EXECUTIVE SUMMARY

In 2000, the Department of Health and Ageing engaged Health Outcomes International Pty Ltd (HOI) in association with the National Centre for HIV Epidemiology and Clinical Research (NCHECR) to undertake a study into the economic effectiveness (or return on investment) of needle and syringe programs (NSPs) in Australia.

The study updates and expands a study previously undertaken by Hurley, Jolley and Kaldor which investigated the effectiveness and cost effectiveness of needle and syringe programs in relation to HIV/AIDS (see 'The effectiveness and cost-effectiveness of needle and syringe exchange programs' in *An Economic Evaluation of Aspects of the Australian HIV/AIDS Strategie*s, Technical Appendix 2 to *Valuing the past…investing in the future - Evaluation of the National HIV/AIDS Strategy 1993-94 to 1995-96)*.

The study seeks to analyse the effectiveness of needle and syringe programs in preventing transmission of HIV, and hepatitis C (HCV) in Australia from 1991 (that is from when NSPs were well established in all jurisdictions except Tasmania) to the end of 2000. The study then uses these findings to calculate the return on investment from NSPs from 1991 to 2000.

EFFECTIVENESS OF NSPS FOR PREVENTING TRANSMISSION OF HIV AND HCV INFECTION

In this study, NCHECR repeated the ecological study of change in HIV prevalence in cities with and without NSPs because several countries have introduced NSPs since the previous study (Hurley et al. 1997). The study also used a similar methodology to assess the effectiveness of NSPs for prevention of HCV infection.

The ecological study design was used to compare HIV and HCV infection among injecting drug users in countries with and without NSPs. Data recorded on HIV and HCV infection included both seroprevalence and seroincidence studies. NSPs were defined as programs distributing needles and syringes, either free or with minimal charge, irrespective of whether they operated from a fixed or mobile site, whether return of a used syringe was mandatory, or the range of other HIV and HCV prevention and treatment services provided.

For HIV, there were 778 calendar years of data from 103 cities with HIV seroprevalence measurements from more than one year and information on NSP implementation. Studies were from 67 cities without NSP, 23 cities that implemented NSP between the first and last study, and 13 cities that already had NSP when the studies were carried out.

The analysis found that cities that introduced NSPs had a mean annual 18.6% decrease in HIV seroprevalence, compared with a mean annual 8.1% increase in HIV seroprevalence in cities that had never introduced NSPs (mean difference –24.7% [95% CI: –43.8%, 0.5%], p=0.06). An analysis which weighted each city by one over the variance of the fitted regression line estimated the mean difference in annual rates of change in HIV-seroprevalence between cities with and without NSPs to be –32.7% [95% CI: -37.5% to -27.6%] p<0.001. In cities with an initial HIV prevalence less than 10% and with sero-surveys over a period of at least three years, the mean annual decrease in HIV prevalence was 4.0% in cities that introduced NSPs, compared with a mean annual 28.6% increase in cities without NSPs (mean difference –25.3% [95% CI: -50.8%, 13.3%], p=0.2). In these cities, the weighted analysis estimated the mean difference to be –18.4% [95% CI: -32.0% to –2.0%] p=0.030. Because the unweighted results are qualitatively very similar and, for all cities, the point estimate is smaller than the weighted analysis, estimates of NSP effectiveness were based on the unweighted analysis, representing a more conservative approach.

For HCV, there were 190 calendar years of HCV seroprevalence data from 101 cities. Data were from 41 cities without NSP, 9 cities that implemented NSP between the first and last study, and 51 cities that already had NSP when the studies were carried out.

Median HCV prevalence was 75% (range 24% to 96%) in studies from cities without NSPs and 60% (range 17% to 98%) in cities with NSPs (NPtrend p=0.01). Overall the results indicated little change in HCV prevalence before

NSPs were introduced, followed by a decline after the introduction of NSPs. If HCV prevalence was 75% or 50% respectively before NSPs were introduced, the results correspond to around a 1.5% or 2% decline in HCV prevalence per annum.

The results of the analysis of the effect of NSPs on HIV and HCV prevalence internationally were then applied to estimates of the Australian injecting drug user population to estimate the number of cases of HIV and HCV avoided as a result of the activities of NSPs over ten years during the 1990s. The estimates are presented below.

ESTIMATES OF INJECTING DRUG USERS LIVING WITH HIV/AIDS

- WITH NSP INTRODUCTION

The number of injecting drug users living with HIV/AIDS is estimated to have peaked in the early 1990s at approximately 470 cases, with a peak in people living with AIDS of less than 100 in the late 1990s. The cumulative number of deaths from HIV/AIDS by 2010 is projected to be approximately 350.

- WITHOUT NSP INTRODUCTION

The number of injecting drug users living with HIV/AIDS is estimated to peak in 2000 at approximately 26,000, with a peak in people living with AIDS of almost 3,000 in 2010. The estimated cumulative number of deaths from HIV/AIDS by 2010 is projected to be approximately 5,000.

- PREVENTED THROUGH NSP INTRODUCTION

By the year 2000, approximately 25,000 HIV infections are estimated to have been prevented among injecting drug users since the introduction of NSPs in 1988, and by 2010 approximately 4,500 deaths are projected to have been prevented.

ESTIMATES OF INJECTING DRUG USERS WITH HCV AND HCV-RELATED DEATHS

- WITH NSP INTRODUCTION

In 2000, the number of injecting drug users living with HCV was estimated to be approximately 200,000 (approximately 150,000 with chronic HCV infection). By 2010 an estimated 11,800 injecting drug users are projected to be living with cirrhosis, and estimated cumulative HCV-related deaths are projected to be 1,800.

- WITHOUT NSP INTRODUCTION

In 2000, the number of injecting drug users living with HCV is estimated to be approximately 220,000 (approximately 165,000 with chronic HCV infection). By 2010 an estimated 12,500 injecting drug users are projected to be living with cirrhosis, and estimated cumulative HCV-related deaths are projected to be 1,900.

- PREVENTED THROUGH NSP INTRODUCTION

By the year 2000, approximately 21,000 HCV infections are estimated to have been prevented among injecting drug users since the introduction of NSPs in 1988, (of which approximately 16,000 would have developed chronic HCV); while by 2010 approximately 650 fewer injecting drug users are projected to be living with cirrhosis and 90 HCV-related deaths would have been prevented.

FINANCIAL EFFECTS OF NSPS

EXPENDITURE ON NSPS

Between 1991 and 2000, an estimated $141 million ($150 million in 2000 prices) was expended on NSPs across Australia, comprised of $122 million (87%) by government, and $19 million (13%) in consumer expenditure.

These data cover expenditure on NSPs operating within the programs managed by State and Territory health authorities. It excludes costs associated with the many retail pharmacies that also sell needles and syringes on a commercial basis, for which reliable data is not available on the number of needles sold or the level of expenditure by consumers.

TREATMENT COSTS AVOIDED

Estimates of the lifetime costs of treatment for HIV and HCV cases avoided are based on past and current treatment regimes by disease stage and applied over the projected lifetime of cases. Standardised costs have been used for each component of health care using year 2000 prices.

- HIV

For HIV, annual treatment costs are estimated to rise progressively to the year 2008 as patients progress to later stages of the disease, at which time they peak at approximately $269 million. Thereafter, annual costs decline, brought about mainly by the declining number of patients in the second and third stages of HIV. Total HIV treatment costs avoided over the lifetime of cases are estimated at $7,025 million (undiscounted). These represent the savings that accrue from a combination of the following:

- ☐ Approximately 25,000 cases of HIV avoided, who
- ☐ live for an average of about 24 years after infection, and who
- ☐ incur average treatment costs of nearly $14,000 each year of their life after diagnosis.

- HCV

For HCV, annual treatment costs rise progressively to the year 2040, at which time they peak at approximately $18.8 million and decline thereafter. The major factor influencing this cost profile is the number of patients who progress to liver failure who, while relatively small in number, have extremely high costs of treatment. Total HCV treatment costs avoided over the lifetime of cases are estimated at $783 million (undiscounted).

Overall, total treatment costs avoided over the life of the cases of HIV and HCV avoided by NSPs are approximately $7,808 million (before discounting). The costs of HIV treatment avoided are approximately ten times those for HCV, which reflects a combination of the number of cases avoided in the first instance (25,000 for HIV compared to 21,000 for HCV), a higher diagnosis rate for HIV than HCV, and higher average annual treatment costs for HIV than for HCV.

FINANCIAL RETURN ON INVESTMENT

The calculation of financial return on investment discounts future cashflows associated with the investment in the NSP program and treatment costs avoided by an agreed discount rate. The discount rate most commonly used in government programs of this nature is 5% per annum. For the purposes of illustration, we have also applied discount rates of 3% and 0%.

- HIV IMPACTS

The results of the analysis of financial return on investment in NSPs to government and in total, having regard to the impacts on HIV alone, are presented in Table 1.

Table 1 Net Present Value of investment in NSPs for HIV.

Discount Rate	Net Present Value, 1991 ($million, Year 2000 Prices)	
	Govt Expenditure	All Expenditure
Lifetime Costs of Treatment		
5%	$2,277	$2,262
3%	$3,415	$3,398
0%	$6,896	$6,876

The analysis indicates that there have been significant financial savings accruing to government from the investment in NSPs to date, and that these savings will continue to accrue into the future.

- HIV AND HCV IMPACTS COMBINED

The financial return on investment in NSPs to government and in total, having regard to the impacts on HIV and HCV combined, are presented in Table 2.

Table 2 Net Present Value of investment in NSPs for HIV and HCV combined.

Discount Rate	Net Present Value, 1991 ($million, Year 2000 Prices)	
	Govt Expenditure	All Expenditure
Lifetime Costs of Treatment		
5%	$2,402	$2,386
3%	$3,653	$3,637
0%	$7,678	$7,658

The analysis indicates that the incorporation of HCV into the NPV calculations has further increased the savings accruing to government and in total.

In summary, the study indicates that the financial return on investment will exceed manyfold the original investment in NSPs, and that the original investment had been fully recouped and surpassed by the end of the investment period, before any future savings are taken into account. The investment in NSPs is justified by the effect on HIV alone, with the effect on HCV providing an additional financial benefit, albeit a smaller one than HIV. Sensitivity analysis on the main variables used in the analysis indicates that the results are robust under a range of alternative assumptions and scenarios.

QUALITY OF LIFE (QOL) EFFECTS OF NSPS

Since both HIV and HCV are potentially life-threatening conditions, one of the main benefits from averting infections is the prevention of premature mortality. In addition, significant quality of life benefits may also accrue from the avoidance of HIV and HCV. The most widely used approach for estimating quality of life benefits in economic evaluations is the quality-adjusted life-year (QALY). In this approach, states of health are assigned a health state preference or 'utility' value, on a scale including 1.0 (full health) and 0 (death). The amount of time an individual spends in a given health state is then multiplied by the health state preference value to calculate the quality-adjusted life-years (QALYs) gained. The main advantage of the QALY approach is that it provides one combined measure of the benefits of a program that both extends life and maintains quality of life.

LIFE YEARS GAINED

The number of life years gained provides a measure of the additional number of years by those persons who would otherwise have been infected with HIV and HCV, but for the effect of NSPs.

The effect of NSPs in terms of life years gained is much greater for HIV than for HCV. The 25,000 persons avoiding HIV are expected to gain an additional 588,000 life years (about 23 years each) than if they had contracted HIV. In comparison, the 21,000 persons avoiding HCV are expected to gain only about 1,200 life years over their lifetime. The difference in these outcomes is essentially due to the different mortality rates associated with each disease and their rate of progression through the various stages.

QUALITY ADJUSTED LIFE YEARS GAINED

The application of an adjustment factor to the number of life years gained to take account of the quality of life effects of these diseases leads to a measure referred to as Quality Adjusted Life Years (QALYs). QALYs gained incorporates both the quantity of life gained, and the quality of life gained by avoiding HIV and HCV.

The 25,000 persons avoiding HIV are expected to gain an additional 715,000 quality adjusted life years than if they had contracted the disease. In comparison, the 21,000 persons avoiding HCV are expected to gain about 120,000 quality adjusted life years over their lifetime. The difference between the two diseases is largely attributable to the greater effect of HIV on the "quantity" of life compared to HCV, rather than the "quality" effect.

Applying the same discount rates used in the financial analysis (viz 5%, 3% and 0%) to QALYs gained results in the figures shown in Table 3

Table 3 Net Present Value of QALYs gained for HIV and HCV

Discount Rate	Net Present Value, 1991 (QALYs)		
	HIV	HCV	HIV & HCV
5%	138,072	32,207	170,279
3%	248,364	50,041	298,406
0%	715,245	119,992	835,237

The analysis of the effects of HIV and HCV on both the quantity of life and the quality of life of persons with these diseases adds a further dimension to the assessment of the effect of NSPs among injecting drug users. The benefits demonstrated for consumers in terms of the number of lives saved, the number of life years gained, and the improved quality of life are additional to the direct financial benefits to governments previously identified.

Our analysis demonstrates that NSPs have contributed significantly to:

- ☐ The number of cases of HIV and HCV avoided;
- ☐ A reduction in the number of deaths from HIV, and to a lesser extent from HCV;
- ☐ An increase in the number of life years among injecting drug users, particularly from the avoidance of HIV; and
- ☐ An improvement in the quality of life among injecting drug users who would otherwise have contracted HIV or HCV.

Each of these outcomes should be considered over and above the direct financial benefits achieved from the investment in NSPs. It is clear that if we were to place a monetary value against any of these outcomes, the financial gains already demonstrated would be significantly increased.

CONCLUSION

The study into the effect of NSPs on HIV and HCV, and the consequent return on investment from these programs has reinforced the original findings by Hurley, Jolley and Kaldor. The results demonstrate that NSPs are effective in reducing the incidence of both diseases and that they represent an effective financial investment by government.

From a financial perspective, we have considered only the direct costs of treatment saved by the avoidance of HIV and HCV. Such an approach is inherently conservative, and it is likely that there are further financial benefits derived from the investment in NSPs not included in our findings. As such, the savings we have demonstrated, if anything, understate the total financial benefits to government and members of the community.

When considering the effect of NSPs on the lives of those immediately affected by their operation, namely injecting drug users, the study again demonstrates that NSPs have a positive impact. This has been measured in terms of avoidance of deaths, gains in the duration of life and improvements in the quality of life of injecting drug users. Such benefits are additional to the financial benefits demonstrated.

The study has considered the investment in NSPs during the 1990s, at which time we have assumed that the investment ceased. The consideration of effect has been limited to the future benefits accruing from the cases of HIV and HCV avoided during the investment period. The results demonstrate that, across all measures of effect used in the study, NSPs have yielded a significant public health benefit, and that continued investment is warranted from both a financial and human perspective.