Faculty of Health Sciences
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Hepatitis C, Treatment and Drug Use in Australian Prison Settings

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.
This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

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Dedication: To my long-time friend Pete Dunstan, our many years of friendship were not nearly enough. May the ferryman row you swiftly to the other side. I suspect you would have no idea how many people will miss you. RIP.

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The author acknowledges that any material published or made publicly available from this thesis cannot be considered as either endorsed by the Western Australian Department of Corrective Services or as an expression of the policies and views of the Department and that any errors of omission or commission are the responsibility of the researcher.

Abbreviations

ALT	Alanine transaminase
ATSI	Aboriginal and Torres Strait Islanders
BBV	Blood-borne viruses
DAA	Direct acting antivirals
DCS	Department of Corrective Services of Western Australia
HCC	Hepatocellular Carcinoma
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HITS-p	Hepatitis C Incidence and Transmission Study in Prisons
HIV	Human Immunodeficiency Virus
HCWA	Hepatitis Council of Western Australia
HREC	Human Research Ethics Committee
IDRS	Illicit Drug Reporting System
IDU	Injecting drug use
IQR	Interquartile Range
LSM	Liver Stiffness Measurement
NSP	Needle and Syringe Program
NDRI	National Drug Research Institute
PAST	Prison Addiction Services Team
PBS	Pharmaceutical Benefits Scheme
PCR	Polymerase chain reaction
PNSP	Prison Needle and Syringe Program
PWID	People who inject drugs
RNA	Ribonucleic acid
REC	Research and Evaluation Committee
SD	standard deviation
TAB	Totalisor Agency Board
TasP	Treatment as Prevention
UNODC	United Nations Office on Drugs and Crime
WAAHIEC	Western Australian Aboriginal Health Information and Ethics Committee
WASUA	Western Australian Substance Users Association

Introduction

The issue of chronic infections of the Hepatitis C Virus (HCV) is widely understood as posing a serious challenge to both public health and to the wellbeing and quality of life for those affected by the virus. The costs of treating HCV are immense; and the costs of not treating HCV in the longer term when care for cirrhosis and hepatocellular carcinoma liver transplants become required, even more so.

In Australia, and indeed in many western countries, the prime risk factor for HCV is the sharing of needles and other equipment used in the injection of illicit drugs. Because people who use illicit drugs are at a significantly increased risk of imprisonment, a disproportionately large number of these users who are commonly infected with the virus continue to comprise the prison population of Australia.

Not only do large numbers of people who inject drugs, both the infected and the uninfected, continue to enter Australian prisons at a substantial rate, but it is also known that many continue to inject, while others may commence injection of drugs during their period of incarceration. Further, there is evidence leading many to conclude that preventing the flow of illicit drugs into prisons as contraband is not currently possible. Where provision of sterile injecting equipment in corrective environments is prohibited and cleaning agents such as bleach are provided inconsistently, this, along with high levels of amateur tattooing and exposure to blood spills via increased risk of violence, has generated a situation where prisons have become central to the ongoing epidemic.

This same central role has led to prisons being identified as ideal locations to implement widespread treatment for HCV, with a literally "captive audience" that can ensure total compliance with the treatment regimen. Despite this, only a minority of eligible prisoners actually take advantage of this opportunity, or are aware of, or have access to this treatment.

With this thesis, I deeply wanted to do something that would be meaningful in the longer term. Having previously worked in needle exchanges and peer-driven projects before my career in research, there was a long-held passion for advocacy for those negatively affected by diverse responses to drugs. As such, an examination centred on some of those most marginalised, that is, prisoners who inject drugs, seemed an important field for research.

There were initially several prominent questions:

- If so many prisoners were eligible, why did so few take up the opportunity for treatment? What were the motivations and barriers to people engaging in treatment for HCV while in prison?
- To better understand the context in which injecting drug use occurs within prisons and how these practices contribute to ongoing transmission of infection within prison environments.
- In terms of rates of incident infection and numbers released from prison still infected, to what extent could outcomes for prisoners and the wider community be improved by increasing the number of prisoners engaged in treatment? How might the effectiveness of this approach compare to implementing preventive measures (e.g. needle and syringe programs within prison) that would have a direct impact on the rate of incident infections?

The first two of these areas were addressed using qualitative in-depth interviews with current and former prisoners, while the third was conducted using epidemic modelling techniques.

In the process of collecting data for the area of contextualising drug use however, it became apparent that there were additional areas requiring exploration using quantitative methods.

The first of these was that there was scant data in the published literature concerning the frequency with which imprisoned drug injectors continue to inject while incarcerated. As higher rates of injection have a direct association with the likelihood and infection of HCV, this seemed an important area to investigate. These findings were later published in the Journal of Substance Abuse[1].

The second of these areas was the phenomenon of renting syringes which emerged during the course of qualitative interviews with drug using former prisoners. Apart from occasional mentions in passing in the literature there did not appear to have been any previous attempts to document either how widespread this practise was or the economic contexts in which it occurred. Since the possibility that there may be large numbers of rental syringes in circulation in prisons, each previously used by an unknown number of people, constitutes a clear risk for transmission of HCV this novel area of research was also considered important for inclusion in this thesis.

In the ongoing absence of an effective vaccine for HCV, it is vital that all efforts be undertaken to bring the epidemic under control. With prisons central to the continuation of the epidemic, as well as an ideal place to implement initiatives to both prevent transmission and treat chronic cases, it is vital more research should focus on this area. It is my hope that this thesis can make a valuable contribution to this area of knowledge so profoundly important to public health.

Abstract

This thesis examined issues surrounding the hepatitis C virus (HCV), its treatment, and injecting drug use as the principal risk factor for infections in Australian prison environments.

The data collection and modelling work was completed in 2016 and since this time, new treatment and new research has advanced the field. The work is presented in the context of the field as it stood at the time of data collection.

Aims: 1) To gain an understanding of the contexts and circumstances under which injection occurs in Australian prisons. 2) To use qualitative data to explore the barriers and motivations of prisoners to engage in treatment for HCV prior to the introduction of new generation of direct acting antiviral (DAAs) medications. 3) To use quantitative data to form an estimate of how many drug users continue to inject in prison, the frequency with which they do so, and predictors of this behavior. 4) To produce an estimate the proportion of prisoners involved in importing needle and syringe units into Australian prisons as contraband, identify characteristics that affect the likelihood of involvement and to describe the nature of this illicit market in terms of price and types of currency that are accepted. 5) To develop an epidemiological model of how altering levels of prisoner involvement in treatment prior to the introduction of DAA medication and lowering incident rates of infection using harm reduction approaches would likely affect progression through HCV-related stages of fibrosis, the proportion of prisoners still infected who are released back into the community, and public health costs projected across several decades.

Methods: A variety of different approaches were used. In-depth interviews using both qualitative and quantitative methods were conducted with 28 former and current prisoners. These data were used to explore drug use history, knowledge and experience of HCV, barriers and motivations to accessing treatment and to contextualize drug use within prisons. Other questions were appended to a national survey of regular injectors, and data taken from 355 former prisoners to explore rates of injection within prison. The same approach was taken with this national survey to collect data from 319 former prisoners to investigate the trade in contraband syringes in prison. Finally, parameters for an epidemic model of the efficacy of HCV treatment in prison were collected from the published literature.

Major findings: 53% of injectors desist from injecting while imprisoned, but of those who do continue, almost a third had injected weekly or more while incarcerated. Injecting commonly occurred in group situations with shared injecting equipment, often involving rented syringes that may have been previously used by numerous people, thereby generating a substantial risk for ongoing transmission of HCV and other blood-borne viruses. Almost a third of imprisoned injectors had imported a needle and syringe into prison, often with the intent to sell or rent it out. Selling needle and syringe units could commonly attract prices in the region of $300 and rental was typically in exchange for drugs, most commonly heroin, thereby providing little incentive for prisoners to discontinue this practice that further contributes to HCV transmission. Cleaning of syringes between injecting episodes was often not ideal and bleach often difficult to obtain. Qualitative data indicates that many of these needles and syringes may have been circulating in prison for a very considerable period and many likely to be contaminated with HCV. While some respondents viewed prison as an opportunity to access treatment for HCV, there were a number of barriers including those identified in previous studies, but also some specific to the prison environment such as an insufficient sentence length to complete treatment, systematic factors and a lengthy assessment process. Epidemic

modelling showed that raising numbers of prisoners engaged in treatment had a significant effect in lessening the number of prisoners released into the community while still infected and also the projected magnitude of this effect relative to numbers engaged in treatment. However, this effect was unlikely to be as great or as cost-effective as introducing preventative measures such as needle and syringe exchange that would lower the incidence of infection within Australian prisons. This strongly suggests that maximum benefit would be obtained by introducing both increased opportunities to access HCV treatment and preventative measures into prisons in tandem, resulting in massive savings to the wider community both in terms of health and financial outcomes.

CHAPTER 1: Review of the literature

This literature review examines the history of knowledge of hepatitis C, the nature of the disease, treatment, prevention, the role of prisons as an epicentre of transmission, and how both prevention and treatment have been applied in prison environments.

Discovery of Hepatitis C

During the 1970s it became apparent that the majority of viral hepatitis infections occurring after blood transfusions were not attributable to either the then known viruses hepatitis A or hepatitis B. On being identified in 1974, the virus was originally referred to as non-A, non-B hepatitis [2]. The virus responsible was eventually isolated and named as the hepatitis C virus (HCV) by Choo and colleagues [3] in the late 1980s.

By the early 1990s the role of percutaneous exposure to infected blood as the most efficient route for transmission of the virus had been clearly identified [4]. There are various ways by which such exposure can occur. These include tattooing and piercing, household transmission (where personal equipment such as razors or toothbrushes are shared), ritual blood exchange, vertical transmission from mother to child, and occasionally transmissions in health care settings generally between patients and health-care providers. Transmission via blood transfusion or tissue transplants is possible, but now uncommon in developed countries where effective screening procedures of donors have been implemented. However, it has long been recognised that the most common risk factor for such exposure is injecting drug use (IDU). This in part is likely due to HCV being estimated as ten times more infectious than Human Immunodeficiency Virus (HIV) per unit of blood, rendering IDU a highly efficient means of transmission [5]. As a result, IDU remains the principle cause of HCV throughout the developed world [6, 7].

HCV is known to have a number of genetically distinct genotypes. According to the classification system devised by Simmonds[8], there are six major genotypes, each of which can be further classified into other subtypes such as HCV 1a, HCV 1b, HCV 3a etcetera. In Australia, HCV 1 is the most common genotype with its three subtypes accounting for 55% of all cases of HCV. This is followed by HCV 3a and HCV 3b accounting for 36%. The remaining genotypes collectively account for just 9%[9]. Other classification systems have been proposed with up to 11 genotypes [10, 11], but generally speaking these can be accommodated under Simmond's system [9].

Acute Hepatitis C and Spontaneous clearance

New infections of HCV are referred to as acute. Symptoms at this stage are uncommon. It is well known that a certain proportion of persons with acute HCV will experience spontaneous resolution of the virus. That is to say, that while antibodies remain detectable, polymerase chain reaction (PCR) testing shows the viral ribonucleic acid (RNA) to be absent. Spontaneous clearance of the disease generally occurs within a period of approximately 12 months after infection, however, there is little consensus in the literature as to the actual proportion that does so with estimates varying from 10-50%. Much of this uncertainty has arisen from the lack of clinical symptoms in acute infections, with few cases and limited follow-up in studies of acute HCV[12]. Further, while most instances of spontaneous clearance occur within six months, it has been suggested that some cases may spontaneously clear the virus at up to 45 months post infection. Hoofnagle[13] for example, noted that approximately 15% of acute HCV cases went into spontaneous clearance with the remaining 85% going on to develop chronic HCV. By contrast, a more recent paper by Micallef et al. [14] estimated that 26% of acute cases experience spontaneous clearance. A number of studies have made the interesting

observation that spontaneous viral clearance was more common in symptomatic patients (25-52%) than in asymptomatic ones (10-15%) [15]. Other researchers have made the observation that a better understanding of the immune functions of cases where spontaneous clearance of the HCV virus does occur may provide vital insights into the development of an effective vaccine [16].

Chronic Hepatitis C

When the infection does not spontaneously remit within six to twelve months, defined as when PCR testing can still detect active RNA, the disease is described as "chronic" and is unlikely to ever spontaneously remit. As with cases of acute HCV, symptoms remain uncommon although levels of alanine transaminase (ALT), an enzyme often elevated in cases of liver disease and commonly used to monitor the extent of damage to the liver, do not generally return to normal, but rather continue to fluctuate for years after the original exposure. Where symptoms are experienced, these are generally similar as those observed in acute cases and are most apparent where the condition is severe or advanced. The most typical symptoms are malaise, nausea, pain in the right upper quadrant, dark urine and jaundice, symptoms common to all hepatitis infections. Nearly all patients however, had a detectable increase in ALT levels, by over ten times in 80% of cases[13]. In an early description of the condition, Hoofnagle [17] noted that only one third of patients were symptomatic. More recent data indicates that a lack of symptoms generally remains the norm with the transition from the acute phase to chronic HCV usually being sub-clinical and with result that many cases are not diagnosed until complications from end stage liver disease manifest [18]. That said, there are certain conditions that are either accepted or considered to be probably associated with chronic HCV. These include presence of abnormal antibodies (mixed cryoglobulinemia), certain kidney diseases (glomeruleonephritis), a skin condition resulting in photosensitivity, blistering, pigmentation and scarring (porphyria cutanea tarda), non-Hodgkin's lymphoma, autoimmune skin rash (lichen planus), presence of autoantibodies, and diabetes mellitus. There are also a large number of miscellaneous conditions whose association with HCV is considered either possible or suspected but with no clear evidence [19].

While a majority of those screening positive for HCV antibodies experience no symptoms, a significant proportion will develop serious symptoms, albeit many years after the initial infection. It is estimated that 20 years following infection, 5-10% of chronic patients will progress to cirrhosis of the liver, and 15-20% after 40 years. Predictors for this progression are various, including consumption of alcohol, age at infection and its duration, coinfection with HIV or HBV, the genotype of HCV involved, how the infection was acquired, the patient's gender, their viral load and the stage of fibrosis. Progression through stages of fibrosis in chronic HCV prior to developing cirrhosis is slow, beginning with no fibrosis (stage 0), and moving through Stage 1 (minimal fibrosis), stage 2 (moderate fibrosis), stage 3 (severe fibrosis) before reaching stage 4 (cirrhosis)[12]. Research suggests that annually, between 1.2% and 2.4% of people experiencing HCV-related cirrhosis will progress to hepatocellular carcinoma (HCC) [20-24]. The distribution of this disease progression is displayed in Figure 1.

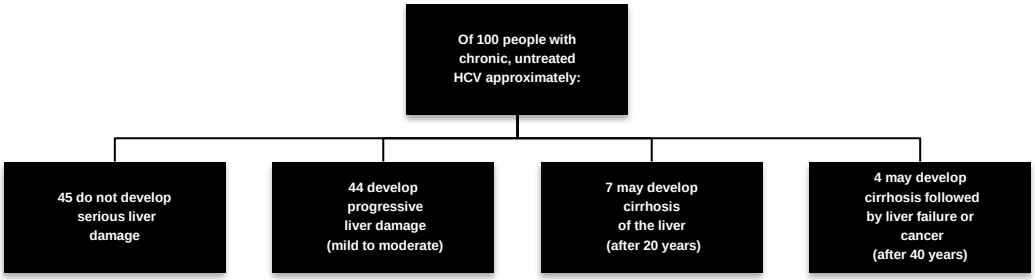

Figure 1: Long term outcomes of chronic hepatitis C infection

Source: ASHM 2006[25]

Global prevalence of HCV

Global population prevalence of HCV has been estimated at 2.8%, ranging from under 1.5% in low prevalence areas to over 3.5% in high prevalence areas [26]. Prevalence of HCV by antibody testing reported by region varies from 1.2% in Australia and Oceania up to 4.7% in the Middle East [27]. Differences between regions may be attributable to a variety of factors including prevalence of IDU, inadequate screening of blood products, outdated, incomplete data [27], and differences in sampling methods used [26]. Regional rates are displayed in detail in Table 1.

Table 1: Global regional prevalence of HCV by antibody testing

Region	HCV Antibody positive (%)	No of HCV Infected
Australia & Oceania	1.2	400,000
Americas	1.5	14,000,000
Asia	2.1	83,000,000
Europe	2.3	17,500,000
Africa	3.2	28,100,000
Middle East	4.7	16,000,000
TOTAL	**2.4**	**159,000,000**

Source: Lavanchy, 2011[27]

More recently, a meta-analysis of the literature examined the relative prevalence of the various genotypes of HCV globally. In examining 1,217 studies from across 117 countries it was concluded that the most prevalent genotype of HCV was genotype 1, accounting for 46.2% of all cases, followed by genotype 3 which accounted for 30.1% [28].

Epidemiology and Projections of HCV in Australia

In 2017 there were 10,537 new notifications of HCV in Australia and an estimated 182,144 people living with a chronic HCV infection [29].

HCV in Australia is a notifiable disease and annual statistics are reported by the Department of Health online in the National Notifiable Diseases Surveillance System. In 2018 there were 11,326 new notifications were reported. Of these, 10,736 were unspecified cases (i.e.: cases where it was not possible to determine whether the infection had occurred recently) while the remaining 590 were incident infections (i.e.: cases where the infection was known to be of recent origin). In 2018, the rate of unspecified notifications was 46.3 per 100,000 persons. New or incident cases in 2018 occurred at a rate of 2.3 per 100,000 persons [30].

As previously noted, injecting drug use has long been identified as the primary risk factor involved in HCV infection. It is therefore unsurprising that the Australian Needle and Syringe Program (NSP) Survey [31] an annual survey of PWID recruited from NSPs across the country, found that overall HCV antibody prevalence was 45% among participants. This prevalence was higher among those reporting heroin (58%) compared to methamphetamine (37%) as the last drug they injected, among participants identifying as Aboriginal or Torres Strait Islander (53%) and those reporting a lifetime history of incarceration (55%). HCV antibody prevalence also varied by jurisdiction (see Figure 2). Other factors were also found to influence the prevalence of HCV amongst drug injectors. The lowest rates were found among PWID aged less than 25 years (19%), and those injecting for less than three years (9%). Rates of 58% were found among PWID who reported heroin as their last drug injected compared with 37% amongst those who had last injected (meth) amphetamine. Re-use of another's used needle and syringe in the month prior to the survey was also a significant factor with 55% of those reporting receptive sharing of equipment testing positive compared with 44% amongst those who had not done so. Prevalence of HCV amongst Indigenous injectors at 53% appeared to be higher than the 43% found amongst non-Indigenous injectors Having been imprisoned in the year proceeding the survey was found to be highly significant with an HCV prevalence of 55% found among PWID who had been imprisoned, compared with 43% amongst those who had not. In considering these data however, it should be noted that participation in the survey was by respondent self-selection and rates of HCV among the wider population of PWID may be somewhat different.

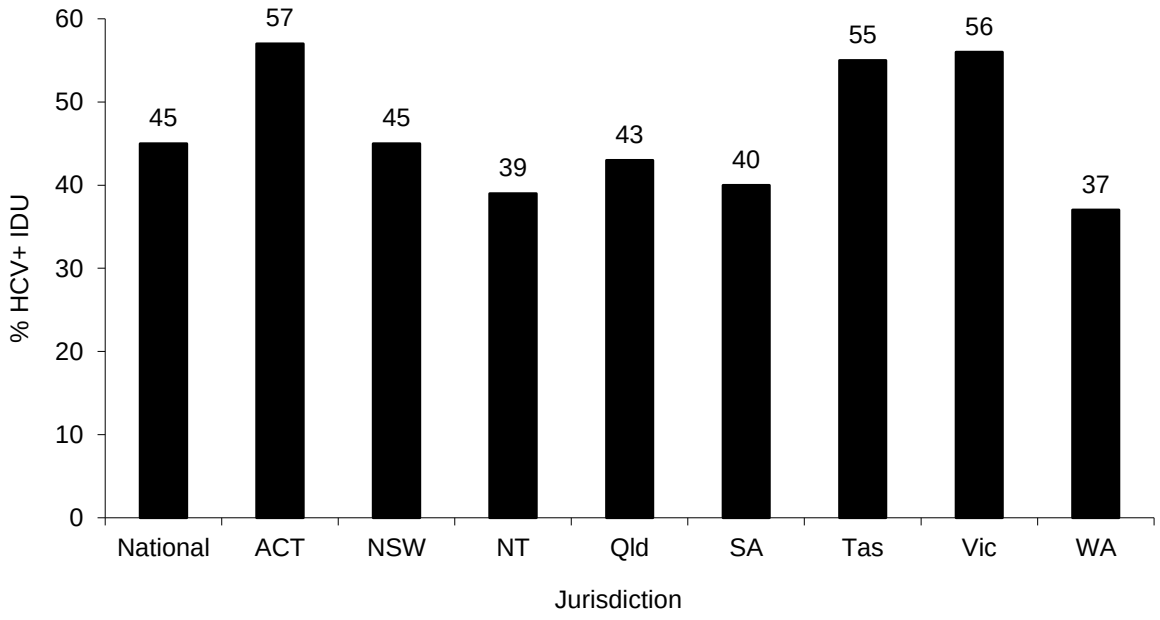

Figure 2: PWID testing positive for HCV antibodies among NSEP attendees by Australian Jurisdiction 2018

Source: [31]

Projections, generally carried out by epidemic modellers, are data-based estimates of how epidemics are likely to develop into the future and are vital to strategic planning in public health. With regards to such projections, a 2010 study found that if current levels of treatment of 3,500 patients per year were maintained, there would be around 11,700 new cases of HCV in Australia per annum for the next 30 years. These would be accompanied

by 228 cases of liver failure, 121 new cases of HCC, 44 liver transplants and 241 liver related deaths at baseline. By 2039, the annual number of these would increase by 11-13%. Increasing treatment rates was found to reduce the number of new cases over 30 years by up to 20% if treatment rates could be improved to 12,000 cases per annum. Substantial reductions in cases of HCC, liver-related death and numbers requiring liver transplants were also observed. [32]. In considering these projections however, it is worth recalling that epidemic models by their nature are required to make certain assumptions. In this case it is important to note that a major assumption is that 30 years into the future, the model's parameters will remained unchanged.

Prevention of Hepatitis C

At time of writing, an effective vaccine for HCV continues to remain elusive. This requires other means of prevention and harm reduction to be sought. Many of these avenues of prevention were summarised by Page et al. [33] as including reduction of sharing drug use equipment, ongoing testing for HCV and counselling, risk reduction within injecting relationships, ceasing injection or taking breaks, needle and syringe exchange, HCV treatment (Treatment as Prevention (TasP), especially with newly emerging direct acting antivirals (DAA)) treatments as well as combinations of these strategies with opiate substitution therapies. A major Australian report [34]found that between 2000-2009, needle and syringe programs (NSPs) had directly adverted 96, 667 new HCV infections. The report also found that for every dollar spent on NSPs, in excess of four dollars were saved in healthcare costs over the next ten years with further savings anticipated in the longer term. The majority of these savings were related to HCV. It is unlikely however, that NSP alone can provide sufficient coverage to ensure an adequate supply of sterile injecting equipment, especially in areas where access to NSP is difficult. For this reason it is necessary to expand the supply of clean equipment via pharmacies, vending machines and secondary needle exchange [35, 36]. The Fourth National Hepatitis C Strategy [37] also lists NSP as the frontline in prevention in Australia and notes that their use in the future is likely to expand. It also notes priority actions as being:

- Increased availability, access to and use of sterile injecting equipment among PWID.
- Continued support for increased access to evidence-based harm-reduction and drug treatment programs including NSP, peer education and opioid substitution programs.
- Building greater understanding of and skills within priority populations, healthcare professionals and the community sector with regards to HCV transmission.
- Consider the impact of new drug therapies (DAAs) that will cure the large majority of cases of HCV.

Treatment of Hepatitis C

Following the initial identification of the virus, treatment in the early 1990s consisted of treatment with interferon alfa, but this produced low rates of success in achieving sustained viremic response (SVR) i.e.: no detectable HCV RNA 24 weeks after completion of the course of medication. Over the course of the next twenty years, improvements were made in the treatment of HCV using combination therapy first of interferon with a second anti-viral agent, ribavirin, and later of pegylated interferon in combination with ribavirin, the latter resulting in rates of SVR of 45-50% in cases of genotype one and 80% in cases of genotypes two or three [38]. Following the approval of

pegylated interferon, Poynard et al. [39] published a paper comparing the effectiveness of 10 different treatment regimens in achieving SVR from 3,010 participants across four studies. Of these participants, 69% were assessed as having HCV genotype 1, 28% as having genotype 2 or 3 and 3% as having another type. Results ranged from just 5% attaining SVR up to 63% SVR in participants receiving high doses of both pegylated interferon and ribavirin. A complete breakdown of these results is shown in Table 2 below.

Table 2: Relative effectiveness of ten HCV treatment regimens (N=3010)

Treatment regimen	Participants achieving SVR
24 weeks interferon	5%
48 weeks interferon	16%
0.5mcg Pegylated interferon per kg bodyweight	21%
1.0mcg Pegylated interferon per kg bodyweight	27%
1.5mcg Pegylated interferon per kg bodyweight	29%
24 weeks interferon & ribavirin	34%
48 weeks interferon & ribavirin	51%
0.5mcg Pegylated interferon per kg bodyweight & ribavirin	54%
1.5mcg Pegylated interferon per kg bodyweight & low dose ribavirin	56%
1.5mcg Pegylated interferon per kg bodyweight& high dose ribavirin	63%

Source: Poynard et al. [39]

Treatment of HCV at the time work on this thesis was conducted was dominated by the use of pegylated interferon alfa-2a in combination with ribavirin. When treating genotype one, the addition of a protease inhibitor such as telaprevir or boceprevir was common [40]. Level of treatment effectiveness to achieve SVR using these medications, was dependent on genotype ranging from around 40% to 80%. [41-45]. The treatment process was lengthy, again depending on the genotype or strain of HCV involved, with genotype one generally taking 48 weeks and genotype three generally taking 24 weeks[32, 42, 43, 45].

In addition to the effects on health and quality of life of those infected, and the risk of ongoing transmission to other members of the community, even if, as discussed above, only a relatively small proportion of these cases proceed to advanced stages of the disease, the cost of medications to treat HCV is substantial. In cases where the virus has resulted in HCC or liver failure where a liver transplant is required, these costs are even more expensive and represent an enormous burden on public health systems around the globe. Treatment for HCV itself is costly with a course of 24 weeks of interferon and ribavirin for chronic infections in 2008 costing $10,829 and 48 weeks costing $18,835. A liver transplant in 2010 cost $120,017 with successive years of follow-up treatment costing $13,363. At levels of treatment in 2010, health sector costs (including medication), patient and family costs, and productivity costs for all patients in Australia were estimated to total $476.6 million per annum. At those treatment levels, projections estimated that all costs (without discounting) associated with HCV treatment in Australia between 2010 and 2039 would total in excess of $32 billion [32]. In Australia, these costs are currently borne by the Pharmaceutical Benefits Scheme (PBS) rather than by the patient themselves.

An additional challenge in the treatment of HCV was the association of interferon-based medications with a wide range of unpleasant side effects. These include depression,

disruptions to the concentration span, elevated transaminases, fatigue, flu-like symptoms, haematological toxicity, hair loss, irritability, psychiatric sequalae, skin rashes, thyroid dysfunction, upper respiratory tract congestion, and weight loss [46, 47]. Beyond being merely unpleasant, it is also likely that these side effects often resulted in patients' non-adherence to medication which has been shown to have an adverse impact on achieving a sustained virological response [48, 49].

Since the work undertaken for this thesis these forms of HCV treatment have largely been replaced by direct acting antivirals (DAA) that, being free of interferon, involve fewer side-effects, and are also of shorter duration, being orally administered as opposed to regular injections and of greater levels of effectiveness [38, 50]. At time of writing however, these newer medications were only just becoming widely available in Australia, and whether they would be available within prison environments was uncertain.

Other potential barriers to accessing treatment may lie in the knowledge, beliefs and attitudes of people infected with the virus. A 2005 Australian study of 100 PWID found that almost half mistakenly believed that current injecting drug use would exclude people from treatment, and there was very little awareness about details of the treatment such as duration or the genotypes that have the best response to treatment. There were thirty participants who had declined offers of treatment. The main reasons given included concerns about side effects, not feeling sick enough to warrant treatment, and having other health priorities at the time [51]. These types of issues were also noted by Mehta et al. [52] in devising a framework for conceptualising the factors involved in accessing and uptake of treatment for HCV. Barriers to entering treatment for HCV identified during their overview of the existing literature included low patient motivation, unstable lifestyle, active IDU, alcohol use, depression, provider-perceived adherence to treatment, perceptions of re-infection, lack of counselling, lack of access to primary healthcare, and health insurance issues. These findings were then employed in an adaptation of Andersen's model of health services utilisation[53] for HCV[54]. Mehta'a adaptation is shown in Figure 3.

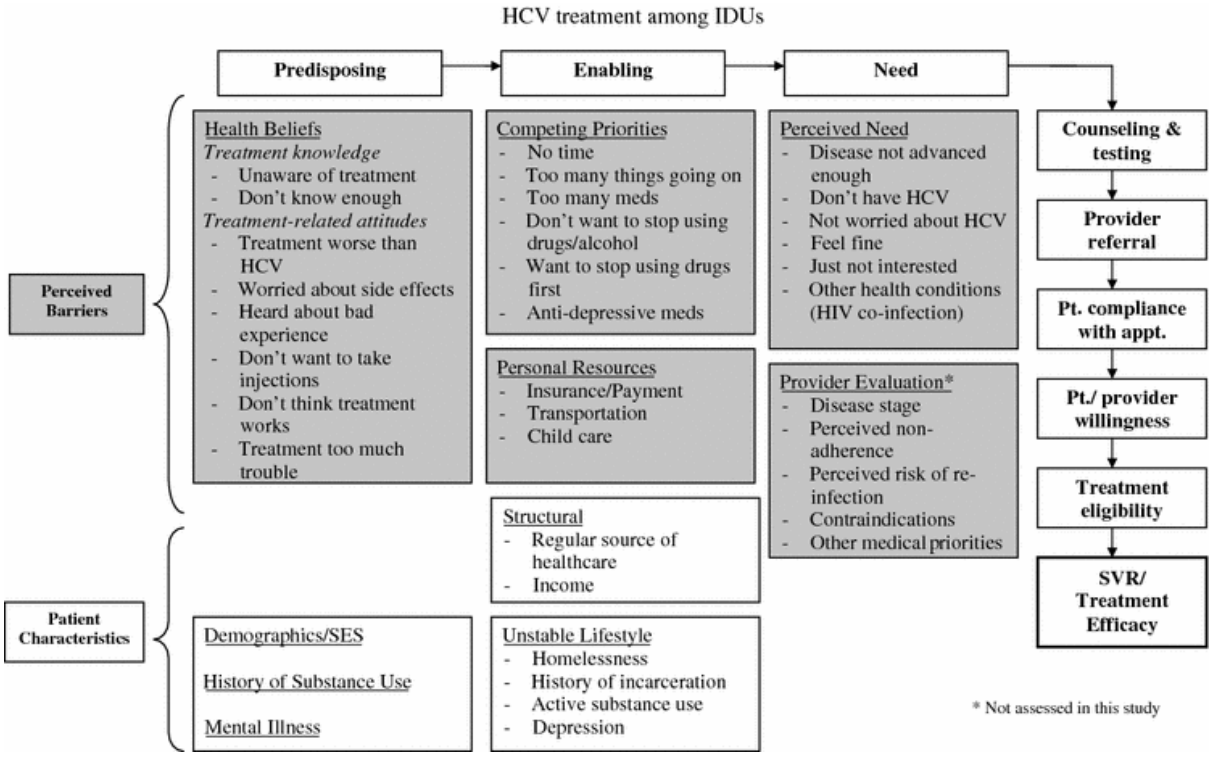

Figure 3: Andersen's Model of Health Service Utilisation adapted for HCV using Mehta's framework [54]**.**

Mehta and colleagues [54] employed this adaptation of Andersen's model as the conceptual basis to help understand treatment uptake among a sample of 597 HCV infected PWID in the United States in 2005. They concluded that the major barrier to accessing treatment was a failure to pass the evaluation stage mainly due to ongoing drug use and possibly unstable lifestyle factors. Also found to be important were fear of the treatment, low perceived need and competing priorities. Issues of cost and lack of health insurance were found to be of limited importance compared to treatment knowledge and competing priorities. The authors noted the need for efforts in addressing knowledge of and fear of treatment if potential patients were even to reach the pre-treatment evaluation stage. It should be noted that Mehta's adaptation deals only with accessing HCV treatments in the mainstream community and that other factors it does not consider are likely to be in play in an artificial environment such as prisons. Further, it deals almost exclusively with barriers to entering treatment with little consideration of motivations that may encourage engagement. These shortcomings of the model will be addressed in the course of this thesis.

It should be noted that being free of IDU for 12 months is no longer considered a formal restriction to accessing HCV treatment in Australia under Section 100 of the PBS, although for reasons such as stigma and discrimination, some patients who continue to inject drugs may remain adverse to accessing treatment [55]. However, at the time interviews with current prisoners were conducted for this thesis it did remain a criteria for exclusion by the Department of Corrective Services in Western Australia [56] although this restriction has since been lifted. Further, advances in technology have largely allowed the role of liver biopsy in assessment for HCV treatment to be replaced by ultrasound transient elastography to measure and assess liver stiffness measurement (LSM). As liver

biopsy is an invasive procedure, and often not well tolerated by patients, especially where multiple samples had to be taken, this advance is likely to have removed a serious barrier to accessing treatment [57]. The reliance on hospital-based models of care in the interferon treatment era represented a key barrier to treatment uptake, especially among PWID who may have experienced stigma and discrimination from health care professionals in these environments[58].

In addition to treatment acting as a means of curing HCV directly, it has also been noted to have a role in prevention, with modelling carried out in Victoria suggesting that a treatment rate of 25 per 1000 PWID could reduce HCV prevalence by 14% in five years, by 32% in 15 years and by 50% within 30 years [59]. The importance of HCV treatment as prevention (TasP) is becoming one of increasing importance, with promising results shown by combination approaches of anti-viral treatment, opioid substitution treatment and needle and syringe programs being demonstrated through modelling techniques to be potentially able to result in decreases in excess of 50% of chronic HCV prevalence over 10 years [60].

Hepatitis C in Prisons

Studies of prisoner health around the world have consistently reported higher rates of HCV amongst incarcerated persons than is found in the general population. Indeed, prisons have been identified as "*a focus for the hepatitis C epidemic*"[61]. With high rates of imprisonment for drug related crime, including consumer and provider offences, the prison population tends to include a large number of individuals with a history of injecting drug use. Nevertheless, illicit drug offences account for around 10% of most serious offences or charges in Australian prisons[62]. Further, prisons constitute high risk environments for ongoing viral transmission because the nature of the environment often involves unsafe injecting practices, amateur tattooing, high levels of violence and unsafe or non-consensual sex [63].

The prevalence of HCV among prison populations differs greatly around the world. While there are a large number of existing studies concerning these levels of prevalence, Table 3 below represents a small selection of these that demonstrate the scope of this diversity and also the substantial differences of prevalence of HCV antibodies between prisoners who inject drugs and those who do not.

Table 3: Summary of international studies of HCV antibody prevalence in prisoners

Study	Country	Sample size	% Prisoners HCV +	% Prisoners who inject HCV+
Weild, A., et al. (2000) [64]	England and Wales	4,778	9% males 11% females	30% males 34% females
Christensen, P., et al. (2000) [65]	Denmark	325	10%	87%
Baillargeon, J., et al. (2009) [66]	USA (Texas)	325, 477	11%	-
Weinbaum, C., et al. (2005) [67]	USA (various jurisdictions)	N/A (review article)	16%-41%	74%
Rhodes, A., et al. (2008) [68]	USA (various jurisdictions)	509	24%	-
Adjei, A., et al. (2008) [69]	Ghana	1,366	19%	-
Butler, T., et al. (2015) [70]	Australia	793	31%	58%
Miller, E., et al.(2006) [71]	Australia	1,347	30%	-

Australia

As of the 30th June 2018 there were 42,974 sentenced and remand prisoners in Australia. With a median age of 35 years, 92% (31,200) of these prisoners were male. More than half of all prisoners had been incarcerated on a previous occasion. The median aggregate length of sentence was three years, however, the median expected time to serve was under two years. Indigenous prisoners accounted for 28% (11,849) of the entire prison population although this varied across jurisdiction, ranging from just nine percent in Victoria up to 84% in the Northern Territory [72]. Despite this though, Indigenous persons were overrepresented in the prison population given that in 2016 they compromised just around three percent of the general Australian population [73].

A national health survey of new entrants to prison was carried out in 2013[70]. Of the 793 prisoners screened nationally in 2013 31% were positive for HCV antibodies. These rates differed substantially across jurisdictions, ranging from 8% in the Northern Territory up to 52% in Queensland. Unsurprisingly prevalence for HCV was higher amongst injectors with 58% screening positive. These rates differed across jurisdictions as shown in Figure 4 below.

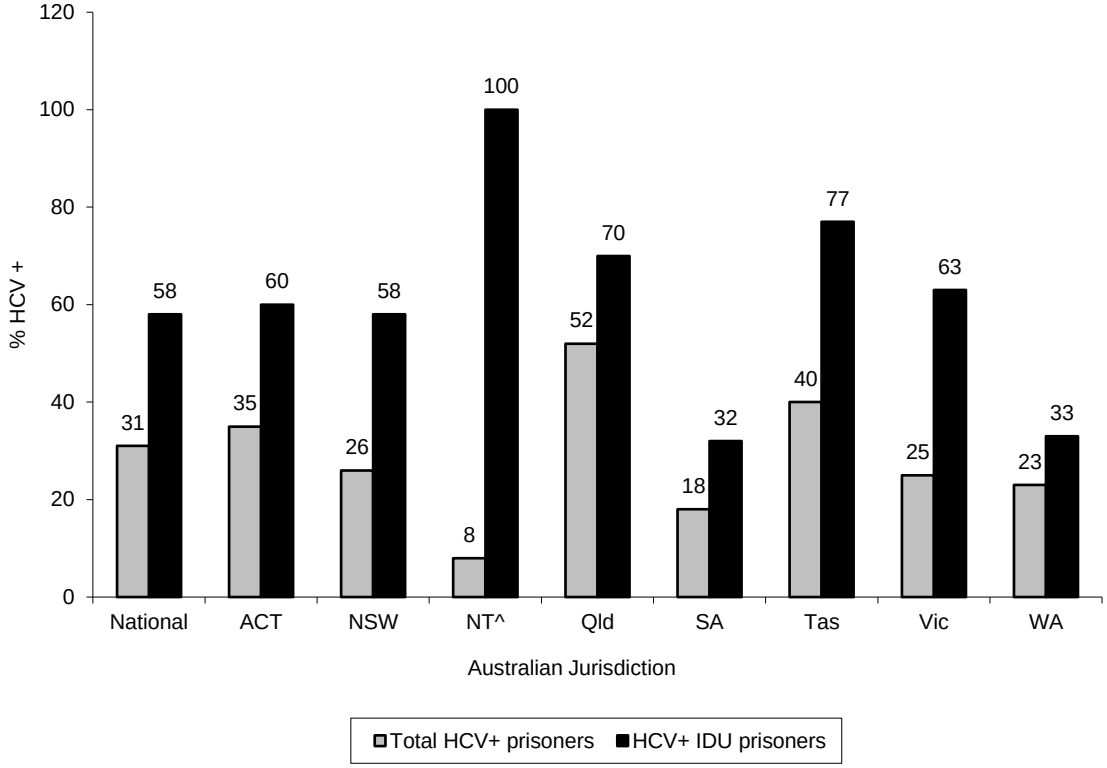

Figure 4: Percent of prisoners and prisoners with a history of injecting drug use screening positive for HCV antibodies in 2013

^ The tested sample in the NT (N=37) contained only two prisoners with a history of injection, both of whom (ie: 100%) were HCV+

The study also showed important gender differences with 56% of male prisoners who inject screening positive compared to 67% of female prisoners who inject. Amongst non-injecting prisoners, four percent of males tested positive compared to 6% of females.

Other findings of the Prison Entrants' Study largely replicate findings of research based in the mainstream population. These include that rates of HCV are increased in direct relation to the duration of injecting with 29% of those injecting for three to five years being HCV positive, rising to 71% amongst prisoners who had been injecting for more than 10 years. Similarly, the rate of injection was a significant factor with more than half of prisoners who injected less than daily screening positive for HCV antibodies compared with over three quarters among prisoners who injected on a daily or more frequent basis. Remoteness of the prisoners' usual residence was also found to be important with those dwelling in "*highly accessible or accessible*" locations being more likely to test positive for HCV antibodies compared to those from "*moderately accessible*" or "*remote/very remote areas*". The study also noted that while prisoners who self-reported as being HCV positive were generally correct, nearly two thirds of those who were not sure about their status were in fact, positive for HCV antibodies. Although identifying as Indigenous was identified as a significant factor in the Prison Entrants' Survey for being HCV positive in the 2007 sample, this effect was not apparent in either the 2010 or 2013 samples[70] . When interpreting this data, it is necessary to consider several limitations of this study. Firstly, all respondents entered the study by participant self-selection and the sample size represents only around 2% of the Australian prison population which may raise questions as to how representative this sample actually is. Secondly, as with many such studies of HCV, prevalence data was based on presence of HCV antibodies rather than active RNA. This means that the test can only indicate if the participant has ever had HCV and not

whether the infection is currently detectable. Thirdly, Butler's study, as its name implies deals specifically with prison entrants and thus provides little insight into ongoing incident infections within prisons.

As the genotype of HCV is clinically relevant to treatment delivery, a study of 354 samples taken from Australian prisoners with identified incident infections were tested, determining that the most common genotype in Australian prisons was 3a followed by 1a. The study also noted that concurrent infection with multiple genotypes was common as was reinfection [74].

History of injecting drug use

As injecting drug use is the main risk factor for transmission of HCV in the wider Australian community accounting for around 80% of infections [75], the same is likely true for prison environments, due in part to the disproportionately large number of illicit drug users incarcerated at any given time. A national survey of Australian prison entrants found that nearly half of new prisoners had a lifetime history of having injected drugs and of these, over two thirds had injected in the month immediately prior to entering prison [70]. A national survey of people who inject drugs on a regular basis found that over half of the 2013 sample had a history of imprisonment [76]. An annual Australian survey of NSP clients reported in 2013 that of 2,407 PWID interviewed from NSP sites around the country, 10% had been imprisoned in the 12 months preceding the survey, and of these, 29% indicated that they had continued to inject whilst imprisoned[77]. An annual report on Australian prisoners revealed that in 2013 illicit drug offences, along with unlawful entry with intent, to be the second most common most serious offence or charge accounting for 12% of prisoners most serious charges. Among female prisoners illicit drug offences were actually the most common serious charge [78].

An earlier study of prisoners in New South Wales in 2009 found 84% of prisoners interviewed reported a history of having ever used illicit drugs [79]. This can be compared with 40% of Australian adults with a life history of illicit drug use in 2010 [80]. The same survey of New South Wales prisoners also found that more than half of those surveyed believed that their current sentence was currently linked to drugs, 43% reported using having consumed illicit drugs while in prison and 17% reported having injected illicit drugs while in prison. Of those with a history of injecting, 22% reported that their most recent injection had taken place while in prison. Of those who reported having injected in prison during the previous month, 15% reported having done so on a daily basis. The type of drugs reportedly consumed or injected within prison is displayed in Table 4. It was further reported that 32 prisoners had initiated to heroin use while in prison and 48% described obtaining drugs in prison as '*easy'* or '*very easy*'[79].

Table 4: Numbers of prisoners reporting consumption and injection of illicit drugs while in prison

Drug type	Consumed		Injected	
	n	%	n	%
Cannabis	307	31.4	N/A	-
Heroin	150	15.4	125	12.8
Other's methadone/buprenorphine	98	10.0	48	4.9
Meth/amphetamines (powder/paste)	94	9.6	69	7.1
Benzodiazepines	81	8.3	3	0.3
Crystal methamphetamine	71	7.3	48	4.9
Cocaine	58	5.9	41	4.2
Other opiates	52	5.3	46	4.7
Ecstasy	36	3.7	9	0.9
Steroids	18	1.8	10	1.0
LSD	15	1.5	3	0.3
Solvents/petrol	6	0.6	N/A	-
Amyl nitrate	1	0.1	N/A	-

Source: 2009 NSW Inmate Health Survey[79]

Drug use in prisons as a risk factor for hepatitis C transmission

Studies that have attempted to calculate incident rates of HCV in prison environments are rare. Of those existing studies, there is considerable variation in HCV incident rates in prison. In part this is likely affected by the number of infected prison entrants which in turn reflects the background incidence of injecting drug use and HCV infection in the wider community in which individual studies were undertaken. Other likely causes of these differences are covered below.

One such example was carried out in a Rhode Island prison by Macalino et al. [81] The study took blood samples from inmates at intake and again after twelve months. The samples tested at follow up were from 446 inmates who had been continuously imprisoned for that time. Incidence of HCV transmission was found to be low at 0.4 per 100 person-years. Prevalence amongst the entire intake cohort was 23.1%.

A few studies have attempted to examine incident rates of HCV within Australian prison environments and revealed these rates to have a widely diverse range. One study of 120 imprisoned PWID in New South Wales reported an incident infection rate of 34.2 per hundred person years, despite a decreased frequency of injection in prison. This study also noted that no particular drug, frequency of injecting in prison, or frequency of sharing was significantly associated with incident HCV infection [82].

Another New South Wales study of 90 prisoners found an overall incidence rate of 7.1 per hundred person years. It also found higher incident rates among those who had served multiple sentences than those who had been continuously imprisoned (10.8 vs. 4.5 per hundred person years) and elevated incident rates among prisoners with a history of injecting drugs (19.3 per hundred person years [83].

A 2010 study of 488 Australian prisoners with a history of drug injection found an overall HCV incidence rate of 31.6 per hundred person years. A number of factors were found to significantly affect this incident rate including being female (42 per hundred

person years), having been continuously imprisoned (22.6 per hundred person years), ever having been tattooed (36.5 per hundred person years), injected in the three months prior to imprisonment (46.6 per hundred person years), main drug injected (ranging from 32.3 per hundred person years for methamphetamine, up to 40.7 per hundred person years for methadone / buprenorphine) and receiving methadone maintenance therapy (60.1 per hundred person years). The last finding is curious since it seems counterintuitive to previous research showing that methadone maintenance in prisons reduced the frequency of injecting [84, 85]. The authors speculated that this may be due to prisoners injecting methadone as opposed to oral consumption [86].

More recently, papers deriving from the Hepatitis C Incidence and Transmission Study in Prisons (HITS-p) have tended to find somewhat lower levels of incident rates in Australian prisons. The study of 210 prisoners with a history of injecting drug use in New South Wales tested prisoners for HCV every 6-12 months for up to four years. This study found an estimated HCV incident rate of 14.08 per 100 person years. Under multivariable Cox regression, his rate was found to be significantly affected by Indigenous identity (27.05 per hundred person years), injecting daily or more during follow-up (36.84 per hundred person years) and injection of heroin during follow-up (43.20 per hundred person years) [87].

Other papers arising from the HITS-p study found an incidence rate of 14.1 per hundred person years, falling to 10.3 per hundred person years among persons who had been continuously imprisoned [88]. Similarly another paper arising from the HITS-p study found an overall incidence rate of infection of 11.4 per hundred person years, falling to 6.3 per hundred person years among those who were continually imprisoned, thereby supporting previous findings that repeated incarceration may in itself be a risk factor for transmission [89].

A study by Cunningham and colleagues examined the HITS-p data from 2005-2014. From among 320 HCV negative cases, an incident rate of 11.4 per hundred person years was observed, falling to 6.3 per hundred person years among those continuously imprisoned, again supporting the idea that repeat incarceration in itself constitutes a risk factor for HCV transmission. Among other factors found to be independently associated with HCV transmission were drug injection on a more than weekly basis and, perhaps unsurprisingly, the sharing of needles and syringes [90].

Another study from the HITS-p project calculated a maximum likelihood estimate for per-injection probability of infection. The probability of HCV infection per injection event was found to be quite low with the best estimate being 0.57%, however, it must be considered that the majority of injecting events involved sharing of equipment and the mean number of sharing events per year could be very high, ranging from just one to 429 with a mean of 56 occasions in the prospective group and 47 in the retrospective group. Sensitivity analysis by varying levels of risk factors was found to cause significant differences to the per-event probability of infection ranging from just 0.17% assuming under-reporting of sharing, up to 6% depending on the proportion of injecting equipment assumed to be contaminated with HCV [91].

A recent study of prisoners in Queensland with a background prevalence HCV rate of 55% found a crude incident rate of HCV infection of 5.1 per 100 person years. It was observed that seropositivity was highly associated with an injection history of longer than 20 years and injection of drugs intended as opiate substitutes [92].

Sharing of injecting equipment

The role of sharing injection equipment in prison in the transmission of HCV is well documented. It is of particular salience in that while imprisoned PWID tend to inject less frequently, the instances of shared injecting occasions tend to increase [89]. Indeed, it has been observed that the scarcity of injecting equipment necessitates the practice of shared injection events in prison environments [93]. Data from the HIPS-p study over 2005-2014 revealed that sharing of needles and syringes among continuously imprisoned PWID was significantly associated with incident HCV infection regardless of the type of drugs involved or the frequency of injection [90]. An Australian study [91]found sharing of needles and syringes in prison to be common place with just three percent of those responding reporting that no one had used the syringe before them, 31% that one person had used the syringe before them, 22% that the syringe had been used by two to five people before them, 17% that the syringe had been used by six or more people and 27% who didn't know. Sharing of other injecting equipment was also widespread. While 35% of those responding reported that no equipment had been used after another person, of the remainder, 56% reported using spoons after someone else, 42% using a filter after another person, 39% using the drug solution after someone else, 35% using water after another person and 24% reported using a tourniquet that had already been used [79].
A small Australian qualitative study of PWID known to have become infected while imprisoned highlighted the risks of sharing injecting equipment. These interviewees described how they would attempt to ensure safer sharing practices by trusting the people that they shared with to truthfully disclose their HCV status and to effectively clean the needle and syringes. Despite this, all but one of the six participants identified shared injecting practices in prison as the likely perceived source of their infection [94].

HCV Prevention in Prisons

There are a number of risks for HCV that are peculiar to prison environments that are described throughout this literature review. These include, but are not limited to the high background prevalence rates of HCV in prison populations and the similarly high rates of injecting drug use among prison entrants, the lack of sterile injecting equipment or access to effective cleaning agents, that injecting in prisons commonly involves sharing equipment, and exposure to blood through violence or amateur tattooing practices. These factors in combination of course, are likely to increase the risk on ongoing incident HCV infection within prisons still further. This necessitates that preventative measures be implemented, and these are discussed in this section.

Calls for preventative measures have been made in the international literature, with a Canadian study by Ford et al. [95] observing that

"*Society needs to urgently consider some alternatives to incarceration of I.V. drug users in an environment where drugs are readily available, where drug rehabilitation programmes are poor or non-existent, where methadone is often non available, and where safe injection practices are often impossible*.".

A 2005 review by Weinbaum et al.[67] of US prisons noted that incarceration was an opportunity for prisoners to access substance use programs which are important in limiting the ongoing transmission of BBVs, but that the availability of these programs was often limited, despite 70-85% of prisoners requiring them. In 1995, just 10% of prisoners had received treatment for substance use in prison. Since then, methadone has been made available to prisoners in seven prison systems, but only to prisoners who were already

receiving it prior to being imprisoned. Only San Juan, Puerto Rico and New York City made methadone available to prisoners not already receiving the treatment.

Weinbaum[67] also identified the nature of the prison environment as setting up barriers, partially through an emphasis on punishment over rehabilitation not fostering attitudes conducive to provision of treatment, and partially through the requirements of security rendering prisoner access to healthcare while incarcerated difficult. It was also noted that there were issues of confidentiality and privacy that made disclosure of infectious diseases an issue and that at time of incarceration, many prisoners were often in crisis, with the result that health care was not a current priority. Although collaborations between prison systems and external bodies had been developed to assist in providing prevention services, the report noted that their implementation was often impeded by financial and institutional constraints.

In Australia, the issue of drug use in prisons is primarily addressed using three approaches. The first of these is supply reduction typically by the use of sniffer dogs and urinalysis of prisoners. The second is demand reduction which includes strategies such as detoxification, opioid substitution therapies, counselling and drug-free units. The third approach is harm reduction, a term which includes initiatives such as education, blood-borne virus testing and the provision of condoms, bleach and needle and syringe programs. An overview of strategies dealing with drug use in Australian prisons published in 2012 noted that while all Australian jurisdictions employed supply and demand reduction strategies in prisons, none had implemented needle exchange programs [96]. This is despite the proven cost effectiveness and efficacy of prison needle exchanges demonstrated over many years in European prisons [97].

There has been some examination of demand reduction strategies in Australian prisons. An Australian study by Dolan and Wodak et al. [98] demonstrated the efficacy of methadone provision within prisons in reducing both injection of heroin and sharing of needles where the dose of methadone was adequate and not restricted by a time frame. Of these prisoners in methadone management, 31% reported injecting in prison compared to 46% of prisoners in standard care, 15% reported injecting heroin in prison compared to 38% in standard care and 21% reported sharing syringes compared to 39% of those prisoners in standard care. A later study reported that maintaining prisoners on methadone treatment for longer than 377 days lowered the HCV conversion rate from 22 per hundred person years for those not on methadone to eight per hundred person years. The study also noted however, the hazards involved with prisoners discontinuing MMT after a shorter period which actually increased their risk of contracting HCV. It was observed that this was particularly associated with prisoners on short sentences [85]. Reductions in heroin use were also observed in a Puerto Rican study which found evidence of heroin use in only one of 20 prisoners assigned to methadone treatment compared with nine of 40 randomly selected prisoners [99]. Despite these findings, it should be noted that provision of methadone and other opioid replacement therapies such as buprenorphine are not consistently available in prisons across various Australian jurisdictions [100]. Problems with administering methadone programs in prison were also noted in a Canadian article which observed;

"Drug rehabilitation programs are inadequate or non-existent, and on the whole, methadone is available only for heroin addicts who were enrolled in the programs before imprisonment. The physician who attempts to provide appropriate treatment often meets with resistance from prison authorities. Failure to address the

addiction makes treatment of HIV or hepatitis C difficult, given that compliance with therapy is linked to treatment of addiction."[101]

The unique role of nurses in prison as a frontline in prevention has been documented since they are in a position to observe track marks, new tattoos and injuries and provide appropriate advice. Conversely, it was also observed that language barriers or low levels of literacy and verbal skills amongst many prisoners make transmission of detailed information regarding prevention and health management problematic [102].

With regards to harm reduction strategies, a qualitative study into perceptions of HCV education and prevention in prisons was carried out with 23 health workers who were involved with the management or provision of these services [103]. The researchers found that while all Australian jurisdictions offered HCV education in some form, however, it was not generally compulsory, with several jurisdictions offering incentives to participate. It was noted that informal discussion was more often more effective than classroom formats. Many employees could elect not to attend voluntary education programs and that mandatory programs were commonly of minimal duration. A common problem was rapid staff turnover resulting in discontinuity of services or programs being terminated. Most interviewees reported that bleach for cleaning syringes was not available or if it was, it was difficult to obtain. This situation was compounded by prisoners' unwillingness to request bleach since doing so may have identified them as injecting drug users to the prison authorities. In the absence of bleach, some educators had advised prisoners to consider the use of shampoo or detergents for cleaning injecting equipment. Although the study did not specifically ask about needle and syringe exchange, several respondents mentioned the perceived desirability of having these programs in prison, although it was acknowledged that this was unlikely to occur in the near future. The study concluded that *"Delivery of hepatitis C education and services in Australia is marred by inconsistency. However, both education programs and psychological support services could be developed by external agencies wishing to reduce the impact of hepatitis C within the prison system"*. [103]

With further regards to bleach, in the absence of new sterile injecting equipment, bleach has long been considered a viable "next-best" option if used as a cleaning agent to sterilise needle and syringe units prior to their reuse by additional individuals [47, 104]. It should be noted however, that some studies have called into question the efficacy of this method [105]. Also, a recent Australian study of people who inject while imprisoned noted that bleach was not always easy to obtain and time for cleaning injecting equipment often limited without attracting attention from guards [94].

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Further evidence regarding the efficacy of educational approaches was found in an Australian study comparing the effectiveness of two different approaches in reducing HCV risk behaviours in prisoners. Participants were randomised to either a standard educational intervention or to a tailored brief behavioural intervention. While prisoners reported increased satisfaction with the tailored intervention, both intervention types were found to result in significant decreases in behaviours associated with HCV risk [106].

The role of needle and syringe exchange in HCV prevention

Needle and syringe exchange programs (NSP) are well known as a frontline method of harm reduction and prevention of HCV transmission. In Australia, epidemic modelling has demonstrated that between 2000 and 2009 these services prevented 96, 667 new cases of HCV, 693 cases of cirrhosis, eight cases of hepatocellular carcinoma and 16 cases of

liver failure. The study also reported that for every dollar invested into NSPs, in excess of four dollars were returned in health cost savings over ten years, with increased returns anticipated over longer time frames, and with the majority of these savings associated with HCV as opposed to other blood-borne viruses such as HIV [34].

Despite the established effectiveness of NSP in the prevention of HCV transmission, their implementation in Australian prisons remains untried and controversial, one paper observing that;
"Replacing speculations concerning syringe distribution in prison by an evidence-based health policy may facilitate reconsideration of harm reduction strategies in prison. However, these decisions are political, and it remains to be seen whether politicians are prepared to apply public health criteria to an environment for which the overriding philosophies are security, punishment, and social control."[107]

A recent evaluation of a prison in the Australian Capital Territory noted that although the concept of prison needle and syringe programs (PNSP) was widely supported by both prisoners and health staff, there was considerable resistance to the idea from custodial staff [108]. In Europe however, PNSP has been in place in a number of countries including Switzerland, Germany, Spain and Moldova for over two decades now. A 2003 review of these programs took into account over 40 prison-based NSP sites and described various models by which PNSP could be implemented. These models included vending machines, direct provision by prison medical staff, provision by external agencies or drug counselling services, and distribution using a peer-driven approach. The review also reported no evidence of an increase in drug use, misuse of syringes as weapons or any difficulties in disposal of syringes. A reduction of sharing needles among prisoners was also observed. However, the review's authors acknowledge some limitations in interpreting their findings. Primarily that caution should be employed in comparing findings taken from different types of correctional institutions and means by which PNSP programs had been implemented. Further, the authors acknowledged that much of drug use and sero-status was by self-report. They also noted that comparison between those prisoners who had access to PNSP and those who did not was prevented by ethical considerations [109].

The United Nations Office of Drugs and Crime have noted a number of advantages of PNSP. These include feasibility and affordability, decreasing the sharing of syringes and in turn decreasing the risk of blood-borne virus transmission, no increase in attacks using injecting equipment thereby contributing to workplace safety, not contributing to increased drug consumption or injection, and a reduction in the instances of abscesses. It was also noted that PNSP enabled referral to treatment programs, could be delivered via a variety of means, were effective in a wide range of prison systems and could coexist with other prevention and treatment initiatives [97].

HCV Testing and Treatment in Australian Prisons

It has been noted that "*Prisons offer an ideal setting for the treatment of hepatitis C because maximum compliance, which is necessary for achieving a sustained virological response can be assured.*"[110] The concept that imprisoned persons have a right to the same quality of health care as that available to the general population is documented in the international literature [101]. Furthermore , it has been observed that a failure to achieve this is not only to the detriment of prisoners but also poses risks to wider society [111]. In this sense, the importance of providing adequate testing and treatment for HCV in prison environments can be considered self-evident.

The previously discussed Australian study by Dyer and Tolliday [103] also examined aspects of testing and treatment in prisons available to inmates known to be HCV positive. A number of issues posing barriers to treatment were identified. These included under staffing and under-qualified staffing, prisoners lack of understanding of literature provided and prisoners sometimes being unwilling to access services due to concerns over lack of privacy or of drawing attention to themselves. Further costs and time constraints were also incurred with the frequent hospital visits required during the course of treatment. The high cost of treatment itself was identified as an additional barrier, resulting in some custodial facilities only able to treat a limited number of patients at a time. Other barriers identified included issues surrounding patient psychiatric history, risk of re-infection and the length of sentence. It was noted that if the prisoner was released before treatment was completed that follow up was often difficult and further efforts in this area were required.

Although the 2013 National Prisoner Entrants' Blood-borne Virus and Risk Behaviour Survey found only four prison entrants currently receiving treatment for HCV, 37% said they were '*willing*' or '*very willing*' to receive treatment as opposed to just 13% who were either '*unwilling*' or '*very unwilling*'. Opinion was divided however on the issue of whether they would be more willing to receive treatment while in prison than in the community with 25% indicating that they would, 23% saying that they wouldn't and 21% who were unsure. The survey also noted that there were just 9% of prison entrants (including five who identified as Indigenous) who had ever received treatment for HCV, and observed that this suggests that there may be "*great potential*" to increase numbers of prisoners receiving HCV treatment [70].

One possible model of assessment and treatment in prisons examined in a 2013 Australian study was a nurse-led outreach program. The program enrolled 391 patients of whom 36% completed eligibility assessments with 27% initiating treatment. Although 7% discontinued treatment, of those who completed until follow-up, sustained virological response was achieved by 69%. The study's authors concluded that this showed potential for this approach in terms of treatment uptake and positive outcomes, although it should be noted that there was no attempt to compare these findings with evaluation of alternative models. Some difficulties and imitating factors were observed however, notably that prison guards, while generally supportive often had little understanding of HCV, and prison nurses often lacked knowledge regarding the side effects of treatment or how to manage them. These side effects were also noted as a source of anxiety among prisoners who may otherwise have considered treatment. Also observed were issues related to prison environments where custodial issues were prioritised over healthcare thereby restricting access to treatment [112].

Another evaluation of a prison HCV assessment and treatment service was conducted in New South Wales from 1996 to 2005. Of those prisoners treated, 55% attained a sustained virological response and there were no reports of failure to adhere to therapy. It is notable that in this instance, liver biopsies were performed within the prison thereby avoiding the inconvenience of having to transport prisoners to a specialist clinic. Also, during the course of the evaluation the restriction excluding currently active PWID from engaging in treatment was lifted expanding the number of prisoners eligible for treatment. The principal reason for exclusion was the situation where prisoners were likely to be released before treatment could be completed. It should be noted however, that this evaluation was carried out prior to the introduction of DAA medications with a much shorter

duration of treatment which would likely have rendered this issue less commonplace. The study concluded that prison offered an opportunity for assessment and treatment of HCV with the added benefits of being able to reach groups such as Indigenous Australians, PWID and those with psychiatric conditions who are often difficult to engage in the wider community [113]. The observation that imprisonment offered an opportunity for treatment of HCV was also noted Post et al. [114], adding that the introduction of DAA medications would likely expand this opportunity.

Despite this opportunity for treatment, there are nevertheless some issues specific to the prison environment that create difficulties. One of these is a lack of specialist medical staff on site, necessitating transport of prisoners to hepatology clinics outside of the prison. In recent years, this problem has been somewhat mitigated by the use of technologies such as teleconferencing. Another approach to the issue of lack of specialist staff has been the move to a nurse-led model of care in which a substantial proportion of tasks involved in assessment for treatment that would normally be handled by specialists are transferred to nurses. Following the assessment, the patient is triaged according to the nurses' evaluation of likely adverse effects of treatment. This triage process results in low-risk patients being discussed in teleconference with a specialist, medium –risk patients actually participating in the teleconference and only high-risk cases being transferred out of the prison to be assessed in person by specialist doctors. Another issue is the length of time taken to complete the clinical pathway of assessment prior to treatment, often taking five to six months which often exceeded the average length of prisoners' sentence. The problem of duration of sentence also extended to a loss of follow-up when prisoners were released prior to completing treatment. Under some models, the duration of sentence is further extended by assessment only commencing following evidence of persistently elevated transaminase levels for more than six months and the prisoner having to sign a waiver to the effect that they would not be granted parole until treatment was complete[115] . Former prisoners commonly report obstacles to continuing treatment including long waiting times to be screened in the community, difficulty obtaining medications, lack of health insurance and lack of awareness as to how to access care in the community. It has been suggested that this problem be addressed by creating drug-free transitional environments to facilitate continuation of care outside of prison [116].

Factors affecting treatment uptake specific to prisons were also explored in a qualitative study of 116 prisoners and 29 health professionals in New South Wales, Queensland and Western Australia. The study developed a model identifying a number of domains describing both barriers and motivations affecting prisoner readiness for treatment. Barriers identified included prisoner stress, lack of knowledge about treatment in prison, prisoner perceptions of treatment, fears related to treatment, issues with physical health, substance use and issues related to being transferred to another prison for treatment. Other barriers were created by the treatment process itself including lack of continuity, waiting times, hospital visits, access to prison clinics, perceptions of a lack of care or support, treatment eligibility due to medical comorbidities. Barriers at the community level included stigma and discrimination and issues surrounding confidentiality. The study also identified motivators to entering treatment. These included protecting family and children, health and wellbeing, career, life changing events, removing stigma, peer-based knowledge and encouragement from nurses [117].

Conclusion

The HCV virus constitutes a long-running global epidemic with injecting drug use as the prime route of transmission. Although many of those who progress to a chronic infection will remain asymptomatic, those who do not may experience a decline in quality of life due to symptoms such as fatigue and nausea. In the most serious cases the disease may progress to cirrhosis of the liver possibly leading to the development of hepatocellular carcinoma and / or liver failure, conditions requiring a highly expensive liver transplant to avoid death. Given the very large number of people with chronic HCV around the world, this has the potential to present an enormous burden to public health systems of all countries. If this situation is to be avoided, it is highly desirable to treat infected persons much earlier in the disease's progression. However, the number of people with HCV who are actually receiving treatment for the disease is very low [115]. Australian projections have shown that unless the current situation changes, the number of HCV cases and associated poor outcomes will increase enormously over the next three decades. It is therefore of vast importance that the number of people with HCV engaged with treatment be greatly increased.

As people who inject drugs tend to experience very high rates of incarceration, prisons may provide a unique opportunity to engage many more people in HCV treatment programs. Indeed, studies from many nations have consistently shown the prevalence of HCV among imprisoned populations to be very high, largely due to the large numbers of people who inject drugs present within those populations and other studies have shown HCV treatment programs in prison environments to be both feasible and effective. Despite this, there are commonly barriers at the governmental level that result in failures to provide continuity of care, prevention and treatment throughout imprisonment although it is acknowledged in the literature that these failings constitute violations of human rights regarding discrimination, cruel and inhuman treatment and access to health [118].

However, while the high background prevalence of HCV in prisons does offer great opportunities to enable more people to access treatment programs, the prison environment also houses high levels of unsafe injecting practices due to a lack of clean equipment and widespread instances of shared injecting occasions. In order that HCV treatment programs are not undermined by ongoing transmission of HCV within the prison system, then enhanced preventative and harm reduction measures will also need to be put in place. Further to this challenge, it is known that there exist a number of barriers to accessing HCV treatment in the community and the nature of the prison environment is likely to give rise to additional barriers which will need to be better understood if the objective of increasing the number of prisoners engaged in HCV treatment is to be achieved.

Rationale for this Thesis

It is evident from the review of the literature that there a number of substantial gaps in the research pertaining to HCV, its treatment, and drug use within the context of Australian prison settings. In part, this is likely due to the acknowledged difficulty of conducting research in prison settings [119].

HCV has been identified as a serious challenge to public health, and prisons identified as a central focus of the epidemic[61]. With this in mind, it is absolutely vital that research be conducted with a view to eliminating these gaps in the published literature.

In the process of conceptualising this thesis there were several areas identified as priority areas of interest. The first of these concerned prisoners themselves in terms of their understanding of HCV and its treatment, and the motivations and barriers they perceived and experienced in accessing treatment while incarcerated. The second concerned the fact that while injection of drugs both inside and outside of prison is widely acknowledged as the prime risk factor for transmission of HCV [5], there is a serious dearth of published knowledge surrounding the contexts and frequency in which injecting occurs within prison. Thirdly and finally, it is desirable to model the estimated benefits and costs of both increased treatment and prevention initiatives relative to each other.

There are of course models of treatment utilisation dealing with why or why not patients accept treatment courses to deal with various conditions. In the case of HCV, while Mehta's adaptation of Andersen's model [52] seems compelling, it is primarily focussed on disincentives rather than motivations, and further, does not deal with the very artificial and regulated environment of prisons where additional issues are likely to be at play. Although the proportion of prisoners known to be infected with HCV is vastly higher than that of the general Australian community, and prisons identified as ideal settings in which to undergo treatment for the disease, the number of prisoners utilising this opportunity to undergo treatment remains small. It is clearly desirable to gain a better understanding of why this should be the case and if and how it can be improved. In order to do this, it is necessary to gain an understanding of how prisoners perceive and experience motivations and barriers to entering treatment as well as their understanding of the disease (Chapter 3).

Similarly, against a backdrop of very high HCV prevalence with little harm reduction strategies in place, it is necessary to understand the context in which injection episodes in Australian prisons occurs. There are multiple questions here; how often does injection occur, how many prisoners are present at injecting events, how often do prisoners share needles and syringes, and how regularly does effective cleaning of needles and syringes occur (Chapters 3 and 4). All of these are questions that have not been well researched, but are important questions to understanding the spread of the virus within prisons.

Furthermore, there is a serious dearth in the scientific literature exploring the economic environment of illicit drugs in Australian prisons. Questions specific to this area are those addressing how the nature of this illicit economy may contribute to risk factors for transmission of HCV. These include how many prisoners are importing illicit needles and syringes into prisons, how many of these units are for personal use as opposed to those intended to be on sold or rented out, the number of prisoners typically present at an injecting occasion where shared or rented equipment is being used, and what are the rewards and benefits that encourage this ongoing importation of contraband (Chapter 5).

With regards to the treatment of HCV within prisons, while it is generally acknowledged that prisons are an ideal environment to undergo the necessary procedures, there are relatively few prisoners actually engaged in treatment, and little research into treatment outcomes [110] or how increasing numbers who are engaged may impact of public health. Key questions in this area include how increased levels of treatment may affect the rate of incident infections in prison, and how they would affect the numbers of still infected prisoners being released back into the community. Assessing this requires epidemiological modelling.

Further to this, there is also the question of would prevention be better than cure? This essentially comes down to lowering the incidence of infection. There is no clear plan on how this should be approached in Australian prisons and current estimates of incident rates of infection vary greatly [82, 83]. This requires epidemiological modelling with considerable estimation involved in the parameters employed. Although hypothetical, this line of investigation remains worthy and is investigated in Chapter 6.

These are a diverse range of areas and it is clearly not possible to address them all with one single approach. A range of methods is required, including qualitative, quantitative, mixed methods, and mathematical modelling to adequately respond to the various questions raised by each. The specific aims and the exact method of approaches required by each of these aims is addressed in detail in the methods section in Chapter 2.

CHAPTER 2: Aims, objectives and methods

This chapter describes the aims, objectives and methods used in this thesis. The research had five aims which are described below.

Aims:

1) To gain an understanding of the contexts and circumstances under which injection occurs in Australian prisons.
2) To use qualitative data to explore the barriers and motivations of prisoners to engage in treatment for HCV prior to the introduction of new generation of direct acting antiviral (DAAs) medications.
3) To use quantitative data to form an estimate of how many drug users continue to inject in prison, the frequency with which they do so, and the predictors of this behavior.
4) To produce an estimate the proportion of prisoners involved in importing needle and syringe units into Australian prisons as contraband, identify characteristics that affect the likelihood of involvement and to describe the nature of this illicit market in terms of price and types of currency that are accepted.
5) To develop an epidemiological model of how altering levels of prisoner involvement in treatment prior to the introduction of DAA medication and lowering incident rates of infection using harm reduction approaches would likely affect progression through HCV-related stages of fibrosis, proportion of prisoners still infected who are released back into the community and public health costs projected across several decades.

Methods:

As this thesis examined a number of different lines of enquiry a mixed methods approach was required. These are detailed below

Study One – Qualitative data was used to investigate the situations under which

a) The injection of illicit drugs in prisons occurs and
b) The barriers and enablers for engaging with HCV treatment in prisons from the perspective of the prisoners prior to the introduction of DAA medications.

Quantitative data was also collected regarding demographics, drug use history and knowledge of HCV in order to contextualize these findings although these are not findings in and of themselves. Results from this study are located in Chapter 3.

Study Two – Quantitative data was collected from former prisoners to investigate the frequency under which injection of illicit drugs occurs in Australian prisons, and the characteristics of those most likely to do so. Results from this study are located in Chapter 4.

Study Three – Quantitative data was collected from former prisoners to gain insights into the proportion and characteristics of prisoners who inject drugs who are likely to be involved in the importation of needle and syringe units as contraband and the on-sale or rental of these items. This study also investigated the prices and types of currency involved in this illicit economy. Results from this study are located in Chapter 5.

Study Four – This study generated an epidemic model of transmission of HCV in Australian prisons and compared the effectiveness of HCV treatment prior to the introduction of new generation DAA medications with potential harm reduction initiatives in preventing ongoing transmission. The model was also used to project the

likely costs of treating prisoners several decades into the future. Results from this study are located in Chapter 6.

Methods employed for each study are discussed separately below.

Study One: In depth interviews

This study investigated two separate questions:

a) The situations under which injection of illicit drugs in prisons occurs and
b) The barriers and enablers for engaging with HCV treatment in prisons.

A total of 28 in-depth interviews were undertaken with current (n=15) and former prisoners (n=13), This approach allowed former prisoners to be questioned regarding drug use practices while in prison, a line of enquiry that for reasons of confidentially was not permitted among current prisoners by the Department of Corrective Services (DCS). The data collected from these interviews is presented in Chapter 3 with the bulk of the commentary presented in the discussion section located in Chapter 7. These two groups necessitated using slightly different approaches to the recruitment and interview process.

Recruitment of former prisoners

Former prisoners were recruited from across three sites in the Perth metropolitan area in Western Australia; The Western Australian Substance Users Association (a peer-based users collective), Hepatitis WA (an organisation providing support for those affected by HCV which also operates a needle and syringe provision program) and Outcare (an organisation providing various support services to people recently released from prison). Recruitment was achieved through posters that were designed in consultation with key staff of these organisations and members of the project reference group which included researchers, BBV educators and outreach workers, Aboriginal health workers and staff of the Department of Corrective Services (DCS). The posters were displayed in the services' reception areas, and fliers were provided to clients identified as likely to be eligible by the services' staff. Information sheets were provided for staff of the services to explain the nature of the study and assist in identifying clients likely to be eligible. It is acknowledged that this approach is likely to result in a sample with unusually high levels of awareness of HCV and its treatment. This is covered in the discussion section. Reproductions of this material can be found in Appendix A.

To be eligible to participate respondents had to:

- Be over 18 years of age.
- Have been released from an adult prison within the last 6 months.
- To have had either an ongoing HCV infection prior to imprisonment, or an infection believed to have occurred while imprisoned.

Participation was voluntary, by self-selection and confidential with no identifiable data collected. All interviews with former prisoners were conducted at public locations in the inner city, primarily coffee shops and public houses. Statements of informed consent were read to the participants prior to the interview and responses noted by the interviewer. Due to the illicit nature of the topics covered in the interview, signed consent was not required with verbal consent considered sufficient, a process approved by the Curtin

Human Research Ethics Committee. Questionnaires were administered by the interviewer and participants were reimbursed $30 for their time and costs of transport. No potential participants refused to continue after being read the statement of consent and no participants failed to complete the interview in its entirety.

Recruitment of current prisoners

Recruitment was achieved through posters designed in consultation with DCS staff to be displayed in the health clinics of both prisons selected in co-operation with DCS as recruitment sites. These prisons were an all-male maximum-security facility and an all-female minimum-security facility. Posters were displayed in prison health clinics where clinicians were encouraged to recruit prisoners who met the eligibility criteria. As with former prisoners, it is acknowledged that this approach to recruitment is likely to lead to a sample with unusually high levels of awareness of HCV and its treatment. These limitations are described in the Discussion (Chapter 7). Reproductions of this recruitment material can be found in Appendix A.

In order to participate, current prisoners had to:

- Have been (or currently being) treated for HCV whilst in prison
  or;
- Currently have a chronic HCV infection ***and*** have served a sentence of at least two years while infected to ensure participants had adequate opportunity to access prison health services and potentially commence treatment.
- Whether infection had occurred prior to or during treatment was not a consideration for eligibility to participate.

By necessity, DCS clinical staff were extensively involved in the recruitment process. Details of the process used in the recruitment of current prisoners are shown in Figure 5 below.

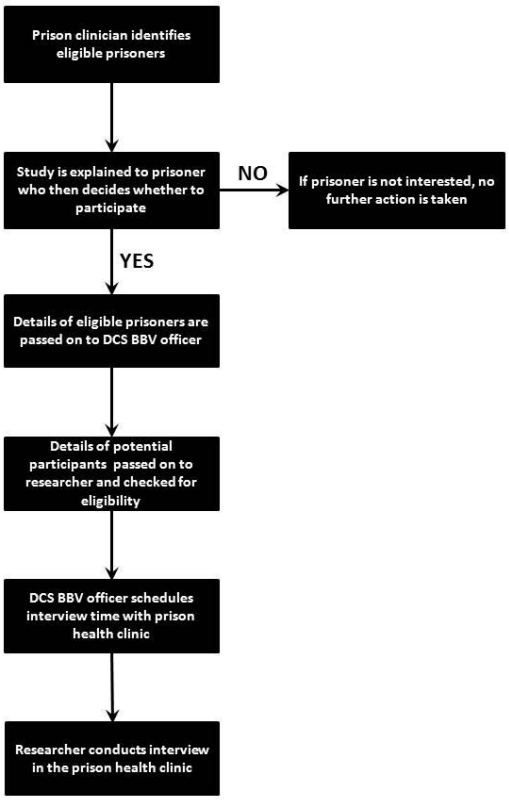

Figure 5: Recruitment process flowchart for use with current prisoners

All participation was voluntary by self-selection and confidential with no identifiable data collected. A total of 13 current prisoners were interviewed. All interviews were conducted within the health clinic at the respective prisons. Statements of informed consent were read to the participants explaining the nature and purpose of the study prior to the interview and responses noted by the interviewer. If agreement to participate was obtained, the consent form was signed by the interviewer on behalf of the participant. As per agreement with Curtin University HREC, participants were not required to sign the consent form since this would constitute identifying information and verbal consent was deemed sufficient. All participants were offered copies of the study information sheet to keep. In accordance with DCS requirements, current prisoners were not offered any form of inducement to participate. No potential participants refused to continue after being read the statement of consent and no participants failed to complete the interview in its entirety.

Conduct of the interviews

In-depth interviews were conducted with both current and former prisoners. An interview guide was developed to ensure the interviews remained within the parameters of the study and prompts or probes were used to ensure that sufficient detail was elicited from each participant.

In order to provide descriptives and context to those responding to the qualitative component, quantitative data was collected to obtain basic demographic data and prison history. Information concerning history of drug use and knowledge and experience of

HCV and its treatment was also collected. It should be noted that as all recruitment of participants was achieved through peer support and clinical services that knowledge of HCV among respondents was likely better and not necessarily reflective of that among the broader Australian prison population.

There were two qualitative components of the questionnaire. The first of these dealt with exploring the contexts under which injection of drugs occurs in Australian prisons. Due to restrictions imposed by the Department of Corrective Services on the interviews with current prisoners, questions relating to injecting in the prison setting could not be asked. Therefore, this section was only asked of former prisoners. The second section dealt with exploring barriers and motivations to accessing treatment for HCV while in prison prior to the introduction of new generation direct acting antiviral (DAA) drugs.

In the case of former prisoners, these qualitative components were recorded using digital equipment. This was not permitted for current prisoners by agreement with the Department of Corrective Services so data gathered from these interviews was transcribed directly by an assistant. Generally, the interview format involved an interview length of 20 to 50 minutes depending upon the depth of qualitative information the participant chose to disclose. The survey instruments used for interviews with both former and current prisoners are located in Appendices B and C respectively.

Analysis of quantitative data

All analysis of the quantitative data was performed using the SPSS version 19 statistics software package [120] to generate frequencies and descriptives, thereby providing context to the qualitative data that addressed the experiences of injection in prison and barriers and motivations to entering treatment for HCV in Australian prisons.

Analysis of qualitative data

The qualitative components of the interviews were transcribed and then coded using NVivo software [121]. Thematic analysis was conducted to explore emerging issues surrounding contexts under which injection in prisons occurs. The coding schema that emerged from this analysis is displayed in Chapter 3, Figure 6. Similarly, motivations and barriers to entering treatment for HCV prior to the introduction of DAA treatments in prison were examined in the context of Mehta's adaptation of Andersen's model of health services utilisation for HCV[52]. How such a model might be applied in a prison health service environment was also considered. This model was chosen as it was specific to HCV and had been used in the past to understand how patients with HCV choose to access relevant health services

Transcripts of interviews with participants identifying as Indigenous were examined by four Aboriginal health researchers with a view to identifying and interpreting data that may be of specific indigenous relevance.

Study Two: Determining the rates of injection within Australian prisons

This study utilized data collected from former prisoners participating in the 2009 Illicit Drugs Reporting System (IDRS).

The IDRS is a Commonwealth government funded annual survey designed to monitor national trends in illicit drug markets including use, price, availability and purity as well as monitoring harms such as criminal involvement and injecting practices. Data are collected in June of each year. A minimum of 100 participants are recruited from each of Australia's eight capital cities, primarily from needle and syringe programs. This data collection has continued in all Australian jurisdictions since 2000. The author of this thesis has been consistently involved in the collection of Western Australian data from the IDRS project since 2001. Participants are required to be at least 18 years old, to have resided in their current city for at least 12 consecutive months, and have been injecting on at least a monthly basis. Participation is entirely voluntary and by participant self-selection. IDRS respondents are reimbursed $40 for travel and other related expenses. The IDRS history and methods are described in detail elsewhere[122]. Supplementary data collected from the IDRS sample was used in this thesis to explore the rates at which injection occurs in Australian prisons.

Retrospective, cross-sectional data were collected from regular PWID taking part in Australia's 2009 Illicit Drug Reporting System (IDRS) [123] which recruited a study sample of 881 PWID. The 2009 IDRS survey instrument included a series of additional questions on in-prison injecting practices in the past ten years. As per agreement with the IDRS national co-ordinators, the number of additional questions permitted to be appended to the main survey was strictly limited. Five specific questions were included, covering prison history, history of injection in prison and frequency of injection during the most recent period of incarceration. These five additional questions are reproduced in full in Appendix D.

Data concerning injection behaviours while in prison were collected from participants who had been incarcerated at least once in their lifetime and had been released from their last incarceration period no more than 10 years ago and had not commenced injection since their last release from prison, yielding a study group of 355 former prisoners.

All data analyses were carried out using IBM SPSS Statistics version 19[120]. Binary logistic regression was used to identify factors associated with injecting in prison, having been identified as an appropriate statistical approach with benefits of ease of interpretation. Demographic data and variables relating to drug use history routinely collected by the IDRS were tested as independent variables including sex, highest school grade completed, age of first injection, drug of choice, having previously been in drug treatment, income per week, having received income from crime in the last month, and length of the most recent prison sentence. Factors found to be significant by univariate regression were then incorporated into a multivariate model and analysed using the backward-stepwise method.

Study Three: Investigating the illicit needle and syringe trade in prisons

Data collection for this component took an extremely similar approach to that of Study 2 in terms of recruitment and gathering of data. A small number of questions were appended to the 2011 IDRS survey [124] with 319 respondents who had been imprisoned within the last ten years providing data. These questions investigated the degree to which unsanctioned importation and trading of needles and syringes occur within Australian prison environments and the nature of the transactions involved in this trading. The demographic data routinely collected by the IDRS of those involved in sale or rental of

needle and syringe units was analysed using binary logistic regression using the backstep method to determine the characteristics of those most likely to engage in these practices, this having been identified as an appropriate statistical approach with benefits of ease of interpretation. Again, by agreement with the survey's national co-ordinators, the number of questions permitted to be appended to the main IDRS survey was strictly limited. Questions asked covered time elapsed since last imprisonment, if the participant had ever imported injecting equipment into prison, if they had ever rented or bought a syringe in prison, how much renting or buying injecting equipment in prison cost and how many people were typically present at an injecting occasion. These questions can be found in full in Appendix E. By 2011, a history of imprisonment had been incorporated into the core IDRS questions and so did not need to be addressed in these additional questions. Analysis of this data was undertaken using SPSS software [120].

Study Four: Modelling the effectiveness of HCV treatment and prevention within Australian Prison Environments

This component of the thesis employed deterministic epidemic modelling methods based upon an adaptation of a Susceptible–Infected–Susceptible (S-I-S) compartmental model structure to be applied to HCV in Australian prisons. The model structure included treatment and unexposed compartments, as well as multiple HCV disease states (within the 'Infected' S-I-S category) to investigate how HCV infection via injecting drug use moves through the Australian prison environment and to examine the influence of varying the rates of treatment provision and incident infection. Compartmental modelling has been well described in the literature [125-127], and previously used to describe the HCV epidemic in Australia[128]. The model structure used here is similar to the other HCV modelling conducted in Australia. A compartmental flowchart of the model was developed to reflect how treatment may be integrated into the prison environment and the movement of prisoners through it in terms of their infectious states. Numbers of prisoners engaged in treatment were varied as were the estimated impacts of using harm reduction methods such as needle and syringe exchange to determine health outcomes.

Designing the model

A compartmental population deterministic differential equation modelling approach was chosen to be used. As infection with HCV does not provide the individual with any immunity post-recovery [129], a Susceptible-Infected-Susceptible (S-I-S) type model design was employed. However, this type of modelling approach was made relevant to HCV by including various health states for the population of people living with HCV (I: Infected in the S-I-S approach). As the effects of increased levels of engagement with treatment for HCV was a consideration of interest, a treatment compartment was also included in the design. It should be noted that the treatment approaches considered involved those available prior to newer generation DAA medications which became available only after the modelling component of this thesis was completed. Differential stages of infection, as people progress with disease fibrosis, were also included.

For the purposes of the modelling exercise, injection was assumed to be the only risk factor of interest in HCV transmission and prisoners in the model were considered separately on the basis of their injecting status. Further, as WA DCS clinical protocols at time of modelling did not permit people continuing to inject to participate in treatment for HCV [56], only infected prisoners who were not currently injecting were considered eligible to receive treatment under the model conditions. Similarly, it was assumed that those who had ceased injection and completed treatment would generally not resume

injecting while in prison. These prisoners were placed in an "unexposed" compartment until their release that effectively functioned as "immune" since they were no longer exposed to any avenues for reinfection to occur.

Levels of HCV disease states used in the model (F0/F1, F2/F3, F4, Hepatocellular carcinoma (HCC) and liver failure) were informed by earlier modelling work conducted by Razali et al [128]. Following discussion with supervisors, it was assumed that infected persons whose stage of disease progression was F4 (cirrhosis), HCC or liver failure would not access treatment for HCV, due to having more immediate health concerns. It was also assumed that persons engaged in treatment would not progress to higher disease stage while they remained in treatment.

There are no centrally collated records of number of prisoners receiving treatment for HCV throughout Australia, thereby necessitating that this figure be estimated. Out of 14,526 prisoners in NSW, WA and the ACT, only 114 were receiving treatment for HCV in 2009[100]. Applying the figures that HCV prevalence amongst NSW prisons entrants is around one third[79], a proportion of which may be acute cases which will resolve[14], suggest that between 2-3% of Australian prisoners infected with HCV are receiving treatment. As prevalence of HCV in prisons vary greatly between Australian jurisdictions however[130], this figure is unlikely to be wholly accurate and in the absence of better data, a treatment engagement rate of around 4% was assumed to be likely to reflect current levels of treatment among all chronically HCV infected prisoners. However, under the assumptions employed by the model, only infected prisoners who had ceased injecting were eligible to receive treatment for HCV. As it is known that approximately half of all injectors cease injecting upon admission to prison[1], a figure of 8% of chronically infected prisoners who have ceased injection was taken as the default treatment level for the model.

Effects of the modelling were computed using the software package Matlab 2009a Student version [131]. The Matlab codes used are found in Appendix F. Rates of treatment were set at a default level of 8% of those eligible and varied from 0% up to 20%. Incidence rates of HCV infection were set at a default level of 34.2 per hundred person years[82]. Although this incident rate is high compared to others reported in the literature, employing it allowed expanded scope to experiment with the effects of lower incident rates that might be obtained by the introduction of harm reduction measures such as prison needle and syringe programs (PNSP). Outcomes examined included new infections, numbers of liver failure, hepatocellular carcinoma and related deaths, numbers of infected released from prison into the wider community, relative discounted costs of treatment projected over ten years, and incremental cost-effectiveness ratios (ICER) of various levels engaged in treatment. Statistical significance of how outcomes were affected by varying levels of engagement in treatment and rates of incident infection were assessed using Yates Chi Square and Newcombe-Wilson hybrid score confidence intervals without a continuity correction [132]. Data from this modelling was further analysed to determine the respective costs to the public purse of providing treatment to infected prisoners. These costs were projected into the future using the health economics method of discounting [133]. Findings from the model are presented in Chapter 6.

Ethics

Ethics approval for the in-depth interview and modelling components was obtained from Curtin University's Human Research Ethics Committee (HREC). Because of the large

number of Aboriginal persons incarcerated in Western Australia, additional ethics approval was also obtained from the Western Australian Aboriginal Health Information and Ethics Committee (WAAHIEC). Permission to interview current prisoners in DCS facilities was obtained from the Department's Research and Evaluation Committee (REC). Questions concerning rates of injection and the trade in illicit syringes in prison were assessed and approved along with the rest of the annual IDRS questionnaire by ethics committees in each Australian jurisdiction.

CHAPTER 3: Findings from the In-Depth Interview Sample

AIMS: This chapter deals with the findings of the in-depth interviews of both current and former prisoners. The aims were to utilise qualitative data to explore both the circumstances under which injection of illicit drugs occurs in Australian prisons and, the barriers and motivations to entering treatment for HCV prior to the introduction of the newer generation of direct acting antivirals (DAA) medications. Major demographics, drug use history, and knowledge of HCV are also presented to assist in placing these findings in context as it is likely that some of these may influence the findings. For example, knowledge of HCV is likely to influence involvement in treatment and vice versa while drug use history is likely to influence the contexts under which drug use occurs in prison. It should be noted that the majority of the commentary on the findings of this chapter are located in the Discussion (Chapter 7).

Synopsis of methods

This study conducted a series of qualitative in-depth interviews with current and former prisoners with a view to investigating the situations in which injecting occurs in prison environments, and barriers and enablers for entering treatment for HCV in prisons. Participants were recruited via needle exchanges, outreach and support services and prison health clinics. Confidential interviews were conducted in cafes and pubs in the inner city and participants reimbursed $30 for their time and travel expenses. A total of 28 interviews were carried out, although only former prisoners provided data concerning drug use in prison due to an agreement with DCS that current prisoners were not to be asked about illicit activities occurring while incarcerated. This qualitative data was investigated via thematic analysis using NVivo software. Some additional quantitative data was also collected including basic demographics, drug use history and knowledge of HCV and its treatment in order to better describe the interview sample.

Characteristics of the sample

Demographics

In total 28 respondents, 15 ex-prisoners and 13 current prisoners were interviewed. All had had HCV while imprisoned although it was not necessarily contracted within prison.

The age of respondents ranged from 21 to 50 years with a median age of 35. Identifying as Aboriginal or Torres Strait Islander was reported by 29% (n=8) and 93% (n=26) typically resided in Perth.

The number of times respondents had been incarcerated in an adult prison ranged from one to 15 with a median of four occasions. Multiple episodes of imprisonment were reported by 86% (n=24) of the study group. The length of respondents' current sentence, or in the case of former prisoners, their most recent sentence, varied greatly, ranging from one month to 264 months (i.e.: 22 years) with a median of 20 months.

Drug use history

The vast majority (n=26, 93%) of respondents reported having injected drugs at some stage in their past. The two exceptions attributed the source of their HCV infection to amateur tattooing practices. Actively injecting in the month prior to their most recent reception to prison was reported by 22 (79%) of the sample. A history of having used illicit drugs whilst in prison was reported by 21 (75%) of the study group. A history of having injected whilst incarcerated was reported by 15 (54%) of respondents. The drugs most commonly reported as having been injected in prison were pharmaceutical opiates (50%, n=14), heroin (46%, n=13), (meth)amphetamines (36%, n=10).

Among the 15 respondents who reported having injected whilst imprisoned, the frequency of self-reported injection varied greatly, ranging from *'isolated incidents'* to multiple times daily with the most common response being *'less than monthly'*(53%, n=8). Asked about the number of times they had injected during their most recent sentence revealed that more than half of those responding (53%, n=8) had done so more than five times. These respondents were also asked how many times they had used a needle and syringe after another prisoner. While 27% (n=4) reported having never done this, the modal response by 40% (n=6) was that they had done so more than five times. Asked how many different individuals may have used the needle and syringe before them, resulted in more than half (53%, n=8) stating that they believed this would involve more than five people. The ten respondents who thought others had used the needle and syringe before them were asked how likely they thought that some of those people may have been infected with HCV, with 80% (n=8) stating that they thought it was *'very likely'*. Numbers of other people present at an injecting occasion in prison ranged from none to *'six or more'*. The most common response was *'four to five'* (27%, n=4). The use of other injecting equipment after other prisoners was reported by 13 respondents, with the most commonly shared items being spoons (73%, n=11) and the drug or solution/mix itself (67%, n=10).

Of the 15 respondents who reported having ever injected in prison, (87%, n=13) indicated that they had ever tried to clean used injecting equipment. The most common agents used for cleaning were cold water, used by 85% (n=11) of respondents and bleach, used by 69% (n=9). Asked about methods employed for cleaning injecting equipment, the most common, reported by 85% (n=11) was rinsing and flushing multiple times. It was often observed however that more rigorous methods of cleaning such as bleach were often impractical or unavailable in prisons.

Experience and knowledge of HCV among the qualitative sample

Of the entire sample (n=28), 13 had not received any treatment for HCV, nine were currently receiving treatment, four had completed treatment and two were undergoing preliminary assessment for treatment. All of the current prisoners had received some level of treatment or assessment. This however, is likely an artefact arising from recruitment of current prisoners in the sample being drawn from the prison health clinic facilities. Respondents were asked if they had attended a drug related health program in prison. There were 21 (75%) who indicated that they had done so. Only one respondent (female, ex-prisoner, not in treatment) was not aware treatment for HCV was available.

The question of the proportion of prisoners respondents believed to be positive for HCV produced a wide disparity of answers ranging from 25% to 100%. Most (n=19, 68%) however, believed the answer to lie between 70 and 80%, and a further eight (29%) thought it to lie between 50 and 80%. Most (n=21, 75%) of respondents were aware that

some people do experience spontaneous resolution from HCV, however there were also five (18%) who didn't know and two (7%) who said it was not possible to experience a spontaneous resolution from HCV.

Asked how they believed they had contracted HCV, 19 (70%) of respondents indicated that it was the result of sharing needles, and one (4%) said it was due to sharing other injecting equipment. Tattooing accounted for another six (21%) infections. By far the most commonly recognised risk was sharing needles mentioned by 27 (96%) of respondents.
Although the potential symptoms of HCV infection are numerous, the fact that the majority of those infected do not experience symptoms makes it unsurprising that the majority of respondents were unable to cite many symptoms, with seven (25%) saying that they didn't know.

Contexts of injection in prison

As has been demonstrated in the preceding sections, injection of drugs clearly does occur to some degree in Australian prisons. There is scant literature however, detailing the circumstances and contexts under which injecting in prisons takes place. As it is likely that these practices occur in situations that may present serious risks from a health perspective including transmission of HCV, it is highly desirable to know more about these practices.

Analysis of the qualitative data

Thematic analysis of the interview transcripts found that the commentary concerning drug use in prison fell into three main domains; obtaining drugs and syringes, using drugs in prison, and syringe cleaning and maintenance. Each of these areas had a number of sub-domains which are detailed below and their relationship to each other is shown in Figure 6.

1. **Obtaining drugs and syringes.**
   This major domain refers to the processes and methods by which drugs and injecting equipment are obtained by prisoners within custodial environments. Three sub-domains were identified:
   a) **Importing contraband:** This sub-domain covered data relating to the illicit importation of drugs and injecting equipment into the prison system from the external community.
   b) **Obtaining drugs in prison:** Covers information pertaining to the acquisition of drugs within the prison environment.
   c) **Manufacturing equipment:** Deals with in-situ manufacture of injecting equipment in the absence of sterile, surgical-grade needles and syringes.

2. **Using drugs in prisons.**
   The second major domain covers the actual consumption of illicit drugs within the prison environment. Sub-domains identified were:
   a) **Sharing of equipment:** This sub-domain deals with the number of prisoners involved in injecting opportunities and the ways in which syringes and other equipment are shared.
   b) **Types of drugs used:** Covers types of drugs, both illicit and pharmaceutical contraband, that are consumed in the prison environment.

c) **Implications of HCV:** Ways in which having HCV or the possibility of contracting it influenced injecting practices in prison.
d) **Reasons unrelated to HCV for suspending use:** This sub-domain covers reasons why injection in prison was suspended for reasons unrelated to the possible transmission of blood-borne viruses.

3. **Syringe cleaning and maintenance.**
The last major domain contains information pertaining to the cleaning of syringes for reuse and maintaining them in a useable condition. Three sub-domains were identified:
a) **Maintenance:** Deals with methods used to ensure that needles and syringes remain in a useable condition.
b) **Obtaining of bleach:** Contains information concerning the availability of bleach in prisons for the purposes of cleaning syringes and the methods used to obtain it.
c) **Cleaning practices:** Deals with the procedures employed in prisons to clean syringes in preparation for reuse.

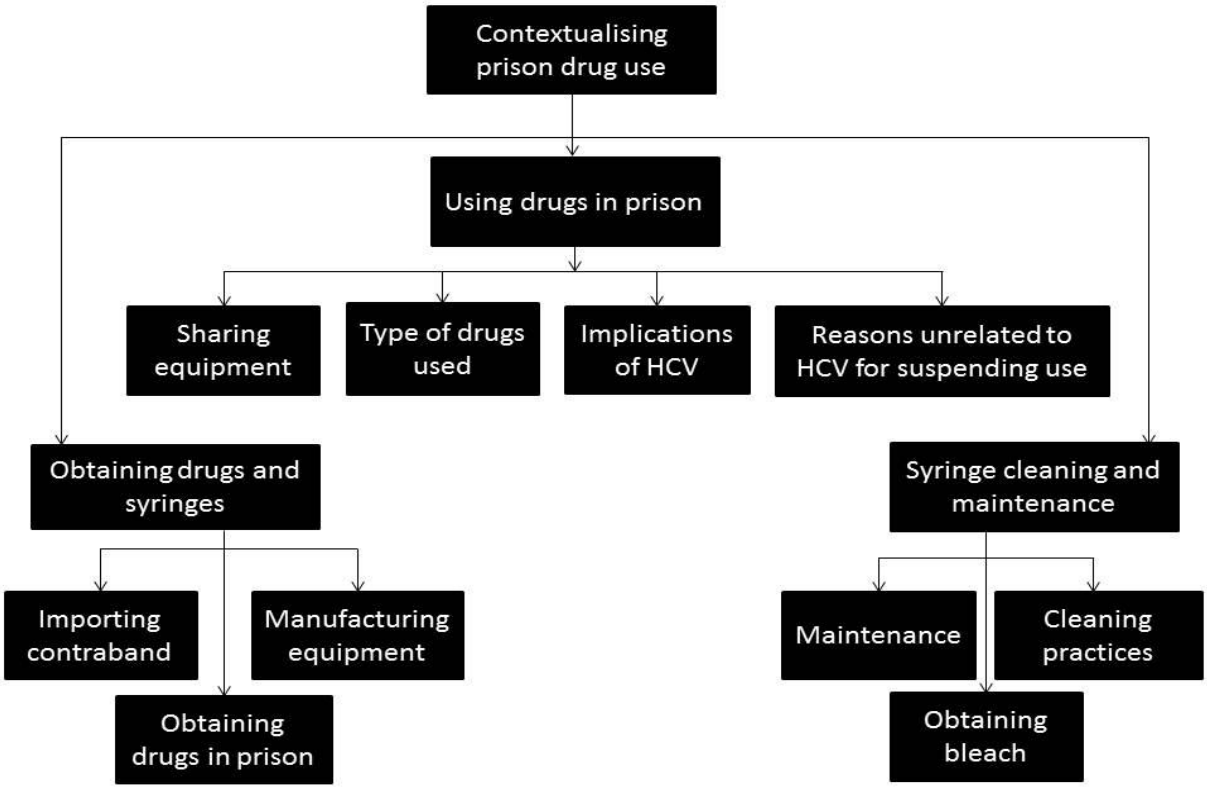

Figure 6: Coding schema for data analysis of contexts of injection in prison

Obtaining drugs and syringes

At time of writing, there is no prison in any Australian jurisdiction that supplies prisoners with sterile injecting equipment or has a needle and syringe exchange program in place. Furthermore, intoxicating drugs continue to be smuggled both into prisons and out of prison dispensaries. With 55% of prison entrants having a history of injecting drug use

and 61% of these reporting injecting in the month prior to incarceration [130] it is probably unsurprising that illicit markets in drugs and injecting equipment have been established within Australian prisons. From data collected, this tends to manifest in three main forms: the importation of drugs and injecting equipment into prison as smuggled contraband, the acquisition of drugs and equipment within prisons and the manufacture of home-made equipment in the absence of sterile, surgical grade needles and syringes.

Importing contraband

Although the smuggling of contraband into prisons is an established phenomenon, relatively little is known about the details. Two important themes that emerged from these interviews were the practice of cutting syringes down to enable easier concealment, and the practice of smuggling in additional syringes with the intent of renting or selling them to other prisoners. This practice of syringe rental has only been addressed by isolated papers in the peer reviewed literature [134] and is explored in depth in Chapter 5.

Interviewer: *"It must take a long time to accumulate that much cash if you're injecting on a daily basis in prison wouldn't it?"*

"Well, see, It depends alright? If my mate's in gaol and he's got drugs I'm gunna look after him, know what I mean? It's like after I found out I had hep C, right whenever I used to go to gaol I used to take a few cut-downs with me. Say, a 100 unit fit, cut down to a 50, with the plunger cut, not the bottom, 'cause I like to draw back a bit."

Interviewer: *"Is this so it's easier to hide? Or...why are you cutting it down?"*

"Yeah. So I can hide it - number one, and number two, so it's not as big, you know what I mean, so it's not running around with a pen up ya bum."

Interviewer: *"Yeah, OK. So when you were shooting up in gaol, how many of you would there all be together? Or is this something you do by yourself?"*

"Ummm...that's what I'm saying. Umm...at first, I didn't care. I didn't know about hep C or anything you know what I mean? So if you share the same needle with numerous people you know what I mean? Now, I normally take two in with me…one for myself and one to rent. Then I can rent me my fit... I used to keep two you … one for myself and one to rent. Half time I take to gaol three … or get a couple bought in, …Sell them, …, get up to $1200 for a cut down in gaol."

Male, former prisoner

Examples of cut-down syringes like those described can be seen in Figure 7 below. Apart from issues related to their functionality, it is not clear how such modifications may affect the units' sterility and ease of effective cleansing if it is intended for use by multiple persons.

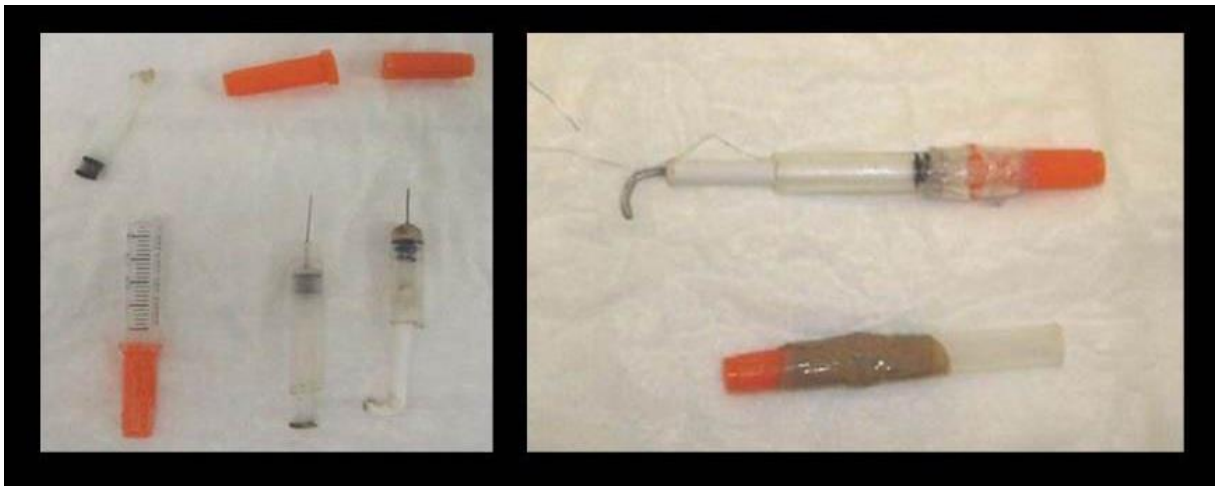

Figure 7: Examples of modified syringes seized in Australian prisons (Credit: T. Butler)

Another respondent went into substantial detail concerning the process of importing contraband such as drugs and injecting equipment into prison. Interestingly, there is little in the published scientific literature on the subject of importing contraband into prisons, the paucity of which is considered in the Discussion section.

Interviewer: *"You were telling us how you were still injecting while in prison. Can you give us a picture of how that works? I mean it must be difficult to get the drugs and the needles and stuff...how does injecting in prison..."*

"Well, it's simple - you smuggle your drugs in, you smuggle your syringe in, then you put your gear in a fit and away you go."

Interviewer: *"How did you smuggle this stuff though? You get searched at entry don't you?"*

"Where there's a will, there's a way you know? I've known people smuggle syringes in through their noses … big Italian guys with big noses. You know, get a syringe, cut it down you know, stick it up the nose &the screws are none the wiser. The prison officers bring them in for the right price. There's a multitude of ways. That's about how often I get ..I'd get two visits every week, I'd get a shot on every visit."

Interviewer: *"So you'd have friends bring it in from the outside yeah?"*

"Yeah. And if I did some courier work then I'd really party because..."

Interviewer: *"What do you mean by that?"*

"If a big heroin dealer comes in, I'm only getting $100 or $50 packets for myself, but if a big dealer comes in and they've got no way of getting it in and I'd be a courier for them and I'd get in five or six grams then I'd make myself a gram...gram and a half and then I'd party. Then I'm injecting, snorting, smoking, shouting everybody...rich you know, party up, party up.

Interviewer: *"And with these people who are bringing it in...I mean why don't they get detected? Just asking...with the dogs and whatever?"*

"Not everybody's...I mean, they say 'everybody's suspicious' and that but you'd be surprised who brings it in like, like the 72 year-old grandmother coming in to visit her grandson. The prison officer isn't going to suspect that but the grandmother's bringing it in. This guy was on non-contact visits OK? His grandmother used to come in and he used to take out packs of chips and biscuits and some drinks and that for her so she's comfortable throughout the visit. And she would get a razor, open up the packets, put syringes, put gear and all that, and then supa-glue it all back together. And then at the end of the visit she used to say to the prison officer 'Oh Sir, I'm too old for this sugary stuff, can you give this back to my grandson please?'. And so the screw would take it in and give it back to the grandson, - take him eight or nine fits and a gram of heroin. There's plenty of ways - there's always ways. They did end up getting caught, because they told someone and someone opened up their mouth."

Male, former prisoner

Another respondent observed that there were additional benefits to the importation of contraband, in that there were substantial profits to be made by on-selling or rental, a finding not widely reported in the peer-reviewed literature with few exceptions[134]. This finding is considered in detail in chapter 5

Interviewer: *"Have you ever managed to get in a personal syringe?"*

"Yeah I have. Yeah."

Interviewer: *"And that time when you were inside, did you share that or keep it just for yourself?"*

"I did in the end yeah."

Interviewer: *"What made you decide to share it? If you've got a perfectly clean syringe that only you use, it seems strange that you...."*

"I actually went into prison with four syringes and I ended up selling three of them."

Interviewer: *"I'm told syringes in prison can be pretty lucrative if you sell them or rent them?"*

"Yeah. You can get like $150 for a syringe."

This same respondent continued at a later point to discuss the importation of Subutex:

"Subutex yeah. And the odd heroin. It's mainly Subutex now 'cause they can get $400 for a full pill now inside prison. It's usually bought in on visitors because not many people in prisons are doing the Subutex treatment."

Male, former prisoner

Other respondents noted that if one was not personally involved in the importation of drugs and injecting equipment into prisons, then the issue of contacts or "who you know" became of substantial importance.

Interviewer: *"How easy is it to get hold of these drugs in prison?"*

"Oh, it's very easy. …It depends who you know, I think 'cause I've been to gaol so many times I know a lot of the guys."

Interviewer: *"So, how do you usually pay for that?"*

"There's different ways,...you can either get or I can organise on the phone for drugs to be dropped off to someone and brought in or... a lot of people in gaol can't get drugs so, I'll get them drugs off someone else and, I'll get some out of that and...heaps come in through visits"

Male, former prisoner

The importance of having contacts was further emphasised by another respondent who observed that gangs involved in organised crime were often well-placed to import contraband.

"<a Tasmanian prison> and there's all the <organised crime outfits> sort of filtered down the coast, down to Tasmania, and when their friends get put in they sort of send it into them."

Male, former prisoner

One respondent indicated that the decision to import contraband was not necessarily voluntary and some degree of coercion could be involved.

Interviewer: *Were you actually using drugs while you were in gaol?"*

"No IV drugs, but there's plenty...you can get pot in gaol, heroin in gaol, you can get anything. But the biggest thing I suppose at the moment would be Subutex, Suboxone."

Interviewer: *"From people diverting their dose I'm assuming?"*

"Diverting their dose and having their girlfriends come in and giving each other a toungueie and shoving half an ounce of heroin and Subbies down their gob - that type of stuff. All that goes on. I was offered to be paid because I didn't have any people outside of my 'Coies' - co-offenders. 'Cause I had a small circle of friends, and none of them knew what they did. These standover blokes tried to get me to bring in some grams of fucking...some grams of heroin on my visit. Now, I'm not even supposed to be in Supermax. I was supposed to be in X-Wing. Now if I'd got caught doing that the screws would have fuckin' gone mental, the guy's dope whoever it was would have gone mental."

Interviewer: *"So, what did you do about that?"*

"I didn't do it."

Interviewer: *"It sounds like you were under a bit of pressure - it can't have been easy to say 'no' to that kind of thing?"*

"Well, I did and it was fucking hard."

Male, former prisoner

It was evident that despite an absence of peer-reviewed literature on the subject that the importation of drugs and injecting equipment into Australian prisons as contraband was not uncommon with syringes often cut-down to make them easier to conceal. Where the prisoner themselves was not directly involved, contacts both within and without the prison were typically relied on. It was also noted that importing such contraband could be particularly lucrative. This is likely connected to the involvement of organised crime in this importation and the observation that smuggling of contraband was occasionally coerced by other prisoners.

Importation of contraband was not the only source of obtaining injecting equipment however and the prison dispensary was also noted as a convenient source of needle and syringe units either by exploiting systematic loopholes, errors or lack of attention on the part of staff.

"And with people on hep C treatment, what they're supposed to do is after … they're put in a room by themselves. Well, the nurse will stand outside, but she'll listen for the needle getting dropped into the thing (sharps disposal bin) so they'll take in a pencil."

Interviewer: *"Right."*

"Drop the pencil and take the fit."

Interviewer: *"Is there anything else you'd like to tell me about? Anything you think would be useful? Or interesting?"*

"Yeah, up at <a WA prison>, I went up there when it first opened and they seemed to be like not on the ball and..."

Interviewer: *"You mean the staff?"*

"Yeah."

Interviewer: *"Medical staff?"*

"Medical staff. Everyone getting a flu injection. They were just throwing them (Needles and syringes) out into the rubbish so there was like a constant supply."

Interviewer: *"Needles? Did they not know what was going on, or just not care?"*

"Eventually they caught on, but by that time there was probably two or three hundred of them (syringes) kicking around the prison. And they've slowly gotta find them all and get them back."

Male, former prisoner

One respondent observed that occasionally, clean injecting equipment could be clandestinely obtained with assistance of sympathetic medical staff in the dispensary.

"I had a. "PAST nurse" who's basically the nurse who dispenses the methadone and Suboxone. He's a believer in clean needles and on the quiet, I could give him a dirty needle and he would give me a clean one."

Interviewer: *"OK - that didn't cost you anything though?"*

"Nah."

Male, former prisoner

Manufacturing equipment

As the smuggled nature and high cost of syringes in Australian prisons tends to make them scarce commodities, sometimes prisoners resort to manufacturing makeshift injecting equipment in situ. Several respondents described methods by which this could be achieved. Often this equipment involved component parts that not only had issues

surrounding their sterility and ability to be cleaned, but also their actual utility and the potential to cause significant vein damage.

"A fit can last in gaol for a long time, because once the rubber goes and people cut a thong and use a match, and it's turned into a plunger. As long as you've got a barrel and something sharp at the end, people will inject…I've actually seen football pumps...you know, basketball pumps, I've actually seen people use the needle out of one of those, actually sharpen one of those up..."

Interviewer: *"That's a pretty big gauge..."*

"It's huge...I just went 'You guys are fucking crazy' you know? I seriously… No way, 'cause the amount of blood and everything that was coming out you know, and there were three or four guys waiting to use it."

Male, former prisoner

"I have seen as for a hypodermic....a biro, a piece of thong, - the piece that you'd push into yourself, a chicken's rib, sharpened and held into the end with Blu-tack."

Interviewer: *"Inventive if nothing else..."*

"Disgusting!"

Interviewer: *"So..."*

"That's the worst I've seen. And I've seen... so many...that's the absolute worst I've seen. Other ones were a bit better, but still so many people using them. Like a Visine bottle."

Interviewer: *"I don't know what that is?"*

"You know - eye drops?"

Interviewer: *"Oh yeah."*

"With just the end of a butterfly in the end and so you can squeeze it."

Interviewer: *"Where would you get an infusion from in prison?"*

"They have like a "dirty bin" and if someone's left in there alone..."

Male, former prisoner

It was evident from a number of respondents that a wide range of methods of makeshift needle and syringe manufacture existed.

"There's some really bunky home-made syringes in the prisons."

Interviewer: *"What would you make them out of?"*

"Well, sometimes they've been made out of thongs - you know, the rubber of thongs."

Interviewer: *"That's for the plunger, yeah?"*

"Yeah. And the sharps, they actually break and so they make them out of cotton wool tips and wrap plastic around it, and the actual needles get sharpened and stuff like that'

Interviewer: *"They'd cut the barrel down to make it easier to hide I'm assuming?"*

"Yeah. Yeah."

Interviewer: *"So how, with these syringes, would they have been doing the circulation around the prison for a long time?"*

"Some of them have, yeah."

Male, former prisoner

Obtaining drugs in prison

Where prisoners were not in a position to arrange to import contraband, there was sometimes the option of obtaining drugs from within the prison itself. A very large number of respondents provided commentary in regards to this and the nature of transactions involved. It was noted that as well as cash transactions, money was often channelled through Totalisator Agency Boards (TAB) accounts, and sometimes barter with commodities such as tobacco were involved.

Interviewer: *"You'd think in prison it would be harder to get drugs than on the outside. Do you think that's accurate? Harder? Easier? Same?"*

"It's not hard."

Interviewer: *"Can anyone do it? Is it a matter of who you know?"*

"Just a matter of who you know"

Interviewer: *"So, how would you pay for drugs while you were inside?"*

"There are various ways. You can have money put into a TAB account for example which is one way. Or, if you can't do that, if you have money, you can actually buy the person tobacco products or whatever he wants."

Male, former prisoner

Interviewer: *"OK. With those drugs that you're injecting in that group, how do people usually pay for them?"*

"Well, you can get money put into a TAB account on the outside. Or you can pay with tobacco or stuff like that."

Interviewer: *"OK, so sometimes cash, and sometimes it's just swapsies?"*

"Yeah."

Male, former prisoner

A common source of obtaining drugs within prison appeared to be the dispensary itself. One respondent made the observation that it was often worth being observant while waiting in the prison dispensary to see who was being prescribed drugs such as Subutex

with a view to approaching them later to engage in trade.

"I've spent a lot of time in gaol and like I was right amongst the drug scene in gaol, and when you're getting your methadone or your Subutex from the medics, you're at the medics a lot, and you know people's routine and you see who's going to get more injections and so on. Like while I was living in gaol, you look out for them things because you can hit them up for needles and etcetera like that. Needles in gaol are like $100 a pop."

Male, former prisoner

Despite observed-dosing procedures for Subutex and Suboxone, one respondent reported that the well-known practice of smuggling these drugs before they had dissolved out of pharmacies in the wider community also occurred in prison dispensaries.

"I'll get them drugs off someone else and I'll get some out of that...heaps come in through visits … heaps. Yeah, and the medical centre."

Interviewer: *"What, as in swiped medications or..."*

"Subutex."

Interviewer: *"Or are you saying the staff are doing something?"*

"No, just a lot like I said are on Suboxone or Subutex and just diverting it from the medical centre."

Interviewer: *"So, stick it under your tongue and walk out?"*

"Yeah. Yeah. Yeah."

Interviewer: *"So, just the same as you do on the outside in the chemist?"*

"Yeah. Yeah."

Male, former prisoner

Another respondent also described methods of smuggling Subutex out of the prison dispensary. This person also discussed the lucrative practice of being able to on-sell this medication in prison, but also observed there was a downside to this of commonly being threatened by other prisoners attempting to steal their drug supply.

"I was on Subutex at one stage in the prison, one of five people on it and I was...cutting it and sneaking it out, so a couple of sentences of supply after gaol with drugs."
Interviewer: *"So..."*

"Not fun - threatened with knives every day, but if I wanted it..."

Interviewer: *"That's people standing over you for your script?"*

"Yeah. But if… my mate's gunna be sitting there partying with me going "this is unreal how much what happens, but I don't envy you one bit" just the amount of pressure I had on me. But if we wanted to do that, that's what I had to put up with.

Interviewer: *"So this is what - what's under your tongue, you just pretend to swallow it and leave the dispensary - is that how...?"*

"Oh, there's a million different ways if you want it. Went through a stage of putting Glad Wrap on my tongue, and fake tablets underneath my tongue, and you tell them that it's there and push it up onto the roof of my mouth, 'cause so many people been caught there, they've basically got a torch in your mouth now and checking, but where there's a will there's a way.

Interviewer: *"And so, if you were selling Subutex, what would you expect in return?"*

"Money. I left gaol with three and a half grand."

Male, former prisoner

Evidently however, not all prisoners were comfortable with the idea of using diverted pharmaceuticals.

"Some people think you use methadone to get smashed but it's there to stop you using. It doesn't get you stoned, it just takes away the pain. Some people try to get prescribed methadone to get stoned. Some of these boys are just fuckin' mad cunts".

Male, current prisoner

Another common source of drugs was by barter in exchange for injecting equipment that had been imported into prison as contraband with the intent to rent out or sell to other prisoners. While these transactions frequently involved money, barter as a means of obtaining drugs was also common.

"So if you share the same needle with numerous people you know what I mean? Now, I normally take two in with me...one for myself and one to rent. Then I can rent me my fit..."

Interviewer: *"What would you charge me for that?"*

"A shot. For my mate and for me."

Interviewer: *"So, two shots to rent a fit?"*

"And that's just to use it."

This interviewee continued later:

"I used to keep two you know what I mean - one for myself and one to rent. Half time I take to gaol three you know what I mean or get a couple bought in, you know what I mean? Sell them, blah blah blah blah blah, get up to (a large sum of money – exact amount is unclear) for a cut down in gaol."

Male, former prisoner

Throughout the course of the interviews, it became increasingly apparent that renting out needles under barter arrangements as a means of obtaining drugs in prison was actually a quite common practice.

Interviewer: *"With that fit you lent to other people - did you just lend it or did you rent it out?"*

"I rented it."

Interviewer: *"What did they usually give you for that?"*

"Heroin."

Interviewer: *"Just for yourself or..."*

"Yep."

Interviewer: *"OK. Was that enough to cover you, or did you ever have to buy heroin?"*

"No, most of it was covered by the rental of the needle."

Interviewer: *"Do a lot of people do that?"*

"Yeah."

Female, former prisoner

One respondent made the observation that while they had paid for drugs using T.A.B. accounts etc. with a modicum of organisation, renting out a syringe in prison could easily cover the entire costs of their drug supply. They also noted however, the previously mentioned problem of being "stood over" by other prisoners with no intention to pay for the rental.

"At one stage I had a fair bit of drugs and I had three separate syringes. One was mine, one was my mate's and one we let everyone else use."

Interviewer: *"Did you just let them use it, or did you rent it out?"*

"Rent it."

Interviewer: *"And what would you usually get for renting it?"*

"A bit of their drugs."

Interviewer: *"So what - a hit for you and a hit for your mate? Is that how it usually works?"*
"Yeah."

Interviewer: *"Did you ever actually have to pay for drugs in prison or where you able to supply yourself just by that?"*

"I've paid before. You just send money to a T.A.B. account, or money order to another prisoner."

Interviewer: *"So, just being able to rent out a syringe isn't enough to supply you?"*

"Oh yeah - bloody oath it is, but you've gotta be careful, 'cause the next bloke will stand over you for it, so you've gotta be careful who knows what."

Male, former prisoner

The diverse nature of these barter arrangements was described by one respondent who indicated that the drugs typically involved ranged from tobacco, cannabis and Subutex through to heroin.

Interviewer: *"Some people have told me they rent their syringes out in return for a hit - does that happen a lot?"*

"It does. Yeah. All the time."

Interviewer: *"Have you ever tried doing that?"*

"Oh yeah, I've done it before as well. And people have done it with me as well."

Interviewer: *"What sort of arrangement would you have there? They'd have the syringe in return for...?"*

"A packet of whatever. You know, a packet of heroin or whatever...or Subutex."

Interviewer: *"Is that a question of choice or is that just whatever happens to be around at the time?"*

"Well, mainly, it's Subutex and heroin you know? And...and marijuana."

Male, former prisoner

As several previously examined excerpts from interviews have implied, in addition to the importation of drugs into prison as contraband, there is also a substantial trade for these items within prisons themselves. A number of interviewees described the nature of these illicit transactions, the majority of which appeared to involve heroin or buprenorphine. Buprenorphine in particular was especially lucrative with single tablets able to be sold at a greatly inflated cost compared to the prices these diverted medications could command outside of prison environments. It was observed that where drug transactions involved money that this was often achieved by transfer of cash across Totalisator Agency Boards (T.A.B.) accounts. It was also observed that access to drugs could be enhanced (albeit not necessarily voluntarily) by contacts in organized crime to facilitate using visitors as couriers, or by diversion of medications such as buprenorphine from the prison clinical dispensary.

It is evident that illicit drug use in Australian prisons is widespread and this is in turn driving injecting as a relatively common practice. In the absence of a supply of sterile injecting equipment and against a high background prevalence of HCV this constitutes a serious risk for ongoing transmission of the virus. Further, this absence of clean needles and syringes appears to have resulted in the development of a thriving market for contraband equipment, further increasing the risk of viral transmission with the phenomenon of rental syringes that may be used by a very large number of individuals with little guarantee that this equipment is effectively cleaned between uses. This would appear to make a substantive argument in favor of providing needle and syringe exchange in prison (NSEP), an argument further strengthened by the practice of some prisoners to manufacture makeshift injecting equipment likely to result in vascular damage and be impractical to effectively clean between uses.

Using drugs in prison

Sharing equipment

A number of respondents provided information regarding the situations in which injection in prison actually took place. Frequently these involved injecting in groups in which equipment such as syringes were shared among the group although others indicated a clear preference for injecting alone. Others reporting possessing a needle and syringe unit(s) for their own personal use, but commonly also possessing unit for sale or to be rented out. Again, this illicit economy of injecting equipment is explored in detail in Chapter 5.

Interviewer: *"So when you shot up in gaol just those two times...was that after you knew you had hep C or…"*

"Yeah.."

Interviewer: *"OK. So did you just do this by yourself?"*

"No, no - there were three of us."

Interviewer: *"And that was all with the one fit?"*

"Yeah...but I don't know how many people used it before I did, 'cause it was old."

Male, former prisoner

That sharing injecting equipment carried health risks was acknowledged, one respondent describing how sharing injecting equipment in prison led to one of his injecting partners who had recovered from HCV actually became reinfected as a result. It was also acknowledged that sharing in groups could involve large numbers of people both in the past, or present at the same injecting occasion.

"*I shared with a guy who had actually gotten rid of it, and he bleached this syringe and everything you know? And he got tested again and it came up positive. And that was a false reading, 'cause the next time he came up negative. But he was pretty dirty on himself..."*

Interviewer: *"For sharing in the first place when he'd already got over it?"*

"Yeah."

Interviewer: *"Yeah. So, he went second?"*

"Well, it had been a used syringe."

Interviewer: *"Oh, yeah OK. Does that sort of thing happen a lot in prison?"*

"Sharing?"

Interviewer: *"Yeah."*

"Yeah. It does."

This same respondent later returned to the subject:

Interviewer: *"And when people are shooting up in a group in prison, how does that normally work out?"*

"Well, you just all sit in your cell, and there might be four or five of you. And one guy'll have a shot and he'll rinse it out and then the other guy will do the same you know? And it'll go around until everybody's finished."

Male, former prisoner

Interviewer: *"So when you were sharing, how many of you would there be in that sort of group?"*

"I've shared from one to six people at a time."

Interviewer: *"And do you reckon those people would also share with other people?"*

"Oh yeah. Yeah. Yeah."

Interviewer: *"So in actual fact there would be quite a large number of people?"*

"Oh, no doubt.

Male, former prisoner

It became apparent that the practice of sharing injecting equipment in prisons was commonly a group activity. It was also evident that even in cases where the respondent kept a syringe for their own personal use, the one they let other prisoners use may have been used by very substantial numbers of people in the past.

Interviewer: *"So, how does injecting in (prisons) work?"*

"We all share needles."

Interviewer: *"OK. How many people do you reckon would typically have shared a needle before you've used it?"*

"I actually have one that I use myself, and one that I let everybody use."

Interviewer: *"OK."*

"So, I'd probably have to say the one I was letting people use, probably 50 people would use and it would get fricken' blunt. But mine would have been used the same amount of times, but I knew I was the only person that had used that needle."

Female, former prisoner

One respondent observed that because injection often occurred in groups, it could become obvious to other prisoners what was occurring, leading to attempts to forcibly "gate crash" the injection session, thereby requiring more secretive means of sharing drugs and injecting equipment.

Interviewer: *"So, when you did shoot up in prison would it just be you and your cellmate, or would there be a big group of you?"*

"Oh, sometimes it's a group, but like, it depends - what gaol, where you are, what you're having, how quiet you're trying to keep it. Like at <a WA prison>, I was in a yard and there's like a basketball court, and all the cells face the basketball court, so if like five people go into a room, 50 people see that five people went in..."

Interviewer: *"So it would be pretty obvious what you were doing?"*

"So, they'd be knocking on the door - they want in. That got to the point it was so hectic that we had to plead that I wasn't getting anything anymore and we'd just wait till we all got locked down. I was two out with my friend and our two other mates were next door - we used to unscrew the light switch and pass them the shot through the light switch. Party at night - smoke dope at night. We had to keep it...we were in <a WA prison> and there was nothing there. I'm the smallest whitest bloke in the gaol and they weren't happy with that. Sometimes, I've been in rooms and there's a lot of people but it depends who it is. Like there was a couple of blokes, like they can do that, they can have a shot and people come to the door and they'll tell you 'Fuck off!' you know - we're doing it, whereas someone like me, I can't do that. You know like, 'cause I'm not Aboriginal or nothing like that. So, it's different depending on who you are.

Male, former prisoner

Types of drugs used

Asked about what types of drugs they had mainly used or were popular in Australian prisons elicited data from 14 respondents. Of these, there were 11 mentions of heroin in this context, nine of buprenorphine (primarily Subutex), six of cannabis, two of morphine, and isolated mentions of oxycodone and amphetamines.

Interviewer: *"That brings us to the question when you were in prison last time, did you...were you actually injecting while you were inside?"*

"Yes."

Interviewer: *"OK, how often do you reckon you would have done that?"*

"Twice a week."

Interviewer: *"And what were you injecting?"*

"Heroin."

Male, former prisoner

Despite the apparent dominance of heroin, analysis of interview transcripts revealed a common perception that buprenorphine use was coming to replace it as the prison drug of choice for injection.

Interviewer: *"OK. So, while you were in prison last time, how often would you have injected?"*

"Once, twice a week."

Interviewer: *"And that's usually Subutex?"*

"Subutex yeah. And the odd heroin. It's mainly Subutex now 'cause they can get $400 for a full pill now inside prison."

Male, former prisoner

Interviewer: *"Were you actually using drugs while you were in gaol?"*

"Me, ahh...no IV drugs, but there's plenty...you can get pot in gaol, heroin in gaol, you can get anything. But the biggest thing I suppose at the moment would be Subutex, Suboxone."

Male, former prisoner

Although virtually all respondents in the study group were familiar with the issue of diverted Subutex in prisons there was less consensus on the availability of heroin with some respondents believing it to be common while others did not believe it to be at all frequent in prisons. One respondent suggested that this was again about what contacts one had in prison, but also noted problems similar to the previously observed "gate crashing" issue where heroin was involved, thereby providing an incentive to avoid the drug.

Interviewer: *"So it's all about who you know?"*

"Yeah. And what you're bringing to the table."

Interviewer: *"And so, what you're bringing is the syringe?"*

"I brought the drugs half the time, 'cause my brothers were on a certain medication that one pill in gaol is worth $200 and you can break it up and go 15 ways in it."

Interviewer: *"What is this - morph?"*

"Uh..Subutex."

Interviewer: *"OK."*

"And I was on Subutex at one stage in the prison, one of five people on it and I was pretty...cutting it and sneaking it out, so a couple of sentences of supply after gaol with drugs."

This same respondent continued later in the interview:

"No smack in gaol."

Interviewer: *"Mm-hm. What's the big drug in gaol then?"*

"Subutex. 'Cause it goes so far - you only need a little bit and it gets you off your head. In gaol, the only heroin's there - maybe someone who's got connections to a heroin dealer, gets it and keeps it to themself, or there's too many problems. Everyone wants...you could not get in some heroin and not expect a fight. 'Cause someone in the gaol would fight -"Why do I get left out?" 'cause there's just all...it's like high school - it's just everyone talks shit. You might have one shot with your friend, and by the time it gets to the other side of the gaol, you've shouted half the wing and left that bloke out and he's sort of thinking well, 'cause his brother's cousin's heard this...and, no. You don't see heroin in gaol."

Interviewer: *"OK."*

"It comes and then it goes away. Subutex is like everyday - people are looking for it."

Male, former prisoner

Implications of HCV

Respondents were asked about how knowledge of their own or others HCV status might affect their decisions about injecting and sharing equipment with others while in prison. Apart from the large number of prisoners who choose to stop injecting while imprisoned [1], there appeared to be two major approaches to personal harm reduction employed. The first being to only inject with groups believed to be sero-concordant, although this approach of course relies on both knowledge of their own sero-status, and the honesty of all participants involved in the injecting episode. The second main method observed was keeping a needle and syringe unit for their own use while possibly having others to lend, rent out or sell.

One respondent indicated that while they did practice sero-sorting, injecting only with other people positive for HCV, the lack of awareness that different genotypes existed still allowed for the possibility for infection with multiple genotypes of HCV to occur.

Interviewer: *"On those occasions when you were sharing, did you already know you had hepatitis C then?"*

"Yep."

Interviewer: *"Yep?"*
"Yep."
Interviewer: *"So did you do anything about that? By which I mean you might do things like go last if you knew you had it and they didn't?"*

"No, well, any time I've ever had an injection in gaol with other people it was always clear that I had hep C, and nine times out of ten, everybody else there had hep C."

Interviewer: *"So, it just wasn't an issue?"*

"It wasn't an issue yeah. Because at the time, I didn't know, none of us knew about the strains and about re-catching it and stuff. So it was like 'You got Hep C, I've got hep C...Sweet, let's have a shot'. No problems, we just didn't think it was a drama. Whereas now, it's a lot different."

Male, former prisoner

Another respondent however was clearly aware that various genotypes existed and such basic levels of sero-sorting would not protect against cross infection. This respondent therefore opted to employ the alternate strategy of keeping one syringe for personal use and a second for use by others.

Interviewer: *"Once you found out you did have it, did that change who you'd share needles with at all?"*

"When I found out I had it I used to take two (syringes) in. So I had my personal one...'cause as I said, I've got Strain 3. I don't need any other strains, or HIV or...know what I mean?"

Interviewer: *"Sure."*

"So that's what I mean. I used to keep two - one for myself and one to rent."

Male, former prisoner

A female respondent took this strategy a step further by also not sharing equipment like mixing spoons, and ultimately moving to injecting alone.

Interviewer: *"Now, since you've only just recently found out you had hep C, this stuff (sharing equipment) must have been before you knew you had it. Is that right?"*

"Yes."

Interviewer: *"Now that you know you've got it, once you found out in gaol, did you do anything to change the way you were injecting or do anything to avoid transmission that you weren't already doing?"*

"Yeah - I stopped sharing spoons. I had my own fit, but I also used my own spoon. I stopped sharing. I still let people use that fit, but I'd just hand it over to them and I stopped using with that group, I'd just use by myself in the morning and by myself at night."

Female, former prisoner

Another shortcoming of the sero-sorting procedure was noted by a respondent who preferred to use their own injecting equipment who observed that while HCV was asked about and virtually a "green card" to join an injecting group of others perceived as sero-concordent, HIV/AIDS was rarely talked about and those infected with the disease unlikely to be forthcoming with this information.

"I mean, everyone in gaol treats hep C as a 'green card' - you can jump on board any fit, and people are naive to the fact about AIDS in gaol. And, people with AIDS are segregated and there's not many people with it, but you've got to keep in mind there probably is someone and if it comes down to them having a shot or telling everyone they've got AIDS, they're not going to tell ya. That's why I continued to get blood tests while I was in gaol and I always made sure I had my own syringe."

Interviewer: *"Did you share with other people while you were in gaol?"*

"I have. Yes."

Interviewer: *"How did you decide who you would share with and who you wouldn't? Or you just didn't worry about it or..."*

"It's not that...well, at one stage I had a fair bit of drugs and I had three separate syringes. One was mine, one was my mate's and one we let everyone else use."

Male, former prisoner

Another shortcoming of the sero-sorting approach was that it was fundamentally reliant on the honesty of those prisoners participating in the injection session. One respondent observed that this could work both ways, with prisoners falsely claiming to already have HCV in order to get invited to join in the injection session with other HCV positive inmates, but also with prisoners falsely claiming to be uninfected in order to gain access to "clean" injecting equipment.

Interviewer: *"Are most people in that group (injecting together) - they're all positive?"*

"Yeah, otherwise they wouldn't be doing it. Some people you know...that being said, "This syringe hasn't been used" and anyway, they've been lied to and ended up with hep C and stuff."

Interviewer: *"Yep. So what do people who haven't got hep C do if they want to shoot up in prison?"*

"Well, they either don't shoot up or they get their own syringe and just keep it."
Interviewer: *"Do you think people who don't have it ever actually lie about having it, so they can share with other people?"*

"Some people have done that yeah."

Interviewer: *"One guy said to me that 'having hep C in prison is kinda like your green card..your invitation to the party', 'cause if you don't have it, you don't get invited to come and shoot up with these people?"*

"Yeah..."

Interviewer: *"So I'm wondering about how many people lie about having it, or actually deliberately try and get it. Do you think that happens?"*

"It does happen."

Interviewer: *"What? People deliberately trying to get it, or people just lying that they've got it?"*

"Ummm...no. People have lied so they can use somebody's clean syringe."

Male, former prisoner

A couple of respondents made comments concerning the lack of appreciation of the risks of sharing among younger users in prison or their apathy towards these issues.

"New blokes in prison "go wrong" because they assume that 'We've all got HCV, so we can share', but there's no understanding of different strains. They're not concerned about other things. There was a rumour that did the rounds that someone in the prison had HIV, but even that didn't stop the young people sharing. They don't think about taking it back outside to their people."

Male, current prisoner

Reasons unrelated to HCV for suspending use

The risk of contracting blood-borne viruses such as HCV was not the only reason prisoners suspend injection of drugs in prison, and a number of respondents discussed some of these.

One respondent noted that while blood borne viruses were a reason for suspending injection while in prison, so were financial factors and also concerns over hygiene due to syringes often being smuggled into prison concealed in body cavities.

"You don't know what these blokes have got, whether they've got AIDS or Hep C or anything, and half of them don't care whether they have it."

Interviewer: *"So was that why you didn't inject in prison?"*

"Yes. That was a big reason why I didn't. I...it's Russian roulette. You know - you've got 40 or 50 blokes who've used a cut-down one ml syringe, and for that long it's been shoved up someone's arse to mix up a fucking shot. And prison deals are very very tiny, very very expensive and it's just not worth it. So, if I did ever get it I'd smoke it - just chase the dragon up in bed."

Male, former prisoner

Another made reference to the issues that other respondents had mentioned regarding the aggression and "stand over" tactics that sometimes accompany drugs in prison environments, responding to this by suspending injection while in prison and acquiring friends with the physical capacity to be a useful defence.

Interviewer: *"So, while we're on the subject, did you inject while you were in prison?"*

"Ahh...ahh..no. I kept to myself. I had a really bad experience down in Tasmania so...I, that's why I panicked when I got locked up. I was freaking right out and I kept to myself, I found a big strong bloke and sort of became his mate and he didn't expect anything from me if you know what I mean. So, I just sort of stuck by him. And he looked after me so I was lucky there."

Male, former prisoner

Several respondents mentioned the poor quality of syringes in prison as a reason for suspending injection, noting "dirty needles", "not a good enough shot", and damage to the needle due to multiple uses.

Interviewer: *"So, last time you were in prison, you obviously knew you had hep C. Did you say...did you inject at all while you were in prison?"*

"Nah."

Interviewer: *"Not even by yourself?"*

"Nah. No way. It's like, there's only one needle and there's been that many people. Nah."

Interviewer: *"You were in prison before you had hep C right?"*

"Yeah."

Interviewer: *"Would you have shared then?"*

"Nah."

Interviewer: *"OK. Why not?"*

"'cause it's like (the needle) it's barbed wire. There's one needle and...I dunno. I didn't wanna."

Male, former prisoner

In addition to the reasons described above, one respondent explained their reason for ceasing injecting in prison as due to realisations that a prison term represented an opportunity to reform from drugs and get their life and family back.

Interviewer: *"Where you using while you were in gaol?"*

"No, never have."

Interviewer: *"Can I ask why, apart from the treatment, which I assume is part of why you didn't, why did you not use in gaol?"*

"Uhh... because I'd lost, just lost three years of my life like that. I seriously hurt someone, I nearly killed someone to get in there, and life's...I mean, there's too much to offer mate. I've wasted 15 years on drugs, and since I've got my family back, and life's going great."

Male, former prisoner

It was evident that injection of drugs in Australian prison environments was relatively commonplace, and while many prisoners preferred to use alone, instances of injecting occasions where equipment was shared between multiple individuals were also common. These sharing practices took place despite widespread understanding of the risk they constituted for ongoing transmission of HCV. Although some prisoners attempted to mitigate this via the use of sero-sorting (i.e.: only injecting with individuals believed to share the same HCV status as themselves, this method relies upon the honesty of participants and their correct awareness of their current HCV status and, as such, is unlikely to be reliable. It was also noted that This awareness of HCV related risks was one of the more prominent reasons given for individuals choosing to suspend injection while incarcerated.

Syringe cleaning and maintenance

Maintenance

As interview transcripts already examined have demonstrated, it was not uncommon for needles and syringes to have been circulating for some time in prisons, and consequently undergoing a significant amount of wear and tear, one respondent described the state of some syringes in prison:

Interviewer: *"Well, it's got to be a bit blunter after all that time too hasn't it?"*

". I sorta think you get to the stage where you don't even worry about that . There's some in there you can't even see whether you're drawing back or not. You've gotta hope you've got 'em in there, and squirt it in."

Male, former prisoner

Due to this and the relative scarcity of new syringes, it becomes necessary to perform some level of maintenance on those already in circulation although only one respondent provided any details on this practice. This included the sharpening of reused needles on rocks or sandpaper.

Interviewer: *"So how long do you reckon the average lifespan of a syringe in prison would be?"*

"Well, when I was doing well, and I had my own syringe, my own syringe would last me a week and then I'd give it away. And I'd have no idea how long...but I've known syringes to be in gaol for six months...same syringe you know.."

Interviewer: *"You'd think it was getting a bit blunt by then?"*

"Yeah but, you find someone who knows a little bit about rocks, you find a nice sharpening stone on the ground somewhere and you sit there patiently, or you get some sandpaper out of the wood work, or you use sandpaper, or you use glass, a lot of different ways you know? To sharpen...to sharpen it up."

Male, former prisoner

Cleaning practices

Respondents from the study group were asked about their practices of cleaning reused and shared needle and syringe units. Some of these were quite thorough, despite the process being somewhat inconvenient.

Interviewer: *"How would they usually rinse it out?"*

"Some people just hot water, some people have bleach...can get hold of bleach.

Interviewer: *"I'm just thinking...shooting up in a group is obviously not what you want to be caught doing, it's not something you want to be caught doing, so you'd want to be pretty quick and efficient about it wouldn't you?"*

"Yeah. Yeah yeah."

Interviewer: *"But doesn't the cleaning in between each person kind of get in the way?"*

"No, but everybody does rinse it out - doesn't matter. They'll rinse it you know?"

Male, former prisoner

Interviewer: *"OK. Did you actually try to clean the needles while you were doing that?"*

"Umm yeah."

Interviewer: *"How did you do that?"*

"With water, a bit of bleach."

Female, former prisoner

It was evident however, that the process of cleaning syringes was not always so thorough, one respondent noting a disinclination to use bleach due to it causing the rubber on the syringe plunger to perish more rapidly.

Interviewer: *"With the needles, you said you never kept one for longer than a week? Did you ever bother to clean it in that time?"*

"With ones that only I was using I'd just rinse it with water. And three was my magic number - bang, bang, bang. And that was it."

Interviewer: *"Could you get bleach in prison?"*

"Yeah, I could…"

Interviewer: *"If you wanted to?"*

"Yeah, but I didn't."

Interviewer: *"Why?"*

"'Cause it ate away at the plastic on the plunger. It makes the syringe deteriorate faster. And they're precious and you don't want it to deteriorate faster, so you just use water. Just use water."

Male, former prisoner

Other respondents noted inconsistent cleaning practices due to risk of detection by corrective services staff or difficulties in accessing bleach leading to sub-optimal cleaning of shared injecting equipment.

"I've had the same syringe in gaol for two years and it and it's been used thousands of times. You know what I mean?"

Interviewer: *"Just by you or by...?"*

"No, by other people … you've gotta sort of like, look after them. You've gotta clean them 'cause they're just so hard to come by."

Interviewer: *"Did you ever rent it out?"*

"Yeah. I always but some days...you can't really, you've sort of got the officers coming, and there's that many people that want to use it, it might like, someone will use it and it gets equipped, washed, sort of, but, there's no like, you're meant to, I think they give you them things in gaol, that are meant to be cleaned out three times with water, three...you know, it never gets that."

Male, former prisoner

Interviewer: *"And have you tried to clean those needles?"*

"Tried to, sometimes..."

Interviewer: *"I mean, it's not something you throw out...something you value is it?"*

"You rinse it in water, but basically, there's no access to bleach and stuff like that. They need bleach and they need other stuff like that you can get hold of like these cleaning products..."

Male, former prisoner

Obtaining bleach

Although bleach is a recommended agent for use in the decontamination of used syringes [47], in practice it is not provided consistently in prisons across Australian jurisdictions. [135]. A number of respondents described how they would access bleach while in prisons in the absence of an officially sanctioned supply.

"You rinse it (the syringe) in water, but basically, there's no access to bleach and stuff like that. They need bleach and they need other stuff like that you can get hold of like these cleaning products..."

Interviewer: *"Wouldn't it be a problem to go to the guards and say 'Hey, I want bleach' 'cause it would be pretty obvious what you wanted it for?"*

"Oh yeah, exactly, you can't do it. Alright - anyway, the only way to get it is the blood spill kits and stuff like that. So you gotta get onto a sweeper or someone a bit higher up in the gaol that's got a bit more freedom."

Interviewer: *"What do you mean by 'a sweeper'?"*

"Oh, you got different jobs in gaol. So just say a bloke who sweeps corridors. When you first getting up brings you a coffee. Things like that. So he's got a little bit more run-around the gaol. So he's got access to a lot more stuff, where he's not just in a yard."

Male, former prisoner

Interviewer: *"So, did you ever try to clean your needles while you were in prison? And how would you do that?"*

"I would...they have things in every wing. It's called a blood-spill kit. And in those blood-spill kits is bleach. And I would steal one of those."

Male, former prisoner

Interviewer: *"Did you make any attempt to clean those needles between each of you?"*

"Yeah"

Interviewer: *"How would you do that?"*

"Just with a bit of bleach."

Interviewer: *"Can you get bleach in prison?"*

"Ah rarely, but it all depends on where you work."

Interviewer: *"OK. So where would you lot get it from?"*

"The laundry."

Interviewer: *"OK. That's where you were working?"*

"No no. A mate was working there."

Male, former prisoner

Interestingly, one respondent made reference to the fact that although there was no officially sanctioned supply of bleach, its use for cleaning syringes was nevertheless recommended in the compulsory health course provided upon induction to prison.

Interviewer: *"You talked about how the drug course you did in prison taught you how to clean needles. What did you learn from that and how did you do it?"*

"Oh, I didn't need a clean needle, 'cause I always had my own, but they say 'Listen, if you are going to use, this is what you get: try and find the bleach, deal with the bleach, you know...'"

Interviewer: *"Can you get bleach in prison?"*

"No, it's very very hard but it's like everything...there's yeast in the kitchen - you can steal it, there's bleach somewhere -you can steal it. I managed to get some bleach at <A WA prison>. At <another WA prison> we stole it outta the laundry -there was bleach there. I filled up a glove and put it into the laundry bag and sent it back, 'cause you get searched when you leave and come into work So I put it in the laundry bag and sent it back and it got dropped off at my room for me."

Male, former prisoner

Despite there being no official supply of bleach available, some respondents described how sometimes prisoners had obtained a supply with the assistance of prison staff.

Interviewer: *"How easy is it to get hold of bleach in prison?"*

"Umm...Alright yeah, oh no... but I was on toilet cleaning so I was alright."

Interviewer: *"So you had lots of bleach anyhow?"*

"Yeah."

Interviewer: *"OK. You obviously had access to bleach because of that. Don't you think that for people who actually have to go and ask the officers for it, it might be kind of obvious what they wanted it for?"*

"(unclear)...give you a container...(unclear)...if they're not on the ball..."
Interviewer: *"The officers that is?"*

"Yeah yeah. Like they'll give you the container and say 'Oh, Bring it back when you're finished. Bring it straight back and don't give any out' and that's all they'd say."

Female, former prisoner

Due to the scarcity and high value of new, clean needles in Australian prisons and the fact that much injection in prison occurs in circumstances where equipment is shared, it is desirable from a health perspective that needles are rigorously cleaned before their re-use. A number of respondents provided details of the cleaning methods used and the circumstances under which cleaning of syringes took place in prisons. It was observed that while cleaning practices were frequently employed, best-practice methods were used inconsistently and access to cleaning products such as bleach were not reliable.

With respect to reusing and sharing injecting equipment, it was evident that the majority of interview participants were aware of the desirability of maintaining and cleaning needles and syringes as a means of preventing ongoing transmission of HCV. However, it was commonly noted that the secretive and often rushed nature of injecting occasions in prison often rendered ideal methods of cleaning such as three times with water, three times with bleach and three times with water unfeasible. Further problematic was the difficulty in accessing cleaning agents like bleach which generally was not available through legitimate channels and thus frequently had to be obtained through clandestine means such as stealing from the prison laundry. This not only makes a strong case for ensuring the adequate provision of cleaning agents to prisoners, but also for the provision of new sterile injecting equipment via needle and syringe exchange in prisons (NSEP). If these measures are not implemented then ongoing transmission of HCV within Australian prisons is virtually inevitable and will likely necessitate much more expensive initiatives

such as enhanced access for prisoners to treatment for HCV to avoid yet more newly infected individuals being released into the wider community.

Summary

In the absence of clean injecting equipment in prison, importing needle and syringe units into prison as contraband was not unusual. Often these needles were "cut down" for ease of concealment. It was also apparent that not all of these were for the respondents' own use, but imported with the intention to sell or rent out. Importation of drugs, primarily heroin and buprenorphine were also not uncommon. Buprenorphine was also smuggled out of prison dispensaries. Trade in this injecting equipment and drugs within prisons was noted to be extremely lucrative and it was reported that some prisoners were coerced into becoming involved in their importation. It was generally agreed that obtaining drugs in prison was relatively easy although it was helpful to have established contacts. Payment was generally made either by deposits into T.A.B. accounts or by barter for goods such as tobacco or heroin. The manufacture of makeshift needle and syringe units was also reported, their manufacture and components often presenting significant health risks.

Injecting episodes in prisons typically occurred in group situations although some respondents reported having their own needle and syringe unit personal use and another to rent out to other group members which may have been used by many previous people with clear implications for BBV transmission. To some extent this risk was managed by restricting injection to other group members believed to be sero-concordent. While cleaning of needle and syringe units was generally attempted, the practice was inconsistently applied and effective cleaning agents such as bleach often difficult to obtain. A number of these factors were identified as reasons why many prisoners discontinue injection while incarcerated.

Barriers and motivations for commencement of treatment for HCV

The qualitative data was further analysed to acquire a better understanding of why uptake of treatment for HCV was relatively low in Australian prisons prior to the introduction of new direct-acting antiviral drugs (DAAs), and to gain insights into the factors that have acted as barriers and motivations to prisoners entering treatment.

Analysis of the qualitative data revealed a wide range of issues that were perceived as both barriers to entering treatment and also as motivational factors to commence HCV treatment within West Australian prisons. Participants were asked what influenced them personally, but also what may have influenced their fellow prisoners. In all, eleven distinct domains influencing decisions to enter treatment were identified. These domains are described below.

1. **Issues surrounding the knowledge of treatment and HCV;**
   This domain deals with how respondents' awareness of HCV and its treatment affect their decisions as to whether to engage with treatment.
2. **Issues concerning use of drugs and alcohol;**
   Explores perceptions by respondents that their own or other's ongoing use of drugs was an issue (almost invariably a barrier rather than a motivator) to entering treatment for HCV.
3. **Concerns about side effects vs perceptions that their condition was not sufficiently advanced to warrant treatment;**
   Given that HCV treatment is both prolonged and often unpleasant while HCV itself is frequently symptomless, this domain looks at how respondents' weigh up these factors in forming decisions to enter treatment.
4. **Issues concerning the assessment process;**
   This domain examines how the assessment process for HCV treatment in Australian prisons might impact on decisions to enter treatment.
5. **Issues concerning systematic and service factors within prison environments;**
   Explores the impact of the prison environment and health service delivery within them.
6. **Barriers caused by a short length of sentence;**
   Looks at respondents' experiences of either deciding not to undergo treatment while in prison or of being refused treatment due to their prison sentence being of insufficient duration to complete the treatment course.
7. **Mental health and other pre-existing conditions;**
   This domain concerns issues surrounding depression and other pre-existing health conditions that may present barriers to entering treatment.
8. **Issues surrounding stigmatised status of HCV infection;**
   Explores how respondents' perceptions of HCV being a stigmatised disease influenced decisions to enter treatment.
9. **Factors related to family;**
   This domain considers how relations with family and family and major family events can act as factors in making treatment decisions.
10. **Concerns about health and long-term consequences of infection;**
    Explores long term concerns surrounding HCV infection as a motivating factor to enter treatment.

11. **Issues specific to Aboriginal Prisoners;**
    This domain considered the possibility that there may be cultural factors specifically related to identifying as Aboriginal that affect the decision whether to enter treatment for HCV or not.

It was the goal of this research to understand these domains in relation to Mehta's HCV adaptation of Andersen's model of health services use[54]. There were however, a number of domains that could not be explained by Mehta's model. In part this is because while Mehta's model is adequate at identifying barriers to accessing treatment for HCV, it appears less so at identifying factors that motivate people to access such treatment. Also, this is a reflection of Mehta's model applying to HCV health consumers as a whole, as opposed to those in the artificial and strictly regulated environment of prison. An example of how Mehta's model might be adapted to include these additional factors is shown below in Figure 8.

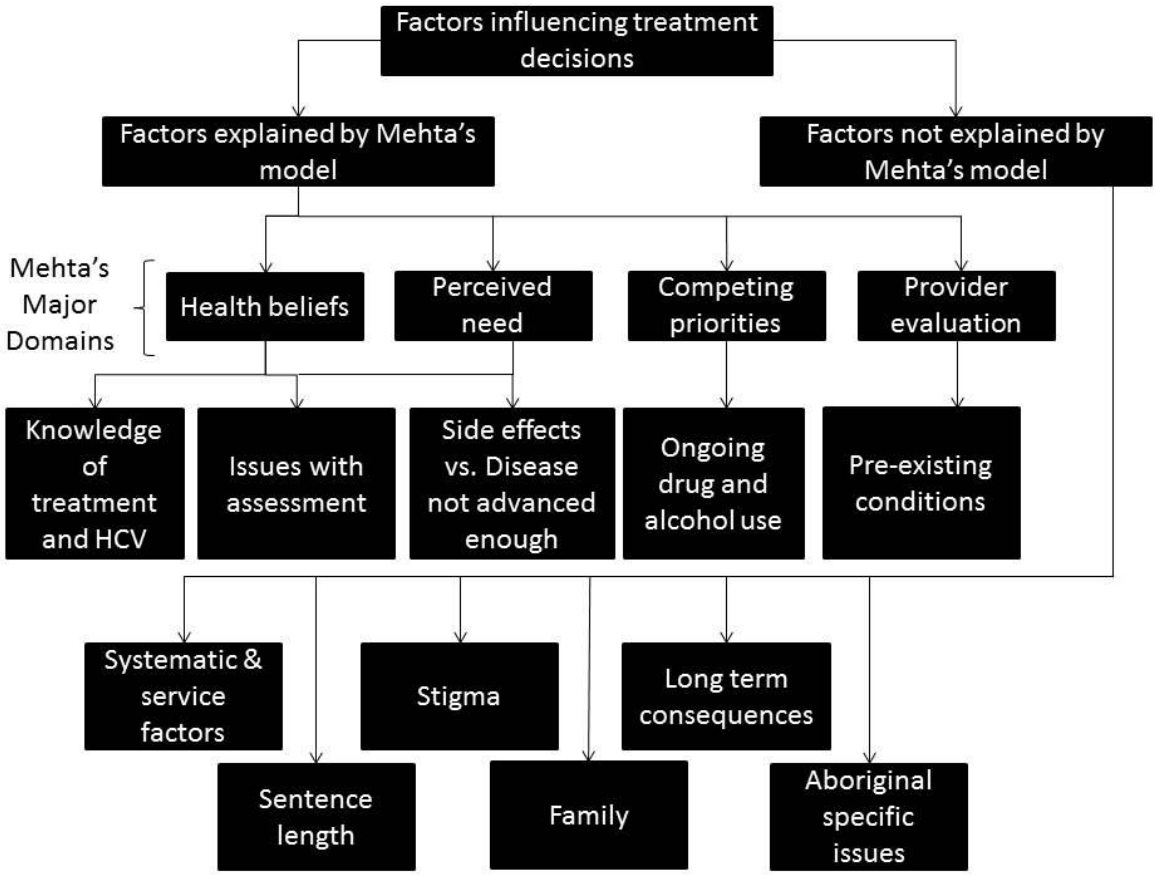

Figure 8: Relationship of thematic domains identified in this study to those of Mehta's adaptation for HCV of Andersen's behavioural model of health services use

Issues surrounding the knowledge of treatment and HCV

Although Mehta's version of Andersen's model of health services use (see Figure 3 in Review of the Literature, Chapter 1) lists knowledge and awareness amongst predisposing factors for accessing treatment for HCV, very few respondents actually raised this. At the time of interview only one respondent (female, former prisoner, never treated) was still unaware that treatment for HCV was available. It must be considered though that this apparently high level of awareness is very likely an artefact of the study's recruitment of

respondents via prison clinics and user support groups in the community where information about treatment was readily available. However, one of the respondents who did raise the areas of knowledge and information as pertinent to accessing treatment for HCV was particularly expansive on the issue:

Interviewer: *"Were you aware you could get treated?"*

"I wasn't aware that I could, but I did see other people getting treated. When I was in gaol, just the other people getting treated and it was a bit scary because they didn't look too well at all. And I think that was at the time when they used to have an injection every day."

Interviewer: *"And did that make any impact on your decision to get treatment while you were there?"*

"Nah,. I still throughout gaol didn't have an understanding of hepatitis and what it meant for my body and my future so until I got that information, I didn't take it as seriously as I probably should have you know?"

Interviewer: *"So if you'd had that information you would have tried to get treatment while you were there?"*

"Oh, I would have tried."

This same respondent later added:

"I would have tried, at least you know 'cause the group of friends that I've got, the guys that I've got hep C from, we all grew up together, we were all kids together, so it's an almost family environment, you live with someone for 10 years, five years with someone in a juvenile facility and then five years in an adult facility, it becomes like family so, you're all sort of making the decisions about the same sort of things together, and no one was interested in more information on hep C, we all sort of thought about it: We've all sort of got hep C, what can we do about it - nothing- 'cause nobody told us "you can get treated" or anything. So nobody really did it, But once I got the information I jumped at the opportunity."

Interviewer: *"Do you think that's (lack of information) why other people don't (get treated), or are there other things in play there?"*

"Yes, I do think that if more people were given knowledge of the treatment that more people would take it up. If there's more information given then people are going to know and they're going to want to do something about it. Of course, you're going to have people out there that won't, but I guarantee the majority of people out there do. I've lived in Australia, I've lived all over Australia, and in America and I've been in and out of gaol, and 90% of the people I meet have been drug people...sorry, good people with drug problems. And with drug problems comes the Hep C, the HIV and all that sort of stuff. So they're all good people, they've just got a bit of a drug problem that turns out to be a life changing, threatening thing. These are good people, give them information about what's going on and they'll want to clean up and get fit and healthy and all that sort of stuff.

Interviewer: *"If you had had symptoms at the time do you think that would have changed anything?"*

"I don't know if I would have recognised symptoms at the time. Because I had no knowledge of what to expect."

Male, ex-prisoner

Another respondent was less concerned about seeking out information, but implied that prison authorities were involved in concealing the fact that HCV treatments could be accessed in prison.

Interviewer: *"Have there been times when you were in there for longer stretches when you might have entered treatment?"*

"Yeah. Longest stretch I've done is four years straight and there was no treatment offered."

Interviewer: *"Did you know it was around then?"*

"Yeah."

Interviewer: *"If you had known they were offering it (treatment in prison) would you have gone for it?"*

"Yeah. Sure."

Interviewer: *"But they don't do anything to publicise the fact that it's there?"*

"Not at all."

Male, ex-prisoner

Issues concerning use of drugs and alcohol

Ongoing use of alcohol and, more often, injecting drug use was the most commonly identified barrier to accessing treatment with 19 interviewees making reference to either their own or others' drug use being an issue.

One issue here is that at the time the interviews took place there was a degree of unwillingness by treatment providers to allow people still using drugs and alcohol to commence treatment with interferon. The Western Australian Department of Corrective Services (DCS) policy exclusion criteria for referral to specialist treatment for HCV specifically including "*positive urine tests for illicit substances while in prison*" and "*Patients unable to convince the treating medical officer that they are genuinely resolved to avoid liver toxic substances*" [56]. It is understood however, that DCS has since lifted this restriction.

Interviewer: *"You weren't offered treatment because you were drinking and you weren't allowed to?"*

"Yeah, 'cause when you're doing treatment, you can't drink, you can't use other drugs, you can't smoke pot, you can't do anything because it affects your interferon. But now I've sort of pulled up a bit. I'm on the Suboxone program. Alright, so yeah - now I'm thinking about doing it."

Male, ex-prisoner

Also recognised was that ongoing injecting drug use carried with it a considerable risk of re-infection, thereby limiting the utility of undergoing treatment. That is to say, that there were a number of respondents with limited, if any, intention to cease injection who considered that the risk of reinfection made undergoing treatment pointless.

"People keep using and these people are aware that they would keep on reinfecting themselves and they won't go on treatment while they continue to use themselves."

Male, current prisoner

"They're not ready to stop the lifestyle; they want to keep on using and coming back to gaol. If you're not ready to make a change and stop using it's not worth taking the treatment otherwise it's worthless."

Male, current prisoner

More common however, were respondents who indicated that due to ongoing injecting drug use, or a presumption that they would resume injecting upon release, that entering treatment for HCV held little salience for them although they may otherwise have been eligible.

"They won't take the opportunity because they want to use again. They're not in the right frame of mind. All they want to do is party and stuff, even if they are in prison. People want to use again, so they don't want to go through the pain of treatment if they're going to use drugs."

Male, current prisoner

"The boys are still using in here and sharing the same needle. People don't want to change. They want to get out and use again, they're still young and just want to get stoned and smashed."

Male, current prisoner

Although most respondents who identified issues surrounding ongoing drug use as a barrier to entering treatment, this was not universally the case, with one respondent identifying that his prime motivation for entering treatment was to resume drinking upon release from prison.

"I like to drink, but you can't have hepatitis C and drink a lot because drinking is also bad for your liver."

Male, current prisoner

Concerns about side effects vs perceptions that their condition was not sufficiently advanced to warrant treatment

In addition to treatment for HCV being a lengthy process, the principal medication at the time of interview was interferon which is associated with a wide range of side-effects, many of them unpleasant. These include, but are not exclusive to flu-like symptoms, haematological toxicity, elevated transaminases, nausea, fatigue and psychiatric sequalae [46]. HCV however, is a long term chronic condition and a large number of those infected will experience few, if any symptoms [13]. While this situation is likely to have mitigated with the introduction of new generation DAA medications, at the time of interviews, this situation led to a number of respondents making comments concerning themselves or others regarding weighing up the relative value of a potentially unpleasant treatment process against a disease that was currently causing few problems.

Indeed, of the 26 respondents who commented elsewhere in the interview on whether they had experienced any HCV related symptoms, 65% (n=17) had never had any symptoms while in prison and just 8% (n=2) had experienced serious symptoms while in prison. The first of these reported having first gone to see the prison doctor due to "*feeling sick every day*". The second of these spoke of kidney pain and extreme tiredness, but believed them to be psychosomatic, or *"all in the head"*. Of the remainder (27%, n=7), three reported some pain they believed to be related to HCV, but only after consuming

alcohol or drugs the night before, one reported being "a bit yellow in the eye sometimes" and three made reference to lethargy, one of these noting that it was "*very subtle*".

Interviewer: *"OK. Why do you think they don't care about HCV?"*

"Their lifestyle, the way they want to lead their lifestyle. I don't know, you'd have to ask them. They don't care. It doesn't do nothing, doesn't do nothing to them, they reckon it's fuck all. In gaol hep C's fuck all. That's...that's the word on the street."

Interviewer: *"Why's that?"*

"It's just the way people see it - "oh you got hep C, oh, it's fuck all.""

Male, ex-prisoner

Interviewer: *"Ok. So, have you ever considered getting treatment?"*

"Yeah, I have. I've enquired a couple of times. When I've enquired outside of gaol and inside of gaol. I get on...I've known the leader of the PAST team in gaol - the Prison Addiction Services Team, and I had a chat to him and the doctor and they sort of advised me against it."

Interviewer: *"Why was that?"*

"Well, I'm...I get very paranoid about my weight, 'cause of my drug use and I've seen how Interferon reacts to people, and I've seen big blokes just wither away to nothing, and when I'm scraping onto 65 kilos as it is, I don't wanna...I've seen them, it was like having chemo...they were stuffed."

Interviewer: *"So, that put you off the idea?"*

"Yeah. Big time. Big time. I might wait until they've found a better way or something."

Interviewer: *"I mean, I guess another question is, if you've never had symptoms why would you consider treatment?"*

"Exactly. And all you ever hear is you know, worst case, it knocks ten years off your life. A bloke on drugs can't think about next week, let alone losing ten years thirty years down the track - they couldn't care less."

Male, ex-prisoner

Some respondents however, were not deterred by what they had heard or personally experienced of side effects and were determined to complete the treatment.

Interviewer: *"So, did you know anyone else who'd done treatment?"*

"A couple of guys in prison, and they ended up very sick. I think one bloke actually stopped because it was affecting him that much. Whether he had bad reactions to it or...I'm not sure. But besides, no. No-one in the community or no-one else."

Interviewer: *"So seeing those guys who had the bad reaction, did that make you think twice about having treatment at all?"*

"Not at all."

This same respondent went on to describe the effects that he personally experienced while undergoing treatment.

*"In <a WA prison> there are a few blokes after I'd come off it, there were a few blokes who I think will be going on it. They said 'What's it like?' and I said 'Well, it's like what they say: it's pretty hectic. Hectic stuff, I couldn't eat, I had ulcers in my mouth, I had ulcers all down my throat,... I got isolated, got depressed...',...but they were still planning on doing it! *laughs*"*

Interviewer: *"OK, when you had all those horrible effects, did you ever think twice about what you were doing? Did you ever think 'This was a really crappy idea, I should never have done this?'"*

"No, no. I was determined to get through it."

Interviewer: *"So, getting rid of the disease and having a nice good quality of life is worth that sort of thing?"*

"Absolutely. And there were times there where the ulcers I had in my mouth were so painful, they'd wake me up every night. I couldn't sleep 'cause every time I'd move, or my cheek moved or my mouth moved, the ulcers were that painful... But I was determined to do it."

Male, ex-prisoner

Issues concerning the assessment process

Elements that are intrinsic to the prison environment, typically surrounding issues of security and Western Australian prisons often being located a considerable geographic distance from specialist medical services such as gastroenterologists, often rendered assessment of prisoners preparing for HCV treatment complex and lengthy.

Often the issues described involved the need to be taken out of the prison to be assessed by specialist medical staff at a hospital. A number of respondents indicated that this was associated with the security level of the prison involved. It should be noted that some of these issues have since been resolved by the implementation of video conferencing technology in prison clinics rendering the transport of prisoners to specialist clinics unnecessary.

"It's a big hassle to go and see a doctor. I didn't want to go to hospital shackled and handcuffed, but that doesn't happen at <a lower security prison>. It puts people off treatment."

Female, current prisoner

"I went to hospital for tests and I was shackled to a wheelchair. It was degrading and everyone stares at you. At <a lower security prison> though, you just walk right through, there's no hassles. No one looks sideways, there's no hassle."

Female, current prisoner

Another respondent spoke of how he was not personally bothered by the process of being shackled for purposes of assessment, but was acutely aware that his appearance in restraints and in the company of prison warders was making other people at the hospital uncomfortable.

A different issue was the discomfort of the liver biopsy as part of the assessment process. One respondent spoke about how a fear of the process involved in obtaining the tissue sample deterred many people from undergoing treatment. As with the issues surrounding

the need to be transported from the prison for specialist assessment, this is likely less of an issue now, with ultrasounds in the prison clinic replacing the requirements for biopsy that existed at the time of interview.

"People talked about this needle, and how they used to take a chunk out of your liver "which would fuckin' hurt". And some guys just could not do it – they didn't want to have the needle for the biopsy."
Male, current prisoner

The other major issue concerning assessment was the time consumed by the process. This has likely become a lesser issue since the introduction of DAA drugs with a shorter treatment protocol, but nevertheless was a significant barrier at the time interviews with participants were conducted. Although there were three respondents who commented on how efficient the system was, two of them even suggesting it might be quicker than in the community, this was by no means a universal experience. The following comments were typical.

Interviewer: "*And you said they offered you treatment?"*

"They mentioned that there is this treatment - Interferon., and I said "yeah, put me on it straight away." And they said "Well, you've got to go through all the tests and you've got to see a psych." and all this sort of stuff, and I said "Yeah, no worries, I'll do it.", but I didn't expect it to take so long."

Interviewer: "*OK, and I'm sure they had you assessed first?"*

"I was assessed in <a high security prison>, and as I said, it was two years between getting into <a high security prison> to <a low security prison>, going back and forth. The delays were in from <a high security prison> I'd go in under escort to the hospital, have a blood tests, come back to the prison, wait three months, go back, get the results: "Oh, sorry, we didn't get all the blood." Get more blood, go back to prison, three months later, go back in: "Oh, now we'll refer you to the nurse." Go back in, three months later, go back in - it's fucking unreal - it really is."

Interviewer: "*How do you feel about all those trips out of prison? Is that like a day out or is it a big hassle?"*

"Well, yeah, it's good to get out - out and about."

Interviewer: "*But you'd be taken into public in shackles wouldn't you? That would be a bit intimidating I'd think?"*

"Oh yeah - handcuffs and shackles, yeah. I mean, that didn't worry me, it was just the fact that I wanted to start this program. And it wouldn't be like, in the community, you be chasing these things up yourself. In there, it's out of your control. They just make an appointment for another three months, and then go "Oh, sorry, we didn't get all the bloods we were supposed to last time, so we get all the bloods this time." And then say, "Oh, sorry, you're meant to see the psych first." So then you book another three months and you go and see the psych."

Interviewer: "*How many trips out to the hospital did you end up making in total?"*

"Oh, must have done five. And there's two or three months in between those trips. At least."
From the same interview;

Interviewer: "*OK, so how long from then until you got assessed?"*

"Till I actually started it?"

Interviewer: "*No, until...till you got to the actual hospital to get your..."*

"Umm...oh, it was probably six months after that until I had my first trip to hospital, to have my first lot of bloods done."

Interviewer: "*Yep. And then?"*

"There were three or four different tests and they took a number of months in between each one."

Interviewer: *"Yep. And so by the time you actually got started, two years had passed - is that right?"*

"I started <in> June uhh..yeah, last year, and I finished in December. So I started in June last year, so that's...well, that's two and a half years isn't it? I suppose. Two years...just over two years. And I remember it being such a big thing, and I'm...I'm whinging about it, and there's nothing I could do, and I knew if I was in the community I could just go up. I mean, there is a health review line we could call in prison in case anything goes wrong."

Interviewer: *"Did you ever have to use that?"*

"Well, I rung them a couple of times, and they said 'well, it's just up to the hospital. It's the hospital that's giving out these appointments.' But I don't believe that, I believe if I was in the community, I wouldn't have to wait three months in between each appointment."

Interviewer: *"I guess that must have been pretty frustrating for you?"*

"Well, very frustrating. Yeah. 'Cause I was getting closer to my release date and my parole date and I still hadn't got out, and then they said 'yeah, you're right to start, oh - but you're getting out in two months so we won't start you.'"

Interviewer: *"So, if your parole hadn't been knocked back they wouldn't have started you at all?"*

"They wouldn't have done it. I would have had to come out to the community and do it yeah. And they knocked my parole back, and I said 'Please can I start it now?'. I was up for parole seven months later, but I didn't tell them that, I said I had to stay in for another...until 2011 I was in for. Umm, so they said 'Yeah, alright, we'll start you on it now.' So, I started it."

Male, ex-prisoner

These types of delays were noted by multiple respondents.

"Have wanted it (treatment) for the last six months, yet only just got the ultrasound tests done. It's taking forever and I don't know why."

Female, current prisoner

Interviewer: *"So, if you're in a more secure prison, is everything more difficult there or..."*

"Yeah, yeah, very difficult. And you have to be doing over a certain amount of time to get on Interferon."

Interviewer: *"So what would be the minimum time before they treat you?"*

"Oh it'd take a good six...other bloke said it took him two years to get on it."

Interviewer: *"Why do you reckon it takes that long?"*

"Just, just the backlog in the hepatology place. The people waiting to see and that. And probably because they're prisoners, yeah you know, you're last on the list."

Male, ex prisoner

Issues concerning systematic and service factors within prison environments

Although it has been noted that "*Prisons offer an ideal setting for the treatment of hepatitis C because maximum compliance, which is necessary for achieving a sustained virological response can be assured.*"[110], uptake of treatment in prisons is surprisingly low despite the high background prevalence of HCV. A number of respondents in the study group provided information suggesting that systematic and service factors played a considerable part in this. One respondent provided a lengthy and largely negative critique of the clinical services available in prisons, especially with regards to staffing issues.

"umm...the medical centre umm was just about, you know, it was impossible to get down there for anything. Never mind like your injections for...there was no one in the medical centre that could do anything."

Interviewer: *"Right, so what - you mean it wasn't staffed?"*

"Yeah, no, no staff. Yeah, qualified staff. I mean, no one wanted to work like in the medical centre at <a WA prison>. All the ladies that were there were slowly like, just quitting. They were getting new people in that never knew what was going on or never had any experience. Where medication times might take an hour in each unit, they were taking three hours, because they were like new medics and they didn't know...Some days you wouldn't get down that day, you'd have to wait a few more days.

Interviewer: *"Is that typical for prisons or was that just a <prison name> problem?"*

"Yeah. You get that in a lot of prisons, even at <prison name> the medical centre there's shocking.

Interviewer: *"Can I just ask why you said "even at <prison name>"? Has that got a better reputation or something?"*

"No, I don't know why I said "<prison name>", but no, they're all just the same really. Yeah, as far as the medical centres go. I think they sort of look it that, "you're in gaol so we'll see you when we can." Yeah, but it shouldn't really be like that. I don't think so anyway."

Interviewer: *"Do you think that's the only problem or is there other stuff?"*

*"The medical centres are like something that …You know, trying to get proper treatment in gaol for anything's like *heh!* hard. Yeah."*

Male, ex-prisoner

Another respondent was also critical of clinical staff noting conflicting opinions between doctors and nurses and inappropriate security responses to prisoners who disagreed with staff members' decisions.

Interviewer: *"So why do you think so few people take up the opportunity to get treated in prison then?"*

"It's just...the medical staff are...very ordinary in gaol eh. Very very ordinary. It's like the doctor might say something, and then when it gets to the nurses, they'll make up their own mind and say "oh no. Sorry". And if you argue the point they'll call up a screw and say "Oh, he's being a problem, get rid of him" and you get punished for basically sticking up for your rights."

Male, ex-prisoner

The suggestion that some prisons' clinical services were superior to others was a recurrent one, one example being a respondent (Female, current prisoner) who observed that she was making more progress towards entering treatment at <prison name> than she had at <prison name> where *"the nurses were just lazy"*.

One respondent made specific reference to the lack of confidentiality in dosing procedures in prison clinics and how this made it very difficult to conceal patients' HCV status.

"The nature of the prison environment also creates complications – people know when you go for medication and people can find out by standing behind them in line…other prisoners are listening and trying to watch to see what medication other people in that line are receiving."

Male, current prisoner

Another issue with dosing mentioned by several respondents involved prison restrictions on the clinics providing take-away doses of medication. While paracetamol was provided, it had to be consumed in the clinic as a prophylactic in case of headaches that might be induced by interferon, rather than being available to the prisoner at the time it was needed.

Several respondents referred to prison overcrowding and having to share cells as being an issue for people considering commencing a treatment known to affect mood.

"In <prison name> everyone's doubled up in cells which might make it harder, whereas in <a lower security prison> it's easier to approach. In a bigger prison it might be harder."

Female, current prisoner

"People need their own space while on treatment and officers don't seem to realize that. I've been dreaming about fighting my cellmate and flogging him. I've warned the prison officers about this, but they won't do anything."

Male, current prisoner

In some cases, actual entry to prison could disrupt already existing treatment programs. One respondent described how his treatment was discontinued upon admission to prison and restarted months later. This seems a curious decision, since this would have incurred substantially more financial costs to the Department of Corrective Services than if they had continued his treatment.

Interviewer: *"OK, so what made you decide to get treatment then?"*

"I was on it before I come to prison. And they kicked me off because I went to prison. Then I had to make another phone call, had to wait another six months, and then, and then they put me back on it."

Interviewer: *"Why didn't they just continue?"*

"Because I went to prison."

Interviewer: *"OK"*

"And they didn't seem too happy about that."

Interviewer: *"Uh huh. Why do you think that was?"*

"You tell me and we'll both know."

Interviewer: *"OK, so you went to prison, and your treatment had been stopped - what did you have to do to get back on it?"*

"They said "Oh we've made an appointment and we'll call you in a few months." A few months went by, six months went by. Nothing had happened. So I went to the medics and said "Blah blah blah, and you know, what happened, told me story, and they rang up, got me an appointment with the doctor and the doctor got me straight back on it. So, the clinic didn't organise another interview - I had to do it myself."

Interviewer: *"Did you have to organise the first one that didn't happen, or did they offer that?"*

"Eh?"

Interviewer: *"With that interview that didn't happen, was that something that..."*

"Yeah, I had to organise it, yeah."

Interviewer: *"And then they just didn't follow through with it."*

"Nuh."

Interviewer: *"Does that sort of thing happen a lot in prison?"*

"Yeah..yeah."

Male, ex-prisoner

By their very nature, prisons are highly artificial environments with much of their routine operations dominated by regulations and security concerns. As a result, it is unsurprising that a number of respondents commented on how the nature of the prison environment and services provided influenced decisions to enter treatment for HCV. These included the need to be escorted to the prison clinic by guards who often had higher priorities, and a shortage of suitable trained medical staff. Other issues were identified with overcrowding of prisons increasing stress levels of prisoners already experiencing labile mood as a result of treatment with interferon.

Barriers caused by a short length of sentence

Treatment of HCV is a lengthy program lasting between 24 and 48 weeks[136] (p147) and a review of 72 trials of interferon and ribavirin, involving 9,991 patients reported a median treatment duration of 29 weeks and a maximum of 78 weeks [137]. This is not including the often-lengthy patient assessment process that proceeds commencing actual treatment.

As a result, there were five respondents who indicated that they had not undergone treatment while in prison due to the length of their sentence being too short to complete the course of treatment before their release date. It should be noted that the introduction of DAA medications with shorter courses of medication since the in-depth interviews were conducted will likely ameliorate this problem.
The following quotes were typical.

"The nurse..she went through the whole history. Because I'm on the methadone program, and I needed the methadone in the prison she asked me if I had hep C, and did I want to do anything about it? And I said, I'm only going to be here for a month, and I'm still going to use drugs so there's not much point doing it so..."

Interviewer: *"Do you reckon you would have done something about it if you had been in for a longer stint?"*

"Possibly, yeah."

Interviewer: *"So, if you were in there for a year, do you reckon that would make it attractive?"*

"Yeah. Probably would have. Because in a year I probably would have got off the methadone, got on the interferon and then...yeah. Yeah.I probably would have."

Male, ex-prisoner

"And basically, in the process (assessment) you've gotta get your biopsy done, cut open, cells taken out, there's a waiting list, and it all depends on your sentence. So, you've gotta be looking at doing three years at least to get on the program."

Interviewer: *"So, they won't treat you if you're only in for six months or something?"*

"No. 'cause you've got to be a sentenced prisoner, and most of the time if you're on remand, so you can cut a year out there on remand and then you've got a six months to a year, year and a half waiting list and then they approve you, and half the time, well, most people I know of on interferon, yeah sure, they want to get their hep C treated."

Male, ex-prisoner

A third respondent described how he was refused treatment, but was eventually able to commence the program when he was denied parole, thereby significantly extending his sentence.

Interviewer: "So you still thought it was worth getting treated?"

"Yep. And especially being in prison. I think it's a good environment, you've got a medic there 24/7, and there was a stage there, 'cause it took so long to try and get on it, I was up for parole, and they said 'You may as well wait until you go into the community now before we start you'And then I got knocked back parole, so they started me then. So, luckily I got (???unclear) through, 'cause it would be very hard to do in the community."

Mental health and other pre-existing conditions

Although mental health issues are known to be widespread in the prison population [79], there were surprisingly few respondents who spoke about mental illness and receiving treatment for HCV. The first however, went into considerable detail.

"I've tried to get treatment in gaol for it, but because I suffer from severe depression, they won't allow me to go on the Interferon program because the main side effect from that is, you know, depression and they think I might try and do something to myself, so they've never allowed me to go onto it. So, I've just had problems, getting any treatment for it in gaol. I suppose they're only looking out for my, … that I don't do anything to myself, but I mean, I suppose I'm going to have it for the rest of my life. If I can't have it because I suffer with depression. I have been out to umm...Royal Perth from the prison. Like, taken out and seen the specialists and you know, they've told me that they don't thinkme being on the interferon and suffering from depression is good because I've been in Graylands. As well as being to gaol, I've had a court order for me to reside at Graylands for depression."

Interviewer: "*Is that because you were a danger to yourself?*"

"A danger to myself and a danger to society. Yeah. The main thing with the interferon is depression, and they just think with what I've already got, that I already suffer with that it could put me in a ...you know, and they can't afford to watch me 24 hours a day. WhichI think it is fair. But I still would like something done about my hep C. Yeah."

Interviewer: "*They can't just give you antidepressants to balance it out?*"

"I'm already on antidepressants and I still go through mental health (treatment) at Royal Health hospital now. And I still like get depression all the time. It's just that I've been on I think, every medication I can for...yeah, I dunno, but I can't seem to get rid of it."

"I look at what the specialists have said to me about the depression and how the depression from that. The one (treatment regime) that I would have had to go on would be a twelve months because I had the number One..."

Interviewer: "*Genotype?*"

"Yeah.. I mean I can't be watched for twelve months so...I'm going to have to live with it. Yeah."

"I've been a couple of times at <A WA prison> *and seen about the hepatitis C and I've been out to Royal Perth and they've said that they don't want to put me on the interferon. And then a couple of years later I was out there again and I thought, that I'd have another try and the same thing came up about the depression. So, so they have tried. It's not like they just shrugged me off."*

Interviewer: *"But a lot of people in prison have mental health issues. That must disqualify a lot of people?"*

"Yeah, I know other people that have tried for the umm program but haven't got it for the same reason that I haven't been able to do it. And I mean, I know that, if I tried out here it's only going to be exactly the same. Most probably be worse out here because I'm by myself."

Male, ex-prisoner

A second respondent talked about personally making the decision not to consider treatment due to his mental state at the time.

Interviewer: *"Were you offered treatment?"*

"I have been offered treatment."

Interviewer: *"While in prison?"*

"Yeah"

Interviewer: *"And you didn't take that up obviously?"*

"No I didn't. This last sentence, I lost my daughter - she died, and it was hard enough coping with that, let alone coping with the depression from the Interferon and stuff like that you know?"

Interviewer: *"If you'd been in a better headspace at the time, would you have considered treatment?"*

"Umm...yeah, but possibly. Yeah. If I didn't have all these other things that I had to cope with during gaol, I probably would have done it you know? But I was depressed as it was."

Male, ex-prisoner

Apart from pre-existing mental health conditions, there was also one respondent (Female, prisoner, currently in treatment) who reported delays in beginning treatment due to her having the hereditary disorder haemochromatosis. This necessitated first lowering her body's iron levels prior to commencing treatment.

An additional respondent (Female, ex-prisoner) was unaware that treatment was available in prison, but speculated that she had not been offered treatment in prison due to being pregnant at the time.

Issues surrounding stigmatised status of HCV infection

Issues of stigma and discrimination have been long associated with HCV, a report from the NSW Anti-Discrimination board noting that discrimination against those infected with HCV was "*widespread and frequently motivated by fear and ignorance*." and "*based on the stigma associated with injecting drug use and associated stereotypes*". It also observed that this discrimination most commonly occurred in the context of accessing medical care [138]. In practice though, only two respondents reported perceiving discrimination of this kind;

"But you could, you could quite easily stand and stand and bleed to death in the showers,. None of the screws will touch it because you know, you could have AIDS. You could have Hep C, you could have Hep B. And they think we deserve it. Who gives a fuck whether he dies or not. Just hose it down with fucking bleach and be done with it. 'Cause they go through searches, they put on gloves they just go to extremes which, which makes people feel bad about opening up to "Oh I think...could I have a Hep C test please?". You know... a screw's going to eventually find out about it and that goes around all the officers, and then you get targeted out just in Chinese whispers. It comes back that you're a fucking HIV...riddled with HIV and you're just about ready to die."

Interviewer: *"That would sound like a pretty fair disincentive wouldn't it to get treatment..."*

"Exactly my point."

Interviewer: *"How much confidentiality is there exactly between the medical arm and the guards?"*

"Good question. I don't know."

Male, ex-prisoner

"I had two biopsies on the same day, because they didn't remove enough liver tissue on the first time. It was fucked. Maybe it was deliberate because they're dirty on a crim."

Male, current prisoner

Other respondents who discussed the stigmatised nature of the disease appeared much more concerned with the perceptions of other people around or close to them rather than those of clinical staff.

Interviewer: *"Why do you think so few people in prison take up the opportunity to seek treatment for HCV?"*

"People see hep C as "dirty" and don't want to disclose to other prisoners…there's a lot of stigma is the main reason, and people don't like to disclose that they're positive for HCV while in prison."

Male, current prisoner

Interviewer: *"Why do you think so few people in prison take up the opportunity to seek treatment for HCV?"*

"They think the worst, that everyone in prison will find out."

Female, current prisoner

One respondent, who referred to HCV as *"a dirty disease"* described how when explaining his habit of disposing of toothbrushes and razors to prevent other family members contracting HCV actually found it preferable to feign mental illness than to confess to having a stigmatised disease:

"When my mother asked me about this behaviour, rather than admit to having HCV, I told her I'd developed obsessive compulsive disorder in prison"

Male, current prisoner

That said, an unexpected finding was that more respondents discussed issues related to the status of stigmatisation of the disease as motivations for seeking treatment.

Interviewer: *"So, what made you decide to have treatment?"*

"Just to get rid of it, so I'm disease free."

Interviewer: *"But you weren't having any symptoms were you?"*

"Nah. Just want to be disease free. I want to get a nice girlfriend - I don't want to say "oh, I've got Hep C" you know?"

Interviewer: *"So, it's just the feeling about having it and how it wasn't sort of acceptable?"*

"Yeah. Yeah."

Male, ex-prisoner

"It's a junky's disease. Some people don't care that they have it, but I do. Health and fitness are very important to me"

Male, current prisoner

Factors related to family

Issues with family were commonly mentioned as motivating factors towards engaging with treatment for HCV. Desires to be present for children and other family members were especially common, and one (male, current prisoner) specifically mentioned that his attitude towards his drug use and treatment had been changed by becoming a parent. Other comments along these lines were typical.

"I wasn't ready before to come off drugs but coming to gaol – I've got four kids I've got to be there for. I'm really hurting this time. I'm ready for treatment now. It's safe to say I'll never use drugs again."

Female, current prisoner

"I commenced treatment because I have kids and hepatitis C takes ten years off your life. I've stopped using because I've got kids, and just over it."

Male, current prisoner

Some respondents' issues related to family were much more specific in nature. One respondent (male, current prisoner) indicated that he was concerned about what he referred to as *"home transmission"*, that is, the possibility that he might inadvertently infect other family members, making particular reference to the possibility that his teenage son might contract HCV through using his razors or toothbrushes.

Another respondent was motivated to enter treatment through a need to assist his ill spouse:

"I didn't like having it (HCV), I want to be a kidney donor to my wife and you can't be a donor if you have the disease."

Male, current prisoner

Although, for the most part, issues with family served as an encouragement to enter treatment, occasionally family stresses were identified as a barrier to doing so, some observing that the absence of family stressors in prison was an advantage.

"The pros of getting treated in prison outweigh the cons. There are too many distractions outside, career, children, life etc. So here in prison is really the perfect time to get it done."

Male, current prisoner

"*I'd rather start treatment in here (in prison) where I didn't have kids or work."*

Female, current prisoner

Concerns about health and long-term consequences of infection

Although very few respondents had actually experienced symptoms from their HCV infection at the time of the interview, many were motivated to enter treatment by concerns about what effects the disease might have on them in the longer term.

Interviewer: *"I guess the question that comes to my mind here is: you've got this condition that's not actually giving you any really major symptoms - why would you go on a long course of treatment that really does give you really unpleasant symptoms?"*

"'cause I was told in the long run, it may lessen my life span by ten or twenty years."

Interviewer: *"Yep, OK."*

"I'm assuming, and this is only my guess, that I'd probably had it for four or five years. Assuming it's going back to my partner and that's when it started. I've been told that you don't start getting bad symptoms for at least ten years of having it. But yeah, anything that lengthens your life mate, is worth doing."

Males, ex-prisoner

"Even though I've got no symptoms, treatment is worth having. In ten years my liver might start to fail."

Female, current prisoner

Interestingly, even when the concerns for the future were based on misinformation, they could still have a motivational effect on decisions to engage with treatment for HCV:

"I decided to have treatment because I didn't want to be on renal dialysis in 15 years."

Female, current prisoner

Issues specific to Aboriginal Prisoners

As it is known that Aboriginal prison entrants test positive for HCV antibodies at a substantially higher rate than non-Aboriginal prison entrants (43% vs. 33% in the general prison population and 64% vs. 58% among PWID), and 24% of Australian prisoners are Aboriginal, it has been observed that "*Culturally appropriate prevention strategies including education, hepatitis B vaccination and hepatitis C treatment should target this group*"[130]. With this in mind, it was considered desirable to examine the data with respect to identifying cultural issues in influencing HCV treatment decisions.

Although there were eight respondents in the sample who identified as Aboriginal, half of these were in some stage of treatment or assessment, and comments specific to race or culture having a role to play in influencing decisions to enter treatment were rare.

One respondent (Male, current prisoner) talked about his concern regarding side effects of the medication, but erroneously speculated that this may be a uniquely Aboriginal perspective, observing that he associated exclusively with other Aboriginal prisoners.

Another spoke specifically about the behaviour of young Aboriginal males in prison and their reluctance to enter treatment. It should be noted however, that these behaviours are by no means exclusive to young Aboriginal males.

"The boys are still using in here and sharing the same needle. People don't want to change. They want to get out and use again, they're still young and just want to get stoned and smashed."

Male, current prisoner

Summary

This chapter presents the results of qualitative in-depth interviews with 28 respondents (13 current prisoners and 15 recently released prisoners) exploring the contexts in which injection of drugs occurs in prison environments, and the various barriers and motivations to engaging in treatment for HCV in prisons prior to the introduction of DAA medications and other technologies. In addition to this, information concerning demographics, drug use and prison history, and knowledge of HCV was collected to provide background and context to the qualitative data.

Most (79%) of the sample were male, 29% identified as Aboriginal and the median times of imprisonment was four. All participants were positive for HCV antibodies while imprisoned although they may not necessarily have contracted the disease while incarcerated. There were only two respondents with no history of injecting drugs, both of whom attributed their infection to amateur tattooing. Injection of drugs while imprisoned was reported by 54% of the sample. Of these, more than half (53%) reported injection while in prison on at least a weekly basis, and 73% reported using a needle and syringe unit after someone else, with the majority believing the needle and syringe unit previously had been used by more than five people. Although numbers of infected prisoners were commonly overestimated, overall, knowledge of HCV and issues associated with treatment was surprisingly good. This however, is likely an artefact of participants being recruited from peer support groups and prison clinical services where such information is widely accessible.

With regards to contextualizing drug use in prison, it was found that in the absence of clean needle and syringe units in prison, that importation of these items as contraband was relatively commonplace. This importation was also found to not only for prisoners' personal use, but also to rent or sell to other prisoners, a concept further explored in Chapter 5. The importation of illicit drugs, particularly heroin and diverted buprenorphine was also noted as common and able to command prices very much higher than what would be found outside of prison environments. The phenomena of smuggling drugs and sometimes injecting equipment out of the prison dispensary was also noted as was the manufacture and use of improvised injecting equipment. Injection in groups was also observed to be typical, involving sharing and reusing of injecting equipment carrying with it a number of health risks including transmission of HCV. Some respondents reported methods of minimising these risks such as only injecting in sero-concordant groups or having a personal needle and syringe unit separate from others that were shared. Maintenance and cleaning of reused equipment was discussed, revealing that while cleaning was generally attempted, it was frequently inconsistent and access to cleansing agents such as bleach often difficult.

Barriers and motivations to entering treatment for HCV while imprisoned were explored against the background of Mehta's model of health services use in HCV treatment[52] . This model deals with many perceived barriers to entering treatment for HCV in the mainstream community, but does not address some barriers most pertinent to prison environments. Two of the most pertinent issues addressed here were intrusive medical evaluations and having too short period of incarceration in which to complete treatment. It is likely that the introduction of new DAAs and the use of ultrasound techniques over biopsy will see new approaches to this issue. The issue of people identifying as Aboriginal was considered here, but there did not appear to be specific reasons for their lack of engaging in HCV treatment found.

CHAPTER 4: Rates of injecting and associated risk of hepatitis C transmission in prisons

As discussed in the literature review relatively little is known about patterns of injection in Australian prisons or the characteristics of those involved in the practice. Nevertheless the injection of illicit drugs in the prison environment is known to be a major factor of HCV transmission [61, 88-90]. As higher frequencies of injecting episodes represent increased opportunities for exposure and thus infection with the virus, it is highly desirable to know more about how widespread injection of drugs is in Australian prisons and how frequently individuals who inject do so.

This chapter presents findings from the 2009 Illicit Drug Reporting System (IDRS) which explored the demographic characteristics of PWID who continued to inject while imprisoned and the frequency at which injection occurred.

Synopsis of methods

A sample of 355 former prisoners who inject drugs was recruited via a larger annual nationwide survey; the 2009 Illicit Drugs Reporting System (IDRS). The IDRS is a self-selected convenience sample of approximately 900 regular injecting drug users sampled from the capital city in each Australian jurisdiction with the aim of monitoring changing trends in illicit drug use. These participants were asked a small number of additional questions investigating a history of imprisonment, time elapsed since the last period of imprisonment, duration of last imprisonment, whether they had continued to inject while imprisoned and if so, whether they had done so in the last 12 months and the frequency with which they did so. These questions can be located in Appendix D. Data pertaining to demographic and drug use history routinely collected by the IDRS and the number of occasions of imprisonment were analysed under univariant binary logistic regression to determine which were independent variables with a significant influence on whether individuals continued to inject while in prison. All variables were then included in a multivariant model. The back-step method of removing factors found to be non-significant from the model until only significant factors remain was then employed to identify factors significant in influencing this behaviour. All data was analysed using SPSS version 19.

Characteristics of the study group

As described in Methods (Chapter 2) of this thesis the participants for this explorative study were taking part in the 2009 Illicit Drug Reporting System Of the total 881 respondents, 355 fulfilled the criteria (i.e.: having been in prison in the past ten years) to complete the additional questions relating to injecting during incarceration and thus formed the study group.

Of the 355 participants, 201 (57%) had been released within the last three years and 283 (80%) within the last six years. The median age of participants was 36 years (range 18-62) Three quarters of the study group (76%) were male, 14% identified as Aboriginal or Torres St. Islander, and the vast majority had been born in Australia (87%), had English as their first language (96%), identified as heterosexual (91%) and were unemployed at the time of interview (85%). Almost half (46%) were currently in drug treatment, primarily opioid replacement therapies.

A total of 83% (n=294) of respondents reported that outside of prison, they were typically injecting on at least a weekly basis with the most commonly reported frequency of current injection being "*more than weekly, but not daily*" (33%, n=117). The variables examined were those routinely collected by the IDRS in terms of demographics and drug use history. These demographic variables are displayed in Table 5.

Table 5: Characteristics examined in this study

Characteristic	
Median age	36 (range 18-62)
Released within the last three years	57% (n=202)
Released within the last six years	80% (n=284)
Male	76% (n=270)
Identify as ATSI	14% (n=50)
Born in Australia	87% (n=309)
Identify as heterosexual	91% (n=323)
Unemployed at time of interview	85% (n=302)
In drug treatment at time of interview	46% (n=163)
Injecting weekly or more outside prison	83% (n=294)
Injected in prison in last 10 years	46% (n=162)

Injecting in prison

Almost half of the study group (46%; n=162) reported they had injected while in prison within the last ten years. This included two respondents who reported they had initiated injecting while in prison. The proportion of participants reporting injecting while in prison varied significantly across the eight jurisdictions although only Queensland varied significantly from the national level (χ^2 =18.945, df=7, p=.008). This variation is displayed in Table 6 below.

Table 6: Jurisdictional differences of participants reporting injection in prison

Jurisdiction	Percent ever inject in prison (n)	n
Queensland	70	37
Western Australia	53	40
New South Wales	51	82
South Australia	43	21
Tasmania	42	38
Victoria	40	68
Australian Capital Territory	37	35
Northern Territory	24	34
National	46	355

In the univariate analysis factors found to be significantly associated with injection in prison were: being male, having left school prior to completing year 10, initiation to injecting prior to 17 years of age, reporting heroin or other opiates as the drug of choice,

injecting on at least a daily basis in the month prior to survey, having ever been in drug treatment, receiving income of $250 or less in the month prior to survey, having received income from criminal activity in the month prior to survey, and increased length of sentence.

Factors significantly associated with injection in prison in the univariate analysis were incorporated into a multivariate model, and using the back-step method, non-significant variables were removed until only ones of statistical significance remained. These were found to be gender, with males significantly more likely than females to inject in prison (OR=1.9, 95% CI=1.069-3.290), having received income from criminal activity in the month prior to survey (OR=3.1, 95% CI=1.823-5.287) and serving a sentence of longer than six months on the last incarceration period (OR=2.6, 95% CI=1.6-4.1). All independent variables considered in the model prior to elimination using the backstep method are displayed in Table 7.

Table 7: All factors tested for association with having ever injected in prison (n=355)

Factor	n*	Prison injecting (%)	Univariate		Multivariate	
			Odds ratio	p value	Odds ratio	p value
Sex						
Male	269	49	1.7		2.1	
Female	86	37	1.0	.047	1.0	.017
Grade at school completed						
Yr 9 or less	149	53	1.6		1.6	
Yr 10 or beyond	206	41	1.0	.022	1.0	.087
Age 1st injected						
17 years or less	211	51	1.7		1.6	
>17 years	142	38	1.0	.015	1.0	.091
Drug of choice						
Opiates	233	53	2.3		1.5	
Other	121	33	1.0	<.001	1.0	.143
Frequency of injection last month						
Daily or more	177	51	1.5		1.5	
Less than daily	177	40	1.0	.042	1.0	.120
Currently in drug treatment						
Yes	166	55	2.0		1.8	
No	189	38	1.0	.002	1.0	.113
Previously been in drug treatment						
Yes	206	52	1.8		1.4	
No	147	38	1.0	.011	1.0	.354
Income per week						
<=$250	176	52	1.6		1.4	
>$250	151	41	1.0	.043	1.0	.195
Received income from crime in last month						
Yes	88	66	3.0		2.3	
No	240	39	1.0	<.001	1.0	.005
Length of most recent sentence						
>6mths	162	59	2.8		2.5	
<=6mths	193	35	1.0	<.001	1.0	<.001

* May not always total 355 due to missing data

Of the study group who had injected in prison, 150 responded to the question of injection frequency during their most recent term in prison. One third (33%; of respondents had

only injected in "*isolated instances*" whilst in prison. This did not differ by gender. The full range of injecting frequency is illustrated in Figure 9.

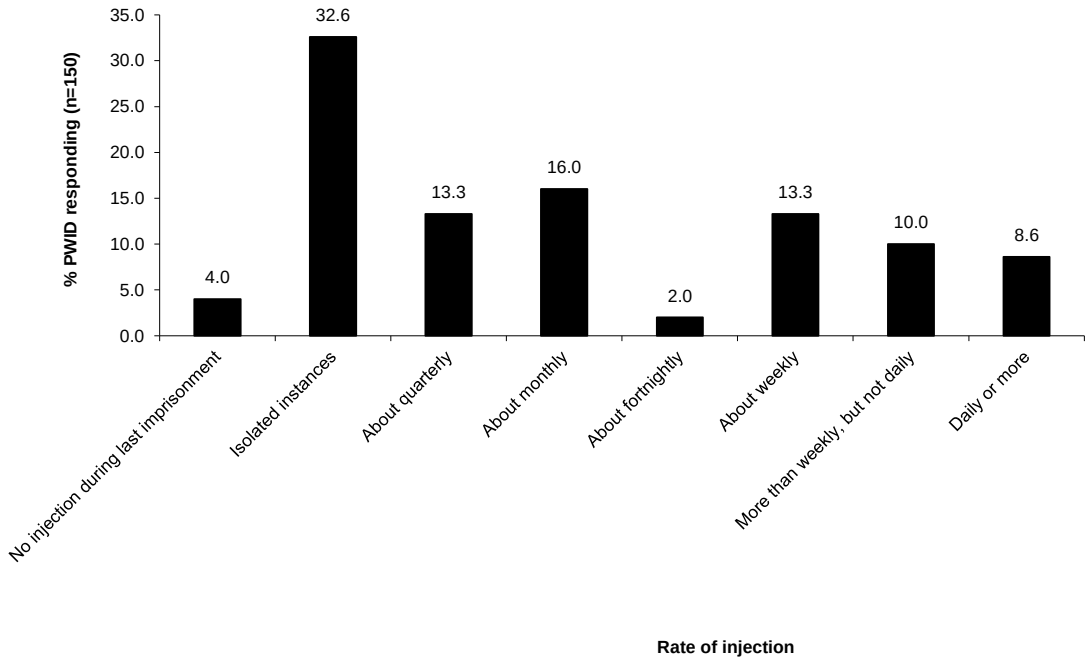

Figure 9: Rates of injecting frequency in prison

Summary

Of the regular injectors interviewed in the 2009 Illicit Drug Reporting System, 355 were found to have been imprisoned during the previous decade. Of these, over one third (37%) reported either having not injected during their last imprisonment or having done so on only isolated instances. Motivations to discontinue or greatly reduce injection are not necessarily restricted to the risks associated with HCV and many of these were discussed by respondents in the in-depth interviews described in Chapter 3. One respondent was particularly expansive in this regard:

"You don't know what these blokes have got, whether they've got AIDS or Hep C or anything, and half of them don't care whether they have it…That was a big reason why I didn't. I...it's Russian roulette. You know - you've got 40 or 50 blokes who've used a cut-down one ml syringe, and for that long it's been shoved up someone's arse to mix up a fucking shot. And prison deals are very very tiny, very very expensive and it's just not worth it. So, if I did ever get it I'd smoke it - just chase the dragon up in bed."

More than half (63%) reported having injected drugs while imprisoned although this rate varied significantly between Australian jurisdictions. Multivariate analysis revealed that injecting while in prison was significantly associated with being male, having received income from criminal activity in the month proceeding the survey and with the most recent prison sentence exceeding six months in duration.

The modal frequency of injecting during the last sentence was '*isolated instances'*. However, around a third (32%) of those responding indicated that during their last imprisonment they had injected at least weekly. Naturally, these high rates of injection constitute increased opportunities for exposure to BBVs. In the absence of sterile injecting equipment in Australian prisons, this is likely to constitute a substantial risk for transmission of blood-borne viruses such as HCV, particularly where as seen in Chapter

3, shared injecting occasions are commonplace. This is especially concerning in a prison environment with high background prevalence rates of HCV among injectors [70] that has led to prisons being identified as "*a focus of the HCV epidemic in Australia*" [61].

It is known that the principal route of HCV transmission in the developed world is by injecting drug use [6]. This strongly supports the idea that needle and syringe exchange programs be implemented in Australian prisons allowing inmates access to clean injecting equipment. Although this concept remains controversial, it has nevertheless been implemented in a number of European countries to great effect with minimal unintended consequences [109].

CHAPTER 5: Exploring the illicit market for needles and syringes in prison

While it is well known that needles and syringes are imported into prison as contraband [134, 139-142], it became apparent in the course of qualitative interviews with former prisoners for this thesis (refer to Chapter 3) that this contraband was not just for prisoners' personal use, but that there was an established culture of selling and renting out needles and syringes to other prisoners. This is a phenomena that has received little if any coverage in the scientific literature, although it is occasionally mentioned in passing [140, 141, 143]. As the practice of renting out needles and syringes poses a serious risk for the transmission of HCV and other blood-borne viruses, it is desirable to know more about the extent to which this practice occurs. This chapter reports the data obtained from interviews with former prisoners concerning the importation of contraband needle and syringe units into prison and of the nature and frequency of the transactions involved in the renting and selling of contraband needles and syringes in Australian prisons.

Synopsis of methods

A sample of 322 former prisoners who inject drugs was recruited via a larger annual nationwide survey the Illicit Drugs Reporting System (IDRS) in 2011. The IDRS is a self-selected convenience sample of approximately 900 regular injecting drug users sampled from the capital city in each Australian jurisdiction with the aim of monitoring changing trends in illicit drug use. In order to be eligible to answer the additional module concerning importation of injecting equipment respondents had to have served a custodial sentence within the past 10 years. These participants were asked a small number of additional questions investigating whether they had ever imported injecting equipment as contraband into prisons, bought or rented out a needle and syringe unit while in prison and the amount of money or goods involved in the transaction. These questions can be located in Appendix E. Data pertaining to the number of prison sentences served and demographic and drug use history that are routinely collected by the IDRS was analysed with a view to determining if they constituted a significant factor to whether respondents had been involved in the importation of needles and syringes as contraband and the practice of renting or selling this equipment in prison. This analysis was conducted using binary logistic regression. Continuous independent variables were converted to categorical ones by using the median value as a demarcation point. All independent variables were first analysed under univariant analysis to determine those that were significant in their own right. All independent variables were then included in a multivariant model which used the back-step method to remove all non-significant variables until only significant independent variables influencing involvement in these activities remained. All data was analysed using SPSS version 19.

Demographics

The age of respondents constituting the study group ranged from 21 to 58 years with a mean and median of 38 years. Age at the time of last imprisonment ranged from 17 to 55 with a mean of 34 and a median age of 35. Males accounted for 79% (n=255) of the sample and 88% (n=282) were born in Australia with 95% (n=306) reporting English as their primary language spoken at home. Identifying as Aboriginal or Torres Strait Islander was reported by 17% (n=54) of the sample and 88% (n=284) identified as heterosexual. Years of school completed ranged from three to thirteen with a mean and median of ten. Completion of any form of post-school qualification was reported by 49% (n=156) of the

sample and 89% (n=285) were unemployed at the time of interview. Being in any form of treatment for their drug use at the time of the interview was reported by 51% (n=163) of the sample. The sample was drawn from all Australian states and territories as shown in Table 8.

Table 8: Demographic characteristics of the study group (n=322)

Characteristic	Value
Mean age	38 (range 21-58)
Mean age at last imprisonment	34 (range 17-55)
Male (%)	79
Born in Australia (%)	88
Main language is English (%)	95
ATSI (%)	17
Heterosexual (%)	88
Mean years of school	10 (range 3-13)
Post-school qualifications (%)	49
Unemployed at time of interview (%)	89
In treatment for drug use (%)	51
Australian jurisdiction (%)	
New South Wales	22
Victoria	24
Queensland	15
Australian Capital Territory	9
South Australia	8
Tasmania	8
Northern Territory	8
Western Australia	5

Drug use history

Although most respondents in the sample reported (meth)amphetamines as the drug they had first injected (50%, n=162), followed by heroin (42%, n=135), at the time of the interview, most reported heroin as their '*drug of choice*' (n=57%, n=184), followed by (meth)amphetamine (22%, n=71). Similarly, heroin was reported as both the drug most injected in the month prior to interview (47%, n=151) and the drug most recently injected prior to interview (46%, n=149). The modal frequency of injection at time of interview was '*more than weekly, but not daily*' reported by 38% (n=123). Age of respondents at first injection ranged from eight to 42 with a mean of 19 and a median of 17 years. A full breakdown of drug use history is presented in Table 9.

Table 9: Drug use history (n=322)

Variable		Number	Percent*
Age first injected		Mean (19)	-
		Median (17)	-
		Range (8-42)	-
Drug First Injected	Heroin	135	42
	Other opiates	16	5
	(Meth)amphetamines	162	50
	Other	8	2
Drug of Choice	Heroin	184	57
	Other opiates	33	10
	(Meth)amphetamines	71	22
	Cannabis	17	5
	Other	15	5
	Missing	2	<1
Drug most injected in last month	Heroin	151	47
	Other opiates	73	23
	(Meth)amphetamines	82	25
	Other	13	4
	Missing	3	<1
Last drug injected	Heroin	149	46
	Other opiates	81	25
	(Meth)amphetamines	81	25
	Other	10	3
How often injected in last month	None	1	<1
	Weekly or less	58	18
	More than weekly but not daily	123	38
	Once a day	58	18
	2 to 3 times a day	70	22
	More than 3 times a day	10	3
	Missing	2	<1

*** Percentages may not total 100 due to rounding.**

History of imprisonment

With extreme outliers of more than two standard deviations from the mean excluded, the number of custodial sentences ranged from one through to 19. The median number was three (iqr=2-6) and the mean five (sd=7.046). More than three quarters (77%, n=248) had been imprisoned more than once. More than a half of the sample (57%, n=184) had been in prison in the three years prior to interview, and more than three quarters (76%, n=245) in the last five years.

Importing syringes into prison

Asked if they had ever taken syringes into prison or had one brought in for them, 30% (n=97) reported they had.

Of these, the vast majority (86%, n=83) indicated that they had imported syringes into prison for their own personal use. Nevertheless, almost a third (31%, n=30) indicated they had imported syringes into prison with the intent to sell them, and 18% (n=17)

indicated that they had imported syringes into prison with the intent of renting them out. This data was collected from questions appended to the 2011 IDRS questionnaire which are located in Appendix E.

Demographic characteristics and elements of drug use and prison history, routinely collected by the IDRS and thought likely to be influential in the decision to illicitly import needles and syringes into prison, were analysed for significance using univariate binary regression (Table 10).

Table 10: Factors associated with importing syringes into prison under univariate analysis (n=320)

Factor	n*	Importing syringes (%)	Univariate		Multivariate	
			Odds ratio	p value	Odds ratio	p value
Gender						
Female	66	30				
Male	254	30	1.018	.952	1.308	.489
Age						
38 or less	169	26				
Over 38	152	35	1.521	.086	1.116	.813
Age at Last Imprisonment						
35 or less	178	26				
Over 35	143	36	1.591	.058	1.240	.631
Country of Birth						
Australia	282	33				
Other	39	13	3.293	.016	4.054	.010
Main Language						
English	305	31				
Other	15	13	2.940	.161	2.242	.477
Aboriginal						
Aboriginal	54	39				
Non-Aboriginal	265	29	1.583	.139	1.427	.332
Sexuality						
Heterosexual	283	29				
Other	38	40	1.599	.189	1.091	.857
Education						
Up to 10 years	227	32				
More than 10 years	92	27	1.245	.425	1.090	.796
Age of First Injection						
17 or less	181	38				
Older than 17	139	21	2.283	.001	2.192	.014
Years Since First Injection						
18 or less	162	23				
Longer than 18 years	158	38	2.068	.003	1.035	.927
Drug First Injected						
Heroin	135	36				
Other	185	27	1.531	.082	1.666	.074
Drug of Choice						
Heroin	184	35				
Other	135	24	1.717	.034	1.721	.066
Frequency of Injection						
Less than daily	181	29				
Daily or more	138	33	1.200	.456	1.821	.038
Number of Sentences						
Once	74	8				
Multiple	238	37	6.770	<.001	7.434	<.001

Factors found to have a significance level of 0.1 or less were then incorporated into a multivariate model. Using the back-step regression method, factors found to be significant in influencing the importation of needle and syringe units into prison were found to be having been born in Australia (OR 4.032, 95% CI 1.488-10.925, p=.006), having first injected drugs at 17 years of age or less (OR 2.142, 95% CI 1.251-3.668, p=.005) and having served multiple prison sentences (OR 7.055, 95% CI 2.911-17.098, p<.001).

Obtaining and providing syringes in prison

Asked if they had ever participated in a transaction (renting or purchasing) involving syringes in prison, 25% (n=79) indicated they had. A quarter (n=19) reported renting a syringe from another prisoner for either money or barter, and 37% (n=29) reported purchasing a syringe. Just over a third (n=26) reported renting a syringe to other prisoners and 58% (n=45) reported having sold syringes to other prisoners.

Demographic factors and drug use history routinely collected by the IDRS and thought to have potential to affect involvement in prison transactions of contraband needle and syringe units were examined using univariate binary analysis (Table 11).

Table 11: Factors associated with selling or renting syringes in prison under univariate analysis (n=319)

Factor	n*	Selling or renting (%)	Univariate		Multivariate	
			Odds ratio	p value	Odds ratio	p value
Gender						
Female	66	21				
Male	255	26	1.271	.473	1.006	.987
Age						
38 or less	170	25				
Over 38	152	24	1.091	.738	1.505	.383
Age at Last Imprisonment						
35 or less	179	26				
Over 35	143	23	1.153	.587	1.319	.540
Country of Birth						
Australia	282	27				
Other	40	10	.3.261	.030	4.044	.020
Main Language						
English	306	25				
Other	15	13	2.186	.310	1.554	.636
Aboriginal						
Aboriginal	54	26				
Non-Aboriginal	266	24	1.082	.817	1.045	.908
Sexuality						
Heterosexual	284	24				
Other	38	26	1.113	.786	1.420	.472
Education						
Up to 10 years	228	27				
More than 10 years	92	19	1.648	.104	1.438	.300
Age of First Injection						
17 or less	182	29				
Older than 17	139	19	1.659	.061	1.278	.443
Years Since First Injection						
18 or less	162	20				
Longer than 18 years	159	29	1.591	.076	1.592	.223
Drug First Injected						
Heroin	135	22				
Other	186	26	.799	.398	1.122	.696
Drug of Choice						
Heroin	184	26				
Other	136	23	1.083	.762	1.103	.743
Frequency of Injection						
Less than daily	182	26				
Daily or more	138	23	1.236	.422	1.097	.751
Number of Sentences						
Once	74	7				
Multiple	239	30	5.950	<.001	5.972	<.001

Factors found to have a significance level of 0.1 or less were incorporated into a multivariate model. Using the back-step regression method, factors found to be significant in influencing involvement in prison transactions of contraband needle and syringe units were found to be having been born in Australia (OR 3.711, 95% CI 1.26110.915, p=.017) and having been imprisoned on more than one occasion (OR 6.394, 95% CI 2.467-16.574, p<.001).

Cost and currency in syringe transactions in prison

Transactions involving money

Asked about the monetary cost of renting a syringe the last time they were in prison yielded a range from five dollars to $100 with a mean price of $41 (sd=$31) and a median price of $30 (iqr=$20-$50). This finding should be treated with caution since this information was provided by a small number of respondents (n=19) The relatively small number of respondents able to provide this information compared to those reporting barter transactions suggests that monetary transactions for syringe rental may not be a typical practice. There was also one individual respondent who reported having borrowed a syringe for no cost, suggesting that lending syringes as a favour does occasionally occur.

The question relating to the cost of buying a syringe outright yielded substantially greater numbers of PWID responding (n=61). Prices ranged from $10 up to $600. However, if the two individuals citing prices of $500 and $600 respectively are excluded as extreme outliers, being more than two standard deviations removed from the mean, cited prices ranged from $10 - $300 with a mean price of $110 (sd=$103), a median price of $100 (iqr=$50-$100) and a modal price of $100 (n=22).

Transactions involving barter

Respondents were also asked about barter type deals for renting and buying syringes. Information on barter deals was provided by 34 (11%) of respondents and information on barter deals for outright sale of syringes by 25 (8%). The most commonly bartered commodities were tobacco, followed by illicit drugs. The type of drugs was often not specified, although where they were, this was usually stated to be heroin. This data was extracted from open-ended questions appended to the 2011 IDRS which are located in Appendix E.

For syringe rental, one shot of heroin or a packet of cigarettes/tobacco were the most typical transactions. There was one instance mentioning syringe rental for trade in items such as chocolate, soft drink or confectionary. One respondent (female, bisexual, 21 years) spoke about renting syringes in exchange for unspecified sexual favours.

Barter for drugs was rarely mentioned for purchase of syringes. As with syringe rental, tobacco was the most commonly used trade item. One respondent mentioned trading in cannabis. Quantities of goods traded varied greatly ranging from "*$10 worth of drugs*" up to "*seven deals*" or in the case of tobacco ranging from half a pouch of tobacco up to seven pouches.

Summary

There were 322 participants who injected drugs on a regular basis recruited from the 2011 Illicit Drug Reporting System who had served a prison sentence within the past decade. These participants were asked additional questions concerning their involvement in the

importation of needle and syringe units into Australian prisons and the nature of the illicit market within prisons surrounding these items. This is an area whose importance became apparent during the qualitative interviews conducted for this thesis and is largely unexplored in the existing literature.

The stated aim of the Chapter was "To produce an estimate the proportion of prisoners involved in importing needle and syringe units into Australian prisons as contraband" with a view to determining how widespread the practice was. Although it is extremely likely that the practice of importing and selling/rental of needles and syringes is more common among individuals who continue to inject in prison, it is not necessarily exclusive to them and it is likely that anyone, especially individuals who have served previous sentences, would be aware of how lucrative the practice of renting and selling of needles and syringes has the potential to be and so, might themselves become involved. With this in mind the additional questions were asked of all respondents who had been imprisoned within the previous decade.

These additional questions revealed that almost one third (30%) of these participants had either personally imported contraband needle and syringe units into prison or had arranged for these items to be imported on their behalf. While the majority of these were imported for the participants' individual use, a substantial number were imported with the intent to rent out to other prisoners or for outright sale. Multivariate analysis revealed that the importation of needle and syringe units into prison was significantly associated with having been born in Australia, initiation to injecting drug use at 17 years of age or less, and having served multiple prison sentences.

Involvement in prison transactions in which needle and syringe units were bought, sold, rented out or rented for the participant's own use was reported by 25% of these participants. Factors found to be significantly associated with this involvement under multivariate analysis were found to be having been born in Australia and multiple occasions of imprisonment. A possible reason for why these factors may be especially influential in these practices can be found in literature published after analysis for this chapter was conducted which noted the importance of having developed social networks as a virtual prerequisite to becoming involved in this clandestine prison economy [134]. Indeed, the existence of such social networks in prison was alluded to by a number of individuals interviewed in the in-depth interviews represented in Chapter 3 of this thesis, one even noting that the circle in which they moved in prison consisted largely of other prisoners whom they had known since childhood.

Outright sale of a needle and syringe unit was found to typically cost around $100 although much higher prices were occasionally reported. The rental of syringes was more typically paid for by barter, trading in either opiates or tobacco.

It is evident that the sale and rental of contraband needle and syringe units within prisons is potentially highly lucrative, and in the absence of sterile injecting equipment this likely constitutes a significant disincentive for prisoners to cease the practice, an observation also made in recent literature [134] published since data collection and analysis for this chapter was undertaken. Renting is of particular concern where a needle and syringe unit may potentially have been used by many individuals in a prison environment where effective cleaning agents such as bleach are frequently not readily available, thereby creating a serious risk for transmission of blood-borne viruses including HCV. This was well illustrated in the in-depth interviews contained in Chapter 3 where it was noted that

injecting occasions in prison environments commonly involved sharing equipment among a substantial number of people and cleaning of equipment using optimal methods between individual users appeared to be the exception rather than the norm. Where rental syringes are concerned, this practice implies that the needle and syringe may not only have been shared among those present at a given injecting occasion, but also among an unknown number of previous users with no guarantee of effective cleaning methods having been employed.

It is therefore evident that the phenomenon of a prison economy centred around rental of contraband injecting equipment substantially increases the already considerable infection risks posed by injecting drug use in an environment where new sterile injecting equipment or effective cleaning agents such as bleach are not made available to inmates. This suggests that needle and syringe exchange in prisons may serve a second function beyond preventing the sharing of used equipment in the first instance, but also, by providing free injecting equipment to effectively disrupt the highly lucrative and risky market for contraband needle and syringes.

CHAPTER 6: Modelling the HCV epidemic in prison environments prior to introduction of DAA medications

This study aimed to use epidemic modelling techniques to estimate the potential impact of increasing numbers of prisoners engaged in HCV treatment prior to the introduction of direct acting antiviral (DAA) medications. It specifically examined the prevalence of existing and new incident cases of HCV both among prisoners currently undergoing a sentence and as they are released back into the wider community. This study also assesses the associated costs of using pre-DAA medications to bring about the modelled impact. The effectiveness of this approach is considered with respect to that of the alternative strategy of inducing a decline in incident cases of HCV infection within prisons by the introduction of preventative measures.

The data collection and modelling work was completed in 2016 and since this time, new treatment and new research has advanced the field. The work is presented in the context of the field as it stood at the time of data collection.

Synopsis of methods

This component of the thesis constructed a deterministic epidemic model of the movement of HCV through prison environments. As infection with HCV does not provide the individual with any immunity post-recovery, a Susceptible-Infected-Susceptible (S-I-S) type model design was employed. The model also included a treatment compartment and compartments modelling the various stages of disease progression. Parameters for the model were taken from the existing literature and estimates made where such published data was not available. The independent variables were the number of prisoners receiving treatment for HCV, set at a default of 8%, an estimate derived from data available from prison services in several Australian jurisdictions and an incident infection rate set at a default of 34.2 per hundred person years. Although this incident rate is substantially higher than others reported in the literature, this allowed for considerable scope to experiment with the effect of lowering the incident rate in the model. These independent variables were altered to explore the effects of increasing the number of prisoners accessing treatment and the likely effect of introducing preventative harm reduction initiatives such as prison needle and syringe programs (PNSP). Effects of the modelling were computed using the software package Matlab 2009a Student version. Outcomes examined included new infections, numbers of liver failure, hepatocellular carcinoma and related deaths, numbers of infected released from prison into the wider community, relative discounted costs of treatment projected over ten years, and incremental cost-effectiveness ratios (ICER) of various levels engaged in treatment. Statistical significance of how outcomes were affected by varying levels of engagement in treatment and rates of incident infection were assessed using Yates chi square and Newcombe-Wilson hybrid score confidence intervals without a continuity correction. Data from this modelling was further analysed to determine the respective costs to the public purse of providing treatment to infected prisoners. These costs were projected into the future using the health economics method of discounting

Designing the model

The full flowchart used for the model is displayed in Figure 10 below. Keys to the various arrows in the flowchart are shown in Tables 12 through 14. Baseline conditions for the model compartments, parameters for rates of movement between compartments, exit

rates from the model, and their source in the scientific literature are located in Tables 15 and 16.

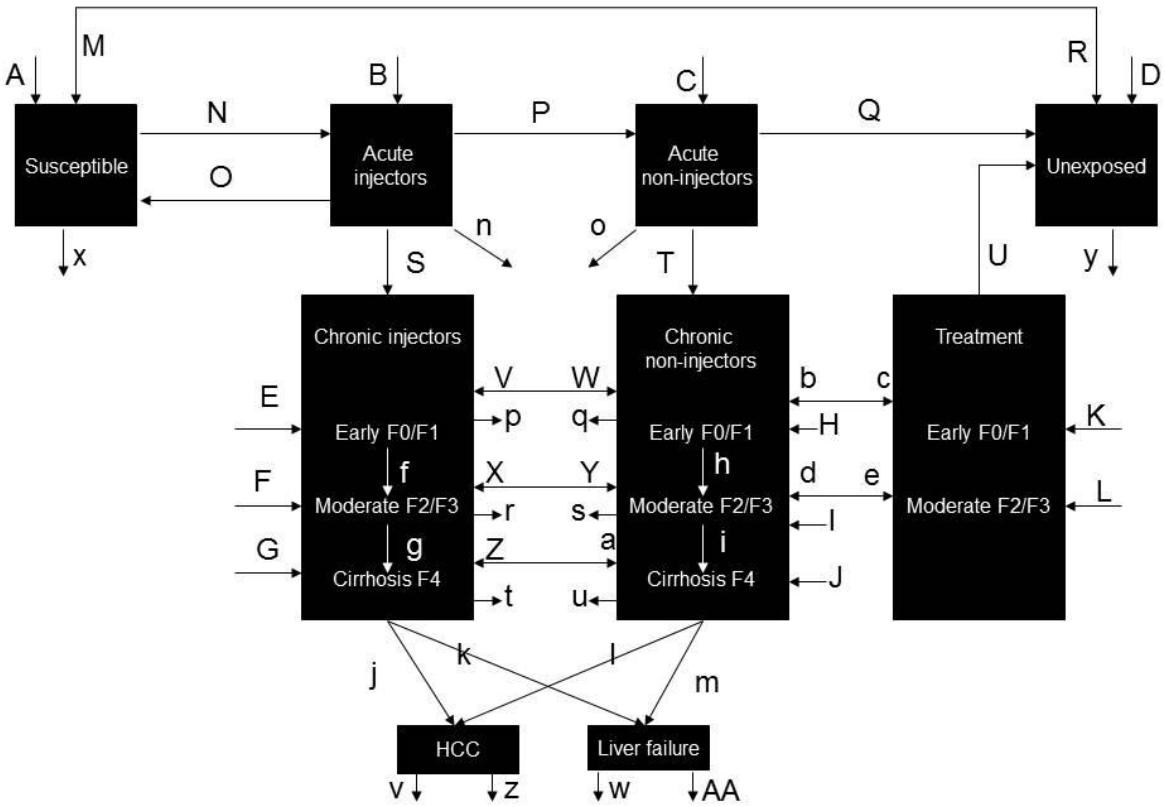

Figure 10: Flowchart of modelling states for HCV in prison environments

Table 12: Key to symbols denoting new entrants to the model prior to introduction of DAA medications in Figure 13

Flowchart Symbol	Descriptor
A	Proportion entering prison into Susceptible compartment.
B	Proportion entering prison into acute injectors compartment.
C	Proportion entering prison into acute non-injectors compartment.
D	Proportion entering prison into unexposed compartment.
E	Proportion entering prison into the chronic injectors F0/F1 compartment.
F	Proportion entering prison into the chronic injectors F2/F3 compartment.
G	Proportion entering prison into the chronic injectors F4 compartment.
H	Proportion entering prison into the chronic non-injectors F0/F1 compartment.
I	Proportion entering prison into the chronic non-injectors F2/F3 compartment.
J	Proportion entering into the chronic non-injectors F4 compartment.
K	Proportion entering into the treatment F0/F1 compartment.
L	Proportion entering into the Treatment F2/F3 compartment.

Table 13: Key to symbols denoting movement between compartments in the model prior to introduction of DAA medications in Figure 13

Flowchart Symbol	Descriptor
M	Proportion Unexposed taking up injecting and moving to susceptible compartment.
N	Proportion Susceptible becoming infected and moving to acute injectors compartment (i.e.: rate of incident infection).
O	Proportion of acute injectors who auto-remit and move back to Susceptible compartment.
P	Proportion of acute injectors who cease injection and move to the Acute non-injectors compartment.
Q	Proportion of Acute Non-injectors who auto-remit and move to the Unexposed compartment.
R	Proportion of susceptible who cease injection and move to the Unexposed compartment.
S	Proportion of acute injectors who progress to the chronic injectors F0/F1compartment.
T	Proportion of acute non-injectors who progress to the Chronic Non-injectors F0/F1compartment.
U	Proportion of treated achieving sustained viremic response and moving to the Unexposed compartment.
V	Proportion of chronic F0/F1Non-injectors taking up injection and moving to the F0/F1Chronic Injectors compartment.
W	Proportion of chronic F0/F1injectors ceasing injection and moving to the Chronic F0/F1Non-injectors compartment.
X	Proportion of chronic F2/F3Non-injectors taking up injection and moving to the Chronic F2/F3 Injectors compartment.
Y	Proportion of chronic F2/F3 injectors ceasing injection and moving to the Chronic F2/F3Non-injectors compartment.
Z	Proportion of chronic F4 Non-injectors taking up injection and moving to the Chronic F4 Injectors compartment.
a	Proportion of chronic F4 injectors ceasing injection and moving to the Chronic F4 Non-injectors compartment.
b	Proportion of F0/F1treated failing to achieve sustained viremic response and returning to the Chronic F0/F1 Non-injectors compartment.
c	Proportion of chronic F0/F1non-injectors commencing treatment and moving to the F0/F1Treatment compartment.
d	Proportion of F2/F3 treated failing to achieve sustained viremic response and returning to the Chronic F2/F3 Non-injectors compartment.
e	Proportion of chronic F2/F3 non-injectors commencing treatment and moving to the F2/F3Treatment compartment.
f	Proportion of chronic injectors progressing from early to moderate stage HCV.
g	Proportion of chronic injectors progressing from moderate stage to cirrhosis.
h	Proportion of chronic non-injectors progressing from early to moderate stage HCV.
i	Proportion of chronic non-injectors progressing from moderate stage to cirrhosis.
j	Proportion of chronic injectors developing HCC.
k	Proportion of chronic injectors developing liver failure.
l	Proportion of chronic non-injectors developing HCC.
m	Proportion of chronic non-injectors developing liver failure.

Table 14: Key to symbols denoting exits from the model prior to introduction of DAA medications in Figure 13

Flowchart Symbol	Descriptor
n	Proportion of acute injectors released infected.
o	Proportion of acute non-injectors released infected.
p	Proportion of chronic injectors released F0/F1.
q	Proportion of chronic non-injectors released F0/F1.
r	Proportion of chronic injectors released F2/F3.
s	Proportion of chronic non-injectors released F2/F3.
t	Proportion of chronic injectors released F4.
u	Proportion of chronic non-injectors released F4.
v	Proportion of HCC released infected.
w	Proportion experiencing liver failure released infected.
x	Proportion of susceptible released uninfected.
y	Proportion of unexposed released uninfected.
z	Proportion dying of HCC related causes.
AA	Proportion dying of liver failure related causes.

Baseline Parameters

Table 15 documents the parameters taken from the literature and other estimates used to assign the numbers present at baseline in each compartment of the model. These same parameters were also used to distribute new prison entrants to their respective compartments. Throughout the modelling exercise, baseline default parameters were 8% currently engaged in HCV treatment which based on available prison statistics was considered an estimate likely to be reflective of current reality, and an incident infection rate of 0.34[82]. Although this incident rate is higher than many others reported in the literature, taking it as the default enabled great scope to demonstrate the modelled effects of much smaller incident rates that might be achieved by the introduction of prevention initiatives such as prison needle and syringe exchange (PNSP).

Table 15: Parameters distributing baseline conditions and new prison entrants prior to introduction of DAA medications

Parameter	Figure	Source
Total number of *sentenced* prisoners at 30th June 2010	23,333	[144]
Proportion of prisoners who have ever injected	0.55	[130]
Proportion of ever injected who injected in the month before reception to prison (ie: active injectors)	0.61	[130]
Proportion ever injected admitted to prison who are HCV+	0.60	[130]
Proportion of PWID who have never injected in prison	0.54	[1]
Proportion of PWID who have injected in prison but discontinued injection upon reception to their current imprisonment	0.37	[1]
Proportion of HCV+ who have auto-remitted	0.26 (0.22-0.29)	[14]
Proportion of infected who are acute/incident cases at baseline	34.2 per 100 person years	[82]
Proportion of infected new entrants who are acute/incident cases	6.5 per 100 person years	[145]
Proportion of chronic FO/F1 & F2/F3 cases in treatment at baseline	0.08	[100]
Proportion of new prison entrants already engaged in HCV treatment	0.005	[130]
Proportion assigned to F0/F1 stages of disease progression	0.3 (0.3-0.4)	[136]
Proportion assigned to F2/F3 stages of disease progression	0.6 (0.6-0.7)	[136]
Proportion assigned to F4 stages of disease progression	0.1(0.05-0.1)	[136]
Proportion assigned to HCC or liver failure stages of disease progression	0.04 of all F4 cases	[136]
Proportion assigned by annual transition probability to liver failure	0.055 (0.040-0.092)	[20-22, 146-159]
Proportion assigned by annual transition probability to HCC	0.031(0.024-0.038)	[20-22, 146-159]

Parameters for movement through the model

Table 16 documents the parameters taken from the literature and other estimates used to control movement through the various compartments of the model. The decision that prisoners at the F4 stage of HCV progression were unlikely to be eligible for treatment was arrived at after extensive discussion with thesis supervisors.

Table 16: Parameters for movement prior to introduction of DAA medications through the model

Parameter	Figure	Source
Proportion Unexposed resuming injection and moving to Susceptible	0.02	Estimate
Proportion Susceptible becoming infected and moving to Acute injectors compartment	0.34 (default value)	[82]
Proportion of acute injectors who auto-remit and move back to Susceptible compartment	0.26	[14]
Proportion of Acute injectors who cease injection and move to Acute non-injectors compartment	0.01	Estimate
Proportion of Acute non-injectors who auto-remit and move to Unexposed compartment	0.26	[14]
Proportion of Susceptible who cease injection and move to the Unexposed compartment	0.01	Estimate
Proportion of Acute injectors who progress to the Chronic injectors F0/F1compartment	1.48	[14]
Proportion of acute non-injectors who progress to the Chronic Non-injectors F0/F1 compartment	1.48	[14]
Proportion of treated achieving sustained viremic response and moving to the Unexposed compartment	0.57	[43-45, 160-164]
Proportion of treated failing to achieve sustained viremic response and moving to the chronic non-injectors compartment	0.43	[43-45, 160-164]
Proportion of chronic F0/F1 non-injectors resuming injection and moving to the Chronic F0/F1 Injectors compartment	0.02	Estimate
Proportion chronic F0/F1 injectors ceasing injection and moving to the Chronic F0/F1Non-Injectors compartment	0.01	Estimate
Proportion of chronic F2/F3 non-injectors resuming injection and moving to Chronic F2/F3 injectors compartment	0.02	Estimate
Proportion of chronic F2/F3 injectors ceasing injection and moving to chronic F2/F3 non-injectors compartment	0.01	Estimate
Proportion of chronic F4 non-injectors resuming injection and moving to chronic F4 injectors compartment	0.02	Estimate

Table 16 cont: Parameters for movement prior to introduction of DAA medications through the model

Parameter	Figure	Source
Proportion of treated F0/F1failing to achieve sustained viremic response and returning to the chronic F0/F1 non-injectors compartment	0.43	[43-45, 160-164]
Proportion of chronic F4 injectors ceasing injection and moving to chronic F4 non-injectors compartment	0.01	Estimate
Proportion of chronic F0/F1Non-injectors commencing treatment and moving to the F0/F1treatment compartment	0.08 (default value)	Estimate
Proportion of F2/F3 treated failing to achieve sustained viremic response and returning to the chronic F2/F3 non-injectors compartment	0.43	[43-45, 160-164]
Proportion of chronic F2/F3 non-injectors commencing treatment and moving to the F2/F3 treatment compartment	0.08 (default value)	Estimate
Proportion of Chronic injectors progressing from early to moderate stage HCV	0.048	[165]
Proportion of Chronic injectors progressing from moderate stage to cirrhosis	0.116	[165]
Proportion of Chronic non injectors progressing from early to moderate stage HCV	0.048	[165]
Proportion of Chronic non - injectors progressing from moderate stage to cirrhosis	0.116	[165]
Proportion of Chronic Injectors developing HCC	0.032	[20-22, 146-159]
Proportion of Chronic Injectors developing liver failure	0.056	[20-22, 146-159]
Proportion of Chronic non-Injectors developing HCC	0.032	[20-22, 146-159]
Proportion of Chronic non-Injectors developing liver failure	0.056	[20-22, 146-159]
New receptions to full-time custody 2009/10	30,005	[166]
Annual deaths not attributable to HCV	0.002	[167, 168]
Deaths attributable to HCC	0.606	[152]
Deaths attributable to liver failure	0.138	[21]
Exits from prison	1.0	Estimate

Results

The model was used to estimate both the potential impact of various HCV treatment uptake scenarios prior to introduction of DAA medications and also the potential of preventative strategies. This was done by varying the proportion of HCV infected prisoners engaged in treatment and the incidence of infection, modelled over ten years. Treatment rates modelled among eligible prisoners were 0% (i.e: no treatment), 4%, 8% (the estimated current scenario and default), 12% and 20%. Incidence rates of infection

per hundred person years modelled were 0.10, 0.193 (the rate reported by Butler et al. among injecting prisoners in a New South Wales study[83]), 0.25, 0.30, and 0.342, a New South Wales rate among injecting prisoners reported by Dolan et al., the current scenario and default[82]).

Effects of varying numbers of HCV infected engaged in treatment on the number of infected prisoners

Model simulations revealed that the level of treatment uptake in the absence of DAA medications did not have a noticeable effect on the prevalence of HCV within prisons, considering realistic treatment uptake levels and the rate of flow of new entrants into prisons with HCV and those treated in prisons exiting. Assuming the default incident rate of 0.34, there was no level of treatment that made any significant difference to the number of infected injectors within the prison population, remaining static at 44% after ten years regardless of numbers engaged in treatment (Table 17). It must be considered however, that if this modelling was to be repeated utilising parameters specific to the newer DAA medications with shorter duration, increased effectiveness and fewer side effects resulting in improved compliance with treatment, very different results may be probable.

Table 17: Numbers and percent of prisoners infected with HCV by level of treatment engagement prior to introduction of DAA medications

	Level of infected non-injectors engaged in treatment														
	No treatment			4%			8%			12%			20%		
Time elapsed	n infect	% pop*	%** PWID	n infect	% pop*	%** PWID	n infect	% pop*	%** PWID	n infect	% pop*	%** PWID	n infect	% pop*	%** PWID
Base	5696	24	31	5696	24	31	5696	24	31	5696	24	31	5696	24	31
2 Yrs	8033	27	43	8033	27	43	8115	28	43	8154	28	43	8228	28	43
4 Yrs	8370	28	44	8370	28	44	8507	28	44	8571	28	44	8693	28	44
6 Yrs	8416	28	44	8416	28	44	8569	28	44	8641	28	44	8776	28	44
8 Yrs	8422	28	44	8422	28	44	8579	28	44	8653	28	44	8791	28	44
10 Yrs	8423	28	44	8423	28	44	8581	28	44	8655	28	44	8794	28	44

*** Percent of the entire prison population who are HCV infected**

**** Percent of the prison population who inject who are HCV infected**

Effects within prisons of lowering incident rates of HCV infection on numbers of infected prisoners prior to introduction of DAA medications.

With a view to exploring the comparison between the effectiveness of treatment provision and the introduction of disease prevention initiatives such as needle and syringe programs in prison, additional simulations with the model involved lowering the rates of incident infection from the default of 0.34 (i.e. 34 per hundred person years) [82] while maintaining the default treatment level of 8% of infected non-injecting prisoners. This baseline figure of 8% was generated from an estimate based on number of HCV positive prisoners entering prison [130], those who cease injection while imprisoned [1], and the proportion of prisoners known to be engaged in treatment across various Australian jurisdictions [100] at time of modelling.

Even with substantial reductions in HCV incidence in prisons, *among the entire prison population, regardless of injecting status*, the number of people living with HCV in prison is not likely to reduce substantially. Although a reduction in rate of incident infection to 0.3 did not show any significant difference from the default rate in terms of number of prisoners infected with HCV, lowering the incidence to 0.193 saw numbers of infected fall to 26% of all prisoners (χ^2=12.00, p=0.001, 95% CI 0.0055-0.0198), and reducing the incidence to 0.1 resulted in 25% of all prisoners infected (χ^2=35.94, p<0.001, 95% CI 0.0147-0.0289). The reason for little change in HCV prevalence in prisons even with large reductions in HCV incidence in prisons is that the vast majority of HCV infections that exist in prisons were acquired in the community prior to entry to prison. The prevalence of HCV in prisons was sustained with a steady inflow of new prisoners with HCV. It is probable that this level of influx may be lowered by the introduction of new DAA medications as more infected persons in the wider community become able to access these newer treatments and achieve a sustained viremic response with the increased efficacy and compliance with treatment these newer medications are likely to produce.

Among *prisoners who inject drugs in prison*, at the default level of engagement in treatment of 8%, lowering the incidence of infection to 0.25 resulted in a significant reduction in the proportion of infected from 43% at the default incidence of 0.34 to 40% (χ^2=14.46, p<0.001, 95% CI 0.0156-0.0483) after two years. Further reductions in the incidence to 0.19 saw a fall in infections among prisoners who inject to 37% (χ^2=41.47, p<0.001, 95% CI 0.0375-0.0701) and reducing the incidence to 0.1 produced a reduction in the proportion of HCV infections to 34% (χ^2=124.82, p<0.001, 95% CI 0.0763-0.1085).

There was a significant decrease in the proportion of *injecting prisoners* infected occurring at an incidence of 0.25, with the proportion of infected falling to 41%. This can be compared to 44% at the default incidence (χ^2=16.82, p<0.001, 95% CI 0.0178-0.0501). A lower incidence of 0.1 resulted in a further reduction to 34 (χ^2=153.60, p<0.001, 95% CI 0.0852-0.1170). These findings are displayed in Table 18.

Table 18: Numbers and percent of prisoners infected with HCV by incident infection rate prior to introduction of DAA medications

	Rate of incident infection														
	0.1			0.19			0.25			0.3			0.34		
Time elapsed	n infect	% pop*	%** PWID	n infect	% pop*	%** PWID	n infect	% pop*	%** PWID	n infect	% pop*	%** PWID	n infect	% pop*	%** PWID
Base	5696	24	31	5696	24	31	5696	24	31	5696	24	31	5696	24	31
2 Yrs	7472	25	34	7741	26	37	7893	27	40	8019	27	41	8115	28	43
4 Yrs	7786	26	34	8093	27	38	8263	27	41	8402	28	43	8507	28	44
6 Yrs	7838	26	34	8150	27	38	8323	27	41	8463	28	43	8569	28	44
8 Yrs	7846	26	34	8160	27	38	8332	27	41	8473	28	43	8579	28	44
10 Yrs	7847	26	34	8161	27	38	8334	27	41	8475	28	43	8581	28	44

*** Percent of the entire prison population who are HCV infected**

**** Percent of the prison population who inject who are HCV infected**

Liver failure, hepatocellular carcinoma and related deaths

After ten years, virtually no effect was discernible on numbers of prisoners experiencing either liver failure or HCC. At the default level of treatment and incident rate prior to introduction of DAA medications, there were 17 prisoners with liver failure and seven with HCC. Even lowering the incidence to 10 per hundred person years had no discernible effect on these numbers. Raising the level of engagement in treatment to 20% reduced the estimated number of cases of liver failure by one and produced no change to the number of cases of HCC.

Similarly, it was found that the cumulative number of deaths within prison resulting from HCC or liver failure were highly unresponsive to altering either the proportion of eligible prisoners in treatment or the rate of incident infection. In a scenario where no treatment was provided with an incident infection rate of 0.34, after ten years the cumulative number of deaths resulting from HCC was 37 and 20 further deaths were attributable to liver failure. Even after raising levels of treatment engagement to 20% while lowering the incident infection rate to 0.1 there were 35 deaths resulting from HCC and 19 from liver failure.

Effects of altering numbers of prisoners engaged in treatment on the numbers of infected released from prison

It was evident that altering the proportion of eligible infected prisoners engaged in treatment prior to introduction of DAA medications had a significant effect on the proportion of prisoners released back into the community who were still infected with HCV. This is the primary benefit of providing HCV treatment in prisons. It is a pragmatic site at which to target HCV treatment and ensure adherence to therapy. Unsurprisingly, the default level of 8% engaged in treatment was found to be significantly better than either 4% engaged in treatment or providing no treatment at all, resulting in 1969 fewer prisoners being released back into the community while still infected than if no treatment was provided.

Raising the proportion of eligible prisoners engaged in treatment to 12% (i.e. an estimated 537 people on treatment over 10 years) resulted in 925 less infected released prisoners than the default. The possibility of increasing levels of treatment engagement to 20% (i.e. an estimated 860 people on treatment over 10 years) was predicted to result in 2668 fewer HCV infected cases being released from prison than the default level after ten years. These findings are detailed in Table 19.

Table 19: Proportion of prisoners released into the community with HCV infection after ten years by levels engaged in treatment prior to introduction of DAA medications

% of eligible infected engaged in treatment	Total prisoners released	Number of infected released	% of all releases infected	Difference from default number infected released	Significance compared to default
No treatment	293,722	79,796	27%	+1969	(χ^2=30.319, p<0.001, 95%CI 0.0041-0.0086)
4%	293,535	78,791	27%	+964	(χ^2=7.295, p=0.01, 95%CI 0.0009-0.0031)
8% (default)	293,356	77,827	27%	-	-
12%	293,183	76,902	26%	-925	(χ^2=6.773, p=0.009, (95%CI 0.0007-0.0053)
20%	292,860	75,159	26%	-2668	(χ^2=56.953, p<0.001, 95%CI 0.0064-0.0109

***Default levels used were 8% eligible engaged in treatment and 0.342 incident infection rate**

Effects of altering the incident infection rate on the numbers of infected released from prison

It was found that even relatively small decreases in the incident infection rate could produce significant reductions in the number of prisoners who were released while still infected (Table 20). A modest reduction from the default incident infection rate of 0.342 to 0.3 resulted in 973 less infected prisoners being released into the community which was comparable to the effect of increasing treatment engagement to 12%.

Assuming incident infection rates could be further lowered to 0.193 (i.e. the rate reported in a 2001 study in New South Wales prisons [83]) then, this resulted in 3,825 fewer prisoners released back into the community while still infected. This effect was found to be significantly greater than the result of increasing levels of treatment engagement to 12% (χ^2=77.304, p<0.001, 95%CI 0.0078-0.0123), or indeed to 20% (χ^2=14.784, p<0.001, 95% CI 0.0021-0.0066).

Table 20: Proportion of prisoners released into the community with HCV infection after ten years by rate of incident infection within prison

Rate of incident infection	Total prisoners released	Number of infected released	% of all releases infected	Difference from default number infected released	Significance compared to default
0.1	293,356	71,183	24%	-6644	(χ^2=396.972, p<0.001, 95%CI 0.0204-0.0249)
0.193	293,356	74,002	25%	-3825	(χ^2=129.937, p<0.001, 95%CI 0.0108-0.0153)
0.25	293,356	75,568	26%	-2259	(χ^2=45.005, p<0.001, 95%CI 0.0055-0.0099)
0.3	293,356	76,854	26%	-973	(χ^2=8.295, p=0.0039, 95%CI 0.0011-0.0056)
0.342 (default)	293,356	77,827	27%	-	-

***Default levels used were 8% eligible engaged in treatment and 0.342 incident infection rate**

It was observed that simultaneously raising the proportion of treated prisoners to 12% while lowering incident infection rates to Butler's rate of 0.193 [83] resulted in 73,076 infected prisoners released out of a total of 293,184 which was a significantly better outcome than raising levels of engagement in treatment to 20% alone (χ^2=42.285, p<0.001, 95%CI 0.0052-0.0096), but significantly less effective than lowering incident infection rates to 0.1 alone (χ^2=34.396, p<0.001, 95%CI 0.0044-0.0088).

Table 21 presents a breakdown of prisoners released into the community by stage of disease progression against the various level of treatment scenarios and varying rates of incident infection. It is evident that the largest effects are found among the lower levels (i.e. F0/F1) of disease progression. The number of prisoners released with liver failure or HCC was found to be extremely unresponsive to changes in either level of prisoners engaged in treatment or to rate of incident infection.

Table 21: Cumulative numbers of infected prisoners released at various stages of disease progression after 10 years by level of treatment engagement and rate of incident infection prior to introduction of DAA medications

	F0/F1^	F2/F3	F4	HCC	Liver failure	All chronic HCV cases
No treatment	61,362	13,623	3,190	60	145	78,381
4% treatment	60,592	13,410	3,169	60	145	77,376
8% treatment	59,853	13,206	3,149	60	144	76,412
12% treatment	59,142	13,011	3,131	59	143	75,486
20% treatment	57,803	12,645	3,095	59	141	73,743
0.1 incidence	54,105	13,066	3,136	60	143	70,511
0.193 incidence	56,544	13,125	3,142	60	143	73,014
0.25 incidence	57,898	13,159	3,145	60	144	74,405
0.3 incidence	59,010	13,186	3,148	60	144	75,547
0.342 incidence	59,853	13,206	3,149	60	144	76,412

***Default levels used were 8% eligible engaged in treatment and 0.342 incident infection rate**

^Includes only those acute cases released from prison who progressed to chronic HCV. Those who auto-remitted are considered to have recovered and were not included in further analysis.

Relative costs of HCV treatment.

The relative costs of treating prisoners infected with chronic HCV with pegylated Interferon and Ribavirin prior to introduction of DAA medications were considered with respect to the number of prisoners still infected that each treatment scenario would result in being released back into the wider Australian community.

The length of time and accordingly, cost, spent on drug treatment to achieve a sustained viremic response varies depending on the genotype of the virus, with genotype 1 generally requiring 48 weeks of treatment at a cost of $18,835 in 2008 Australian dollars and genotype 3 requiring 24 weeks at a cost of $10,829[32].

Relative numbers of prisoners in treatment with these two main genotypes were approximated by using the percentages obtained from 2,176 HCV patients in Australia, suggesting that the ratio of genotype 1 to genotype 3 was 55:36 [136]. A five percent discount was then applied over a ten-year period using the equation

Present Value = [A/(1+0.05)^10]

where A is the nominal cost of treatment prior to introduction of DAA medications [169].

This analysis suggests that the current default scenario with 8% of eligible prisoners in treatment costs $56,164,731 over ten years. To raise this level to 12% would require the expenditure of an additional $16,688,022 and to raise it to 20% an additional $48,133,426 (Tables 22-25).

Table 22: Discounted costs of providing default level treatment (8%) to eligible prisoners over 10 years prior to introduction of DAA medications

Year	Numbers in 48 week treatment	Numbers in 24 week treatment	Discounted cost of treatment	Number of infected released from prison
Baseline	158	62	$3,646,959	0
1	232	92	$5,106,850	6,040
2	275	109	$5,762,302	6,704
3	295	117	$5,894,185	6,704
4	304	120	$5,787,818	6,551
5	308	123	$5,585,100	6,288
6	310	123	$5,349,159	6,007
7	311	123	$5,106,682	5,728
8	311	123	$4,868,471	5,458
9	311	123	$4,638,643	5,199
10	311	123	$4,418,562	4,951
Total			**$56,164,731**	**59,666**

Table 23: Discounted costs of providing treatment to 4% of eligible prisoners over 10 years prior to introduction of DAA medications

Year	Numbers in 48 week treatment	Numbers in 24 week treatment	Discounted cost of treatment	Number of infected released from prison compared to default treatment level
Baseline	158	62	$3,473,294	0
1	174	69	$3,839,802	+44
2	189	75	$3,961,752	+84
3	197	78	$3,928,322	+127
4	200	79	$3,811,653	+87
5	202	80	$3,660,344	+82
6	203	80	$3,498,575	+77
7	203	80	$3,337,068	+72
8	203	80	$3,180,200	+69
9	203	80	$3,029,571	+65
10	203	80	$2,885,624	+63
Total			**$38,779,872**	**+733**

Table 24: Discounted costs of providing treatment to 12% of eligible prisoners over 10 years prior to introduction of DAA medications

Year	Numbers in 48 week treatment	Numbers in 24 week treatment	Discounted cost of treatment	Number of infected released from prison compared to default treatment level
Baseline	158	62	$3,646,959	0
1	288	114	$6,340,208	-43
2	357	141	$7,494,981	-82
3	389	154	$7,778,418	-50
4	404	160	$7,680,364	-83
5	410	162	$7,428,813	-78
6	413	163	$7,122,542	-74
7	414	164	$6,803,030	-70
8	415	164	$6,487,190	-67
9	415	164	$6,181,618	-63
10	415	164	$5,888,630	-59
Total			**$7,285,2753**	**-704**

Table 25: Discounted costs of providing treatment to 20% of eligible prisoners over 10 years prior to introduction of DAA medications

Year	Numbers in 48 week treatment	Numbers in 24 week treatment	Discounted cost of treatment	Number of infected released from prison compared to default treatment level
Baseline	158	61	$3,646,959	0
1	396	156	$8,710,068	-126
2	514	203	$10,770,104	-237
3	567	224	$11,320,907	-213
4	591	234	$11,234,960	-238
5	601	238	$10,892,921	-225
6	606	240	$10,456,383	-212
7	608	241	$9,993,463	-201
8	609	241	$9,532,490	-191
9	610	241	$9,084,908	-181
10	610	241	$8,654,994	-172
Total			$104,298,157	-2,032

Analysis of incremental cost-effectiveness ratios (ICER) shows that if levels of engagement in treatment were raised from the 8% default to 12% of eligible prisoners, this would result in 704 fewer infected prisoners being released into the community at a cost of $23,705 each. Further raising levels of engagement in treatment to 20% would result in 1,328 fewer infected prisoners being released than under the 12% scenario, at a cost of $23,679 each.

From this, we can establish that the costs of increasing numbers of prisoners involved in treatment over ten years from 8% to 20% would result in an increased cost of $48,133,426, or a factor of approximately 1.9 times. Accordingly, this would also result in an increase of prisoners still uninfected released back into the community from 733 to 1,328 or a factor of approximately 1.8 times. (Table 26). Although this appears an efficient cost-effectiveness ratio in terms of reducing the absolute numbers of infected prisoners released back into the community from 59,666 by 2,032, it also implies that 57,634 will still be released over ten years, a reduction of just 3.4%, thereby remaining a significant hazard to public health.

Table 26: Incremental cost-effectiveness ratios (ICER) of various treatment scenarios compared with no treatment (0.34 incident rate) prior to introduction of DAA medications

Level of eligible prisoners engaged in treatment	Cost of treatment over ten years*	Increased cost	Number of infected released from prison over 10 years*	Increased number of uninfected prisoners released	ICER
No treatment	$0		61,164		
4% treated	$38,779,872	$38,779,872	60,399	765	$50,693
8% treated	$56,164,731	$17,384,859	59,666	733	$23,717
12% treated	$72,852,753	$16,688,022	58,962	704	$23,705
20% treated	$104,298,157	$31,445,404	57,634	1,328	$23,679

***Costs and number of infected released have been discounted by 5% over ten years**

Summary

In this chapter epidemic modelling methods were utilised to examine the effect of raising the proportion of prisoners engaged in treatment for HCV prior to the introduction of DAA treatments.

Parameters for the model were taken from figures in the published literature, and estimates used when necessary. It was found that increasing the proportion of prisoners engaged in treatment prior to the introduction of DAA medications would indeed result in a statistically significant lower proportion of prisoners released into the mainstream community.

However, the level of the infected prisoners released would remain very high.
These findings were compared to estimates of the introduction of prison needle and syringe exchange and other means of lowering the incident rate of HCV infection in Australian prisons. However, it must be taken into account that the size of these decrements in incident rates are purely hypothetical and until the actual introduction of measures such as needle exchange in Australian prisons occurs and the effects measured, there is no real means to provide more evidence based parameters.

From this we conclude that lowering the incidence rate of HCV infection of prisoners in preventative measures to be substantially more effective than treatment. That said however, there is no reason why the approaches of increased engagement in treatment and decreasing the prison HCV incident rate by measures such as prison needle and syringe exchange (PNSP) should be mutually exclusive, and maximum benefit would likely result from employing both approaches in tandem. Again, where the treatment in question employs newer DAA medications, the benefits are likely to be greater still.
This has been discussed at length in the Discussion (Chapter 7).

CHAPTER 7: Discussion

Introduction

Throughout this thesis the major goals have been to obtain a better understanding of the risk factors underlying transmission of HCV in Australian prisons, identifying the barriers and motivations for prisoners in accessing treatment, documenting injecting drug use in prisons, and how improved access to treatment for the virus in those environments may result in superior outcomes. As conducting research in prisons is notoriously difficult [119], there is relatively little data concerning injection practices that pose a high risk for HCV transmission, why prisoners make the decision to enter treatment or the relative costs and benefits of increasing numbers in treatment versus preventative approaches.

With a view to investigating these questions, this research employed a number of distinct but related studies. A mixed-methods in-depth interview with current and former prisoners who had had HCV while incarcerated was used to contextualise the circumstances under which episodes of injecting and sharing equipment occurred. This interview also explored participants' understanding of HCV and their underlying considerations into whether or not to undergo treatment. A nationwide study of PWID was then used to quantify the frequency of injection in prisons, and the proportion of PWID who continue to inject while imprisoned. Also revealed by the in-depth was the largely undocumented and risky practice of renting needles and syringes which warranted further investigation.

These studies provide new depth of understanding into both the risk behaviours associated with HCV transmission in Australian prisons, and also the motivations behind prisoners' decisions to seek treatment. Armed with this knowledge, a final question became apparent: can techniques of epidemic modelling be employed to investigate the potential relative benefits of increased levels of treatment versus preventative approaches such as needle and syringe exchange that will mitigate the high risk of injecting behaviours that underlie HCV transmission in Australian prisons?

In this chapter, the results of each of these studies is examined and discussed.

The data collection and modelling work was completed in 2016 and since this time, new treatment and new research has advanced the field. The work is presented in the context of the field as it stood at the time of data collection

The in-depth interviews

Interviews were conducted with 28 current and former prisoners to explore drug use practices while imprisoned and barriers and motivations towards engaging with treatment for HCV while in prison. In order to place this data in context, information regarding demographics and drug use history, knowledge and experience of HCV and its treatment were also collected. All 28 subjects in the qualitative sample were either infected with chronic HCV or in some stage of treatment, ranging from the assessment stage to completion with sustained viremic response.

Contextualising drug use in prison

Having addressed knowledge and experience of HCV and its treatment, the in-depth interviews turned to contextualise drug use in prisons and was found to fall into three broad domains: obtaining drugs and needles and syringes; the administration of injectable drugs in prison; and, the cleaning and maintenance of injecting equipment. It was evident that each of these carried a variety of risks and harms in addition to the possibility of ongoing transmission of HCV and other blood-borne viruses.

Injecting equipment

As there is currently no provision of sterile injecting equipment in Australian prisons, needle and syringes need to be initially imported into prisons as contraband. Some of this contraband was brought in by inmates themselves on reception to prison, and some by visitors. Various methods of smuggling were described, but the principle means appeared to be concealment in body cavities which may well compromise the sterility of the contraband. This method of smuggling also necessitates the cutting down of needles and syringes into a much shorter form. It is not clear to what degree this may compromise the ability of the user to effectively clean these needles and syringes.

It was also apparent from these data that needles and syringes were not bought in exclusively for the respondents' personal use, but that it was potentially a very lucrative venture to either sell outright or rent out contraband syringes to other prisoners. This illicit trade in contraband injecting equipment is discussed in detail in Chapter 5. Nevertheless, it should be noted that the phenomenon of renting out needles and syringes to multiple other prisoners, with effective sterilisation procedures between injecting episodes by no means guaranteed, constitutes a substantial risk for the transmission of blood borne viruses. It is also worth noting that the figure of up to $1,200 to sell a cut down needle and syringe is significantly higher than the typical prices found in the examination of contraband equipment reported upon in Chapter 5, and is likely to be the exception rather than a reflection of the modal price. Other documentation on the illicit market for injecting equipment in prisons in the published literature is scarce, with the 2016 paper by Treloar et al. being a notable exception. The authors of this noted that an imported needle and syringe unit could command prices ranging from $50-$350 with prices between $100-$150 being typical. They further observed that such high prices were a significant disincentive for prisoners to discontinue this practice leading onto increased risk of HCV transmission and that the introduction of NSP in prisons would likely provide an opportunity to disrupt this clandestine market [134]. This suggests an important dual role for the introduction of needle and syringe programs in Australian prisons that would serve to both provide prisoners with ready access to free sterile injecting equipment and also undermine the lucrative practice of renting out syringes. While NSP in prisons is controversial, such programs have been implemented with success in a number of European countries[109]. Failing this, it remains necessary for prison authorities to acknowledge the reality of sharing injecting equipment among prison inmates and accordingly facilitate access to effective cleaning agents such as bleach which a number of respondents in the in-depth interviews indicated was not typically the case.

Importation of illicit drugs

Also mentioned was the prospect of becoming a courier for a much more established dealer, importing considerably more heroin than would normally be feasible. Such an arrangement was not only potentially lucrative to the courier, but also gave the person

responsible a considerable personal supply of drugs which was seen as beneficial by respondents as allowing them to "*party*" and provide treats to other inmates. However, in an environment where occasions of injection are known to be significantly reduced [17], and accompanied by reduced tolerance, this may carry an increased risk of overdose.

The main drugs being imported into prison, at the time of this investigation, appeared to be heroin and buprenorphine, either as Subutex or Suboxone. One respondent noted that a Subutex tablet in prison could be sold for up to $400. Since the Illicit Drug Reporting System (IDRS) did not collect data on the price of illicit Subutex prior to 2007, it is not possible to directly compare prices for diverted Subutex in WA prisons with prices in the wider community by year. Nevertheless, it is worth noting that between 2007 and 2014, the median price for 8mg of diverted Subutex reported by the IDRS in WA consistently remained between $25 and $50 [170-177] which may be considered indicative of the extremely high price that drugs can command in prisons. It was clarified that the buprenorphine for sale in prisons was generally imported rather than smuggled out of the prison dispensary.

An additional hazard of the practice of importing drugs was identified by one respondent who reported that was known for some prisoners to be '*stood over*' by others to try to coerce them to have their visitors courier drugs into the prison, thereby transferring the risk of detection to those not directly benefitting from their sale.

It was generally agreed that obtaining drugs in prison was reasonably easy, although several respondents added that this was affected by '*who you know'* or *'how well connected you were'*. It should be considered however, that virtually all of the respondents this data was gathered from had a history of injecting drug use. It is likely that other prisoners without this level of drug use may not experience this same ease of obtaining drugs during their incarceration. One respondent commented that prisoners associated with organised crime syndicates were often well placed to arrange for the importation of drugs.

With regards to actually obtaining drugs within prison, typical methods of payment tended to be either by transfer of money into T.A.B. accounts (i.e. The Totalisator Agency Board, a body that oversees gambling on racing events in Australia and New Zealand) or by barter for goods such as tobacco.

The dispensary was observed to be a good source of drugs (buprenorphine in particular) within prison and respondents described a number of strategies to smuggle these items out of the dispensary and into the wider prison environment. One respondent reported how smuggling their doses of buprenorphine out of the dispensary to on-sell enabled them to leave prison in possession of several thousand dollars in profit. This practice was not without hazards however, and he also noted that threats of physical violence from other prisoners with no intention of paying for this contraband were frequent.

While it is not usual for prison authorities to publicly acknowledge the use of illicit drugs in prisons, it is nevertheless clear from the data collected from the in-depth interviews that despite the secure nature of prisons, substantial amounts of drugs are imported as contraband or diverted from the prison dispensary. With 63% of prisoners reporting IDU in the month prior to imprisonment [178] and with nearly two thirds of these likely to continue injection while incarcerated [1], the continued demand for drugs is likely to be substantial. Since comprehensively searching everybody including prisoners, staff and visitors every time they enter the prison or leave the dispensary is almost certainly

unfeasible, it is necessary that the existence of drugs as contraband and their use in prisons is acknowledged and appropriate harm reduction initiatives put in place.

Obtaining and manufacturing of injecting equipment

It was clear that needles and syringes, both intact and cut down, were relatively scarce but highly valued commodities in prison. On occasions when such equipment was not available, respondents reported that some prisoners became very innovative in manufacturing substitutes. Materials reportedly used included a biro pen barrel or a squeezable eye drops bottle as a substitute for a syringe barrel, and pieces of rubber thong and a match stick as a plunger. How functional some of these makeshift syringes might be is questionable, but their ongoing manufacture suggests that they are acceptable to imprisoned PWID in the absence of surgical-grade equipment. Materials used as substitutes for needles and syringes were more concerning and included used infusions (butterflies) retrieved from sharps bins, sharpened stems from cotton buds, sharpened spikes from bicycle pumps intended to inflate sports balls, and sharpened chicken bones, typically attached to the barrel with adhesives such as Blu-Tack ™. In addition to the risk of BBV transmission due to shared injecting occasions and needles and syringes having been in circulation in the prison for some time, these needles and syringes would almost certainly carry additional hazards of substantial scarring, vascular damage, septicaemia and other infections. The hazards posed to health by this makeshift equipment constitutes a further justification to prisons providing access to clean medical grade injection equipment via prison based NSP.

The practice of needle and syringe rental was again mentioned by several respondents as a common way of accessing injecting equipment within prison, with shots of heroin typically nominated as the currency involved in such transactions. One respondent also mentioned the issue of threats of physical violence associated with this practice by other prisoners with no intention of paying for the rental. It was also observed that some medical staff were sympathetic to the idea of needle exchange in prisons and were known to clandestinely provide prisoners with clean injecting equipment. Although this is widely acknowledged to occur, published data regarding actual figures of importation of illicit drugs into Australian prisons is scant. In part, this is likely a result of corrective services reluctance to allow researchers to question current inmates about drug use practices in prison, but also, the sensitive nature of this data rendering departments overseeing corrective services disinclined to release it into the public domain. While it is likely that this data exists and could potentially be accessed via freedom of information procedures, this would only reflect the contraband that was actually detected, possibly not reflecting the full degree to which such importation actually occurs.

Injection of drugs in prison

Respondents were asked about the actual situations under which the injection of drugs occurred in prisons. It was generally agreed that sharing of equipment and injecting in groups, typically of between two to seven people were regular occurrences. Some respondents noted that they had a needle and syringe reserved for their personal use and another that they let everyone else use. One respondent suggested that the needles and syringes they lent out could be used by perhaps 50 different individuals and noted the problem that over time, re-used needles tended to become blunt. Another noted that those individuals sharing needles and syringes in a group sharing situation were probably also sharing needles and syringes with other groups of prisoners, suggesting that the

number of individuals involved in a prison injecting network as a risk for transmission of HCV and other blood-borne viruses could be very substantial indeed. One respondent noted that it was often fairly obvious to other prisoners when group injecting events were taking place, and that this could result in substantial pressure from other prisoners trying to "gate crash" and join in.

Once again, the data indicates the relatively commonplace nature of sharing injecting equipment and using in groups in Australian prisons. The reality of this situation needs to be acknowledged and harm reduction measures such as prison needle and syringe exchange, provision of bleach and peer-based health education initiatives are required if negative outcomes are to be avoided.

Asked about the major drugs in prison, most respondents agreed that this was heroin followed by buprenorphine. One respondent notably disagreed with others stating that '*you don't see heroin in gaol',* and that buprenorphine was the major drug, which may suggest that the drugs a prisoner can access while imprisoned are affected by how well networked they are. It is also interesting to note that while this same sample was asked during the quantitative portion of the interview what drugs they had ever used in prison (Chapter 3) cannabis was by far the most commonly nominated followed by heroin, but rarely mentioned in the qualitative component. As virtually all of the qualitative sample were injecting drug users, this may suggest that while cannabis is commonly used in prison environments, it was of little real salience to the sample, and compared to heroin, possibly of relatively little importance to the illicit economy at play in Australian prisons.

Prisoners' strategies for preventing transmission of HCV

It was evident that there were two main approaches to dealing with the issue of HCV transmission when injecting drugs in prison. The first of these was restricting injecting episodes to within sero-concordant groups, generally situations where all were known to be HCV positive. This of course only represents a partial harm-reduction strategy since it does not preclude the possibility of contracting additional genotypes of HCV or indeed, other blood-borne viruses such as HBV or HIV. This risk is likely to be heightened when, as mentioned above, some group members are also involved in injecting with members of other groups. A similar approach of "sero-sorting" as also been recorded in the wider injecting community outside of prisons where sharing of injecting equipment was found to be more common among people known to be of the same HCV status[179].

The second approach, which was closely associated with the phenomenon of renting syringes (documented in detail in Chapter 5) was to obtain one needle and syringe unit for personal use and another for use by other prisoners. This is likely to be an effective harm reduction strategy for those who actually own the needle and syringe, providing that they do not confuse their own needle and syringe with those for use by others, an error that might be easy to make, especially if already intoxicated. Also, it is unlikely to overcome transmission risks associated with the sharing of other items such as spoons, water etc. It is however, likely to be problematic for those lending, buying or renting the needles and syringes, with no real means of knowing how many people have used it previously, who these people were or their sero-status, and whether the syringe has been adequately cleaned between users. Indeed, one respondent noted that it has been known for needles and syringes to be fraudulently sold as being in an unused, pristine condition, resulting in new HCV infections.

An interesting observation was that it was often not easy for uninfected prisoners to gain access to group injecting episodes with HCV infection likened to *'a green card…your invitation to the party.'* While this raises the possibility of prisoners lying about their sero-status to gain access to injecting equipment or group occasions to inject drugs, it also carries implications in the light of statements by several respondents to the effect that understanding of the implications of HCV infection, especially by young prisoners, are often poor, leading to a disregard for safer injecting practices against the practicalities of obtaining drugs and injecting equipment in prison. Some respondents in the in-depth interviews suggested that while there were compulsory health courses concerning BBVs on entry to prison, information such as the implications of infection may carry more salience if provided by peer educators. Also interesting is that in contrast to the earlier observation that a barrier to seeking treatment in prison was not wishing to be known to be HCV positive, for other prisoners involved in drug-seeking behaviour, being perceived to be infected may be a desirable thing.

Other reasons for modifying injecting behaviour in prison

Other reasons were given by some respondents for either modifying or discontinuing their injecting behaviours while in prison that were not directly related to HCV. These included the number of people previously who had used the needle and syringe, that equipment was likely to have been smuggled in body cavities, the cost of drugs in prison, not wanting to associate with other prisoners, the poor condition of most needles and syringes in prison, and using prison as an opportunity to rehabilitate from drug use.

This perceived *'poor condition'* of prison needles and syringes largely arises from them having been in circulation, often for some quite considerable time, and this necessitated occasional maintenance. Re-sharpening of the needle was reportedly undertaken using a variety of materials including stones, sandpaper and glass. With one respondent describing the use of needles in prison as *'like barbed wire'*, it is unclear how effective these re-sharpening methods may be.

Also important from a harm reduction perspective was the process of sterilising needles and syringes between different individuals using them. Although bleach is the preferred agent for cleaning needles and syringes, its supply is not consistent across Australian prisons. Access to bleach in prisons was generally identified as difficult, generally necessitating theft from blood-spill kits, diversion from the prison laundry, or cooperation from other prisoners engaged in toilet cleaning duties. One respondent mentioned that it was occasionally possible to locate sympathetic medical staff in the prison dispensary who would supply bleach. Requesting bleach from prison guards was possible, but generally not an avenue taken since it would identify the prisoner as a probable user of illicit drugs with likely negative consequences. One respondent noted that bleach was not always desirable due to the belief that its repeated use resulted in perishing of the rubber on the syringe plungers.

Rinsing of needles and syringes between uses was common practise, but how effective this was in multiple injecting events was often questionable, sometimes very thorough, sometimes haphazard and sometimes impracticable. Bleach was used sometimes, but not consistently.

It is evident that there are a number of less salubrious aspects of injecting drug use in prison that motivate many prisoners to suspend or at least decrease their use while

incarcerated. Those who do continue to inject however face a range of hazards as described above. Many of these could be remedied by the implementation of prison needle and syringe exchange programs, thereby ensuring a supply of sterile injecting equipment in as-new condition. Failing this, it is essential that access to effective cleaning agents such as bleach be facilitated to mitigate the risk of ongoing HCV transmission.

Barriers and motivations to accessing treatment

Finally, the in depth interviews examined the barriers and motivations of prisoners to entering treatment for HCV as informed by the framework provided by Mehta's adaptation of Andresen's behavioural model of health services use for HCV treatment [52]. This investigation revealed that the majority of thematic domains covered by Mehta's adaptation continue to be relevant in the Australian prison environment. There were however, additional domains identified that were specific to prison environments, and others that were actually motivational to engage with treatment but are not well described by Mehta's model. Conversely, some of Mehta's thematic domains such as demographics and socio-economic status, homelessness, health insurance or ability to afford payment, access to transport, income, child care, or previous history of incarceration clearly had minimal salience where treatment within prison was concerned. For convenience, Mehta's adaptation of Andresen's model is reproduced below (Figure 11). It must be noted that these findings relate to a period when the work on this thesis was undertaken which was prior to the introduction of direct acting antiviral (DAA) medications were introduced.

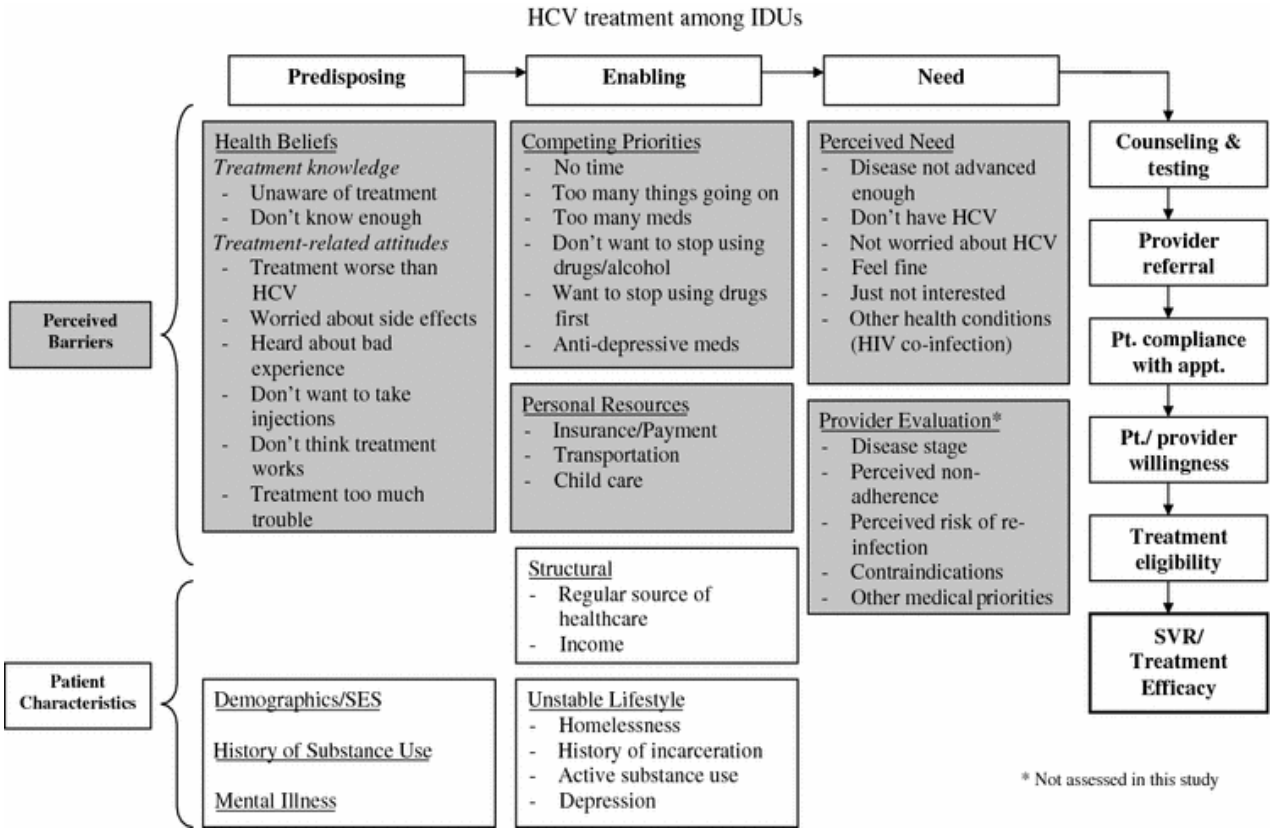

Figure 11: Andersen's Model of Health Services Use adapted for HCV using Mehta's framework

Awareness that treatment is available

With virtually all participants in the qualitative interviews recruited through needle exchanges and prison clinics, it is perhaps unsurprising that the vast majority were aware that treatment was available for HCV. Indeed, only one (female, former prisoner,) was unaware that the disease could be treated. There were however two former prisoners who both indicated that they would have tried to access treatment if either they had known more about their condition or had been aware that treatment for HCV was actually available in prison. Although this lack of awareness was not widely represented among participants, this would suggest that Mehta's domain of *Treatment knowledge* may be of some importance here and it is entirely possible that there may be a significant number of HCV infected prisoners, especially those not in close contact with prison clinical services, who are unaware that treatment is offered in prisons or why it may be desirable to access it. At least one participant suggested that HCV related information might be better received using a peer-based delivery model and this idea should probably be further explored.

Competing priorities to seeking treatment

As the vast majority of the qualitative sample had a history of injecting drugs and more than half reported having injected while imprisoned (Chapter 4), comments fitting under Mehta's domain of *Competing priorities – don't want to stop using drugs or alcohol* or *Active substance use* were especially common, and made by a substantial number of respondents. There was clear recognition among most respondents that ongoing drug use or an intention to resume use upon release made accessing treatment of little interest for many drug users due to the high risk of reinfection. It is known that over a third of prison entrants injected in the month before prison, and the majority of those with a history of injection are positive for HCV antibodies[130]. Also, data presented in Chapter 4 shows that just under half of all injecting prisoners continue to inject while imprisoned. Against this background, this qualitative data indicates that ongoing injecting drug use is likely to present a serious barrier to entering treatment for a great many HCV infected prisoners especially where, at time of interview, ongoing IDU remains an exclusion criteria within the WA Corrective Services [56]. Although this restriction has since been lifted, there nevertheless remain a number of barriers to treatment for HCV in prison. Some of these have been addressed in more recent approaches [117] and should be considered in revised models that include issues specific to treatment in Australian prisons.

Concerns about side effects

There were a number of comments concerning weighing up concerns about the side effects of treatment against the costs of having a condition which, during the most recent period of imprisonment, was not resulting in significant symptoms. It was not always clear-cut whether these remarks fell under Mehta's domains of *Treatment being worse than HCV, Worried about side effects, Disease not advanced enough, Heard about bad experiences, Not worried about HCV*, or *Feel fine*, and indeed, these domains are not necessarily mutually exclusive. Nevertheless, these were clearly considerations that played a significant role in a number of respondents' decisions whether to enter treatment for their HCV. Several male respondents commented at different stages of the interview about concerns regarding weight loss or being too exhausted to work-out as a side effect of treatment. This may be a particularly salient concern in a potentially violent environment like prison

where being "*big*" is likely to be viewed as advantageous. These potential side effects of interferon-based treatment have been well documented in the past as have their association with non-compliance to treatment resulting in failure to result in a sustained virological response[46-49]. It should also be noted that since the time of writing this thesis a new generation of Direct Acting Antiviral (DAA) medications have been introduced greatly mitigating these side effects and shortening the duration of treatment. This development was prophetically noted by Spaulding who observed in 1999 that ;"*as treatment becomes more effective and less costly, addressing HCV in prisons should become an even higher priority*" [180].

Issues surrounding assessment for treatment

Some respondents commented on the assessment process prior to commencing treatment. This was especially in reference to the amount of time it took, generally involving several trips out of prison to the hospital often spread over a number of months, and in one case over two years. This lengthy process of assessment is also documented in the literature suggesting around 15-24 months to be typical[112, 181]. In addition to this, these trips were always under guard and often involved the prisoner arriving at the hospital in shackles which several respondents indicated they found unappealing or degrading. It should also be noted that numerous trips outside the prison under escort represents a costly imposition on the DCS. Under some treatment models these delays may be still further extended by delaying the assessment process until there is evidence of persistently elevated transaminase levels for more than six months [115].Another aspect of the assessment process mentioned was the pain involved in undergoing a liver biopsy which reportedly presented a serious barrier to some prisoners. Although these factors surrounding the assessment process certainly fall under Mehta's domain of *Treatment is too much trouble*, developments in recent years are likely to render these concerns much less salient than they have been in the past. Firstly, prison clinics in Western Australia have now installed video conferencing equipment thereby reducing the need to take prisoners to hospital under guard for assessment. This process involves patients triaged as low-risk to be discussed by prison nurses with specialists over teleconference, those assessed as medium risk to participate in the teleconference and only patients assessed as high-risk to be actually transported out of prison to an interview with the specialist in person [116]. Secondly, the painful liver biopsy procedure has been replaced with a non-invasive ultrasound which is less likely to pose the same level of deterrence to people considering treatment [57].

Other treatment issues specific to prisons

Respondents described a range of systematic and issues specific to prison environments. These issues included difficulty accessing the clinical facility in a timely manner, inadequate staffing of the clinic, inferior medical care, takeaway doses of painkillers not being permitted, high levels of violence, and shared cells not being appropriate while undergoing a treatment that caused unpleasant side effects including mood swings. Most of these can be viewed as loosely fitting into Mehta's domain of *Treatment being too much trouble*, although the issue of accessing the clinic, which often required being accompanied by a guard, could be viewed as falling under the domain of *Transportation*. The issue of the respondent who reported having their existing treatment program terminated upon entry to prison is more difficult to apply Mehta's model to, beyond that it is clearly related to *Incarceration*. It is unclear how common such issues are, and also unclear why the

Department of Corrective Services (DCS) would take this action, only to recommence the respondent back on treatment some months later.

Several respondents identified a serious barrier to entering treatment in prison in that the DCS clinical service would not commence anyone on treatment for HCV unless that person was serving a sufficient length of sentence to complete the entire treatment program. One respondent suggested that anyone serving a sentence of less than three years would be unlikely to gain access to treatment for HCV while in prison. If accurate, this would likely impact on a large number of cases who would otherwise be eligible for treatment since half of all prisoners in Australia serve a sentence of less than 3.2 years[182]. Another respondent discussed how he was unexpectedly able to access treatment only because his sentence became markedly longer when his parole was rejected. Part of this problem is historically linked to the lengthy times required for assessment of suitability for treatment. As discussed above, the recent installation of video conferencing equipment in prison clinics is likely to speed this process up considerably, somewhat mitigating this problem. The length of the treatment itself is also part of this issue, but may well improve in the future as new generations of DAA medications, with shorter treatment programs, become available. Another option may be if better continuity of care for released prisoners still on treatment can be implemented to ensure they can be immediately inducted into a treatment program in the community. While it is not immediately obvious how the issue of short sentence length fits into Mehta's model, it can be understood as being loosely related to *Perceived non-adherence by the service provider*.

Barriers related to mental health and other pre-existing conditions

Issues of mental health, and other pre-existing conditions as barriers to treatment are much more easily understood in relation to Mehta's domains of *Mental illness, Depression, Anti-depressive medication, Other health conditions,* and *Contraindications*. Only two respondents made direct reference to mental health issues that prevented them from accessing treatment while in prison. However, mental health issues are known to be endemic among prisoner populations. In 2009, the NSW Inmate Health Survey reported that almost half of prisoners had ever been assessed or treated for an "emotional or mental problem" and substantial numbers had ever been admitted to a psychiatric unit. By self-report, more than a third of prisoners reported experiencing depression, and reporting experiencing schizophrenia or psychotic conditions was not uncommon [79]. This suggests that these issues are likely to affect significant numbers of prisoners who would otherwise be eligible candidates for treatment. These mental health issues are of particular concern in the treatment of HCV due to side effects of interferon such as depression, homicidal ideation, suicidal ideation, suicide and attempted suicide [183, 184]. As such, pre-existing mental health conditions are commonly included as exclusion criteria in HCV treatment protocols involving interferon, and those of the Western Australian DCS are no exception [56]. Barriers related to mental health issues may also be somewhat alleviated using nurse-driven models such as that described by Lloyd et al. in which patients are triaged by nurses and those assessed as high risk (category C) referred to a specialist [112].These mental health issues are less likely to remain barriers to many seeking treatment as newer generations of DAA medications with fewer neurological side effects are introduced It should be noted however, that at the time work on this thesis was undertaken these medications were not widely available in Australia, and their inclusion on the Pharmaceutical Benefits Scheme and thus their availability in prisons was not widely anticipated.

The role of stigmatisation

The issues of stigma and discrimination were interesting because although widely understood as problematic to people with HCV[138], they do not feature at all in Mehta's model. Some respondents viewed the issue as a serious barrier to seeking treatment in prison, primarily out of fear of discrimination if other prisoners or guards found out they were infected. However, it was also very interesting that other respondents actually considered the stigmatised nature of HCV a motivation to seek out treatment in order to get rid of a virus viewed as "*dirty*" or "*a junky's disease*".

Issues related to family

Issues related to family were commonly mentioned as motivators to both enter treatment and cease drug use, with particular reference to wanting to be around for children or concerns that they may infect family members. These generally, cannot be defined under any domains in Mehta's model which was primarily designed to identify barriers as opposed to motivations. There were three other respondents who noted that issues involving family or work could serve as barriers to entering treatment which can be understood as falling under the domain in Mehta's model of *Too many things going on*. Of these however, two observed that this actually made prison a good opportunity to undergo treatment where the pressures of family and work were largely removed.

Long term health concerns

Long term concerns were frequently mentioned as motivations to enter treatment. These were understandings of how HCV could impact on their health many years away. All of these were discussed by respondents either currently in treatment or under assessment. As with issues related to family, as a motivation to enter treatment, this was not well described under Mehta's model unless it is understood as the inverse of the domain *Not worried about HCV,* an attitude that is likely not exclusive to the prison environment. It should however be considered that these types of concerns may potentially form useful motivational instruments for counsellors and medical staff in directing clients towards HCV treatment.

Issues related to Aboriginality

Although it was initially hypothesised that there may be issues with regards to identifying as Aboriginal involved in the decision-making process to enter treatment for HCV while in prison, there was little evidence found to support this, either by the investigators, or by the Aboriginal health researchers invited to examine these data. Similarly, although published literature is scant, a study of prisoners in New South Wales found no differences between Aboriginal and Non-Aboriginals in terms of viral distribution or treatment outcomes [114] suggesting that Aboriginality is not a significant issue with regards to HCV in Australian prisons.

Reflections on the utility of Mehta's Model

In the course of this study, Mehta's adaptation for HCV of Andersen's Behavioural Model of Health Services Use was found to provide reasonable explanations for why many prisoners with chronic HCV infections do not take advantage of the opportunity during their imprisonment to undergo treatment for the disease. It was, however, found to have

considerably less utility in explaining factors that motivate prisoners to enter treatment and these need to be explored further.

More serious issues with the utility of the model were observed with regards to a number of barriers to undergoing treatment that were specific to the prison environment, most notably prison sentences that were too short to complete treatment and issues surrounding access to clinical services or how these services were administered. Although Mehta's model was able to provide a partial framework to explore these issues, they were often not able to be adequately examined through this lens.

As it is desirable, from a point of view of both a duty of care and public health to optimise the level of engagement in HCV treatment among prisoners, the shortcomings of Mehta's model have important implications for treatment provision in Australian prisons. There is a clear need for the development of a more specialised model capable of conceptualising not only those domains already identified in Mehta's model, but also of those barriers and motivations to engaging in HCV treatment that are unique to the prison environment. It is self-evident that a truly utilitarian model needs to be able to explain both factors that prohibit entry to treatment and those that serve to encourage engagement. Motivations to enter treatment in particular are an area likely to be impacted by new generation DAA treatments for HCV with shorter duration and less side effects and as such, require consideration when exploring the level of treatment uptake among prisoners and their eligibility for treatment.

Against these findings, it becomes possible to envision what factors an adaptation of Mehta's model to reflect barriers and enablers to entering HCV treatment in prison environments would need to have added and these are summarised in Table 27 below. It should be considered however that this data was taken from a relatively small sample of 28 interviewees and as such, it is possible that some of these factors may be relatively unimportant while others may yet to be identified. In order to fully validate the adapted model a much larger sample should be interviewed, possibly by clinic nurses when prisoners present and are detected positive for HCV antibodies.

Table 27: Additional factors to be included for adaption of Mehta's model to prisons.

Barriers and motivations to entering treatment for HCV in Australian prisons	Factor
Barriers	*Six month wait for assessment *Lengthy assessment process *Sentence too short to complete treatment *Having to forgo parole *Lack of continuity of care upon release *Over-crowding / lack of privacy *Need for escort to clinic *Stigmatisation *Violence *No takeaway of analgesics *Staffing and perceived inferior medical care
Enablers and motivators	*Away from family concerns *Away from stressors outside of prison *stigmatisation *Implementation of new DAA medications

With these factors in mind, and having validation from a larger study group of both health workers within prison settings and their clients, a possible model for adaptation from Mehta's work might closely resemble the relationship of thematic domains identified in this thesis to those of Mehta's adaptation for HCV of Andersen's behavioural model of health services use. For convenience, this possible model is reproduced below in Figure 12.

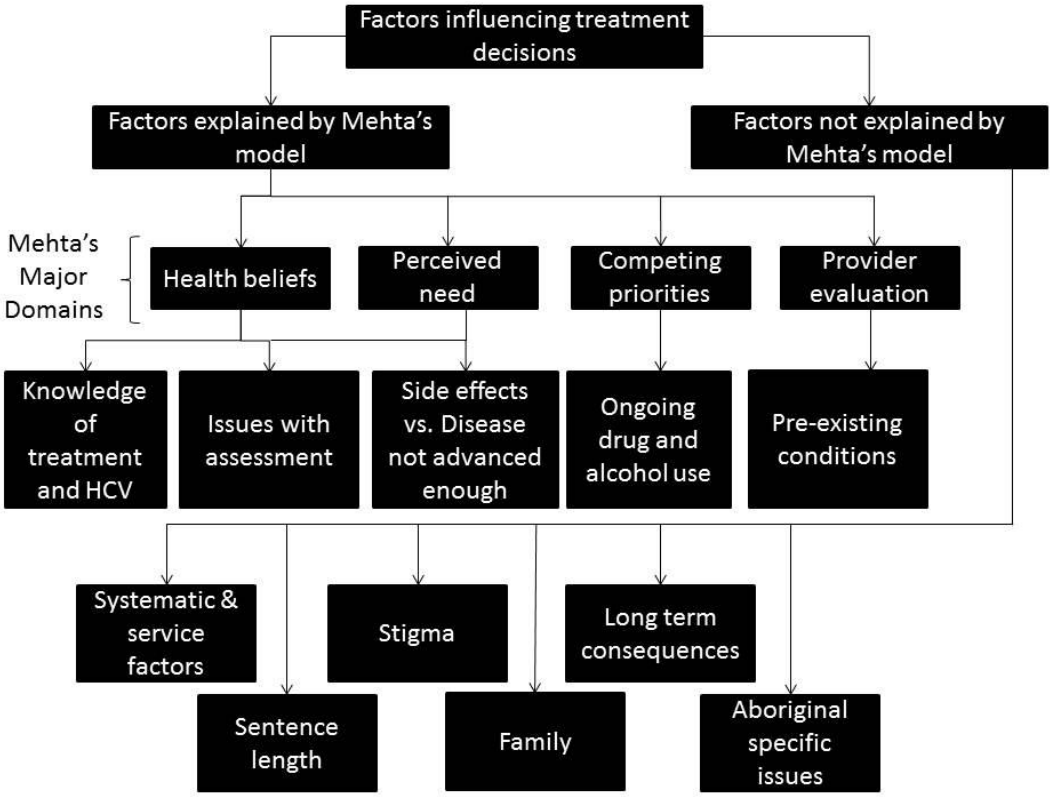

Figure 12: Potential structure of a model for uptake of HCV treatment in prisons adapted from that of Mehta's model in the general community.

Other considerations

As with the model developed by Yap and colleagues [117],It should be considered that the importance of some of these identified barriers to prisoners entering treatment for HCV may be diminished in the not too distant future by the emergence of a new generation of direct acting antivirals for treatment of the disease. As these do not contain interferon, they will likely involve fewer side-effects, treatment will be of shorter duration, and of greater levels of effectiveness [38, 50]. At time of undertaking this thesis however, these newer medications were not widely available in Australia, and were not considered likely to be covered by the Pharmaceutical Benefits Scheme (PBS), and thereby not offered in Australian prisons. Although this has since proven not to be the case and DAA medications have indeed been made available in Australian prisons, this is a relatively recent development and it remains to be seen what barriers to treatment will remain after their introduction, and indeed, if new barriers may emerge.

Rates of injection in prison

Participants in the 2009 Illicit Drug Reporting System (IDRS) were asked additional questions to determine the frequency of injection while imprisoned. Of those across Australia almost half of the participants with a history of incarceration in the past decade reported ever injecting while incarcerated. There were significant variations in numbers reporting injection in prison between the eight states and territories, but the underlying causes of this variation is unclear and warrants further investigation. These findings are supported by the annual Needle and Syringe Program survey carried out that same year

which found that of the national sample, 339 respondents reported having been imprisoned in the previous year. Of these, 33% reported having injected during this period of imprisonment, but across Australian jurisdictions this ranged from 11% in the Australian Capital Territory up to 50% in the Northern Territory. Even after excluding jurisdictions with less than 10 respondents, rates were still as diverse as 14% in South Australia and as high as 46% in Queensland [185].

Factors associated with injecting drug use in prison

Factors associated with injecting drug use while imprisoned in this study were male gender, the length of the last period of incarceration, with those whose last sentence was greater than six months more likely to inject compared to those with a shorter sentence, and having derived income from criminal activity in the past six months. The finding that deriving income from criminal activity in the months prior to imprisonment was significantly associated with injecting in prison was unexpected and may suggest that injection while imprisoned may in some way be a predictor of continued offending upon release. These findings add to those of previous Australian research which identified male sex, unemployment, use of three or more drug types prior to imprisonment, history of sharing needles and syringes, receiving a prison tattoo and HCV exposure as risk factors for injecting in prison [186]. An earlier study also found having been in a childhood institution, aged 24-40 years and an increased number of previous imprisonments to be risk factors, but curiously also reported that being female was more strongly associated with injection in prison than being male [187].

Frequency of injecting in prison

Although a small portion of respondents reported injecting on at least a daily basis during their most recent imprisonment, two-thirds of respondents reported infrequent injecting (once a month or less) while imprisoned. In addition to the PWID who suspended injecting altogether while imprisoned, of those respondents who did continue injecting during their most recent imprisonment, approximately half of these were injecting less than monthly during their last prison stay. This is in contrast to the very large majority of ex-prisoners interviewed who were injecting more frequently than weekly at the time of interview, thus providing support to previous findings [17, 89, 188] that PWID tend to inject less frequently while imprisoned.

The findings also support those of previous research that a relatively small number of PWID commence injecting drugs while imprisoned [187, 189]. Since the current study only investigated behaviours during the most recent imprisonment it is likely that the actual number of PWID who initiate injecting during imprisonment may well be higher.

Implications for harm reduction

The majority of PWID who have a history of imprisonment either suspend injecting whilst in prison, or at least slow the rate at which they inject. However, as other studies of prison populations have found, any injection drug use in prison is likely to be high-risk due to a lack of clean injecting equipment resulting in increased sharing behaviours [17, 103]. This constitutes a strong argument for harm reduction strategies to be readily available in prisons. The use of opioid replacement therapies, in particular methadone maintenance treatment (MMT), in prisons has been shown to lower the use and injection of opiates in prison [84, 98, 99]. However, MMT is not offered consistently across Australian jurisdictions. While it is available in all states and territories (although only to

females in Queensland), several jurisdictions restrict it to prisoners already on the program prior to incarceration. Curiously, the 2010 study by Teutsch et al. found a conflicting result with prisoners receiving MMT having significantly higher incident rates of HCV transmission and is a finding requiring further investigation [86].Buprenorphine, and more recently buprenorphine combined with naloxone are also available, but this availability is not widespread or consistent across all Australian jurisdictions, many providing maintenance, but only a few offering initiation to these treatments, and that generally one to two weeks prior to prisoners' release [190]. Although assessing the impact of buprenorphine / naloxone on rates of injection in prison was beyond the scope of this study, it is nevertheless an area in which more research is required.

The introduction of prison based needle and syringe programs (NSPs) has been strongly advocated for in Australian prisons but are yet to be trialled despite their success in other countries including Switzerland, Germany, Spain and Moldova [109]. A recent study by The Burnet Institute of the Alexander Maconochie Centre in the Australian Capital Territory found that the proposal of NSP in prisons was overwhelmingly supported by prisoners, ex-prisoners and community-based service providers and strongly supported by prison health staff. However, the report also identified strong objections to NSP from custodial staff and their union representatives. Comments from key informants interviewed included refusal to work in a correctional facility offering NSP, threats of strikes, and confusion as to how an NSP would be implemented[108]. Much of this anxiety has likely arisen from fears that blood-filled syringes could be used as weapons [191], despite no evidence that this has occurred in European countries which have already implemented NSP in correctional facilities [109]. Regardless, this, in combination with moral concerns from politicians and the wider community has, at present, resulted in planned trials of NSP in Australian prisons being abandoned.

Although previous studies have provided some data on injection rates in prisons in single Australian jurisdictions [186, 192], this study provides new data at the national level across all Australian jurisdictions that provides information on the extent of injection among PWID in prison and predictors of ongoing injection while incarcerated. This data supports earlier findings that most PWID who experience imprisonment either suspend injecting whilst imprisoned, or reduce the frequency at which they inject. Nevertheless, injection is still common in prisons around Australia. These data carry important implications regarding the need for improved access to treatment for drug use and provision of harm reduction measures across Australian prisons. The implementation of harm reduction measures such as NSP in prisons would not only be of benefit to prisoners themselves by lowering incident rates of HCV infection in prison, but also of benefit to the wider community due to lowering the proportion of infected persons released from prison. Economic benefits are also likely with a 2009 report by the National Centre in HIV Epidemiology and Clinical Research finding that for every one dollar invested in NSPs in Australia would result in four dollars in healthcare savings over the next decade with further savings accruing in the longer term [34].

Injecting equipment as contraband

Although it is widely known that the importation of needles and syringes into prisons does occur, there is relatively little reported in the published scientific literature exploring this practice in depth, the frequency with which it occurs, or the economic factors surrounding it[134, 139-141]. This therefore, is a novel area of research, largely uninformed by the existing literature.

That almost one third of injectors interviewed with a history of imprisonment reported having imported needles and syringes into prison as contraband suggests that this behaviour is not uncommon. Although the overwhelming majority of these respondents reported having imported needles and syringes for their own personal use, it was notable that this importation was significantly associated with having shared injecting equipment during the most recent injecting episode while in prison. In Australian prison environments where there is evidence that almost one third of all new prison entrants are positive for HCV antibodies[70], this would imply that the practice of importing needles and syringes as contraband constitutes a high risk for transmission of the HCV virus.

There was also a significant association between having imported needles and syringes as contraband and having been imprisoned on more than one occasion. Other significant associations were found with regards to having been born in Australia, initiation to injection before the age of 17, and nominating heroin as the current drug of choice. The latter is interesting since respondents' current drug of choice does not necessarily reflect their drug of choice at the time of their last period of imprisonment. This finding thus has two possible interpretations: either that primary heroin users are more likely to attempt to import needles and syringes into prison, or, that the importation of needles and syringes as contraband may be an important predictor of those drug users likely to progress to heroin use as their principal drug.

Transactions involving injecting equipment in prisons

While the vast majority of respondents who did report importing needles and syringes into prisons was for personal use, a substantial number reported that they had imported this equipment with an intent to rent out or sell outright.

Having ever participated in some form of transaction involving needles and syringes in prison was reported by a quarter of the sample. Once again, this was found to be significantly associated with sharing injecting equipment in prison. It was also significantly associated with having completed more than one prison sentence, although this may simply be a reflection of those respondents with multiple prison sentences having experienced a wider window of opportunity and development of networks for such transactions to occur. The most common type of transaction was selling a needle and syringe unit to another prisoner. This was followed in descending order of frequency by the purchase of a needle and syringe unit, renting a needle and syringe unit out to another prisoner and renting a needles and syringe unit from another prisoner.

In the context of needles and syringe rental, the significant association with sharing equipment in prison is particularly concerning. While it is not possible to determine from this data how many prisoners may have used a rental needle and syringe in the past, the 2009 NSW Inmate Health Study indicated that only a very small minority of those responding reported that no one had used the needle and syringe before them, most that one or more people had used the equipment before them and that more than a quarter didn't know[79]. This would indicate that it is quite possible that a rental needle and syringe unit may have previously been used by a substantial number of people, a view also echoed in the qualitative interviews reported elsewhere in this thesis. Data from these qualitative interviews also indicate that adequate needle and syringe cleansing between users is not routine, especially where multiple prisoners may be present at a single injecting event. This suggests that the rental of needles and syringes units in Australian prisons with

a high background prevalence of HCV may constitute a significant risk factor for transmission of the virus.

The motivation behind importation of needles and syringes not intended for personal use is clearly driven by financial considerations. In the absence of the provision of sterile injecting equipment in Australian prisons, the importation of needles and syringes as contraband clearly offers lucrative opportunities for those prisoners who succeed in importing them. With regards to outright selling of useable needles and syringes, prices were typically around $100, but often $300 and ranging up to $600. Rental of needles and syringes were less often financial transactions, but more often barter arrangements, with the owner typically receiving a shot of heroin for both themselves and their cell-mate, or a substantial quantity of tobacco.

As this level of remuneration provides a considerable motivation for the importation of injecting equipment as contraband, it seems clear that the practice of importing injecting equipment into prisons is unlikely to cease, and the rental of needles and syringes likely to continue as a serious risk factor of HCV transmission in the absence of sterile injecting equipment. As this demand is clearly driven by the absence of sterile injecting equipment in prisons, the existence of the rental market for needles and syringes constitutes yet another strong argument for the provision of needle and syringe exchange in prisons. Failing this, it is imperative that prisoners' access to effective cleaning agents such as bleach be ensured so as to maximise the likelihood that rental syringes are adequately cleaned between uses.

Modelling the potential of treatment in prisons

It is evident that HCV continues to present a significant challenge within Australian prisons, and so long as the proportion of new entrants to prison who inject drugs or are already infected remain high [130], this situation seems unlikely to change. Apart from high levels of violence resulting in blood contact and unsanctioned tattooing practices, prisons remain a high risk for HCV transmission due to large numbers of injectors who continue to inject drugs while incarcerated (Chapter 4) and the absence of sterile injecting equipment resulting in high rates of sharing of equipment (Chapters 3 and 5). Previous research has observed that prisons are a "*focus for the hepatitis C epidemic*" [61]and that there is little chance of controlling the HCV epidemic in Australia unless concerted efforts towards its control are first taken in prisons [61] [193]. It is likely that this undertaking will require measures to both reduce the risk of incident infection in prison and also reducing levels of HCV prevalence.

The study described in Chapter 6 employed compartmental modelling techniques to investigate the potential to better reduce the pool of HCV infected prisoners by increasing numbers engaged in treatment for HCV and, the effect of reducing the incident infection rate within prisons by means of prevention initiatives such as needle and syringe exchange.

Epidemic models are rarely ever a completely accurate representation of reality because generally, for the majority of them it is necessary to include at least some estimations and assumptions in their underlying parameters. The assumptions on which the current model was based are discussed in detail in Chapter 6. Also, it was noted that the structure of the model caused artificial changes in the size of the prison population as levels of treatment engagement were altered. This was an artefact of the assumption that no prisoners would commence treatment if they were not serving a sentence of sufficient length as is currently

the case in Australian prisons. This effect however did not have any substantive impact on the outcome variables of interest.

One parameter that required estimation due to a lack of formal centrally collated records was the number of Australian prisoners currently in treatment for HCV. This highlights the desirability of creating such a repository of data to better enable accurate tracking of treatment of prisoners across the country. This would however, require national coordination of a number of different datasets from the various Australian States and Territories.

Modelling the effects of treatment

As discussed in Chapter 6, levels of engagement in treatment were set at a default of 8% of all eligible prisoners. The effects on outcome measures were investigated by varying this level of involvement in treatment from no treatment to a high of 20%. Although 8% of all eligible prisoners in treatment is substantially higher than the approximately 1% of all HCV infected persons in Australia [194], prisons have nevertheless been described as an ideal environment in which HCV can be treated [110], and it is reasonable to believe that higher numbers could be engaged in treatment.

Throughout the process of increasing the proportion of prisoners engaged in treatment up to the idealised 20% level, the outputs of the model within its current parameters revealed no significant effect on numbers of prisoners infected. This finding is perhaps unsurprising, given that with 31% of all new entrants to prison testing positive for HCV antibodies[70], the rate of infected persons coming into the prison system is already substantially higher than the maximum level considered feasible for engaging prisoners in treatment for HCV prior to the introduction of newer DAA medications.

Modelling the effects of preventative strategies

Rates of incident infection within prisons were set at a default level of 34 per hundred person years [82]. This incident infection rate was varied from the default down to a rate of 10 per hundred person years, the lowest rate considered plausible. It should be noted that this figure is an estimate. As a rate of 19 per hundred person years has been previously reported in New South Wales [83], it seems likely that that scope for reduction exists. Other rates of 30 and 25 per hundred person years modelled were somewhat arbitrary, but considered reasonable decrements from the default level.

Despite the high levels of prison entrants already infected with HCV in the model, preventative measures to lower the incidence within prison appeared to have potential to reduce the proportion of infected prisoners. Even a relatively modest reduction to an incidence of 25 per hundred person years was found to reduce the number of new infections by 222 after two years, and reduce the number of infected prisoners who inject. A further reduction to 19 per hundred person years over the same time frame resulted in 374 fewer new infections and a further decline in the number of infected prisoners who inject. It must be considered however, that the baseline rate of incident infection of 34 per hundred person years is substantially higher than many others reported in the literature, a rate of 16.4 per hundred person years was derived in the meta-analysis conducted by Laney et al. for example [195]. Findings from the HITS-P study have since found a still lower incidence rate of 6.3 per hundred person years among those subjects who had been continuously imprisoned [90], but this paper was not in publication at the

time the modelling exercise was undertaken. The possibility therefore must be considered that the substantial reductions in number of incident infections produced by the model may to some extent be a reflection of this.

Hepatocellular carcinoma, liver failure and death

As numbers of prisoners experiencing hepatocellular carcinoma or liver failure arising from HCV was already very low at baseline, it is perhaps unsurprising that numbers progressing to these disease states over time was found to be extremely unresponsive to either raising levels of engagement in treatment or lowering rates of incident infection. If these serious health concerns are to be addressed within prison populations, then other strategies must be considered, with particular reference to liver transplants. Liver transplants however, are expensive, with 2010 figures indicating an initial cost of $120, 017 and an additional cost of $13, 363 per annum thereafter [32]. Given the relative scarcity of suitable organs for transplant and the associated expense however, provision of liver transplants to prisoners, a proportion of whom are likely to resume injecting upon release, would almost certainly prove highly contentious. Less controversial measures may include monitoring for hepatocellular carcinoma using regular six month ultrasound screenings and monitoring patient levels of alpha-fetoprotein which is known to become elevated as a common indicator of hepatocellular carcinoma [196].

With regards to deaths, even setting both treatment levels and rates of incident infection at maximum levels, had no statistically significant effect on HCV-related deaths in prison, only reducing the cumulative number of deaths arising from liver failure or hepatocellular carcinoma by three after ten years. Setting levels of treatment involvement and incident infection at more realistically attainable levels of 12% and 19 per hundred person years however, resulted in only one less death from HCC and had no impact at all on deaths from liver failure. Although these findings were not statistically significant, it should be considered that the numbers of deaths were very small regardless of how incidence and level of treatment involvement were adjusted. These findings also appear to be well reflected in modelling of HCV across a similar time frame in the wider Australian community with NSPs estimated to prevent 96,667 cumulative incident cases between 2000 and 2009, but only reducing cases of HCC by eight, cases of liver failure by 16 and liver-related deaths by four [34].

Implications of the findings of the model

Both raising levels of engagement in treatment and lowering the rates of incident infection were found to have significant potential to impact upon the proportion of prisoners released back into the community still infected with HCV. That said, however, adjusting the level of incident infection to that found by Butler et al. [83] of 19 per hundred person years was found to significantly exceed the effect of raising the level of engagement in treatment to the hypothetical ideal of 20% (estimated to be higher than can currently be realistically achieved) with 1,157 fewer infected prisoners released, or a decrease of one percent of all released prisoners at ten years from baseline. It was notable that neither adjusting the level of engagement in treatment or the rate of incident infection had any significant effect on the number of prisoners released with liver failure or HCC.

Although providing the current default level of 8% engagement in treatment clearly had better outcomes in terms of infected prisoners released than lower levels of treatment engagement, it is nevertheless expensive, costing in excess of 56 million dollars over ten

years, and further increasing these levels to 12% engagement would cost in excess of 72 million dollars over the same time frame. It should be noted that this is based on the cost of interferon and ribavirin only. There are of course other costs associated with treatment including initial assessment and ongoing monitoring, but the unique nature of the prison environment, including security issues, make it difficult to extrapolate these from known costs in the general community.

Raising levels of engagement in treatment is of course likely to be a challenge. Barriers and motivations to prisoners entering treatment, have been considered extensively in Chapter 3. Of particular interest here however is the frequently mentioned difficulty of prisoners' length of sentence being insufficiently long to complete the course of treatment. As noted earlier, since the modelling was undertaken, this is an issue that may have been somewhat alleviated by the recent arrival of a new generation of DAA drugs with shorter periods of treatment required and fewer unpleasant side effects.

It is evident that reducing the rates of incident infection within prisons by introducing preventative measures has the potential to be more effective in reducing the number of prisoners infected with HCV back into the community than raising the level of prisoners engaged in treatment. Indeed, Teutsch et al. noted the importance for improved understandings of prison-specific transmission risks for HCV and the role of uptake and effectiveness of preventative programs in regards to this [86].There are a number of strategies that could be employed to achieve this reduction, however, their respective costs and the degree to which they would reduce incident rates of infection are difficult to quantify since this would vary greatly depending on the chosen approach, the model under which they were implemented, and the ability and willingness of prisoners to access these strategies when required.

Superficially, the most obvious approach would be to halt the influx of injectable drugs into prisons, thereby removing injecting as a risk factor for transmission. However, preventing the flow of drugs into prison is generally acknowledged as extremely difficult, if not impossible to achieve [108]. Hence, other strategies need to be considered.

The first of these involves providing evidence-based treatment options for treating drug dependence in the prison setting. Opioid replacement therapies, methadone and buprenorphine are known to reduce rates of injecting in prison [98] thereby decreasing for the risk of transmission of HCV to occur. However, the availability of replacement therapies varies by state and territory and within states and territories. For example methadone is not available in Northern Territory prisons and some jurisdictions restrict the provision of methadone and buprenorphine to prisoners already prescribed these drugs on entry [1]. This ad hoc variation in availability suggests there is clear scope for the expansion of these programmes within prisons.

Perhaps a more controversial option is to introduce needle and syringe exchange to Australian prisons. As previously discussed, this approach has been established in a number of European countries with promising results[109]. In addition to this, increasing the availability of bleach as a cleaning agent for needles should be considered as it is currently only available in prisons in three Australian jurisdictions [135].

An additional strategy would be to reduce the number of injecting drug users in prison. It is known that almost half of prison entrants have a history of injecting drug use and of these, 67% reported injecting in the month prior to prison entry and 58% of PWID prison

entrants tested positive for HCV antibodies[70]. Further, along with sexual assault, drug offences are the second most common reason for imprisonment in Australia[182] and a New South Wales study found that 54% of prisoners believed that their sentence was somehow linked to their drug use [79]. These figures suggest that, political will not withstanding, there may be ample scope to reduce the number of injecting drug users in prison and as a result, reduce the number of HCV infected persons involved in injecting while incarcerated. This could be achieved by increased emphasis on directing arrested drug users into alternative forms of corrective actions including fines, community service or mandatory treatment for their drug use. A more radical approach may be to consider changes to the law regarding the possession of drugs for personal use, but the various options in this domain are beyond the scope of this thesis.

The findings of this study demonstrate clear benefits of both increasing the levels of prisoners engaged in treatment and decreasing rates of HCV incident infection within prisons, especially with reference to the number of prisoners released still infected back into the community. With prisons identified as "*an ideal setting for the treatment of hepatitis C because maximum compliance, which is necessary for achieving a sustained virological response can be assured*" [110], it follows that, despite the expense involved, the opportunities for treatment presented by a sentence in prison should not be squandered. Not only may treatment in prison avoid vastly more expensive medical responses such as liver transplants in the future, but it is likely that governments owe a duty of care to those who they choose to incarcerate, which includes the provision of treatment for HCV where appropriate.

Lowering the rate of incident infection of HCV within prisons was found to be even more effective than increasing levels of engagement in treatment, and almost certainly a cheaper option. The two approaches are by no means mutually exclusive however, and neither are the various means discussed of lowering the incidence of infection. In order to achieve the most optimal response in terms of numbers of prisoners released back into the community who are not infected with HCV, a variety of different strategies should be employed.

Limitations of the Thesis

Limitations of this thesis include the recruitment of almost all interviewed PWID from major metropolitan centres around Australia and so the injection patterns described in this study may not be generalisable to prisons located in other countries or in rural areas of Australia where the availability of drugs is likely to be different. As participation in the study was voluntary and by self-selection, selection bias may be present. This may be of particular salience in the case of current prisoners who, while potential participants may not wish to reveal their drug using history or who have concerns about the power dynamics with prison staff involved in the recruitment process. Likewise, all data collected in this study relied on self-report, and it must be considered that this may not be completely reliable, especially when dealing with matters of an illicit nature such as injection of drugs.

With specific regard to the qualitative in-depth interviews with former prisoners, although participants had to have been released from prison no more than six months before the interview, it is possible that some of the data obtained may pertain to earlier periods of incarceration. This may have produced possible instances of recall bias or of providing

data no longer relevant due to factors such as changing policies or improvements in available HCV treatments.

With regards to interviews with current prisoners, it is important to note that by necessity, all recruitment was undertaken via prison health services, which may mean that prisoners not in contact with these health services may not have had the opportunity to participate in the study, despite being eligible to participate. It is also important to note that restrictions imposed by DCS prohibited interviewers to ask current prisoners about their drug use while in prison. Similarly, all recruitment was, by necessity, undertaken via either DCS clinical services or peer-support groups in the wider community. It needs to be acknowledged that, while unavoidable, this approach is likely to have produced respondents with a disproportionate level of knowledge of HCV and participation in HCV treatment than may be reflective of the wider drug using community.

The epidemic modelling component carries with it the same limitations of all simulations, that is, that they rest upon certain assumptions. Those that have been employed are those which we are confident provide a reasonable reflection of the reality of the prison health system being modelled. Further, where useable parameters do not exist in the published literature, estimates need to be made. It is our contention that where this has been necessary in both epidemic modelling and estimates of the proportion of contaminated needles and syringes in prison that such estimates stand as plausible reflections of the likely reality of the situation.

Conclusions

In the ongoing absence of an effective vaccine, the issue of HCV as a serious challenge to public health seems unlikely to diminish in the foreseeable future. As the Australian prison population remains a heavy concentration of people who inject drugs, those already infected with the virus, and an epicentre for incident infections, it also remains a vital point for public health interventions to control the spread of HCV in the wider Australian community.

This thesis examined a number of aspects related to HCV within Australian prisons with injecting drug use understood to be the principal risk factor for ongoing transmission of the virus. This research began with the core questions of why are prisons, already identified as an ideal opportunity to engage chronically infected prisoners in treatment, not seeing larger numbers of eligible prisoners take advantage of this opportunity, and what would be the likely benefits and costs of increasing numbers engaged in treatment?

Through a series of in-depth interviews with current and ex-prisoners a number of motivations and barriers to entering treatment were identified, thereby providing a variety of avenues that could be acted upon to increase numbers of prisoners engaged in treatment (Chapter 3). These interviews however, and additional modules of questions appended to the IDRS, also revealed that ongoing injection and sharing of needles and syringes among imprisoned PWID was commonplace, as was the practice of importing needles and syringe units for sale or rental to multiple users (Chapters 4 and 5). These findings would suggest that the benefits of increased rates of treatment for HCV are likely to be offset by ongoing rates of incident infection within prison due to continuing injection and sharing of needles and syringe units. Further, due to its lucrative nature, the illicit market for needles and syringes or drugs in prisons seem unlikely to decrease under the current environment, thus ensuring their continued importation and use. Finally, a simulation using epidemic modelling techniques found that while increasing numbers of prisoners engaged in treatment would reduce the number being released back into the community while still infected, this effect was small and expensive to achieve, and that preventative measures were likely to be much more effective both in terms of results and costs. These conclusions are explained below.

With few infected people in the community actually engaging in treatment, Australian prisons have been identified as ideal locations to access high risk/high prevalence populations to undergo treatment for HCV. That said, the estimate made in this thesis of only 4% of chronically infected prisoners accessing treatment seems very low for a supposedly "*ideal location*". This suggests that enhanced approaches to education within Australian prisons should emphasise the long-term benefits of engaging in treatment for HCV.

Qualitative interviewing techniques were used to explore current and former prisoners' perceived barriers to entering treatment in prison. The data collected were analysed against the background of Mehta's adaptation of Andersen's Behavioural Model of Health Service Use. This revealed some of the major barriers to accessing treatment in prison to be ongoing use of drugs or intent to resume using them upon release, and concern about side effects of the medication weighed up against the belief that their disease was not advanced enough to warrant treatment. As injecting use of drugs is known to be the leading risk factor for transmission, it is unsurprising that this use would manifest as a major barrier to entering treatment with respondents viewing treatment while still using

drugs as pointless due to the risk of reinfection. This problem may suggest scope for an expanded role by prison services for treating addiction as a precursor to entering treatment for HCV, but this would of course necessitate a willingness on the part of drug using prisoners to comply. It should be noted that after the initial undertaking of this thesis that WA DCS has since removed the ongoing injection of drugs as a basis for refusal to engage patients in treatment for HCV. The problem of side effects of medication was identified as a major barrier to entering treatment. This issue however has likely been greatly ameliorated by the arrival of new generation DAA medications in the time since qualitative interviews for this thesis were undertaken. This is also likely applicable to barriers caused by existing mental illness and possibly other pre-existing health conditions.

As DCS clinical guidelines do not allow prisoners to commence treatment for HCV unless they are going to be in prison for a sufficient length of time to complete the treatment program this unsurprisingly presented a barrier for entering treatment to a number of respondents. With the recent adoption of video conferencing in prison clinics having improved the efficiency of the lengthy pre-treatment assessment process, it is likely that this now presents less of a barrier than it did at the time of interview. Additional efficiencies are likely to be noted with wider adoption of the Nurse-led model of care described by Lloyd et al. in which patients are triaged by nurses and the assessment approach tailored accordingly [112]. Further improvements are likely as newer generations of treatment medication with shorter programs become available. If programs ensuring better continuity of care allowing prisoners to immediately engage with programs to continue their treatment upon release into the community can be developed, it may be possible to eradicate this barrier altogether.

Other important barriers to treatment that were identified were systematic ones often related to the ways custodial environments and their clinics operate. Some of these, like improving timely access to see a doctor or the issue of multiple prisoners in single cells may be difficult to fix and likely require substantial funding. Other issues may be intractable. For example, it was clear that some prisoners found not being permitted to take painkillers like paracetamol away from the clinic in case the interferon precipitated headaches etc. to be problematic. From the point of view of the DCS however, allowing prisoners to take away medications that could be stockpiled and potentially used in a suicide attempt is clearly unacceptable.

Although Mehta's model is primarily designed to identify barriers to accessing treatment, these qualitative interviews also identified several factors that actually acted as motivations to seek treatment opportunities in prisons. These included wishing to be rid of a stigmatised disease, family issues (or, while in prison, the lack thereof) and concern about the long-term effects of HCV. The last of these is perhaps most interesting since asking respondents about the symptoms and effects of HCV resulted in very few mentioning long-term effects such as liver failure, HCC or indeed, fatality. In addition, during in-depth interviews, several respondents noted that while most PWID have some understanding about the risks involved for contracting HCV, there was poor appreciation of the implications for long term infection, especially among younger users. This is not to say that imprisoned users are necessarily unaware of these issues, but rather that they lack salience for many. This may indicate that awareness raising programs about the potential long-term consequences of chronic HCV infection may be the easiest leverage point for increasing the numbers of people accessing treatment for HCV during periods of incarceration.

High risk behaviours for ongoing transmission among imprisoned injecting drug users were found to be common place. Almost three quarters of the Perth-based sample of current and former prisoners reported using a needle and syringe after someone else in prison and almost half had done so on more than six occasions although most of these believed the needles and syringe unit had almost certainly been previously used by multiple people at least some of which were almost certainly HCV positive. Injecting in group situations where needles and syringes and other equipment was shared appeared to be normative and rinsing of needles and syringes between users likely to be inconsistently performed and with bleach not always used or available. Although respondents indicated that these group injecting episodes tended to occur with other sero-concordant prisoners, it seems that this shared sero-status was more often assumed than rigorously "policed". Further, the possibility must be considered that prisoners with HCV antibodies but who had cleared the disease could potentially be reinfected despite this sero-sorting process, as must the possibility that it allows for 'superinfection' with multiple genotypes of HCV despite all participants participating in the injecting session being positive for HCV antibodies.

A nationwide survey of people who inject drugs was used to determine how common injecting while imprisoned actually was. This revealed that just over half of PWID who had been imprisoned desisted from injecting drugs while imprisoned. Of those who had injected while imprisoned however, almost one third reported having done so on an at least weekly basis during their most recent imprisonment, with substantial numbers reporting injecting daily or more.

It was evident that some prisoners imported needles and syringes exclusively for personal use into prisons as contraband. This importation however, also manifested as the practice of smuggling additional needles and syringes with the intent to rent them out or sell outright. The practice of renting needles and syringes is especially concerning, since these needles and syringes may have potentially been used by a very large number of prisoners, some of which are almost certainly HCV positive, and with little guarantee that efficient cleaning of the needles and syringe unit has occurred between individual users. As this was a very lucrative practice, with each rental typically attracting a hit or two of heroin, or occasionally a quantity of tobacco, and outright sale of needles and syringes, this importation of needles and syringes seems unlikely to cease, regardless of risks involved. Similarly, the importation of drugs into prison was potentially lucrative, with one respondent noting that a single pill of Subutex could be sold in prison for substantial amounts of money, many more times the price of an illicitly sold pill in the wider community.

These findings can be viewed in the light of the recent review of the state-of-the-art Alexander Maconochie Centre in the Australian Capital Territory that acknowledged that it is not realistically feasible to prevent the flow of drugs and other contraband into Australian prisons. As long as the present status quo is maintained, there remains in the prison system substantial potential for ongoing transmission of HCV and other blood-borne viruses to occur via unsafe injecting practices [108].

Mathematical modelling of epidemic disease was used to evaluate how increased levels of engagement in treatment for HCV could be applied in prison environments. This process revealed that doing so would result in significantly lower levels of infected prisoners released back into the wider community, thereby lowering the potential for further

communication of the disease in the general populace. It would also lessen the necessity and costs of more expensive treatments in the future such as liver transplants. However, with the numbers of infected entering the prison model being much higher than can possibly be treated, it did not have any capacity to significantly affect incident rates of infection or progression through disease states. Also, any substantive increase in numbers of prisoners undergoing treatment would incur significant expense and, as seen with regards to the barriers to entering treatment, likely to be difficult to achieve in practice.

Much more substantive and likely lower cost results were found to be achieved by the introduction of preventative measures that directly impact on the rate of incident infection within prisons. As stated above, the Australian prison population contains a large number of injecting drug users and high-risk injecting episodes are common. With the lucrative prices commanded by contraband drugs and syringes in prison, supply to meet this demand is unlikely to be curtailed in the foreseeable future. Against this scenario, the obvious preventative measure that could be introduced is needle and syringe programs. This is neither a new idea, nor as controversial as it may appear, such programs having been successfully trialled in a number of European prisons for many years now. Not only would NSP have a substantial direct impact in terms of lowered incident rates of infection, but would also likely undermine the trade in contraband syringes. Taken together with increased numbers of prisoners in treatment for HCV, NSP has the potential to become a frontline strategy in combating the HCV epidemic in Australian prisons, bringing health benefits to both individual prisoners and to the public health of the Australian community as a whole. This of course opens important new avenues for future research, specifically into the new generation of pharmaceutical treatments for HCV with their shorter duration of treatment and fewer side effects. It should be investigated how these may affect uptake and eligibility for treatment among prisoners, and also, what models of NSP may be most suitable for implementation in Australian custodial environments.

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APPENDICES

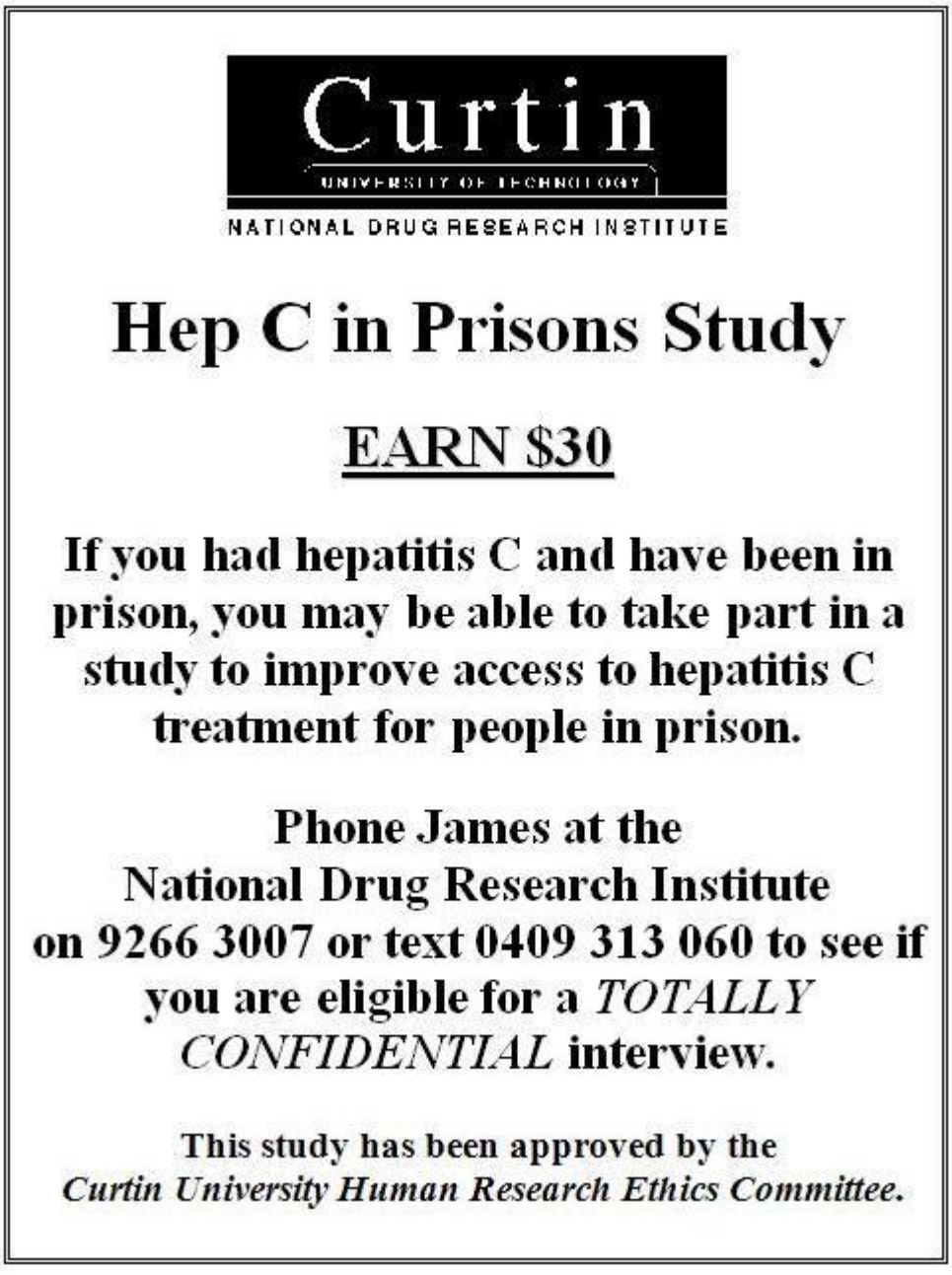
APPENDIX A: Recruitment materials

Recruitment materials for former prisoners

This section contains materials used in the community in the recruitment of former prisoners for in-depth interviews.

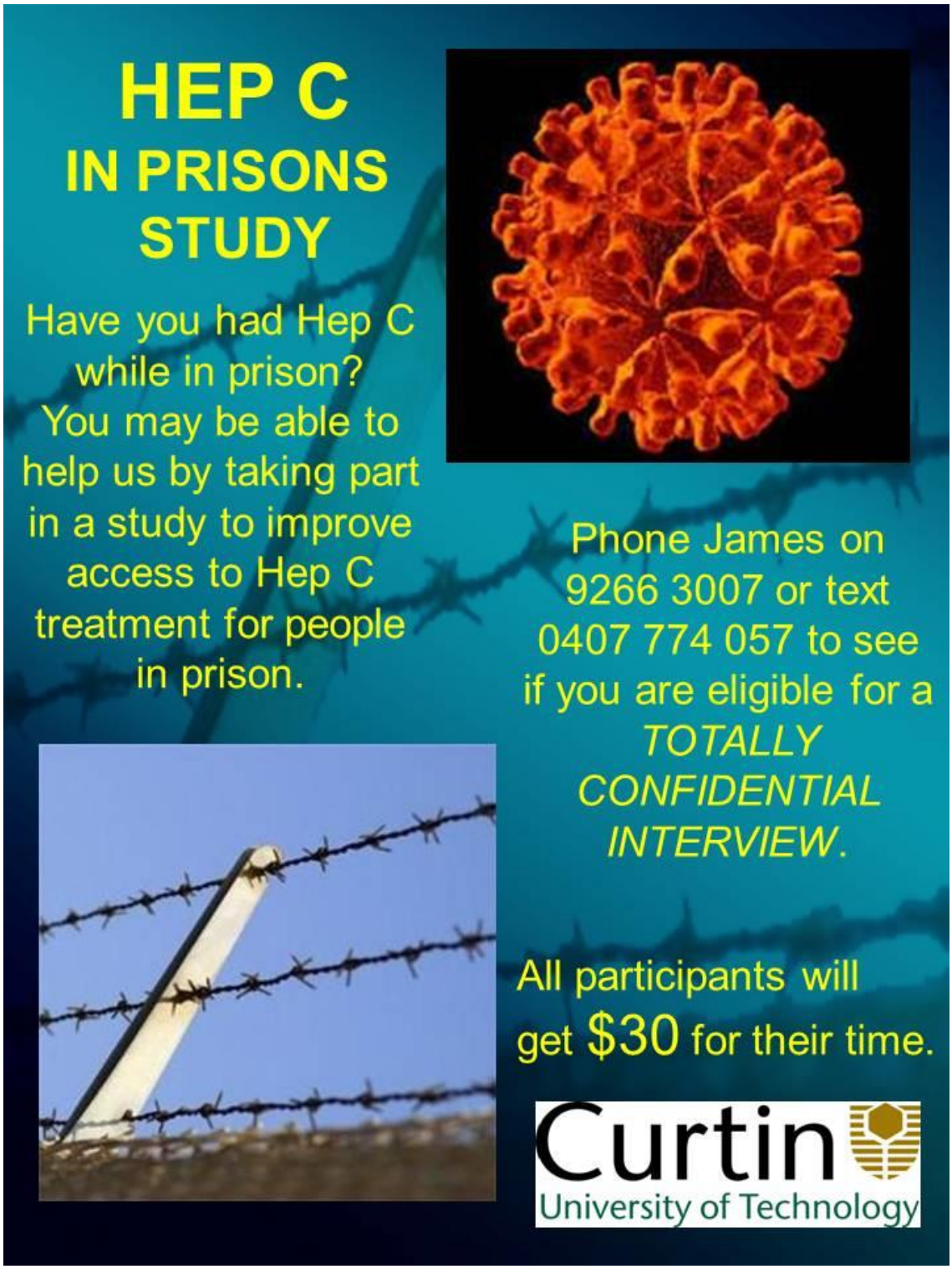
Recruitment flier for former prisoners

Hand flier for distribution to former prisoners by staff in recruitment centres at WASUA, HCWA and Outcare.



Recruitment poster for former prisoners

A3 recruitment poster for display in reception areas of WASUA, HCWA and Outcare.



Information for case workers

Information about the study provided to staff at WASUA, HCWA and Outreach to outline the purpose of the study and to enable identification of eligible participants.

The Hepatitis C in Prisons Study
Information for Case Workers

This study is being run by the National Drug Research Institute (NDRI), a part of Curtin University of Technology.

The study aims to investigate why uptake for Hepatitis C (HCV) treatment in prisons is so low by identifying barriers to accessing this treatment. The findings of the research have the potential to improve health outcomes for people who have HCV whilst incarcerated.

The study involves a confidential one-off face-to-face interview with eligible ex-prisoners.

All ex-prisoner participants will be reimbursed $30 for their time and costs of transport.

Many of your clients may be eligible to participate.

ELIGIBILITY CRITERIA

Persons eligible to take part in the study will:

- **Be over 18 years of age.**
- **Have been released from an *adult* prison within the last 6 months.**
- **Are known to have had *ACTIVE* HCV *whilst* imprisoned.**
- **At this stage of the study, it is NOT IMPORTANT whether or not they have received HCV treatment whilst in prison.**
- **Preference will be given to people whose most recent prison term is three months or more.**

All participation is completely voluntary and no name-identified data will be collected. Participants may use a false name if they wish.

Please provide a recruitment flier to clients meeting these criteria who wish to participate and request they contact the project team to arrange a mutually convenient time for the interview to take place.

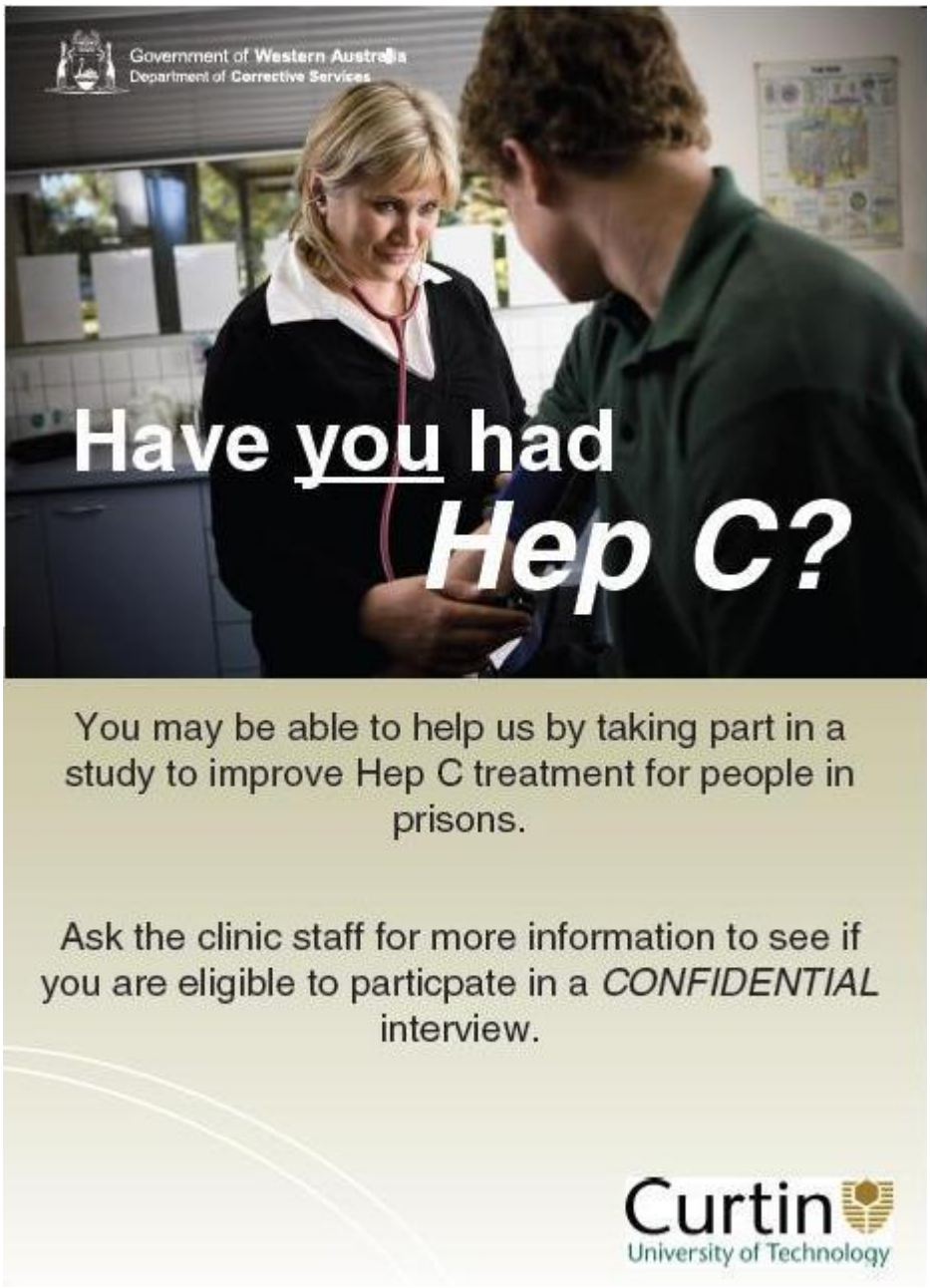
If you have any questions please contact James on 9266 3007 or email james.fetherston@postgrad.curtin.edu.eu
A full copy of the project description is available on request.
This study has been approved by the Curtin Human Research Ethics Committee (ref:201/2008) and the Department of Corrective Services.

Recruitment materials for current prisoners

This section contains material used in the recruitment of currently incarcerated participants.

Recruitment poster for current prisoners

A3 poster displayed in health clinics at Western Australian prisons



Information sheet for prison clinicians

Information about the study provided to clinicians in Casuarina Prison and Boronia Pre-Release Centre for Women to outline the purpose of the study and to enable identification of eligible participants.

The Hepatitis C in Prisons Study
Information for Clinicians

This study is being run by the National Drug Research Institute (NDRI), a part of Curtin University.

The study aims to investigate why uptake for Hepatitis C (HCV) treatment in prisons is so low by identifying barriers to accessing this treatment. The findings of the research have the potential to improve health outcomes for people who have HCV whilst incarcerated.

The study involves a confidential one-off face-to-face interview with eligible prisoners.

Many of your patients may be eligible to participate.

ELIGIBILITY CRITERIA

Persons eligible to take part in the study will:

- **Have been (or currently being) treated for HCV whilst in prison**

OR

- **Currently have a chronic HCV infection *AND* have served a sentence of at least two years whilst infected.**

All participation is completely voluntary and no name-identified data will be collected. Participants may use a false name if they wish.

Details of prisoners who are eligible and interested to participate should be passed on to Holly Beasley Blood-Borne Viruses Coordinator, Health Services DCS) on 9264 1288 or Holly.Beasley@correctiveservices.wa.gov.au

If you have any questions please contact the project coordinator James Fetherston on 9266 3007 or email james.fetherston@postgrad.curtin.edu.eu
A full copy of the project description is available on request.
This study has been approved by the Curtin Human Research Ethics Committee (ref:201/2008) and the Department of Corrective Services.

APPENDIX B: Informed consent forms and questionnaire for former prisoners

This Appendix contains the questionnaire and informed consent form used for interviewing former prisoners. The questionnaire includes quantitative items concerning demographic data, drug use history, knowledge of HCV and qualitative in-depth interview questions concerning experiences of HCV, treatment for HCV and drug use while in prison.

COMMUNITY QUESTIONNAIRE

ALL QUESTIONS ARE TO BE READ TO THE PARTICIPANT BY THE INTERVIEWER

This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 201/2008). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

This must be read aloud to participants and a copy given to them

Information for Community Participants & Statement of Informed Consent

You have been asked to participate in a study of hepatitis C (HCV) and its treatment in prisons. The main aim of this study is to improve access to HCV treatment for people who are in prison.

This study is being run by the National Drug Research Institute, a part of Curtin University of Technology.

During this interview I will ask you questions about your knowledge of HCV, your experiences about HCV treatment in the prison system, and what you think may be problems to accessing this treatment.

You do not have to agree to this participate in this interview. You do not have to answer any questions you don't want to. You may stop and leave at any time you wish. No action will be taken if you do not wish to continue.

After the interview is completed you will be given $30 for your time and travel costs.

No information such as your name will be collected that could be used to identify you.
The data collected from your interview will be kept in a locked filing cabinet at Curtin University of Technology. The data will be identified only by a number that cannot be traced back to you.

This study has been approved by the Curtin Human Research Ethics Committee and by the Western Australian Aboriginal Health Information and Ethics Committee (WAAIEC).

This must be read aloud to participants and signed by the interviewer

Information for Community Participants & Statement of Informed Consent

You have been asked to participate in a study of hepatitis C (HCV) and its treatment in prisons. The main aim of this study is to improve access to HCV treatment for people who are in prison.

This study is being run by the National Drug Research Institute, a part of Curtin University of Technology.

During this interview I will ask you questions about your knowledge of HCV, your experiences about HCV treatment in the prison system, and what you think may be problems to accessing this treatment.

You do not have to agree to this participate in this interview. You do not have to answer any questions you don't want to. You may stop and leave at any time you wish. No action will be taken if you do not wish to continue.

After the interview is completed you will be given $30 for your time and travel costs.

No information such as your name will be collected that could be used to identify you.
The data collected from your interview will be kept in a locked filing cabinet at Curtin University of Technology. The data will be identified only by a number that cannot be traced back to you.

This study has been approved by the Curtin Human Research Ethics Committee and by the Western Australian Aboriginal Health Information and Ethics Committee (WAAIEC).

Do you have any questions?

Are you willing to participate? ❑

Are you willing to allow the interview to be recorded? ❑

The nature and purpose of this study has been explained to the subject and they have agreed to participate.

Interviewer's signature:_____

Date:_____

Interview #:_____

HCV Treatment Questionnaire V3.0

SECTION A: Interview Details

A1	ID Number	❑❑
A2	Date	❑❑/❑❑/❑❑
A3	Interviewer's Initials	❑❑
A4	State/Territory	❑❑❑

SECTION B: Demographics

B1	How old are you?	❑❑❑
B2	Gender	❑ Male ❑ Female ❑ Transgender/Intersex/Other
B3	Do you identify as Aboriginal or Torres Strait Islander?	❑ No ❑ Aboriginal / Torres Strait Islander
B3a	Where do you usually live?	❑ Perth ❑ Sydney ❑ Another city ❑ Rural area ❑ Regional area
B4	What was the highest level of education you completed?	❑ No schooling ❑ Year 8 or below ❑ Left between yr 8 and yr 10 ❑ School certificate / yr 10 ❑ HSC/ TEE/TEA etc. ❑ Trade / professional qualification ❑ Incomplete tertiary qualification ❑ Completed tertiary qualification ❑ Higher degree

B5	What was the main language spoken at home where you grew up?	❑ English ❑ Other ❑ If other specify:_____
B6	How many times have you been in a adult's prison?	❑❑
B7	How many months were you been in prison last time?	❑❑❑

Section Two: In Depth Interview

Now I'm going to ask you some questions about your own experiences of having HCV and about treatment services in prison.

1) **Can you tell me about when you first found out you had hepatitis C?**
   Prompts: How did you find out? (regular test, on prison entry etc.)
   How did you feel about it when you found out?
   What kind of things had you heard about HCV when you first found out?
   Where/how do you think you caught HCV?
   Were you unwell or symptomatic at the time?

2) **After finding out you had HCV where did you go for information?**
   Prompts: Were you given any pamphlets etc.?
   Did you get pre/post test counseling? (elaborate?)
   How useful was counseling?
   Who did you talk to?
   What did you find out?

3) **(Before you commenced treatment) what (had) have you heard about treatment?**
   Prompts: Costs?
   Issues getting accepted onto the program?
   Issues surrounding side effects?
   Peer influences?
   Other aspects eg: "not worth it"?
   Where does treatment start?
   What did you think could be done about it?

4) **Tell me about why you decided to commence or not commence treatment?**
   Prompts: Explore areas surrounding availability, symptoms, concerns over future health, eligibility, potential side effects, hassles with treatment administration, stigma, other etc.
   Did you receive any medical advice?
   Did you see any information (brochures etc.) about treatment?
   Indigenous specific issues?

5) **Tell me about your experiences of undergoing treatment?**
   Prompts: Experiences of the assessment process?
   Experiences of dosing?
   What were the obvious benefits?
   Did you experience any side effects?
   Are you still on treatment or did you complete/discontinue?

6) **Why do you think so few people in prison take up the opportunity to seek treatment for HCV?**

7) If you injected while in prison, tell me about that?

Prompts: How often did you do this?
How did you get the drugs?
How did you pay for the drugs?
How did you get the needles?
How did you clean the needles?
How many of you would there be?
Did you know you had HCV at the time?
Did you do anything to avoid transmission?

8) Is there anything else about these issues you'd like to tell me about?

9) Other notes

SECTION C: Injecting History and Patterns

C1	Have you ever injected drugs?	❑ No ❑ Yes ❑ Yes, but only as directed by doctor (eg: insulin etc.)
C2	How old were you when you first injected?	❑❑
C3	How long in months since you last injected drugs? **(if less than 1 put 1)**	❑❑❑
C4	Did you inject any drugs in the month prior to entering prison?	❑ Yes ❑ No

C5	Have you ever taken any of the following drugs?		Ever used drug	Used in 12 months before prison	Ever injected drug	Ever used drug in prison	Ever injected drug in prison
		Alcohol	❑	❑	❑	❑	❑
		Tobacco	❑	❑		❑	
		Cannabis	❑	❑		❑	
		Heroin	❑	❑	❑	❑	❑
		Your methadone	❑	❑	❑	❑	❑
		Other's methadone	❑	❑	❑	❑	❑
		Your Subutex/Suboxone	❑	❑	❑	❑	❑
		Other's Subutex/Suboxone	❑	❑	❑	❑	❑
		Other opiates	❑	❑	❑	❑	❑
		Crystal meth/ice	❑	❑	❑	❑	❑
		Other Amphetamines/speed	❑	❑	❑	❑	❑
		Cocaine	❑	❑	❑	❑	❑
		Ecstasy or designer drugs	❑	❑	❑	❑	❑
		LSD or acid	❑	❑	❑	❑	❑
		Tranquilisers/benzos	❑	❑	❑	❑	❑
		Steroids	❑	❑	❑	❑	❑
		Inhalants	❑	❑		❑	
		Other (specify) _____	❑	❑	❑	❑	❑
		Other (specify) _____	❑	❑	❑	❑	❑

C6	How often did you inject drugs while in prison?	❑ Didn't inject **(skip to C12)** ❑ Less than monthly ❑ Monthly ❑ Weekly or less ❑ More than weekly, but not daily ❑ Daily ❑ More than once most days
C7	How many times have you injected whilst in prison last time?	❑ None ❑ Once ❑ Twice ❑ 3-5 times ❑ More than five times
C8	While in prison, how many times did you reuse a needle and syringe that had been used by someone else in the past?	❑ None ❑ Once ❑ Twice ❑ 3-5 times ❑ More than five times
C8a	Whilst in prison how many people have you typically injected with?	❑❑
C9	When you injected in prison how many other people do you think had used the needle and syringe before you? **(if none skip to C11)**	❑ None ❑ One ❑ Two ❑ 3-5 people ❑ More than five people

C10	How likely do you think it is that some of those people may have been infected with hepatitis C?	❑ Very unlikely ❑ Unlikely ❑ Maybe/possibly ❑ Likely ❑ Very Likely ❑ Don't know ❑ Refused to answer
C11	While in prison did you share any of the following equipment after someone else had used it? (multiple responses possible)	❑ Spoon ❑ Water ❑ Filter ❑ Tourniquet ❑ Drug ❑ Solution/mix
C11a	Whilst in prison have you ever attempted to clean used injecting equipment? (If "no" go to C12)	❑ Yes ❑ No
C11b	What cleaning substances have you used for this purpose? (multiple responses possible)	❑ Hot water ❑ Cold Water ❑ Boiling water ❑ Bleach ❑ Soap/detergent ❑ Swabs ❑ Other (Specify)_____

C11c	What cleaning method did you use for this purpose? (multiple responses possible)	❑ Rinse/flush once ❑ Rinse/flush more than once ❑ Wipe ❑ Soak ❑ Other (Specify)_____
C12	About what percent of prisoners do you think might be positive for Hepatitis C?	❑❑❑%
C13	Have you ever received any tattoos or piercings whilst in prison?	❑ Yes ❑ No

Section D: HCV Status and treatment history

D1	What is your current HCV status?	❑ I have had HCV and cleared the virus *without* treatment ❑ I have known I have HCV for 6 mths or less ❑ I have chronic (longer than 6 months) HCV ❑ I have HCV and am currently in treatment ❑ I have had HCV and cleared the virus *with* treatment ❑ I have had HCV but don't know my current status ❑ Other (specify)_____ _____ _____
D1a	When was the last date you were tested for HCV? (mm/yy)	❑❑/❑❑
D1b	Do you know your current viremic status?	❑ HCV+ ❑ PCR+ ❑ Don't know ❑ Cleared with treatment ❑ Auto-remitted

D1c	Do you know what genotype(s) of HCV you have/had? (multiple responses possible)	❑ 1 ❑ 1a ❑ 1b ❑ 2 ❑ 2 a/c ❑ 2b ❑ 3a ❑ 3b ❑ 4 ❑ 5 ❑ 6 ❑ 6a ❑ Don't know ❑ Other (specify)_____
D2	Can HCV be treated?	❑ Yes ❑ No ❑ Don't know
D3	Can people "get over" HCV? (if clarification required: can HCV be "cured"/"cleared" etc.)	❑ Yes ❑ No ❑ Don't know

D4	Can you name three ways you can get HCV? **(Don't prompt)**	1 _____ 2 _____ 3 _____
D4a	Do you know where you got HCV from?	❑ Sharing needles ❑ Sharing other injecting equipment ❑ Tattooing/piercing ❑ Sharing personal equipment (razors,etc.) ❑ Don't know ❑ Refused to answer ❑ Other (specify)_____

D5	What are the symptoms or effects of HCV? **(multiple responses allowed. Do not read out)**	❑ Many people show no symptoms ❑ Fatigue ❑ Nausea ❑ Fever ❑ Aches and pains ❑ Mood swings ❑ Anxiety ❑ Depression ❑ Abdominal pain ❑ Dry/itchy skin ❑ "Brain fog"/malaise ❑ Cirrhosis ❑ Heptocellular carcinoma ❑ Liver failure ❑ Pale faeces ❑ Dislike of smoking ❑ Death ❑ Don't know ❑ Other (specify)_____ _____ _____ _____

D6	Have you received any treatment for HCV in prison?	❑ Yes, & I completed treatment ❑ Yes, and am still receiving treatment ❑ Yes, but have discontinued treatment (reason)_____ _____ _____ ❑ No (reason)_____ _____ _____
D7	If you received treatment in prison what kind was it?	❑ Interferon ❑ Ribavirin ❑ Pegyulated Interferon and Ribavirin (Pegasys or Pegulon) ❑ Don't know ❑ Other (includes complimentary therapies) (specify)_____ _____

D8	While in prison did you attend the HIP-HOP or other drug related health program?	❑ Yes HIP-HOP ❑ Yes other program Specify_____ ❑ No ❑ Don't know

APPENDIX C: Informed consent forms and questionnaire for current prisoners

This Appendix contains the questionnaire and informed consent form used for interviewing current prisoners. The questionnaire includes quantitative items concerning demographic data, drug use history, knowledge of HCV and qualitative in-depth interview questions concerning experiences of HCV, and treatment for HCV.

PRISONER QUESTIONNAIRE

ALL QUESTIONS ARE TO BE READ TO THE PARTICIPANT BY THE INTERVIEWER

This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 201/2008). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

This must be read aloud to participants and a copy given to them

Information for Prison Participants & Statement of Informed Consent

You have been asked to be in a study of hepatitis C (HCV) in prisons. The main aim of this study is to find ways to improve access to HCV treatment for people who are in prison.

This study is being run by the National Drug Research Institute, a part of Curtin University.

I will ask you questions about your knowledge of HCV, your experiences about HCV treatment in prison, and what you think may be problems with this treatment.

You do not have to agree to be in this interview. You do not have to answer any questions you don't want to. You may stop and leave at any time you wish. No action will be taken if you do not wish to continue. Being in this study will have no impact on your trial outcomes, sentence, release date or parole.

Some of the questions I am going to ask you are personal and may be related to *past* criminal behaviour such as illicit drug use. But, if you disclose current criminal behaviour not related to drug use I will be obliged to report that behaviour.

No information such as your name will be collected that could be used to identify you and no information will be released to the Department of Corrective Services.
The data you give will be kept in a locked filing cabinet at Curtin University. The data will be identified only by a number that cannot be traced back to you.

This study has been approved by the Curtin Human Research Ethics Committee, the Department of Corrective Services and by the Western Australian Aboriginal Health Information and Ethics Committee (WAAIEC).

This must be read aloud to participants and signed by the interviewer

Information for Prison Participants & Statement of Informed Consent

You have been asked to be in a study of hepatitis C (HCV) in prisons. The main aim of this study is to find ways to improve access to HCV treatment for people who are in prison.

This study is being run by the National Drug Research Institute, a part of Curtin University.

I will ask you questions about your knowledge of HCV, your experiences about HCV treatment in prison, and what you think may be problems with this treatment.

You do not have to agree to be in this interview. You do not have to answer any questions you don't want to. You may stop and leave at any time you wish. No action will be taken if you do not wish to continue. Being in this study will have no impact on your trial outcomes, sentence, release date or parole.

Some of the questions I am going to ask you are personal and may be related to *past* criminal behaviour such as illicit drug use. But, if you disclose current criminal behaviour not related to drug use I will be obliged to report that behaviour.

No information such as your name will be collected that could be used to identify you and no information will be released to the Department of Corrective Services.
The data you give will be kept in a locked filing cabinet at Curtin University. The data will be identified only by a number that cannot be traced back to you.

This study has been approved by the Curtin Human Research Ethics Committee, the Department of Corrective Services and by the Western Australian Aboriginal Health Information and Ethics Committee (WAAIEC).

Do you have any questions?

Are you willing to participate?

The nature and purpose of this study has been explained to the subject and they have agreed to participate.

Interviewer's signature:_____

Date:_____

Interview #:_____

HCV Treatment Questionnaire V3.0

SECTION A: Interview Details

A1	ID Number	❑❑
A2	Date	❑❑/❑❑/❑❑
A3	Interviewer's Initials	❑❑
A4	State/Territory	❑❑❑
A5	Prison	_____

SECTION B: Demographics

B1	How old are you?	❑❑❑
B2	Gender	❑ Male ❑ Female ❑ Transgender/Intersex/Other
B3	Do you identify as Aboriginal or Torres Strait Islander?	❑ No ❑ Aboriginal / Torres Strait Islander
B3a	Where do you usually live?	❑ Perth ❑ Sydney ❑ Another city ❑ Rural area ❑ Regional area

B4	What was the highest level of education you completed?	❑ No schooling ❑ Year 8 or below ❑ Left between yr 8 and yr 10 ❑ School certificate / yr 10 ❑ HSC/ TEE/TEA etc. ❑ Trade / professional qualification ❑ Incomplete tertiary qualification ❑ Completed tertiary qualification ❑ Higher degree
B5	What was the main language spoken at home where you grew up?	❑ English ❑ Other ❑ If other specify:_____
B6	How many times have you been in an adult's prison?	❑❑
B7	How many months have you been in prison this time?	❑❑❑
B8	How long until your earliest release date? (months)	❑❑❑

Section Two: In Depth Interview

Now I'm going to ask you some questions about your own experiences of having HCV and about treatment services in prison.

1) **Can you tell me about when you first found out you had hepatitis C?**
   Prompts: How did you find out? (regular test, on prison entry etc.)
   How did you feel about it when you found out?
   What kind of things had you heard about HCV when you first found out?
   Where/how do you think you caught HCV?
   Were you unwell or symptomatic at the time

2) **After finding out you had HCV where did you go for information?**
   Prompts: Were you given any pamphlets etc.?
   Did you get pre/post test counseling? (elaborate?)
   How useful was counseling?
   Who did you talk to?
   What did you find out?

3) **(Before you commenced treatment) what (had) have you heard about treatment?**
   Prompts: Costs?
   Issues getting accepted onto the program?
   Issues surrounding side effects?
   Peer influences?
   Other aspects eg: "not worth it"?
   Where does treatment start?
   What did you think could be done about it?

4) **Tell me about why you decided to commence or not commence treatment?**
   Prompts: Explore areas surrounding availability, symptoms, concerns over future health, eligibility, potential side effects, hassles with treatment administration, stigma, other etc.
   Did you receive any medical advice?
   Did you see any information (brochures etc.) about treatment?
   Indigenous specific issues?

5) **Tell me about your experiences of undergoing treatment?**
   Prompts: Experiences of the assessment process?
   Experiences of dosing?
   What were the obvious benefits?
   Did you experience any side effects?
   Are you still on treatment or did you complete/discontinue?

6) **Why do you think so few people in prison take up the opportunity to seek treatment for HCV**

7) **Is there anything else about these issues you'd like to tell me about**

8) **Other notes**

SECTION C: Injecting History and Patterns

C1	Have you ever injected drugs?	❑ No ❑ Yes ❑ Yes, but only as directed by doctor (eg: insulin etc.)
C2	How old were you when you first injected?	❑❑
C3	How long in months since you last injected drugs? **(if less than 1 put 1)**	❑❑❑
C4	Did you inject any drugs in the month prior to entering prison?	❑ Yes ❑ No

C5	Have you ever taken any of the following drugs?		Ever used drug	Used in 12 months before prison	Ever injected drug	Ever used drug in prison	Ever injected drug in prison
		Alcohol	❑	❑	❑	❑	❑
		Tobacco	❑	❑		❑	
		Cannabis	❑	❑		❑	
		Heroin	❑	❑	❑	❑	❑
		Your methadone	❑	❑	❑	❑	❑
		Other's methadone	❑	❑	❑	❑	❑
		Your Subutex/Suboxone	❑	❑	❑	❑	❑
		Other's Subutex/Suboxone	❑	❑	❑	❑	❑
		Other opiates	❑	❑	❑	❑	❑
		Crystal meth/ice	❑	❑	❑	❑	❑
		Other Amphetamines/speed	❑	❑	❑	❑	❑
		Cocaine	❑	❑	❑	❑	❑
		Ecstasy or designer drugs	❑	❑	❑	❑	❑
		LSD or acid	❑	❑	❑	❑	❑
		Tranquilisers/benzos	❑	❑	❑	❑	❑
		Steroids	❑	❑	❑	❑	❑
		Inhalants	❑	❑		❑	
		Other (specify) _____	❑	❑	❑	❑	❑
		Other (specify) _____	❑	❑	❑	❑	❑

C6	How often have you injected drugs while in prison?	❑ Didn't inject **(skip to C12)** ❑ Less than monthly ❑ Monthly ❑ Weekly or less ❑ More than weekly, but not daily ❑ Daily ❑ More than once most days
C7	How many times have you injected whilst in prison this time?	❑ None ❑ Once ❑ Twice ❑ 3-5 times ❑ More than five times
C8	While in prison, how many times did you reuse a needle and syringe after someone else had used it in the past?	❑ None ❑ Once ❑ Twice ❑ 3-5 times ❑ More than five times other
C8a	Whilst in prison how many people have you typically injected with?	❑❑
C9	When you have injected in prison how many other people do you think have used the needle and syringe before you? **(if none skip to C11)**	❑ None ❑ One ❑ Two ❑ 3-5 people ❑ More than five people

C10	How likely do you think it is that some of those people may have been infected with hepatitis C?	❑ Very unlikely ❑ Unlikely ❑ Maybe/possibly ❑ Likely ❑ Very Likely ❑ Don't know ❑ Refused to answer
C11	While in prison did you share any of the following equipment after someone else had used it? (multiple responses possible)	❑ Spoon ❑ Water ❑ Filter ❑ Tourniquet ❑ Drug ❑ Solution/mix
C11a	Whilst in prison have you ever attempted to clean used injecting equipment? (If "no" go to C12)	❑ Yes ❑ No
C11b	What cleaning substances have you used for this purpose? (multiple responses possible)	❑ Hot water ❑ Cold Water ❑ Boiling water ❑ Bleach ❑ Soap/detergent ❑ Swabs ❑ Other (Specify)_____

C11c	What cleaning method did you use for this purpose? (multiple responses possible)	❑ Rinse/flush once ❑ Rinse/flush more than once ❑ Wipe ❑ Soak ❑ Other (Specify)_____
C12	About what percent of prisoners do you think might be positive for Hepatitis C?	❑❑❑%
C13	Have you ever received any tattoos or piercings whilst in prison?	❑ Yes ❑ No

Section D: HCV Status and treatment history

D1	What is your current HCV status?	❑ I have had HCV and cleared the virus *without* treatment ❑ I have known I have HCV for 6 mths or less ❑ I have chronic (longer than 6 months) HCV ❑ I have HCV and am currently in treatment ❑ I have had HCV and cleared the virus *with* treatment ❑ I have had HCV but don't know my current status ❑ Other (specify)_____ _____ _____
D1a	When was the last date you were tested for HCV? (mm/yy)	❑❑/❑❑
D1b	Do you know your current viremic status?	❑ HCV+ ❑ PCR+ ❑ Don't know ❑ Cleared with treatment ❑ Auto-remitted

D1c	Do you know what genotype(s) of HCV you have/had? (multiple responses possible)	❑ 1 ❑ 1a ❑ 1b ❑ 2 ❑ 2 a/c ❑ 2b ❑ 3a ❑ 3b ❑ 4 ❑ 5 ❑ 6 ❑ 6a ❑ Don't know ❑ Other (specify)_____
D2	Can HCV be treated?	❑ Yes ❑ No ❑ Don't know
D3	Can people "get over" HCV? (if clarification required: can HCV be "cured"/"cleared" etc.)	❑ Yes ❑ No ❑ Don't know

D4	Can you name three ways you can get HCV? **(Don't prompt)**	1 _____ 2 _____ 3 _____
D4a	Do you know where you got HCV from?	❑ Sharing needles ❑ Sharing other injecting equipment ❑ Tattooing/piercing ❑ Sharing personal equipment (razors,etc.) ❑ Don't know ❑ Refused to answer ❑ Other (specify)_____

D5	What are the symptoms or effects of HCV? **(multiple responses allowed. Do not read out)**	❑ Many people show no symptoms ❑ Fatigue ❑ Nausea ❑ Fever ❑ Aches and pains ❑ Mood swings ❑ Anxiety ❑ Depression ❑ Abdominal pain ❑ Dry/itchy skin ❑ "Brain fog"/malaise ❑ Cirrhosis ❑ Heptocellular carcinoma ❑ Liver failure ❑ Pale faeces ❑ Dislike of smoking ❑ Death ❑ Don't know ❑ Other (specify)_____ _____ _____ _____

D6	Have you received any treatment for HCV in prison?	❑ Yes, & I completed treatment ❑ Yes, and am still receiving treatment ❑ Yes, but have discontinued treatment (reason)_____ _____ _____ ❑ I was eligible for treatment whilst in prison, but did not receive any ❑ I was not eligible for treatment (reason)_____ _____ _____ ❑ I have not received treatment (eligibility unknown) ❑ Don't know
D7	If you received treatment in prison what kind was it?	❑ Interferon ❑ Ribavirin ❑ Pegyulated Interferon and Ribavirin (Pegasys or Pegulon) ❑ Don't know ❑ Other (includes complimentary therapies) (specify)_____ _____

D8	While in prison did you attend the HIP-HOP or other drug related health program?	❑ Yes HIP-HOP ❑ Yes other program Specify_____ ❑ No ❑ Don't know

APPENDIX D: Questionnaire items concerning rates of injection in prison

This appendix contains the additional questions concerning rates of injection while imprisoned that were appended to the 2009 IDRS survey form.

i)	**Have you ever been in prison? (If "no", skip to next section)**	No ❑ Yes ❑
ii)	**If yes, when were you last released?**	❑❑❑❑ (Year)
iii)	**Have you ever injected in prison? (If "no" skip to question vi)**	No ❑ Yes ❑
iv)	**If yes, did you inject in the last 12 months?**	No ❑ Yes ❑
v)	**How often on average did you inject whilst in prison LAST TIME?**	Never ❑ About once per year ❑ About twice a year ❑ About quarterly ❑ About monthly ❑ About fortnightly ❑ About weekly ❑ More than weekly but not daily ❑ Daily ❑ Multiple times per day ❑
vi)	**How long were you in prison for last time?**	❑❑❑ (Months)

APPENDIX E: Questionnaire items concerning the illicit syringe trade

This appendix contains the additional questionnaire items regarding the importation and trade in illicit syringes in prisons that were appended to the 2011 IDRS survey form. It should be noted that by 2011 the item "*Have you ever been in prison?*" had been incorporated into the main battery of questions in the IDRS survey. Only those respondents with a prison history were required to answer these additional questions.

i)	**How long since you were last imprisoned? (months)**	❑❑❑
ii)	**Have you ever taken a syringe into prison, or had one taken in for you? (tick as many as apply)**	No, never ❑ Yes, for my personal use ❑ Yes, to rent out ❑ Yes, to sell ❑
iii)	**Have you ever rented, bought or sold a syringe in prison? (tick as many as apply)**	No, never ❑ Yes, I have rented a syringe for my own use ❑ Yes, I have rented out a syringe to someone else ❑ Yes, I have bought a syringe ❑ Yes, I have sold a syringe ❑

iv)	**Last time you were in prison how much did it typically cost to rent or buy a syringe in prison (includes money, drugs, sexual favours etc.)**	To rent_____ To buy outright_____
v)	**If you have shared injecting equipment in prison, how many people were sharing equipment during the most recent injecting occasion?**	❑❑

APPENDIX F: Matlab codes

The driver code

This is the Matlab code used to drive the epidemic model of HCV in prison environments prior to introduction of DAA medications.

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%MATLAB 5.0 MAT-file, Platform: PCWIN, Created on: Fri Oct 23 10:48:35 2009
__IM
%% This is the code modeling the impact of treatment on HCV in
%% prisons%%%
clear % clears all variables
clc % clears the command screen
format short g % prevents Matlab from outputing in exponential notation

global Rate_of_Entry Prop_Susc Inj_Autorem New_Inj Susc_Inj_Cease Infection Susc_Rel
Death_Rate Prop_Ac_inj Ac_Inj_Chron Ac_Inj_Cease Ac_Inj_Rel Prop_Ac_Noninj
Noninj_Autorem Ac_Noninj_Chron Ac_Noninj_Rel Prop_UnX SVR_Early SVR_Moderate
UnX_Rel Prop_Chron_Inj_Early Chron_Noninj_Resume_Early Chron_Inj_Cease_Early
Chron_Inj_Mod Chron_Inj_Rel_Early Prop_Chron_Inj_Moderate
Chron_Noninj_Resume_Moderate Chron_Inj_Cirh Chron_Inj_Cease_Moderate
Chron_Inj_Rel_Moderate Prop_Chron_Inj_F4 Chron_Noninj_Resume_F4
Chron_Inj_Cease_F4 Chron_Inj_Rel_F4 Chron_Inj_HCC Chron_Inj_LF
Prop_Chron_Noninj_Early Rx_Fail_Early Chron_Noninj_Mod Rx_Uptake_Early
Chron_Noninj_Rel_Early Prop_Chron_Noninj_Moderate Rx_Fail_Moderate
Chron_Noninj_Cirh Rx_Uptake_Moderate Chron_Noninj_Rel_Moderate
Prop_Chron_Noninj_F4 Chron_Noninj_Rel_F4 Chron_Noninj_HCC Prop_Rx_Early
Prop_Rx_Moderate HCC_Rel HCC_Deaths LF_Rel LF_Deaths Chron_Noninj_LF;

Rate_of_Entry=30005; %numbers of new prison entrants every year
Prop_Susc=0.16; %proportion of new prisoners entering susceptible (A)
Inj_Autorem=0.52; %rate of acute injectors who resolve and move to susceptible (O)
New_Inj=0.02; %prioners who take up injecting and move from unexposed to susceptible NB:
all rates of ceasing and taking up injection have been arbitrarily set to 0.02(M)
Susc_Inj_Cease=0.01; %proportion of susceptible ceasing injecting and moving to unexposed.
(R)
% The next five lines allow the rate of incident infection to be adjusted.
%Infection=0.1; %experimental variable
%Infection=0.193; % (Butler, Karamina, Levy, Kaldor 2004)
%Infection=0.25; % experimental variable
%Infection=0.3; % experimental variable
Infection=0.34; % default rate of infection based on 34 per hundred person years (Dolan et al)
(N)
Susc_Rel=1.0; %proportion susceptible released from prison (x)
Death_Rate=0.001; % this refers to non-HCV deaths from all compartments
Prop_Ac_inj=0.002; %proportion of new prisoners entering actute injectors (B)
Ac_Inj_Chron=1.48; %rate of actute inject injectors progressing to early chronic stage (S)
Ac_Inj_Cease=0.01; %proportion of acute injectors who cease injecting (P)
Ac_Inj_Rel=1.0; % proportion of acute injectors released from prison (n)
Prop_Ac_Noninj=0.006; %proportion of new prisoners entering acute non-injectors (C)
Noninj_Autorem=0.52; %rate of acute non-injectors who resolve and move to unexposed (Q)
Ac_Noninj_Chron=1.48%rate of actute injectors who progress to early chronic stage (T)
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Ac_Noninj_Rel=1.0; %proportion of accute non-injectors released from prison (o)
Prop_UnX=0.60; %proportion of new prisoners entering unexposed (D)
SVR_Early=0.57; %proportion of early cases in treatment achieving sustained viremic response and moving to unexposed (U)
SVR_Moderate=0.57; %proportion of moderate cases in treatment achieving sustained viremic response and moving to unexposed (U)
UnX_Rel=1.0; %proportion of unexposed released from prison (y)
Prop_Chron_Inj_Early=0.05 %proportion of new prisoners entering Injectors chronic F0/F1 compartment; (E)
Chron_Noninj_Resume_Early=0.02; %proportion of chronic F0/F1 non-injectors who resume injecting (V)
Chron_Inj_Cease_Early=0.01; %proportion of chronic F0/F1 injectors who cease injecting (W)
Chron_Inj_Mod=0.048; %proportion of chronic injectors progressing from early to moderate stage HCV (f)
Chron_Inj_Rel_Early=1.0; %proportion of chronic F0/F1 injectors released from prison (p)
Prop_Chron_Inj_Moderate=0.013%proportion of new prisoners entering the injecting chronic F2/F3 compartment (F)
Chron_Noninj_Resume_Moderate=0.02; %proportion of Chronic F2/F3 non-injectors who resume injecting (X)
Chron_Inj_Cirh=0.116; %proportion of F2/F3 chronic injectors progressing to F4(g)
Chron_Inj_Cease_Moderate=0.01; %proportion of chronic F2/F3 injectors who cease injecting(Y)
Chron_Inj_Rel_Moderate=1.0; %proportion of chronic F2/F3 injectors released from prison(r)
Chron_Noninj_LF=0.056; %proportion of chronic F4 non-injectors developing liver failure(m)
Prop_Chron_Inj_F4=0.002; %proportion of all new prisoners entering the injecting chronic F4 compartment(G)
Chron_Noninj_Resume_F4=0.02; %proportion of chronic F4 non-injectors who resume injecting(Z)
Chron_Inj_Cease_F4=0.01; %proportion of chronic F4 injectors who stop injecting(a)
Chron_Inj_Rel_F4=1.0; %proportion of chronic F4 injectors released from prison(t)
Chron_Inj_HCC=0.032; %proportion of chronic F4 injectors developing HCC(j)
Chron_Inj_LF=0.056; %proportion of chronic injectors developing liver failure (k)
Prop_Chron_Noninj_Early=0.13; %proportion of all new prisoners entering the non-injecting F0/F1 compartment(H)
Rx_Fail_Early=0.43; %proportion of F0/F1 in treatment failing to achieve SVR(b)
Chron_Noninj_Mod=0.048; %proportion of non-injectors F0/F1 progressing to F2/F3(h)
% The next five lines allow the level F0/F1 non-injectors taking up treatment to be altered.
%Rx_Uptake_Early=0.00; %proportion of F0/F1 non-injectors taking up treatment(c)
%Rx_Uptake_Early=0.04; %proportion of F0/F1 non-injectors taking up treatment(c)
Rx_Uptake_Early=0.08; %default proportion of F0/F1 non-injectors taking up treatment(c)
%Rx_Uptake_Early=0.12; %proportion of F0/F1 non-injectors taking up treatment(c)
%Rx_Uptake_Early=0.20; %proportion of F0/F1 non-injectors taking up treatment(c)
Chron_Noninj_Rel_Early=1.0; %proportion of chronic F0/F1 non-injectors released from prison(q)
Prop_Chron_Noninj_Moderate=0.03; %proportion of all new prisoners entering the non-injecting F2/F3 compartment (I)
Rx_Fail_Moderate=0.43; %proportion of F2/F3 in treatment who fail to achieve SVR(d)
Chron_Noninj_Cirh=0.116; %proportion of F2/F3 non-injectors progressing to F4(i)
% The next five lines allow the level F2/F3 non-injectors taking up treatment to be altered.
%Rx_Uptake_Moderate=0.00; % proportion of chronic F2/F3 non-injectors taking up treatment(e)
%Rx_Uptake_Moderate=0.04; % proportion of chronic F2/F3 non-injectors taking up treatment(e)
Rx_Uptake_Moderate=0.08; % proportion of chronic F2/F3 non-injectors taking up treatment(e)

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%Rx_Uptake_Moderate=0.12; % proportion of chronic F2/F3 non-injectors taking up treatment(e)
%Rx_Uptake_Moderate=0.20; % proportion of chronic F2/F3 non-injectors taking up treatment(e)
Chron_Noninj_Rel_Moderate=1.0; %proportion of chronic F2/F3 non-injectors released from prison(s)
Prop_Chron_Noninj_F4=0.005; %proportion of all new prisoners entering the non-injectors F4 compartment (J)
Chron_Noninj_Rel_F4=1.0; %proportion of chronic F4 non-injectors released from prison(u)
Chron_Noninj_HCC=0.032; %proportion of chronic F4 non-injectors developing HCC(l)
Prop_Rx_Early=0.004; %proportion of new prison entrants entering treatment at F0/F1 stage(K)
Prop_Rx_Moderate=0.001; %proportion of new prison entrants entering treatment at F2/F3 stage(L)
HCC_Rel=1.0; %proportion with HCC released from prison(v)
HCC_Deaths=0.606; %proportion dying due to HCC(z)
LF_Rel=1.0; %proportion with liver failure released from prison(w)
LF_Deaths=0.138; %proportion dying due to liver failure(AA)
time_span = 1/12*(0:120);
InitialConditions = [3727 281 688 13908 1067 260 39 2410 587 97 210 51 2 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0];
[t,y] = ode45(@NewHCCequations2,time_span,InitialConditions);
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Model equations

This is the Matlab code that computes the equations for movement between compartments in the epidemic model of HCV in prison environments prior to introduction of DAA medications.

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%%Equations for HCV in Prisons using flowchart V.11%%
function YDOT = HCCequations2(t,Y)

global Rate_of_Entry Prop_Susc Inj_Autorem New_Inj Susc_Inj_Cease Infection Susc_Rel
Death_Rate Prop_Ac_inj Ac_Inj_Chron Ac_Inj_Cease Ac_Inj_Rel Prop_Ac_Noninj
Noninj_Autorem Ac_Noninj_Chron Ac_Noninj_Rel Prop_UnX SVR_Early SVR_Moderate
UnX_Rel Prop_Chron_Inj_Early Chron_Noninj_Resume_Early Chron_Inj_Cease_Early
Chron_Inj_Mod Chron_Inj_Rel_Early Prop_Chron_Inj_Moderate
Chron_Noninj_Resume_Moderate Chron_Inj_Cirh Chron_Inj_Cease_Moderate
Chron_Inj_Rel_Moderate Prop_Chron_Inj_F4 Chron_Noninj_Resume_F4
Chron_Inj_Cease_F4 Chron_Inj_Rel_F4 Chron_Inj_HCC Chron_Inj_LF
Prop_Chron_Noninj_Early Rx_Fail_Early Chron_Noninj_Mod Rx_Uptake_Early
Chron_Noninj_Rel_Early Prop_Chron_Noninj_Moderate Rx_Fail_Moderate
Chron_Noninj_Cirh Rx_Uptake_Moderate Chron_Noninj_Rel_Moderate
Prop_Chron_Noninj_F4 Chron_Noninj_Rel_F4 Chron_Noninj_HCC Prop_Rx_Early
Prop_Rx_Moderate HCC_Rel HCC_Deaths LF_Rel LF_Deaths Chron_Noninj_LF;


YDOT = zeros(27,1);


%Calculates dY(1)/dt This is the Susceptible Compartment
YDOT(1)=(Rate_of_Entry*Prop_Susc)+(Inj_Autorem*Y(2))+(New_Inj*Y(4))-
(Susc_Inj_Cease*Y(1))-(Infection*Y(1))-(Susc_Rel*Y(1))-(Death_Rate*Y(1));

%Calculates dY(2)/dt This is the Acute Injectors Compartment
YDOT(2)=(Rate_of_Entry*Prop_Ac_inj)+(Infection*Y(1))-(Inj_Autorem*Y(2))-
(Ac_Inj_Chron*Y(2))-(Ac_Inj_Cease*Y(2))-(Ac_Inj_Rel*Y(2))-(Death_Rate*Y(2));

% Calculates dY(3)/dt This is the Acute Non-Injectors Compartment
YDOT(3)=(Rate_of_Entry*Prop_Ac_Noninj)+(Ac_Inj_Cease*Y(2))-(Noninj_Autorem*Y(3))-
(Ac_Noninj_Chron*Y(3))-(Ac_Noninj_Rel*Y(3))-(Death_Rate*Y(3));

% Calculates dY(4)/dt This is the Unexposed Compartment
YDOT(4)=(Rate_of_Entry*Prop_UnX)+(Noninj_Autorem*Y(3))+(SVR_Early*Y(11))+(SVR_
Moderate*Y(12))+(Susc_Inj_Cease*Y(1))-(New_Inj*Y(4))-(UnX_Rel*Y(4))-(Death_Rate*Y(4));

% Calculates dY(5)/dt This is the Chronic Injectors F0/F1 Compartment
YDOT(5)=(Rate_of_Entry*Prop_Chron_Inj_Early)+(Ac_Inj_Chron*Y(2))+(Chron_Noninj_R
esume_Early*Y(8))-(Chron_Inj_Cease_Early*Y(5))-(Chron_Inj_Mod*Y(5))-
(Chron_Inj_Rel_Early*Y(5))-(Death_Rate*Y(5));

% Calculates dY(6)/dt This is the Chronic Injectors F2/F3 Compartment
YDOT(6)=(Rate_of_Entry*Prop_Chron_Inj_Moderate)+(Chron_Inj_Mod*Y(5))+(Chron_No
ninj_Resume_Moderate*Y(9))-(Chron_Inj_Cirh*Y(6))-(Chron_Inj_Cease_Moderate*Y(6))-
(Chron_Inj_Rel_Moderate*Y(6))-(Death_Rate*Y(6));

% Calculates dY(7)/dt This is the Chronic Injectors F4 Compartment
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YDOT(7)=(Rate_of_Entry*Prop_Chron_Inj_F4)+(Chron_Inj_Cirh*Y(6))+(Chron_Noninj_Re
sume_F4*Y(10))-(Chron_Inj_Cease_F4*Y(7))-(Chron_Inj_Rel_F4*Y(7))-
(Chron_Inj_HCC*Y(7))-(Chron_Inj_LF*Y(7))-(Death_Rate*Y(7));

% Calculates dY(8)/dt This is the Chronic Non-Injectors F0/F1 Compartment
YDOT(8)=(Rate_of_Entry*Prop_Chron_Noninj_Early)+(Ac_Noninj_Chron*Y(3))+(Chron_I
nj_Cease_Early*Y(5))+(Rx_Fail_Early*Y(11))-(Chron_Noninj_Mod*Y(8))-
(Rx_Uptake_Early*Y(8))-(Chron_Noninj_Resume_Early*Y(8))-
(Chron_Noninj_Rel_Early*Y(8))-(Death_Rate*Y(8));

% Calculates dY(9)/dt This is the Chronic Non-Injectors F2/F3 Compartment
YDOT(9)=(Rate_of_Entry*Prop_Chron_Noninj_Moderate)+(Chron_Noninj_Mod*Y(8))+(Rx
_Fail_Moderate*Y(12))+(Chron_Inj_Cease_Moderate*Y(6))-(Chron_Noninj_Cirh*Y(9))-
(Rx_Uptake_Moderate*Y(9))-(Chron_Noninj_Resume_Moderate*Y(9))-
(Chron_Noninj_Rel_Moderate*Y(9))-(Death_Rate*Y(9));

% Calculates dY(10)/dt This is the Chronic Non-Injectors F4 Compartment
YDOT(10)=(Rate_of_Entry*Prop_Chron_Noninj_F4)+(Chron_Noninj_Cirh*Y(9))+(Chron_I
nj_Cease_F4*Y(7))-(Chron_Noninj_Resume_F4*Y(10))-(Chron_Noninj_Rel_F4*Y(10))-
(Chron_Noninj_HCC*Y(10))-(Chron_Noninj_LF*Y(10))-(Death_Rate*Y(7));

% Calculates dY(11)/dt This is the Treatment F0/F1 Stage Compartment
YDOT(11)=(Rate_of_Entry*Prop_Rx_Early)+(Rx_Uptake_Early*Y(8))-(SVR_Early*Y(11))-
(Rx_Fail_Early*Y(11))-(Death_Rate*Y(11));

% Calculates dY(12)/dt This is the Treatment F2/F3 Stage Compartment
YDOT(12)=(Rate_of_Entry*Prop_Rx_Moderate)+(Rx_Uptake_Moderate*Y(9))-
(SVR_Moderate*Y(12))-(Rx_Fail_Moderate*Y(12))-(Death_Rate*Y(12));

% Calculates dHCC/dt This is the HCC Compartment
YDOT(13)=(Chron_Inj_HCC*Y(7))+(Chron_Noninj_HCC*Y(10))-(HCC_Rel*Y(13))-
(HCC_Deaths*Y(13))-(Death_Rate*Y(13));

% Calculates dLiver_Failure/dt This is the Liver Failure Compartment
YDOT(14)=(Chron_Inj_LF*Y(7))+(Chron_Noninj_LF*Y(10))-(LF_Rel*Y(14))-
(LF_Deaths*Y(14))-(Death_Rate*Y(14));

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Cumulative incidence calculation, based on the previous fundamental 14
% equations
YDOT(15)=Infection*Y(1);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Cumulative number of prisoners commencing treatment
YDOT(16)= (Rx_Uptake_Early*Y(8)) + (Rx_Uptake_Moderate*Y(9));

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Cumulative number of people released with HCV
YDOT(17)=(Ac_Inj_Rel*Y(2)) + (Ac_Noninj_Rel*Y(3)) + (Chron_Inj_Rel_Early*Y(5)) +
(Chron_Inj_Rel_Moderate*Y(6)) + (Chron_Inj_Rel_F4*Y(7)) +
(Chron_Noninj_Rel_Early*Y(8)) + (Chron_Noninj_Rel_Moderate*Y(9)) +
(Chron_Noninj_Rel_F4*Y(10)) + (HCC_Rel*Y(13)) + (LF_Rel*Y(14));
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%%

% Cumulative number of people released in total
YDOT(18)=(Ac_Inj_Rel*Y(2)) + (Ac_Noninj_Rel*Y(3)) + (Chron_Inj_Rel_Early*Y(5)) + (Chron_Inj_Rel_Moderate*Y(6)) + (Chron_Inj_Rel_F4*Y(7)) + (Chron_Noninj_Rel_Early*Y(8)) + (Chron_Noninj_Rel_Moderate*Y(9)) + (Chron_Noninj_Rel_F4*Y(10)) + (HCC_Rel*Y(13)) + (LF_Rel*Y(14))+ (Susc_Rel*Y(1))+ (UnX_Rel*Y(4));

%%

% Cumulative number of people released with actute infection
YDOT(19)=(Ac_Inj_Rel*Y(2)) + (Ac_Noninj_Rel*Y(3));

%%

% Cumulative number of people released with F0/F1 stage
YDOT(20)=(Chron_Inj_Rel_Early*Y(5)) + (Chron_Noninj_Rel_Early*Y(8));

%%

% Cumulative number of people released with F2/F3 stage
YDOT(21)=(Chron_Inj_Rel_Moderate*Y(6)) + (Chron_Noninj_Rel_Moderate*Y(9));

%%

% Cumulative number of people released with F4 stage
YDOT(22)=(Chron_Inj_Rel_F4*Y(7)) + (Chron_Noninj_Rel_F4*Y(10));

%%

% Cumulative number of people released with HCC
YDOT(23)=(HCC_Rel*Y(13));

%%

%Cumulative number of people released with liver failure
YDOT(24)=(LF_Rel*Y(14));

%%

%Cumulative number of HCC deaths
YDOT(25)=(HCC_Deaths*Y(13));

%%

% Cumulative number of LF deaths
YDOT(26)=(LF_Deaths*Y(14));

%%

%Cumulative numbers with HCC/LF
YDOT
(27)=(Chron_Inj_HCC*Y(7))+(Chron_Noninj_HCC*Y(10))+(Chron_Inj_LF*Y(7))+(Chron_Noninj_LF*Y(10));