norris, S., de Knegt, R. J., Sanchez Avila, J. F., Sonderup, M., Zuckerman, E., et al. (2015). Historical epidemiology of hepatitis C virus (HCV) in select countries—Volume 2. *Journal of Viral Hepatitis*, *22*(Suppl. 1), 6–25.
Scott, N., McBryde, E., Vickerman, P., Martin, N. K., Stone, J., Drummer, H., et al. (2015). The role of a hepatitis C virus vaccine: Modelling the benefits alongside direct-acting antiviral treatments. *BMC Medicine*, *13*, 198.
Simmons, B., Saleem, J., Hill, A., Riley, R. D., & Cooke, G. S. (2016). Risk of late relapse or reinfection with hepatitis C virus after achieving a sustained virological response: A systematic review and meta-analysis. *Clinical Infectious Diseases*, *62*, 683–694.
Smith, B. D., Drobeniuc, J., Jewett, A., Branson, B. M., Garfein, R. S., Teshale, E., et al. (2011). Evaluation of three rapid screening assays for detection of antibodies to hepatitis C virus. *Journal of Infectious Diseases*, *204*, 825–831.
Smith, B. D., Teshale, E., Jewett, A., Weinbaum, C. M., Neaigus, A., Hagan, H., et al. (2011). Performance of premarket rapid hepatitis C virus antibody assays in 4 national human immunodeficiency virus behavioral surveillance system sites. *Clinical Infectious Diseases*, *53*, 780–786.
Sulkowski, M., Ward, K., Falade-Nwulia, O., Moon, J., Sutcliffe, C., Brinkley, S., Haselhuhn, T., Thomas, D., Katz, S., Herne, K., Arteaga, L., & Mehta, S. H. (2017). Randomized controlled trial of cash incentives or peer mentors to improve HCV linkage and treatment among HIV/HCV coinfected persons who inject drugs: the CHAMPS Study. *Journal of Hepatology*, *66*, S719.
Tahan, V., Almashhrawi, A., Kahveci, A. M., Mutrux, R., & Ibdah, J. A. (2016). Extension for community health outcomes-hepatitis C: Small steps carve big footprints in the allocation of scarce resources for hepatitis C virus treatment to remote developing areas. *World Journal of Hepatology*, *8*, 509–512.
Tait, J. M., Stephens, B. P., McIntyre, P., Evans, M., & Dillon, J. F. (2013). Dry blood spot testing for hepatitis C in people who injected drugs: Reaching the populations other tests cannot reach. *Journal of Hepatology*, *58*, S204.
Terrence Higgins Trust. Retrieved July 3, 2016 from https://www.tht.org.uk/sexual-health/About-HIV/HIV-postal-test.
The Polaris Observatory (2017). Global prevalence and genotype distribution of hepatitis C virus infection in 2015: A modelling study. *The Lancet Gastroenterology & Hepatology*, *2*, 161–166.
Treloar, C., & Rance, J. (2014). How to build trustworthy hepatitis C services in an opioid treatment clinic?: A qualitative study of clients and health workers in a co-located setting. *International Journal of Drug Policy*, *25*, 865–870.
Trooskin, S. B., Poceta, J., Towey, C. M., Yolken, A., Rose, J. S., Luqman, N. L., et al. (2015). Results from a geographically focused, community-based HCV screening: Linkage-to-care and patient navigation program. *Journal of General Internal Medicine*, *30*, 950–957.
Tsui, J. I., Evans, J. L., Lum, P. J., Hahn, J. A., & Page, K. (2014). Association of opioid agonist therapy with lower incidence of hepatitis C virus infection in young adult injection drug users. *JAMA Internal Medicine*, *174*, 1974–1981.
Turner, K. M., Hutchinson, S., Vickerman, P., Hope, V., Craine, N., Palmateer, N., et al. (2011). The impact of needle and syringe provision and opiate substitution

therapy on the incidence of hepatitis C virus in injecting drug users: Pooling of UK evidence. *Addiction*, *106*, 1978–1988.
UNITAID. (2015). Hepatitis C Diagnostics Technology Landscape. In.
van den Berg, C. H., Smit, C., Bakker, M., Geskus, R. B., Berkhout, B., Jurriaans, S., et al. (2007). Major decline of hepatitis C virus incidence rate over two decades in a cohort of drug users. *European Journal of Epidemiology*, *22*, 183–193.
Weir, A., McLeod, A., Innes, H., Valerio, H., Aspinall, E. J., Goldberg, D. J., et al. (2016). Hepatitis C reinfection following treatment induced viral clearance among people who have injected drugs. *Drug and Alcohol Dependence*, *165*, 53–60.
White, B., Day, C., Thein, H. H., Doab, A., Bates, A., Holden, J., et al. (2008). Acceptability of hepatitis C virus testing methods among injecting drug users. *Drug and Alcohol Review*, *27*, 666–670.
White, B., Dore, G. J., Lloyd, A. R., Rawlinson, W. D., & Maher, L. (2014). Opioid substitution therapy protects against hepatitis C virus acquisition in people who inject drugs: The HITS-c study. *Medical Journal of Australia*, *201*, 326–329.
WHO (2014). In W. H. Organization (Ed.), *Guidelines for the screening, care and treatment of persons with hepatitis C infection*, Geneva, Switzerland: WHO.
WHO (2016). *Combating hepatitis B and C to reach elimination by 2030*. WHO.
Wiessing, L., Ferri, M., Grady, B., Kantzanou, M., Sperle, I., Cullen, K. J., et al. (2014). Hepatitis C virus infection epidemiology among people who inject drugs in Europe: A systematic review of data for scaling up treatment and prevention. *PLoS One*, *9*, e103345.
Williams, R., Aspinall, R., Bellis, M., Camps-Walsh, G., Cramp, M., Dhawan, A., et al. (2014). Addressing liver disease in the UK: A blueprint for attaining excellence in health care and reducing premature mortality from lifestyle issues of excess consumption of alcohol, obesity and viral hepatitis. *The Lancet*, *384*, 1953–1997.
Wodak, A. D., Ritter, A. J., & Watson, C. R. (2002). Separating politics and scientific research on heroin prescription. *Medical Journal of Australia*, *176*, 449. author reply 450.
Wong, V. W., Wong, G. L., Chim, A. M., Cheng, T. F., Cheung, S. W., Lai, C. M., et al. (2014). Targeted hepatitis C screening among ex-injection drug users in the community. *Journal of Gastroenterology and Hepatology*, *29*, 116–120.
Young, J., Rossi, C., Gill, J., Walmsley, S., Cooper, C., Cox, J., et al. (2017). Risk factors for hepatitis C virus reinfection after sustained virologic response in patients co-infected with HIV. *Clinical Infectious Diseases*, *64*(9), 1154–1162. http://dx.doi.org/10.1093/cid/cix126.
Zeuzem, S., Ghalib, R., Reddy, K. R., Pockros, P. J., Ben Ari, Z., Zhao, Y., Brown, D. D., Wan, S., DiNubile, M. J., Nguyen, B. Y., Robertson, M. N., Wahl, J., Barr, E., & Butterton, J. R. (2015). Grazoprevir-elbasvir combination therapy for treatment-naive cirrhotic and noncirrhotic patients with chronic hepatitis C virus genotype 1, 4, or 6 infection: A randomized trial. *Annals of Internal Medicine*, *163*, 1–13.
Zhou, K., Fitzpatrick, T., Walsh, N., Kim, J. Y., Chou, R., Lackey, M., et al. (2016). Interventions to optimise the care continuum for chronic viral hepatitis: A systematic review and meta-analyses. *Lancet Infectious Diseases*, *16*(12), 1409–1422. http://dx.doi.org/10.1016/S1473-3099(16)30208-0. Epub 2016 Sep 5.
Zickmund, S., Ho, E., Masuda, M., Ippolito, L., & LaBrecque, D. (2003). They treated me like a leper: Stigmatization and the quality of life of patients with hepatitis C. *Journal of General Internal Medicine*, *18*, 835–844.