Epidemiological and economic impact of potential increased hepatitis C treatment uptake in Australia

2010

NATIONAL CENTRE IN HIV EPIDEMIOLOGY AND CLINICAL RESEARCH

UNSW THE UNIVERSITY OF NEW SOUTH WALES

ISBN 978 0 7334 2892-0

This publication is available at Internet address **http://www.nchecr.unsw.edu.au**

Suggested citation:
National Centre in HIV Epidemiology and Clinical Research. Epidemiological and economic impact of potential increased hepatitis C treatment uptake in Australia 2010. National Centre in HIV Epidemiology and Clinical Research, The University of New South Wales, Sydney, NSW

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Executive summary

Hepatitis C virus (HCV) is a blood-borne virus; HCV infection is one of the most commonly notified diseases in Australia and is a major health problem. About 284,000 people were infected with HCV in Australia in 2008, with nearly 10,000 new infections occurring each year. Most new HCV infections are a result of injecting drug users (IDUs) sharing injecting equipment.

Despite advances in HCV therapy and most of the treatment costs covered by the government, the number of HCV-infected people receiving treatment has remained low, at around 3,500 (1-2% of chronic HCV cases) in 2008. At current HCV treatment levels, the burden of advanced liver disease is projected to continue to rise over the next two decades.

This project investigated the possible effects of increased rates of treatment, compared with current treatment rates, on the future health and economic burden of hepatitis C around Australia.

Methods

A dynamic mathematical model was used to reflect the current burden and project the future burden of chronic HCV infection around Australia for each of the following treatment scenarios:

- *Current treatment scenario*: no change from current practice;
- *Reduction scenario*: treatments decline to 2,000 per year from 2010 onwards;
- *Increased scenario 1*: treatments increase steadily to 6,000 per year from 2011 onwards;
- *Increased scenario 2*: treatments increase steadily to 8,000 per year from 2012 onwards;
- *Increased scenario 3*: treatments increase steadily to 12,000 per year from 2014 onwards.

Key findings

Under the current treatment scenario, where about 3,500 cases are treated each year, it was estimated that there would be about 11,700 new cases of hepatitis C in Australia in 2010, which would remain relatively stable over the next 30 years (Figure 1). The model estimated 228 new cases of liver failure, 121 new cases of hepatocellular carcinoma (HCC), 44 liver transplant cases, and 241 liver-related deaths in 2010. These cases would increase by 11-13% in the next 30 years under current conditions.

Under the reduced treatment scenario, where treatments decreased to 2,000 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%.

If treatment rates are increased over the next five years to 6,000, 8,000, or 12,000 cases per year (increased treatment scenarios 1, 2, and 3), the number of new cases of liver failure and HCC over 30 years would be expected to decrease by 6-7%, 12-14%, and 20-22%, respectively. Similarly, the number of liver-related deaths and liver transplants would decline by 3-4%, 9-10%, and 17-18% respectively over the period.

Under the increased treatment scenarios 1, 2, and 3, the incremental quality-adjusted life years (QALYs) gained would be 1,174, 1,778 and 2,687 per year, respectively.

Under the increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $3.5m, $5.5m, and $9m each year respectively over the next 30 years (5% discount). There would no longer be cost savings if the health sector cost is increased by 50%.

From a health sector perspective, the incremental cost-effectiveness ratios (ICERs) for increased treatment scenarios 1, 2, and 3 relative to the current treatment scenario were $17,028, $16,891, and $16,577 per QALY respectively for the period 2010-2039 (5% discount).

Conclusions

Increased hepatitis C treatment up to about three times the current levels will increase life years (LYs) and QALYs in the long-term, and is associated with total cost savings. It is cost-effective and comparable to other well-accepted public health interventions. Strategies to improve treatment uptake remains a critical priority.

Acknowledgements

This report was conducted by a team of investigators at the National Centre in HIV Epidemiology and Clinical Research, The University of New South Wales, Sydney, Australia and the Toronto Health Economics and Technology Assessment Collaborative, University of Toronto, Toronto, Canada. The technical analysis was carried out by Rosie Thein, Alexander Hoare, David Wilson, and Murray Krahn. Greg Dore acted in an advisory manner. Amy Kwon, Jenny Iversen, and Lisa Maher provided and interpreted data for use in the analysis.

The authors would also like to thank Ann Magnus, Deakin University, Melbourne and Jonathan Anderson, NCHECR, Sydney, and Louisa Wright and James Jansson for their technical assistance.

The work presented in this report was funded by Roche Products (Australia) Pty Ltd. Dr. Krahn is the F. Norman Hughes Chair in Pharmacoeconomics, Faculty of Pharmacy, University of Toronto. The National Centre in HIV Epidemiology and Clinical Research is funded by the Australian Government Department of Health and Ageing and is affiliated with the Faculty of Medicine, The University of New South Wales.

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Contents

Glossary

Abbreviations

CEA	Cost-effectiveness analysis
CUA	Cost-utility analysis
HCC	Hepatocellular carcinoma
HCV	Hepatitis C virus
ICER	Incremental cost-effectiveness ratio
IDU(s)	Injecting drug user(s)
LY(s)	Life year(s)
MBS	Medical Benefits Schedule
NCHECR	National Centre in HIV Epidemiology and Clinical Research
PBS	Pharmaceutical Benefits Scheme
PEG-IFN	Pegylated interferon
QALY(s)	Quality-Adjusted-Life-Year(s)
SVR	Sustained virological response

Definition of terms

Cost-effectiveness analysis	A technique in which the cost and effects of an intervention and an alternative are presented in a ratio of incremental cost to incremental effect.
Cost-effectiveness ratio	The incremental cost of using an intervention to obtain a unit of effectiveness (such as dollars per life-year gained) compared with an alternative, such as another treatment or no treatment.
Cost-utility analysis	A type of cost-effectiveness analysis that uses quality-adjusted life-years as the effectiveness end point. By convention, cost-utility analyses are often referred to as cost-effectiveness analyses; however, not all cost-effectiveness studies use cost-utility methods.
Cost-utility ratio	The incremental cost of an intervention to achieve one quality-adjusted life-year, compared with an alternate intervention.
Direct medical costs/health sector costs	The cost of medical resources consumed, such as physician visits, surgery, medical supplies, and hospitalisation. These costs are included in the numerator of the cost-effectiveness ratio.
Discounting	The conversion of future dollars spent and future health outcomes (such as life-years saved in 20 years from an intervention provided today) to their present value.
Effectiveness	The extent to which an intervention achieves health improvements, which can be measured in terms of such outcomes as cases of disease prevented, years of life saved, or quality-adjusted life-years saved
Health state	The condition of a person's health, including any disease, disability, and functional status
Incremental cost	The difference between the cost of an intervention and the cost of the comparator.
Incremental effect	The difference between the effect of an intervention and the effect of the comparator.
Incremental cost-effectiveness ratio	The incremental cost of an intervention divided by the incremental effectiveness.

Quality-adjusted life years	A method that assigns a preference weight to each health state, determines the time spent in each state, and estimates life expectancy as the sum of the products of each preference weight and time spent in each state.
Sensitivity analysis	Analysis that determines the impact of changing one or several variables in a model or analysis on the outcome of the analysis. A sensitivity analysis allows a range of plausible inputs to be considered when there is uncertainty about the true value of an input. An example is comparing results using a discount rate of 5% with result using rates of 0% and 3%.
Sustained virological response	Undetectable HCV RNA by a sensitive assay at the end of a 24-week follow-up period after completion of treatment. It is considered a 'cure' for the infection.
Time cost	The cost of the time a patient incurs while seeking or receiving care.
Utility	A person's preference for a particular health state or treatment outcome, measured by using the standard gamble technique, the time-tradeoff, or rating scale. The time-tradeoff and rating scale methods do not incorporate uncertainty into their questions and technically do not produce 'utilities'. Higher levels of utility indicate a greater preference.

Introduction

Hepatitis C virus infection

The public health burden of hepatitis C virus (HCV) infection is substantial, costing the Australian health care system approximately $156 million in 2004/05 [1]. An estimated 284,000 people are currently infected with HCV in Australia [2], and liver disease caused by HCV infection is now the leading indication for liver transplantation [3]. Existing preventive and therapeutic efforts are inadequate. Approximately 10,000 new infections occur each year in Australia, primarily through sharing of injecting equipment by injecting drug users (IDUs) [4, 5]. Although some people are able to clear the hepatitis C virus from their bodies without treatment, most HCV infections become chronic or long-lasting [6, 7]. This can result in progressive liver disease, cirrhosis (advanced scarring of the liver), liver failure, and liver cancer (hepatocellular carcinoma (HCC)) [8]. There are various HCV strains (genotypes), each having different chances of achieving a sustained virological response (SVR) [9, 10].

Treatment for hepatitis C

Treatment for hepatitis C has improved in recent years with the shift from standard interferon and ribavirin therapy, prior to 2004, to pegylated interferon (PEG-IFN) and ribavirin combination therapy, which consists of weekly injections combined with daily oral medication. The treatment is administered over a period of either 24 or 48 weeks (depending on the strain of HCV), involves significant side effects and requires complex medical support. Depending on the strain of the virus, effective antiviral treatment has a cure rate of 40-50% of people with genotype 1 (the most common genotype in Australia) and 70-80% for non-1 genotypes [9, 11, 12].

Antiviral therapy is provided largely through the Highly Specialised Drugs Program (the S100 scheme) [3]. The number of prescriptions for hepatitis C treatment through the S100 scheme has tripled from around 1,150 in 2003 to around 3,500 in 2007 [3]. The number of prescriptions for treatment of chronic hepatitis C initially increased considerably following the removal in April 2006 of the requirement for biopsy-proven liver damage prior to treatment, and the increase continued in 2008 [2, 13].

The clinical benefits of successful treatment are considerable, including a low probability of HCV re-infection [14-16], reduced injury to the liver [17], halting the progression (and even regression) of severe liver disease [18], long-term improvement in health-related quality of life [19-21] and productivity [19, 21], reduced rates of HCC [22], and improved survival [8]. Modelling and economic evaluation can provide guidance to policymakers who want to ensure that scarce health care resources are used in the most effective and cost-effective manner possible.

This project aimed to examine the possible effects of increased rates of treatment, compared with current treatment rates, on the future health and economic burden of hepatitis C around Australia.

Overview of methods

A population-based dynamic mathematical model of HCV transmission was developed to describe the present HCV epidemic in Australia and to forecast the expected epidemic trends in the future due to changes in treatment rates for hepatitis C. The model describes IDUs and non-IDUs aged 15-64 in Australia. Non-IDUs considered were those who acquired HCV through routes other than injecting drug use. See Appendix J for a schematic diagram of the model structure and model input parameters.

The model tracked the shifts in the number of IDUs in the population, including the entry of new injectors, transitions between injecting status (for example, transition from occasional to regular), and the rate of cessation of injecting. The infection of IDUs with HCV was simulated based on injecting behaviour and mixing in the population. The model also tracked the natural history of disease progression for people infected with HCV. The model was used to estimate the number of people in each HCV health state, including important clinical endpoints such as liver failure, HCC, and liver transplant, as well as drug-related, disease-related, and background death rates.

The mathematical model was calibrated to be consistent with available epidemiologic data in Australia in terms of incidence and prevalence of HCV and to reflect clinical data on progression of HCV infection, that is, incidence of liver failure and HCC, the number of liver transplants and liver-related deaths, and the number of people treated in the year 2008 [2].

Separate analyses were carried out for Australia at a national level and for each State and Territory. State and Territory-specific demographic data and Australian population-specific epidemiologic and behavioural data were used to inform inputs for the State and Territory model simulations.

Economic analysis

A cost-effectiveness and cost-utility analysis was performed to compare the costs and benefits associated with current levels of treatment for hepatitis C with four alternative hepatitis C treatment scenarios in Australia and in each State and Territory. The economic analysis was that of a health sector perspective as well as the recommended societal perspective. Under the health sector costs, drug costs accrue to the federal government and the remaining costs accrue to the State government. The societal perspective considers all costs, regardless of who incurs them, including such components as patients/family time and out-of-pocket costs, and productivity losses and gains related to their illness or its treatment. The economic impact was modelled for three time horizons: from the year 2010 until 2013 (four-year time horizon); from the year 2010 until 2039 (30-year time horizon), and from the year 2010 until 2079 (lifetime time horizon). Costs were discounted at 3% and 5% annually. Separate economic analyses were carried out for Australia at a national level and for each State and Territory using population-based cost and utility data.

Hepatitis C treatment scenarios

Currently, approximately 3,500 people infected with hepatitis C (~1-2% of people infected with chronic hepatitis C) receive combination PEG-IFN and ribavirin therapy each year in Australia [3]. Treatment scenarios simulated in this study include:

- *Current treatment scenario*: no change from current practice;
- *Reduction scenario*: treatments decline to 2,000 from 2010 onwards;
- *Increased scenario 1*: treatments increase steadily to 6,000 per year from 2011 onwards;
- *Increased scenario 2*: treatments increase steadily to 8,000 per year from 2012 onwards;
- *Increased scenario 3*: treatments increase steadily to 12,000 per year from 2014 onwards.

Further details of methods are provided in Appendix J.

Key outcomes

The key health outcomes of the analysis include the number of new HCV cases averted, new liver failure cases averted, new HCC cases averted, liver transplant cases averted, the number of hepatitis C related deaths averted, and LYs gained. The years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C. Based on an Australian linkage study [23] and published literature [23], it was assumed that the average age at liver-related death was 65 (range, 61-70) years.

The key economic outcomes include total costs associated with hepatitis C care, QALYs, and incremental cost-effectiveness ratio (ICER), defined as the additional cost of a specific treatment strategy divided by its additional health benefit, expressed here as cost per SVR, LY gained or QALY gained. The ICER for an alternative treatment scenario was compared in reference to the next most effective option as well as to the current treatment scenario.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in Australia

Key findings

Effect on new HCV cases in Australia over the period 2010-2039

Under levels of current treatment, where about 3,500 cases are treated each year, it was estimated that there would be approximately 11,700 new cases of hepatitis C in Australia in 2010, which would remain relatively stable over the next 30 years (Figure 1). The model estimated 228 new cases of liver failure, 121 new cases of HCC, 44 liver transplant cases, and 241 liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an 11-13% increase by 2039.

Under the reduced treatment scenario, where treatment decreased from approximately 3,500 to 2,000 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 1,288 additional cases of HCV (43 per year), 1,114 new cases of liver failure (37 per year), 535 new cases of HCC (18 per year), 174 cases receiving liver transplants (six per year), and 894 liver-related deaths (30 per year) relative to the current treatment scenario (Table 1).

If treatment rates are increased over the next five years from approximately 3,500 cases to 6,000, 8,000, or 12,000 cases per year (increased treatment scenarios 1, 2, and 3), the number of new cases of liver failure over 30 years would be expected to decrease by 7%, 14%, and 22%, respectively. Similarly, the number of new cases of HCC would decline relatively by 6%, 12%, and 20% and liver-related death by 3%, 9%, and 17%, respectively. Numbers of liver transplants would decline by 4%, 10%, and 18%, respectively over the period (Figure 1).

Compared with the current treatment scenario, it was estimated that there would be 2,621 to 8,360 fewer new cases of HCV (87-279 per year), 696 to 1,257 fewer new cases of liver failure (23-42 per year), 338 to 609 fewer new cases of HCC (11-20 per year), 111 to 200 fewer cases receiving liver transplants (4-7 per year), and 572 to 1,031 fewer liver-related deaths (19-34 per year) over the period, with increased treatment rates from 6,000 to 12,000.

Figure 1: Expected epidemiological outcomes associated with changes in HCV treatment rates in Australia

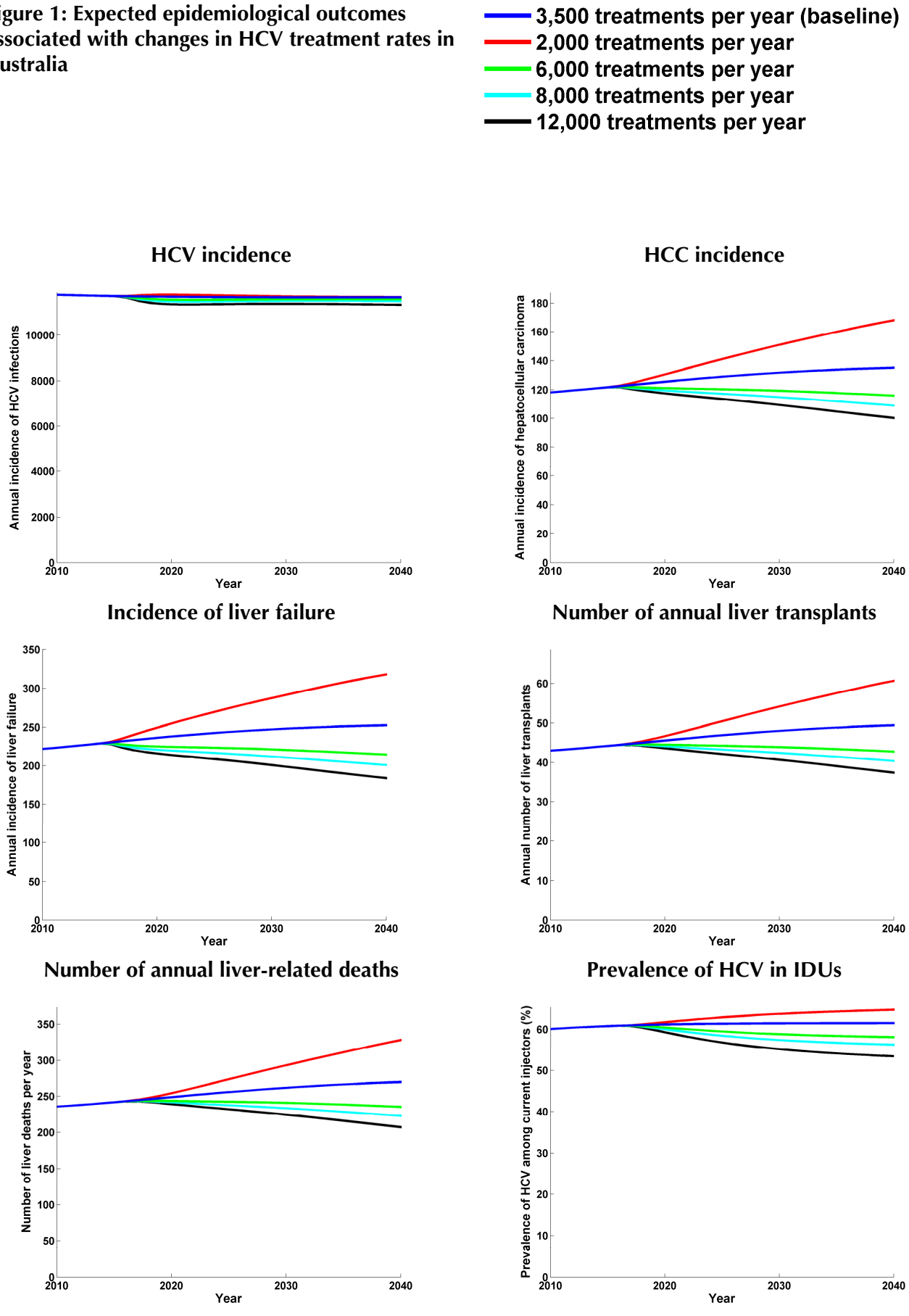

Table 1. Health impact of hepatitis C treatment strategies in Australia, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	153,414	-17,641	11,288	15,373	20,353
Number of treatment gains (sustained virological response)		-26,280	24,840	36,886	53,776
HCV cases / cases averted	350,465	-1,288	2,621	4,582	8,360
Liver failure cases / cases averted	7,330	-1,114	696	948	1,257
HCC cases / cases averted	3,908	-535	338	460	609
HCV-related liver transplant cases / cases averted	1,424	-174	111	151	200
Liver-related deaths / deaths averted	7,772	-894	572	779	1,031

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in Australia over the period 2010-2039

Under the current treatment scenario, it was estimated that about 5,114 LYs per year (153,414 / 30) would be lost over the 30-year period due to liver-related death (Table 1).

Under the reduced scenario, 588 additional LYs would be lost each year (Table 1) and 1,122 fewer QALYs gained each year relative to the current treatment scenario.

According to increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 376, 512 and 678 per year, respectively over the next 30 years (Table 1). Compared with the current treatment scenario, the respective incremental QALYs gained would be 1,174, 1,778 and 2,687 per year, respectively.

Cost of hepatitis C

Annual hepatitis C related health care costs (in 2008 Australian dollars) ranged from $858 for diagnosed early stage of disease to $120,017 for patients requiring a liver transplant (see Table 2). Patient and family costs associated with hepatitis C ranged from $2,800 for early stage disease to $13,700 for a liver transplant. Lifetime productivity costs per person with incident HCV were: $35,143 (undiscounted); $23,222 (3% discount); and $19,624 (5% discount).

Table 2. Annual health care costs of hepatitis C (2008 Australian dollars)

Description	Value ($)	95% CI* ($)	Ref
Annual costs of care			
Acute hepatitis C	858	832-884	†
Pre-cirrhosis stage of chronic hepatitis C (fibrosis stage 0 to 3) - 1st year	858	832-884	
Pre-cirrhosis stage of chronic hepatitis C (fibrosis stage 0 to 3) - successive years	347	337-358	
Compensated cirrhosis (fibrosis stage 4)	887	861-914	
Decompensated cirrhosis (liver failure) - includes ascites, variceal haemorrhage and hepatic encephalopathy	13,363	12,762-13,964	
Hepatocellular carcinoma	17,872	14,655-21,089	
Liver transplant - 1st year	120,017	98,414-141,620	
Liver transplant - successive years	13,363	10,958-15,768	‡
Costs of HCV treatment			§
Treatment of acute HCV patients with pegylated interferon only or pegylated interferon and ribavirin - 24 weeks	10,782	10,458-11,105	
Treatment of chronic HCV patients with pegylated interferon and ribavirin - 24 weeks	10,829	10,458-11,105	
Treatment of chronic HCV patients with pegylated interferon and ribavirin - 48 weeks	18,835	18,270-19,400	

* Uncertainty in cost estimates was based on a Canadian population-based analysis of health care costs associated with hepatitis C: a population-based analysis (Paterson, Krahn et al).
†Assumes annual health care costs of acute hepatitis C equivalent to costs of pre-cirrhosis stage of hepatitis C. However, it has been reported that the majority of acute hepatitis C cases are asymptomatic and about 25-30% of patients develop symptoms.
‡Costs of care for successive years of liver transplant assume the same as costs of care for liver failure.
§Costs of HCV treatment include drugs and monitoring (including follow-up).
Costs are inflated to 2008 dollars, using the health component of consumer price index.
CI, confidence intervals; LB, lower bound; UB, upper bound; HCV, hepatitis C virus.

Effect on costs incurred through HCV infection in Australia over the period 2010-2039

Under the current scenario, an estimated $476.6m in total costs would be incurred on average due to hepatitis C each year over the next 30 years (Table 3). Of these costs, $102.4m (21%), $250.8m (53%), and $123.4m (26%) were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $46.1m (45%) of the total health sector costs on average each year.

Compared with the current treatment scenario, about $2.6m additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

According to increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $3.5m, $5.5m, and $9.1m each year, respectively. If the health sector cost is increased by 50%, there would no longer be cost savings.

Table 4 shows the disaggregated 30-year projected costs by HCV disease state. The proportion of total costs attributable to people with cirrhosis and its sequelae and liver transplantation decreased from 20% to 16%, reflecting the slowing of disease progression in people on treatment and the reduction in the burden of disease.

Cost-effectiveness and cost-utility analysis

Table 5 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. From a health sector perspective, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the next best strategy was $17,028, $16,627, and $15,974 per QALY, respectively. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $17,028, $16,891 and $16,577 per QALY, respectively.

See Appendix A for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in Australia over the period 2010 to 2013 and 2010 to 2079.

Table 3. Costs associated with hepatitis C treatment strategies in Australia, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*2,579,598,071*	*-481,221,284*	*450,079,546*	*668,635,523*	*976,085,478*
Other costs	*3,162,972,486*	*52,970,450*	*-39,196,255*	*-55,523,050*	*-80,616,803*
Total	5,742,570,557	-428,250,835	410,883,291	613,112,473	895,468,674
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	14,016,213,646	764,877,197	-796,867,402	-1,206,126,989	-1,822,030,663
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	12,316,512,629	45,261,697	-92,096,274	-161,027,723	-293,812,112
Total costs	**32,075,296,831**	**381,888,059**	**-478,080,385**	**-754,042,239**	**-1,220,374,101**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*1,731,206,371*	*-318,240,762*	*311,181,018*	*465,323,714*	*687,173,778*
Other costs	*2,120,637,444*	*18,151,944*	*-9,893,223*	*-12,734,668*	*-17,069,770*
Total	3,851,843,815	-300,088,818	301,287,796	452,589,046	670,104,008
Patient/family costs†	9,418,436,260	434,266,412	-460,634,158	-698,685,406	-1,058,883,441
Productivity costs†	5,478,586,116	22,153,521	-40,521,318	-69,532,345	-124,286,053
Total costs	**18,748,866,191**	**156,331,115**	**-199,867,680**	**-315,628,705**	**-513,065,486**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*1,381,616,746*	*-250,333,924*	*251,777,236*	*378,053,646*	*562,219,723*
Other costs	*1,691,381,588*	*6,187,729*	*150,892*	*1,904,980*	*4,677,705*
Total	3,072,998,334	-244,146,196	251,928,128	379,958,626	566,897,428
Patient/family costs†	7,522,955,130	306,625,818	-329,286,393	-500,202,476	-759,806,941
Productivity costs†	3,702,290,839	15,638,426	-27,029,022	-45,859,703	-80,923,267
Total costs†	**14,298,244,303**	**78,118,048**	**-104,387,287**	**-166,103,554**	**-273,832,780**

†Incremental costs for each alternative treatment scenario relative to current treatment scenario. Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Table 4. Projected 30-year health care costs of hepatitis C by disease stage under alternative treatment scenarios in Australia, 2010-2039 (5% discount, 2008 Australian dollars)

Description	Hepatitis C treatment scenarios				
	Current scenario (% of total)	Reduction scenario (% of total)	Increased scenario 1 (% of total)	Increased scenario 2 (% of total)	Increased scenario 3 (% of total)
Acute hepatitis C	31,964,848 (2.3%)	32,083,040 (2.5%)	31,734,160 (2.1%)	31,562,590 (2.0%)	31,232,931 (1.9%)
Fibrosis stage 0	327,282,593 (23.5%)	267,999,082 (20.8%)	403,439,297 (27.0%)	445,840,537 (28.9%)	510,634,868 (31.7%)
Fibrosis stage 1	273,026,378 (19.6%)	229,177,369 (17.8%)	325,661,546 (21.8%)	352,960,981 (22.9%)	391,124,833 (24.7%)
Fibrosis stage 2	360,111,804 (25.8%)	338,731,253 (26.2%)	350,902,403 (23.5%)	338,649,850 (21.9%)	315,093,893 (19.5%)
Fibrosis stage 3	125,811,124 (9.0%)	128,520,231 (10.0%)	118,964,912 (8.0%)	115,641,105 (7.5%)	111,302,944 (6.9%)
Compensated cirrhosis	109,267,485 (7.8%)	111,415,896 (8.6%)	106,629,712 (7.1%)	105,443,451 (6.8%)	103,727,656 (6.4%)
Decompensated cirrhosis	87,758,051 (6.3%)	97,918,718 (7.6%)	81,236,202 (5.4%)	78,876,750 (5.1%)	76,002,114 (4.7%)
Hepatocellular carcinoma	22,989,765 (1.6%)	25,763,110 (2.0%)	21,216,742 (1.4%)	20,575,187 (1.3%)	19,792,931 (1.2%)
Liver transplant	56,924,343 (4.1%)	59,485,726 (4.6%)	55,173,999 (3.7%)	54,539,359 (3.5%)	53,775,041 (3.3%)
Total costs	**1,395,136,390**	**1,291,094,426**	**1,494,958,974**	**1,544,089,810**	**1,612,687,210**

Table 5. Cost-effectiveness and cost-utility analysis, Australia (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	2,828,852,138		87,995		
Current scenario	3,072,998,334	244,146,196	81,290	6,705	$36,413
Increased scenario 1	3,324,926,462	251,928,128	76,843	4,448	$56,642
Increased scenario 2	3,452,956,960	379,958,626	75,227	6,063	$62,668
Increased scenario 3	3,639,895,763	566,897,428	73,269	8,021	$70,676
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	2,828,852,138		56,786		
Current scenario	3,072,998,334	244,146,196	70,539	13,753	17,753
Increased scenario 1	3,324,926,462	251,928,128	84,500	13,961	18,045
Increased scenario 2	3,452,956,960	379,958,626	91,499	20,961	18,127
Increased scenario 3	3,639,895,763	566,897,428	101,696	31,157	18,195
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	2,828,852,138		6,228,117		
Current scenario	3,072,998,334	244,146,196	6,241,830	13,713	17,803
Increased scenario 1	3,324,926,462	251,928,128	6,256,625	14,795	17,028
Increased scenario 2	3,452,956,960	128,030,498	6,264,325	7,700	16,627
Increased scenario 3	3,639,895,763	186,938,803	6,276,028	11,703	15,974

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in the Australian Capital Territory

The epidemiologic and economic trends under various HCV treatment scenarios for ACT would be similar to the national trends since Australian population-specific epidemiologic and behavioural data were used to inform inputs for the ACT model simulations.

Key findings

Effect on new HCV cases in ACT over the period 2010-2039

Under the current treatment scenario, where about 47 cases on average are treated each year, it was estimated that there would be approximately 160 new cases of hepatitis C in ACT in 2010, which would remain relatively stable over the next 30 years (Figure 2). The model estimated about three new cases of liver failure, one to two new cases of HCC, nil to one liver transplant cases, and three liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an increase of between 11-13% by 2039.

Under the reduced treatment scenario, whereby treatment decreased from approximately 47 to 26 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 17 additional HCV cases, 15 new cases of liver failure, seven new cases of HCC, two cases receiving liver transplants, and 105 liver-related deaths relative to current treatment scenario (Table 6).

If treatment rates are increased over the next five years from approximately 47 cases to 78, 103, or 157 cases per year (increased treatment scenarios 1, 2, and 3), it was estimated that there would be 35 to 113 fewer new HCV cases, nine to 17 fewer new cases of liver failure, five to eight fewer new cases of HCC, one to three fewer cases receiving liver transplants, and eight to 14 fewer liver-related deaths over the 30-year period relative to the current treatment scenario (Table 6).

Figure 2: Expected epidemiological outcomes associated with changes in HCV treatment rates in Australian Capital Territory

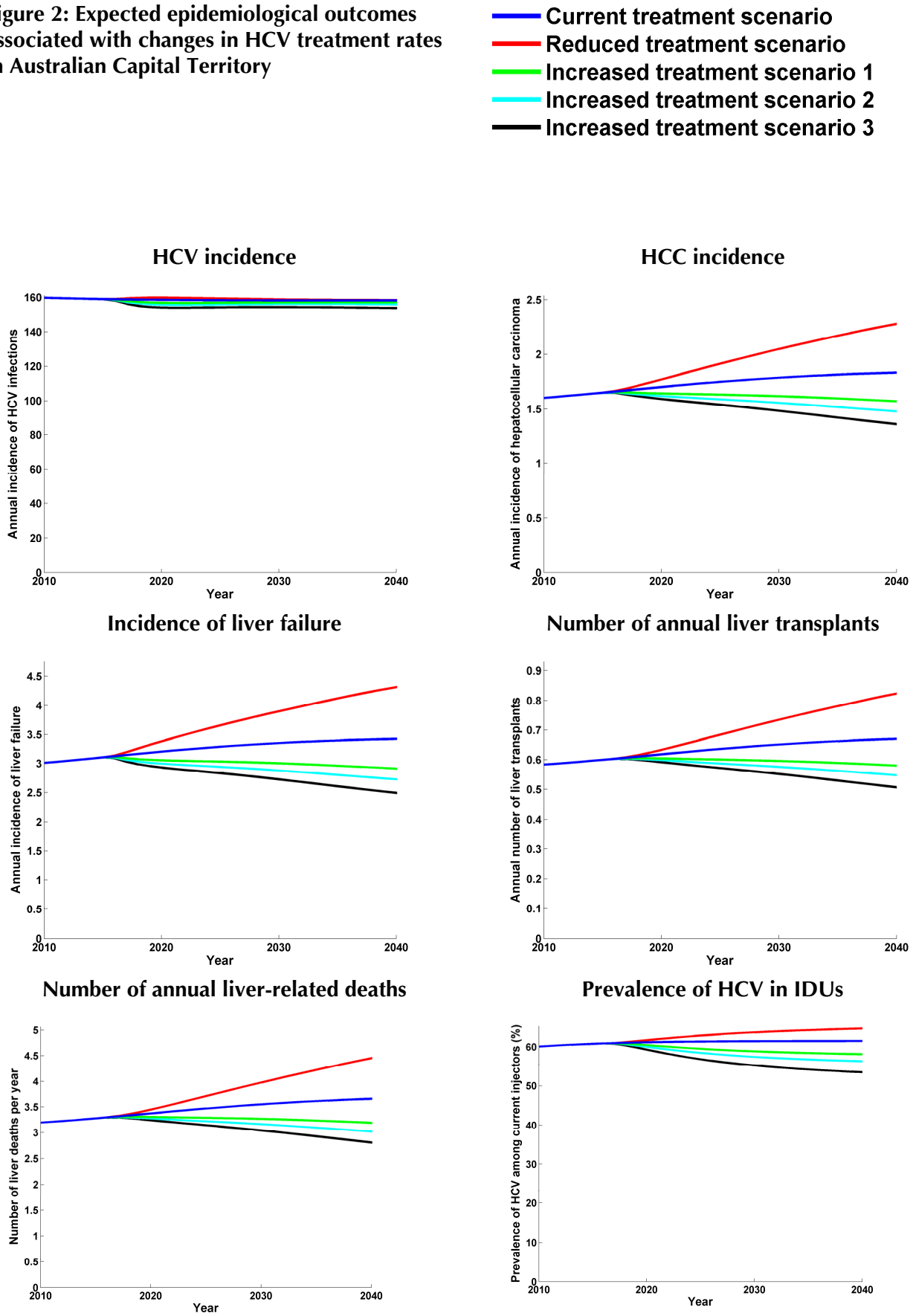

Table 6. Health impact of hepatitis C treatment strategies in ACT, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	2,080	-239	152	208	276
Number of treatment gains (Sustained virological response)		-356	336	500	729
HCV cases / cases averted	4,752	-17	35	62	113
Liver failure cases / cases averted	99	-15	9	13	17
HCC cases / cases averted	53	-7	5	6	8
HCV-related liver transplant cases / cases averted	19	-2	1	2	3
Liver-related deaths / deaths averted	105	-12	8	11	14

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in ACT over the period 2010-2039 (undiscounted)

Under the current treatment scenario, it was estimated that 2,080 LYs (69 per year) would be lost over the 30-year period due to liver-related death (Table 7).

About 239 additional LYs (eight per year) would be lost and 456 fewer QALYs (15 per year) would be gained under the reduced treatment scenario relative to the current treatment scenario.

Under the increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 152, 208, and 276, respectively (range, five to nine per year) over the next 30 years (Table 6). Compared with the current treatment scenario, the respective incremental QALYs gained would be 475, 723, and 1,093 (range, 16-36 per year).

Effect on costs incurred through HCV infection in ACT over the period 2010-2039 (5% discount)

Under the current scenario, an estimated $6.5m in total costs would be incurred on average due to hepatitis C each year over the next 30 years (Table 7). Of these costs, $1.4m, $3.4m, and $1.7m, were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $624,500 of the total health sector costs on average each year.

Compared with the current treatment scenario, about $35,300 additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

Under the increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $46,300, $75,000, and $124,000 each year, respectively.

Table 7. Costs associated with hepatitis C treatment strategies in ACT, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*34,978,705*	*-6,525,088*	*6,099,673*	*9,066,631*	*13,235,135*
Other costs	*42,889,180*	*717,951*	*-522,581*	*-752,114*	*-1,094,024*
Total	77,867,885	-5,807,137	5,577,092	8,314,517	12,141,111
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	190,056,227	10,370,721	-10,755,484	-16,350,372	-24,710,112
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	167,008,878	613,739	-1,245,369	-2,183,079	-3,984,433
Total costs	434,932,990	5,177,323	-6,423,761	-10,218,933	-16,553,434
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*23,474,726*	*-4,315,035*	*4,212,416*	*6,309,402*	*9,317,954*
Other costs	*28,755,357*	*245,950*	*-128,890*	*-172,206*	*-232,033*
Total	52,230,082	-4,069,086	4,083,526	6,137,196	9,085,921
Patient/family costs†	127,711,557	5,887,920	-6,208,836	-9,470,681	-14,361,130
Productivity costs†	74,288,318	300,357	-547,141	-942,608	-1,685,567
Total costs	254,229,957	2,119,192	-2,672,451	-4,276,093	-6,960,776
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*18,734,378*	*-3,394,206*	*3,405,280*	*5,125,876*	*7,623,785*
Other costs	*22,934,745*	*83,774*	*5,692*	*26,174*	*62,998*
Total	41,669,122	-3,310,432	3,410,972	5,152,050	7,686,783
Patient/family costs†	102,009,327	4,157,241	-4,433,718	-6,779,819	-10,305,300
Productivity costs†	50,202,196	212,009	-364,537	-621,662	-1,097,534
Total costs†	193,880,646	1,058,818	-1,387,283	-2,249,431	-3,716,050

†Incremental costs for each alternative treatment scenario relative to current treatment scenario. Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Cost-effectiveness and cost-utility analysis

Table 8 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $17,119, $16,897 and $16,572 per QALY, respectively.

Table 8. Cost-effectiveness and cost-utility analysis, ACT (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (LY lost)‡**	**Increased effect§**	**ICER* ($/LY)**
Reduction scenario	38,358,691		1,193		
Current scenario	41,669,122	3,310,432	1,102	91	$36,418
Increased scenario 1	45,080,095	3,410,972	1,042	60	$56,978
Increased scenario 2	46,821,172	5,152,050	1,020	82	$62,693
Increased scenario 3	49,355,905	7,686,783	993	109	$70,655
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	38,358,691		770		
Current scenario	41,669,122	3,310,432	956	186	17,754
Increased scenario 1	45,080,095	3,410,972	1,145	188	18,107
Increased scenario 2	46,821,172	5,152,050	1,241	284	18,132
Increased scenario 3	49,355,905	7,686,783	1,379	423	18,191
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	38,358,691		84,452		
Current scenario	41,669,122	3,310,432	84,638	186	17,806
Increased scenario 1	45,080,095	3,410,972	84,837	199	17,119
Increased scenario 2	46,821,172	1,741,078	84,943	106	16,478
Increased scenario 3	49,355,905	2,534,733	85,101	159	15,950

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

See Appendix B for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in ACT over the period 2010 to 2013 and 2010 to 2079.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in New South Wales

The epidemiologic and economic trends under various HCV treatment scenarios for NSW would be similar to the national trends since Australian population-specific epidemiologic and behavioural data were used to inform inputs for the NSW model simulations.

Key findings

Effect on new HCV cases in NSW over the period 2010-2039

Under the current treatment scenario, where about 1,044 cases on average are treated each year, it was estimated that there would be approximately 3,557 new cases of hepatitis C in NSW in 2010, which would remain relatively stable over the next 30 years (Figure 3). The model estimated about 69 new cases of liver failure, 37 new cases of HCC, 13 cases receiving liver transplants, and 73 liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an 11-13% increase by 2039.

Under the reduced treatment scenario, where treatment decreased from approximately 1,044 to 618 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 391 additional HCV cases, 337 new cases of liver failure, 162 new cases of HCC, 53 cases receiving liver transplants, and 271 liver-related deaths relative to current treatment scenario (Table 9).

If treatment rates are increased over the next five years from approximately 1,100 cases to 1,800, 2,300, or 3,500 cases per year (increased treatment scenarios 1, 2, and 3), it was estimated that there would be 795 to 2,535 fewer new HCV cases, 211 to 381 fewer new cases of liver failure, 102 to 185 fewer new cases of HCC, 34 to 61 fewer cases receiving liver transplants, and 173 to 313 fewer liver-related deaths over the 30-year period relative to the current treatment scenario (Table 9).

Figure 3: Expected epidemiological outcomes associated with changes in HCV treatment rates in New South Wales

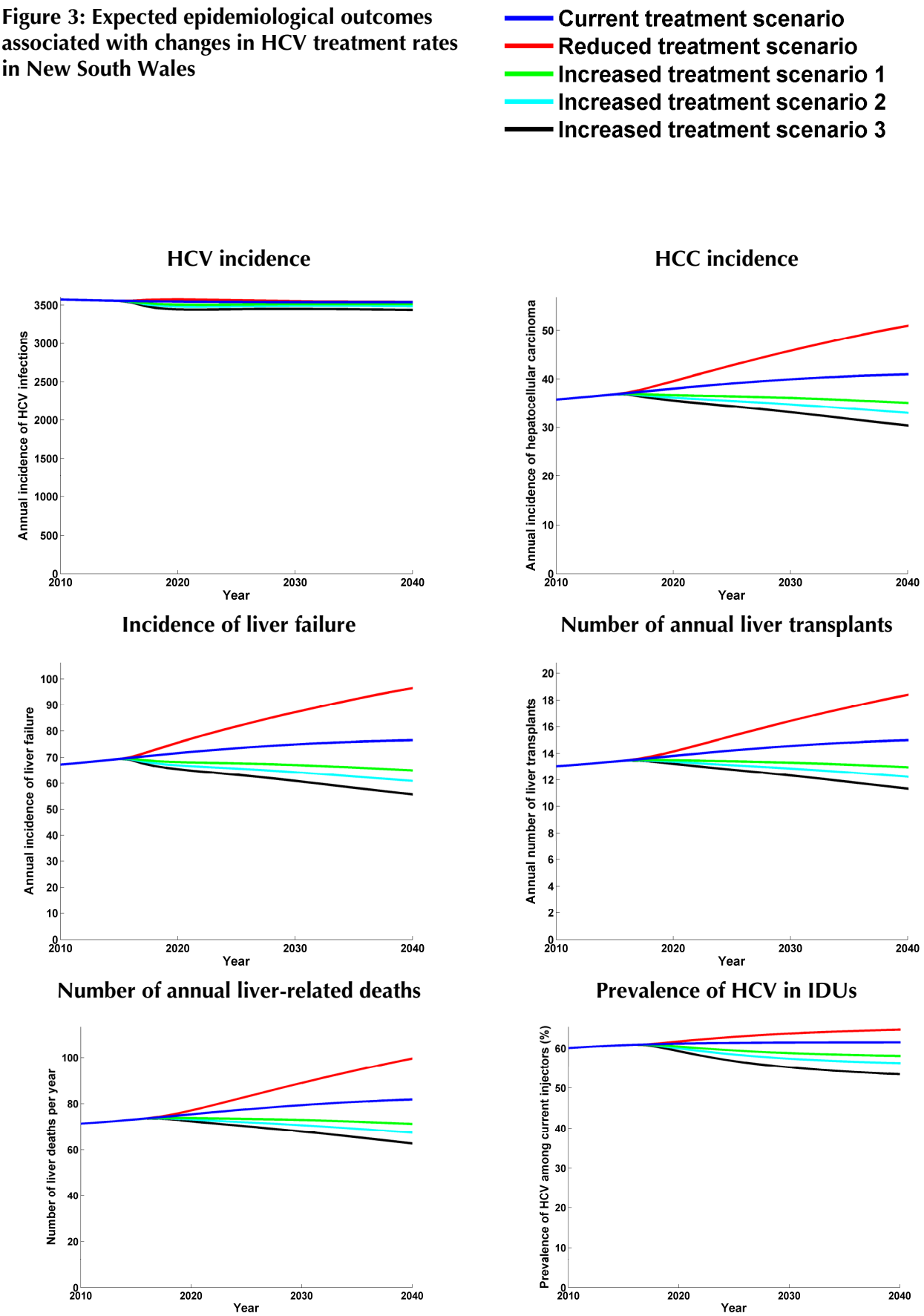

Table 9. Health impact of hepatitis C treatment strategies in NSW, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	46,510	-5,344	3,423	4,659	6,171
Number of treatment gains (Sustained virological response)		-7,965	7,531	11,181	16,304
HCV cases / cases averted	106,250	-391	795	1,389	2,535
Liver failure cases / cases averted	2,222	-337	211	287	381
HCC cases / cases averted	1,185	-162	102	139	185
HCV-related liver transplant cases / cases averted	432	-53	34	46	61
Liver-related deaths / deaths averted	2,356	-271	173	236	313

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in NSW over the period 2010-2039 (undiscounted)

Under the current treatment scenario, it was estimated that 46,510 LYs (1,550 per year) would be lost over the 30-year period due to liver-related death (Table 9).

Under the reduced treatment scenario, about 5,344 additional LYs (178 per year) would be lost and 10,199 fewer QALYs (340 per year) would be gained under the reduced treatment scenario relative to the current treatment scenario.

According to the increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 3,423, 4,659, and 6,171, respectively (114-206 per year) over the next 30 years (Table 9). Compared with the current treatment scenario, the respective incremental QALYs gained would be 10,676, 16,164, and 24,442, respectively (356-815 per year).

Effect on costs incurred through HCV infection in NSW over the period 2010-2039 (5% discount)

Under the current scenario, an estimated $144.5m in total costs would be incurred on average due to hepatitis C each year over the next 30 years (Table 10). Of these costs, $31m, $76m, and $37m, were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $14m (45%) of the total health sector costs on average each year.

Compared with the current treatment scenario, about $787,100 additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

Under increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $1m, $2m, and $3m each year, respectively.

Table 10. Costs associated with hepatitis C treatment strategies in NSW, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*782,051,413*	*-145,858,222*	*136,473,088*	*202,708,836*	*295,909,906*
Other costs	*958,912,804*	*16,024,453*	*-11,889,896*	*-16,810,711*	*-24,453,760*
Total	1,740,964,217	-129,833,769	124,583,192	185,898,125	271,456,146
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	4,249,264,614	231,723,341	-241,638,219	-365,533,698	-552,434,439
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	3,733,973,985	13,724,125	-27,923,726	-48,806,872	-89,079,910
Total costs	**9,724,202,816**	**115,613,697**	**-144,978,752**	**-228,442,445**	**-370,058,202**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*524,846,271*	*-96,438,909*	*94,366,506*	*141,060,779*	*208,326,880*
Other costs	*642,909,777*	*5,483,847*	*-3,001,716*	*-3,847,112*	*-5,183,772*
Total	1,167,756,048	-90,955,062	91,364,790	137,213,668	203,143,107
Patient/family costs†	2,855,366,976	131,535,737	-139,689,344	-211,724,913	-321,060,612
Productivity costs†	1,660,933,661	6,713,731	-12,287,498	-21,073,158	-37,683,391
Total costs	**5,684,056,684**	**47,294,406**	**-60,612,051**	**-95,584,403**	**-155,600,896**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*418,861,915*	*-75,848,357*	*76,358,211*	*114,598,690*	*170,447,499*
Other costs	*512,772,963*	*1,863,218*	*45,238*	*587,371*	*1,411,443*
Total	931,634,879	-73,985,139	76,403,449	115,186,061	171,858,942
Patient/family costs†	2,280,718,329	92,859,261	-99,862,444	-151,566,000	-230,384,390
Productivity costs†	1,122,417,676	4,737,745	-8,196,796	-13,897,671	-24,536,574
Total costs†	**4,334,770,883**	**23,611,867**	**-31,655,791**	**-50,277,610**	**-83,062,021**

†Incremental costs for each alternative treatment scenario relative to current treatment scenario. Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Cost-effectiveness and cost-utility analysis

Table 11 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $17,028, $16,898 and $16,574 per QALY, respectively.

Table 11. Cost-effectiveness and cost-utility analysis, NSW (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	857,649,740		26,675		
Current scenario	931,634,879	73,985,139	24,645	2,030	$36,439
Increased scenario 1	1,008,038,327	76,403,449	23,296	1,349	$56,640
Increased scenario 2	1,046,820,939	115,186,061	22,807	1,837	$62,699
Increased scenario 3	1,103,493,821	171,858,942	22,212	2,432	$70,661
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	857,649,740		17,219		
Current scenario	931,634,879	73,985,139	21,385	4,166	17,759
Increased scenario 1	1,008,038,327	76,403,449	25,619	4,234	18,046
Increased scenario 2	1,046,820,939	115,186,061	27,737	6,352	18,133
Increased scenario 3	1,103,493,821	171,858,942	30,832	9,447	18,192
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	857,649,740		1,888,170		
Current scenario	931,634,879	73,985,139	1,892,323	4,153	17,815
Increased scenario 1	1,008,038,327	76,403,449	1,896,810	4,487	17,028
Increased scenario 2	1,046,820,939	38,782,612	1,899,139	2,329	16,649
Increased scenario 3	1,103,493,821	56,672,881	1,902,692	3,553	15,951

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

See Appendix C for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in NSW over the period 2010 to 2013 and 2010 to 2079.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in the Northern Territory

The epidemiologic and economic trends under various HCV treatment scenarios for NT would be similar to the national trends since Australian population-specific epidemiologic and behavioural data were used to inform inputs for the NT model simulations.

Key findings

Effect on new HCV cases in NT over the period 2010-2039

Under the current treatment scenario, where about 36 cases on average are treated each year, it was estimated that there would be approximately 121 new cases of hepatitis C in NT in 2010, which would remain relatively stable over the next 30 years (Figure 4). The model estimated about two new cases of liver failure, one to two new cases of HCC, nil to one case receiving liver transplant, and two to three liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an increase of 11-13% by 2039.

Under the reduced treatment scenario, where treatment decreased from approximately 36 to 21 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 13 additional HCV cases, 11 new cases of liver failure, six new cases of HCC, two cases receiving liver transplants, and nine liver-related deaths relative to current treatment scenario (Table 12).

If treatment rates are increased over the next five years from approximately 36 cases to 60, 78, and 120 cases per year (increased treatment scenarios 1, 2, and 3), it was estimated that there would be 27 to 86 fewer new HCV cases, seven to 13 fewer new cases of liver failure, three to six fewer new cases of HCC, one to two fewer cases receiving liver transplants, and six to 11 fewer liver-related deaths over the 30-year period relative to the current treatment scenario (Table 12).

Figure 4: Expected epidemiological outcomes associated with changes in HCV treatment rates in the Northern Territory

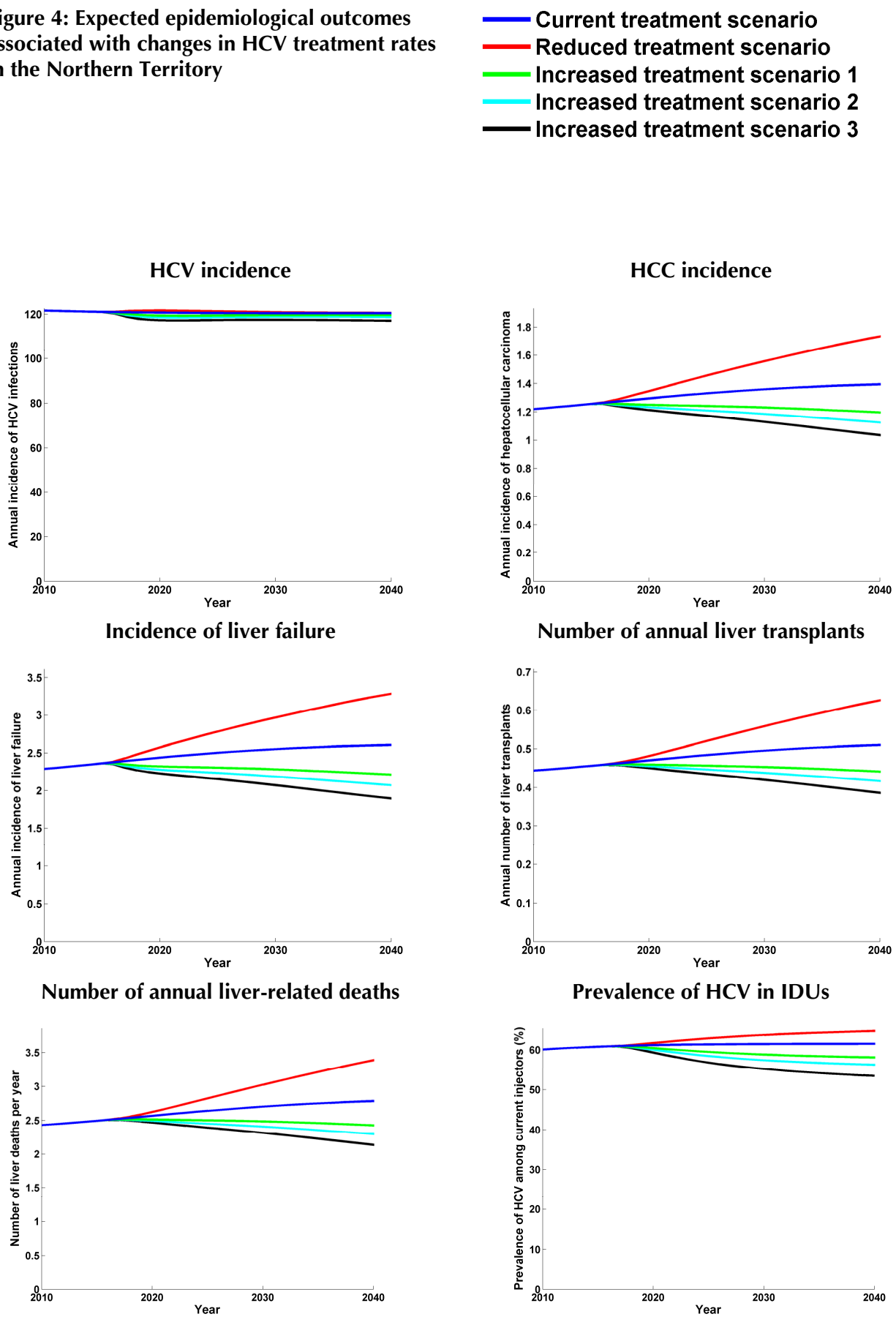

Table 12. Health impact of hepatitis C treatment strategies in NT, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	1,583	-182	116	159	210
Number of treatment gains (Sustained virological response)		-271	256	381	555
HCV cases / cases averted	3,617	-13	27	47	86
Liver failure cases / cases averted	76	-11	7	10	13
HCC cases / cases averted	40	-6	3	5	6
HCV-related liver transplant cases / cases averted	15	-2	1	2	2
Liver-related deaths / deaths averted	80	-9	6	8	11

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in NT over the period 2010-2039 (undiscounted)

Under the current treatment scenario, it was estimated that 1,583 LYs (53 per year) would be lost over the 30-year period due to liver-related death in NT (Table 12).

Under the reduced treatment scenario, about 182 additional LYs (6 per year) would be lost and 347 fewer QALYs (12 per year) would be gained under the reduced treatment scenario relative to the current treatment scenario.

According to the increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 116,159, and 210, respectively (four to seven per year) over the next 30 years (Table 12). Compared with the current treatment scenario, the respective incremental QALYs gained would be 363, 551, and 832, respectively (12-28 per year).

Effect on costs incurred through HCV infection in NT over the period 2010-2039 (5% discount)

Under the current scenario, an estimated $5m in total costs would be incurred on average due to hepatitis C each year over the next 30 years (Table 13). Of these costs, $1m, $3m, and $1m, were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $475,300 (45%) of the total health sector costs on average each year.

Compared with the current treatment scenario, about $26,700 additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

Under increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $36,000, $57,000, and $94,000 each year, respectively.

Table 13. Costs associated with hepatitis C treatment strategies in NT, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*26,622,411*	*-4,963,764*	*4,645,196*	*6,900,914*	*10,074,148*
Other costs	*32,643,070*	*544,047*	*-404,221*	*-573,679*	*-830,492*
Total	59,265,481	-4,419,717	4,240,975	6,327,234	9,243,657
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	144,652,498	7,880,487	-8,222,500	-12,451,386	-18,796,416
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	127,111,035	467,041	-950,358	-1,662,180	-3,031,358
Total costs	331,029,014	3,927,811	-4,931,883	-7,786,332	-12,584,118
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*17,866,694*	*-3,281,073*	*3,211,567*	*4,802,957*	*7,091,751*
Other costs	*21,885,773*	*185,879*	*-101,902*	*-131,805*	*-175,195*
Total	39,752,467	-3,095,194	3,109,665	4,671,152	6,916,556
Patient/family costs†	97,201,754	4,472,071	-4,752,826	-7,213,492	-10,922,266
Productivity costs†	56,541,085	228,389	-418,131	-717,811	-1,282,153
Total costs	193,495,305	1,605,266	-2,061,292	-3,260,151	-5,287,863
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*14,258,799*	*-2,579,995*	*2,598,432*	*3,902,424*	*5,801,849*
Other costs	*17,455,689*	*62,905*	*1,712*	*19,407*	*49,005*
Total	31,714,488	-2,517,090	2,600,144	3,921,831	5,850,853
Patient/family costs†	77,639,695	3,156,437	-3,397,445	-5,164,643	-7,836,550
Productivity costs†	38,209,052	161,124	-278,897	-473,466	-834,737
Total costs†	147,563,235	800,472	-1,076,198	-1,716,278	-2,820,434

†Incremental costs for each alternative treatment scenario relative to current treatment scenario.
Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Cost-effectiveness and cost-utility analysis

Table 14 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $17,033, $16,885 and $16,588 per QALY, respectively.

Table 14. Cost-effectiveness and cost-utility analysis, NT (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	29,197,398		908		
Current scenario	31,714,488	2,517,090	839	69	$36,473
Increased scenario 1	34,314,632	2,600,144	793	46	$56,660
Increased scenario 2	35,636,319	3,921,831	776	63	$62,645
Increased scenario 3	37,565,341	5,850,853	756	83	$70,727
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	29,197,398		586		
Current scenario	31,714,488	2,517,090	728	142	17,766
Increased scenario 1	34,314,632	2,600,144	872	144	18,049
Increased scenario 2	35,636,319	3,921,831	944	216	18,124
Increased scenario 3	37,565,341	5,850,853	1,049	321	18,203
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	29,197,398		64,277		
Current scenario	31,714,488	2,517,090	64,418	141	17,830
Increased scenario 1	34,314,632	2,600,144	64,571	153	17,033
Increased scenario 2	35,636,319	1,321,687	64,650	80	16,602
Increased scenario 3	37,565,341	1,929,022	64,771	120	16,015

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

See Appendix D for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in the Northern Territory over the period 2010 to 2013 and 2010 to 2079.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in Queensland

The epidemiologic and economic trends under various HCV treatment scenarios for QLD would be similar to the national trends since Australian population-specific epidemiologic and behavioural data were used to inform inputs for the QLD model simulations.

Key findings

Effect on new HCV cases in QLD over the period 2010-2039

Under the current treatment scenario, where about 778 cases on average are treated each year, it was estimated that there would be approximately 2,652 new cases of hepatitis C in QLD in 2010, which would remain relatively stable over the next 30 years (Figure 5). The model estimated about 52 new cases of liver failure, 27 new cases of HCC, ten cases receiving liver transplants, and 54 liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an 11-13% increase by 2039.

Under the reduced treatment scenario, where treatment decreased from approximately 778 to 461 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 291 additional HCV cases, 252 new cases of liver failure, 121 new cases of HCC, 39 cases receiving liver transplants, and 202 liver-related deaths relative to current treatment scenario (Table 15).

If treatment rates are increased over the next five years from approximately 778 cases to 1,300, 1,700, and 2,600 cases per year (increased treatment scenarios 1, 2, and 3), it was estimated that there would be 593 to 1,890 fewer new HCV cases, 157 to 284 fewer new cases of liver failure, 76 to 138 fewer new cases of HCC, 25 to 45 fewer cases receiving liver transplants, and 129 to 233 fewer liver-related deaths over the 30-year period relative to the current treatment scenario (Table 15).

Figure 5: Expected epidemiological outcomes associated with changes in HCV treatment rates in Queensland

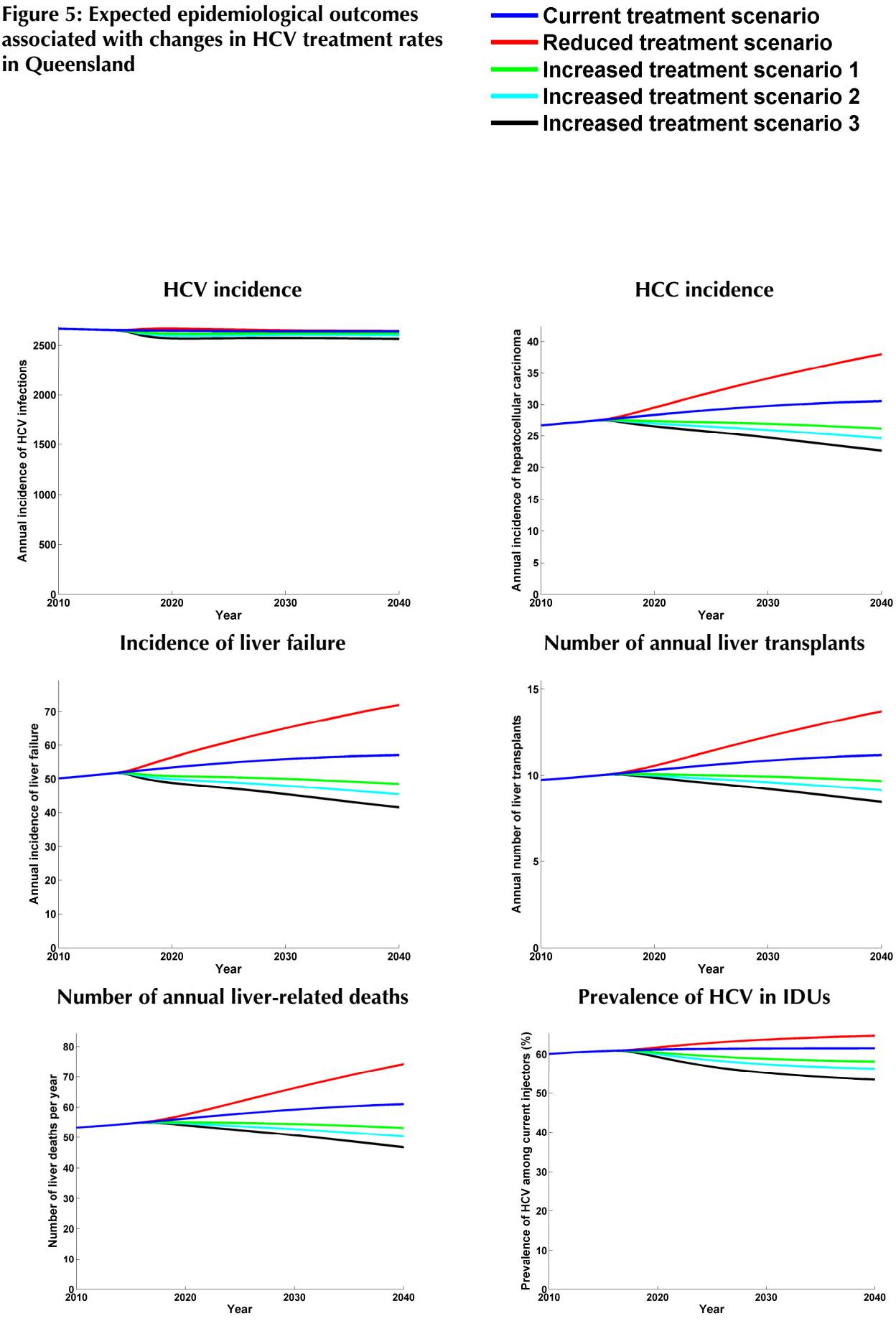

Table 15. Health impact of hepatitis C treatment strategies in QLD, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	34,678	-3,991	2,553	3,474	4,602
Number of treatment gains (Sustained virological response)		-5,943	5,616	8,337	12,157
HCV cases / cases averted	79,220	-291	593	1,036	1,890
Liver failure cases / cases averted	1,657	-252	157	214	284
HCC cases / cases averted	883	-121	76	104	138
HCV-related liver transplant cases / cases averted	322	-39	25	34	45
Liver-related deaths / deaths averted	1,757	-202	129	176	233

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario.
Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in QLD over the period 2010-2039 (undiscounted)

Under the current treatment scenario, it was estimated that 34,678 LYs (1,156 per year) would be lost over the 30-year period due to liver-related death in QLD (Table 15).

Under the reduced treatment scenario, about 3,991 additional LYs (133 per year) would be lost and 7,615 fewer QALYs (254 per year) would be gained under the reduced treatment scenario relative to the current treatment scenario.

According to the increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 2,553, 3,474, and 4,602, respectively (85-153 per year) over the next 30 years (Table 15). Compared to current treatment scenario, the respective incremental QALYs gained would be 7,963, 12,052, and 18,228, respectively (265-608 per year).

Effect on costs incurred through HCV infection in QLD over the period 2010-2039 (5% discount)

Under the current scenario, an estimated $108m in total costs would be incurred on average due to hepatitis C each year over the next 30 years (Table 16). Of these costs, $23m, $57m, and $28m, were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $10m (45%) of the total health sector costs on average each year.

Compared with the current treatment scenario, about $590,400 additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

Under increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $788,400, $1m, and $2m each year, respectively.

Table 16. Costs associated with hepatitis C treatment strategies in QLD, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*583,099,281*	*-108,805,128*	*101,747,077*	*151,141,534*	*220,622,973*
Other costs	*714,966,998*	*11,997,496*	*-8,877,740*	*-12,535,893*	*-18,249,519*
Total	1,298,066,279	-96,807,632	92,869,337	138,605,641	202,373,454
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	3,168,262,245	173,029,907	-180,226,026	-272,558,531	-411,981,802
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	2,784,058,111	10,230,770	-20,824,450	-36,392,324	-66,428,436
Total costs	7,250,386,635	86,453,044	-108,181,139	-170,345,214	-276,036,785
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*391,326,550*	*-71,970,833*	*70,357,078*	*105,177,610*	*155,329,046*
Other costs	*479,354,621*	*4,116,117*	*-2,246,574*	*-2,869,385*	*-3,875,879*
Total	870,681,170	-67,854,716	68,110,504	102,308,226	151,453,168
Patient/family costs†	2,128,968,666	98,260,008	-104,197,969	-157,874,393	-239,448,744
Productivity costs†	1,238,394,714	5,009,468	-9,164,281	-15,713,005	-28,102,646
Total costs	4,238,044,550	35,414,760	-45,251,746	-71,279,173	-116,098,222
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*312,304,375*	*-56,623,305*	*56,932,202*	*85,447,832*	*127,089,843*
Other costs	*382,324,410*	*1,407,028*	*27,084*	*437,330*	*1,044,202*
Total	694,628,785	-55,216,277	56,959,287	85,885,162	128,134,045
Patient/family costs†	1,700,509,162	69,390,583	-74,495,983	-113,017,896	-171,830,683
Productivity costs†	836,876,084	3,537,212	-6,113,759	-10,362,709	-18,299,117
Total costs†	3,232,014,031	17,711,518	-23,650,455	-37,495,444	-61,995,755

†Incremental costs for each alternative treatment scenario relative to current treatment scenario.
Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Cost-effectiveness and cost-utility analysis

Table 17 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $17,017, $16,897 and $16,568 per QALY, respectively.

Table 17. Cost-effectiveness and cost-utility analysis, QLD (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	639,412,508		19,892		
Current scenario	694,628,785	55,216,277	18,375	1,517	$36,389
Increased scenario 1	751,588,072	56,959,287	17,369	1,006	$56,604
Increased scenario 2	780,513,947	85,885,162	17,005	1,370	$62,695
Increased scenario 3	822,762,830	128,134,045	16,561	1,814	$70,635
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	639,412,508		12,834		
Current scenario	694,628,785	55,216,277	15,945	3,111	17,747
Increased scenario 1	751,588,072	56,959,287	19,102	3,158	18,038
Increased scenario 2	780,513,947	85,885,162	20,681	4,737	18,132
Increased scenario 3	822,762,830	128,134,045	22,990	7,045	18,187
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	639,412,508		1,407,817		
Current scenario	694,628,785	55,216,277	1,410,920	3,103	17,793
Increased scenario 1	751,588,072	56,959,287	1,414,267	3,347	17,017
Increased scenario 2	780,513,947	28,925,875	1,416,003	1,736	16,666
Increased scenario 3	822,762,830	42,248,883	1,418,654	2,651	15,937

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

See Appendix E for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in QLD over the period 2010 to 2013 and 2010 to 2079.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in South Australia

The epidemiologic and economic trends under various HCV treatment scenarios for South Australia would be similar to the national trends since Australian population-specific epidemiologic and behavioural data were used to inform inputs for the South Australia model simulations.

Key findings

Effect on new HCV cases in South Australia over the period 2010-2039

Under the current treatment scenario, where about 263 cases on average are treated each year, it was estimated that there would be approximately 897 new cases of hepatitis C in South Australia in 2010, which would remain relatively stable over the next 30 years (Figure 6). The model estimated about 17 new cases of liver failure, nine new cases of HCC, three cases receiving liver transplants, and 18 liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an 11-13% increase by 2039.

Under the reduced treatment scenario, where treatment decreased from approximately 263 to 156 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 98 additional HCV cases, 85 new cases of liver failure, 41 new cases of HCC, 13 cases receiving liver transplants, and 68 liver-related deaths relative to current treatment scenario (Table 18).

If treatment rates are increased over the next five years from approximately 263 cases to 443, 579, and 887 cases per year (increased treatment scenarios 1, 2, and 3), it was estimated that there would be 200 to 639 fewer new HCV cases, 53 to 96 fewer new cases of liver failure, 26 to 47 fewer new cases of HCC, eight to 15 fewer cases receiving liver transplants, and 44 to 79 fewer liver-related deaths over the 30-year period relative to the current treatment scenario (Table 18).

Figure 7: Expected epidemiological outcomes associated with changes in HCV treatment rates in South Australia

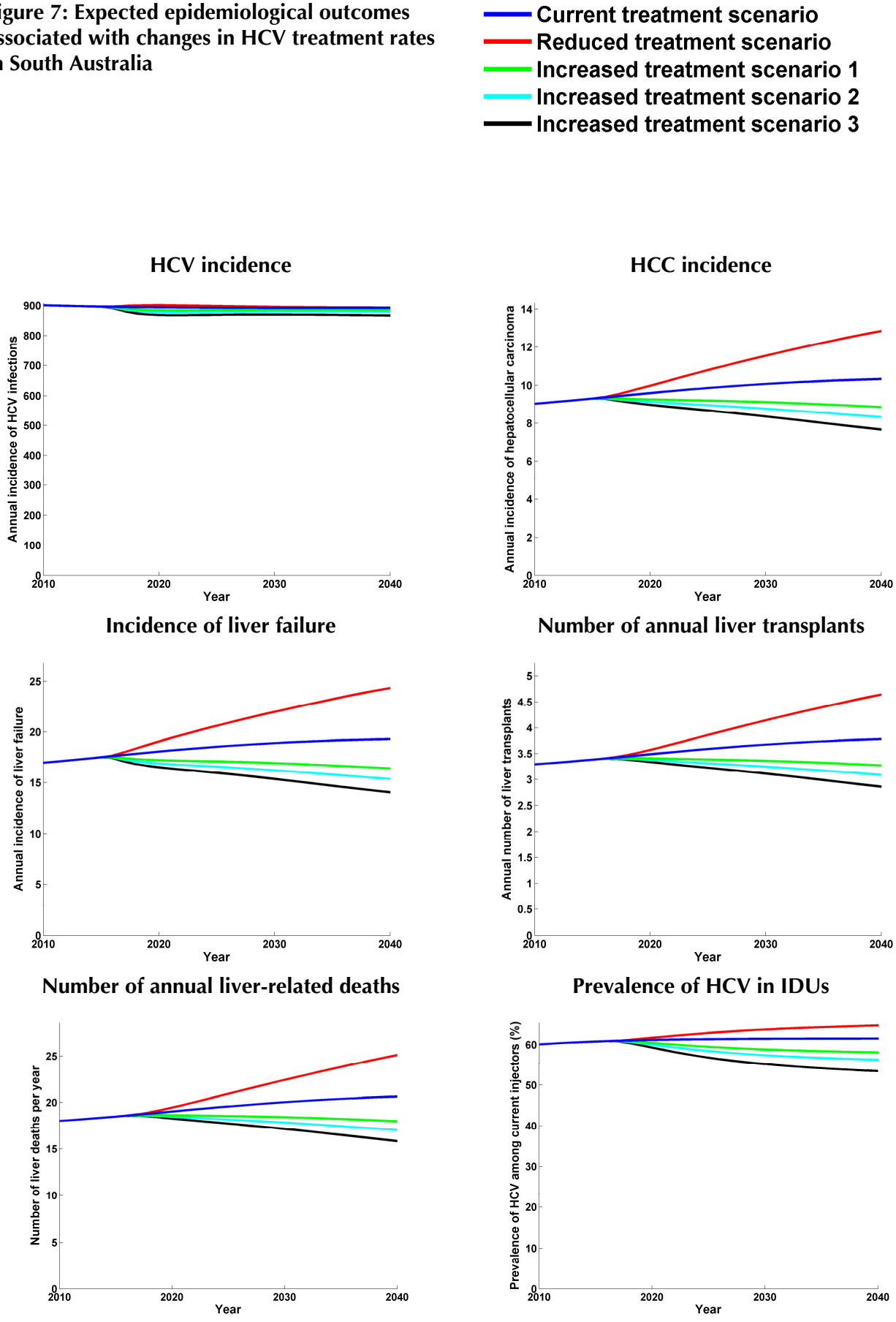

Table 18. Health impact of hepatitis C treatment strategies in South Australia, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	11,731	-1,346	861	1,177	1,557
Number of treatment gains (Sustained virological response)		-2,008	1,898	2,822	4,113
HCV cases / cases averted	26,800	-98	200	351	639
Liver failure cases / cases averted	561	-85	53	73	96
HCC cases / cases averted	299	-41	26	35	47
HCV-related liver transplant cases / cases averted	109	-13	8	12	15
Liver-related deaths / deaths averted	594	-68	44	60	79

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in South Australia over the period 2010-2039 (undiscounted)

Under the current treatment scenario, it was estimated that 11,731 LYs (391 per year) would be lost over the 30-year period due to liver-related death in South Australia (Table 18).

Under the reduced treatment scenario, about 1,346 additional LYs (45 per year) would be lost and 2,570 fewer QALYs (86 per year) would be gained under the reduced treatment scenario relative to the current treatment scenario.

According to the increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 861, 1,177, and 1,557, respectively (29-52 per year) over the next 30 years (Table 18). Compared with the current treatment scenario, the respective incremental QALYs gained would be 2,688, 4,082, and 6,167, respectively (90-206 per year).

Effect on costs incurred through HCV infection in South Australia over the period 2010-2039 (5% discount)

Under the current scenario, an estimated $36m in total costs would be incurred on average due to hepatitis C each year over the next 30 years (Table 19). Of these costs, $8m, $19m, and $9m, were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $3.5m (45%) of the total health sector costs on average each year.

Compared with the current treatment scenario, about $198,000 additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

Under increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $264,000, $425,500, and $700,000 each year, respectively.

Table 19. Costs associated with hepatitis C treatment strategies in South Australia, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*197,260,316*	*-36,777,272*	*34,417,728*	*51,129,271*	*74,634,792*
Other costs	*241,870,990*	*4,029,923*	*-2,977,976*	*-4,264,254*	*-6,176,566*
Total	439,131,306	-32,747,348	31,439,752	46,865,016	68,458,225
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	1,071,810,710	58,383,912	-60,834,885	-92,324,736	-139,383,483
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	941,836,494	3,460,467	-7,035,494	-12,321,549	-22,473,684
Total costs	2,452,778,511	29,097,030	-36,430,627	-57,781,269	-93,398,941
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*132,384,310*	*-24,309,029*	*23,788,173*	*35,590,054*	*52,547,278*
Other costs	*162,164,156*	*1,376,588*	*-744,533*	*-985,350*	*-1,313,096*
Total	294,548,465	-22,932,442	23,043,640	34,604,703	51,234,182
Patient/family costs†	720,221,605	33,131,275	-35,148,588	-53,498,173	-81,013,372
Productivity costs†	418,944,476	1,692,099	-3,094,017	-5,322,335	-9,507,898
Total costs	1,433,714,546	11,890,931	-15,198,965	-24,215,805	-39,287,087
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*105,651,401*	*-19,114,268*	*19,242,070*	*28,920,061*	*42,994,601*
Other costs	*129,339,166*	*465,640*	*20,278*	*137,230*	*351,779*
Total	234,990,567	-18,648,628	19,262,348	29,057,291	43,346,380
Patient/family costs†	575,275,402	23,383,970	-25,116,416	-38,309,518	-58,137,115
Productivity costs†	283,112,247	1,193,670	-2,063,003	-3,511,274	-6,191,291
Total costs†	1,093,378,216	5,929,012	-7,917,071	-12,763,501	-20,982,025

†Incremental costs for each alternative treatment scenario relative to current treatment scenario. Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Cost-effectiveness and cost-utility analysis

Table 20 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $17,067, $16,866 and $16,565 per QALY, respectively.

Table 20. Cost-effectiveness and cost-utility analysis, South Australia (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	216,341,938		6,727		
Current scenario	234,990,567	18,648,628	6,216	511	$36,476
Increased scenario 1	254,252,915	19,262,348	5,877	339	$56,784
Increased scenario 2	264,047,857	29,057,291	5,752	464	$62,568
Increased scenario 3	278,336,947	43,346,380	5,602	614	$70,623
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	216,341,938		4,344		
Current scenario	234,990,567	18,648,628	5,394	1,050	17,767
Increased scenario 1	254,252,915	19,262,348	6,460	1,066	18,074
Increased scenario 2	264,047,857	29,057,291	6,999	1,605	18,109
Increased scenario 3	278,336,947	43,346,380	7,778	2,384	18,185
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	216,341,938		476,263		
Current scenario	234,990,567	18,648,628	477,309	1,046	17,831
Increased scenario 1	254,252,915	19,262,348	478,438	1,129	17,067
Increased scenario 2	264,047,857	9,794,943	479,032	594	16,484
Increased scenario 3	278,336,947	14,289,089	479,926	894	15,986

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

See Appendix F for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in South Australia over the period 2010 to 2013 and 2010 to 2079.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in Tasmania

The epidemiologic and economic trends under various HCV treatment scenarios for Tasmania would be similar to the national trends since Australian population-specific epidemiologic and behavioural data were used to inform inputs for the Tasmanian model simulations.

Key findings

Effect on new HCV cases in Tasmania over the period 2010-2039

Under the current treatment scenario, where about 73 cases on average are treated each year, it was estimated that there would be approximately 250 new cases of hepatitis C in Tasmania in 2010, which would remain relatively stable over the next 30 years (Figure 7). The model estimated about five new cases of liver failure, two to three new cases of HCC, one case receiving liver transplant, and five liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an increase of between 11-13% by 2039.

Under the reduced treatment scenario, where treatment decreased from approximately 73 to 44 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 27 additional HCV cases, 24 new cases of liver failure, 11 new cases of HCC, four cases receiving liver transplants, and 19 liver-related deaths relative to current treatment scenario (Table 21).

If treatment rates are increased over the next five years from approximately 73 cases to 124, 162, and 247 cases per year (increased treatment scenarios 1, 2, and 3), it was estimated that there would be 56-178 fewer new HCV cases, 15-27 fewer new cases of liver failure, seven to 13 fewer new cases of HCC, 2-4 fewer cases receiving liver transplants, and 12-22 fewer liver-related deaths over the 30-year period relative to the current treatment scenario (Table 21).

Figure 7: Expected epidemiological outcomes associated with changes in HCV treatment rates in Tasmania

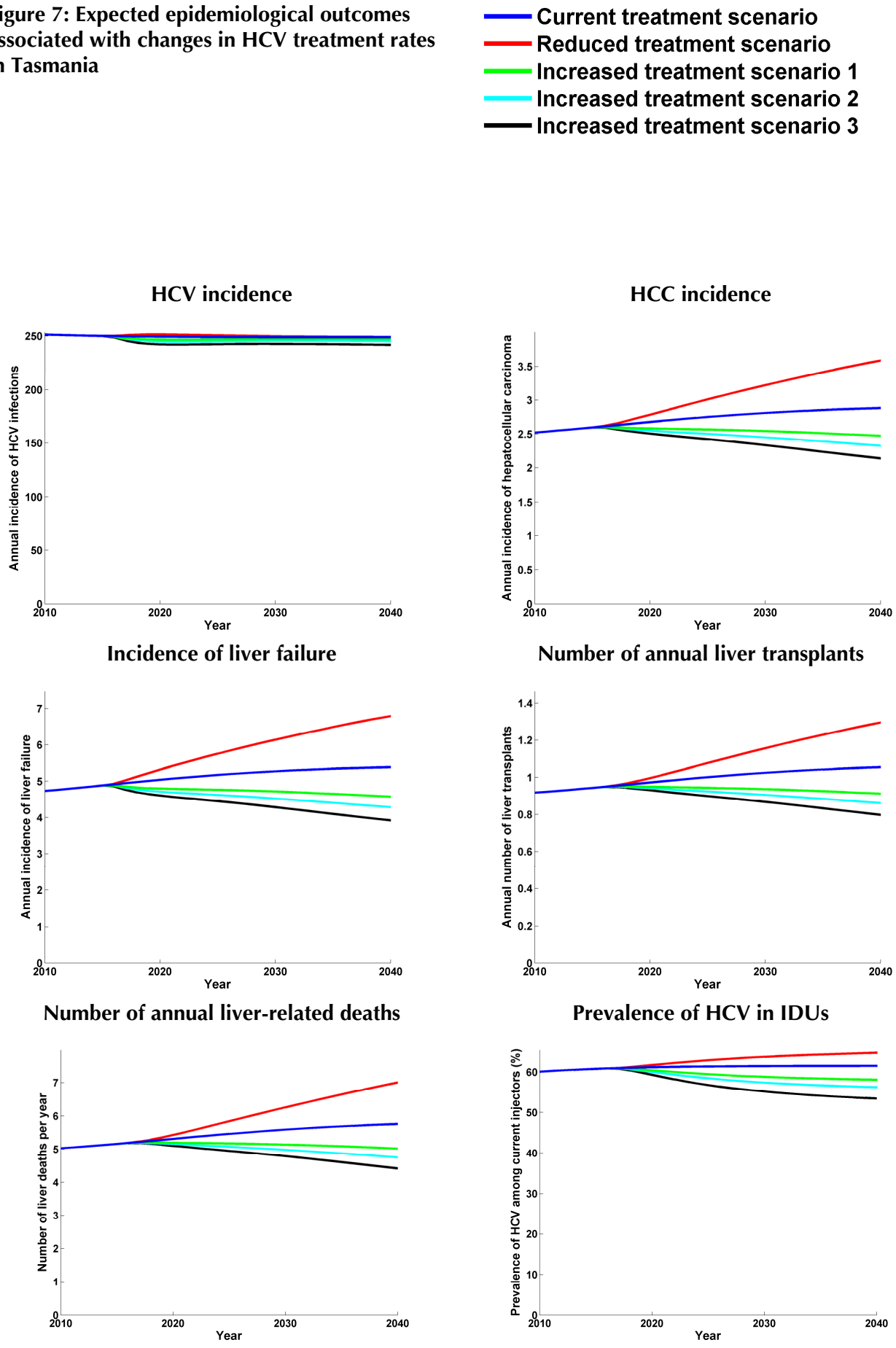

Table 21. Health impact of hepatitis C treatment strategies in Tasmania, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	3,273	-376	242	327	434
Number of treatment gains (Sustained virological response)		-560	531	786	1,147
HCV cases / cases averted	7,477	-27	56	98	178
Liver failure cases / cases averted	156	-24	15	20	27
HCC cases / cases averted	83	-11	7	10	13
HCV-related liver transplant cases / cases averted	30	-4	2	3	4
Liver-related deaths / deaths averted	166	-19	12	17	22

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in Tasmania over the period 2010-2039 (undiscounted)

Under the current treatment scenario, it was estimated that 3,273 LYs (109 per year) would be lost over the 30-year period due to liver-related death in Tasmania (Table 21).

Under the reduced treatment scenario, about 376 additional LYs (13 per year) would be lost and 717 fewer QALYs (24 per year) would be gained under the reduced treatment scenario relative to the current treatment scenario.

According to the increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 242, 327, and 434, respectively (8-14 per year) over the next 30 years (Table 21). Compared with the current treatment scenario, the respective incremental QALYs gained would be 753, 1,136, and 1,720, respectively (25-57 per year).

Effect on costs incurred through HCV infection in Tasmania over the period 2010-2039 (5% discount)

Under the current scenario, about $10m total costs on average would incur through hepatitis C each year over the next 30 years in Tasmania (Table 22). Of these costs, $2m, $5m, and $3m, were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $982,600 (45%) of the total health sector costs on average each year.

Compared with the current treatment scenario, about $55,300 additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

Under increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $75,100, $117,200, and $195,000 each year, respectively.

Table 22. Costs associated with hepatitis C treatment strategies in Tasmania, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*55,037,118*	*-10,263,066*	*9,603,635*	*14,266,202*	*20,825,521*
Other costs	*67,483,825*	*1,126,016*	*-844,167*	*-1,176,353*	*-1,719,429*
Total	122,520,943	-9,137,050	8,759,467	13,089,849	19,106,092
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	299,043,300	16,298,515	-17,042,295	-25,689,829	-38,870,439
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	262,779,402	965,568	-1,967,655	-3,431,814	-6,268,203
Total costs	684,343,645	8,127,032	-10,250,483	-16,031,794	-26,032,550
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*36,936,221*	*-6,784,715*	*6,643,361*	*9,924,748*	*14,661,137*
Other costs	*45,245,031*	*384,964*	*-215,940*	*-266,581*	*-363,844*
Total	82,181,252	-6,399,750	6,427,421	9,658,167	14,297,293
Patient/family costs†	200,947,245	9,250,382	-9,858,336	-14,873,937	-22,589,087
Productivity costs†	116,888,601	472,259	-866,466	-1,481,122	-2,651,492
Total costs	400,017,099	3,322,891	-4,297,381	-6,696,892	-10,943,286
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*29,477,537*	*-5,335,479*	*5,377,335*	*8,061,163*	*11,995,037*
Other costs	*36,086,616*	*130,483*	*-294*	*44,363*	*100,051*
Total	65,564,154	-5,204,996	5,377,041	8,105,525	12,095,088
Patient/family costs†	160,506,147	6,529,684	-7,051,149	-10,644,250	-16,208,525
Productivity costs†	78,990,394	333,206	-578,338	-976,476	-1,726,383
Total costs†	305,060,695	1,657,894	-2,252,446	-3,515,200	-5,839,820

†Incremental costs for each alternative treatment scenario relative to current treatment scenario. Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Cost-effectiveness and cost-utility analysis

Table 23 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $16,973, $16,931 and $16,579 per QALY respectively.

Table 23. Cost-effectiveness and cost-utility analysis, Tasmania (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	60,359,157		1,877		
Current scenario	65,564,154	5,204,996	1,734	143	$36,458
Increased scenario 1	70,941,195	5,377,041	1,639	95	$56,446
Increased scenario 2	73,669,679	8,105,525	1,605	129	$62,831
Increased scenario 3	77,659,242	12,095,088	1,563	171	$70,686
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	60,359,157		1,212		
Current scenario	65,564,154	5,204,996	1,505	293	17,763
Increased scenario 1	70,941,195	5,377,041	1,804	299	18,005
Increased scenario 2	73,669,679	8,105,525	1,951	446	18,157
Increased scenario 3	77,659,242	12,095,088	2,170	665	18,196
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	60,359,157		132,881		
Current scenario	65,564,154	5,204,996	133,173	292	17,824
Increased scenario 1	70,941,195	5,377,041	133,490	317	16,973
Increased scenario 2	73,669,679	2,728,484	133,652	162	16,848
Increased scenario 3	77,659,242	3,989,563	133,902	251	15,908

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

See Appendix G for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in Tasmania over the period 2010 to 2013 and 2010 to 2079.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in Victoria

The epidemiologic and economic trends under various HCV treatment scenarios for Victoria would be similar to the national trends since Australian population-specific epidemiologic and behavioural data were used to inform inputs for the Victoria model simulations.

Key findings

Effect on new HCV cases in Victoria over the period 2010-2039

Under the current treatment scenario, where about 785 cases on average are treated each year, it was estimated that there would be approximately 2,673 new cases of hepatitis C in Victoria in 2010, which would remain relatively stable over the next 30 years (Figure 8). The model estimated about 52 new cases of liver failure, 28 new cases of HCC, ten cases receiving liver transplants, and 55 liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an 11-13% increase by 2039.

Under the reduced treatment scenario, where treatment decreased from approximately 785 to 464 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 294 additional HCV cases, 254 new cases of liver failure, 122 new cases of HCC, 40 cases receiving liver transplants, and 204 additional liver-related deaths relative to current treatment scenario (Table 24).

If treatment rates are increased over the next five years from approximately 785 cases to 1,320, 1,726, and 2,642 cases per year (increased treatment scenarios 1, 2, and 3), it was estimated that there would be 597-1,905 fewer new HCV cases, 159-286 fewer new cases of liver failure, 77-139 fewer new cases of HCC, 25-46 fewer cases receiving liver transplants, and 130-235 fewer liver-related deaths over the 30-year period relative to the current treatment scenario (Table 24).

Figure 8: Expected epidemiological outcomes associated with changes in HCV treatment rates in Victoria

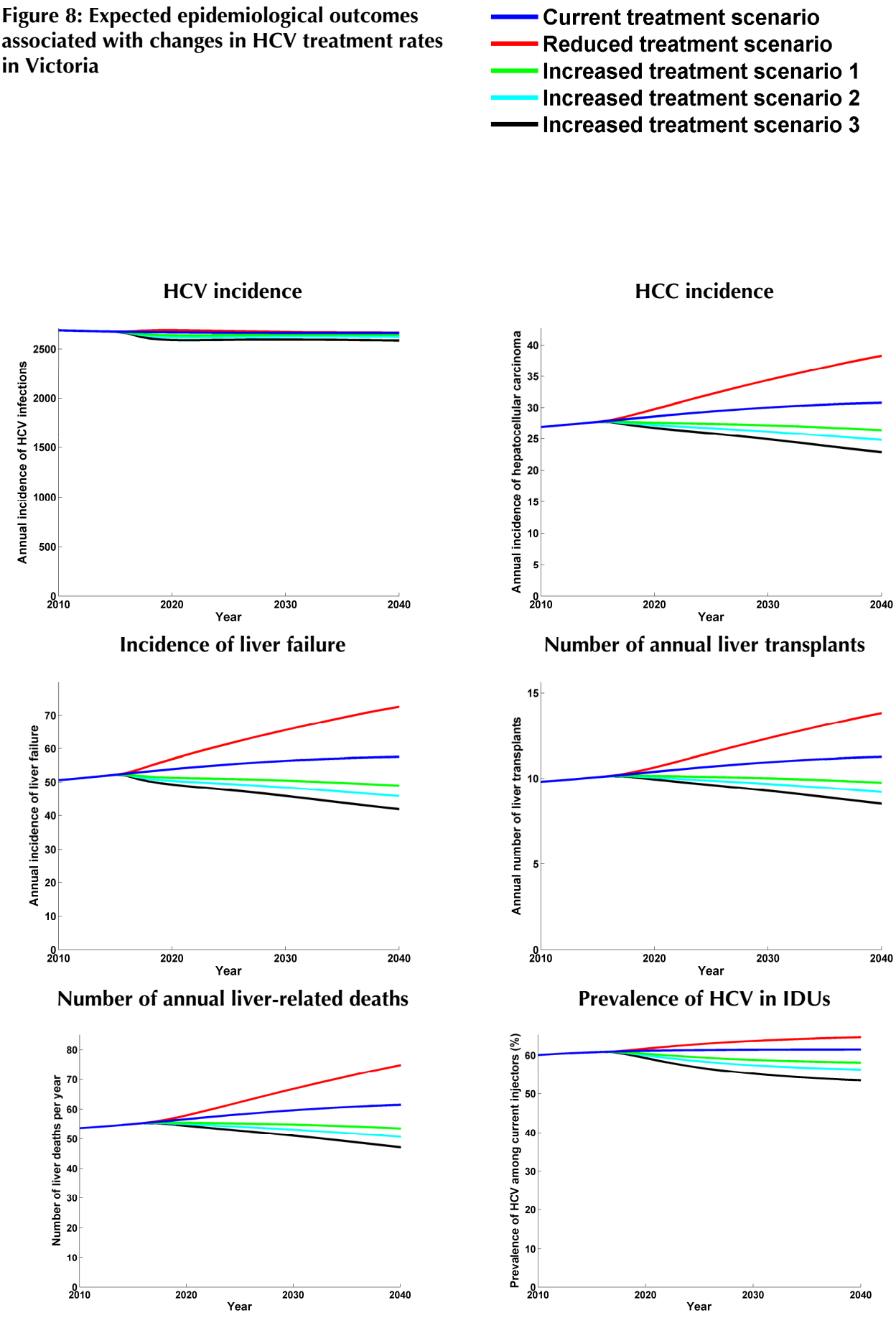

Table 24. Health impact of hepatitis C treatment strategies in Victoria, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	34,955	-4,025	2,575	3,503	4,637
Number of treatment gains (Sustained virological response)		-5,991	5,662	8,405	12,253
HCV cases / cases averted	79,853	-294	597	1,044	1,905
Liver failure cases / cases averted	1,670	-254	159	216	286
HCC cases / cases averted	890	-122	77	105	139
HCV-related liver transplant cases / cases averted	325	-40	25	34	46
Liver-related deaths / deaths averted	1,771	-204	130	177	235

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in Victoria over the period 2010-2039 (undiscounted)

Under the current treatment scenario, it was estimated that 34,955 LYs (1,165 per year) would be lost over the 30-year period due to liver-related death in Victoria (Table 24).

Under the reduced treatment scenario, about 4,025 additional LYs (134 per year) would be lost and 7,679 fewer QALYs (256 per year) would be gained under the reduced treatment scenario relative to the current treatment scenario.

According to the increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 2,575, 3,503, and 4,637, respectively (86-155 per year) over the next 30 years (Table 24). Compared with the current treatment scenario, the respective incremental QALYs gained would be 8,030, 12,154, and 18,368, respectively (268-612 per year).

Effect on costs incurred through HCV infection in Victoria over the period 2010-2039 (5% discount)

Under the current scenario, about $109m in total costs would be incurred on average due to hepatitis C each year over the next 30 years in Victoria (Table 25). Of these costs, $23.5m, $57m, and $28m, were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $10.5m (45%) of the total health sector costs on average each year.

Compared with the current treatment scenario, about $596,100 additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

Under increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $796,300, $1m, and $2m each year, respectively.

Table 25. Costs associated with hepatitis C treatment strategies in Victoria, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*587,761,333*	*-109,684,368*	*102,561,281*	*152,349,242*	*222,399,046*
Other costs	*720,683,383*	*12,106,343*	*-8,963,754*	*-12,658,156*	*-18,368,470*
Total	1,308,444,716	-97,578,026	93,597,528	139,691,086	204,030,577
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	3,193,593,422	174,475,488	-181,744,399	-274,852,594	-415,144,598
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	2,806,317,517	10,315,533	-20,996,190	-36,693,245	-66,944,394
Total costs	7,308,355,655	87,212,996	-109,143,062	-171,854,754	-278,058,415
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*394,455,322*	*-72,558,470*	*70,926,418*	*106,027,546*	*156,570,580*
Other costs	*483,187,208*	*4,156,457*	*-2,273,839*	*-2,906,004*	*-3,889,315*
Total	877,642,530	-68,402,013	68,652,579	103,121,542	152,681,265
Patient/family costs†	2,145,990,397	99,090,537	-105,089,109	-159,223,330	-241,262,940
Productivity costs†	1,248,296,075	5,051,380	-9,241,157	-15,845,020	-28,318,245
Total costs	4,271,929,002	35,739,903	-45,677,686	-71,946,807	-116,899,920
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*314,801,341*	*-57,089,367*	*57,396,864*	*86,144,317*	*128,099,848*
Other costs	*385,381,209*	*1,423,376*	*20,542*	*430,885*	*1,065,825*
Total	700,182,551	-55,665,991	57,417,406	86,575,202	129,165,673
Patient/family costs†	1,714,105,239	69,982,457	-75,140,526	-113,994,839	-173,119,015
Productivity costs†	843,567,181	3,567,094	-6,165,723	-10,450,863	-18,438,101
Total costs†	3,257,854,970	17,883,559	-23,888,843	-37,870,500	-62,391,443

†Incremental costs for each alternative treatment scenario relative to current treatment scenario. Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Cost-effectiveness and cost-utility analysis

Table 26 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $17,007, $16,887 and $16,577 per QALY, respectively.

Table 26. Cost-effectiveness and cost-utility analysis, Victoria (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	644,516,559		20,052		
Current scenario	700,182,551	55,665,991	18,522	1,530	$36,374
Increased scenario 1	757,599,956	57,417,406	17,507	1,015	$56,568
Increased scenario 2	786,757,753	86,575,202	17,140	1,382	$62,655
Increased scenario 3	829,348,224	129,165,673	16,694	1,828	$70,676
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	644,516,559		12,935		
Current scenario	700,182,551	55,665,991	16,072	3,137	17,743
Increased scenario 1	757,599,956	57,417,406	19,257	3,184	18,031
Increased scenario 2	786,757,753	86,575,202	20,849	4,777	18,125
Increased scenario 3	829,348,224	129,165,673	23,171	7,099	18,195
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	644,516,559		1,419,071		
Current scenario	700,182,551	55,665,991	1,422,201	3,130	17,786
Increased scenario 1	757,599,956	57,417,406	1,425,577	3,376	17,007
Increased scenario 2	786,757,753	29,157,796	1,427,327	1,751	16,656
Increased scenario 3	829,348,224	42,590,471	1,429,993	2,665	15,980

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

See Appendix H for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in Victoria over the period 2010 to 2013 and 2010 to 2079.

Epidemiological and economic evaluation of hepatitis C treatment scenarios in Western Australia

The epidemiologic and economic trends under various HCV treatment scenarios for Western Australia would be similar to the national trends since Australian population-specific epidemiologic and behavioural data were used to inform inputs for the WA model simulations.

Key findings

Effect on new HCV cases in Western Australia over the period 2010-2039

Under the current treatment scenario, where about 391 cases on average are treated each year, it was estimated that there would be approximately 1,334 new cases of hepatitis C in Western Australia in 2010, which would remain relatively stable over the next 30 years (Figure 9). The model estimated about 26 new cases of liver failure, 14 new cases of HCC, five cases receiving liver transplants, and 27 liver-related deaths in 2010. The annual number of these cases would increase each year under current conditions to an increase of between 11-13% by 2039.

Under the reduced treatment scenario, where treatment decreased from approximately 391 to 232 cases per year, the number of new cases of liver failure, HCC, liver transplants and liver-related deaths over the next 30 years could all be expected to increase, by 41-43%. It was estimated that there would be 146 additional HCV cases, 126 new cases of liver failure, 61 new cases of HCC, 20 cases receiving liver transplants, and 101 additional liver-related deaths relative to current treatment scenario (Table 27).

If treatment rates are increased over the next five years from approximately 232 cases to 658, 861, and 1,318 cases per year (increased treatment scenarios 1, 2, and 3), it was estimated that there would be 298-950 fewer new HCV cases, 79-143 fewer new cases of liver failure, 38-69 fewer new cases of HCC, 13-23 fewer cases receiving liver transplants, and 65-117 fewer liver-related deaths over the 30-year period relative to the current treatment scenario (Table 27).

Figure 9: Expected epidemiological outcomes associated with changes in HCV treatment rates in Western Australia

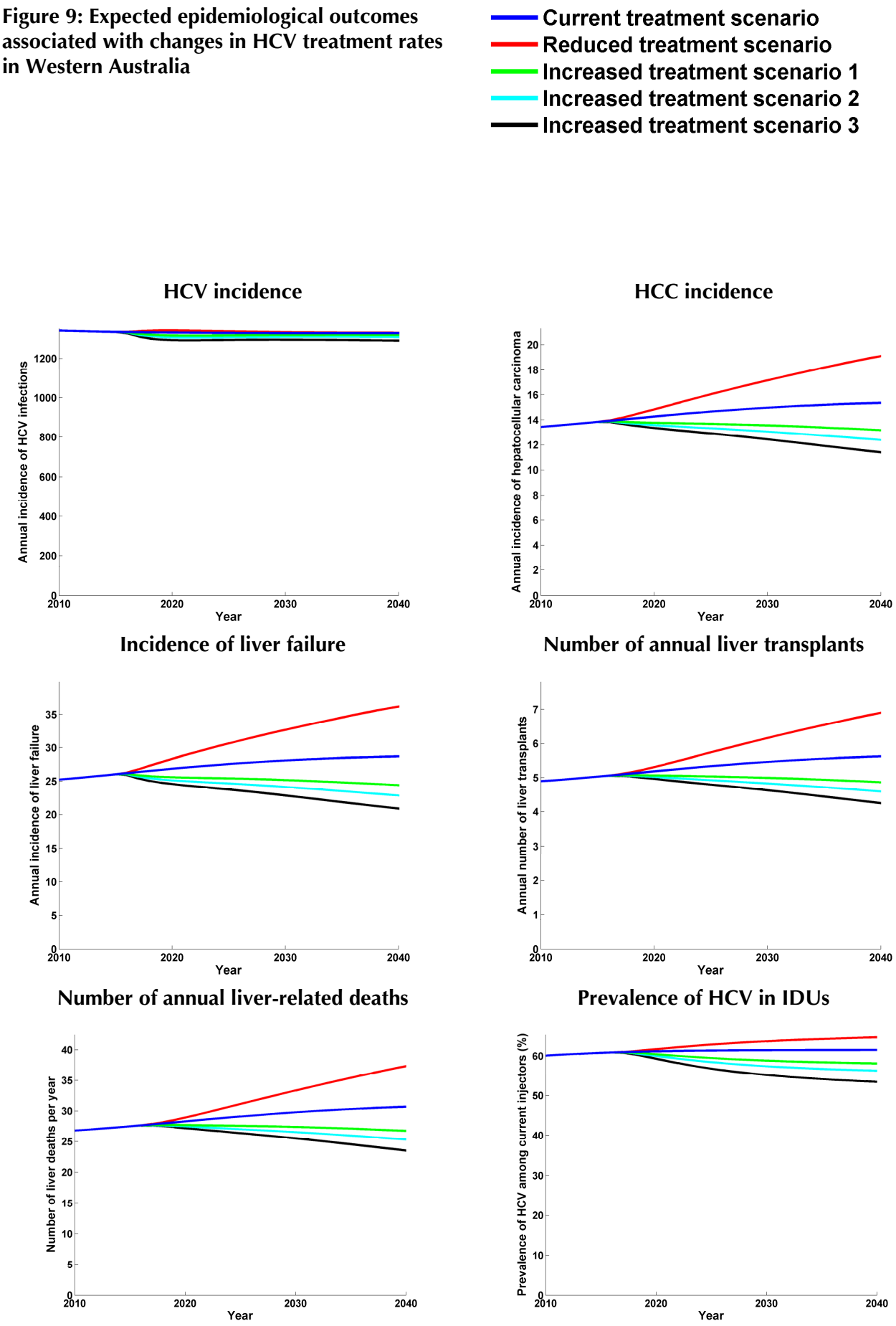

Table 27. Health impact of hepatitis C treatment strategies in Western Australia, 2010-2039

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Life years lost / gained	17,439	-2,001	1,283	1,746	2,313
Number of treatment gains (Sustained virological response)		-2,985	2,823	4,191	6,112
HCV cases / cases averted	39,838	-146	298	521	950
Liver failure cases / cases averted	833	-126	79	108	143
HCC cases / cases averted	444	-61	38	52	69
HCV-related liver transplant cases / cases averted	162	-20	13	17	23
Liver-related deaths / deaths averted	883	-101	65	88	117

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Effect on life years in Western Australia over the period 2010-2039 (undiscounted)

Under the current treatment scenario, it was estimated that 17,439 LYs (581 per year) would be lost over the 30-year period due to liver-related death in Western Australia (Table 27).

Under the reduced treatment scenario, about 2,001 additional LYs (67 per year) would be lost and 3,820 fewer QALYs (127 per year) would be gained under the reduced treatment scenario relative to the current treatment scenario.

According to the increased treatment scenarios 1, 2, and 3, the incremental LYs gained relative to the current treatment scenario would be 1,283, 1,746, and 2,313, respectively (43-77 per year) over the next 30 years (Table 27). Compared with the current treatment scenario, the respective incremental QALYs gained would be 4,001, 6,058, and 9,162, respectively (133-305 per year).

Effect on costs incurred through HCV infection in Western Australia over the period 2010-2039 (5% discount)

Under the current scenario, about $54m in total costs would be incurred on average due to hepatitis C each year over the next 30 years in Western Australia (Table 28). Of these costs, $12m, $28.5m, and $14m, were attributed to health sector costs, patient and family costs, and productivity costs, respectively. Drug costs accounted for about $5m (45%) of the total health sector costs on average each year.

Compared with the current treatment scenario, about $294,000 additional total costs would accrue on average each year under the reduced treatment scenario over the next 30 years.

Under increased treatment scenarios 1, 2, and 3, there would be total cost savings on average of about $395,000, $627,000, and $1m each year, respectively.

Table 28. Costs associated with hepatitis C treatment strategies in Western Australia, 2010-2039

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*293,224,936*	*-54,671,143*	*51,163,739*	*76,009,597*	*110,954,383*
Other costs	*359,538,116*	*5,991,964*	*-4,449,787*	*-6,289,282*	*-9,158,916*
Total	652,763,052	-48,679,179	46,713,952	69,720,316	101,795,467
Treated (% Total)	*58%*	*51%*	*63%*	*66%*	*69%*
Patient/family costs†	1,593,232,965	86,797,149	-90,551,009	-136,987,821	-207,083,759
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	1,400,027,472	5,145,014	-10,466,557	-18,294,255	-33,394,567
Total costs	3,646,023,489	43,262,983	-54,303,614	-85,561,760	-138,682,859
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*196,787,573*	*-36,137,666*	*35,372,394*	*52,889,240*	*78,111,029*
Other costs	*241,055,013*	*2,046,930*	*-1,121,013*	*-1,433,636*	*-1,937,345*
Total	437,842,587	-34,090,736	34,251,382	51,455,604	76,173,684
Patient/family costs†	1,070,600,018	49,256,590	-52,338,225	-79,334,048	-120,342,585
Productivity costs†	622,755,253	2,515,637	-4,604,899	-7,897,692	-14,125,949
Total costs	2,131,197,858	17,681,491	-22,691,742	-35,776,136	-58,294,850
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*157,049,444*	*-28,415,867*	*28,618,720*	*42,964,829*	*63,906,237*
Other costs	*192,261,113*	*692,466*	*19,778*	*226,835*	*533,880*
Total	349,310,557	-27,723,401	28,638,498	43,191,664	64,440,117
Patient/family costs†	855,139,265	34,766,058	-37,411,238	-56,785,435	-86,349,433
Productivity costs†	420,842,436	1,774,564	-3,071,483	-5,207,931	-9,197,300
Total costs†	1,625,292,258	8,817,220	-11,844,223	-18,801,701	-31,106,617

†Incremental costs for each alternative treatment scenario relative to current treatment scenario. Positive value indicates increase in cost.
*Pegylated interferon and ribavirin costs.
Costs are expressed in 2008 Australian dollars.

Cost-effectiveness and cost-utility analysis

Table 29 summarises cost-effectiveness and cost-utility results. ICERs of each strategy are reported relative to the next best strategy. Alternatively, the ICERs for increased treatment scenarios 1, 2, and 3 relative to the current scenario were $17,036, $16,912 and $16,580 per QALY, respectively.

Table 29. Cost-effectiveness and cost-utility analysis, Western Australia (2010-2039; 5% discount) from a health sector perspective: incremental cost per life year gained; incremental cost per sustained virological response achieved; and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	321,587,156		10,000		
Current scenario	349,310,557	27,723,401	9,240	760	$36,473
Increased scenario 1	377,949,055	28,638,498	8,735	505	$56,673
Increased scenario 2	392,502,221	43,191,664	8,552	688	$62,753
Increased scenario 3	413,750,674	64,440,117	8,329	912	$70,692
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	321,587,156		6,458		
Current scenario	349,310,557	27,723,401	8,018	1,560	17,766
Increased scenario 1	377,949,055	28,638,498	9,605	1,586	18,052
Increased scenario 2	392,502,221	43,191,664	10,399	2,381	18,143
Increased scenario 3	413,750,674	64,440,117	11,559	3,541	18,197
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	321,587,156		707,959		
Current scenario	349,310,557	27,723,401	709,514	1,555	17,830
Increased scenario 1	377,949,055	28,638,498	711,195	1,681	17,036
Increased scenario 2	392,502,221	14,553,166	712,068	873	16,672
Increased scenario 3	413,750,674	21,248,453	713,401	1,333	15,945

‡Years of potential life lost due to HCV was estimated using the life expectancy of the average Australian, adjusted for premature mortality associated with hepatitis C.
†Incremental Quality-Adjusted Life Years (QALYs) gained.
§Incremental life years (LYs) gained.
*ICER, incremental cost-effectiveness ratio of each strategy relative to the next best strategy; SVR, sustained virological response. Both costs and effects are discounted at 5%.

See Appendix I for summaries of health and economic outcomes associated with hepatitis C treatment scenarios in Western Australia over the period 2010 to 2013 and 2010 to 2079.

Discussion

The projected HCV incidence of approximately 11,700 in 2010 is generally consistent with a previous study carried out in Australia by the HCV Projections Working Group [5]. Under levels of current treatment at around 3,500 chronic HCV cases per year, it was estimated that there would be an increase of between 11-13% in the number of new cases of liver failure and HCC, liver transplant cases, and liver-related deaths attributable to HCV in 2039. The model suggests that if annual treatment rates are increased twofold, compared with current levels, there would be a modest decline in the number of new cases of liver failure (7%) and HCC (6%), people receiving a liver transplant (4%), and the number of liver-related deaths (3%) over the next 30 years. However, if treatment rates are increased by three- to fourfold, these numbers would be expected to decrease by about 20%. The economic analyses suggest that increased treatment uptake of up to three- to fourfold is associated with substantial long-term total cost savings and gains in LYs and QALYs; however, this will also be associated with increased health sector costs due to increased drug costs. Most cost savings were found to be in patient and family time costs associated with hepatitis C care.

A decline in treatment uptake has been reported in Europe [24] and in the United States [25] due to lack of diagnosis or physician referral [25]. Although this scenario is unlikely under current conditions in Australia, factors such as patients and/or clinicians delaying treatment in anticipation of new treatments, such as specifically targeted antiviral therapy for HCV (STAT-C) becoming available, or government inaction on disease awareness or clinic funding, are potential threats to treatment uptake rates. This analysis showed that a decline in the treatment uptake from 3,500 to 2,000 chronic HCV cases per year is associated with a substantial increase in the long-term liver-related consequences (41-43%; see Figure 1) and total costs (55% relative to current levels of treatment; see Table 3). Previous HCV Projections Working Group's estimates in 2005, suggest that the number of cirrhosis cases, new cases of liver failure and HCC would double by 2025 if the number of people with chronic HCV receiving treatment for hepatitis C continues at about 2,000 per year [4]. Direct comparison of the current model with previous models is hampered by variation in the methodologies, natural history data, and treatment efficacy.

Compared with the current treatment scenario, increased treatment scenarios are cost-effective, with an ICER in the range of $16,500 to $17,000 per QALY. Although direct comparison is hampered by the variation in the comparator group, these estimates are within the range reported by other studies: $4,000 to $35,000 per QALY for interferon-based therapies for chronic HCV infection, which is regarded as good value for money when compared with other well accepted medical interventions [26-28]. A previous Australian study estimated the ICER at $5,625 per QALY for six months' treatment with interferon or $8,250 per QALY gained for 12 months treatment [28].

In this analysis, QALY gains exceed life expectancy gains, suggesting that a substantial proportion of the clinical benefit associated with treating chronic hepatitis C results from averting progression to advanced liver disease stages, associated with a poorer quality of life

[29]. These findings are consistent with previous studies [27, 28], in which benefits of treatment were mainly due to improvements in health-related quality of life rather than survival.

In the sensitivity analyses, treatment efficacy for HCV genotype 1 patients with no fibrosis to mild fibrosis stage (F0 to F2), costs of PEG-IFN and ribavirin, and utilities for F0 to F2 stage were the key drivers in the model. Increased treatment scenarios become more cost-effective as treatment efficacy for HCV genotype 1 patients with F0 to F2 stage increases, drug costs decrease, and utilities for F0 to F2 stage decrease. The model showed no cost savings if the health sector cost increases by 50% over the period. Sensitivity results revealed that the model was robust to all variables, including transition probabilities, treatment efficacy, health care costs and utilities. All simulations fall below a willingness-to-pay threshold of $50,000 per QALY.

Treating hepatitis C is one strategy aiming to reduce the burden of disease. It is possible to cure hepatitis C in at least half of those treated; however, access to appropriate treatment services remains limited for many people with hepatitis C. There appears to be considerable scope for expanding the treatment of hepatitis C and delivering substantial health gains to individuals suffering from the effects of the virus in Australian settings. Despite the National Hepatitis C Strategy 2005-2008 priority area for action to improve access to treatment and support and increase treatment uptake among people with hepatitis C, and NSW Hepatitis C Treatment and Care Strategy recommendations of broadening HCV treatment service delivery, there is currently limited capacity in most of Australia's hepatitis C treatment services to treat more people with hepatitis C. Pilot studies such as training of medical service providers in hepatitis C, GP initiation of treatment, integrating hepatitis C treatment services within opiate pharmacotherapy settings and prison settings, and assessment of costs and effectiveness of these programs are currently underway or under consideration to improve hepatitis C treatment uptake. This study provides evidence that increased treatment uptake by up to three- to fourfold is associated with substantial health benefits, long-term total cost savings, and gains in LYs and QALYs, and help guide implementation of programs to increase the capacity of treatment services.

Limitations

There are several methodological issues that need to be considered in interpreting the results. First, in the epidemic transmission model, it was assumed that injecting behaviour such as frequency of injecting and sharing rates among the IDU population over time were constant. Treatment may have an impact on injecting behaviour. However, data are lacking to inform the model. Increased treatment uptake may also increase awareness of hepatitis C and education among the population, which in turn may have an indirect effect on disease transmission.

Second, only the current standard of care with combination PEG-IFN and ribavirin therapy and its direct impact on the burden of disease were considered in the analyses. New potential improved treatments, which should increase SVR rates among people receiving treatment and other preventive measures that could reduce new infections, were not considered in the analyses.

Third, the analyses did not address opportunity costs, the value of the alternative use of resources, which is unknown.

Fourth, a friction cost approach was used in the productivity analysis rather than the human capital approach because this approach is recommended by several reimbursement agencies and because it reduces the risk of increasing any uncertainty in the estimates of productivity gains excessively [30]. Taxation and welfare payments were not included in the estimation of productivity costs.

Finally, in the economic analyses, health care resource use is considered proportional to increased treatment uptake. Strategies designed to increase treatment uptake, such as training and education of health care personnel was not considered, and thus, may lead to overestimation of total cost savings.

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Appendix A: Additional results and tables for Australia

Table A.1. Health impact of hepatitis C treatment strategies in Australia, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario*			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	3,362	2,492	4,987	6,188	8,708
Health effects* 2010-2013					
Life years lost / gained	19,198	-28	34	49	70
Number of treatment gains (Sustained virological response)		-2,287	3,145	4,961	8,014
HCV cases / cases averted	46,877	-99	142	225	368
Liver failure cases / cases averted	922	-8	9	12	17
HCC cases / cases averted	490	-2	3	4	6
HCV-related liver transplant cases / cases averted	178	0	0	0	1
Liver-related deaths / deaths averted	973	-1	2	2	4

Undiscounted health outcomes.
*Incremental refers to the difference in effect, between current scenario and alternative scenario. Positive indicates increased benefit relative to current treatment scenario.
HCV, hepatitis C virus; SVR, sustained virological response; HCC, hepatocellular carcinoma.

Table A.2. Costs associated with hepatitis C treatment strategies in Australia, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*336,076,246*	*-34,585,530*	*48,798,192*	*77,047,113*	*124,538,732*
Other costs	*409,734,567*	*-8,174,877*	*11,539,058*	*18,248,970*	*29,549,723*
Total	745,810,813	-42,760,406	60,337,250	95,296,083	154,088,455
Treated (% Total)	*58%*	*55%*	*61%*	*63%*	*66%*
Patient/family costs†	1,846,367,371	-2,420,856	3,121,776	4,970,327	7,967,795
Treated	*8%*	*7%*	*9%*	*10%*	*11%*
Productivity costs†	1,647,407,100	3,478,903	-4,994,327	-7,916,016	-12,942,022
Total costs	**4,239,585,284**	**-41,702,360**	**58,464,699**	**92,350,394**	**149,114,228**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*321,629,746*	*-32,018,668*	*45,239,007*	*71,434,344*	*115,484,686*
Other costs	*392,042,392*	*-7,571,977*	*10,703,396*	*16,928,901*	*27,416,506*
Total	713,672,139	-39,590,645	55,942,403	88,363,245	142,901,192
Patient/family costs†	1,767,118,927	-2,278,620	2,952,901	4,701,663	7,542,662
Productivity costs†	1,041,966,978	2,127,082	-3,056,080	-4,843,858	-7,920,252
Total costs	**3,522,758,044**	**-39,742,183**	**55,839,224**	**88,221,050**	**142,523,602**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*312,749,031*	*-30,455,244*	*43,068,938*	*68,011,937*	*109,963,274*
Other costs	*381,166,334*	*-7,204,626*	*10,193,667*	*16,123,643*	*26,115,059*
Total	693,915,365	-37,659,870	53,262,605	84,135,580	136,078,333
Patient/family costs†	1,718,401,262	-2,190,799	2,848,053	4,534,847	7,278,459
Productivity costs†	856,285,434	1,709,154	-2,456,916	-3,894,169	-6,367,908
Total costs†	**3,268,602,060**	**-38,141,515**	**53,653,742**	**84,776,257**	**136,988,884**

†Incremental costs for each alternative treatment scenario relative to current treatment scenario. Positive value indicates increase in cost. *Pegylated interferon and ribavirin costs. Costs are expressed in 2008 Australian dollars.

Table A.3. Health impact of hepatitis C treatment strategies in Australia, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	3,466	1,996	5,887	7,757	11,848
Health effects* 2010-2069					
Life years lost / gained	370,430	-92,124	52,034	71,064	94,115
Number of treatment gains (Sustained virological response)		-57,894	49,660	72,272	100,454
HCV cases / cases averted	817,514	-2,028	7,371	13,689	25,923
Liver failure cases / cases averted	17,524	-4,808	2,702	3,691	4,885
HCC cases / cases averted	9,379	-2,486	1,400	1,912	2,531
HCV-related liver transplant cases / cases averted	3,432	-878	495	677	896
Liver-related deaths / deaths averted	18,765	-4,667	2,636	3,600	4,768

Table A.4. Costs associated with hepatitis C treatment strategies in Australia, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	242,638	139,725	412,095	542,979	829,338
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*6,056,130,457*	*-1,039,209,126*	*880,049,341*	*1,281,249,916*	*1,781,754,566*
Other costs	*7,474,392,061*	*522,897,368*	*-368,134,083*	*-532,281,755*	*-764,132,911*
Total	13,530,522,518	-516,311,759	511,915,258	748,968,161	1,017,621,655
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	32,838,967,772	2,946,138,029	-2,795,857,131	-4,200,595,635	-6,185,210,037
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	28,730,196,033	71,269,382	-259,056,506	-481,093,149	-911,019,396
Total costs	75,099,686,322	2,501,095,652	-2,542,998,379	-3,932,720,623	-6,078,607,778
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*2,583,676,759*	*-455,916,334*	*418,336,592*	*618,267,931*	*888,789,160*
Other costs	*3,177,256,881*	*128,068,524*	*-87,364,633*	*-125,055,645*	*-178,710,462*
Total	5,760,933,640	-327,847,810	330,971,959	493,212,286	710,078,697
Patient/family costs†	14,033,377,000	958,967,807	-943,102,239	-1,421,448,246	-2,114,631,919
Productivity costs†	8,138,092,188	25,703,401	-66,666,986	-119,765,372	-221,554,077
Total costs	27,932,402,829	656,823,399	-678,797,266	-1,048,001,332	-1,626,107,299
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	1,743,911,622	-309,099,625	297,777,829	443,784,146	648,998,671
Other costs	*2,140,282,607*	*51,482,249*	*-31,919,680*	*-44,601,944*	*-62,415,229*
Total	3,884,194,229	-257,617,376	265,858,149	399,182,202	586,583,443
Patient/family costs†	9,484,136,562	526,914,422	-532,244,127	-804,256,229	-1,204,656,538
Productivity costs†	4,657,419,584	16,770,332	-36,215,051	-63,533,246	-115,234,990
Total costs†	18,025,750,375	286,067,378	-302,601,028	-468,607,273	-733,308,085

Table A.5. Cost-effectiveness and cost-utility analysis, Australia (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	3,626,576,853		117,838		
Current scenario	3,884,194,229	257,617,376	103,862	13,976	$18,433
Increased scenario 1	4,150,052,378	265,858,149	95,396	8,466	$31,403
Increased scenario 2	4,283,376,431	399,182,202	92,309	11,553	$34,553
Increased scenario 3	4,470,777,672	586,583,443	88,554	15,308	$38,320
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	3,626,576,853		71,922		
Current scenario	3,884,194,229	257,617,376	88,992	17,069	15,092
Increased scenario 1	4,150,052,378	265,858,149	105,597	16,605	16,011
Increased scenario 2	4,283,376,431	399,182,202	113,731	24,740	16,135
Increased scenario 3	4,470,777,672	586,583,443	125,151	36,160	16,222
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	3,626,576,853		7,830,274		
Current scenario	3,884,194,229	257,617,376	7,853,252	22,978	11,212
Increased scenario 1	4,150,052,378	265,858,149	7,876,690	23,439	11,343
Increased scenario 2	4,283,376,431	399,182,202	7,888,719	35,467	11,255
Increased scenario 3	4,470,777,672	586,583,443	7,906,450	53,198	11,026

Table A.6. Sensitivity analysis: increase in health sector cost, including drug cost versus total cost savings, 2010-2039

Health sector cost	HCV treatment scenarios				
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Base case	14,298,244,303	78,118,048	-104,387,287	-166,103,554	-273,832,780
10% increase	14,605,544,136	53,703,429	-79,194,474	-128,107,692	-217,143,037
20% increase	14,912,843,969	29,288,809	-54,001,662	-90,111,829	-160,453,294
30% increase	15,220,143,803	4,874,190	-28,808,849	-52,115,966	-103,763,551
40% increase	15,527,443,636	-19,540,430	-3,616,036	-14,120,104	-47,073,808
50% increase	15,834,743,470	-43,955,050	21,576,777	23,875,759	9,615,935

Appendix B: Additional results and tables for ACT

Table B.1. Health impact of hepatitis C treatment strategies in ACT, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	46	34	67	84	118
Health effects* 2010-2013					
Life years lost / gained	260	0	0	1	1
Number of treatment gains (Sustained virological response)		-31	41	67	109
HCV cases / cases averted	636	-1	2	3	5
Liver failure cases / cases averted	13	0	0	0	0
HCC cases / cases averted	7	0	0	0	0
HCV-related liver transplant cases / cases averted	2	0	0	0	0
Liver-related deaths / deaths averted	13	0	0	0	0

Table B.2. Costs associated with hepatitis C treatment strategies in ACT, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*4,557,111*	*-468,438*	*636,852*	*1,042,812*	*1,690,543*
Other costs	*5,555,899*	*-110,743*	*151,392*	*247,066*	*401,034*
Total	10,113,010	-579,181	788,243	1,289,878	2,091,577
Patient/family costs†	25,036,283	-32,869	46,372	67,823	107,604
Productivity costs†	22,338,381	47,216	-63,190	-106,816	-175,783
Total costs	**57,487,674**	**-564,834**	**771,426**	**1,250,885**	**2,023,397**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*4,361,220*	*-433,664*	*590,027*	*966,814*	*1,567,670*
Other costs	*5,315,998*	*-102,574*	*140,335*	*229,187*	*372,090*
Total	9,677,217	-536,238	730,362	1,196,001	1,939,760
Patient/family costs†	23,961,695	-30,936	43,681	64,140	101,880
Productivity costs†	14,128,788	28,866	-38,631	-65,360	-107,583
Total costs	**47,767,701**	**-538,308**	**735,412**	**1,194,780**	**1,934,058**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*4,240,799*	*-412,484*	*561,492*	*920,475*	*1,492,737*
Other costs	*5,168,521*	*-97,597*	*133,594*	*218,280*	*354,432*
Total	9,409,320	-510,080	695,086	1,138,756	1,847,169
Patient/family costs†	23,301,096	-29,742	42,018	61,854	98,323
Productivity costs†	11,611,001	23,192	-31,039	-52,545	-86,500
Total costs†	**44,321,417**	**-516,630**	**706,065**	**1,148,064**	**1,858,992**

Table B.3. Health impact of hepatitis C treatment strategies in ACT, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	47	27	80	105	161
Health effects* 2010-2069					
Life years lost / gained	5,023	-1,249	704	964	1,276
Number of treatment gains (Sustained virological response)		-785	673	980	1,362
HCV cases / cases averted	11,085	-28	100	186	352
Liver failure cases / cases averted	238	-65	37	50	66
HCC cases / cases averted	127	-34	19	26	34
HCV-related liver transplant cases / cases averted	47	-12	7	9	12
Liver-related deaths / deaths averted	254	-63	36	49	65

Table B.4. Costs associated with hepatitis C treatment strategies in ACT, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	3,290	1,895	5,586	7,362	11,246
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*82,119,621*	*-14,091,283*	*11,931,272*	*17,373,654*	*24,159,732*
Other costs	*101,350,962*	*7,089,977*	*-4,980,201*	*-7,216,628*	*-10,362,514*
Total	183,470,583	-7,001,306	6,951,071	10,157,026	13,797,218
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	445,288,100	39,947,943	-37,856,035	-56,954,194	-83,874,116
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	389,574,176	966,564	-3,507,703	-6,522,776	-12,353,574
Total costs	1,018,332,859	33,913,201	-34,412,666	-53,319,944	-82,430,472
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*35,034,013*	*-6,181,889*	*5,665,827*	*8,383,326*	*12,051,782*
Other costs	*43,082,847*	*1,736,381*	*-1,178,568*	*-1,695,178*	*-2,423,888*
Total	78,116,860	-4,445,508	4,487,259	6,688,148	9,627,894
Patient/family costs†	190,289,028	13,002,679	-12,749,429	-19,271,058	-28,676,950
Productivity costs†	110,350,552	348,506	-901,390	-1,623,722	-3,004,517
Total costs	378,756,440	8,905,677	-9,163,560	-14,206,631	-22,053,572
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	23,647,007	-4,191,058	4,029,234	6,017,183	8,800,473
Other costs	*29,021,726*	*697,954*	*-428,789*	*-604,412*	*-846,786*
Total	52,668,733	-3,493,104	3,600,445	5,412,772	7,953,687
Patient/family costs†	128,602,476	7,144,264	-7,185,042	-10,902,667	-16,337,418
Productivity costs†	63,153,504	227,362	-488,990	-861,300	-1,562,803
Total costs†	244,424,713	3,878,522	-4,073,587	-6,351,195	-9,946,534

Table B.5. Cost-effectiveness and cost-utility analysis, ACT (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (LY lost)‡**	**Increased effect§**	**ICER* ($/LY)**
Reduction scenario	49,175,629		1,598		
Current scenario	52,668,733	3,493,104	1,408	189	$18,433
Increased scenario 1	56,269,178	3,600,445	1,294	114	$31,498
Increased scenario 2	58,081,504	5,412,772	1,252	157	$34,561
Increased scenario 3	60,622,419	7,953,687	1,201	208	$38,313
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	49,175,629		975		
Current scenario	52,668,733	3,493,104	1,207	231	15,093
Increased scenario 1	56,269,178	3,600,445	1,431	224	16,056
Increased scenario 2	58,081,504	5,412,772	1,542	335	16,139
Increased scenario 3	60,622,419	7,953,687	1,697	490	16,219
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	49,175,629		106,177		
Current scenario	52,668,733	3,493,104	106,488	312	11,212
Increased scenario 1	56,269,178	3,600,445	106,805	316	11,378
Increased scenario 2	58,081,504	5,412,772	106,969	481	11,258
Increased scenario 3	60,622,419	7,953,687	107,210	721	11,024

Appendix C: Additional results and tables for NSW

Table C.1. Health impact of hepatitis C treatment strategies in NSW, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	1,019	757	1,513	1,874	2,641
Health effects* 2010-2013					
Life years lost / gained	5,820	-8	10	15	21
Number of treatment gains (Sustained virological response)		-688	955	1,500	2,432
HCV cases / cases averted	14,212	-30	43	68	112
Liver failure cases / cases averted	280	-2	3	4	5
HCC cases / cases averted	149	-1	1	1	2
HCV-related liver transplant cases / cases averted	54	0	0	0	0
Liver-related deaths / deaths averted	295	0	1	1	1

Table C.2. Costs associated with hepatitis C treatment strategies in NSW, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*101,887,576*	*-10,399,686*	*14,839,687*	*23,300,872*	*37,781,534*
Other costs	*124,218,173*	*-2,460,295*	*3,508,476*	*5,521,094*	*8,963,390*
Total	226,105,749	-12,859,982	18,348,162	28,821,966	46,744,924
Patient/family costs†	559,760,041	-742,529	944,649	1,518,537	2,409,362
Productivity costs†	499,443,218	1,042,979	-1,518,373	-2,387,572	-3,928,648
Total costs	**1,285,309,008**	**-12,559,532**	**17,774,439**	**27,952,931**	**45,225,637**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*97,507,860*	*-9,626,647*	*13,757,966*	*21,602,539*	*35,035,224*
Other costs	*118,854,472*	*-2,278,551*	*3,254,551*	*5,121,494*	*8,316,425*
Total	216,362,332	-11,905,198	17,012,517	26,724,033	43,351,650
Patient/family costs†	535,734,453	-698,469	893,734	1,435,966	2,281,059
Productivity costs†	315,892,457	637,584	-929,152	-1,460,881	-2,404,321
Total costs	**1,067,989,242**	**-11,966,084**	**16,977,099**	**26,699,118**	**43,228,387**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*94,815,512*	*-9,155,848*	*13,098,408*	*20,567,007*	*33,360,432*
Other costs	*115,557,199*	*-2,167,824*	*3,099,659*	*4,877,741*	*7,921,717*
Total	210,372,711	-11,323,671	16,198,067	25,444,748	41,282,149
Patient/family costs†	520,964,819	-671,282	862,115	1,384,717	2,201,313
Productivity costs†	259,599,547	512,249	-747,009	-1,174,412	-1,933,119
Total costs†	**990,937,076**	**-11,482,704**	**16,313,173**	**25,655,052**	**41,550,343**

Table C.3. Health impact of hepatitis C treatment strategies in NSW, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	1,051	605	1,785	2,352	3,592
Health effects* 2010-2069					
Life years lost / gained	112,303	-27,923	15,776	21,542	28,534
Number of treatment gains (Sustained virological response)		-17,549	15,056	21,909	30,455
HCV cases / cases averted	247,844	-615	2,235	4,150	7,859
Liver failure cases / cases averted	5,313	-1,457	819	1,119	1,481
HCC cases / cases averted	2,843	-754	424	579	767
HCV-related liver transplant cases / cases averted	1,040	-266	150	205	272
Liver-related deaths / deaths averted	5,689	-1,415	799	1,091	1,445

Table C.4. Costs associated with hepatitis C treatment strategies in NSW, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	73,560	42,365	124,937	164,607	251,432
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*1,836,024,626*	*-315,025,696*	*266,824,950*	*388,437,559*	*540,161,424*
Other costs	*2,265,997,321*	*158,479,257*	*-111,616,628*	*-161,342,573*	*-231,676,813*
Total	4,102,021,947	-156,546,439	155,208,322	227,094,986	308,484,611
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	9,955,719,994	892,990,286	-847,673,189	-1,273,347,550	-1,875,215,335
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	8,710,073,107	21,601,342	-78,538,578	-145,832,784	-276,195,545
Total costs	22,767,815,048	758,045,190	-771,003,446	-1,192,085,347	-1,842,926,269
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*783,287,992*	*-138,178,833*	*126,852,239*	*187,429,694*	*269,449,703*
Other costs	*963,242,829*	*38,803,652*	*-26,489,387*	*-37,897,224*	*-54,188,736*
Total	1,746,530,821	-99,375,181	100,362,852	149,532,470	215,260,967
Patient/family costs†	4,254,469,440	290,601,483	-285,960,292	-430,839,999	-641,131,607
Productivity costs†	2,467,210,515	7,788,379	-20,214,164	-36,301,282	-67,172,140
Total costs	8,468,210,775	199,014,682	-205,811,604	-317,608,811	-493,042,780
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	528,698,123	-93,664,775	90,303,913	134,526,615	196,755,849
Other costs	*648,865,280*	*15,593,517*	*-9,677,885*	*-13,511,047*	*-18,929,272*
Total	1,177,563,403	-78,071,258	80,626,029	121,015,568	177,826,577
Patient/family costs†	2,875,285,944	159,640,314	-161,393,822	-243,743,821	-365,249,530
Productivity costs†	1,411,982,103	5,080,269	-10,981,822	-19,255,425	-34,938,931
Total costs†	5,464,831,451	86,649,325	-91,749,615	-141,983,679	-222,361,884

Table C.5. Cost-effectiveness and cost-utility analysis, NSW (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	1,099,492,145		35,722		
Current scenario	1,177,563,403	78,071,258	31,487	4,235	$18,437
Increased scenario 1	1,258,189,432	80,626,029	28,920	2,567	$31,406
Increased scenario 2	1,298,578,971	121,015,568	27,986	3,501	$34,562
Increased scenario 3	1,355,389,981	177,826,577	26,846	4,641	$38,315
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	1,099,492,145		21,808		
Current scenario	1,177,563,403	78,071,258	26,979	5,172	15,096
Increased scenario 1	1,258,189,432	80,626,029	32,015	5,035	16,013
Increased scenario 2	1,298,578,971	121,015,568	34,477	7,498	16,140
Increased scenario 3	1,355,389,981	177,826,577	37,943	10,963	16,220
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	1,099,492,145		2,373,893		
Current scenario	1,177,563,403	78,071,258	2,380,854	6,961	11,215
Increased scenario 1	1,258,189,432	80,626,029	2,387,962	7,107	11,344
Increased scenario 2	1,298,578,971	121,015,568	2,391,603	10,749	11,258
Increased scenario 3	1,355,389,981	177,826,577	2,396,984	16,130	11,025

Appendix D: Additional results and tables for NT

Table D.1. Health impact of hepatitis C treatment strategies in NT, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	35	26	51	64	90
Health effects* 2010-2013					
Life years lost / gained	198	0	0	1	1
Number of treatment gains (Sustained virological response)		-23	32	51	82
HCV cases / cases averted	484	-1	1	2	4
Liver failure cases / cases averted	10	0	0	0	0
HCC cases / cases averted	5	0	0	0	0
HCV-related liver transplant cases / cases averted	2	0	0	0	0
Liver-related deaths / deaths averted	10	0	0	0	0

Table D.2. Costs associated with hepatitis C treatment strategies in NT, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*3,468,433*	*-350,230*	*503,070*	*797,295*	*1,281,828*
Other costs	*4,228,605*	*-82,949*	*118,986*	*188,785*	*304,300*
Total	7,697,038	-433,179	622,056	986,080	1,586,128
Patient/family costs†	19,055,222	-25,680	32,347	50,994	83,088
Productivity costs†	17,001,883	34,952	-51,391	-82,019	-132,748
Total costs	**43,754,142**	**-423,907**	**603,012**	**955,054**	**1,536,468**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*3,319,340*	*-324,143*	*466,369*	*739,244*	*1,188,581*
Other costs	*4,046,015*	*-76,808*	*110,366*	*175,137*	*282,318*
Total	7,365,355	-400,950	576,736	914,381	1,470,899
Patient/family costs†	18,237,348	-24,137	30,592	48,252	78,620
Productivity costs†	10,753,506	21,363	-31,445	-50,191	-81,231
Total costs	**36,356,208**	**-403,725**	**575,882**	**912,442**	**1,468,288**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*3,227,687*	*-308,256*	*443,992*	*703,847*	*1,131,719*
Other costs	*3,933,770*	*-73,067*	*105,109*	*166,811*	*268,907*
Total	7,161,457	-381,324	549,101	870,658	1,400,626
Patient/family costs†	17,734,563	-23,186	29,503	46,549	75,845
Productivity costs†	8,837,200	17,161	-25,279	-40,351	-65,306
Total costs†	**33,733,221**	**-387,348**	**553,325**	**876,855**	**1,411,165**

Table D.3. Health impact of hepatitis C treatment strategies in NT, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	36	21	61	80	122
Health effects* 2010-2069					
Life years lost / gained	3,823	-950	537	733	971
Number of treatment gains (Sustained virological response)		-597	512	746	1,037
HCV cases / cases averted	8,437	-21	76	141	267
Liver failure cases / cases averted	181	-50	28	38	50
HCC cases / cases averted	97	-26	14	20	26
HCV-related liver transplant cases / cases averted	35	-9	5	7	9
Liver-related deaths / deaths averted	194	-48	27	37	49

Table D.4. Costs associated with hepatitis C treatment strategies in NT, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	2,504	1,442	4,253	5,604	8,559
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*62,501,519*	*-10,722,736*	*9,082,693*	*13,223,192*	*18,389,176*
Other costs	*77,138,529*	*5,392,788*	*-3,798,906*	*-5,494,212*	*-7,884,273*
Total	139,640,048	-5,329,948	5,283,786	7,728,980	10,504,903
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	338,910,315	30,390,059	-28,852,647	-43,355,793	-63,825,301
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	296,506,217	735,313	-2,673,269	-4,965,354	-9,400,755
Total costs	775,056,580	25,795,424	-26,242,130	-40,592,166	-62,721,153
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*26,664,506*	*-4,702,042*	*4,317,467*	*6,381,358*	*9,172,563*
Other costs	*32,790,476*	*1,319,944*	*-901,409*	*-1,291,056*	*-1,843,276*
Total	59,454,982	-3,382,097	3,416,059	5,090,302	7,329,287
Patient/family costs†	144,829,668	9,886,611	-9,732,037	-14,672,798	-21,817,771
Productivity costs†	83,988,167	264,985	-687,947	-1,236,248	-2,285,933
Total costs	288,272,817	6,769,498	-7,003,925	-10,818,743	-16,774,416
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	17,997,817	-3,186,531	3,073,182	4,580,769	6,697,471
Other costs	*22,088,512*	*530,214*	*-329,255*	*-460,588*	*-643,366*
Total	40,086,329	-2,656,316	2,743,927	4,120,180	6,054,105
Patient/family costs†	97,879,823	5,429,622	-5,492,028	-8,302,652	-12,427,465
Productivity costs†	48,066,334	172,789	-373,695	-655,871	-1,188,824
Total costs†	186,032,487	2,946,095	-3,121,796	-4,838,343	-7,562,184

Table D.5. Cost-effectiveness and cost-utility analysis, NT (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (LY lost)‡**	**Increased effect§**	**ICER* ($/LY)**
Reduction scenario	37,430,013		1,216		
Current scenario	40,086,329	2,656,316	1,072	144	$18,442
Increased scenario 1	42,830,257	2,743,927	985	87	$31,410
Increased scenario 2	44,206,510	4,120,180	953	119	$34,547
Increased scenario 3	46,140,435	6,054,105	914	158	$38,337
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	37,430,013		743		
Current scenario	40,086,329	2,656,316	918	176	15,101
Increased scenario 1	42,830,257	2,743,927	1,090	171	16,014
Increased scenario 2	44,206,510	4,120,180	1,174	255	16,133
Increased scenario 3	46,140,435	6,054,105	1,291	373	16,229
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	37,430,013		80,812		
Current scenario	40,086,329	2,656,316	81,048	237	11,219
Increased scenario 1	42,830,257	2,743,927	81,290	242	11,345
Increased scenario 2	44,206,510	4,120,180	81,415	366	11,253
Increased scenario 3	46,140,435	6,054,105	81,597	549	11,031

Appendix E: Additional results and tables for QLD

Table E.1. Health impact of hepatitis C treatment strategies in QLD, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	760	562	1,129	1,397	1,971
Health effects* 2010-2013					
Life years lost / gained	4,340	-6	8	11	16
Number of treatment gains (Sustained virological response)		-521	714	1,119	1,816
HCV cases / cases averted	10,596	-23	32	51	84
Liver failure cases / cases averted	208	-2	2	3	4
HCC cases / cases averted	111	-1	1	1	1
HCV-related liver transplant cases / cases averted	40	0	0	0	0
Liver-related deaths / deaths averted	220	0	0	1	1

Table E.2. Costs associated with hepatitis C treatment strategies in QLD, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*75,967,593*	*-7,885,763*	*11,079,522*	*17,379,935*	*28,207,937*
Other costs	*92,617,360*	*-1,862,296*	*2,618,298*	*4,117,968*	*6,690,501*
Total	168,584,954	-9,748,059	13,697,820	21,497,904	34,898,438
Patient/family costs†	417,358,243	-541,064	696,957	1,130,612	1,786,589
Productivity costs†	372,384,522	796,269	-1,137,596	-1,781,740	-2,938,150
Total costs	**958,327,718**	**-9,492,855**	**13,257,181**	**20,846,775**	**33,746,877**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*72,702,067*	*-7,301,460*	*10,272,144*	*16,113,271*	*26,158,156*
Other costs	*88,618,179*	*-1,725,189*	*2,428,861*	*3,819,949*	*6,207,748*
Total	161,320,246	-9,026,649	12,701,005	19,933,220	32,365,904
Patient/family costs†	399,444,696	-509,609	659,627	1,069,196	1,691,839
Productivity costs†	235,529,126	486,950	-696,168	-1,090,173	-1,798,191
Total costs	**796,294,068**	**-9,049,308**	**12,664,464**	**19,912,243**	**32,259,553**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*70,694,646*	*-6,945,539*	*9,779,851*	*15,340,939*	*24,908,107*
Other costs	*86,159,729*	*-1,641,639*	*2,313,303*	*3,638,159*	*5,913,218*
Total	156,854,375	-8,587,178	12,093,154	18,979,097	30,821,326
Patient/family costs†	388,432,415	-490,176	636,436	1,031,075	1,632,933
Productivity costs†	193,557,144	391,324	-559,713	-876,388	-1,445,806
Total costs†	**738,843,933**	**-8,686,030**	**12,169,877**	**19,133,784**	**31,008,452**

Table E.3. Health impact of hepatitis C treatment strategies in QLD, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	784	451	1,331	1,753	2,678
Health effects* 2010-2069					
Life years lost / gained	83,733	-20,829	11,764	16,062	21,276
Number of treatment gains (Sustained virological response)		-13,088	11,226	16,336	22,708
HCV cases / cases averted	184,793	-459	1,667	3,094	5,860
Liver failure cases / cases averted	3,961	-1,087	611	834	1,104
HCC cases / cases averted	2,120	-562	316	432	572
HCV-related liver transplant cases / cases averted	776	-199	112	153	203
Liver-related deaths / deaths averted	4,242	-1,055	596	814	1,078

Table E.4. Costs associated with hepatitis C treatment strategies in QLD, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	54,847	31,580	93,156	122,732	187,473
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*1,368,944,024*	*-234,930,717*	*198,935,691*	*289,621,030*	*402,734,841*
Other costs	*1,689,532,005*	*118,232,130*	*-83,237,313*	*-120,299,802*	*-172,759,467*
Total	3,058,476,029	-116,698,588	115,698,378	169,321,228	229,975,374
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	7,423,008,063	666,107,195	-632,093,077	-949,428,205	-1,398,258,542
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	6,494,250,355	16,115,616	-58,566,451	-108,737,366	-205,947,137
Total costs	16,975,734,447	565,524,223	-574,961,150	-888,844,343	-1,374,230,305
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*584,021,259*	*-103,090,289*	*94,577,877*	*139,750,309*	*200,901,562*
Other costs	*718,195,684*	*28,965,378*	*-19,760,027*	*-28,257,471*	*-40,415,339*
Total	1,302,216,942	-74,124,911	74,817,850	111,492,838	160,486,222
Patient/family costs†	3,172,142,428	216,870,406	-213,259,576	-321,247,424	-478,096,732
Productivity costs†	1,839,556,566	5,812,955	-15,074,791	-27,067,282	-50,090,171
Total costs	6,313,915,936	148,558,451	-153,516,518	-236,821,867	-367,700,681
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	394,198,489	-69,906,324	67,329,842	100,306,107	146,705,025
Other costs	*483,795,172*	*11,647,163*	*-7,222,985*	*-10,074,614*	*-14,122,487*
Total	877,993,661	-58,259,161	60,106,858	90,231,493	132,582,538
Patient/family costs†	2,143,819,992	119,187,760	-120,374,668	-181,746,005	-272,387,501
Productivity costs†	1,052,775,943	3,793,508	-8,190,388	-14,357,485	-26,055,356
Total costs†	4,074,589,596	64,722,107	-68,458,199	-105,871,996	-165,860,320

Table E.5. Cost-effectiveness and cost-utility analysis, QLD (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	819,734,499		26,638		
Current scenario	877,993,661	58,259,161	23,477	3,161	$18,429
Increased scenario 1	938,100,518	60,106,858	21,562	1,915	$31,393
Increased scenario 2	968,225,154	90,231,493	20,866	2,611	$34,561
Increased scenario 3	1,010,576,198	132,582,538	20,016	3,461	$38,306
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	819,734,499		16,255		
Current scenario	877,993,661	58,259,161	20,116	3,861	15,090
Increased scenario 1	938,100,518	60,106,858	23,871	3,755	16,006
Increased scenario 2	968,225,154	90,231,493	25,707	5,591	16,139
Increased scenario 3	1,010,576,198	132,582,538	28,292	8,176	16,216
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	819,734,499		1,769,973		
Current scenario	877,993,661	58,259,161	1,775,170	5,197	11,209
Increased scenario 1	938,100,518	60,106,858	1,780,471	5,301	11,339
Increased scenario 2	968,225,154	90,231,493	1,783,185	8,015	11,258
Increased scenario 3	1,010,576,198	132,582,538	1,787,199	12,029	11,022

Appendix F: Additional results and tables for SA

Table F.1. Health impact of hepatitis C treatment strategies in South Australia, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	257	192	380	475	667
Health Effects* 2010-2013					
Life years lost / gained	1,468	-2	2	4	5
Number of treatment gains (Sustained virological response)		-172	237	383	615
HCV cases / cases averted	3,585	-7	11	17	28
Liver failure cases / cases averted	71	-1	1	1	1
HCC cases / cases averted	37	0	0	0	0
HCV-related liver transplant cases / cases averted	14	0	0	0	0
Liver-related deaths / deaths averted	74	0	0	0	0

Table F.2. Costs associated with hepatitis C treatment strategies in South Australia, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*25,699,551*	*-2,591,152*	*3,688,757*	*5,934,493*	*9,548,078*
Other costs	*31,332,187*	*-613,826*	*873,989*	*1,403,843*	*2,264,334*
Total	57,031,738	-3,204,978	4,562,746	7,338,336	11,812,412
Patient/family costs†	141,190,562	-190,361	248,147	371,083	603,157
Productivity costs†	125,976,132	258,697	-372,581	-613,774	-994,953
Total costs	**324,198,432**	**-3,136,642**	**4,438,312**	**7,095,645**	**11,420,616**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*24,594,836*	*-2,398,087*	*3,419,049*	*5,502,834*	*8,854,341*
Other costs	*29,979,273*	*-568,370*	*810,529*	*1,302,458*	*2,100,974*
Total	54,574,109	-2,966,457	4,229,578	6,805,291	10,955,314
Patient/family costs†	135,130,489	-178,906	234,348	351,395	571,224
Productivity costs†	79,678,560	158,091	-227,923	-375,672	-608,964
Total costs	**269,383,159**	**-2,987,272**	**4,236,003**	**6,781,014**	**10,917,574**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*23,915,733*	*-2,280,522*	*3,254,629*	*5,239,604*	*8,431,265*
Other costs	*29,147,585*	*-540,680*	*771,827*	*1,240,605*	*2,001,306*
Total	53,063,318	-2,821,202	4,026,457	6,480,209	10,432,571
Patient/family costs†	131,405,083	-171,843	225,795	339,155	551,368
Productivity costs†	65,479,627	126,985	-183,204	-302,072	-489,648
Total costs†	**249,948,029**	**-2,866,060**	**4,069,048**	**6,517,292**	**10,494,291**

Table F.3. Health impact of hepatitis C treatment strategies in South Australia, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	265	153	450	593	906
Health effects* 2010-2069					
Life years lost / gained	28,327	-7,041	3,977	5,436	7,198
Number of treatment gains (Sustained virological response)		-4,426	3,796	5,528	7,682
HCV cases / cases averted	62,515	-155	563	1,047	1,983
Liver failure cases / cases averted	1,340	-367	206	282	374
HCC cases / cases averted	717	-190	107	146	194
HCV-related liver transplant cases / cases averted	262	-67	38	52	69
Liver-related deaths / deaths averted	1,435	-357	201	275	365

Table F.4. Costs associated with hepatitis C treatment strategies in South Australia, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	18,554	10,688	31,508	41,526	63,422
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*463,108,702*	*-79,448,936*	*67,299,880*	*97,973,024*	*136,242,300*
Other costs	*571,562,737*	*39,956,168*	*-28,126,299*	*-40,726,519*	*-58,447,270*
Total	1,034,671,439	-39,492,768	39,173,580	57,246,504	77,795,030
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	2,511,175,587	225,169,042	-213,685,859	-321,319,439	-473,038,485
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	2,196,980,218	5,448,267	-19,798,988	-36,798,718	-69,672,124
Total costs	5,742,827,244	191,124,541	-194,311,266	-300,871,653	-464,915,578
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*197,572,223*	*-34,837,850*	*31,983,102*	*47,284,834*	*67,964,206*
Other costs	*242,963,189*	*9,779,268*	*-6,667,081*	*-9,575,865*	*-13,674,412*
Total	440,535,412	-25,058,582	25,316,021	37,708,969	54,289,794
Patient/family costs†	1,073,123,501	73,250,378	-72,039,575	-108,770,360	-161,747,514
Productivity costs†	622,315,300	1,963,236	-5,092,774	-9,164,149	-16,946,263
Total costs	2,135,974,213	50,155,031	-51,816,327	-80,225,540	-124,403,983
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	133,355,880	-23,608,464	22,760,097	33,946,060	49,630,303
Other costs	*163,666,335*	*3,928,081*	*-2,431,349*	*-3,419,776*	*-4,779,121*
Total	297,022,215	-19,680,383	20,328,748	30,526,284	44,851,182
Patient/family costs†	725,245,868	40,227,136	-40,635,053	-61,561,754	-92,155,327
Productivity costs†	356,150,381	1,280,091	-2,765,240	-4,862,983	-8,815,238
Total costs†	1,378,418,464	21,826,844	-23,071,545	-35,898,452	-56,119,383

Table F.5. Cost-effectiveness and cost-utility analysis, South Australia (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (LY lost)‡**	**Increased effect§**	**ICER* ($/LY)**
Reduction scenario	277,341,832		9,009		
Current scenario	297,022,215	19,680,383	7,942	1,067	$18,442
Increased scenario 1	317,350,963	20,328,748	7,296	646	$31,449
Increased scenario 2	327,548,499	30,526,284	7,058	884	$34,521
Increased scenario 3	341,873,397	44,851,182	6,771	1,171	$38,302
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	277,341,832		5,502		
Current scenario	297,022,215	19,680,383	6,805	1,303	15,101
Increased scenario 1	317,350,963	20,328,748	8,073	1,268	16,033
Increased scenario 2	327,548,499	30,526,284	8,699	1,894	16,121
Increased scenario 3	341,873,397	44,851,182	9,571	2,766	16,215
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	277,341,832		598,779		
Current scenario	297,022,215	19,680,383	600,534	1,754	11,219
Increased scenario 1	317,350,963	20,328,748	602,323	1,790	11,360
Increased scenario 2	327,548,499	30,526,284	603,248	2,715	11,244
Increased scenario 3	341,873,397	44,851,182	604,603	4,070	11,021

Appendix G: Additional results and tables for TAS

Table G.1. Health impact of hepatitis C treatment strategies in Tasmania, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	72	53	107	131	186
Health effects* 2010-2013					
Life years lost / gained	410	-1	1	1	1
Number of treatment gains (Sustained virological response)		-48	68	104	171
HCV cases / cases averted	1,000	-2	3	5	8
Liver failure cases / cases averted	20	0	0	0	0
HCC cases / cases averted	10	0	0	0	0
HCV-related liver transplant cases / cases averted	4	0	0	0	0
Liver-related deaths / deaths averted	21	0	0	0	0

Table G.2. Costs associated with hepatitis C treatment strategies in Tasmania, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*7,170,368*	*-727,442*	*1,059,465*	*1,624,120*	*2,655,634*
Other costs	*8,741,923*	*-172,216*	*249,802*	*385,459*	*630,168*
Total	15,912,291	-899,657	1,309,266	2,009,580	3,285,802
Patient/family costs†	39,393,217	-52,682	62,962	110,284	170,429
Productivity costs†	35,148,336	72,657	-110,251	-164,851	-275,820
Total costs	**90,453,843**	**-879,682**	**1,261,977**	**1,955,013**	**3,180,412**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*6,862,144*	*-673,305*	*982,471*	*1,505,498*	*2,462,544*
Other costs	*8,364,450*	*-159,479*	*231,780*	*357,499*	*584,669*
Total	15,226,594	-832,784	1,214,251	1,862,997	3,047,213
Patient/family costs†	37,702,409	-49,532	59,709	104,152	161,321
Productivity costs†	22,230,939	44,407	-67,501	-100,840	-168,797
Total costs	**75,159,943**	**-837,908**	**1,206,459**	**1,866,309**	**3,039,737**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*6,672,669*	*-640,336*	*935,517*	*1,433,179*	*2,344,792*
Other costs	*8,132,403*	*-151,719*	*220,785*	*340,446*	*556,911*
Total	14,805,073	-792,056	1,156,302	1,773,625	2,901,703
Patient/family costs†	36,662,992	-47,589	57,683	100,351	155,661
Productivity costs†	18,269,322	35,673	-54,287	-81,052	-135,714
Total costs†	**69,737,387**	**-803,972**	**1,159,698**	**1,792,924**	**2,921,651**

Table G.3. Health impact of hepatitis C treatment strategies in Tasmania, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	74	43	126	165	253
Health effects* 2010-2069					
Life years lost / gained	7,903	-1,965	1,111	1,515	2,008
Number of treatment gains (Sustained virological response)		-1,235	1,060	1,541	2,143
HCV cases / cases averted	17,442	-43	157	292	553
Liver failure cases / cases averted	374	-103	58	79	104
HCC cases / cases averted	200	-53	30	41	54
HCV-related liver transplant cases / cases averted	73	-19	11	14	19
Liver-related deaths / deaths averted	400	-100	56	77	102

Table G.4. Costs associated with hepatitis C treatment strategies in Tasmania, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	5,177	2,982	8,794	11,583	17,694
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*129,210,826*	*-22,168,538*	*18,776,181*	*27,337,879*	*38,015,016*
Other costs	*159,470,304*	*11,150,495*	*-7,864,441*	*-11,346,041*	*-16,302,454*
Total	288,681,129	-11,018,043	10,911,740	15,991,838	21,712,563
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	700,636,989	62,834,102	-59,696,103	-89,574,060	-131,960,921
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	612,973,994	1,520,281	-5,530,747	-10,258,961	-19,436,274
Total costs	1,602,292,112	53,336,341	-54,315,109	-83,841,183	-129,684,633
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*55,124,141*	*-9,722,256*	*8,929,242*	*13,188,272*	*18,962,742*
Other costs	*67,788,573*	*2,729,607*	*-1,869,488*	*-2,662,338*	*-3,812,480*
Total	122,912,714	-6,992,649	7,059,755	10,525,934	15,150,262
Patient/family costs†	299,409,535	20,444,307	-20,153,359	-30,293,183	-45,113,980
Productivity costs†	173,630,592	547,936	-1,424,505	-2,552,594	-4,726,719
Total costs	595,952,841	13,999,593	-14,518,109	-22,319,843	-34,690,437
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	37,207,296	-6,589,355	6,358,617	9,463,740	13,846,527
Other costs	*45,664,157*	*1,096,640*	*-684,844*	*-947,566*	*-1,331,383*
Total	82,871,453	-5,492,716	5,673,773	8,516,174	12,515,144
Patient/family costs†	202,349,036	11,229,241	-11,381,990	-17,130,797	-25,699,605
Productivity costs†	99,368,582	357,330	-774,411	-1,353,445	-2,458,430
Total costs†	384,589,071	6,093,855	-6,482,628	-9,968,069	-15,642,892

Table G.5. Cost-effectiveness and cost-utility analysis, Tasmania (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	77,378,737		2,514		
Current scenario	82,871,453	5,492,716	2,216	298	$18,440
Increased scenario 1	88,545,226	5,673,773	2,035	181	$31,342
Increased scenario 2	91,387,626	8,516,174	1,970	246	$34,605
Increased scenario 3	95,386,597	12,515,144	1,889	327	$38,323
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	77,378,737		1,535		
Current scenario	82,871,453	5,492,716	1,899	364	15,099
Increased scenario 1	88,545,226	5,673,773	2,254	355	15,981
Increased scenario 2	91,387,626	8,516,174	2,426	527	16,158
Increased scenario 3	95,386,597	12,515,144	2,670	771	16,223
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	77,378,737		167,064		
Current scenario	82,871,453	5,492,716	167,553	490	11,217
Increased scenario 1	88,545,226	5,673,773	168,055	501	11,320
Increased scenario 2	91,387,626	8,516,174	168,309	755	11,273
Increased scenario 3	95,386,597	12,515,144	168,688	1,135	11,027

Appendix H: Additional results and tables for VIC

Table H.1. Health impact of hepatitis C treatment strategies in Victoria, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	766	566	1,139	1,411	1,984
Health effects* 2010-2013					
Life years lost / gained	4,374	-6	8	11	16
Number of treatment gains (Sustained virological response)		-527	723	1,132	1,826
HCV cases / cases averted	10,681	-23	33	51	84
Liver failure cases / cases averted	210	-2	2	3	4
HCC cases / cases averted	112	-1	1	1	1
HCV-related liver transplant cases / cases averted	41	0	0	0	0
Liver-related deaths / deaths averted	222	0	0	1	1

Table H.2. Costs associated with hepatitis C treatment strategies in Victoria, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*76,574,978*	*-7,975,727*	*11,201,657*	*17,571,850*	*28,373,956*
Other costs	*93,357,858*	*-1,882,706*	*2,645,795*	*4,161,347*	*6,732,553*
Total	169,932,835	-9,858,433	13,847,451	21,733,197	35,106,509
Patient/family costs†	420,695,162	-541,654	695,379	1,128,590	1,815,859
Productivity costs†	375,361,864	807,110	-1,153,581	-1,806,811	-2,947,935
Total costs	**965,989,862**	**-9,592,977**	**13,389,250**	**21,054,975**	**33,974,433**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*73,283,342*	*-7,385,141*	*10,385,892*	*16,292,023*	*26,311,120*
Other costs	*89,326,702*	*-1,744,190*	*2,454,496*	*3,860,394*	*6,246,518*
Total	162,610,044	-9,129,331	12,840,388	20,152,417	32,557,638
Patient/family costs†	402,638,391	-510,326	658,427	1,067,736	1,718,951
Productivity costs†	237,412,263	493,619	-706,014	-1,105,612	-1,804,051
Total costs	**802,660,698**	**-9,146,037**	**12,792,801**	**20,114,541**	**32,472,538**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*71,259,871*	*-7,025,379*	*9,888,467*	*15,511,635*	*25,053,146*
Other costs	*86,848,596*	*-1,659,779*	*2,337,798*	*3,676,806*	*5,949,994*
Total	158,108,467	-8,685,157	12,226,265	19,188,441	31,003,141
Patient/family costs†	391,538,063	-490,964	635,458	1,029,946	1,658,728
Productivity costs†	195,104,700	396,705	-567,662	-888,852	-1,450,450
Total costs†	**744,751,231**	**-8,779,417**	**12,294,060**	**19,329,534**	**31,211,419**

Table H.3. Health impact of hepatitis C treatment strategies in Victoria, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	790	455	1,341	1,767	2,699
Health effects* 2010-2069					
Life years lost / gained	84,403	-20,998	11,860	16,193	21,444
Number of treatment gains (Sustained virological response)		-13,194	11,317	16,468	22,888
HCV cases / cases averted	186,270	-462	1,680	3,119	5,906
Liver failure cases / cases averted	3,993	-1,096	616	841	1,113
HCC cases / cases averted	2,137	-567	319	436	577
HCV-related liver transplant cases / cases averted	782	-200	113	154	204
Liver-related deaths / deaths averted	4,276	-1,064	601	820	1,086

Table H.4. Costs associated with hepatitis C treatment strategies in Victoria, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	55,285	31,830	93,904	123,720	188,964
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*1,379,889,140*	*-236,816,262*	*200,524,909*	*291,932,799*	*405,971,101*
Other costs	*1,703,040,331*	*119,196,527*	*-83,922,021*	*-121,289,525*	*-174,107,415*
Total	3,082,929,471	-117,619,735	116,602,888	170,643,275	231,863,687
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	7,482,357,202	671,505,361	-637,232,352	-957,145,614	-1,409,294,086
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	6,546,173,766	16,242,924	-59,042,064	-109,620,220	-207,573,775
Total costs	17,111,460,439	570,128,550	-579,671,528	-896,122,559	-1,385,004,175
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*588,690,683*	*-103,926,057*	*95,340,236*	*140,875,698*	*202,508,742*
Other costs	*723,937,875*	*29,206,220*	*-19,928,564*	*-28,498,826*	*-40,719,013*
Total	1,312,628,558	-74,719,837	75,411,672	112,376,872	161,789,729
Patient/family costs†	3,197,504,650	218,652,416	-215,025,128	-323,906,049	-481,815,167
Productivity costs†	1,854,264,390	5,860,547	-15,199,338	-27,290,762	-50,480,648
Total costs	6,364,397,598	149,793,127	-154,812,794	-238,819,939	-370,506,086
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	397,350,223	-70,478,254	67,877,329	101,120,922	147,872,477
Other costs	*487,663,259*	*11,746,244*	*-7,288,083*	*-10,165,934*	*-14,221,222*
Total	885,013,482	-58,732,010	60,589,245	90,954,988	133,651,255
Patient/family costs†	2,160,960,475	120,179,291	-121,387,182	-183,274,098	-274,478,006
Productivity costs†	1,061,193,222	3,825,129	-8,259,118	-14,477,849	-26,255,993
Total costs†	4,107,167,180	65,272,410	-69,057,055	-106,796,958	-167,082,745

Table H.5. Cost-effectiveness and cost-utility analysis, Victoria (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (LY lost)‡**	**Increased effect§**	**ICER* ($/LY)**
Reduction scenario	826,281,472		26,852		
Current scenario	885,013,482	58,732,010	23,665	3,187	$18,426
Increased scenario 1	945,602,728	60,589,245	21,734	1,931	$31,381
Increased scenario 2	975,968,471	90,954,988	21,032	2,633	$34,549
Increased scenario 3	1,018,664,737	133,651,255	20,177	3,488	$38,320
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	826,281,472		16,384		
Current scenario	885,013,482	58,732,010	20,277	3,893	15,087
Increased scenario 1	945,602,728	60,589,245	24,063	3,787	16,000
Increased scenario 2	975,968,471	90,954,988	25,914	5,638	16,133
Increased scenario 3	1,018,664,737	133,651,255	28,516	8,239	16,222
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	826,281,472		1,784,123		
Current scenario	885,013,482	58,732,010	1,789,363	5,241	11,207
Increased scenario 1	945,602,728	60,589,245	1,794,709	5,346	11,335
Increased scenario 2	975,968,471	90,954,988	1,797,445	8,082	11,254
Increased scenario 3	1,018,664,737	133,651,255	1,801,484	12,121	11,026

Appendix I: Additional results and tables for WA

Table I.1. Health impact of hepatitis C treatment strategies in Western Australia, 2010-2013

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	382	285	566	701	989
Health effects* 2010-2013					
Life years lost / gained	2,182	-3	4	6	8
Number of treatment gains (Sustained virological response)		-256	357	560	910
HCV cases / cases averted	5,329	-11	16	25	42
Liver failure cases / cases averted	105	-1	1	1	2
HCC cases / cases averted	56	0	0	0	1
HCV-related liver transplant cases / cases averted	20	0	0	0	0
Liver-related deaths / deaths averted	111	0	0	0	0

Table I.2. Costs associated with hepatitis C treatment strategies in WA, 2010-2013

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*38,202,047*	*-3,856,845*	*5,535,863*	*8,711,317*	*14,144,308*
Other costs	*46,574,944*	*-913,588*	*1,309,461*	*2,065,377*	*3,356,524*
Total	84,776,991	-4,770,433	6,845,324	10,776,694	17,500,832
Patient/family costs†	209,877,828	-282,675	357,812	576,839	909,000
Productivity costs†	187,262,174	384,248	-565,510	-889,479	-1,468,627
Total costs	**481,916,994**	**-4,668,859**	**6,637,626**	**10,464,054**	**16,941,205**
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*36,559,902*	*-3,569,548*	*5,131,914*	*8,075,966*	*13,115,805*
Other costs	*44,563,857*	*-845,954*	*1,214,582*	*1,915,787*	*3,114,161*
Total	81,123,759	-4,415,502	6,346,496	9,991,753	16,229,966
Patient/family costs†	200,869,602	-265,678	338,353	545,212	860,379
Productivity costs†	118,441,290	234,821	-346,046	-544,204	-898,771
Total costs	**400,434,652**	**-4,446,360**	**6,338,803**	**9,992,760**	**16,191,574**
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	*35,550,425*	*-3,394,599*	*4,885,630*	*7,688,586*	*12,488,603*
Other costs	*43,327,565*	*-804,754*	*1,156,710*	*1,824,541*	*2,966,300*
Total	78,877,989	-4,199,353	6,042,340	9,513,127	15,454,903
Patient/family costs†	195,331,832	-255,199	326,276	525,592	830,169
Productivity costs†	97,334,714	188,620	-278,204	-437,469	-722,616
Total costs†	**371,544,535**	**-4,265,932**	**6,090,411**	**9,601,250**	**15,562,455**

Table I.3. Health impact of hepatitis C treatment strategies in Western Australia, 2010-2079

Description	HCV treatment scenarios				
		incremental, relative to the current scenario			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Average number of HCV cases treated per year	394	227	669	882	1,347
Health effects* 2010-2069					
Life years lost / gained	42,107	-10,466	5,914	8,076	10,698
Number of treatment gains (Sustained virological response)		-6,579	5,645	8,214	11,418
HCV cases / cases averted	92,927	-230	838	1,556	2,947
Liver failure cases / cases averted	1,992	-546	307	419	555
HCC cases / cases averted	1,066	-282	159	217	288
HCV-related liver transplant cases / cases averted	390	-100	56	77	102
Liver-related deaths / deaths averted	2,133	-530	300	409	542

Table I.4. Costs associated with hepatitis C treatment strategies in WA, 2010-2079

Description	HCV treatment scenarios				
		Incremental $, relative to the current scenario†			
	Current scenario	Reduction scenario	Increased scenario 1	Increased scenario 2	Increased scenario 3
Total number of HCV cases treated	27,581	15,887	46,842	61,715	94,270
Costs: (undiscounted)					
Health sector costs†					
*Drug costs**	*688,405,169*	*-118,101,564*	*100,039,567*	*145,649,244*	*202,536,285*
Other costs	*849,620,656*	*59,397,217*	*-41,838,914*	*-60,477,074*	*-86,853,459*
Total	1,538,025,825	-58,704,347	58,200,654	85,172,171	115,682,827
Treated (% Total)	*58%*	*50%*	*64%*	*66%*	*69%*
Patient/family costs†	3,732,830,567	334,722,904	-317,774,890	-477,360,109	-703,047,285
Treated	*8%*	*6%*	*10%*	*11%*	*13%*
Productivity costs†	3,265,782,667	8,099,202	-29,442,889	-54,671,458	-103,550,703
Total costs	8,536,639,060	284,117,758	-289,017,125	-446,859,397	-690,915,161
Costs: (3% discount)					
Health sector costs†					
*Drug costs**	*293,688,572*	*-51,788,471*	*47,553,109*	*70,275,548*	*101,029,051*
Other costs	*361,161,757*	*14,537,792*	*-9,926,759*	*-14,199,487*	*-20,310,752*
Total	654,850,329	-37,250,679	37,626,350	56,076,062	80,718,299
Patient/family costs†	1,595,184,150	108,893,719	-107,179,997	-161,487,782	-240,349,699
Productivity costs†	925,063,359	2,918,459	-7,576,662	-13,606,961	-25,182,217
Total costs	3,175,097,838	74,561,499	-77,130,310	-119,018,682	-184,813,616
Costs: (5% discount)					
Health sector costs†					
*Drug costs**	198,231,797	-35,096,357	33,847,767	50,436,958	73,770,580
Other costs	*243,288,020*	*5,839,522*	*-3,625,461*	*-5,058,793*	*-7,092,414*
Total	441,519,817	-29,256,834	30,222,306	45,378,165	66,678,166
Patient/family costs†	1,078,068,426	59,803,495	-60,481,284	-91,345,945	-136,915,571
Productivity costs†	529,412,672	1,902,916	-4,115,591	-7,216,616	-13,097,454
Total costs†	2,049,000,916	32,449,577	-34,374,570	-53,184,396	-83,334,859

Table I.5. Cost-effectiveness and cost-utility analysis, Western Australia (2010-2079: 5% discount) from a health sector perspective: incremental cost per LY gained, incremental cost per SVR achieved, and incremental cost per QALY gained

Treatment scenario	Cost ($)	Increased cost	Effect (LY lost)‡	Increased effect§	ICER* ($/LY)
Reduction scenario	412,262,983		13,392		
Current scenario	441,519,817	29,256,834	11,806	1,586	$18,442
Increased scenario 1	471,742,123	30,222,306	10,844	962	$31,414
Increased scenario 2	486,897,983	45,378,165	10,494	1,312	$34,581
Increased scenario 3	508,197,983	66,678,166	10,066	1,740	$38,325
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (SVR)**	**Increased effect**	**ICER* ($/SVR)**
Reduction scenario	412,262,983		8,178		
Current scenario	441,519,817	29,256,834	10,116	1,937	15,101
Increased scenario 1	471,742,123	30,222,306	12,003	1,887	16,016
Increased scenario 2	486,897,983	45,378,165	12,926	2,810	16,148
Increased scenario 3	508,197,983	66,678,166	14,226	4,110	16,224
Treatment scenario	**Cost ($)**	**Increased cost**	**Effect (QALY)**	**Increased effect†**	**ICER* ($/QALY)**
Reduction scenario	412,262,983		890,078		
Current scenario	441,519,817	29,256,834	892,686	2,608	11,219
Increased scenario 1	471,742,123	30,222,306	895,349	2,664	11,347
Increased scenario 2	486,897,983	45,378,165	896,714	4,028	11,265
Increased scenario 3	508,197,983	66,678,166	898,732	6,046	11,028

Appendix J: Methods and data sources

A dynamic mathematical transmission model of HCV infection was developed to describe the transmission of HCV through a population and track the disease progression of HCV-infected individuals. A schematic diagram of the model structure is shown in Figure J.1. The model is a compartmental model based on 240 ordinary differential equations, which describe the estimated number of people in a population in each mutually exclusive compartment based on HCV-related and behavioural status. The model was solved numerically in MATLAB software and was used to estimate the number of people in each HCV health state, including important clinical endpoints such as liver failure, HCC, and liver transplant, as well as liver-related death. These outputs were used as inputs in an economic analysis to estimate the economic burden of hepatitis C from the year 2010 until 2039 (30-year time horizon). A cost-effectiveness (CEA) and cost-utility (CUA) analysis was performed to compare the costs and benefits associated with current levels of treatment for hepatitis C with four alternative hepatitis C treatment scenarios. Currently, approximately 3,500 people infected with hepatitis C (~1-2% of all chronic hepatitis C cases) receive combination PEG-IFN and ribavirin therapy each year in Australia [3]. In this study we simulate the following treatment scenarios:

- Current treatment scenario: no change from current practice;
- Reduction scenario: treatments decline to 2,000 from 2010 onwards;
- Increased scenario 1: treatments increase steadily to 6,000 per year from 2011 onwards;
- Increased scenario 2: treatments increase steadily to 8,000 per year from 2012 onwards;
- Increased scenario 3: treatments increase steadily to 12,000 per year from 2014 onwards.

Health benefits, measured in terms of life years (LYs) gained, quality-adjusted life years (QALYs) gained, and total health care-related costs for each treatment strategy were computed from a societal perspective, which accounts for benefits, risks, and costs to all parties according to the Panel on Cost-Effectiveness of Health and Medicine [31] (although patient-time costs and productivity costs were excluded in the CEA). Other key health outcomes of the analysis include the number of new liver failure cases averted, new HCC cases averted, the number of liver transplants avoided, and the number of liver-related deaths averted. The years of potential life lost due to HCV was estimated using the life expectancy of the average Australian [32], adjusted for premature mortality associated with hepatitis C [23]. Based on published literature [23, 33], it was assumed that the average age at liver-related death was 65 (range, 61-70) years.

The comparative efficiencies of alternative HCV treatment scenarios were measured by the incremental cost-effectiveness ratio (ICER), defined as the additional cost of a specific strategy, divided by its additional health benefit, expressed as cost per QALY gained. The ICER for an alternative treatment scenario was computed in reference to the next most effective option. All costs and benefits were discounted at an annual rate of 5%, based on Pharmaceutical Benefits Advisory Committee guidelines to reflect the higher present value of money [30].

Data sources

The model was parameterised using the best available biological, behavioural, clinical and epidemiological data from the National Annual Surveillance Reports [3], Australian Needle and Syringe Program Survey behavioural reports [34], and published peer-reviewed literature. These values were used to estimate the annual incidence of HCV, as previously described [35], and important clinical endpoints. Stage-specific transition probabilities were derived from a meta-analysis of more than 100 hepatitis C natural history studies [36]. Transition probabilities for end-stage liver disease (i.e., progression from F4 to liver failure or HCC) were derived from pooled results of published literature [37-55]. Competing mortality risk data were obtained from the published literature [42, 46, 54, 56]. Characteristics of individuals with chronic HCV infection undergoing treatment, including liver disease stage were obtained from an Australian HCV Clinical Audit Study (unpublished). Treatment efficacy data as a function of genotype and stage of liver disease were based on a published randomised controlled trial [9]. The model inputs that characterise the population and the natural history of hepatitis C with their uncertainty bounds are summarised in Table J.1 and Table J.2.

Mathematical HCV epidemic transmission model

The model describes IDUs and non-IDUs aged 15-64 in Australia (Figure 1). Definitions for IDU status were based on the Australian NSP Survey [34]: a 'regular IDU' is defined as someone who reported injecting 'more than weekly' in the month prior to the survey; and an 'occasional IDU' is defined as someone who reported injecting 'less than weekly' in the month prior to the survey. These are generally consistent with the previous HCV Projections Working Group definitions [5]. Non-IDUs considered were those who acquired HCV through routes other than injecting drug use. The model tracked the shifts in the number of IDUs in the population, including the entry of new injectors, transitions between injecting status (e.g., transition from occasional to regular), and the rate of cessation of injecting. The infection of IDUs with HCV was simulated based on injecting behaviour and mixing in the population. The analyses were stratified by gender and genotype. The model inputs that characterise the population are summarised in Table J.1.

Natural history model of hepatitis C

The model tracked the natural history of disease progression for people infected with HCV and captures the fact that an individual who is infected with HCV and clears the virus remains susceptible to re-infection. Among spontaneous clearers, it was assumed that re-infection rate was similar to that of the initial infection. Among those who had achieved a successful treatment and cleared the virus (sustained virological response), it was assumed that re-infection rate is decreased to approximately 10% of the initial infection rate [14-16].

Fifteen compartments describe IDUs and non-IDUs who are monoinfected with HCV: in acute stage, liver fibrosis stages F0, F1, F2, F3, F4 (compensated cirrhosis), and for each of these, whether they are untreated or receiving treatment. People infected with HCV who have advanced fibrosis can progress to clinical outcomes of liver failure, HCC, or may receive a liver transplant. It was assumed that individuals that progress to these three clinical outcomes no longer inject drugs. Annual transition probabilities determined the movements of individuals through different health states. We assumed that liver disease progresses one stage at a time. We also assumed that regression from a later to an earlier stage (e.g., F1 to F0, F3 to F2) does not occur, although there is evidence to suggest that this may occur in some individuals with successful treatment [57]. Each year, individuals face competing mortality risks from liver failure, HCC, and other causes unrelated to HCV, including drug-related and background death. Annual background death rates were adjusted taking into account premature mortality due to HCV infection [23, 33]. The model inputs that characterise the natural history of hepatitis C are summarised in Table J.2.

HCV treatment

Based on an Australian HCV Clinical Audit Study (unpublished), the proportion of people with chronic HCV infection within each stage commencing treatment is as follows: 58% F0 stage; 44% F1 stage; 66% F2 stage; 68% F3 stage; and 62% F4 stage (Table J.2). The overall proportion of IDUs among the treated population is approximately 80%. Current IDUs represent approximately 5% of the treated population. The current standard treatment for chronic hepatitis C is combination therapy with pegylated interferon (PEG-IFN) alfa and ribavirin administered for 24 weeks for HCV genotypes 2 or 3 or 48 weeks for HCV genotype 1 [9, 11, 12]. We assumed that people with acute HCV infection and those in the advanced disease stages (i.e., liver failure, HCC) would not undergo treatment on the basis that only a small minority of these groups would receive treatment each year in real life. However, cases with liver failure and HCC are considered for liver transplantation. We also assumed that antiviral therapy for hepatitis C is considered only once. Patients who do not achieve sustained response to therapy receive no further treatment. Non-adherence to therapy (~15%) [58, 59] was also considered and hepatitis C treatment cost adjusted accordingly.

Model calibration

The mathematical model was calibrated to be consistent with available epidemiologic data in Australia in terms of incidence and prevalence of HCV and to reflect clinical data on progression of HCV infection, that is, incidence of liver failure and HCC, the number of liver transplants and liver-related death, and the number of people treated in the year 2008.[2] We assume that changes in treatment numbers would not have a major impact on these estimates in the base year (2010).

Costs

Resource use was considered under the following broad headings: i) health sector resource use; ii) patient and family resource use; and iii) productivity losses and gains. Resource use in other sectors such as voluntary sector and other home help visits associated with

treatment are difficult to identify, measure or value. Therefore, these costs were not included in this analysis.

Annual health care costs of patients in each HCV state were identified through published literature [28, 60] and the creation of a model of service delivery reflecting current practice. Health care-related costs include specialist and GP visits, medications, prescription drugs, laboratory and diagnostic tests, procedures, emergency department visits, hospitalisations, nursing personnel, psychological support, social support, counselling and education. Based on a Canadian population-based study (Paterson et al, unpublished), we assumed that mental health services are used in 50% of the people infected with chronic HCV infection. The unit costs of hospitalisation were estimated based on the frequency and proportions of admission to hospital with different health states of HCV and deriving a weighted average cost per admission in a health state using cost weights for admission to an Australian public hospital [61, 62]. Total costs are quantities of resource use multiplied by their unit costs. Unit costs for resource categories were based on the Medical Benefits Schedule (MBS) [63], Pharmaceutical Benefits Scheme (PBS) [64], National Admitted Patient Care Collection (NAPCC) 2004-05 [61], and National Hospital Cost Data Collection [65]. All costs were expressed in 2008 Australian dollars using the health care component of the Consumer Price Index. Annual health care costs of hepatitis C and patient and family time costs are summarised in Table 3.

In the absence of Australian data, patient and family resource use was estimated based on a multicentre Canadian study conducted between 2006 and 2008 which used a convenience sampling method for comprehensive data collection, including patient's time, time of relatives/carers, and out-of-pocket expenses associated with medical care, including travel to and from care, waiting for appointments, receipt of care, and non-prescription medication costs during the three months prior to the survey (Federico, Krahn et al, unpublished). Australian costs were obtained using Purchasing Power Parities for GDP to convert Canadian dollars to Australian currency, and then inflated to 2008 dollars, using the Consumer Price Index for health care. Patient and carer/family time costs and out-of-pocket expenses are shown in Table J.3, J.4, and J.5.

Productivity losses associated with hepatitis C were estimated using the friction cost method [66]. This method explicitly considers economic circumstances that limit production losses due to disease. In this study, a three-month replacement and gender-specific wages were used to estimate productivity loss per person with HCV, and discounted at 3%, 0%, and 5%. Inputs for friction costs involve estimating the workforce participation rate of HCV-infected individuals for the rest of their working life, compared with a cohort of population controls who are not HCV infected, measuring their respective disability, mortality, workplace absenteeism, and employment/work force participation. Mortality among HCV-infected individuals was estimated using a decision tree in DATA PRO [67]. Survival time and age-specific mortality rates of an HCV-infected population was compared with that of the general population [68]. The proportion of full-time and part-time employment among people infected with hepatitis C was based on a study evaluating the acceptability of different methods of HCV testing among IDUs recruited through primary healthcare and drug treatment services [69, 70]. In this study, it was found that 61% of the IDUs with chronic hepatitis C reported unemployment.

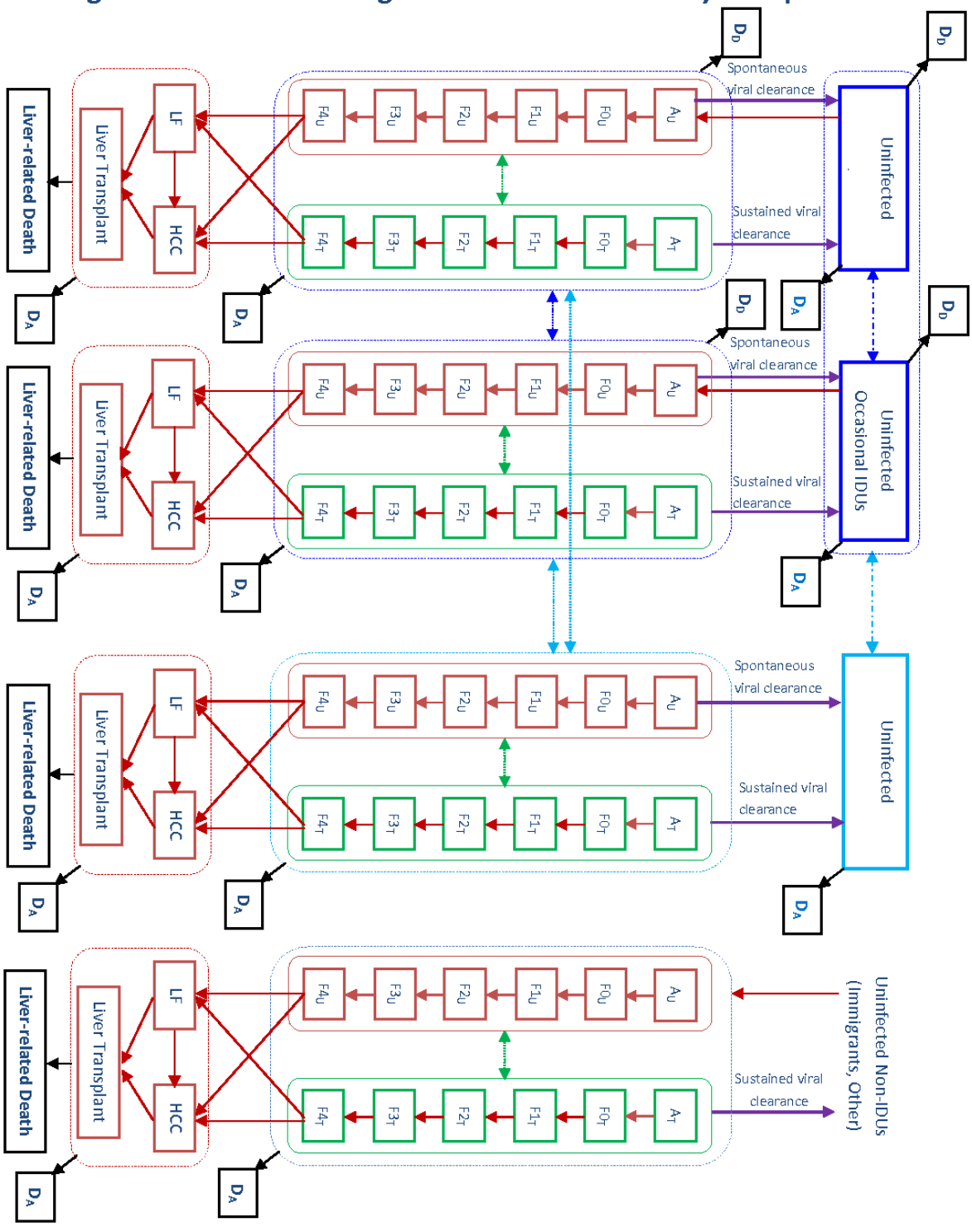
Utilities

Utilities for HCV-related health states, sustained response to treatment, and disutility associated with HCV treatment, was based on peer-reviewed publications [71-73] and presented in Table J.6. A QALY framework was used in the economic analyses [31, 74]. The amount of time an individual spends in a given health state is multiplied by the health state preference value to calculate the number of QALYs gained. Thus, the QALY approach provides a combined measure of the benefits of an intervention that both extends life and maintains quality of life [75, 76].

Uncertainty and sensitivity analyses

In order to identify factors that are the most influential for yielding variation in model outputs, one-way sensitivity analyses were performed by varying key model parameters (e.g., transition probabilities, treatment efficacy, costs, utilities, and discount rate) within the ranges specified in Table 2, Table J.2, and Table J.6. The ranges were based on 95% confidence intervals where available or calculable. Health care costs were halved and doubled to obtain lower and upper limits. Latin hypercube sampling [77-79], an efficient type of stratified Monte Carlo sampling, was used to sample 100 parameter sets using the SaSAT software [79]. The model was then run 100 times, once for each set of parameter values, as an uncertainty analysis.

Figure J.1. Schematic diagram of the natural history of hepatitis C



Abbreviations	Description
IDU	Injecting drug users
Regular IDUs	An injecting drug user who has been injecting for 12 months or more and who reported injecting 'more than weekly' in the month prior to the survey
Occasional IDUs	An injecting drug user who has been injecting for less than 12 months or someone who injects less than weekly
Former IDUs	Past injecting drug users
Non-IDUs	Individuals who have never been injecting drug users
Sustained viral clearance	Undetectable viraemia 24 weeks after treatment for hepatitis C
A	Acute hepatitis C virus infection
$_u$	Untreated
$_T$	Treated for hepatitis C
F0	No fibrosis
F1	Portal fibrosis without septa (mild fibrosis)
F2	Portal fibrosis with rare septa (moderate fibrosis)
F3	Numerous septa without cirrhosis (bridging fibrosis – severe)
F4	Compensated cirrhosis
LF	Liver failure
HCC	Hepatocellular carcinoma
D_A	All cause death
D_D	Drug-related death

Table J.1. Model parameters: Demographics, drug injection behavior, and epidemiologic

Description	Value	Range	Ref
Demographics			
Total size of IDUs in Australia in 2007	196,000	105,000-236,500	[80, 81],*
Number of male regular IDUs	94,462	37,413-103,661	†
Number of female regular IDUs	49,488	19,602-54,310	†
Number of male occasional IDUs	34,351	13,109-36,320	†
Number of female occasional IDUs	17,966	7,115-19,719	†
Entry rate into the IDU population per unit time: from non-IDU to occasional IDU	0.14	0.09-0.2	calibrated
Entry rate into the IDU population per unit time: from occasional IDU to regular IDU	0.21	0.19-0.25	calibrated
Exit rate from regular IDU population per unit time (average time of injecting drugs among regular IDUs = 12.5 years, range 8-17 years)	0.08	0.059-0.125	[82-85]
Exit rate from regular IDU to occasional IDU	0		[85],‡
Exit rate from occasional IDU population per unit time (average time of injecting drugs among occasional IDUs = six years)	0.163	0.15-0.17	[85]
Annual background death rate:			[23, 32],§
Male	0.003	0.00075-0.02338	
Female	0.0018	0.00028-0.01383	
Annual drug-related death among IDUs	0.0083	0.0056-0.0121	[56]
Drug injection behaviour			
Number of injections per male regular IDU per year	565	480-662	[34],‖
Number of injections per female regular IDU per year	515	426-651	[34],‖
Number of injections per male occasional IDU per year	19	12-22	[34]
Number of injections per female occasional IDU per year	18	15-22	[34]
Proportion of injections that are shared among male regular IDUs		0.47-0.48	[34],¶
Proportion of injections that are shared among female regular IDUs		0.43-0.48	[34],¶
Proportion of injections that are shared among male occasional IDUs		0.25-0.27	[34],¶
Proportion of injections that are shared among female occasional IDUs		0.19-0.3	[34],¶
Epidemiologic			
Transmission probability of HCV per injection with a contaminated syringe	0.0275	0.015-0.04	[86-93],±
Transmission probability of HCV among non-IDUs	0.0005		Assumption
HCV prevalence among male regular IDUs	67%	61-73%	[34],‡
HCV prevalence among female regular IDUs	73%	63-82%	[34],‡
HCV prevalence among male occasional IDUs	65%	52-80%	[34],‡
HCV prevalence among female occasional IDUs	71%	57-84%	[34],‡

*Using the same pattern for the change in the number of IDUs in Australia as that estimated by Law et al. [94], and adjusting slightly to the magnitude recently estimated by Mathers et al.[80].

†The estimated size of each IDU status in Australia is based on the probability distribution function and the total size of IDUs in Australia.

‡Assumed that regular IDUs quit injecting completely, and not entering into occasional IDU population.
§Australian Bureau of Statistics (ABS) age and gender-specific mortality data was adjusted taking into account premature mortality associated with HCV infection [23].

‖The average number of injections per IDU per year was estimated based on the weighted average of injecting frequency stratifications from the NSP survey: i.e., the proportions of IDUs who did not inject in the last month, injected weekly or less, injected more than weekly, injected once daily, injected two to three times per day, and injected more than three times per day. It was assumed that IDUs who did not inject in the last month inject an average of once every two months, those who inject weekly or less inject an average of once every fortnight, those who inject more than weekly inject once every five days on average, IDUs who inject two to three times per day inject an average of 2.5 times per day and those who inject more than three times each day inject an average of four to five times per day.

¶The average proportion of injections that are shared was estimated based on the weighted average of sharing of needles and syringes (reused someone else's used needles and syringes last month) stratifications from the NSP survey: i.e., the number of IDUs who did not reuse someone else's used needles and syringes in the last month, the number of IDUs who reused once, reused twice, reused 3-5 times, and reused more than five times. It was assumed that IDUs who reused someone else's used needles and syringes 3-5 times last month an average of four times and those who reused more than five times last month an average of six times per month.

±No study has directly estimated the probability of HCV transmission per injection by IDUs using a contaminated syringe. Numerous studies have estimated the transmission risk of HCV in an occupational setting due to needlestick injury.[86-93] In the absence of other data, these data were used to estimate transmission risk among IDUs sharing syringes. A review of these studies, paying particular attention on long-term cohort studies with larger number of cases, lead to a plausible range of transmission risk per exposure of 1.5-4%.

‡Regression analysis was performed to determine the best-fitting linear prediction line across 1999 to 2007 data after excluding outliers. 2007 data was used in the model.

*All rates are per year.

Table J.2. Natural history of hepatitis C and treatment parameters

Description			Value (95% CI)	Ref
Natural history of hepatitis C				
Annual transition probability from fibrosis stage F0 to F1		IDU	0.116 (0.059-0.228)	[36]
		Non-IDU	0.106 (0.094-0.205)	
Annual transition probability from fibrosis stage F1 to F2		IDU	0.085 (0.065-0.110)	[36]
		Non-IDU	0.074 (0.064-0.175)	
Annual transition probability from fibrosis stage F2 to F3		IDU	0.085 (0.049-0.147)	[36]
		Non-IDU	0.106 (0.092-0.225)	
Annual transition probability from fibrosis stage F3 to F4 (compensated cirrhosis)		IDU	0.130 (0.053-0.319)	[36]
		Non-IDU	0.105 (0.092-0.187)	
Annual transition probability from F4 to liver failure			0.037 (0.030-0.092)	[37-54],*
Annual transition probability from F4 to HCC			0.010 (0.009-0.038)	[37-54],*
Annual transition probability from liver failure to HCC			0.068 (0.041-0.099)	[53, 95]
Annual transition probability from liver failure until liver transplant			0.033 (0.017-0.049)	[54, 55]
Annual transition probability until liver transplant for individuals with HCC			0.1 (0.05-0.18)	[96],†
Annual mortality rate (liver-related death)				
Liver failure			0.138 (0.074–0.202)	[42, 46, 54]
HCC			0.605 (0.545-0.676)	
Annual transition probability until liver-related death for individuals who have received a liver transplant		First year	0.169 (0.127-0.210)	[54, 97, 98],‡
		After first year	0.034 (0.024-0.043)	
Annual transition probability until liver-related death for individuals with HCC				
Clinical parameters				
Proportion of HCV genotype-1 in the Australian population			0.55 (0.52-0.58)	[99-103],§
Proportion of HCV genotype non-1 in the Australian population			0.45 (0.42-0.48)	
Treatment for hepatitis C				
Proportion of individuals with chronic HCV infection within each stage commencing treatment		Fibrosis stage 0	58%	‖
		Fibrosis stage 1	44%	
		Fibrosis stage 2	66%	
		Fibrosis stage 3	68%	
		Fibrosis stage 4	62%	
Average duration of treatment		Acute HCV	0.46 years	[104]
		Fibrosis stage 0-4	0.69 (0.46-0.92) years	[11, 12]
Proportion of IDUs who spontaneously clear HCV		Acute HCV	0.25 (0.22-0.29)	[6, 104]
Proportion of HCV-treated individuals who clear the virus due to treatment (sustained virological responders) in Acute HCV			0.70 (0.60-0.90)	[105-109]
Proportion of HCV-treated individuals who clear the virus due to treatment in F0-F2 stage		Genotype-1	0.57 (0.50-0.64)	[9]
		Genotype non-1	0.84 (0.78-0.88)	
Proportion of HCV-treated individuals who clear the virus due to treatment in F3-F4 stage		Genotype-1	0.41 (0.31-0.52)	[9]
		Genotype non-1	0.74 (0.62-0.82)	

*Pooled estimate from published literature [37-53]; weighted using sample size: Annual transition probability from F4 to liver failure: 0.055 (0.040-0.092); Annual transition probability from F4 to HCC: 0.031 (0.024-0.038). Calibrated values 0.037 and 0.01 respectively were used in the model.

†11 of 111 new HCV-related HCC reported cases in 2007 in Australia received a liver transplant [96]. This leads to a 95% confidence interval of 5-18%.

‡The deterministic ordinary differential equation model assumes exponential rates. The best-fitting exponential function over 40 years was determined, leading to an average transition probability of 0.043 (0.0294, 0.0557) per year.

§Pooled estimate based on the published literature;[99-103] weighted using sample size. Assumed similar genotype distributions among IDUs, based on the evidence of decreasing proportions of HCV genotype 1 infections over the period 1970s to 1990s [110].

‖Based on the HCV Clinical Audit Study (unpublished).

Table J.3. Mean (95% confidence intervals) costs to hepatitis C infected patients by stage of liver disease (patient time costs)

Disease Stage	Estimate	95% CI	
		LB	UB
Viral clearance	$331	$207	$456
Chronic HCV	$1,723	$1,120	$2,324
Cirrhosis	$2,381	$1,490	$3,272
Hepatocellular carcinoma	$3,382	$932	$5,833
Liver transplant	$8,173	$2,216	$14,130
Treatment	$1,796	$881	$2,711
Total (weighted)	$2,021	$1,499	$2,544

Source: Federico, Krahn et al. (unpublished).

Table J.4. Mean (95% confidence intervals) costs to carers/family by stage of liver disease

Disease Stage	Estimate	95% CI	
		LB	UB
Viral clearance	$39	$14	$94
Chronic HCV	$77	$30	$124
Cirrhosis	$398	$138	$659
Hepatocellular carcinoma	$1,656	$403	$3,716
Liver transplant	$2,868	$406	$6,143
Treatment	$32	$14	$77
Total (weighted)	$350	$121	$579

Source: Federico, Krahn et al. (unpublished)

Table J.5. Mean (95% confidence intervals) out-of-pocket expenses by stage of liver disease

Disease Stage	Estimate	95% CI	
		LB	UB
Viral clearance	$492	$35	$948
Chronic HCV	$1,028	$597	$1,459
Cirrhosis	$1,432	$473	$2,391
Hepatocellular carcinoma	$2,362	$617	$4,108
Liver transplant	$2,624	$1,183	$4,065
Treatment	$2,599	$27	$5,170
Total (weighted)	$1,220	$887	$1,546

Source: Federico, Krahn et al. (unpublished)

Tables J.3-J.5: 2007 Canadian dollars were converted to Australian dollars using Purchasing Power Parities for GDP, and then inflated to 2008 dollars, using the Consumer Price Index for health care.

Table J.6. Health state utilities for chronic hepatitis C

Health states	Utilities	Reference
	Mean (95% CI)	
Australian population norms (spontaneous viral clearance, never infected)	0.930 (0.928-0.932)	[111]
Sustained virological response	0.87 (0.81-0.93)	[71, 72]
Acute hepatitis C	0.81 (0.64-0.89)	*
Pre-cirrhosis (Fibrosis stage 0 to fibrosis stage 3)	0.81 (0.64-0.89)	[71-73]
Compensated cirrhosis (Fibrosis stage 4)	0.76 (0.62-0.88)	[71-73]
Decompensated cirrhosis (liver failure)	0.69 (0.52-0.87)	[71-73]
Hepatocellular carcinoma (HCC)	0.67 (0.54-0.80)	[71, 72]
Liver transplantation	0.77 (0.64-0.89)	[71, 72]
Disutility of interferon-based therapy	0.05	[71]

*Assumed utility value of 0.81; approximately one-third of people with acute hepatitis C develop symptoms [104].

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