PINE RIVER INSTITUTE: THE SOCIAL RETURN ON INVESTMENT FOR A RESIDENTIAL TREATMENT PROGRAM

We can't afford NOT to invest in our young people

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INTRODUCTION

When compared with other high-income countries, Canada has some of the highest prevalence and frequency rates of substance use among youth. One of five Canadians will experience an addiction or mental health issue within a given year, and 70% of mental illnesses have their onset during adolescence. Canadians aged 15 to 24 are more likely to experience addiction or mental health issues than any other age group. In order to address these issues early in life, young people experiencing severe addiction, mental health and behavioural issues may require intensive, long-term residential treatment. Pine River Institute provides such treatment to young people between the ages of 13 and 19 who face addiction issues, as well as behavioural and psycho-social challenges (Mills & McNeill, 2014). PRI opened in 2006 and is the only program of its kind in Canada, offering a comprehensive suite of wilderness, residential, transition and aftercare treatment. This report focuses on the economic value of the health and behaviour outcomes for young people who have attended PRI since 2010, relative to the cost of service provision.

BACKGROUND

Addiction and mental illness across the lifespan

A recent study estimated that approximately 33% of Canadians over the age of 15 reported having current or a history of problem substance use (Pearson, Janz, & Ali, 2013). Despite the magnitude of the issue, and the future consequences of substance use in adolescence, there is a paucity of literature comparing the economic evaluation of in-depth, long-term and intensive intervention for young people with substance use and mental illness. This gap in the literature is surprising considering it is well documented that failure to intervene and treat psychological issues, including substance use, in early life has long-term economic and societal consequences (Smith & Smith, 2010a) in the following domains.

Health impacts

Substance abuse costs Canadians approximately $40 billion annually; these costs are incurred across health and justice systems, as well as other public sectors supporting individuals who are out of work due to addiction and mental illness. In Ontario, the prevalence of mental illness and substance use was estimated at over 1.5 times that of all cancers combined, and seven times that of all infectious diseases. Indeed, alcohol use was one of the five conditions with the highest impact on life expectancy and functioning of Ontarians (Ratnasingham, Cairney, Rehm, Manson, & Kurdyak, 2012a). Alcohol use disorders contributed to 88% of the total number of deaths attributed to all medical conditions, and 91% of years of life lost due to premature mortality(Ratnasingham, Cairney, Rehm, Manson, & Kurdyak, 2012b).

Criminal justice impacts

Approximately five million Canadians over the age of 15 came into contact with police in 2012, and of those who had police contact, approximately one in five met the criteria for having a substance use or mental disorder (Boyce, Rotenberg, & Karam, 2015). The prevalence of substance use and mental disorders are highest among those aged 15-24 in Canada, and the odds of police contact are also higher among this age group (Boyce et al., 2015). For those who have a substance use or mental disorder, when compared with those who do not, the odds of having police contact are higher even when controlling for socio-demographic variables (Boyce et al., 2015).

Labour force impacts

Incomes are reduced by 20% among U.S. families caring for a child with a mental health or substance use issue, largely due to an average seven fewer weeks worked per year, which accounts for lifetime lost family income of $300,000 per family. This cost, aggregated across all families with a child with addiction or mental health issues, amounts to a total lifetime economic cost of 2.1 trillion dollars (Smith & Smith, 2010b).

PRI INTERVENTION

PRI is a 36-bed residential treatment and wilderness leadership experience for youth aged 13-19, which has been structured as a program to cultivate transformative change in whole families. Before PRI, youth have experienced compromised health, impaired development, and chaotic relationships. PRI's approach focuses on helping adolescents mature, using a developmental and relational model. Admitted youths are placed on one of four treatment teams, each of which has assigned to it a therapist, three residential youth counselors, and a team teacher. PRI treatment is immersive and is experienced through mealtimes, school, and formal treatment programming and is guided by two evidence-informed approaches. The first is Dialectical Behavioural Therapy (Linehan, 1993) modified for substance abusing youths, and the second the Satir Family Model of Therapy (Satir, 1983, 1984). To supplement these formal approaches, PRI fosters a community milieu of accountability, respect, maturity, peer mentorship, and outdoor experiences.

Phases and stages of treatment

Treatment duration varies by individual need, but is typically two months in the Outdoor Leadership Experience (OLE Phase), twelve months at the residential campus (Residence Phase) eventually with shared time between home and the campus (Transition Phase), and up to a year engaged with an aftercare specialist. The mean length of stay for those who complete PRI is 1.3 years (0.6 for non-completers)[1]. The average wait for admission to the program for our sample is 7.7 months.

The parallel process

Another important component to the PRI program is the engagement of parents throughout the intervention – this is called the *Parallel Process*. PRI provides support, programming, and expectations of therapeutic work, which helps facilitate the youth's therapeutic process. Parallel process activities include workshops, group sessions with and without youths, weekly family sessions, and one retreat. These activities foster learning, individual and family growth, and whole-family strategies for change.

Evaluating the return on investment of the PRI intervention.

There is a paucity of literature on methodological approaches for, and studies measuring, interventions that extend beyond brief cognitive behavioural treatment-based interventions, for young people dealing with substance use and mental health issues. Measuring the benefits or outcomes of any addiction and mental health intervention, let alone intensive, long-term programs, is fraught with technical challenges. In addition, there is a lack of frameworks within which to assess what normatively can be considered successful with respect to treatment effects (Trask & Garland, 2012; Trauer, 1998). These challenges are compounded for treatment programs by the lack of clinical literature and evidence supporting treatment modalities within this developmental age and stage; many interventions have been validated and assessed in adult populations, and then adapted for young people, resulting in services and programs that are less effective and responsive to the developmental age and stage of young adulthood (Hoagwood, Burns, Kiser, Ringeisen, & Schoenwald, 2001; Mcgorry, Bates, & Birchwood, 2013). The economic evaluation of such treatment programs also faces technical barriers, with added limitations of short-term time horizons within which to measure treatment impacts vis-à-vis client outcomes. As such, traditional healthcare economic evaluation methods may not capture the allocative efficiency[2] and societal gains of long-term, intensive addiction and mental health treatment, especially for young people (Fujiwara & Dolan, 2014).

1 This length of stay includes the outdoor leadership experience, residential treatment, and transition (phases one through three), but does not include aftercare (phase four).

The Social Return on Investment (SROI) is an expansion of the cost-benefit analysis that is used to estimate and predict the financial return on investment for a program or service. SROI methodology calculates the value for money over time using direct (e.g. actual costs to a payer of hospital visits that would occur in the absence of PRI), and indirect costs (e.g. intangible costs and benefits related to satisfaction and well-being), and demonstrates the timing and the magnitude of change that are attributable to the initial investment. This analysis uses a counterfactual that is represented by what people who could benefit from PRI *would have experienced in the absence* of PRI, or what actions they took before attending PRI.

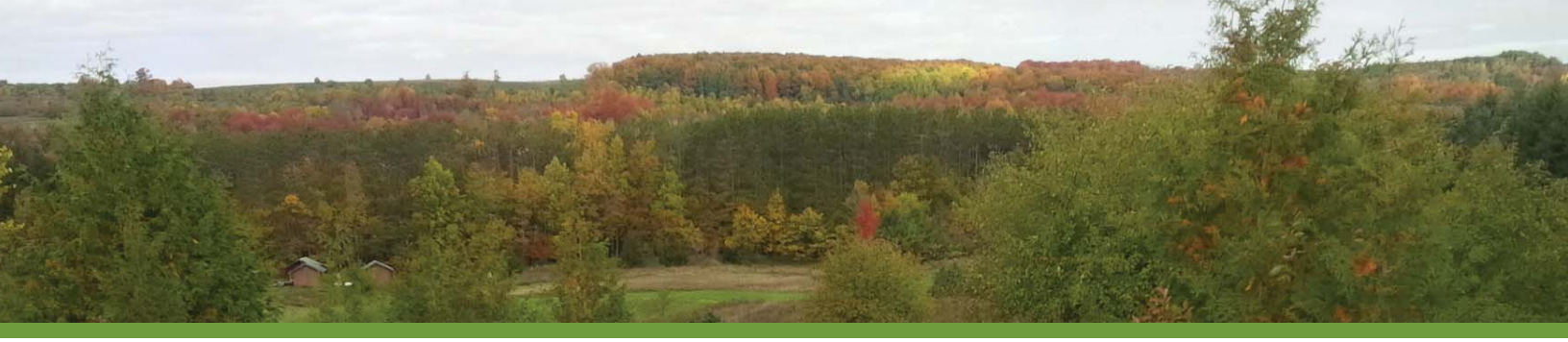
The outcome of the SROI analysis is helpful in economically evaluating the PRI program because it allows for a fulsome analysis from the perspectives of multiple social sectors. This is represented as a ratio or percentage in which an SROI ratio greater than 1:1 indicates a positive return on investment. In other words, the benefits of the investment are greater than its costs. We apply SROI methodology to evaluating this intensive residential service for young people with complex treatment needs. The scope of our SROI will be limited to direct costs and benefits, however, qualitative information from key stakeholders regarding indirect costs and benefits of PRI will be used to guide analysis and interpretation of results.

At the request of PRI, we considered the methods and data used in a previous SROI study (Rotman School of Management, 2011). We expanded the focus of this earlier project and estimated the SROI for PRI across years of admission and social sectors. This project was based on the following research questions:

1. What is the SROI of Pine River Institute's intervention?
2. What are the indirect costs and benefits associated with the PRI intervention?
3. When does the SROI become net positive?

We focus on estimating the return on investment in PRI, from the perspective of the government, across various sectors including health and justice, as well as in terms of labour market outcomes. We monetize the benefits of PRI using data available on costs of outcomes (what costs were avoided), as well as revenue generated (from the increase in labour market participation of PRI youth and their parents/guardians).

2 Allocative efficiency reflects how well society's resources are being used to meet population preferences. In other words, given how much money is being spent on healthcare, are we producing the mix of healthcare services and treatments that people want and need and are we doing it in a way that is cost effective (cost effectiveness efficiency) and doesn't waste resources (technical efficiency)?



METHODS

Overview of the approach

Our calculation of the social return on investment (SROI) for PRI is based on four domains : (1 & 2) the avoided costs across healthcare and justice, and (3 & 4) generated tax revenue[3] arising from increased parent/guardian income, and, from PRI graduate labour force participation, which is expected to be higher because of completers' participation in PRI treatment. We use a counterfactual of those in Ontario[4] with similar issues who did not participate in PRI treatment.

$$Social\ Return\ on\ Investment = \frac{(Benefits\ from\ four\ measured\ outcomes_{it} - cost\ of\ investment_i}{cost\ of\ investment_i}$$

Where i= the individual who attends PRI/their parent/guardian t= lifetime of individual(s)

Since the benefits of the initial investment occur in the future, the net present value (NPV) of the intervention needs to be estimated with an assumption that PRI completer will reach the age 65, the standard age of retirement, using the formula below (Pearce, 2015), employing a discount rate of 3%[5] to avoid overestimating the intervention effect over time (Drummond, Sculpher, Torrance, O'Brien, & Stoddart, 2005).

$$NPV\ of\ SROI = \sum_{t=18}^{65} \frac{Benefits_{it} - Cost_i}{Cost_i * (1 + discount)^t}$$

Data and sample

By 2010, PRI was operating at capacity, had permanent government funding, and had developed its team-based, evidence-informed therapeutic approach. We collected quantitative data from PRI with several pre/post measures for completers of PRI treatment. We included in our sample those individuals admitted from 2010 to 2015 who completed the wilderness, residence, and transition phases at PRI. Our total sample of PRI completers comprised 75 individuals. Our counterfactual is comprised of individuals living in Ontario with addiction and mental health issues across different age groups. Rates of hospitalization and labour force participation across age groups were calculated using Ontario-specific data from Statistics Canada population estimates[6,7]; rates of police contact were obtained using a Canada-wide rate, as data in Ontario was not available (Rehm et al., 2006).

3 Avoided costs are considered for healthcare and justice systems; avoided revenue is considered in terms of labour force participation of parents/guardians and PRI graduates.

4 All data for our counterfactual population is from Ontario except the rates of police contact – those are derived from Canada-wide data. Costs for police contact are calculated using Ontario cost data.

5 See below (page 9) for a more fulsome explanation of discounting in economic evaluations.

6 Canadian Institute for Healthcare Information: Hospital costs for Ontario; Canadian Association for Mental Health: Factsheet on substance use/mental health-related hospitalization.

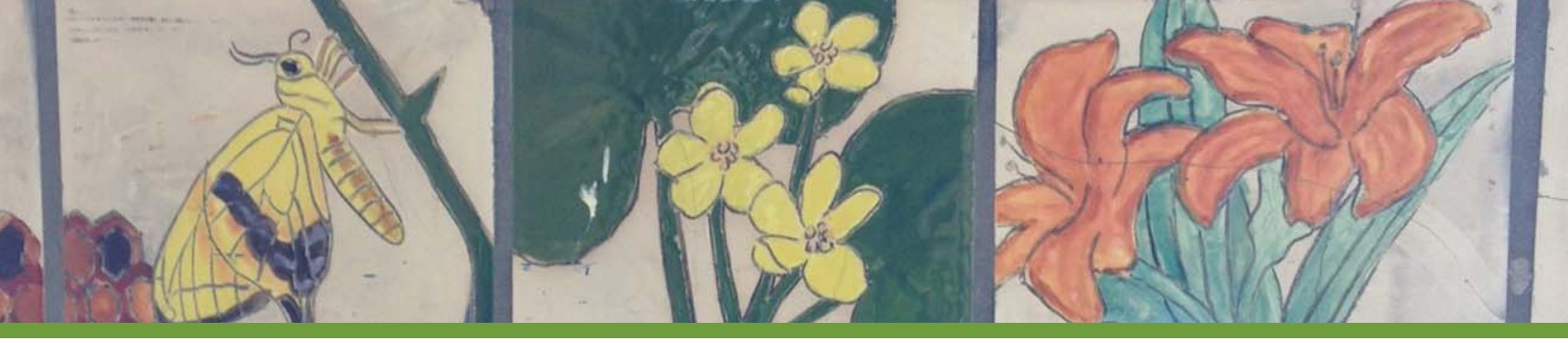
7 CANSIM Table 282-0087

Evaluating the costs and benefits of the PRI intervention

Total investment per year ranges from $4,626,195 in 2010 to $5,185,818 in 2015, with an average of $4,847,083 (Table 1). These investments are predominantly from the Ministry of Health and Long-term Care, who invest in the majority of beds at PRI. Six beds are available for privately funded individuals. We calculated the annual benefits for those who completed PRI from 2010 to 2015. The economic value attached to these benefits is derived from provincial-level data documenting costs for each outcome[ii]. (Table 1)

Table 1: Investment in the PRI program by year and phase of treatment

		Direct Costs	Direct Costs	Overhead	Fiscal Year	Daily	Daily Avg.	Daily
Fiscal Year	Program Phase	Compensation	Program	Factor	Total	Cost	# of Attendees	Cost/ Attendee
2010-11	OLE	257,195	392,264	425,683	1,075,142	2,946	5.50	536
	Residence	1,845,026	253,808	1,375,666	3,474,500	9,519	24.75	385
	Aftercare	41,581	4,661	30,309	76,551	210	6.00	35
	TOTAL	**2,143,802**	**650,733**	**1,831,659**	**4,626,194**	**12,675**		
2011-12	OLE	322,758	379,189	352,220	1,054,167	2,888	6.00	481
	Residence	2,129,612	212,608	1,175,268	3,517,489	9,637	24.00	402
	Aftercare	47,309	3,541	25,515	76,365	209	6.00	35
	TOTAL	**2,499,679**	**595,339**	**1,553,004**	**4,648,021**	**12,734**		
2012-13	OLE	413,948	383,219	405,880	1,203,047	3,296	6.00	549
	Residence	2,037,674	237,111	1,158,213	3,432,998	9,405	25.50	369
	Aftercare	47,282	7,846	28,068	83,196	228	6.00	38
	TOTAL	**2,498,904**	**628,176**	**1,592,161**	**4,719,241**	**12,929**		
2013-14	OLE	422,158	386,087	385,518	1,193,763	3,271	6.50	503
	Residence	2,261,198	228,619	1,187,595	3,677,412	10,075	26.00	388
	Aftercare	48,202	8,909	27,241	84,352	231	7.50	31
	TOTAL	**2,731,558**	**623,616**	**1,600,353**	**4,955,527**	**13,577**		
2014-15	OLE	382,203	374,691	344,814	1,101,708	3,018	6.50	464
	Residence	2,322,328	251,811	1,172,686	3,746,824	10,265	26.00	395
	Aftercare	58,904	9,225	31,038	99,167	272	8.50	32
	TOTAL	**2,763,435**	**635,727**	**1,548,537**	**4,947,699**	**13,555**		
2015-16	OLE	440,526	382,722	421,980	1,245,228	3,412	6.50	525
	Residence	2,303,704	246,643	1,307,253	3,857,600	10,569	27.75	381
	Aftercare	49,522	5,345	28,123	82,990	227	7.50	30
	TOTAL	**2,793,752**	**634,710**	**1,757,356**	**5,185,818**	**14,208**		



Direct cost valuation

The benefits of the intervention are only realized when there is an observable difference in the defined outcome measure. Using avoided healthcare costs as an example the magnitude of the benefits is estimated using the following equation:

$$Avoided\ healthcare\ costs = (healthcare\ utilzation_{i,t} - healthcare\ utilization_{i,c})\ x\ number\ of\ individuals\ x\ avg.cost\ of\ healthcare\ service$$

Where healthcare utilization = number of contacts with the healthcare system (e.g. hospital visits)

Avoided Costs to Healthcare and Justice Systems

Benefits to the healthcare system associated with the completion of PRI were measured in terms of avoided costs associated with urgent mental health and substance use hospitalization, based on the proportion of individuals who reported mental health and/or substance use hospitalizations before and after PRI. We then compared this with rates of hospitalization in our counterfactual population. This allowed us to estimate the province-specific benefit associated with PRI completers compared to hospitalization rates for the counterfactual population. To place a value on the benefit of attending PRI with respect to avoided costs to the judicial system, the proportion of PRI completers who reported having police contact before and after PRI completion was calculated. The value of this difference in avoided cost was estimated using Ontario data about the cost per police contact incident[8]. Costs of contact with the health and judicial systems were calculated using Canadian Institute for Healthcare Information data detailing costs per incident for urgent hospitalizations related to addiction and mental health in Ontario, and the cost per police contact from Ontario respectively. (Table 2)

8 The reported cost of police contacts in Ontario does not vary across age groups.

Table 2: Data sources and model construction

	Health system		Justice	Labour force	Indirect costs	
Outcome measures	Reduction mental health hospitalization rates	Reduction in substance use and related hospitalization	Decrease in police contact	Increase in tax revenue from increase labour participation	Increase in primary caregiver LF	Increase in secondary caregiver LF
All costs adjusted to 2010 dollars[1]	Mental health hospitalization	Substance use hospitalization	Police contact	Tax revenue	Primary caregiver LF	Secondary caregiver LF
Assumptions	Post PRI rate of hospitalization remains constant	Post PRI rate of hospitalization remains constant	Post PRI rate of police contact remains constant	Post PRI late of labour force participation remains constant	Post PRI rate of change in caregiver LF participation is 50% effective	Post PRI rate of change in caregiver LF participation is 50% effective
Age stratified	15-24 25-44 45-64 65+	Not age stratified	Not age stratified	20-29 45-49 25-29 50-54 30-34 55-59 35-39 60-64 40-44	40-44 45-49 50-54 55-59 60-64	40-44 45-49 50-54 55-59 60-64
Source of data	CIHI	CAMH CANSIM	Rehm 2006	Ontario tax calculator Labour Force Survey	Taxtips.ca Labour Force Survey	Taxtips.ca Labour Force Survey
Jurisdiction of data	Ontario	Ontario	Canada: Rates Ontario: Cost	Ontario	Ontario	Ontario
Cost calculation	Cost perindividual per episode weighted by proportion of the population and number of PRI attendees per year	Cost per individual per episode weighted by proportion of the population and number of PRI attendees per year Per capita cost of substance use hospitalization episode disaggregated using total ON population of individuals with MI*proportion of individuals receiving care.	Data from Ontario MoJ	Proportion of individuals in counter factual population working * mean income tax revenues by age group	Number of days missed * mean income by age group (assumed parents' ages start at 40)	Number of days missed * mean income by age group (assumed parents' ages start at 40)
Benefit calculation	Difference of cost*rate of people with MI/SU hospitalized within age group and change in proportion of PRI completer hospitalization Difference * cost of hospitalization rate (CIHI)	Difference of cost*rate of people with MI/SU hospitalized within age group and change in proportion of PRI completer hospitalization Difference * cost of hospitalization rate (CIHI)	Rate of police contact of individuals (adults) in Canada * cost of police contact in Ontario (MoJ)	Tax rate for mean income per age group * number of completers in each year	Mean number of days of work missed for primary caregivers* 50% effectiveness rate	Mean number of days of work missed for primary caregivers *50% effectiveness rate

1 Adjusted to 2010 dollars –to have a common reference for monetary value this year was chosen as it is the year that the PRI program developed into what it is currently.

Value creation for indirect cost-related benefits

In order to attach value to the benefit created by labour market participation following PRI, we calculated the proportion of respondents who reported being employed after PRI. We then used the mean wage earned in each age group until age 65, and the marginal tax rates for each income bracket to measure the tax revenue generated by PRI completers. The comparative value of this tax revenue-benefit was created using labour force participation rates of the counterfactual population selected. Tax revenue generation was estimated using the Labour Force Survey and Ontario tax rates across income levels.

We estimated the mean number of days both primary and secondary parents/guardians reported missing from their jobs in order to care for their child, both prior to and after attending PRI. We estimated the avoided loss by differencing the mean number of days missing multiplied by the mean income for each parent age group (starting from age 40). Because we did not have a comparable population in our counterfactual for this outcome measure, we assumed a 50% effectiveness rate of PRI in reducing the number of days missing from work. We halved the effectiveness rate in order to account for the lack of counterfactual, as well as to account for the likelihood of diminishing returns on investment for indirect benefits gained by parents/guardians as young people (PRI completers) get older and move out of their parents' homes.

Projection over time

Projections accounted for the benefits of future years (up until age 65), as well as end-of-intervention value. We assumed that parents of Pine River attendees were at least 40 at the time of their child's admission in our projections of the net benefit of value derived from not missing time at work due to their child's substance use and/or mental illness.

Discounting

Discounting is a procedure in the valuation of costs and benefits over time in economic evaluations of healthcare interventions that is employed as a result of individuals' tendency to prefer to defer costs to the future, and experience benefits at present (Drummond et al., 2005). Typically in healthcare, economic valuation discounting rates are set between 1%-5% to account for inflation and time-preferences, and are applied to both costs and benefits. In our model we employ a discount rate of 3% as it is slightly higher than the Consumer Price Index (CPI) rate of inflation for general goods (2%) as well as healthcare (2.3%) from 2010 to 2014. We ran sensitivity analyses (Table 3) using alternate discount rates (2% and 5%)[9].

9 Using a higher discount rate can under-estimate net present value and the SROI ratio; using a lower discount rate can inflate the SROI ratio.

Table 3: Sensitivity analyses

Adjusted variable	2010	2011	2012	2013	2014	Average over time
Default scenario (using actual % change for that year and 3% discount rate)	10:1	7:1	5:1	7:1	8:1	**7:1**
Benefit values only						
Best	16:1	9:1	9:1	10:1	11:1	11:1
Worst	10:1	5:1	5:1	6:1	6:1	6:1
Mean value (best and worst)	15:1	8:1	8:1	9:1	10:1	**10:1**
Discount rates: 2%, 5% Benefit values: high, low						
Best	20:1	11:1	11:1	13:1	14:1	14:1
Worst	7:1	4:1	3:1	4:1	4:1	4:1
Mean value (best and worst)	13:1	7:1	7:1	9:1	10:1	**9:1**
						TOTAL AVERAGE SROI=9:1

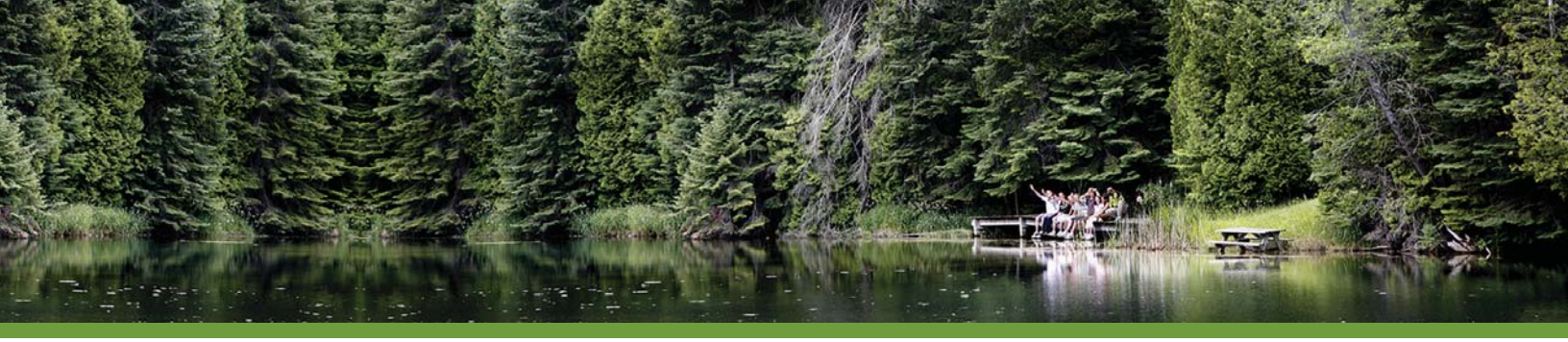
Sensitivity analyses

We chose outcomes and their benefits based on their applicability to direct and indirect costing. We chose conservative estimates of degree of change from PRI follow-up data in order to account for missing data. We ran 'best case' and 'worst case' scenario sensitivity analyses using the highest rates of change across years for PRI completers and the lowest discount rate (2%), compared with the lowest impacts and highest discount rate (5%). Table 3 presents the results of the sensitivity analyses.

RESULTS

After projecting the net benefit of completing PRI until age 65, at a fixed discount rate of 3%, the range of the SROI of completing PRI is from 5:1 to 10:1 from 2010-2014. This means that from society's perspective, using the most likely discount rate assumed here, that there is return of between five and 10 dollars for every dollar invested in the Pine River program. When combining best versus worst-case scenarios in terms of rates of effectiveness pre/post across all years, and high versus low discount rates for costs and these benefits over time, we see the SROI ranges from 4:1 to 14:1 with an average SROI of 9:1, nine dollars for each dollar invested in PRI (see Table 3 above).

At the default discount rate of 3%, a lifetime total benefit for PRI completers across all domains is $7,273,226, and the total investment in PRI is $894,965. The majority of the benefit generated, on average across 2010-2014, arises from the projected impact on labour force participation and associated tax revenue of PRI graduates (43%), followed by the avoided costs from reduction in police contact in PRI completers (21%). The



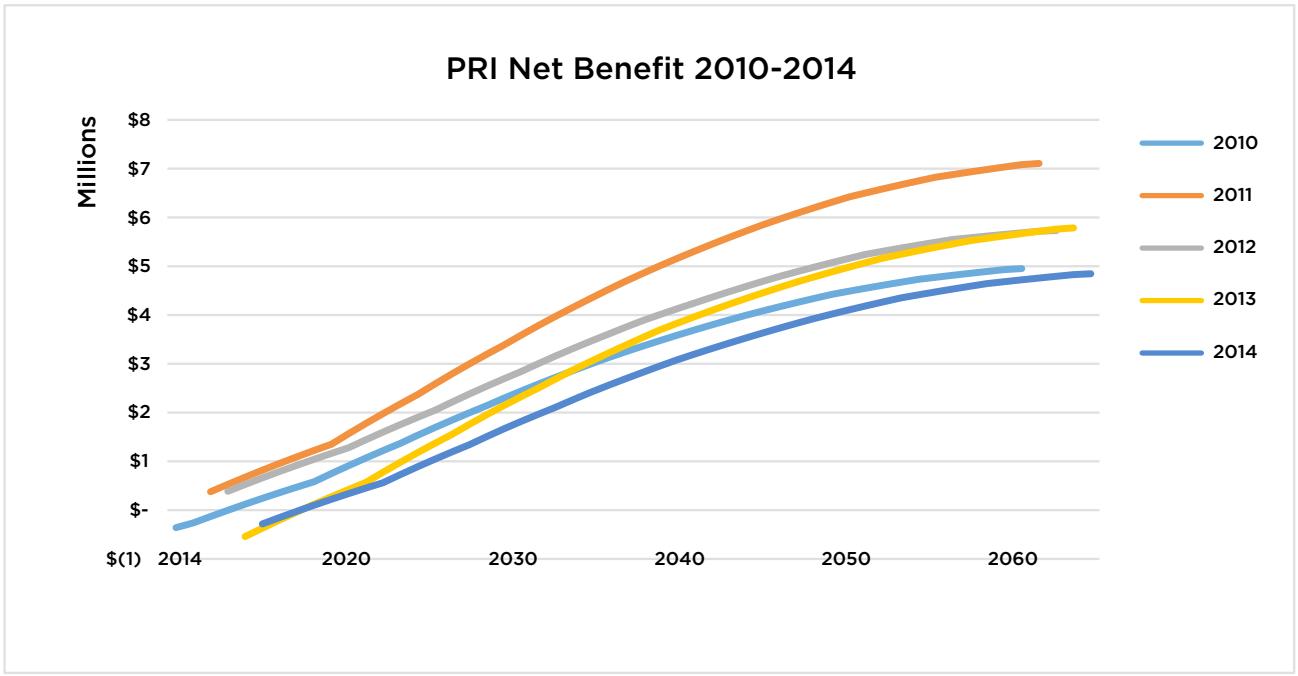
lifetime values attributable to reduced substance use and mental health-related hospital admissions are $84,052 and $1,003,409 respectively, which generate 1% (substance use) and 14% (mental health) of the total return on investment gained (Table 4).

Table 4: Overview of benefits across domains

Outcomes/benefits	Individual outcomes	Lifetime value	Percentage of total value created
Health	Reduced substance use hospital admissions	$84,052	1%
	Reduced mental health hospital admissions	$1,003,409	14%
Justice	Reduced police contact	$1,563,713	21%
Labour Force	Labour force participation and tax revenue	$3,105,127	43%
Labour force outcomes	Primary caregiver Secondary caregiver	$1,284,572 $232,353	18% 3%
Total benefit		**$7,273,226**	**100%**
Total PRI investment		**$894,965**	
AVERAGE SROI 7:1			

The net benefit of attending Pine River, across all outcomes, becomes positive immediately for those admitted in years 2011 and 2012, after two years for those admitted in 2010 and 2014, and after three years for those admitted in 2013. Variation in the time point at which the investment in PRI becomes net positive, as well as the benefit yield across years, could be due to differences in case-mix of students attending, and resulting trajectories in terms of specified outcomes. We discuss this further in our limitations section.

In our sensitivity analyses, when keeping the discount rate constant and shifting benefit values only, the SROI ranges from 5:1 using the year with the lowest benefit yield and lowest rate of change from all years, (2012), to 16:1, using the year with highest benefit yield at the highest rate of change (2010). When we adjust discount rates as well as benefit values, the SROI ranges from 3:1 in 2012 with a 5% discount rate, to 20:1 in 2010 with a 2% discount rate. The mean SROIs for the fixed discount rate scenarios and the variable discount rate scenarios, however, are within one dollar of each other at 10:1 and 9:1 respectively. At the aggregate (across years with variable benefit yields), the average SROI is seven dollars for every dollar invested.



Notes about variable creation

Sector	Outcome measure	Specification	Details
Health	Urgent hospitalization	Proportion of PRI completers pre/post who were admitted to hospital	% change pre/post compared with % hospitalization in CF population (age adjusted in projections).
Health	SU-related hospitalization	Proportion of PRI completers pre/post who were admitted to hospital for SU	% change pre/post compared with % hospitalization in CF population (age adjusted in projections).
Crime	Police contact	Proportion of PRI completers pre/post who were admitted to hospital for SU	% change pre/post compared with % hospitalization in CF population (**not** age adjusted in projections).
Labour market (tax base)	Labour force participation	Proportion of PRI completers participating in LF post PRI	LFP rate compared with LFP rate of Ontario residents with MH/A across age groups
Labour market (parent)	Labour force participation of parent	Rate of PRI completers' caregivers missing work (pre) over past 90 days – both primary and secondary providers	Adjusted the effect by 50% to conservatively estimate impact of recovery

Notes about difference between two models

	DeGroote Model	Rotman Model
Costs	Broken down by year and by phase of treatment	Aggregate number per year
Benefits	Avoided costs across six outcomes, four concerning individuals who complete PRI, and two concerning caregivers of completers derived from Pine River Institute data	Avoided aggregate costs based on a treatment rate weighted by 78% (figure of those who are successfully treated), derived from Canadian data
Counterfactual	Age-adjusted and Ontario-based counterfactual based on Ontarians with mental illness and/or substance use issues across the years of interest (2010-2014).	Canadians with mental illness and/or substance use issues who do not receive treatment/do not recover –based on data from 2002.
Robustness checks	Sensitivity analyses across 2%, 3%, 5% discount rates for outcomes estimated Sensitivity analyses across effectiveness rates (% changes in outcomes) across years of interest	None apparent

DISCUSSION

Many countries' governments and advocacy groups have conducted aggregate-level cost-benefit analyses of the return on investment in mental health services. The 'economic case' for investing in addiction and mental health services at the systems policy-level has been conducted in Canada (Mental Health Commission of Canada, 2013), the UK (Layard, 2012), and Northern Ireland (Friedli & Parsonage, 2007). Other interventions, primarily based in the United States, involving parents/guardians of young people estimate the return on investment in programs in early childhood to be between three and eight dollars for every dollar invested based on outcomes across public sector domains, including justice system contact and labour market participation (Barry & Jenkins, 2007; Karoly et al., 1998; Olds, Hendersen, Phelps, Kitzman, & Hanks, 1993; Reynolds, Temple, Robertson, & Mann, 2001; Schweinhart & Weikart, 1997). The time horizons for these findings vary, however all find a positive value for investment.

One study that calculates the rate of return on investment in programming aimed at improving the well-being for young people with complex needs finds a slightly lower return on investment than found for PRI: The New Economics Foundation estimated a SROI of £5.65 for every £1 spent for the *Catch 22: Ready or Not* campaign (NEF, 2011). This SROI was estimated from a societal perspective and, like other studies, explored the SROI of services not yet in place. Studies with SROIs that pertain to existing programs tend to focus on early childhood interventions and find that the primary source of benefit yield is driven by avoided justice-related costs and labour market participation (Barry & Jenkins, 2007; Reynolds et al., 2001). Few studies explore the impact of treatment on costs incurred by healthcare systems using individual-level costing data and a comparable counterfactual population. It is, therefore, difficult to

compare our findings with respect to health system costs with other studies' findings, and highlights the need for further research in this area.

Limitations

Our SROI is estimated using data from PRI which, akin to much treatment data, and especially post-treatment data, is challenged by missing observations. The sample number of PRI completers during the time period of interest is 75, however for some follow-up questions the response rate is lower. We deal with missing data by using maximum and minimum effectiveness values across all years in the sensitivity analyses. Because PRI collected information across several data points relevant to our outcomes of interest, we selected outcome indicators based on relevance and by the highest number of responders.

The variation in when investment in PRI becomes net-positive may result from a number of individual risk and protective factors of incoming students. As a result of the low sample size of completers each year, we are unable to control for case-mix factors in our analyses to explain the variation in outcomes and subsequent SROI values across years.

Implications for research and policy

Although 70% of all mental disorders can be diagnosed prior to age 25 years (Davidson, 2011; Kessler et al., 2005), only about one fifth of the approximately one million children and adolescents with a mental disorder in Canada receive any care (Government of Canada, 2006; McEwan et al., 2007; Waddell & Shepherd, 2002). The relationship between mental health and addictions is a complex one, with many individuals using substances as a means to cope with the symptoms of mental illness, while some young people who misuse substances may increase their risk for mental disorders. Yet too often treatment does not address mental health and addictions in a holistic manner that is responsive to these nuances (Mulvale et al, 2014), and in a way that is sensitive to the youth's developmental context (Di Rezze et al., 2016) and the needs of the family (Mulvale et al., 2016). The literature is clear that child and youth mental disorders can place a heavy burden on patients, families, health systems and society at large, with risks to social, interpersonal, vocational and economic outcomes and workplace productivity, including increased risk of suicide, criminal behaviour and substance abuse (Kutcher et al., 2010; Kutcher & McDougall, 2009; Mental Health Commission of Canada, 2012) that continue into adulthood. However, studies such as this, that estimate the long-term benefits from cost-intensive programming for this vulnerable population at long-term risk, are rare.

We are unaware of any economic evaluations conducted for programs and services for young people with addiction, mental health and behavioural issues in Canada, particularly those with a wilderness component. Our work contributes to an area with a paucity of literature: the economic evaluation of an intensive wilderness and residential program for youth that takes place over a relatively long period of time. This points to the need for continued research to compare alternate approaches to cost-effective, long-term intervention for this population; to optimize the use of scarce public resources, while meeting the needs of youth with mental illness and addictions, as called for at the national (Mental Health Commission of Canada, 2012) and provincial levels (Ontario Government, 2011; Ontario Mental Health and Addictions Advisory Council, 2015) in Canada.

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