Return on Investment 3:

Evaluating the cost-effectiveness of needle and syringe programs in Australia

2026

UNSW Kirby Institute

UNSW SYDNEY

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Glossary

The following acronyms and terms have been used throughout this document.

ANSPS	Australian Needle Syringe Program Survey
ART	antiretroviral therapy
BCR	benefit-to-cost ratio
CI	confidence interval
CPI	consumer price index
DAA	direct-acting antiviral
HCV	hepatitis C virus
HIV	human immunodeficiency virus
IRID	injection-related injury or disease
LHD	local health district
OAT	opioid agonist therapy
PBS	Pharmaceutical Benefits Scheme
ROI	return on investment
RR	relative risk
NSP	needle and syringe program
UI	uncertainty interval

1. Introduction

Needle and syringe programs (NSPs) provide sterile injecting equipment and safe disposal options to people who inject drugs. They are a key public health strategy that promotes safer injecting practices and offer harm-reduction education, safe sex packs, and referrals to drug treatment, medical care, and social services (1). The first NSP was established in Australia in 1986 and was followed by rapid policy endorsement across states and territories. As of June 2025, Australia had more than 4,600 NSP sites, including primary and secondary services, pharmacies, mobile and outreach programs, and syringe vending machines. In 2025 these NSP sites collectively distributed over 64 million syringes (1).

By reducing the sharing of injecting equipment, particularly needles and syringes, NSPs reduce the transmission of blood-borne viruses such as the human immunodeficiency virus (HIV) and hepatitis C virus (HCV) among people who inject drugs, as well as the morbidity and mortality associated with these infections (2, 3). NSPs have been attributed to the prevention of an HIV epidemic and maintaining low levels of HIV transmission among people who inject drugs (4) with <20 notifications annually (3% of total) attributed to injecting drugs (5, 6). Since the introduction of unrestricted direct-acting antiviral (DAA) therapy in March 2016, primary HCV incidence among people who inject drugs has reduced by 53%, with broader declines in HCV prevalence (7). Alongside the recent availability of effective HCV treatment, the widespread and sustained access to sterile equipment has helped maintain Australia's low and stable HIV and HCV prevalence among people who inject drugs. In addition to preventing HIV and HCV transmission, NSPs may also reduce the risk of injection-related injury and disease (IRID), however, evidence characterising their effectiveness in addressing IRID remains limited (8).

Previous Return on Investment (ROI) studies demonstrated clear cost-benefit gains from NSPs in health outcomes related to HIV and HCV (9, 10). The first ROI study of NSPs in Australia, conducted in 2002 (9), compared HIV and HCV infections among people who inject drugs with and without access to NSPs and reported a net present value exceeding $2 billion between 1990 and 2000. The second ROI study (ROI 2, 2009), found that every dollar invested in NSPs resulted in savings of more than $4 dollars in healthcare costs over the period 2000-2010 (10).

Recent epidemiological shifts in HCV and the prevention landscape may have altered the relative impact and cost-effectiveness of NSPs in the presence of widely accessible HCV treatment. An updated economic assessment incorporating contemporary data is therefore necessary to determine whether NSPs continue to provide strong value for money with regards to addressing HIV and HCV in the DAA era. This project, Return

on Investment 3 (ROI 3), updates previous analyses by conducting a streamlined cost-benefit analysis of NSPs in Australia. It estimates the financial return on NSP investment for 2024, focusing on direct healthcare costs averted in the context of widespread of DAA availability.

1.1 Key Findings

For **every $1.00 invested in NSPs we estimate a return of $2.02** in averted healthcare costs and improved public health outcomes associated with HIV and hepatitis C. Despite a large uncertainty range, our analysis shows that the benefit-to-cost ratio is highly likely to exceed 1, demonstrating a very high level of confidence that the economic benefits of NSPs outweigh their total costs.

- **Exceptional Value:** This finding highlights that NSPs are not only essential public health interventions but also highly cost-effective, yielding a **return approximately 2 times larger than the money invested** through the prevention of new HIV and HCV infections.
- **Effective Prevention:** NSPs have been instrumental in suppressing the transmission of HIV and HCV among people who inject drugs, thereby significantly reducing disease and deaths as well as costs to the healthcare system.
- **Sustained virtual elimination of HIV:** NSPs have played a critical role in maintaining low HIV transmission among people who inject drugs in Australia through sustained access to sterile injecting equipment.
- **Foundation for HCV Elimination:** The sustained effectiveness of NSPs provides the essential platform for Australia to achieve its national targets for the elimination of HIV and HCV as public health threats

These results provide strong evidence of the substantial economic and public health benefits of sustained and adequate fundings for NSPs.

2. Data and methodology

The analysis described in this report is based on an up-to-date and comprehensive economic evaluation of Australia's NSPs to estimate their cost-effectiveness with respect to preventing bloodborne virus transmission and public health benefits. The methodology used in ROI 3 adopts a straightforward cost-benefit analysis framework to estimate the economic return on Australia's NSP for 2024. This approach differs from and addresses a key limitation of the previous ROI 2 (10) modelling approach which relied on a complex HIV and HCV transmission model that incorporated detailed assumptions about injecting behaviour, frequency of sharing, and counterfactual scenarios without NSPs. Although the ROI 2 methodology produced robust estimates, the complexity of this earlier approach limits its accessibility and makes it difficult to update results, limiting the method's ongoing application to informing public health policy. For ROI 3, a simpler approach was taken that required fewer assumptions and allowed for the limited empirical data available to be incorporated transparently.

All the ROI 3 calculations and input parameter estimates described in the following sections are in a Microsoft Excel spreadsheet available through the Kirby Institute website ROI 3 Calculations Spreadsheet. This spreadsheet has been provided for transparency and reproducibility purposes. It also enables the reader to assess the impact of different input parameter values and assumptions on the results.

2.1 Benefit-to-Cost Ratio Calculation and Core Equations

The central output of this analysis is the benefit-to-cost ratio (BCR), which compares the total monetary benefits generated by preventing HIV and HCV infections with total NSP expenditure during the 2024 calendar year. Benefits are defined as the healthcare costs avoided through infections averted, reflecting the most direct and quantifiable economic gain associated with NSP operations. While NSPs may also reduce the burden of IRID, the current evidence base for quantifying the impact of NSPs on IRID incidence is limited, and if included in these calculations would result in greater uncertainty in the estimates. The potential additional BCR associated with preventing IRID is included only as a secondary analysis in this report (see Appendix).

The BCR is calculated by dividing the total expected benefits by the total expected costs, specifically, it is the total healthcare costs avoided through averting HIV and HCV infections divided by the total NSP program costs as shown in the following BCR equation (Eq. 1):

$$\frac{Benefits\ in\ averted\ infections\ in\ monetary\ terms\ (inc.healthcare\ \ other\ costs\ averted)\ per\ year}{NSP\ program\ costs\ per\ year} \quad \textbf{Eq. 1}$$

The following two sections define and describe the equations used to estimate the numerator in the BCR equation.

2.1.1 Estimating infections averted

In this section we define the key parameters and derive the mathematical equations used to calculate the number of HIV and HCV infections averted due to NSPs. The following parameters and equations can be applied to any infection among people who inject drugs. For our analysis we applied the equations to HIV and HCV separately before combining the results.

If for a given year we let:

$N = number\ of\ susceptible\ people\ who\ inject\ drugs,$
$p = proportion\ of\ people\ who\ inject\ drugs\ attending\ NSPs,$
$\mathrm{E_I} = effectiveness\ of\ NSPs\ in\ reducing\ \ an\ infection\ I,$
$\Lambda = overall\ incidence\ rate\ of\ infection\ \ I\ (as\ a\ proportion)\ among\ susceptible\ people\ who\ inject\ drugs\ not\ attending\ NSPs,$
$\Lambda_{NSP} = \ incidence\ rate\ of\ infection\ I\ (as\ a\ proportion)\ among\ susceptible\ people\ who\ inject\ drugs\ \ attending\ NSPs$, and
$\mathrm{I_p} = annual\ new\ infections\ among\ people\ who\ inject\ drugs\ if\ a\ proportion\ p\ attend\ NSPs$

then the reduction in the incidence for the specific infection I due to NSPs will be

$$\Lambda_{NSP} = (1 - \mathrm{E}_I)\Lambda, \quad \textbf{Eq. 2}$$

and the overall number of infections among people who inject drugs will be

$$I_p = N \times p \times \Lambda_{\mathrm{NSP}} + \mathrm{N} \times (1 - \mathrm{p}) \times \Lambda =$$
$$Np(1 - E_I)\Lambda + \mathrm{N}(1 - \mathrm{p})\Lambda =$$
$$\mathrm{N}(1 - \mathrm{p}E_I)\Lambda. \quad \textbf{Eq. 3}$$

Therefore, the number of infections averted each year due to NSPs is then

$$I_0 - I_p = N\Lambda - N(1 - pE_I)\Lambda = Np\mathrm{E_I}\Lambda = \frac{N\mathrm{p}E_I\Lambda_{NSP}}{(1-E_I)}. \quad \textbf{Eq. 4}$$

Equation 4 allows us to estimate the number of infections averted without knowing the incidence rate for people not attending NSPs.

For HCV infections, the incidence rate reflects all acute or incident infection, irrespective of subsequent spontaneous clearance. Spontaneous clearance was not incorporated into the incidence equations but was accounted for in the estimation of HCV health costs by assuming that individuals who spontaneously cleared infection

did not require HCV treatment and therefore did not incur HCV treatment costs (as described in Section 2.2.3). We also assumed the incidence rate (Λ) and efficacy of NSPs (E_{HCV}) are the same for both primary infection and reinfection following cure. NSPs were assumed to have no effect on the roll-out and scale-up of DAA treatment for HCV, which is a conservative assumption as NSPs have likely facilitated access to treatment provision to people who inject drugs through testing and referral at NSP sites, thereby providing additional benefits and contributing to reduced morbidity. The impact of DAA treatment on transmission due to a fall in prevalence is not directly described in Eqs. 2–4 but is implicitly included via the number of people who inject drugs susceptible to HCV.

To validate this simpler methodology for estimating infections averted, we applied Eq. 4 to HIV and HCV separately using the input parameters from the previous ROI 2 study. This cross-application produced estimates highly consistent with ROI 2 results (see Table 1), strongly suggesting the suitability of the ROI 3 methodology for this economic analysis.

Table 1: HIV and HCV incident infections averted using the ROI 3 equations and input parameter values from the ROI 2 analysis compared to the ROI 2 results.

ROI 2 parameters	HIV	HCV
Population size of PWID in 2009	173,000	
NSP coverage	100%	100%
Incidence rate	0.017	0.053
Effectiveness of NSPs	51%	51%
Estimated annual cases of incident infections averted		
ROI 2 modelling estimates	3,205	9,667
ROI 3 calculations applying 2009 ROI 2 parameters	3,076	9,694

Note: *The incidence rates of HIV and HCV were back calculated from the ROI 2 results using estimates of total incidence over time and the population size of people who inject drugs in 2009. The overall effectiveness of NSPs in ROI 2 was estimated based on the change in syringe sharing rates between scenarios with and without NSPs. Estimates for chronic HCV infections will be different because ROI 2 used a different estimate for spontaneous clearance (26% compared to 36% in ROI 3, see Table 5).*

2.1.2 Converting infections averted into monetary terms

The numerator of the BCR equation (Eq. 1) requires the estimates for the number of HIV and HCV infections averted due to NSPs be converted into monetary benefits. To do this, the cost to society of morbidity and mortality of a person living with an infection

and the health care costs associated with the infection need to be considered (including costs for testing, monitoring, treatment, and healthcare use).

A common approach used in cost-benefit analysis to estimate the societal cost of an infection, including in the Australian context, is to multiply the value of a statistical life year by a burden of disease utility weight (11-13). Given most new HCV infections are now treated in the early stages, prior to the development of sequelae (such as cirrhosis, decompensated cirrhosis, and hepatocellular carcinoma), and most people living with HIV receive antiretroviral therapy (ART) and have a suppressed viral load (14), the attributable health burden associated with these infections is substantially reduced. Consequently, we assumed the associated disability weight to be negligible, such that the estimated monetary benefits attributable to NSPs were driven primarily by avoided healthcare costs. The numerator for the BCR equation (Eq. 1) is then given by:

$$Infections\ averted\ \times$$
$$average\ lifteime\ healthcare\ cost\ of\ an\ infection\ in\ 2024\ AUD. \quad \textbf{Eq. 5}$$

Specific healthcare costs for HIV and HCV are described and estimated below in Section 2.2.3.

2.2 Input parameter estimates for ROI 3 calculations

In this section we provide estimates and justifications for the input values to Eq. 4 and Eq. 5. The full list of input values is presented in Table 5 at the end of this section.

2.2.1 Incidence rate of HIV, HCV among people who inject drugs in Australia

The calculation incorporates published estimates of HIV and HCV incidence rates among people who inject drugs in Australia based on data from the Australian Needle Syringe Program Survey (ANSPS). The ANSPS is part of Australia's sentinel surveillance system for blood borne viruses. Through annual surveys of between 1,500–2,500 attendees of more than 50 NSPs across all states and territories, the ANSPS provides prevalence estimates of HIV and HCV as well as sexual and injecting risk behaviour among people who inject drugs attending NSPs. The ANSPS is the most comprehensive source of national data on blood borne viruses among people who inject drugs in Australia.

Previously published analyses of ANSPS data estimated an HIV incidence rate of 0.11 (95% CI: 0.07 – 0.17) per 100 person-years for the period 1995-2012 (Table 5) (4). This equates to a proportion of 0.0011 (95% CI: 0.0007 – 0.0017) susceptible people acquiring HIV each year. This is the most recent robust incidence data for HIV among people who inject drugs in Australia available. Given the low and steady number of HIV

notifications among people who inject drugs since 2012 (<20 per year) (14), we assumed this remained stable over time.

A more recent analysis of ANSPS data provides an estimate for HCV incidence in the DAA era. For the period 2016-2021 the incidence rate of acute HCV infection was estimated at 5.4 (95% CI: 3.9 – 7.4) per 100 person-years or as a proportion 0.054 (95% CI: 0.039 – 0.074) of susceptible people per year (Table 5) (15). As this is a relatively recent estimate, we used this incidence rate in our calculations, however, it may overestimate the incidence in 2024, given HCV RNA prevalence among attendees of NSPs has continued to decline since 2021 (16). The HCV incidence estimate was based on the study's definition of HCV seroconversion, which was defined as an negative HCV antibody test result followed by a positive HCV antibody result. In our model, we interpreted this estimate as representing the rate at which individuals become HCV antibody positive and assumed a subsequent spontaneous clearance rate. As not all people with acute HCV infection progress to chronic HCV infection, spontaneous clearance is therefore accounted for in the estimation of HCV healthcare costs (Section 2.2.3).

2.2.2 NSP coverage and effectiveness estimates

NSP coverage was assumed to be 85% (95% CI: 80% – 90%, Table 5), based on data from the SuperMIX study (17), the only Australian study using community-based recruitment of people who inject drugs enabling a direct estimate of rates of NSP access. In the absence of nationally representative data capturing NSP coverage in community settings, these estimates were considered the most appropriate for informing calculation inputs.

Our analysis was restricted to the effectiveness and costs of NSPs alone. Many studies examining the effectiveness of NSPs in preventing HIV and HCV infections are from settings where NSPs are present in combination with other interventions such as opioid agonist treatment (OAT) and where it is not possible to determine the preventive effect attributable to NSP (18). To evaluate the effectiveness of NSPs as a standalone intervention, we considered the results from two systematic reviews which reported the relative risk (RR) of infection among people attending NSPs versus those who did not (effectiveness = 1 − RR) (19). While both reviews were published prior to or around the time DAAs became widely available and highlighted the difficulties of isolating the impact of NSPs from other harm reduction programs, they provide the best data for NSP effectiveness available.

The strongest available evidence for effectiveness of NSPs for HIV prevention came from a 2014 systematic review and meta-analysis by Aspinall et. al. This review reported a 58% reduction in HIV transmission risk associated with NSP use (95% CI:

19%–78%, Table 5) across six high-quality studies (18). Many studies included in this review were conducted in settings where other prevention strategies such as OAT, antiretroviral therapy, and sexual health promotion programs were also being implemented. Most of the studies included did not adjust for the potential effects of these concurrent interventions, meaning that the independent effect of NSPs could not be fully isolated. Despite the potential for other interventions to contribute to the observed reductions in HIV, in the absence of other evidence examining the effect of NSP in isolation we assumed 58% effectiveness in reducing HIV transmission as a reasonable estimate representing the most robust available estimate.

For HCV, we used effectiveness estimates from a 2018 Cochrane systematic review, which reported a 56% reduction in HCV acquisition risk (95% CI: 20%–76%, Table 5) (18) with NSPs in a univariate analysis. The review also reported a higher effectiveness of 74% from an adjusted analysis that included settings with combined OAT and high-coverage NSPs (18, 20). Given the range of analyses and findings reported in the review, we considered the 56% estimate to be a reasonable estimate of the effectiveness of NSPs alone.

Overall, our approach is consistent with the available evidence and potentially underestimates the overall health benefits and cost-effectiveness of NSPs when implemented alongside complementary harm reduction interventions. NSPs also facilitate engagement with testing, referral pathways, and HIV and HCV treatment, including point-of-care HCV testing (21, 22). These additional benefits were not included in the analysis, meaning our estimates are likely to conservatively underestimate the overall effectiveness of NSPs. The final NSP effectiveness estimates are presented in Table 5 and were applied to current incidence rates among susceptible people who inject drugs (as per Eq. 4) to estimate the number of infections averted.

2.2.3 Healthcare costs

The calculation incorporated the healthcare costs associated with each infection, which primarily reflect treatment and monitoring expenses. As HIV is incurable, an infection requires lifelong care and treatment for the rest of a person's life. The average discounted lifetime cost of HIV management in Australia was estimated in a recent comprehensive economic modelling study (23) at a discounted A$240,493 (95% CI: $166,285–351,252) in 2019. This estimate applied a 5% annual discount rate, consistent with Pharmaceutical Benefits Advisory Committee guidance (24). We inflated the 2019 cost to 2024 Australian dollar values using the heath consumer price index (CPI) (25), resulting in an estimated lifetime cost of A$281,107 (95% CI: $194,367-$410,571, Table 5).

For HCV, which is curable, we estimated the healthcare cost associated with diagnosing and treating a single infection. Even if a person with HCV is cured and re-infected, each infection is considered separately. Although list prices for all drugs on the Pharmaceutical Benefits Scheme (PBS) are publicly available, the actual cost to the Australian Government is unknown because of confidential pricing arrangements with pharmaceutical companies. This is particularly relevant for DAA therapy as the Australian government committed $1.2 billion to provide unrestricted access to DAA treatment during 2016-2021, resulting in an effective reduction of PBS list prices that depends on treatment uptake (number of people treated and the actual amount paid) (26). To obtain the cost of DAA treatment, we first estimated the average PBS list price per DAA therapy course using the list prices on the PBS website and then applied an estimated price reduction.

There are several DAA drug regimens available for HCV in Australia, but most initial treatment is with the regimens Glecaprevir/Pibrentasvir (PBS item: 11353M) and Sofosbuvir/Velpatasvir (PBS item: 11147Q). The Monitoring hepatitis C treatment uptake in Australia (Issue 13) reported that approximately 94% of people with HCV in 2023 were treated with one of these two regimens (27). For healthcare costs estimation, we assumed these were the only two regimens used for initial treatment and normalized the reported proportions, resulting in 43.6% of people living with HCV treated with Glecaprevir/Pibrentasvir and 56.4% treated with Sofosbuvir/Velpatasvir. The regimen Sofosbuvir/Velpatasvir/Voxilaprevir (PBS item: 11658N) is used for retreatment if initial treatment with Sofosbuvir/Velpatasvir fails.

The average cost of HCV treatment was estimated using the PBS cost per script for each DAA regimen. In 2024, Glecaprevir/Pibrentasvir cost A$17,895.47 per script and requires two scripts for initial treatment and three scripts for retreatment following treatment failure (28). Sofosbuvir/Velpatasvir cost A$12,037.13 per script and requires three scripts for both initial treatment and retreatment (29). Sofosbuvir/Velpatasvir/Voxilaprevir, used for retreatment, had the same per-script cost and script requirement as Sofosbuvir/Velpatasvir (30). The average cost for an initial DAA treatment was therefore estimated as the weighted average across regimens: (0.436 × 2 × $17,895.47 + 0.564 × 3 × $12,037.13) = A$35,971.67. Assuming the same regimen distribution for retreatment as for initial treatment, the average cost of DAA retreatment was estimated as (0.436 × 3 × $17,895.47 + 0.564 × 3 × $12,037.13) = A$43,774.10.

According to the 2025 Monitoring Hepatitis C Treatment Uptake in Australia report (27), 8,264 people received HCV treatment in Australia in 2024, including 797 retreatments following treatment failure. We therefore assumed the probability of requiring retreatment after an initial course of treatment was 100% x 797/7467 = 10.7%. Based

on the estimated average costs of initial treatment (A$35,972) and retreatment (A$43,774), the expected average drug cost per person with HCV treated was estimated as (1.0 × $35,972 + 0.107 × $43,774) = A$40,656.

A previous cost-effectiveness analysis estimated the average cost of a DAA treatment to be $10,877 (range: $7,098–$16,260) in 2021, assuming that the Australian Government's committed expenditure of A$1 billion for unrestricted DAA access during 2016-2021 was fully spent and dividing this by the estimated number of treatments over the same period (derived from observed treatment data and modelling projections) (31). A more recent economic evaluation estimated that the actual DAA cost was approximately 63% lower than the published PBS list price by dividing the Australian Government's committed expenditure over 2016-2021 by the reported 88,920 people treated during that period (32). As pharmaceutical prices do not generally follow the broader consumer price index, these estimates were not inflated to 2024 Australian dollars. Together, they suggest that the actual cost of DAA therapy is approximately 60-70% lower than the published PBS list price. Given that the launch price of a new medicine is typically highest, we assumed a 70% reduction from the PBS list price, resulting in an estimated average treatment cost of A$12,197. A sensitivity analysis using the full PBS list price was also conducted to assess the impact of DAA cost assumptions on the estimated return on investment (Appendix 2).

In addition to the drug costs, substantial costs are incurred for HCV testing, linkage-to-care, and pre-treatment assessment. A community-based HCV testing and linkage-to-care campaign conducted in Melbourne in 2021 estimated a total cost of approximately A$5,878 per person before initiating treatment (33). This equates to A$6,980 in 2024 (using the health CPI). Although this estimate was derived from a resource-intensive community-based case-finding program targeting people disengaged from care, and some upstream testing and outreach costs may exceed those in routine service delivery, it is likely to provide a reasonable estimate of treatment initiation costs among people who inject drugs. In fact, this estimate is likely conservative because it excludes post-treatment monitoring, linkage to care following reinfection, and long-term healthcare costs. We therefore used A$6,980 as the lower bound for treatment initiation costs, with a best estimate of A$7,678 (10% above the lower bound), and an upper bound of A$8,376 (20% above the lower bound), representing a ±10% uncertainty range around the best estimate.

The final overall healthcare cost per person treated for HCV was estimated by summing the DAA drug cost and the diagnosis and care cost, resulting in a best estimate of A$19,875 ($7,678 + $12,197) (Table 5). The lower and upper bounds were estimated at A$19,177 (equal to $6,980 + $12,197) and A$20,573 (equal to $8,376 + $12,197), respectively, reflecting uncertainty in the diagnosis and care costs.

This healthcare cost was not applied to all incidence HCV infections because a proportion of individuals spontaneously clear acute infection (up to 12 months after acquisition) and do not progress to chronic HCV requiring DAA treatment (34). Although some people with acute HCV may receive treatment, especially with the scale-up of point-of-care testing incorporating reflex RNA testing following antibody diagnosis or direct RNA testing, we assumed that individuals who spontaneously clear their infection do not receive treatment and therefore incur no HCV-related healthcare costs. Any diagnostic costs incurred before spontaneous clearance were assumed to be negligible and were not included in the analysis.

The proportion of acute HCV infections that spontaneously clear is difficult to estimate, and there is a wide range of published estimates. A systematic review and meta-analysis of 43 published studies between 2004 and 2015 identified six studies with sufficient follow-up to estimate spontaneous clearance and reported that 36.1% (95% CI: 23.5–50.9%) of acute infections cleared within 12 months of acquisition (34). The review also found that individuals who had not spontaneously cleared their infection by 12 months were unlikely to do so thereafter. We used this estimate and its 95% confidence interval to calculate the monetary benefits of averting HCV infections in the BCR equation. Accordingly, the monetary benefits of NSPs averting HCV infections (Eq. 5) were calculated as:

$$HCV\ monetary\ benefits = HCV\ infections\ averted \times (1 - spontaneous\ clearance\ \%) \times average\ HCV\ healthcare\ cost\ in\ 2024\ AUD.$$

The spontaneous clearance estimate used in the ROI 3 analysis was consistent with that applied in the Australian HCV cascade calculations reported in the *HIV, viral hepatitis and sexually transmissible infections in Australia: Annual surveillance report* (7).

2.2.4 NSP costs

Total NSP costs were estimated using a robust, nationally coordinated costing approach, with expenditure data collated by NSP managers across all Australian states and territories. Costs were disaggregated by NSP delivery mechanisms (primary and secondary services, pharmacies, and syringe dispensing machines) and cost components (operating, staffing, postal services, equipment and disposal, consumables, and transport), providing a comprehensive estimate of Australia's national investment in harm reduction (Table 2).

Table 2: NSP cost components and NSP types covered for each component

NSP cost component	NSP types covered
Annual NSP operations funds	Primary, Secondary, Pharmacy NSPs, Syringe Dispensing Machines
Costs of human resources	Primary, Secondary, Pharmacy NSPs
Postal NSP services	Primary, Secondary, Pharmacy NSPs
Costs of needle-syringe distribution/ disposal	All NSP Types
Cost of safe sex packs	All NSP Types
Consumables (water, swabs, filters, butterflies)	All NSP Types
Transport	All NSP Types

Complete NSP expenditure data were received from all states and territories except NSW, where expenditure data were available for 9 out of 15 local health districts (LHDs). However, the total number of syringes distributed were available for all LHDs. The overall NSW NSP costs were then estimated by extrapolating the overall expenditure from the 9 LHDs with available data to the overall state using the syringe distribution data.

For each of the 9 reporting LHDs, the cost per syringe (including operational, distribution, and unit costs) was calculated by dividing total NSP expenditure by the total number of syringes distributed within that LHD. The resulting mean syringe cost was then multiplied by the total number of syringes distributed across all 15 LHDs in NSW to estimate total NSP costs for NSW, as per the following equation:

$$The\ total\ NSP\ costs\ in\ NSW\ =\ total\ number\ of\ syringes\ distributed\ in\ NSW \times mean\ cost\ per\ syringe\ in\ NSW. \qquad \textbf{Eq. 6}$$

The lower and upper bounds for NSW NSP cost were derived from the minimum and maximum syringe costs reported across the 9 LHDs. Using this approach, total NSW NSP costs were estimated at A$11,312,492 (range: $5,926,632–$14,754,195; Table 3).

Table 3: Estimated cost per syringe, number of syringes distributed and total NSP costs in NSW in 2024 (A$).

	Mean	Lower bound	Upper bound
1. Calculated mean cost per syringe	$0.76	$0.40	$1.00
2. Reported total syringes distributed in NSW	14,797,565	14,797,565	14,797,565
3. Total NSP costs in NSW	$ 11,312,492	$ 5,926,632	$14,754,195

Note: *we assumed no uncertainty in the reported total syringes distributed in NSW.*

Total NSP costs across Australia in 2024, representing the denominator of the BCR calculation in Eq. 1, were estimated at A$39.99m (95% UI: $31.73m–$46.30m, 2024 AUD; Table 4). For all jurisdictions except NSW, lower and upper bounds were estimated by applying a ±10% methodological variation to the reported expenditure to account for residual methodological uncertainty despite the use of actual expenditure data. This variation reflects potential differences in reporting practices, categorisation of expenditure items, and the alignment of budget components across states and territories. For NSW, uncertainty was estimated directly using the extrapolation approach described above. Overall, this approach was intended to provide a conservative estimate of plausible variation in total NSP expenditure.

Table 4: Estimated NSP costs for each state and territory and Australia overall in 2024

	Estimate	Lower range	Upper range
ACT	$ 1,291,772	$ 1,162,595	$ 1,420,949
NSW	$ 11,312,492	$ 5,926,632	$ 14,754,195
NT	$ 862,855	$ 776,570	$ 949,141
QLD	$ 7,819,490	$ 7,037,541	$ 8,601,439
SA	$ 2,481,985	$ 2,233,787	$ 2,730,184
TAS	$ 1,075,584	$ 968,026	$ 1,183,143
WA	$ 4,133,885	$ 3,720,497	$ 4,547,274
VIC	$11,009,083	$ 9,908,175	$ 12,109,991
Australia	$ 39,987,147	$ 31,733,822	$ 46,296,316

***Note**: For all jurisdictions except NSW, lower and upper bounds were estimated by applying a ±10% methodological variation for residual uncertainty despite the use of actual expenditure data. This was to account for differences in reporting practices, categorisation of expenditure items, and alignment of budget components across states and territories. For NSW, uncertainty was estimated directly through the extrapolation approach (as described in section 2.2.4 and Table 3). Overall, this method was intended to provide a conservative estimate of plausible variation in total NSP expenditure.*

2.2.5 Final input parameter estimates

The complete set of input parameters used in the ROI 3 calculations, as described in the previous sections, are provided in Table 5. The corresponding best estimates and uncertainty ranges in this table are also available in the "*Epidemiological inputs*" sheet of the ROI 3 Calculations Spreadsheet.

Table 5: Final BCR equation input parameter estimates used in the ROI 3 calculations. Notes provide a summary of the data sources and calculations used to produce the estimates. See main text for further details**.**

Parameters	Best estimate (range)	Notes	Reference
Number of people who inject drugs in Australia	72,984 (54,817 – 108,752)	From 1995-2024 NSP NMDC report	(35)
Incidence rate (proportion of susceptible people per year) of HIV among people who inject drugs	0.0011 (0.0007 – 0.0017)	Estimate and 95% CI from analysis of ANSPS data in 2014. Assumed value for 2024.	(4)
Incidence rate (proportion of susceptible people per year) of HCV among people who inject drugs	0.054 (0.039 – 0.074)	Estimate and 95% CI from analysis of ANSPS data in 2023. Assumed value for 2024.	(15)
Spontaneous clearance rate (proportion of incidence infections)	0.36 (0.235–0.509)	Estimate and 95% CI from systematic review and meta-analysis of publications between 2004–2015. Same as estimate used for HCV cascade.	(34)
Relative risk (RR) of HIV	0.42 (0.22 – 0.81)	Estimate and 95% CI from a systematic review and metanalysis of publications between 2008–2012 on the association between exposure to NSP and a reduction in HIV transmission.	(19)
Relative risk (RR) of HCV	0.44 (0.24 – 0.8)	Estimate and 95% CI from a systematic review and metanalysis publications prior to 2017 on the effect of NSPs on HCV incidence among PWID.	(18)

Lifetime costs for HIV infection (AUD)	$281,107 ($194,367-$410,571)	Discounted (5%) estimate and range of HIV diagnosis, care and treatment for Australia in 2019 inflated to 2024 AUD using health CPI.	(23)
Costs for HCV infection (AUD)	$19,875 ($19,177 – $20,573)	Estimate and range for cost of diagnosis and DAA treatment of an HCV infection in 2024 AUD. See section 2.2.3.	(33, 36, 37)
NSP coverage (%)	85% (80% – 90%)	Estimate from the SuperMIX study.	(17)
NSP costs (AUD)	$ 39,987,147 ($ 31,733,822 – $ 46,296,316)	Collated from NSP expenditure data from all states and territories during 2024.	See Section 2.2.4

***Notes**: [1]Relative risk (RR) of HIV and HCV acquisition with high NSP coverage. Effectiveness = 1-RR. CI = confidence interval.*

2.3 Sensitivity analyses

Given the wide uncertainty ranges in the input parameters, we conducted comprehensive sensitivity analyses. This was done by first generating 10,000 parameter sets through random sampling from each of the input parameters lower and upper bounds (specified in Table 5, assuming a uniform distribution) and then calculating the BCR for each parameter set. Further univariate sensitivity analyses were conducted to examine the effects of alternative assumptions, including the use of the full published DAA list price (i.e., no price reduction), a reduction in DAA treatment costs to A$1,000 to reflect the potential availability of generic therapies in the future, and the inclusion of IRID-related outcomes.

3. Results

3.1 Main findings

The estimated health outcomes and return on investment associated with NSP implementation in Australia are presented in Table 5. This includes the estimated numbers of HIV and HCV infections averted, total cost savings, and the overall national benefit-to-cost ratio for NSPs in 2024. An estimated 94 (95% UI: 17–313) HIV infections and 4,264 (95% UI: 903–13,050) HCV infections were averted in 2024, resulting in total benefits of A$81 million (95% UI: $22 million–$220 million). This corresponds to a national return on investment of A$2.02 (95% UI: 0.56–5.66) for every dollar invested in NSPs.

Table 6: Results from ROI 3 calculations including infections averted, monetary benefits (infection averted x healthcare cost per infection), and the benefit-to-cost ratio (monetary benefits / NSP costs).

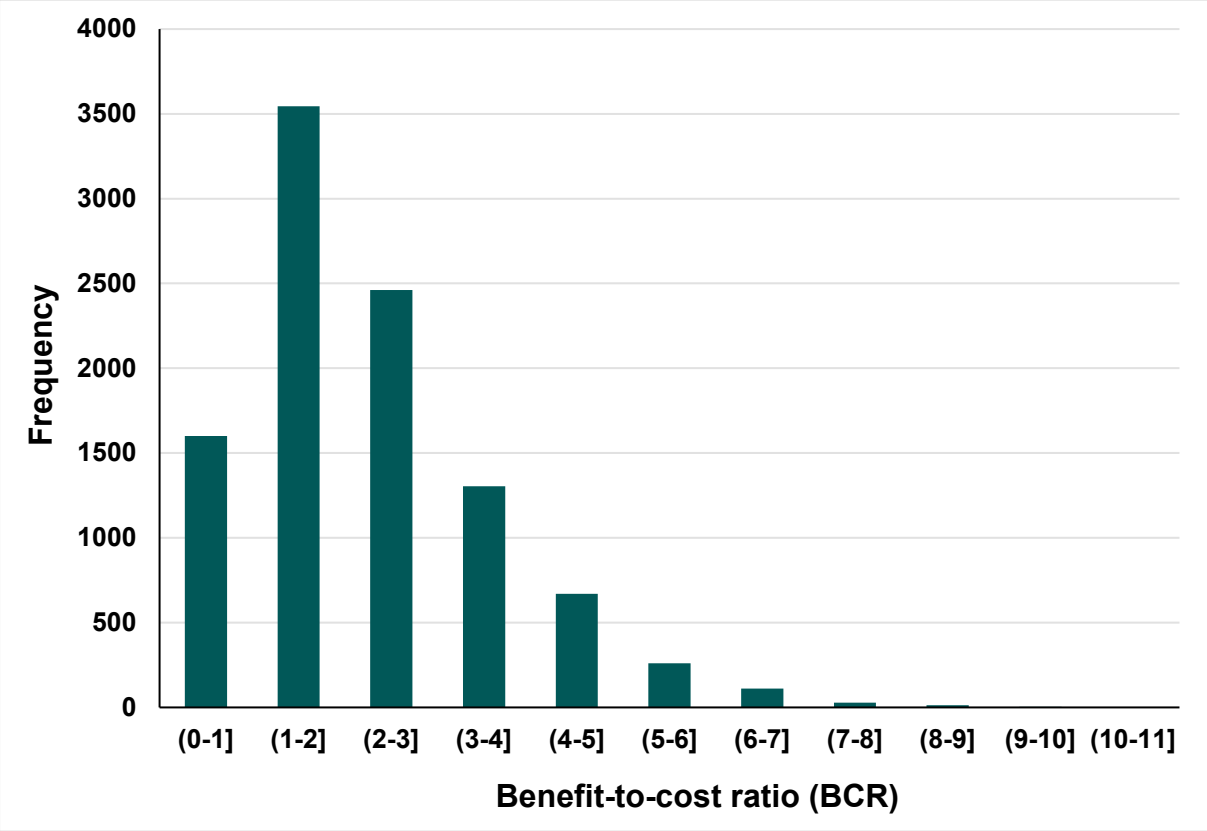
Outcome	Best estimate (95% UI)
HIV infections averted	94 (17 – 315)
HCV infections averted	4,264 (878 – 13,056)
Lifetime monetary benefits from HIV infections averted per year	$26,490,468 ($4,564,924–$99,519,354)
Monetary benefits from averted HCV infections per year	$54,147,614 ($10,811,577 - $166,925,286)
Total benefits (HCV and HIV) per year	$80,638,082 ($21,847,229 – $215,175,008)
Total NSP costs (see Table 5)	$ 39,987,147 ($32,078,828 – $45,957,057)
Benefit-to-cost ratio (BCR)	**2.02 (0.56 – 5.66)**

3.2 Results of the sensitivity analysis

Across all sensitivity analyses, the BCR varied but remained above 1 in the majority of scenarios, indicating that NSPs are likely to generate positive economic returns under a wide range of parameter values and plausible assumptions. In our sensitivity analysis, the BCR exceeded 1 in 83.7% of the sampled parameter sets (Figure 1), demonstrating a very high level of confidence that the economic benefits of NSPs outweigh the total NSP costs. Even under the extreme assumption of a DAA treatment cost of only $1,000

per treatment, the average BCR remained above 1 at AUD 1.25 per dollar invested, with 62.34% of sampled parameter sets producing a BCR greater than 1. Together, these findings demonstrate the robustness of the findings and provide strong evidence that NSPs consistently deliver net economic benefits.

Figure 1: Benefit-to-Cost Ratio (BCR) distribution from 10,000 randomly sampled parameter sets.



Notes: *Bars display the frequency of Monte Carlo simulation iterations falling within each benefit-cost interval (a,b]. Values are rounded up to the nearest integer that is greater than or equal to that number (e.g., 1.99 is in the (1-2] bar while 2.01 is in the (2-3] bar. The (0,1] interval indicates inputs where ROI <1.*

As noted in Section 2.1, the effects of IRID were excluded from the primary analysis due to limited evidence and substantial uncertainty in both incidence and the effectiveness of NSPs in preventing these outcomes. A supplementary analysis incorporating IRID into the BCR is presented in Appendix 1. Despite the uncertainty, including the estimated benefits associated with reduced IRID resulted in only a modest increase in the overall BCR, from $2.02 (95% UI: 0.56–5.66) in the base case analysis to 2.33 (95% UI: 0.80–6.49, Figure A1), indicating that the primary findings were not materially affected by the exclusion of IRID. Variations in DAA therapy costs can have a large effect, with the BCR ranging from 3.96 (1.00 – 11.55) if full list price is used and 1.25 (0.36 – 3.6) if the DAA cost is $1,000. The full results for the DAA cost sensitivity analyses are presented in Appendix 2.

4. Discussion

This updated economic evaluation suggests that for every A$1.00 invested in Australian NSPs, an estimated A$2.02 (95% UI: 0.56–5.66) is returned in averted healthcare costs associated with HIV and HCV infections. Sensitivity analyses demonstrated that these findings were robust to uncertainty in the calculation parameters. The BCR exceeded 1 in 83.7% of calculations, demonstrating strong confidence that the economic benefits of NSPs are likely to outweigh their implementation cost (total costs of NSP). Collectively, these findings demonstrate the robustness of the findings and provide strong evidence that NSPs consistently deliver net economic benefits. NSPs therefore remain a highly cost-effective investment and continue to represent an essential public health intervention in Australia.

The results of this analysis show that the return on investment has approximately halved since the previous evaluation. The ROI 2 study (2009) estimated that every dollar invested in NSP yielded A$4.00 in healthcare savings related to HIV and HCV infections over the period 2000-2010. This reduction in the ROI is not surprising given the substantial changes in the epidemiological and treatment landscape for HCV over the past decade. Following the rollout of DAA therapy, HCV RNA prevalence among people attending NSPs has plummeted from 51% in 2015 to 8% in 2024 (10). Consequently, the estimated numbers of HCV infections averted by NSPs are lower in the current analysis, reducing the overall ROI. This reduction is partially offset by an increase in treatment coverage and the costs associated with care. In ROI 2, the treatment coverage of both infections and the cost for care and treatment were lower and the long-term healthcare costs associated with HIV and HCV (e.g., cirrhosis, decompensated liver disease, hepatocellular carcinoma, and eventually liver transplantation) were estimated but discounted. In contrast, the ROI 3 analysis assumes that individuals who acquire HIV or chronic HCV receive timely treatment because of the widespread availability of testing and treatment services (excluding those who spontaneously clear acute HCV infection). This means in ROI 3, preventing a new infection via NSPs still averts an immediate and substantial healthcare expenditure that mirrors the long-term clinical costs avoided in ROI 2. Overall, our updated estimate of $2 returned for every $1 invested shows that NSPs continue to generate strong economic and public health benefits in Australia.

When DAA costs shift to generic pricing, the cost of a DAA therapy course is expected to fall substantially, reducing the immediate healthcare expenditure for each HCV infection prevented and, consequently, lowering the economic return (as shown in our sensitivity analysis where a DAA cost of $1,000 resulting in a BCR of 1.25; Figure A1). However, even though DAAs reduce the long-term health burden of HCV and improved treatment outcomes, they do not prevent reinfection and continue to involve significant

upfront costs. NSPs therefore remain essential for preventing new infections, reducing treatment demand, and interrupting ongoing transmission, and supporting the long-term sustainability of HCV elimination efforts.

Importantly, NSPs have played a pivotal role in maintaining the near virtual elimination of HIV transmission among people who inject drugs in Australia. Sustained access to sterile injecting equipment through NSPs means Australia has achieved one of the lowest rates of HIV transmission among people who inject drugs globally. Unlike HCV, HIV does not have a curative therapy, and individuals diagnosed with HIV require lifelong treatment and care. Preventing HIV infections therefore generates substantial long-term economic savings while also avoiding significant health and social consequences for affected individuals. The continued suppression of HIV transmission among people who inject drugs represents one of the major public health achievements supported by NSPs and contributes importantly to the overall return on investment observed in ROI 3.

Beyond their direct impact on HIV and HCV prevention, NSPs function as a cornerstone of comprehensive harm reduction and health service engagement. NSPs provide opportunities for testing, treatment initiation, referral to care, and ongoing engagement with healthcare services for people who inject drugs. They also complement other prevention and treatment initiatives, including DAA scale-up programs, and strengthen Australia's broader public health response to blood-borne viruses.

Collectively, these findings highlight that NSPs are not only highly cost-effective interventions but also a foundational component of Australia's efforts to eliminate HIV and HCV as public health threats. The sustained effectiveness of NSPs in preventing new infections, maintaining the near elimination of HIV transmission among people who inject drugs, and supporting progress towards HCV elimination provides strong evidence for the importance of ongoing and adequate investment in NSP programs. Continued funding of NSPs will be critical to preserving past public health gains and achieving Australia's national elimination targets. Without continued investment, these gains may not be sustained, increasing the risk of a resurgence in HIV and HCV transmission.

4.1 Limitations

While the simplified BCR approach enhances clarity and reproducibility, several limitations should be considered.

The analysis only examines the prevention of HIV and HCV infection and does not include the potential economic return on investment from other benefits of NSPs such facilitating access to drug treatment, medical care and social services, and reductions in morbidity associated with injecting related injuries and diseases (IRID). As noted, there is a paucity of data with which to estimate the incidence of IRID among people who inject drugs, and to quantify the effectiveness of NSPS in preventing these outcomes. With the limited data available, a supplementary analysis including IRID suggested only a modest increase in BCR to 2.33 (95% UI: 0.80–6.49), compared with $2.02 (95% UI: 0.56–5.66) in the base case. This estimate of BCR including IRID is far less robust than HIV and HCV outcomes and should be interpreted with caution.

The analysis applies uniform national estimates for NSP coverage and effectiveness and does not account for heterogeneity in risk among people who inject drugs, which may vary by socioeconomic, geographic, the types of drugs injected, and behavioural factors; consequently, effects may be over- or underestimated in specific local contexts. The calculation also assumed no effect of NSPs on uptake or scale-up of direct-acting antiviral (DAA) treatment, despite evidence that NSPs facilitate engagement with testing and care, further contributing to conservative estimates of impact.

The analysis considers only direct healthcare costs and excludes broader societal and indirect benefits, including out-of-pocket and travel costs, reduced secondary transmission, and productivity gains, meaning the estimated return on investment is conservative. Although lifetime infection costs were incorporated, the simplified approach may not fully capture the evolving long-term costs associated with managing complex co-morbidities, ongoing immune disfunction post-DAA treatment, and ageing populations living with HIV and HCV.

The analysis also does not capture potential health gains associated with earlier diagnosis and treatment of HCV infections, including QALY gains from preventing disease progression. While most recently acquired HCV infections are now treated before the development of advanced liver disease, some individuals remain undiagnosed or untreated and may still progress to cirrhosis and other HCV-related complications. Therefore, assuming negligible disability associated with HCV and HIV infections may underestimate the full health benefits attributable to NSPs.

Understanding and obtaining data for the full impact of NSPs in isolation and combination with other interventions will become increasingly important as HCV and

HIV transmission decline and HCV treatment becomes cheaper. If Australia achieves its strategic targets of the virtual elimination of HIV and HCV transmission by 2030 (5, 6) then only considering these infections will result in lower ROI estimates for NSPs that do not reflect the true impact of NSPs and their role in sustained elimination of these infections when achieved.

Finally, the estimated BCR is sensitive to assumptions regarding parameters such as future DAA treatment costs and the inclusion of additional health benefits, including IRID. Accordingly, the precise estimates should be interpreted with caution. However, sensitivity analyses demonstrated that, although the magnitude of the return on investment varied, the overall conclusion that NSPs provide substantial economic value remained unchanged.

5. Conclusions

The ROI 3 findings provide strong updated evidence supporting the continuation and optimal funding of NSPs in Australia. An estimated return of $2.02 for every dollar invested provides a compelling economic justification for sustained investment in NSPs and reinforces their value as a core public health intervention, essential to achieve the elimination of HCV and to sustain the virtual elimination of HIV among people who inject drugs.

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Appendix 1. Injection-related injury or diseases (IRID)

Injection-related injuries and diseases (IRID) comprise a broad range of non-viral harms associated with injecting drug use, through poor injecting technique, use of non-sterile injecting equipment, and contamination of the injecting environment or substance being injected. IRID include soft tissue trauma at the site of injection, vascular injury and complications (e.g. thrombophlebitis, deep vein thrombosis, venous sclerosis, chronic venous insufficiency) and peripheral nerve damage, localised bacterial and fungal infections (e.g. abscesses, cellulitis), and systemic infections (e.g. bacteraemia, sepsis, osteomyelitis, infective endocarditis, osteomyelitis, and septic arthritis). Collectively, IRID contribute to substantial morbidity and mortality among people who inject drugs and associated healthcare costs. Prevention of IRID represents an additional potential benefit of NSPs.

While ROI 1 and ROI 2 evaluations did not include IRID-related outcomes, we explored the potential additional return on investment associated with preventing IRID in the ROI 3 calculations. Due to substantial uncertainty surrounding both IRID incidence and the effectiveness of NSPs in reducing IRID, these outcomes were not included in the primary analysis and were instead examined as a supplementary secondary analysis.

A.1 Incidence of IRID

Data on IRID incidence were obtained from the 2024 National Illicit Drug Reporting System (IDRS), a cross-sectional survey of people who regularly inject drugs recruited from NSPs (51%) and peer referral across all Australian capital cities. Among 877 participants in 2024, 29% reported experiencing at least one injection-related health issue in the month preceding interview. Reported conditions included accidental arterial injection (6%), nerve damage (12%), blood clot (5%), deep vein thrombosis (1%), skin abscess (11%), serious infection such as sepsis or osteomyelitis (3%), infective endocarditis (1%), and ‘dirty hits’ (7%). For calculation purposes, the annual IRID incidence among people who inject drugs with current NSP coverage was estimated at 0.29 (95% CI 0.261 – 0.321) episodes per person-year (38). Lower and upper bounds were estimated with the sample size of 877 from the report (using a normal approximation for the 95% CI calculation).

A.2 Effectiveness of NSP in reducing IRID incidence

Published evidence directly estimating the effectiveness of NSPs in preventing IRID is limited. Consequently, a proxy-based approach was used. Colledge et al. (2020)(8) reported that people who reused their own needle-syringe had a 76% higher risk of IRID compared with those who did not report reuse (RR = 1.76; 95% CI: 1.06–2.91).

Because high NSP coverage is expected to reduce syringe reuse, this association was used as a proxy for the protective effect of NSPs against IRID. Under this assumption, the relative risk of IRID associated with NSP exposure was estimated as the reciprocal of 1.76 (RR = 1/1.76 = 0.568). This corresponds to an estimated NSP effectiveness of 43.2% (1-RR = 1 − 0.568 = 0.432). This estimate should be interpreted cautiously, as it represents an indirect proxy-based estimate rather than a direct measure of NSP effectiveness in preventing IRID.

A.3 Costs per IRID episode

Due to limited Australian cost data, IRID treatment costs were estimated using a simplified approach incorporating both hospitalisation and non-hospitalisation costs to estimate an upper, lower, and median value.

Upper bound estimate: A previous Australian study reported an incidence of injection-related infection hospitalisations of 3.1 per 100 person-years among people who inject drugs (39). The weighted average hospitalisation cost was A$13,809 (range: $10,595–$20,100) in 2023 (40), inflated to $14,361 (range: $11,019–$20,904) in 2024 AUD using the health CPI. Assuming an overall IRID incidence rate of 0.29 episodes per person-year, approximately 11% (0.031/0.29=0.11) of IRID episodes were estimated to result in hospitalisation. Applying this proportion resulted in an estimated upper-bound average cost of A$1,580 per IRID episode ($13,809 x 0.11= $1,867).

Lower bound estimate: A lower-bound estimate was derived by dividing the total annual cost of treating injecting-related infections (A$25,644,055 per year) (41) by the estimated population of people who inject drugs (n=214,700) (1), and then dividing by the incidence rate (0.29 episodes per person-year). This resulted in an estimated cost of A$412 per IRID episode in 2009, inflated to $482 in 2024 AUD.

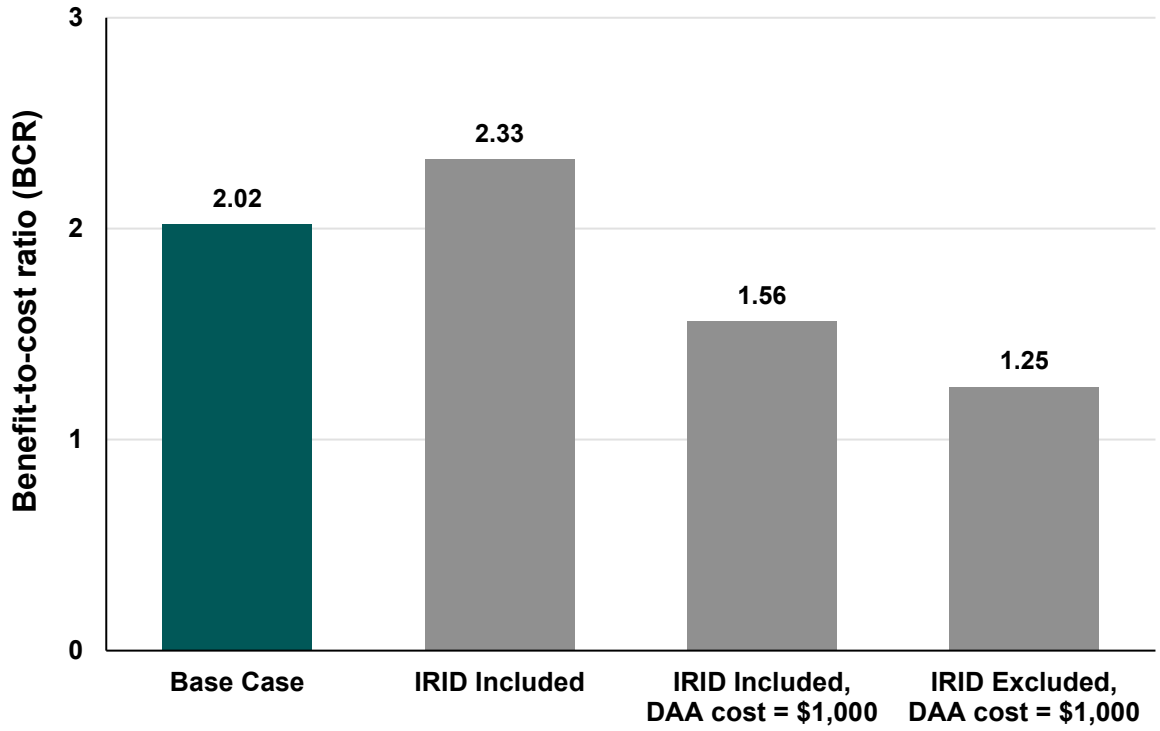
Median estimate: A weighted average cost per IRID was estimated assuming 3.1% of episodes incurred hospitalisation costs (based on a hospitalisation incidence of 3.1 per 100 person years, A$14,361), while the remaining 96.9% incurred non-hospitalisation costs (A$482 per episode). This resulted in an estimated average cost of A$912 per IRID episode.

A.4 BCR including IRID

Including IRID-related benefits in the analysis resulted in a slightly higher BCR of **2.33 (95% UI: 0.80–6.49, Figure A1)**, compared with the base-case BCR excluding IRID **$2.02 (95% UI: 0.56–5.66)**, see Figure A1. The relatively modest increase in BCR indicates that IRID contributed comparatively little to overall ROI estimates compared with HIV and HCV-related benefits under our assumptions. In addition, estimation of

IRID-related benefits was subject to considerable uncertainty due to limited published evidence directly quantifying the NSP effectiveness in reducing IRID and limited Australian cost data. As a result, the Inclusion of IRID produced only a modest increase in the BCR and did not alter the overall conclusion of our primary analysis that NSPs generate substantial net economic benefits.

Figure A1: Benefit-cost ratio (BCR) estimates for the base case compared to univariate sensitivity scenarios with IRID included and with DAA treatment costs reduced to A$1,000.



Appendix 2. Sensitivity in DAA costs

In the main analysis, we applied a 70% price reduction to the published list price, as described in Section 2.2.3, yielding an estimated average DAA treatment cost of A$12,196 per person. This reduced cost was used in the base case analysis. As a sensitivity analysis, we explored the impact of removing the DAA price reduction, using the full published PBS list price rather than the government-negotiated price. Without the 70% price reduction applied to DAA costs, the BCR was substantially higher at 3.96 (95% UI: 1.00–11.55), compared with the base case estimate of 2.02 (95% UI: 0.56–5.66). These results underscore the sensitivity of the ROI estimate to assumptions about DAA treatment costs and highlight the importance of developing a more accurate and transparent understanding of how DAA therapy is priced and funded in Australia. Given that confidential rebate arrangements mean the true government cost remains uncertain, future analyses would benefit from access to more precise expenditure data to produce robust and defensible estimates of the economic value of NSPs.

Figure A2: Benefit-cost ratio (BCR) estimates for the base case compared to univariate sensitivity scenarios with no reduction in DAA treatment cost (grey bar) and A$1,000 DAA treatment cost (light teal bar).