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Impact of the Model Schools Literacy Project on Literacy and Fiscal Outcomes in First Nations in Canada

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Executive Summary

In today's economy, a functional level of literacy is crucial for success on the labour market, and needed for interactions with social service providers such as doctors. For children, literacy is fundamental to success in school, leading to better labour market outcomes later in life. In Canada, literacy skills rank about in the average of OECD countries, depending on the survey considered. According to the Programme of International Assessment of Adult Competencies (PIAAC), more than 40 per cent of Canada's workforce does not have adequate literacy skills. Increasing average literacy skills in Canada, then, could lead to significant increases in GDP.

One group in particular suffers from low literacy levels: First Nations in Canada. In light of this observation, the Martin Family Initiative developed the Model Schools Literacy Program (MSLP) in 2009. This program aims at increasing the literacy skills of First Nations children in Canada. It provides assistance and training to schools and teachers on reserves to foster better literacy skills among the children from kindergarten to grade 3. The MSLP can also act as an important tool supporting the federal government's commitment to reconciliation with Indigenous Peoples.

The results of the MSLP in the first participating schools are promising (O'Sullivan, 2016; Geddes, 2015). In the two pilot schools, students achieved much better literacy scores, both for writing and reading. The MSLP is now being expanded to more schools, and the goal is to see lessons from the program expanded to a greater number of on-reserve school by inspiring others to put their own programs in place, through a demonstration effect.

If the MSLP or similar literacy-improving programs were expanded to every on-reserve school in Canada, what could we expect from the ensuing improvement in literacy in terms of longer-term outcomes, both for individuals and Canada as a whole? This report provides an answer to that question in two parts.

The first part of the report reviews the literature on the relationship between literacy and socio-economic outcomes. Some authors, such as Coulombe, Tremblay, and Marchand (2004) find that better average literacy scores are associated with a higher level of GDP per capita and labour productivity, as well as higher growth rates. Schwerdt and Wiederhold (2018) find similar results using more recent data. Other authors look at the link at the individual level between literacy and labour market outcomes. Green and Riddell (2001, 2007, 2015), for example, use Canadian data to find that better literacy scores are associated with higher earnings. Specifically for the First Nations in Canada, Arriagado and Hango (2016) find that First Nations off reserve in Canada

who obtain better literacy skills are more likely to be employed. The report also reviews other contributions that explore the relationship between better literacy and health, crime, and social engagement. The general view is that better literacy is associated with better outcomes in those categories as well.

The second part of the report is the most substantive and contains an estimation of the impact of the MSLP or similar programs, if they were expanded to more on-reserve schools in Canada. Scaling up the MSLP itself to all on-reserve schools would likely be infeasible, but the success of the MSLP can inspire other organizations to run their own similar programs. In our estimations, we assume that every on-reserve school is participating in a program similar to the MSLP, and estimate the cost savings and additional revenues for Canadian governments that would result from the ensuing increase in literacy. Importantly, the estimation in this report focuses on benefits to governments (through cost savings and increased revenues) and completely abstracts from personal benefits accruing to the students themselves. In that regard, it is thus an under-estimate of the actual benefits to society as a whole from the increase in literacy.

The methodology in the report comprises four steps:

- We first estimate the number of students in a given cohort (i.e., the group of all students that started school for the first time in the same year).
- Second, we estimate the number of these students that would obtain better literacy skills as a result of the MSLP or a similar program. We calculate this number using the success rate (56 per cent) of the MSLP in lifting students out of low literacy, which is itself based on the evaluation of the MSLP in two pilot schools.
- Third, we select a number of outcomes which should improve due to better literacy skills, such as diabetes incidence and incarceration rates, and estimate the number of students in a given cohort that would enjoy better outcomes on each measure.
- Finally, we multiply the number of students that would enjoy these better outcomes on each measure by the per-person cost savings or additional revenues for governments associated with each measure.
- These total annual benefits are then aggregated over the lifetime of the students, using a discount rate of 2.6 per cent, based on the 10-year average of long-term (30 years) federal government bonds.

This methodology is similar to the one used in a report by the KPMG Foundation (2009), who performed a similar evaluation of the *Every Child a Reader* program in the United Kingdom.

In summary, the analysis shows that fiscal benefits to governments (cost savings and additional tax revenues) are about $310 million over the lifetime of students in every cohort (i.e., the group of all students that started school for the first time in the same year) participating in the MSLP or similar literacy-improving programs, or $43,448 per student. Over the lifetime of 20 cohorts of students, these cost savings add up to about $4.9 billion.

Based on the results from the two pilot schools, we estimate the costs of the program at a total of $72.5 million for one cohort, for the four years of elementary school (kindergarten to grade 3). Therefore, for every dollar invested in running the MSLP or a similar program, governments would recoup $7.77 in benefits. In other words, expanding the MSLP or similar programs to every on-reserve schools would generate benefits more than seven times as large as the costs to run the program. Notably, this rate of return is much greater than one even though the benefits considered are rather narrow. In particular, it considers only a subset of potential measures for cost savings, due to data limitations, and it completely ignores the broader social benefits from increased literacy as well as the private benefits accruing to the students themselves and their family. If we were to include those (assuming data would be available), the rate of return would be much higher.

We also test the sensitivity of our estimates to the discount rate used. Assuming instead a discount rate of 0 per cent, total fiscal benefits to governments would reach $722 million, more than twice the amount found with the base discount rate of 2.6 per cent. These benefits translate into a return to investment of $17.42 for every dollar invested. Assuming instead a discount rate of 1.7 per cent, the current rate for long-term federal government bond (30 years), the benefits would be $409 million, or $10.12 for every dollar invested.

Two measures make up most of the benefits of the increase in literacy: reduced welfare payments, and increased income tax revenues, both due to the better labour market outcomes associated with better literacy skills. Among the 7,133 students in a cohort, the better literacy skills resulting from the MSLP or similar programs would reduce the number of welfare recipients by 775. In turn, that would translate into cost savings for Canadian governments of about $147 million over the course of the students' lifetimes. Since many of the 7,133 students in a cohort would work more or have better jobs due to their better literacy skills, we estimate that governments would receive an additional $78 million annually. We include a third work-related measure: the incidence of receiving Employment Insurance benefits. We find that 98 fewer students would be receiving these benefits, resulting in savings of $23.4 million over the students' lifetimes.

The MSLP would also translate into better health outcomes. In the analysis, we estimate that out of the 7,133 students in a cohort, 512 fewer students would be diagnosed with diabetes later in life, resulting in savings to governments of about $6.2 million over the course of the students' lifetimes. The students in the cohort participating in the MSLP would also be less likely to abuse drugs. Combining alcohol, tobacco, cannabis, and other illegal drugs, the cost savings to Canadian governments would total $23.7 million over the course of the students' lifetimes. About half of that amount is related to tobacco smoking.

Better literacy in the early years of education would also lead to lower needs for special education. We estimate that as a result of the MSLP or similar programs, 1,238 fewer students out of the 7,133 in a cohort would require special education at school, translating into savings of $27.1 million over the 12 school years of the students. These students would also have lower

needs for adult literacy remedial classes (571 fewer students), resulting in cost savings of $1.9 million over the students' lifetimes.

Better literacy is often associated with a lower incidence of crime. In our analysis, we consider the costs of incarceration, and find that 32 fewer students out of the 7,133 in a cohort would be incarcerated at least once. Under some assumptions on recidivism, we estimate cost savings for Canadian governments of $2.4 million for one cohort. Finally, we also include abortion costs related to teenage pregnancies. With 633 fewer female students undergoing this procedure, we estimate cost savings for governments of about $273,000.

The report lists a number of caveats to the analysis, mostly due to data limitations. For example, the analysis only includes a limited number of outcomes that are associated with better literacy. With better data, the analysis could consider more measures, such as other health outcomes (e.g., depression) or other crime-related measures. Regarding crime in particular, the analysis in this report is rather narrow: we do not include the costs to the victims that would be avoided, or the costs of policing and hiring prosecutors. The analysis also relies on the small dataset of two pilot schools to determine the success rate of the MSLP and the costs of running the program. A key assumption is that the results of the pilot study in the two reserve schools apply to every school that will participate in the MSLP in the future. In particular, the study uses the literacy improvement rate of students in the pilot (56 per cent of students in a given cohort reach appropriate literacy skills while they would not have done so before participating in the MSLP) and applies it to future cohorts. Since the two pilot schools were not chosen randomly, the success rate for future cohorts could be lower than 56 per cent. However, even a much lower success rate (even lower than a quarter of the current rate) would translate in a positive rate of return according to our analysis. In future work, better data could be used to more precisely estimate both the benefits and costs of the MSLP or similar programs.

Given the youthfulness of the Indigenous youth population, and the increasing share of that group in Canada, investing in the education and skills of Indigenous youth, and of First Nations children in particular, is a win-win proposition for all Canadians. Since its inception, the MSLP has shown considerable promise by improving the literacy skills of the participating students. Improving literacy skills on reserves should lead to higher educational attainment, and eventually to better labour market outcomes. These improvements could play an important role in the federal government's objective of reconciliation with Indigenous Peoples.

Impact of the Model Schools Literacy Project on Literacy and Fiscal Outcomes in First Nations in Canada[1]

In today's economy, a functional level of literacy is crucial for success on the labour market, and needed for interactions with social service providers such as doctors. For children, literacy is also fundamental to success in school, leading to better labour market outcomes later in life. In Canada, literacy skills rank about in the average of OECD countries, depending on the survey considered. Lane and Murray (2018) highlight that according to the Programme of International Assessment of Adult Competencies (PIAAC), more than 40 per cent of Canada's workforce does not have adequate literacy skills. They stress that increasing average literacy skills in Canada would lead to significant increases in GDP.

One group in particular suffers from low literacy levels: First Nations in Canada. In light of this situation, the Martin Family Initiative (MFI) developed the Model Schools Literacy Program (MSLP) in 2009. This program aims at increasing the literacy skills of First Nations children in Canada. Briefly, it provides assistance and training to schools and teachers on First Nations reserves to foster better literacy skills among the children attending. Box 1 provides more details on the MSLP and its history. The MSLP can also act as an important tool supporting the federal government's commitment to reconciliation with Indigenous Peoples.

While still at an early stage, the results of the MSLP in the first participating schools are promising (O'Sullivan, 2016; Geddes, 2015). In the two pilot schools, students achieved much better literacy scores, both for writing and reading. The MSLP is now being expanded to more schools. The ultimate goal is to see the MSLP scaled up to a large number on-reserve school by inspiring other organizations to learn from the MSLP and put their own programs in place. If the MSLP or similar literacy-improving programs were expanded to every on-reserve school in Canada, what could we expect from the ensuing improvement in literacy in terms of longer-term outcomes, both for individuals and Canada as a whole? This report provides an answer to that question in two parts.

First, the report will review the literature on the impact of improved literacy[2] on a number of socio-economic outcomes: employment, unemployment, wages, crime, health, and social engagement such as voting behaviour. In addition, the report will also review contributions in the literature that study the impact of early childhood interventions on these outcomes. Indeed, these

[1] This report was prepared by Simon Lapointe, economist at the Centre for the Study of Living Standards. The author thanks Andrew Sharpe, Don Drummond and Julia O'Sullivan for helpful comments and suggestions, and the Martin Family Initiative for funding this project. Email: simon.lapointe@csls.ca.
[2] The MSLP defines literacy as reading and writing. This report will follow the same definition.

interventions are close to the MSLP in their goals and also target younger children to improve their outcomes later in life.

Box 1: The Model Schools Literacy Program

The Model Schools Literacy Program supports the acquisition of reading and writing skills for Kindergarten to Grade 3 students in First Nations schools. It is administered by the Martin Family Initiative (MFI). Schools are selected by the MFI, and participate in the program for four years, followed by two years of support to sustain the progress.

This partnership between the MFI and participating schools includes continuing professional learning already in place at the school, and enhancing resources for students, school staff, and leaders. Innovative use of technology enables the schools to work together, learning and sharing their best practices in early literacy education across time, distance, and First Nations.

The program started with a pilot study between 2010 and 2016 in two schools: Hillside School in Kettle and Stony Point First Nation, and Walpole Island Elementary School (now known as Bkejwanong Kinomaagewgamig) in Walpole Island First Nation. The pilot study allowed the MFI and involved researchers to determine the main obstacles to better literacy skills: absenteeism, lack of opportunity, poorly developed language skills, and issues within the home environment (O'Sullivan, 2016).

The MSLP identified a number of improvements to make within schools:

- Participating schools introduced measures to increase attendance (e.g., award prizes for attendance);
- Participating schools started scheduling regular 100-minute blocks during the day dedicated to reading instruction, without interruptions;
- Classrooms were re-arranged to include a reading space;
- The libraries in participating schools were also expanded, and added new books to their collection including some featuring Indigenous content;
- Professional development was provided for teachers, focusing on deepening the teachers' knowledge of child development;
- Protocols were developed to identify children with reading problems, and assign them to additional reading instruction.

The MSLP made use of technology to support teaching. For example, participating schools had access to specialists through video-conferencing.

In 2016-2017, the MSLP was expanded to six schools across Canada. In 2018, another six schools joined the program. The current plan is to add another six schools in 2020-2021.

Second, the report will evaluate the cost savings and additional revenues for Canadian governments that will result from the increased literacy after the introduction of the MSLP or similar programs in all on-reserve schools. The methodology is developed in part based on a report by the KPMG Foundation (2009), who performed a similar evaluation of the *Every Child a Reader* program in the United Kingdom.

In summary, the analysis shows that governments will save about $310 million over the lifetime of students in every cohort (i.e., the group of all on-reserve students starting school for the first time in any given year) participating in the MSLP or similar literacy-improving programs, or $43,448 per student. Over the lifetime of 20 cohorts of students, these cost savings add up to about $4.9 billion. In addition, for every dollar invested in running the program, governments would recoup $7.77 in benefits. In other words, expanding the MSLP or similar programs to every on-reserve schools would generate benefits more than seven times as large as the costs to run the program. Notably, this rate of return is much greater than one even though the benefits considered are rather narrow. In particular, it considers only a subset of potential measures for cost savings, due to data limitations, and it completely ignores the broader social benefits from increased literacy as well as the private benefits accruing to the students themselves and their family. If we were to include those (assuming data were available), the rate of return would be much higher.

The report is organized into four sections. The first major section reviews a selection of the vast literature on the relationship between literacy and socio-economic outcomes. The second section discusses results from other literacy interventions in different countries, examining their efficacy in improving literacy and other outcomes among participating students. The third section, the most important, presents the methodology, assumptions, and estimation results for the impact and return on investment of the MSLP. The final section concludes.

1. The Impact of Literacy on Socio-Economic Outcomes: A Review of the Literature

There is a large economics literature studying the link between human capital in general (i.e., knowledge, formal education, cognitive ability) and social and economic outcomes. The theoretical economics literature builds mostly on the work of Mincer (1958) and Becker (1964). The latter's work, in particular, popularized the use of the term "human capital" in economics, making an analogy between the physical means of production (capital) and the skills and knowledge of workers. In the empirical literature that followed, human capital is measured through various proxy variables. Most often, it is captured by the number of years of schooling, or the highest degree obtained. Others measure human capital with literacy and numeracy scores. Schwerdt and Wiederhold (2018) review some of the main contributions in the literature using various measures of human capital.

This report focuses on literacy for two reasons. First, the goal of the MSLP is to increase literacy, so we are mostly interested in the impact of that variable on socio-economic outcomes. Second, literacy might be a better measure of human capital than schooling (Coulombe, Tremblay, and

Marchand, 2004; Schwerdt and Wiederhold, 2018). More specifically, it measures actual cognitive ability,[3] and is a quality-based measure instead of a quantity-based measure like the number of years of education. Indeed, the number of years of education is partly endogenous to the education system in place, such that virtually all students graduating from high school will have the same number of years of education, despite having potentially very different cognitive abilities. The importance of individual cognitive skills compared to educational attainment in determining socio-economic outcomes is also supported by Hanushek and Woesmann (2008), who review international evidence on that question.

This section discusses some of the main contributions on the relationship between literacy and a number of outcomes, using data from various populations. Where possible, we discuss research using data on the Indigenous population or population of First Nations on reserve. However, due to the lack of data on Indigenous populations in Canada and elsewhere, most of the literature discussed is based on the general population. While socio-economic outcomes as well as literacy scores are generally worse in the population of First Nations on reserve than in the general population, we believe that findings on the relationship between these two measures should hold. Better data and more studies would be needed to confirm it.

1.1 Literacy and Macro-Economic Performance

Differences in literacy matter both for individual and societal outcomes (McCracken and Murray, 2010). Indeed, with increases in individual earnings and productivity, and decreases in illness and criminal activity, aggregate economic activity should increase. In this sub-section, the report focuses on the impact of increased literacy on macro-economic performance. The following sections then focus on the impact of literacy on individual outcomes.

Coulombe, Tremblay, and Marchand (2004) and Coulombe and Tremblay (2006) analyze the relationship between literacy and economic growth in a panel of 14 OECD countries over the 1960-1995 period.[4] They use data from the 1994 International Adult Literacy Survey (IALS), which measure the skills of individuals aged 16 to 65 years old in three categories: prose (i.e., understanding text), quantitative (i.e., numeracy), and document (i.e., the ability to use information from documents).

Coulombe, Tremblay, and Marchand (2004) find that the literacy indicators are strongly associated with a higher level of GDP per capita and labour productivity, as well as higher growth rates. Notably, the correlation between the literacy measures and growth remain positive even when including the average years of schooling in the regression equation. This result suggests that literacy levels are better predictors of economic outcomes than the number of years of schooling. In their main estimates, the authors measure literacy as the average level of literacy

[3] Literacy could be defined in many ways. The simplest would be a binary variable indicating whether the individual can read and write. In the literature reviewed in this section, it is measured with tests determining the skills of the individuals, resulting in a continuous measure of literacy.
[4] The data are actually gathered at one point in time only, but on people of various ages. The authors create a synthetic time series based on the age of the participants.

in the population. However, improving literacy among top or bottom performers is unlikely to lead to the same improvements in economic outcomes. To explore this possibility, the authors estimate their regressions using the share of the population that attained proficiency of at least level 4.[5] They find much less conclusive results, indicating that the better economic outcomes are not driven by the top performers reaching higher levels, but by a generally increased level of literacy. Notably, this result supports the idea that better literacy improves economic outcomes by making the workforce more productive on average, as opposed to developing a few individuals who would make disproportionate contributions through, for example, innovation.

Coulombe, Tremblay, and Marchand (2004) also estimate their equations separately based on male and female literacy. They find that female literacy is more strongly associated with better economic outcomes than male literacy. The authors suggest some possible explanations for this result, but their data did not allow the identification of the true channel. The explanations include: initial barriers to education for women, such that those that did increase their literacy had a particularly high innate ability; diminishing marginal returns to the education of men (who already have higher levels of literacy on average); women typically work in occupations that make a greater use of higher literacy levels; and possible biases resulting from the structure of the data.

In a more recent paper, Schwerdt and Wiederhold (2018) update the results of Coulombe, Tremblay, and Marchand (2004) using new data from the Programme for the International Assessment of Adult Competencies (PIAAC). PIAAC is a survey administered by the OECD. In each country, at least 5,000 participants were interviewed about their skills in three domains: literacy, numeracy, and ICT. Schwerdt and Wiederhold (2018) build a panel dataset using the methods of Coulombe, Tremblay, and Marchand (2004), covering 33 developed countries over the 1970-2010 period. In addition to data from PIAAC, the authors obtain economic data from the Penn World Tables.

Schwerdt and Wiederhold (2018) argue that it is important to update the results of Coulombe, Tremblay, and Marchand (2004), since the significant technical changes of the past twenty years might have made literacy skills more important in the labour market. This argument was also made by Dougherty (2003). Using more recent data, Schwerdt and Wiederhold (2018) find results similar to Coulombe, Tremblay, and Marchand (2004): higher literacy is associated with more rapid GDP growth. However, their result is greater in magnitude, possibly reflecting the greater importance of literacy today. Similarly, they find that labour productivity growth is associated with better literacy scores, and the magnitude of the correlation is greater than that found by Coulombe, Tremblay, and Marchand (2004). Finally, Schwerdt and Wiederhold (2018) also find that literacy is a better predictor of growth than schooling, that female literacy has a larger effect on growth than male literacy, and that underinvestment in human capital (i.e., individuals with very low levels of literacy) is more harmful to growth than the development of highly talented individuals favours it.

[5] Literacy in the IALS is measured on a 5-point scale.

In an earlier paper, Bishop (1989) made similar observations regarding the relationship between the skills of the workforce and the productivity of a nation. Using US data, the author argues that the decline in SAT scores between 1967 and 1980 was associated with the decline in labour productivity growth in the 1980s. In his counterfactual analysis, the author claims that the decline in test scores reduced GNP by 0.9 per cent by 1980 and 1.9 per cent by 1987. These numbers suggest that quality of schooling plays extremely important role in economic growth. These numbers might not represent a causal relationship, or could be slightly biased. However, more recent evidence such as the one presented in Hanushek and Kimko (2000) seems to confirm the relationship between school test performance and productivity, and that the relationship may be causal.

1.2 Literacy and Individual Labour Market Outcomes

At the individual level, researchers have also found a positive impact of literacy on labour market outcomes. This impact could be a direct effect of literacy, or an indirect effect through the better educational outcomes attained with better literacy skills. McCracken and Murray (2010) provide an overview of some of the most important impacts of literacy on individual outcomes. This section starts by presenting some evidence for Canada, before discussing results specific to the Indigenous population, and then some international evidence.

A number of studies were conducted using Canadian data. Charette and Meng (1998) were among the first to use objective measurements of literacy. Their data come from the Survey of Literacy Skills Used in Daily Activities (LSUDA) of Statistics Canada, covering Canadians aged 16 to 69 years old, although the authors focus on Canadians aged 25 to 69 years old. This survey employed face-to-face interviews, and obtained measures of reading ability and numeracy.[6] Charette and Meng (1998) estimate regression equations using the reading and numeracy scores as independent variables, and a number of outcomes as dependent variables. Compared to earlier studies, the authors are able to include a large number of socio-economic and geographic controls. For males, they find that literacy (defined in their study as reading ability) decreases the likelihood of an unemployment spell in the last 12 months, and increases the likelihood of working full-time. For females, literacy does not affect these two outcomes. The coefficients were not statistically significant for employment or labour force participation, for males or females. The authors do find, however, that literacy increases the number of weeks worked in the past 12 months. The authors find that for both males and females, increased literacy scores are associated with higher income.

The authors also include the number of years of schooling in their estimations. They find that the number of years of schooling positively affected most labour market outcomes, even when controlling for literacy scores. However, the effect of schooling on income is affected by the addition of literacy and numeracy scores in the regression model. Moreover, the sensitivity analysis is different for men and women. For men, the inclusion of literacy in the regression

[6] The authors point out that the survey included a writing component, but that the data did not allow the computation of a measure comparable to the one for the two other categories.

model decreases the magnitude of the effect of education on income, while the opposite is true for women. Generally then, the authors conclude that researchers studying the effects of education should strive to include broader human capital indicators such as literacy. Regarding the gender differences, the authors argue that choices of fields of study could be a driving factor. Indeed, at least at the time their paper was written, females tend to choose domains such as arts and humanities, such that the number of years of education would be a less accurate measure of marketable human capital.

David Green and W. Craig Riddell published a number of studies in the 2000s looking at the relationship between literacy and labour market outcomes in Canada. Green and Riddell (2001) use Canadian micro-data from the International Adult Literacy Survey (IALS), arguing, as highlighted earlier in this report, that literacy is a better measure of human capital (i.e., the set of skills, competencies, and knowledge) than formal educational attainment. As mentioned earlier in the report, the IALS has three components: prose literacy, quantitative literacy, and document literacy. Each component is measured on a 0-500 scale. Green and Riddell (2001) use the average of the three scores as their literacy indicator. They find that an increase of 10 points on the literacy score increases annual earnings by about 3.1 per cent. Using the individual's percentile of the literacy score instead, they find that an increase of 10 percentiles (e.g., from the median to the 60^{th} percentile) is associated with an increase of 5.5 per cent in annual earnings. Using hourly earnings instead, Green and Riddell (2001) find that a 10-point increase in the literacy score increases earnings by 1.8 per cent. This result implies that about 60 per cent of the literacy effect on earnings is due to increased hourly wages, and 40 per cent to an increase in working hours.

Green and Riddell (2001) also look at the relationship between education, measured either as years of schooling or highest level obtained, and earnings. Similarly to Charette and Meng (1998), they find that the coefficient on education is smaller when including literacy, indicating that literacy itself is an important determinant of labour market outcomes. For example, when estimating the impact of education without accounting for literacy, they find that compared to individuals with only elementary school, high school graduates earn 50 per cent more, and university graduates earn 100 per cent more. When controlling for literacy, high school graduates earn only 18 per cent more than the base group, while university graduates earn 50 per cent more. This substantive decrease in the coefficients highlights the importance of literacy in labour market success. Green and Riddell (2003) find qualitatively similar results with slightly different methods (i.e., quantile and median regressions). Ferrer, Green and Riddell (2006) also provide additional evidence using another group of individuals that traditionally fares worse in the labour market: recent immigrants. They find that literacy increases earnings, and at the same rate for immigrant and native-born Canadians.

Green and Riddell (2007) revisit their estimates in a more recent paper, using data from the 2003 International Adult Literacy and Skills Survey (IALSS), an updated version of the IALS. They find results similar to the earlier ones: average literacy increases earnings. However, they also

disaggregate the literacy into its four components,[7] and find that the impact of literacy on earnings depends on the type of literacy. In particular, document literacy and numeracy have significant impacts on earnings, while prose literacy and problem solving do not.

Green and Riddell (2015) provide a more recent update to their results, again using the Canadian part of the IALSS. They find that formal schooling is the main determinant of literacy skills. Notably, while education has a major impact on future earnings, literacy skills themselves have a significant direct impact on future earnings. In particular, a 25-point increase in literacy and numeracy skills (half of one standard deviation) is associated with an increase in earnings equivalent to one additional year of schooling.

Osberg (2000) provides a more critical view of the results from the IALS. His critique also applies to the more recent PIAAC. According to him, literacy is not readily measurable like years of education, or requires more assumptions to measure.[8] Moreover, the literacy scores reported in the datasets are not pure test results. Instead, they were imputed using test results and socio-economic data, which may bias the results when including the scores in regression estimations.

Shipley and Gluzynski (2011) instead use results from the Programme for International Student Achievement (PISA), which includes a score for reading proficiency for 15 year olds. They also use results from the Youth in Transition Survey (YITS), which followed students who participated in PISA in 1999 until they were 25 years old. With these data, they are able to describe the relationship between reading proficiency at 15 years old and labour market outcomes at 25 years old. They find that individuals with low reading proficiency at 15 years old are much more likely to have low educational attainment. For example, the share of individuals that had completed high school at most by age 25 was 54.0 per cent for those with proficiency below level 3, compared to 22.7 per cent of individuals with proficiency level 4 or 5. At university level, the gap is even more considerable: 9.4 per cent of individuals with low reading skills complete university compared to 45.7 per cent of those with high skills. A greater proportion of low-skilled individuals tend to complete college (29.4 vs 20.6 per cent). These poorer educational outcomes translate into poorer labour market outcomes. In particular, 14.8 per cent of individuals with low skills are not in education or working at age 25, compared to 7.8 per cent of those with high reading proficiency.

[7] The 2003 version of the IALS adds the Problem Solving category to the three existing ones.

[8] Moreover, the scores reported in IALS or PIAAC data do not have a cardinal interpretation; they only rank individuals against each other. Osberg (2000) provides a detailed and critical discussion of the methodology used to impute these scores. Briefly, since tests can take a long time to complete, each individual only answers a subset of potential questions. Statisticians then use sophisticated tools to "predict" the score of each individual, also using socio-economic information to do so.

The Impact of Literacy on Labour Market Outcomes of First Nations in Canada

The 2003 version of the IALS included an over-sampling of First Nations in Canada, which Green and Riddell (2007) leave out of their study, leaving it for later research. We did not find any research using this sample of First Nations in Canada from the 2003 IALS.

However, Arriagado and Hango (2016) conduct an analysis of the impact of literacy in the Indigenous population using results from the 2012 Programme for the International Assessment of Adult Competencies (PIAAC), a more recent survey of individuals aged 16 to 65 years old in Canada and 23 other countries. The PIAAC measures both literacy and numeracy, with scores on a 0-500 scale, and classifies individuals on 5 levels of ability. In this survey, literacy is defined as the ability to understand and use written text in print and electronic format. Generally, individuals reaching level 3 or higher have better outcomes on the labour market. In Canada, the PIAAC oversampled Indigenous people living off reserve in Ontario, Manitoba, Saskatchewan, British Columbia, and the three territories, making this survey particularly relevant for a study on the outcomes experienced by Indigenous Canadians.

Arriagado and Hango (2016) focus on Indigenous people aged 25 to 65 years old. First, they show that First Nations off reserve have much lower levels of literacy than Non-Indigenous Canadians. Only 35 per cent of First Nations off reserve reach level 3 in literacy, compared to 57 per cent of Non-Indigenous Canadians. The PIAAC also asks respondents to estimate how many books were in their house when they were 16 years old. The gap in the presence of books during teenage years could be one explaining factor for the gap in literacy between the two populations. In a finding particularly relevant for the MSLP, Arriagado and Hango (2016) find that First Nations off reserve who had more than 100 books in the home at age 16 are about 70 per cent more likely than those with 25 or fewer to reach literacy skills of level 3 or higher.

Comparing Indigenous and Non-Indigenous Canadians among those who had more than 100 books in the home, a literacy gap still exists: the predicted probability of obtaining level 3 literacy skills was 48.7 per cent for First Nations off reserve who have more than 100 books in the home, compared to 68.3 per cent for Non-indigenous people. This gap of 19.6 percentage points is only slightly lower than the gap of 21.0 percentage points between First Nations off reserve and Non-Indigenous Canadians who had 25 or fewer books in the home.

Looking at the relationship between literacy and labour market outcomes, Arriagado and Hango (2016) find that First Nations off reserve who obtain better literacy skills are more likely to be in employment. Among this group, the probability to be in employment is 75.2 per cent for those with level 3 literacy skills or higher, compared to 69.9 per cent for those with level 2 skills or lower.[9] However, the gap between First Nations off reserve and Non-Indigenous Canadians remains at both skill levels. Indeed, Non-Indigenous Canadians with high literacy (level 3 or higher) have a 91.2 per cent probability of being employed, compared to 86.7 per cent for those with low literacy (level 2 or lower). The data from PIAAC also detail employment in

[9] These numbers are controlling for education and a number of socio-economic factors.

professional and managerial occupation. Interestingly, for that type of job, literacy greatly reduces the employment gap between First Nations off reserve and Non-Indigenous Canadians. Among First Nations off reserve, the predicted probability to be in that type of employment is 46.2 per cent for those with low literacy skills, compared to 65.8 per cent for those with high literacy skills. Among Non-Indigenous Canadians, the respective probabilities are 53.4 per cent and 69.8 per cent. Notably, this latter probability is not statistically significantly different from the 65.8 figure for First Nations off reserve high skill individuals. These numbers suggest that conditional on being employed, the literacy skills of First Nations off reserve are valued in the labour market, and people in that group receive benefits from having these higher skills.

International Evidence

The evidence from Canada mostly points in the same direction: higher literacy skills are strongly associated with higher income and better labour market performance. Evidence from other countries also support this conclusion.

In the United States, Kirsch et al. (1993) study the results of the National Adult Literacy Survey, also finding strong correlations between literacy skills and labour market outcomes. Individuals with poor prose and document literacy skills were more likely to be in poverty (43 per cent for level 1 and 23 per cent for level 2, compared to 12, 8 and 4 per cent for levels 3, 4 and 5, respectively). Individuals with literacy skill levels 1 and 2 were also more likely to receive food stamps as part of their income, and less likely to report receiving interests from savings accounts. They were much more likely to be out of the labour force, and received much lower earnings on average. Kirsch et al. (1993) also break down the population at different skill levels according to occupation. They find that individuals with low skill levels are more likely to be in craft and service jobs, or to be labourers, assemblers, fishermen, or farmers. In contrast, individuals with higher skill levels were more likely to be in managerial or professional positions, while those with skills in the middle of the distribution (level 3) were more likely to be in sales or clerical positions.

Also in the United States, Murnane et al. (1995) show that the importance of basic cognitive skills might also increase over time. Their paper covers the 1970s and 1980s, and finds that skills learned before age 8 became more important predictors of post-high school wages in the 1980s compared to the 1970s. There are a number of more recent papers studying the link between basic cognitive skills or literacy at the individual level in the United States. The goal of this report is not to provide an exhaustive summary of the literature, but many are listed in Hanushek (2002), for example.

A number of studies also find similar results using data from the United Kingdom. These include Currie and Thomas (1999) and McIntosh and Vignoles (2001), who both find that better basic literacy skills increase earnings later in life. In Brazil, Rocha and Ponczek (2011) also find similar results. Dougherty (2003) provides somewhat contradictory evidence from the United Kingdom, arguing that numeracy is more important than literacy.

1.3 Literacy and Health

Low literacy is also often associated with poor health outcomes and behaviour, such as higher rates of obesity, smoking, and drinking.[10] De Coulon *et al.* (2010) review the vast literature on the correlation between education and health outcomes, concluding that there is a robust empirical association between the two. In one early study, Kirsch *et al.* (1993) describe results of the National Adult Literacy Survey in the United States, finding that individuals with low literacy levels are much more likely to report having physical disabilities, long-term illnesses, hearing or visual difficulties, or any health impairments. The results from this survey do not indicate a causal relationship between low literacy and health difficulties: healthier people might be more likely to stay in school, or richer families might invest in both more health and more schooling. De Coulon *et al.* (2010) also warn against causal interpretations of most studies. However, the consistency of results across countries and time periods do highlight the importance of studying this relationship.

An important channel through which literacy might affect health is the concept of *health literacy*. According to this concept, with better literacy skills, individuals have a better access to and understanding of health-promoting information (McCracken and Murray, 2010). For example, an individual with better reading skills can follow medication instructions and self-manage better, leading to better outcomes (Dewalt and Pignone, 2005). This is increasingly important, since hospitals often discharge patients earlier than in the past, leaving them to take more responsibility for their health (Canadian Council of Learning, 2008).

The Canadian Council of Learning (2008) describes the relationship between health literacy and health outcomes in Canada, using the 2003 IALS survey and the 2003 Canadian Community Health Survey. They find that the strongest relationship is between health literacy and the prevalence of diabetes. One explanation for this finding is that while genetics play a role in the development of diabetes, it is strongly influenced by individual behaviour. Moreover, once an individual starts treatment for diabetes, it requires a fair amount of self-management that can be difficult for individuals with low literacy skills. Schillinger et al. (2002), for example, find that among partients with type 2 diabetes, inadequate health literacy is associated with worse glycemic control and a higher likelihood of complications from diabetes (measured in this study by reports of retinopathy). Considering that diabetes is reaching epidemic levels among Canadian Indigenous people (Reading and Wien, 2009), increasing literacy is particularly important in these communities.

In the United States, Weiss et al. (1992) study the relationship between literacy and health outcomes using a sample of 193 persons. They measure their subjects' reading skills and health status, and find that those with reading skills below Grade Level 4 have Sickness Impact Profile

[10] As earlier noted, the report will focus on the link between literacy and health, instead of education and health. However, both measures and concepts are related. For the interested reader, Ross and Wu (1995) offer a comprehensive overview of the relationship between education and health, as a complement to the current report.

(SIP) scores almost twice as large.[11] The relationship remained statistically significant after controlling for a range of socio-economic variables. Sentell and Halpin (2006) also study the impact of literacy on health in the United States using results from the National Adult Literacy Survey (NALS), finding that low literacy is significantly correlated with a higher likelihood of having a condition keeping the individual from work, as well as having a long-term illness. Interestingly, with the inclusion of literacy in the regression estimations, the predictive power of education on health disappeared. This result indicates that literacy differences might partly explain how people with different educational attainment have different health statuses. The inclusion of literacy also reduced the predictive power of race, but not in the sample of people aged 65 years old or more. Therefore, while literacy might explain some of the health gap between races in the United States, the results indicate that race also has a direct effect.

In the United Kingdom, Morrisroe (2014) studies the ability of individuals to understand information in a health care context. The author highlights a number of comparisons between people who have adequate literacy skills and those who do not (based on levels defined in the 2006 Leitch Review in the United Kingdom). For example, 95 per cent of adults with adequate literacy skills know the symptoms of low blood sugar (hypoglycemia), vs. only 50 per cent of those with low literacy. Individuals with low literacy also have difficulty identifying their medication or how to take it according to instructions, and are more likely to show up at emergency departments (especially for manageable conditions such as asthma or obesity-related health problems). Also in the United Kingdom, De Coulon et al. (2010) study the impact of literacy and education on health-risky behaviours, concluding that education is the best predictor for better behaviour instead of literacy.

Other channels might explain the relationship between literacy and health. Seccombe et al. (2005) highlight some related possibilities. For example, consent procedures often contain complicated legal jargon, which may preclude individuals with low literacy from participating in some procedures or in research.

Literacy could also affect the utilization of health services. Seccombe et al. (2005) discuss research that shows that individuals with low literacy are less likely to be screened for breast or prostate cancer, and thus more likely to be diagnosed at an advanced stage of the disease.

Individuals with higher literacy scores are also more likely to have health insurance and regular health care providers. While health insurance is not as crucial in Canada as it is in the United States, some components of health care are not covered even in Canada, most notably pharmaceuticals. Seccombe et al. (2005) study this issue with a sample of adults participating in the Longitudinal Study of Adult Learning (LSAL) in the United States (specifically in Portland, Oregon). From the LSAL, the authors use variables capturing the use of health services, such as visiting a doctor's office, staying overnight at a hospital, prescription medicines, emergency

[11] Sickness Impact Profile (SIP) is "a behaviourally-based measure of sickness-related dysfunction" (Weiss et al., 1992). It includes information on 136 items in 12 categories covering a wide range of daily activities: mobility, alertness, social interactions, sleep, eating, etc. In Weiss et al. (1992), the test was administered orally to avoid measurement error due to low literacy.

visits, and telephone contact with nurses or doctors. They also include a variable indicating whether the individual has health insurance, and measures of health status and literacy skills.

The authors find that 76.9 per cent of low-literacy individuals (level 1) in the sample have a usual provider, compared to 84.7 per cent of high-literacy individuals (levels 4 and 5). Similarly, 63.9 per cent of low-literacy individuals have health insurance, compared to 79.4 per cent of high-literacy individuals. Almost double the share of low-literacy individuals (35.6 per cent) report having difficulties accessing health care, compared to high-literacy individuals (18.8 per cent). That being said, low-literacy individuals are more likely to visit a clinic, to contact a physician or nurse by phone, and to visit an emergency room. In other words, low-literacy individuals use health services more frequently, but are less likely to have a usual provider.

In addition, individuals with lower literacy are more likely to work in jobs that expose them to greater health and safety risks (De Coulon et al., 2010). In turn, these jobs require a greater level of health literacy (McCraken and Murray, 2010). This argument is related to the work of Marmot (2004), who finds that social status and health are closely related.

1.4 Literacy and Crime

Better literacy scores are also associated with a lower likelihood to be involved in criminal activities. In the United States, for example, 85 per cent of juveniles and 60 per cent of adults in the criminal justice system are functionally illiterate (EveryLibrary Insitute, 2019). In Canada, offenders are three times as likely as the rest of the population to have low literacy, as defined in the 2003 IALS, which includes prose and document literacy, as well as numeracy and problem-solving skills (Canadian Association of Chiefs of Police, 2009). More precisely, 65 per cent of people entering correctional facilities have reading skills lower than the equivalent of Grade 8.

However, the relationship between literacy and crime is complicated. For example, a poor social environment with few opportunities may be the cause behind both low literacy and a life in crime. Morrisroe (2014) argues, however, that low literacy could exacerbate risk factors associated with criminal offenses: truancy, poor experience of education, poor employment outcomes, etc. Low literacy skills, then, make it less likely for an individual to pursue higher education, thus reducing that individual's job market prospects. Faced with that reality, some engage in criminal activities instead of continuing through school. The Canadian Association of Chiefs of Police (2009) provide evidence supporting this: at least 75 per cent of adults in prison were persistent offenders in their youth.

Once they enter the criminal justice system, offenders with low literacy skills are often faced with a number of complicated documents to read and decisions to make. The legal system is filled with jargon, and can be difficult to understand even for a highly skilled individual (Canadian Association of Chiefs of Police, 2009). In turn, the person may enter the wrong plea (e.g., plead guilty to make the problem go away) or be re-arrested if they are released and did not understand the conditions.

Low literacy could also be associated with a higher probability of recidivism. Steurer (1996; cited in Vacca, 2008) finds that inmates who underwent correctional education during their stay in prison were 20 per cent less likely to re-offend compared to the general prison population. In fact, if literacy is a problem to begin with, we should expect released individuals to re-offend, since they will still face poor labour market prospects, maybe even poorer than before their first offense (Hendricks et al., 1996).

The next section will discuss evaluations of literacy-related policy interventions in greater detail, but one result warrants discussion here. Indeed, improving literacy skills early has been shown to reduce crime. For example, in the United States, Heckman et al. (2010) argue that between 40 and 65 per cent of the benefits of the Perry pre-school program in Chicago were due to reduction in crime.

1.5 Literacy and Social Engagement

Individuals with better literacy scores tend also to be more engaged within their community. For example, they are more likely to vote in elections. Indeed, they might have more information on the voting and registration process, have more time to go vote, and more interest or time in getting information prior to voting.

Kirsch *et al.* (1993), in their discussion of the results from the National Adult Literacy Survey in the United States, find that the proportion of adults reporting having voted in a recent (last five years) state or national election is strongly correlated with literacy levels. Of those with level 5 prose literacy skills, 89 per cent reported doing so, compared to only 55 per cent of individuals with level 1 skills.

Social engagement is not only about voting; individuals also stay up-to-date on current events by reading newspapers, watching television, or listening to radio. Kirsch et al. (1993) reports that low-literacy individuals are only slightly less likely to read newspapers, especially for news and editorials (92 vs 100 per cent). However, individuals of all skill levels were about as likely to get their information on current events from television or radio. Therefore, while low-literacy individuals are less likely to vote, they do attempt to stay informed on current events.

Kaplan and Venezky (1994) also study the likelihood of voting according to literacy status in the United States, but do not measure literacy skills directly. Instead, these authors use data from the Young Adult Literacy Survey (YALS) on reading practices of individuals and on education levels. They find that increased educational attainment is associated with a greater propensity to vote, and that individuals who kept up with serious news (i.e., on national, financial, or political subjects, rather than softer general interest news) are more likely to vote. However, their results are most likely not causal, and the authors make assumptions that might not stand today (e.g., that it is impossible to obtain serious news on television).

In Canada, Green and Riddell (2007) offer some evidence based on the 2003 IALSS. They find that low-literacy individuals (level 1) are actually more likely to vote in municipal elections

(67.9 per cent) than individuals in the two highest literacy levels (61.7 per cent). However, high-literacy individuals were more likely to vote in federal elections: 84.2 per cent vs. 79.5 per cent.

Green and Riddell (2007) also have data on other types of participation in social life. They find that low-literacy individuals are less likely to directly participate in political organizations (2.6 per cent vs. 6.7 per cent of high-literacy individuals). Moreover, they were much less likely to participate in community or school organizations. Indeed, 11.4 per cent of individuals in the low-literacy group participated in these organizations, compared to 47.4 per cent of the high-literacy group. Green and Riddell (2007) are cautious in the interpretation of their results, noting that they do not imply a causality from literacy to participation. However, they do argue that the evidence points in favour of Sen's (1999) point that literacy allows a fuller participation in society.

2. Quantifying the Impact of Improved Literacy of First Nations on Reserve in Canada

In this section, the report will estimate the potential benefits and costs, and return on investment, of the Model Schools Literacy Program or of similar programs it could inspire in the future. For the purpose of this report, the benefits are limited to fiscal impacts on Canadian governments, including cost savings on a number of government expenditures and additional tax revenues. When interpreting the results, it is important to remember that additional personal benefits accrue to the students participating in the program also. For example, they will be healthier, have greater incomes, and be less likely to spend time in prison. These improvements in well-being are not being captured.

Research on the effectiveness and social impact of educational programs in Canada is rare. To develop our methodology, we look at a study done in the United Kingdom. In particular, the methodology was developed as an adaptation to the context of First Nations reserves in Canada of a report by the KPMG Foundation (2009)[12] that estimated the potential return on investment for the Every Child a Reader initiative, a literacy-improving program in the United Kingdom.

2.1 Methodology

The methodology is based on the substantial literature reviewed in the previous sections finding that increasing literacy will lead to improved outcomes on a number of measures for the students involved in the program. In turn, that will result in reduced costs or additional revenues for governments. For each measure, we estimate the cost savings for governments that result from better outcomes due to the improvement in literacy. The measures included in this study are not comprehensive. They are: diabetes; incarceration; welfare and employment insurance payments; foregone taxes; substance abuse; teenage pregnancies; and additional special education costs and adult literacy classes.

[12] The 2009 publication is the second edition of the report, first published in 2006.

To summarize the methodology we use to calculate the cost savings to governments (i.e., the benefits from the MSLP), we first find the number of additional students in a cohort that will obtain high literacy skills as a result of the MSLP. Then, we multiply that number of students by the annual per-student cost savings for each measure to obtain aggregate cost. For costs that are repeated in time, such as welfare payments or diabetes treatment costs, we then use the aggregate annual savings for each measure to calculate the discounted total benefits over the lifetime of the students in the cohort. Finally, we sum the costs savings or additional revenues on all measures to obtain the total benefits of the program.

The method requires four steps. First, the target population must be defined. In this case, the target population is a one-year cohort of students in on-reserve schools. For the purpose of the analysis, a cohort is defined as the group of students who start school at the same time, in any given year (e.g., all the on-reserve students starting school for the first time in September 2020). This assumes that the program will expand, or be scaled up to every school, either directly with an investment in every on-reserve school, or indirectly through a "demonstration effect." In other words, the MSLP itself could be expanded to other schools, or other organizations could take the insights from the program and apply them to other schools. Moreover, schools themselves could learn from the MSLP and start their own program.

This report estimates that the target population is 7,133 students in a cohort in on-reserve schools. This number is calculated based on an estimate of 71,325 First Nations children aged 5 to 14 living on reserves from the 2016 Census (Statistics Canada, 2018), divided by the 10 grades covered in this age group. This might be an over-estimation of the target population, as some of the students attend provincial schools off-reserve. However, most of the on-reserve students attending provincial schools are at the secondary school level, which is not relevant for the MSLP. Moreover, some aspects of the program could be expanded to provincial schools, thus covering some of these students as well.

Second, we need an estimation of the success rate of the intervention. From the population of students in a cohort in which the MSLP was implemented, how many will actually reach higher levels of literacy? In this report, we assume the success rate based on the pilot study started by the Martin Family Initiative in 2010. O'Sullivan (2016) and Geddes (2015) state that five years after the pilot study took place, 67 per cent of participating Grade 3 students met or exceeded the provincial reading standard (up from 13 per cent), and 91 per cent met or exceeded the writing standard (up from 33 per cent).[13] Therefore, the share of students meeting the reading standards increased by 54 percentage points, and the share meeting writing standards increased by 58 percentage points. The report will take the average of these two improvements (56 percentage points) as the success rate. In other words, we assume that 56 per cent of students in a given cohort reach appropriate literacy skills while they would not have done so before participating in

[13] These numbers are based on tests administered to students that participated in a pilot study. Ontario's provincial assessment of reading and writing (EQAO) were administered to the students in the pilot schools. The EQAO assigns scores from Level 1 to Level 4. The provincial standard is Level 3. It is therefore different from the tests administered in the IALS or PIAAC studies, which assign a score from Level 1 to Level 5, and on which most studies are based. We assume that Level 3 of the EQAO corresponds to the Level 3 of IALS.

the MSLP.[14] This success rate is lower than the one used by the KPMG Foundation in their report (79 per cent).

Third, the methodology requires an estimate of the incidence of the "bad" outcomes related to each measure at different literacy skill levels. For example, the report estimates that about 26.9 per cent of Indigenous individuals with low literacy skills are diagnosed with diabetes, compared to about 13.2 per cent of those with high literacy skills.[15] With these two incidences, we calculate how many students in a cohort will usually be affected by the bad outcome on each measure, and the counterfactual number of students in that cohort that would be affected if literacy skill levels were higher. Returning to the example of diabetes (26.9 vs. 13.2 per cent), the differential incidence rate is equal to 13.7 percentage points. Applying that differential rate to the target population (7,133 students), we obtain a total of 642 fewer students per cohort who would be diagnosed with diabetes in their lifetime due to higher literacy after the introduction of the MSLP. In practical terms, we are not always able to obtain incidence data specific to the First Nations on reserve. When it is not available, we use data for the general Indigenous population if available, or for the general population if more specific data are not available. While the incidence levels are thus not exactly representative of the First Nations on reserve, these figures are the best estimates available. In addition, we do not rely on incidence levels, but on the gap between the incidences at lower and higher levels of literacy. The assumption that increasing literacy leads to the same improvement in outcome (albeit from different levels) is at least more realistic.

Finally, the fourth step required an estimation of the unit cost savings for governments associated with improvements in outcomes for each measure. It is equal to the government spending per person that is affected by the bad outcome for each measure. For example, the report finds that the cost for diabetes includes treatment costs, visits to hospitals and clinics, and is estimated at $1,173 (2020 dollars) annually per person diagnosed with diabetes (Canadian Diabetes Association, 2011) . The methodology focuses on government expenditures, so it does not include out-of-pocket expenses made by individuals. Each unit cost is also accompanied by a frequency and duration assumption, to calculate the cost over an individual's lifetime. For example, the unit cost associated with diabetes is repeated annually from the year of diagnosis until death. We obtain data on unit cost savings from a variety of sources, so the estimates obtained for unit cost savings associated with different measures are obtained for different years. We convert all unit cost savings to 2020 dollars assuming a 2 per cent annual inflation rate.

[14] Since the two pilot schools were not chosen randomly, the success rate for future cohorts could be lower than 56 per cent. However, as seen later in the report, even a much lower success rate (even lower than a quarter of the current rate) would translate in a positive rate of return according to our analysis.

[15] For most of the measures, we define "low literacy" as skills corresponding to Levels 1 and 2 as defined in the IALS, while we define "high literacy" as skills corresponding to Level 3. As explained in a report of the Conference Board of Canada by Campbell and Gagnon (2006), Level 3 skills are the minimum required to cope with everyday life and work, and is the level that should be required to complete high school and enter college. In addition, these levels correspond approximately to the goals of the MSLP (level 3 of the EQAO). However, data limitations mean that estimates for high literacy sometimes correspond to Levels 3, 4, and 5 of the IALS instead.

These components are used to calculate the cost savings for governments for each measure *j* using the following equation:

$$Total\ Cost\ Savings_{jt} = Target\ population \times 56\% \times \Delta Incidence_j \times \frac{Savings_{jt}}{Person}$$

In this equation, $\Delta Incidence_j$ represents the differential incidence of the bad outcome for measure j. In other words, it is the difference between the incidence of that outcome in the low-literacy population and the incidence in the high-literacy population.

From this equation, we obtain annual cost savings. We are interested in the total cost savings over these students' lifetimes after they leave school. For one-time cost savings, we assume that they occur in the first year. For cost savings that are repeated annually, we calculate annual discounted benefits in constant 2020 dollars for every year from the end of schooling until the retirement age of 65 years old (for employment-related outcomes) or until the life expectancy (for other outcomes), assuming a life expectancy of 76 years among the First Nations in Canada (Statistics Canada, 2010).[16]

The KPMG Foundation report used a discount rate of 3.5 per cent for the first 30 years, and 3.0 per cent thereafter. In Canada, the Treasury Board (2007), in their guidelines for cost-benefit analysis, recommend a discount rate of 8 per cent, but note that in many circumstances, a lower "social discount rate" might be more appropriate. The guidelines suggest a rate around 3 per cent. In this study, we follow Seens (2015) and use the average over the past ten years of the interest rate on long-term federal government bonds. Between September 2009 and October 2019, the average yield on Government of Canada benchmark bonds (long term, or 30 years) was 2.6 per cent. For comparison purposes, the rate was 1.7 per cent in November 2019. We use the ten-year average as the discount rate for the whole period in the study. For comparison purposes, we also provide non-discounted estimates in the final section, as well as an estimate using the current rate as the discount rate (1.7 per cent).

The total benefits to government from improving outcomes for measure *j* are therefore calculated as such (with *T* the total number of years relevant to the measure):

$$Total\ Cost\ Savings_{j,T} = \sum_{t=0}^{T} \frac{Annual\ Cost\ Savings_{jt}}{(1 + 0.0261)^t}$$

[16] Statistics Canada (2010) provides a projection to 2017 of the life expectancy at birth of First Nations for males (73.3 years) and females (78.4 years). We take the average of the two, and round it to the closest integer. Ideally, the report would use life expectancy at a later age, but First Nations data were unavailable for that indicator.

2.2 Estimations of Benefits by Measure

The report now turns to the application of the methodology described above to each of the measures chosen. For each measure, we describe the assumptions used to determine the incidence rates and unit costs, and then calculate the cost savings and discuss them.

Diabetes

The first section of this report highlighted the importance of literacy as a determinant of health status. In Indigenous communities, and especially among First Nations on reserves, diabetes is one of the main health problems. As argued earlier, it is also one that can be exacerbated by low literacy, since the treatment requires some self-management. According to a document published by the Canadian Diabetes Association (2011), diabetes is predicted to cost about $3.8 billion (2009 dollars) in direct costs linked to medical treatment and about $12.1 billion (2009 dollars) in indirect costs (long-term disability, premature mortality, loss of economic output, etc.) in 2020 in Canada. The same document states that also by 2020, 4.2 million Canadians will be affected (about 10.8 per cent of Canadians). Focusing on direct costs only, since they are more relevant to governments, these numbers translate to a total cost of $910 per person afflicted with diabetes. Converted to 2020 dollars, this amounts to $1,131. In the context of First Nations reserves, this number might be under-estimated since the treatment costs could be higher in remote regions.

In terms of incidence, the Assembly of First Nations (2011) states that about 20 per cent of First Nations in Canada suffer from diabetes. For First Nations on reserve, the actual incidence of diabetes is likely higher, thus introducing a downward bias to our estimates. The data on the incidence of diabetes are also not available by literacy level, whether for the First Nations on reserve or the overall Canadian population. A report by the Canadian Institute for Health Information (2015), however, do break down obesity rates by income levels: the prevalence of diabetes in the low-income Canadian population (bottom quintile) is 10.0 per cent and the prevalence of diabetes in the high-income Canadian population (top quintile) is 4.9 per cent. Since literacy skills are correlated with income, we use this information to estimate the incidence of diabetes at different literacy skill levels.

We also know that 60 per cent of the Indigenous population has low literacy skills (Gulati, 2013).[17] Then, we can estimate the diabetes rate by literacy level by decomposing the overall First Nations diabetes rate (i.e., 20 per cent) as a weighted average of the diabetes rates among the First Nations population with the two literacy levels:

$$20\% = \left(Diabetes_{FN,L} * 60\%\right) + \left(Diabetes_{FN,H} * 40\%\right)$$

where $Diabetes_{FN,L}$ is the diabetes rate of the low-literacy First Nations population, and $Diabetes_{FN,H}$ the diabetes rate of the high-literacy First Nations population. Assuming that the

[17] Gulati (2013) relies on data from the IALSS, and defines low literacy in that case as skills lower than Level 3, as discussed before in this report.

ratio of the diabetes rates by literacy levels is the same in the general population and in the First Nations population (i.e., $\frac{4.9\,\%}{10.0\,\%} = \frac{Diabetes_{FN,H}}{Diabetes_{FN,L}}$), then we can express the weighted average as such:

$$20\% = \left(Diabetes_{FN,L} * 60\%\right) + \left(\frac{4.9}{10.0} * Diabetes_{FN,L} * 40\%\right)$$

Then, we can solve for the diabetes rate of the low-literacy First Nations population:

$$Diabetes_{FN,L} = \frac{20\,\%}{60\% + \left(\frac{4.9}{10.0} * 40\%\right)}$$

This calculation gives an estimate of the diabetes rate of 25.1 per cent in the low-literacy First Nations population. Applying the ratio of incidences in the overall Canadian population (4.9/10) to that number, we obtain an estimate of the diabetes rate of 12.3 per cent in the high-literacy First Nations population.

Since the costs to governments due to diabetes is annual, it has to be summed over the number of years the target population will live with diabetes on average. According to the *National Report of the First Nations Regional Health Survey*, a document published by the First Nations Information Governance Centre (2018), the average First Nations diabetes diagnosis occurs at 37.8 years old. Therefore, in our calculations, we assume that annual costs associated with diabetes are equal to zero until 37 years old,[18] and $1,131 thereafter. Because we discount cost savings when summing them, the average diagnosis age of 37.8 years old introduces another downward bias to the estimates. Indeed, the average diagnosis age conceals diagnoses at different ages. Obviously, earlier diagnoses cost more than later one. However, the additional years of treatment for an individual diagnoses earlier than at the average age cost much more than the "savings" from years in which an individual that is diagnosed late does not need treatment, simply because the early years are discounted much less than later years.

[18] Assuming an average patient is diagnosed at 37.8 years old, treatment costs start in the 38th year. The treatment costs in that first year will be lower than the per person costs we estimated, since it is only part of a year. However, we assume that adding the expenditures for visits to doctors and diagnosis tests should make up part of the difference in the first year.

Table 1: Estimation of Diabetes-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of diabetes in low literacy population	25.1 %
Incidence diabetes in high literacy population	12.3 %
$\Delta Incidence$	12.8 %
Number of students in cohort diagnosed with diabetes once out of school	
Before the program $(3{,}994 * 25.1\%)$	1,003.6
After the program $(3{,}994 * 12.3\%)$	491.8
Difference $(3{,}994 * 12.8\%)$	511.9
$Annual\ Savings_{jt}/Person$	$1,131
$Total\ Annual\ Cost\ Savings_{jt} = 511.9 * 1{,}131$	$579,998
Total discounted cost savings summed over the lifetime of a cohort (37 years old to 76 years old)	$6,165,749

Table 1 summarizes the calculations done in this report to estimate the cost savings from higher literacy scores due to a lower incidence of diabetes. We find that as a result of the increased literacy skill levels, about 512 fewer of the students in the cohort of 7,133 would be diagnosed with diabetes. That would lead to annual savings of $578,998, or $6,165,749 over the lifetime of a cohort of students in the program.

Incarceration

Indigenous Canadians are greatly over-represented in Canadian prisons. Despite representing only about 4 per cent of the population, they represented about 30 per cent of the admissions to federal and provincial/territorial prisons in 2017/2018 (Malakieh, 2019). For comparison purposes, they represented about 20 per cent of admissions in 2007/2008. One contributing factor to the over-representation of Indigenous Canadians in prisons is the higher share of individuals with low literacy skills in that population.

We estimate the cost of incarceration using data from the Parliamentary Budget Officer (2018), who assess the cost of incarceration in federal prisons at $119,216 per prisoner, per year (converted to 2020 dollars).[19] We do not know the average sentence length for the First Nations population (on- or off-reserve), but the Department of Justice Canada (2004) does provide a median incarceration length for Indigenous youth of 212 days (including all Heritage groups). The median sentence length is less sensitive to outliers such as very long sentences for murders, and it under-estimates how long incarcerated Indigenous Canadian spend in prison. In addition, sentences might be longer for on-reserve First Nations in Canada than for Indigenous Canadians as a whole.

[19] On average, provincial prisons have lower costs, since they have different needs and prisoners with shorter average sentence lengths (PBO, 2018). For simplicity, we assume that costs per inmate are equivalent in provincial and federal prisons.

Indigenous Canadians are also more likely to recidivate than non-Indigenous Canadians. LaPrairie (1996) puts the likelihood of recidivism for Indigenous Canadians at 51 per cent (compared to 28 per cent for non-Indigenous Canadians). For our calculations, we assume that when incarcerated, First Nations on reserve spend time in prison equal to the median sentence length (assuming that the average for the Indigenous population applies to the First Nations on reserve), and that 51 per cent of them recidivate once (and serve the same sentence length), for a typical virtual sentence length of $212\ days \times 1.51 = 320.12\ days$. This is likely an under-estimation, since many recidivate more than once, and sentence lengths likely increase for every sentence beyond the first.

The likelihood of being incarcerated varies according to literacy level as well. To calculate incidence rates of incarceration by literacy skill level, our starting point is the estimate that 65 per cent of the prison population has low literacy skills (Canadian Association of Chiefs of Police, 2009). We also know that in 2017-2018, there were 38,786 inmates in federal and provincial/territorial prisons, or 13.1 per 10,000 (Malakieh, 2019), and that 42 per cent of Canada's population has literacy skills falling in levels 1 and 2 (Canadian Association of Chiefs of Police, 2009). We can use these numbers to estimate the incidence rate of incarceration in both literacy skill level, by dividing an estimate of the number of inmates with low (high) literacy skills in Canada by an estimate of the total population with low (high) literacy in Canada:

$$\frac{(65\% * 38{,}786)\ low\ literacy\ adult\ inmates}{low\ literacy\ adult\ population\ (42\%\ of\ Canadians)} = 20.7\ per\ 10{,}000$$

$$\frac{(35\% * 38{,}786)\ high\ literacy\ adult\ inmates}{high\ literacy\ adult\ population\ (58\%\ of\ Canadians)} = 8.1\ per\ 10{,}000$$

These calculations indicate that the rate of incarceration among low-literacy adults is 20.7 per 10,000 (0.21 per cent) and that the rate of incarceration among high-literacy adults is 8.1 per 10,000 (0.08 per cent). Low-literacy individuals are thus about 2.5 times more likely to be incarcerated.

These numbers, however, are for the general population. We adjust them for the Indigenous population using the ratio of these two incidences (20.7 and 8.1 per 10,000) and the overall Indigenous incarceration rate of 90.8 per 10,000 population, or 0.98 per cent (for all Heritage groups).[20] This latter figure is estimated using data from Justice Canada (2018), stating that 33.1 Indigenous individuals per 10,000 are incarcerated in federal prisons (all Heritage groups), to which we add an estimate of the incarceration rate in provincial/territorial prisons based on the ratio of federal to provincial adult prison population overall provided by Malakieh (2019): 14,129 in federal prisons to 24,657 in provincial/territorial prisons. We also know that 60 per cent of the Indigenous population has low literacy skills (Gulati, 2013).

[20] Due to lack of data specifically about on-reserve First Nations, we rely here on data for the Indigenous population as a whole.

Then, we can estimate the incarceration rate by literacy level by decomposing the overall Indigenous incarceration rate as a weighted average of the incarceration rates among the population with the two literacy levels:

$$90.8\ per\ 10{,}000 = \left(Incarceration_{ind.,L} * 60\%\right) + \left(Incarceration_{ind.,H} * 40\%\right)$$

where $Incarceration_{ind.,L}$ is the incarceration rate of the low-literacy Indigenous population, and $Incarceration_{ind.,H}$ the incarceration rate of the high-literacy Indigenous population. Assuming that the ratio of the incarceration rates by literacy levels is the same in the general population and in the Indigenous population (i.e., $\frac{8.1\ per\ 10{,}000}{20.7\ per\ 10{,}000} = \frac{Incarceration_{ind.,H}}{Incarceration_{ind.,L}}$), then we can express the weighted average as such:

$$90.8\ per\ 10{,}000 = \left(Incarceration_{ind.,L} * 60\%\right) + \left(\frac{8.1}{20.7} * Incarceration_{ind.,L} * 40\%\right)$$

Finally, we can solve for the incarceration rate of the low-literacy Indigenous population:

$$Incarceration_{ind.,L} = \frac{90.8\ per\ 10{,}000}{60\% + \left(\frac{8.1}{20.7} * 40\%\right)}$$

This calculation gives an estimate of 120.1 incarcerations per 10,000 (or 1.2 per cent) in the low-literacy Indigenous population. Applying the ratio of incidences in the overall Canadian population (8.1 and 20.7 per 10,000) to that number, we obtain an estimate of 40.0 incarcerations per 10,000 people (or 0.4 per cent) in the high-literacy Indigenous population.[21]

We assume here that the rates are the same for the overall Indigenous population and the First Nations on reserve. In reality, the rate is probably higher for the First Nations on reserve. If the higher rate also translates in a larger gap between the two literacy level groups, it would bias our results downwards.

Table 2 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of incarceration. We find that as a result of the increased literacy skill levels, about 32 fewer of the students in the cohort of 7,133 would be incarcerated. That would lead to annual savings of $3,344,646. That cost includes the recidivism rate, and we assume it is incurred at 18 years old, after the last year of mandatory schooling. Discounting at a rate of 2.6 per cent, we thus obtain a present value of $2,392,678. It is lower than the calculated nominal value because cost savings taking place in the future are worth less than those taking place today.

[21] This estimation is most likely biased upwards. Indeed, the high-literacy group includes individuals with literacy skills of levels 4 and 5. However, without better data, it is currently the best possible estimate of the difference between incarceration rates by literacy level.

Table 2: Estimation of Incarceration-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of incarceration in low literacy population	1.2 %
Incidence of incarceration in high literacy population	0.4 %
$\Delta Incidence$	0.8%
Number of students in cohort incarcerated	
Before the program $(3{,}994 * 1.2\%)$	48.0
After the program $(3{,}994 * 0.4\%)$	16.0
Difference $(3{,}994 * 0.8\%)$	32.0
$Savings_{jt}/Person$ (median sentence length, including recidivism)	$104,558
$Total\ Annual\ Cost\ Savings_{jt} = 32.0 * \$104{,}558$	$3,344,646
Discounted cost savings over the lifetime of a cohort (occurs at 18 years old)	$2,392,678

Welfare Payments

As discussed in the previous section, higher literacy skills are associated with better labour market outcomes. These better outcomes should translate into lower dependency on welfare and lower unemployment. This report will thus measure the cost savings to governments (i.e., lower welfare payments) associated with higher literacy on these two outcomes. To do so, we will rely on Murray et al. (2009), who estimate the savings in welfare payments that would result from suddenly lifting Canadians with literacy skill levels 1 and 2 to level 3 (i.e., low literacy to high literacy as defined in this report).[22]

For welfare, they estimate the cost savings at $542 million in 2003. They calculate these savings based on a reduction in the number of welfare recipients of 80,000, resulting in annual savings of $6,775 per recipient, or $9,487 per recipient in 2020 dollars assuming a 2 per cent annual inflation rate and no real growth in the welfare benefits between 2003 and 2020. The welfare incidence rate by literacy skill level is estimated using data from Shalla and Schellenberg (1999), who estimate an incidence rate for welfare of 22 per cent for the population with literacy skill level 1, compared to 11 per cent for the population at level 2, 8 per cent at level 3, and 3 per cent at levels 4 and 5.[23] We consider levels 1 and 2 to be low literacy skills. Therefore, the average welfare incidence among those of skills at levels 1 and 2 is 16.5 per cent.

Since this is the incidence for the whole Canadian population, we need to adjust it for the on-reserve population. The overall welfare dependency rate on Canadian reserves is equal to 29.9 per cent (Indigenous Services Canada, 2019). Considering that 60 per cent of the Indigenous population has low literacy skills (Gulati, 2013), and assuming it is equivalent on reserves, [24] we can estimate the welfare incidence rate by literacy level by decomposing the overall welfare

[22] More specifically, they find this estimate using propensity score matching and micro-data from the 2003 IALS.
[23] The incidence rate at levels 4 and 5 is inferred using information from the table in Shalla and Schellenberg (1999).
[24] Unfortunately, data on the on-reserve First Nations population specifically were not available.

incidence rate as a weighted average of the rates among the two populations at different literacy levels:

$$29.9\% = \left(Welfare_{FN,L} * 60\%\right) + \left(Welfare_{FN,H} * 40\%\right)$$

where $Welfare_{FN,L}$ is the welfare incidence rate of the low-literacy First Nations population, and $Welfare_{FN,H}$ the welfare incidence rate of the high-literacy First Nations population. Assuming that the ratio of the welfare incidence rates by literacy levels is the same in the general population and in the First Nations population (i.e., $\frac{8\%}{16.5\%} = \frac{Welfare_{FN,H}}{Welfare_{FN,L}}$), then we can express the weighted average as such:

$$29.9\% = \left(Welfare_{FN,L} * 60\%\right) + \left(\frac{8}{16.5} * Welfare_{FN,L} * 40\%\right)$$

Then, we can solve for the welfare incidence rate of the low-literacy First Nations population:

$$Welfare_{FN,L} = \frac{29.9\%}{60\% + \left(\frac{8}{16.5} * 40\%\right)}$$

This calculation gives an estimate of 37.7 per cent in the low-literacy on-reserve First Nations population. Applying the ratio of the incidences in the overall Canadian population (8 and 16.5 per cent) to that number, we obtain an estimate of 18.3 per cent in the high-literacy on-reserve First Nations population.

Table 3: Estimation of Welfare-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of welfare status in low literacy population	37.7 %
Incidence of welfare status in high literacy population	18.3 %
$\Delta Incidence$	19.4%
Number of students in cohort receiving welfare payments	
Before the program ($3{,}994 * 37.7\%$)	1,504.3
After the program ($3{,}994 * 18.3\%$)	729.4
Difference ($3{,}994 * 19.4\%$)	775.0
$Annual\ Savings_{jt}/Person$	$9,487
$Total\ Annual\ Cost\ Savings_{jt} = 775.0 * \$9{,}487$	$7,351,759
Discounted cost savings summed over the lifetime of a cohort (from 18 to 65 years old)	$146,733,649

Table 3 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of welfare payments. We find that as a result of the increased literacy skill levels, about 775 fewer of the students in the cohort of 7,133 would be

receiving welfare payments. That would lead to annual savings of $7,351,759. Assuming that these savings are repeated annually over the course of the students' work lifetimes (18 to 65 years old), the net present value is equal to $146,733,649.

Employment Insurance Payments

For employment insurance (EI), the cost savings are also obtained from Murray et al. (2009), who find that lifting the literacy skills of people with skills level 1 and 2 to level 3 would save $4,351 million in EI payments in 2003. They calculate this savings based on a reduction in the number of EI recipients of 511,000,[25] translating in savings of $8,515 per recipient, or $11,923 per recipient in 2020 dollars assuming a 2 per cent annual inflation rate and no real growth in the EI benefits between 2003 and 2020. It is important to note that while First Nations on reserve are exempt from paying income tax, they do usually pay employment insurance premiums if they work, and are eligible for these benefits (Canadian Revenue Agency, 2019).[26]

The EI incidence rate is based on data from Shalla and Schellenberg (1999), who estimate that the incidence rate of receiving employment insurance benefits is 21 per cent at literacy skill level 1, 21 per cent at level 2, 19 per cent at level 3, and 11 per cent at levels 4 and 5. Again, these numbers have to be adjusted for the First Nations on reserve. According to the 2016 Census, First Nations on reserve had an unemployment rate of 24.9 per cent, compared to 7.4 per cent for the non-Indigenous population (a ratio of 3.36). We assume that unemployed individuals on reserves are all receiving EI benefits, although some might be unemployed but ineligible for benefits or have their benefits exhausted, thus biasing our results upwards.

Considering that 60 per cent of the Indigenous population has low literacy skills (Gulati, 2013), and assuming it is the same on reserves,[27] we can estimate the EI incidence rate in the First Nations population by literacy level by decomposing the overall EI incidence rate as a weighted average of the rates among the two populations at different literacy levels:

$$24.9\% = \left(EI_{FN,L} * 60\%\right) + \left(EI_{FN,H} * 40\%\right)$$

[25] On average, in 2003, there were about 840,000 EI recipients. The reduction of 511,000 recipients estimated by Murray *et al.* (2009) thus represents a large share of total recipients. Looking closer at provincial estimates, Murray *et al.* (2009) assume large reductions in EI incidence due to literacy improvements. For example, the lifting of individuals from level 1 to level 3 leads to a 18 percentage points decline in EI incidence in Quebec and to a 8 percentage points decline in Ontario (along with large decreases in other provinces as well). Moreover, they assume incidence rates of EI as low as 1 per cent in Ontario for the population lifted to level 3 literacy skills. These assumptions may explain the very large magnitude of the decrease in EI recipients. That being said, we are interested in the amount per person, and the figure of $8,514 corresponds to about 29 weeks of average payments in 2003 (Statistics Canada Table 14-10-0008-01). While $8,514 may be an over-estimate of the per-person cost savings, it is thus not an unrealistic amount.

[26] Another point to consider is that while fewer people receiving Employment Insurance saves costs for the government, it also translates in lower contribution rates, thus also reducing revenues. The analysis abstracts from that aspect of the Employment Insurance system, and focuses on the reduced benefits paid.

[27] Unfortunately, data on the on-reserve First Nations population specifically were not available.

where $EI_{FN,L}$ is the EI incidence rate of the low-literacy First Nations population, and $EI_{FN,H}$ the EI incidence rate of the high-literacy First Nations population. Assuming that the ratio of the EI incidence rates by literacy levels is the same in the general population and in the First Nations population (i.e., $\frac{21\%}{19\%} = \frac{EI_{FN,L}}{EI_{FN,H}}$), then we can express the weighted average as such:

$$24.9\% = \left(EI_{FN,L} * 60\%\right) + \left(\frac{19}{21} * EI_{FN,L} * 40\%\right)$$

Then, we can solve for the incidence rate of EI receipts of the low-literacy First Nations population:

$$EI_{FN,L} = \frac{29.9\%}{60\% + \left(\frac{19}{21} * 40\%\right)}$$

This calculation gives an estimate of 25.9 per cent in the low-literacy First Nations. Applying the ratio of the incidences in the overall Canadian population by literacy levels (19 and 21 per cent) to that number, we obtain an estimate of 23.4 per cent in the high-literacy First Nations population.[28] As in other estimates, we assume that the same rates apply to First Nations on reserve.

Table 4 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of EI payments. We find that as a result of the increased literacy skill levels, about 98 fewer of the students in the cohort of 7,133 would be receiving EI payments annually. That would lead to annual savings of $1,174,111. Assuming that these savings are repeated annually over the course of the students' work lifetimes (18 to 65 years old), the discounted present value is equal to $23,434,072.

[28] For comparison purposes, Arriagada and Hango (2016) find a gap of about 5 percentage points between the predicted probabilities of being employed of First Nations living off-reserve with high and low literacy skill levels. However, they defined high literacy skills as level 3 or higher, in contrast to our definition of level 3 alone.

Table 4: Estimation of Employment Insurance-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of receipt of EI in low literacy population	25.9 %
Incidence of receipt of EI in high literacy population	23.4 %
$\Delta Incidence$	2.5 %
Number of students in cohort receiving EI benefits	
Before the program ($3{,}994 * 25.9\%$)	1,034.0
After the program ($3{,}994 * 23.4\%$)	935.5
Difference ($3{,}994 * 2.5\%$)	98.5
$Annual\ Savings_{jt}/Person$	$11,923
$Total\ Annual\ Cost\ Savings_{jt} = 98.5 * \$11{,}923$	$1,174,111
Discounted cost savings summed over the lifetime of a cohort (from 18 to 65 years old)	$23,434,072

Additional Tax Revenues

Better literacy levels also translate into higher salaries and higher employment rates. In turn, these higher salaries and greater employment mean more income and consumption tax revenues for the government. Due to data constraints, this report focuses on income taxes. The estimation here is simple, and is based on numbers from Murray et al. (2009), who estimate that lifting the population with literacy skills at level 1 or 2 to level 3 would result in an increase in income tax revenues of $11,190 million in 2003. Divided by the approximately 7.4 million people who would be lifted from levels 1 or 2 to level 3, and converted to 2020 dollars, this increase in revenues is equal to about $2,113 per person, annually.

For this outcome, we do not need to calculate incidence rates. We instead assume that the average amount of $2,113 applies to every individual for whom the program successfully increased literacy skills (3,994 students). This results in annual increased revenues of about $8.4 million, or $156.5 million discounted over the working life of one cohort (20 to 65 years old).

Table 5: Estimations of Additional Income Tax Revenues Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
$Annual\ Additional\ Revenues_{jt}/Person$	$2,113
$Total\ Annual\ Additional\ Revenues_{jt} = 3{,}994 * \$2{,}113$	$8,438,924
Discounted Additional Revenues summed over the lifetime of a cohort (from 20 to 65 years old)	$156,511,899
Discounted Additional Revenues summed over the lifetime of a cohort (from 20 to 65 years old), under the assumption that governments only receive half of total annual additional revenues (i.e., $3{,}994 * \$2{,}113 * 0.5$)	$78,255,950

For the First Nations on reserve, this number is likely over-estimated. Indeed, those who work on reserves are exempt from income tax. Assuming that all of them pay taxes would result in an over-estimate of the increased tax revenues.

That being said, the increased revenues might still increase tax revenues for governments in three ways. First, First Nations on reserve may work outside the reserves, in which case their income is taxable in most cases. Second, the increase in literacy, and the ensuing increase in educational attainment, might lead some First Nations to leave the reserve to look for work. In that case, they would most likely no longer be exempt from income tax. Third, if they do stay on reserves, the higher incomes of the MSLP participants would result in spillovers in communities outside the reserves, through increased spending in these communities. In turn, that increased spending would translate in more consumption tax revenues and, through a multiplier effect, increased income and consumption tax revenues from non-Indigenous residents in communities close to the reserves.

For these reasons, we do not include all of the additional tax revenues from taxes in the baseline analysis. Assuming that these two factors (First Nations youth moving away and the multiplier effect) together amount to half of the estimated increased tax revenues, we estimate the total benefits in this category with only 50 per cent of the estimate for tax revenues in Table 5. Therefore, increased tax revenues for governments for one cohort would reach about $78 million.

Costs of Substance Abuse

Low literacy is often associated with a higher likelihood of having substance abuse problems. The costs imposed by substance abuse (including alcohol, tobacco, cannabis, opioids, and other illegal drugs) were estimated in a study by the Canadian Centre on Substance Use and Addiction (2018). They estimate the total cost to Canadian society at $38.4 billion in 2014. The costs are split in four categories: healthcare ($11.1 billion), lost productivity ($15.7 billion), criminal justice ($9.0 billion), and other direct costs ($2.7 billion) such as prevention, fire damage, and worker's compensation. They also provide estimates of costs by individual substances. In this report, we will use four categories: alcohol, tobacco, cannabis, and other illegal drugs (including cocaine, etc.).[29]

[29] While abuse of opioids is a growing problem in Canadian society in general and on reserves specifically, we did not include that drug category in the analysis due to a lack of data on the number of potential abusers. For the number of users, the Canadian Institute for Health Information (2018) provides the number of prescriptions in Canada. Combining the costs to Canadian society with this number translates in costs of $188 per user, annually. However, this is greatly under-estimated, since many people with prescriptions for opioids use the drugs without issues. For the incidence rate, Carriere *et al.* (2018) links data from the 2011 National Household Survey and the Discharge Abstract Database to find that the hospitalization rate is equal to 30.8 per 100,000 for the population not in the labour force over 5 years, compared to 6.5 per 100,000 for those who are employed, also over 5 years. The same report states that for First Nations people living on reserve, the incidence rate for hospitalizations due to opioids is equal to 47.6 per 100,000, compared to 10.8 per 100,000 for Non-Indigenous people (both over 5 years). Combining these numbers, we would estimate the incidence rates for opioid abuse among low-literacy on-reserve First Nations Canadians at 0.027 per cent, and 0.006 per cent among high-literacy on-reserve First Nations

The costs in the healthcare (hospitalizations, surgeries, doctor visits, etc.) and criminal justice (policing, courts, etc.) categories are the costs most obviously paid by governments. The costs due to lost productivity include workers' compensation payments, but also more general social costs such as the loss of productive working years due to premature mortality ($10.1 billion in total). While this social cost is not paid directly by the government, it still represents a loss to society, and loss of tax revenues to the government. We decide to include it in the analysis, thus possibly over-estimating the costs of substance abuse in the context of the study. Another concern is on costs of policing related to cannabis. When the costs were estimated by the CCSA, cannabis was illegal. For that reason, we subtract the costs related to criminal justice for cannabis ($1.8 billion) in this study.

To obtain costs per "user" of the drugs, we also need data on the number of users. We obtain these data from Statistics Canada's Canadian Tobacco, Alcohol and Drugs Survey (Statistics Canada, 2018b). For alcohol, we take the number of heavy drinkers. For tobacco and cannabis, only the total number of users is available, which may underestimate the costs per user since not every smoker is necessarily "abusing" the substance. We use the same source for the "other illegal drugs" category. Combining the costs and the number of users, we obtain estimates of annual cost savings per person equal to $2,280 for alcohol, $2,960 for tobacco, $641 for cannabis, and $6,114 for other illegal drugs. Finally, for each substance category, we assume that these costs are annual and repeat every year from the end of the program (after Grade 6, at 12 years old) until the life expectancy of 76 years old.

Drug usage rates by literacy skill level were not available, so the analysis will rely instead on approximations based on education or income levels. For alcohol, cannabis, and other illegal drugs, these were available from Health Canada's Canadian Addiction Survey (CAS) (Adlaf et al., 2005).

For alcohol, the CAS provides information on the rate of hazardous drinking, among the population who drank alcohol in the past year, broken down by education level. The share of past-year drinkers reporting hazardous levels of drinking among those with less than a high school diploma is 21.8 per cent, compared to 19.2 per cent for those with a high school diploma.[30] Since education is correlated with literacy, we use these two incidences for low (levels 1 and 2) and high (level 3) literacy, respectively. Those numbers are for the population that drank at least once in the past year. In their sample, about 79 per cent of the population reported drinking in the past year. The report does not specify that number for First Nations on reserve, or even for the Indigenous population in general. According to the First Nations Regional Health Survey (First Nations Information Governance Centre, 2018), 57.4 per cent of First Nations adults reported drinking at least once in the past year. Assuming that this share is the same on reserves, and also assuming that the share of drinkers who suffer self-harm is the

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Canadians. These figures resulted in negligible cost savings, even when summed over the lifetime of students in the cohort.

[30] Hazardous drinking is defined as scoring at least 8 on the AUDIT test, a standard test to determine whether someone has alcohol dependence.

same in the on-reserve population as in the general population, the incidence rates used in the report are 12.5 per cent for the low-literacy on-reserve Indigenous population and 11.0 per cent for the high-literacy on-reserve population.

Table 6: Estimation of Alcohol-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of hazardous drinking in low literacy population	12.5 %
Incidence of hazardous drinking in high literacy population	11.0 %
$\Delta Incidence$	1.5 %
Number of students in cohort drinking hazardously	
Before the program $(3{,}994 * 12.5\%)$	499.8
After the program $(3{,}994 * 11.0\%)$	440.2
Difference $(3{,}994 * 1.5\%)$	59.6
$Annual\ Savings_{jt}/Person$	$2,280
$Total\ Annual\ Cost\ Savings_{jt} = 59.6 * \$2{,}280$	$135,892
Discounted cost savings summed over the lifetime of a cohort (from 12 to 76 years old)	$3,625,071

Table 6 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of alcohol abuse. We find that as a result of the increased literacy skill levels, about 60 fewer of the students in the cohort of 7,133 would be drinking alcohol in hazardous quantities annually. That would lead to annual savings of $135,892. Assuming that these savings are repeated annually over the course of the students' lifetimes, their present value is equal to $3,625,071.

For tobacco, we use data from the Canadian Tobacco Use Monitoring Survey of 2012 (Statistics Canada, 2013). That survey estimates the share of current smokers in the overall Canadian population by education level, finding that 19.5 per cent of people without a high school education smoked tobacco, compared to 17.5 per cent of those with a college education. According to Statistics Canada (2015), the share of smokers among First Nations off reserve is about twice that of the non-Indigenous population (27.0 per cent vs. 15.0 per cent, or 1.8 times higher). We assume that this ratio also holds for the First Nations on reserve, and estimate incidence rates for the study by multiplying the overall incidence rates by 1.8, obtaining rates of 31.5 per cent for the high-literacy on-reserve population, and 35.1 per cent for the low-literacy on-reserve population.

Table 7: Estimation of Tobacco-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of tobacco use in low literacy population	35.1 %
Incidence of tobacco use in high literacy population	31.5 %
$\Delta Incidence$	3.6 %
Number of students in cohort using tobacco	
Before the program ($3{,}994 * 35.1\%$)	1,402.1
After the program ($3{,}994 * 31.5\%$)	1,258.3
Difference ($3{,}994 * 3.6\%$)	143.8
$Annual\ Savings_{jt}/Person$	$2,960
$Total\ Annual\ Cost\ Savings_{jt} = 143.8 * \$2{,}960$	$425,719
Discounted cost savings summed over the lifetime of a cohort (from 12 to 76 years old)	$11,356,496

Table 7 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of tobacco usage. We find that as a result of the increased literacy skill levels, about 144 fewer of the students in the cohort of 7,133 would be smoking tobacco. That would lead to annual savings of $425,719. Assuming that these savings are repeated annually over the course of the students' lifetimes, their discounted present value is equal to $11,356,496.

For cannabis, the past-year usage rates were 14.8 per cent and 14.2 per cent, for those with less than high school education and those with a high school diploma, respectively (Adlaf et al., 2005).[31] According to the First Nations Regional Health Survey (First Nations Information Governance Centre, 2018), 30.3 per cent smoked cannabis at least once, compared to 14.1 per cent among the overall Canadian population (Adlaf et al., 2005), or 2.1 times higher for First Nations in Canada. We assume that this ratio also holds for First Nations on reserve, and estimate incidence rates for the study by multiplying the overall incidence rates by 2.1, obtaining rates of 31.8 per cent for the high-literacy on-reserve population, and 30.5 per cent for the low-literacy on-reserve population.

Table 8 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of cannabis usage. We find that as a result of the program and the increased literacy skill levels, about 52 fewer of the students in the cohort of 7,133 would be smoking cannabis. That would lead to annual savings of $33,024. Assuming that these savings are repeated annually over the course of the students' lifetimes, their discounted present value is equal to $880,955.

[31] Among those with a university degree, 10.9 per cent smoked cannabis in the past year. For those with some post-secondary education, the rate is the highest at 16.5 per cent. Since it is not clear who is included in that category (e.g., current college students), we use the completion of secondary education as the divide between low literacy (i.e., levels 1 and 2), and high literacy (i.e., level 3).

Table 8: Estimation of Cannabis-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of cannabis use in low literacy population	31.8 %
Incidence of cannabis use in high literacy population	30.5 %
$\Delta Incidence$	1.3 %
Number of students in cohort using cannabis	
Before the program ($3{,}994 * 14.8\%$)	1,270.4
After the program ($3{,}994 * 10.9\%$)	1,218.9
Difference ($3{,}994 * 3.9\%$)	51.5
$Annual\ Savings_{jt}/Person$	$641
$Total\ Annual\ Cost\ Savings_{jt} = 51.5 * \$641$	$33,024
Discounted cost savings summed over the lifetime of a cohort (from 12 to 76 years old)	$880,955

For other illegal drugs, the share reporting past-year use were 2.9 per cent among those without a high school diploma and 1.7 per cent those with a university degree (Adlaf et al., 2005).[32] About 2.4 per cent of the First Nations population used cocaine regularly in the past year (First Nations Information Governance Centre, 2017), but we do not have information on use of heroin or other illicit drugs. For the estimation of cost savings connected to the use of illicit drugs, we use the incidence rates for the overall population, assuming they are similar for First Nations on reserve: 1.7 per cent for the high-literacy First Nations on reserve population, and 2.9 per cent for the low-literacy First Nations on reserve population.

Table 9 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of use of other illegal drugs such as cocaine. We find that as a result of the increased literacy skill levels, about 48 fewer of the students in the cohort of 7,133 would be using these drugs. That would lead to annual savings of $293,074. Assuming that these savings are repeated annually over the course of the students' lifetimes, their discounted present value is equal to $7,818,036.

[32] Among those with a high school diploma only, the share reporting past-year use of other illegal drugs (cocaine, speed, ecstasy, hallucinogens, heroin) is 3.6 per cent (Adlaf et al., 2005), higher than among those without a high school diploma. However, the two shares are similar, and due to a relatively small sample, they are not statistically different. Furthermore, looking at the use of the drugs by income level, the same survey reports lower use among people with higher incomes. To avoid assuming that literacy increases the usage of illegal drugs, an assumption that would be difficult to justify given the data, we use the incidence of the use of illegal drugs among those with less than high school and among those with a university degree.

Table 9: Estimation of Other Drug-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of use of other illegal drugs in low literacy population	2.9 %
Incidence of use of other illegal drugs in high literacy population	1.7 %
$\Delta Incidence$	1.2 %
Number of students in cohort using other illegal drugs	
Before the program ($3{,}994 * 2.9\%$)	115.8
After the program ($3{,}994 * 1.7\%$)	67.9
Difference ($3{,}994 * 1.2\%$)	47.9
$Annual\ Savings_{jt}/Person$	$6,114
$Total\ Annual\ Cost\ Savings_{jt} = 47.9 * \$6{,}114$	$293,074
Discounted cost savings summed over the lifetime of a cohort (from 12 to 76 years old)	$7,818,036

Teenage Pregnancy

Low literacy skills are also linked to a greater likelihood of teenage pregnancy. The KPMG Foundation argued that cost savings associated with lower rates of teenage pregnancies included savings on delivery costs, social assistance, etc. In this report, to avoid double-counting, we assume that welfare costs are included in the welfare calculations defined above. Moreover, we do not include delivery costs, as teenage girls might instead just become pregnant later in their lives. However, we do include abortion costs.

Limacher et al. (2006) estimate the direct cost to society of a traditional (non-chemical) abortion in a hospital at $849.51. In 2020 dollars, it is equivalent to $1,143.33. We obtain data on the incidence of teenage pregnancy by literacy level from Maxwell and Teplova (2007), who describe the results of the Pathways to Education program in Toronto for the 825 students enrolled in it between 2001 and 2006. As a result of that program, the authors argue, the rate of teenage pregnancies in the target population fell from 3 per cent to 0.75 per cent.

These rates must be adapted for the First Nations population. Unfortunately, the only data available were for First Nations off reserve. In that population, 28 per cent of women became mothers before the age of 20 (Boulet and Badets, 2017). That number does not include teenage girls who were pregnant but decided to end their pregnancy. However, due to lack of data on teenage pregnancies among First Nations women, and due to the lack of data for *on-reserve* First Nations women, the analysis will use 28 per cent as the incidence of teenage *pregnancies* among on-reserve First Nations women, noting that it is an under-estimation of the actual incidence.

Then, we can estimate the teenage pregnancy rate by literacy level by decomposing the overall First Nations teenage pregnancy rate (i.e., 28 per cent) as a weighted average of the teenage pregnancy rates among the First Nations population with the two literacy levels:

$$28\% = \left(Pregnancy_{FN,L} * 60\%\right) + \left(Pregnancy_{FN,H} * 40\%\right)$$

where $Pregnancy_{FN,L}$ is the teenage pregnancy rate of the low-literacy First Nations population, and $Pregnancy_{FN,H}$ the teenage pregnancy rate of the high-literacy First Nations population. Assuming that the ratio of the teenage pregnancy rates by literacy levels is the same in the general population and in the First Nations population (i.e., $\frac{0.75\ \%}{3\ \%} = \frac{Pregnancy_{FN,H}}{Pregnancy_{FN,L}}$), then we can express the weighted average as such:

$$28\% = \left(Pregnancy_{FN,L} * 60\%\right) + \left(\frac{0.75}{3} * Pregnancy_{FN,L} * 40\%\right)$$

Then, we can solve for the teenage pregnancy rate of the low-literacy First Nations population:

$$Pregnancy_{FN,L} = \frac{28\ \%}{60\% + \left(\frac{0.75}{3} * 40\%\right)}$$

This calculation gives an estimate of the teenage pregnancy rate of 40.0 per cent in the low-literacy First Nations population. Applying the ratio 0.75/3 to that number, we obtain an estimate of the teenage pregnancy rate of 10.0 per cent in the high-literacy First Nations population.

Assuming that 52.8 per cent of teenage pregnancies are aborted in the general population (Statistics Canada Table 13-10-0167-01), and that this share holds in the First Nations population, we end up with incidence rates of 21.1 and 5.3 per cent, for low and high-literacy teenage girls, respectively. The target population for this outcome is limited to girls, so only half of the total target population. Finally, we assume that teenage pregnancies occur only once, at 16 years old.

Table 10 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of teenage pregnancies. We find that as a result of the increased literacy skill levels, about 633 fewer of the female students in the cohort of 7,133 would be undergoing an abortion in their teenage years. That would lead to savings of $362,069. Assuming that these savings occur at the age of 16, their discounted present value is equal to $272,713. This amount excludes other important negative impacts of teenage pregnancies, including the impact on children born to teenage mothers, who are more likely to be raised in poverty (i.e., inter-generational spillovers).

Table 10: Estimation of Teenage Abortion-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort (50% female)	3,567
Cohort population lifted from low to high literacy (56% success rate)	1,998
Differential incidence calculation:	
Incidence of teenage abortion in low literacy population	21.1 %
Incidence of teenage abortion in high literacy population	5.3 %
$\Delta Incidence$	15.9 %
Number of students in cohort undergoing an abortion in teenage years	
Before the program $(1{,}998 * 21.1\%)$	844.4
After the program $(1{,}998 * 5.3\%)$	211.1
Difference $(1{,}998 * 15.9\%)$	633.3
$Savings_{jt}/Person$	$1,143
$Total\ Cost\ Savings_{jt} = 633.3 * \$1{,}143$	$362,069
Discounted cost savings (one abortion at 16 years old)	$272,713

Adult and Special Education Costs

The last measures concern additional educational costs imposed by low literacy skills. First, low literacy translates in a greater need for special education. Therefore, improvements in literacy skills should lead into cost savings in that domain. To find the per-student cost, we rely on data from Ontario, assuming that they are similar in other provinces. In Ontario, in 2007-2008, there were a total of 191,899 students with special education needs (Government of Ontario, 2010). Of those, 11.7 per cent had behaviour or language impairment problems, two categories most likely linked to low literacy skills. The annual budget for special education in that year was $2.31 billion (Government of Ontario, 2010). Assuming that 11.7 per cent of the budget was allocated to students in the two categories selected, the per-student costs were $1,408. Budgets are adjusted upwards by 10 per cent for three categories: Northern schools, Indigenous students, and small schools (Nishnawbe Aski Nation, 2012). Since on-reserve schools cater to Indigenous students, and are mostly smaller schools, we adjust the costs upwards by 20 per cent. However, not all on-reserve schools are in the North. For simplicity, we assume that half of them are, and adjust the costs by 5 per cent on that criterion (half of 10 per cent). Therefore, increasing the amount by a total of 25 per cent, and converting it to 2020 dollars, we obtain a per-student amount of $2,146.

For the incidence of special education needs, we rely on the assumptions made in the KPMG Foundation study for the United Kingdom, assuming they hold in First Nations reserves as well. In particular, we assume that 34 per cent of students with low literacy skills need organized special education at school, compared to 3 per cent of those with high literacy skills. These incidences might be under-estimated for on-reserve students. However, if they are both under-estimated, the differential incidence (34 minus 3 per cent) could be relatively accurate. Finally, we assume that these costs are annual over every school year (12 grades).

Table 11 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of special education. We find that as a result of the increased literacy skill levels, about 1,238 fewer of the students in the cohort of 7,133 would be

needing special education. That would lead to annual savings of $2,657,411. Assuming that these savings occur annually over 12 school grades, their discounted present value is equal to $27,078,433.

Table 11: Estimation of Special Education-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of special education in low literacy population	34 %
Incidence of special education in high literacy population	3 %
$\Delta Incidence$	31 %
Number of students in cohort receiving special education	
Before the program $(3{,}994 * 34\%)$	1,358.1
After the program $(3{,}994 * 3\%)$	119.8
Difference $(3{,}994 * 31\%)$	1,238.3
$Annual\ Savings_{jt}/Person$	$2,146
$Total\ Annual\ Cost\ Savings_{jt} = 1{,}238.3 * \$2{,}146$	$2,657,411
Discounted cost savings summed over the lifetime (Grades 1 to 12)	$27,078,433

Second, lower literacy also translates in greater needs for remedial literacy education at adult age. For the cost of these adult classes, we rely on estimates from British Columbia, assuming that they are similar in other provinces. In that province in the 2019-2020 school year, adult education is funded at $4,773 per student (Government of British Columbia, 2019). For the incidence, we rely on the assumption of the KPMG Foundation study, and assume that 14.3 per cent of the low-literacy population needs adult remedial classes, compared to none of the high-literacy population. Finally, we assume that students take one year of remedial classes when they do, and that they take those classes at 19 years old, one year prior to the age at which we assumed they started working.

Table 12: Estimation of Adult Classes-Related Cost Savings Resulting from Higher Literacy

Target population in a cohort	7,133
Cohort population lifted from low to high literacy (56% success rate)	3,994
Differential incidence calculation:	
Incidence of taking adult classes in low literacy population	14.3 %
Incidence of taking adult classes in high literacy population	0 %
$\Delta Incidence$	14.3 %
Number of students in cohort taking adult classes	
Before the program $(3{,}994 * 14.3\%)$	571.2
After the program $(3{,}994 * 0\%)$	0
Difference $(3{,}994 * 14.3\%)$	571.2
$Savings_{jt}/Person$	$4,733
$Total\ Cost\ Savings_{jt} = 571.2 * \$7{,}733$	$2,763,708
Discounted cost savings (class taken at 19 years old)	$1,900,781

Table 12 summarizes the numbers used in this report to estimate the cost savings from higher literacy scores due to a lower incidence of adult remedial classes. We find that as a result of the increased literacy skill levels, about 571 fewer of the students in the cohort of 7,133 would be taking adult classes. That would lead to savings of $2,763,708 for the cohort. Assuming that these savings occur at the age of 19, just before starting their work lives, the discounted present value is equal to $1,900,781.

3.3 Total Benefits of the MSLP: Cost Savings and Additional Revenues

Table 13 shows the results of the estimations of benefits, including the cost savings to governments and additional revenues, for each outcome. The total benefits per cohort from increasing literacy skills in the target population add up to about $310 million, using the average rate on 30-year federal government bonds over the past ten years as the discount rate (2.6 per cent). Over a cohort population of 7,133 students, this translates in benefits of $43,448 per student. The additional tax revenues and reduction in welfare payments are the biggest contributors by far. Assuming the MSLP or similar programs are operated for 20 years, and thus that 20 cohorts of equal size benefit from them, the total benefits of the increase in literacy levels are $4,906 million in 2020 dollars, assuming the same discount rate of 2.6 per cent over these 20 years.

Table 13: Estimation of Benefits (Cost Savings and Additional Revenues) from Increased Literacy

	Cost per student (2020 Dollars)	Incidence in Low Literacy (%)	Incidence in High Literacy (%)	Annual Benefits[33] (2020 Dollars)	Total Benefits over the Students' Lifetime (2020 Dollars)
	A	B	C	D = A * (B-C) * population * 56%	E = discounted sum of D over relevant number of years
Diabetes	4,713	25.1	12.3	578,998	6,165,749
Incarceration	104,558	1.2	0.4	3,344,646	2,392,678
Welfare	9,487	37.8	18.3	7,351,759	146,733,649
Employment insurance	11,923	25.9	23.4	1,174,111	23,434,072
Additional Tax Revenues	2,113	n.a.	n.a.	4,219,462	78,255,950
Substance abuse					
Alcohol	2,280	12.5	11.0	135,892	3,625,071
Tobacco	2,960	35.1	31.5	425,719	11,356,496
Cannabis	641	31.8	30.5	33,024	880,955
Other illegal drugs	6,114	2.9	1.7	293,074	7,818,036
Teenage pregnancy	1,143	21.1	5.3	362,069	272,713
Special education	2,146	34.0	3.0	2,657,411	27,078,433
Adult classes	4,773	14.3	0	2,726,388	1,900,781
Total					309,914,581

[33] The benefits from additional tax revenues are multiplied by 50 per cent.

When estimating the returns to social investments such as the MSLP, the choice of a discount rate is somewhat controversial. Governments might care less about dollar amounts in the future, but should society discount benefits that occur in a long time? Should it care less about future generations? For comparison purposes, we re-estimate the total benefits with a discount rate of 0 per cent. In that case, the total benefits would reach about $722 million, more than twice the amount found with a discount rate of 2.6 per cent. Cost savings related to welfare payments ($353 million) and additional income tax revenues ($194 million) still make up most of the benefits. If instead of using the ten-year average of the rate on 30-year federal government bonds, we used the current rate of 1.7 per cent as the discount rate, we would find an estimate of total benefits of $409 million.

3.4 The Total Costs of the MSLP and Return to Investment

Based on the pilot program, the MFI reports that the MSLP would cost about $140,000 per school annually. Assuming there are 518 band-operated schools on reserves in Canada (Drummond and Rosenbluth, 2013), we estimate the total annual cost of the MSLP applied to all on-reserve schools at about $72.5 million. At the time, the MSLP was a seven-year program: kindergarten to grade 6 (O'Sullivan, 2016). These are annual costs, so we assume they are used for the seven school grades part of the program. Therefore, one seventh of that sum, $10.4 million is relevant to a cohort in any given year.

However, the current incarnation of the MSLP in aimed at children from kindergarten to grade 3, or four years. Assuming that the annual costs remain the same, we can estimate the total cost for a cohort. Summing $10.4 million over four years, discounted at a rate of 2.6 per cent, we obtain total costs of $39.9 million for a cohort. Therefore, the total benefits of $310 million for one cohort of students translate in a return of about $7.77 for every dollar spent. It is important to note that in determining this return, the costs are all incurred in the first four years, while benefits all accrue in the future, sometimes many decades later. Since we are discounting amounts in later years, the benefits are discounted more heavily than the costs. With a zero discount rate, the return to investment is $17.42 for each dollar invested, while it would be $10.12 with a discount rate of 1.7 per cent.

The estimation of the rate of return also assumes that the MSLP is directly expanded to every on-reserve school in the country. A likely scenario instead would be that the MSLP is expanded to a selection of additional schools, and then scaled up to other schools by other organizations who take the insights of the program and apply them elsewhere. In other words, the MSLP might scale up to more schools through a demonstration effect. Moreover, through learning-by-doing, costs are likely to decrease in later years. All in all, this potential over-estimation of the costs of the MSLP in the analysis mean that the return on investment could be under-estimated. With better data on the costs of the program and estimates of the demonstration effect, a more accurate rate of return could be determined.

The results of our analysis point to benefits lower than those of the KPMG Foundation study. In that analysis, they estimated the total benefits at £1,569.6 million over the students' lifetimes.[34] Their target population being 38,700 students, the benefits translate to £47,599 per student. Converted to 2020 dollars using a 2 per cent annual inflation rate and an exchange rate of 1.75 dollars per pound, this amounts to approximately $88,251 per student, about 1.5 times the benefits estimated for the MSLP. In terms of returns to investment, however, the KPMG Foundation study estimated a rate of return over the students' lifetimes of £17 per pound invested (using the savings estimated with moderate certainty), higher than the $7.77 we estimated for the MSLP. As mentioned above, the future costs of running the MSLP might be over-estimated, translating in an under-estimated return on investment. In addition, the KPMG estimate may also be over-estimated. For example, the success rate of 79 per cent may be over-estimated.

While the estimate of the return to investment is lower in this report than in the KPMG Foundation study, a rate of return of over $7 per dollar invested is an attractive return. By investing in the MSLP, even when doing so directly in every on-reserve school across the country (and as such likely over-estimating costs), the government recoups much more than the amount invested in future cost savings and additional revenues. In addition, this return to investment abstracts completely the personal returns to the students involved in the program. They will lead better and healthier lives, have larger incomes, rely less on welfare, and will be less likely to spend time in prison.

3.4 Caveats and Data Gaps

The analysis relies on a number of assumptions and imperfect data. Therefore, the total amount of benefits should be interpreted with caution. In this section, we review some of the potential caveats of the analysis, and discuss how future work could improve the analysis.

Causality between Literacy and Socio-Economic Outcomes

One important implicit assumption in the analysis is the existence of a causal relationship between improved literacy skills and the outcomes considered. If the relationship between literacy and the outcomes considered in the analysis is not causal, then even with increased literacy, we might not observe improved outcomes, which would lead to lower benefits.

Unfortunately, without better data, we cannot be certain whether the relationship is causal. Regarding labour market outcomes, at least one recent study suggest that the relationship with literacy is not causal. Indeed, Gibson et al. (2019) suggest that reading proficiency at age 15 is not associated with better earnings, after controlling for a large number of personal characteristics including education.

[34] Their methodology differed slightly, as they estimated the costs to different degrees of certainty. The estimate of £1,569.6 million represents their estimates with moderate certainty.

Another consideration is that the relationship between literacy and socio-economic outcomes found in research on the overall population might be weaker in the case of the First Nations on reserve. Indeed, while better literacy scores might help an individual in a large town in urban Canada find a better job, many reserves are more remote, where job opportunities are more limited. In that case, better literacy scores might not readily translate in better labour market outcomes. More research would be needed to better understand the relationship between literacy and socio-economic outcomes in the specific case of First Nations on reserve.

An additional limitation to this study is that it does not consider intergenerational effects. Indeed, the better socio-economic outcomes among young First Nations on reserve due to increased literacy would then likely have lasting outcomes for the next generations. For example, when they become parents later, they are more likely to value reading abilities and school education for their own children.

Data Limitations Related to Socio-Economic Measures

Some limitations of the analysis are due to the lack of data. Indeed, there is a particular dearth of data on socio-economic outcomes included in this study specific to the First Nations on reserve. With better data, for example, additional outcomes could be considered. The KPMG study, for example, considers outcomes such as truancy and school exclusions, as well as more health outcomes such as depression and obesity more generally. We could also consider the costs of crime more generally than only through incarcerations, such as the costs of policing and the cost of hiring prosecutors, as well as the costs to victims and the psychological damage due to feeling in danger. Given these data gaps, this study likely under-estimate the benefits of increased literacy.

Even regarding the outcomes we do include in the analysis, the data are often imperfect, forcing us to rely on assumptions of various probabilities to estimate the final costs or incidences. In many cases, these assumptions might lead to downward biases, but we are unable to rule out upward biases as well. The report discusses those biases along with the estimations, but we list them here as a reminder. For under-estimations, we note the following:

- The cost savings related to diabetes are likely under-estimated in the analysis, since the treatment costs for diabetes might be higher on First Nations reserves than in the general population;
- The cost savings related to incarcerations is likely under-estimated in the analysis, since our assumptions on recidivism and sentence length may be too low;
- The incidence of incarceration is likely under-estimated, since we are using the incarceration rate of First Nations off reserve, and the rate may be higher for First Nations on reserve;
- The incidence rates of substance abuse are probably under-estimated, since we used the off-reserve incidence rates due to data limitations, and the rate may be higher for First Nations on reserve;

- The incidence and costs of abortions are probably both under-estimated, since we used off-reserve data sources, and the figures may be higher for First Nations on reserve;
- The costs of special education are likely under-estimated, since they correspond to costs for the overall population (and in only one province), and the costs may be higher for First Nations on reserve.

For over-estimations, we note the following:

- The incidence of receiving Employment Insurance is likely over-estimated, since many First Nations individuals might not qualify for these benefits (if they do not work regularly);
- The amount of income tax recovered for governments is likely over-estimated, since most First Nations on reserve are exempt from income tax;
    - However, First Nations individuals with better literacy skills might work outside the reserve (thus paying income tax), might move out of reserves to look for work, and also spend more off-reserve, which should increase tax revenues from non-Indigenous people there, through a multiplier effect;

Future work could improve the analysis by looking at better datasets. One example is the Canadian Community Health Survey, from which micro-data are available and would allow more precise cross-tabulations of health outcomes by education level (as a proxy for literacy levels).

Data Limitations Related to the Cost of the MSLP

The estimation of the return of the MSLP relies on relatively crude assumptions on the cost of running the program and its effectiveness. In fact, the costs are taken from a quote in Geddes (2015) from a director at the Martin Family Initiative, but since then, more precise estimates of the costs have probably been gathered, and in more schools. In future work, data from administrative sources could be used to estimate a more precise cost of running the program. The MFI also recognizes the importance of evaluating the program and is actively gathering data on the costs of the MSLP (and costs of running on-reserve schools more generally). Those data could be used later to improve our estimates.

In addition, as time passes, the costs of running the MSLP will likely decrease. By expanding the program to more schools, the program will benefit from economies of scale. By gaining experience, the administrators of the program as well as the teachers involved will figure out how to run the program more efficiently, benefitting from learning by doing. We have also assumed that the MSLP will be responsible for the implementation of the program in all on-reserve schools in the country. However, seeing the positive results in the reserves that receive the MSLP, other organizations could implement similar programs in other schools. In that case, the initial investment in the MSLP would be lower than the assumption used in this report.

Data Limitations Related to the Success Rate of the MSLP

The analysis also relies on a success rate of 56 per cent, based on results of the first pilot study for the MSLP. If the long-term success rate of the MSLP or similar programs is lower, the fiscal benefits for governments would also be lower. That being said, even with a much lower rate of success, our analysis predicts a positive rate of return. For example, a success rate of 14 per cent (a quarter of the one used in the analysis) would translate in a return of $1.94 for every dollar invested.

In future work, the analysis could use data from the implementation of the MSLP in more schools, to find a better estimate of the success rate. In addition, if some schools adopt the principles of the MSLP by themselves, through a demonstration effect, the analysis could integrate the rate at which literacy increases among students in these schools to provide a more precise estimate of the return to investment (both through direct investment and through the demonstration effect).

4. Conclusion

This report discussed the potential impacts of the Model Schools Literacy Program for schools on First Nations reserves in Canada. It did so in two parts. First, the report reviewed the literature on the relationship between literacy and socio-economic outcomes. It finds that literacy is associated with better GDP growth, better labour market outcomes, better health, lower crime, and higher social engagement. However, that relationship might not be causal. Indeed, literacy skills and formal education are also closely related, and it is not clear whether education or literacy skills has the greatest impact on those socio-economic outcomes. That being said, one could argue that adequate literacy skills are needed for success in school, such that literacy improvements are a first step towards more formal education, and eventually towards better labour market outcomes.

The second part of the report estimated the benefits and costs of scaling up the MSLP (or implementing new similar programs) to all on-reserve schools in the country. This program started in two pilot schools, with promising results: the students involved achieved much better skill levels in reading and writing. It is currently being expanded to more schools, but if the program is successful, the ultimate goal would be to expand it to more and more schools across the country. The MSLP itself could be expanded to more schools, but it could also serve as a demonstration and inspire other organizations to run their own version of the program in some number of on-reserve schools.

To estimate the benefits of scaling up the MSLP or similar programs to every on-reserve school, the report develops a methodology similar to a report by the KPMG Foundation (2009). We first estimate the number of students in a given cohort (i.e., the group of all students that started school for the first time in the same year) that would obtain better literacy skills as a result of the program. We calculate this number using the total number of students in on-reserve schools and the success rate of the MSLP in lifting students out of low literacy, based on the pilot schools.

We then select a number of measures which should improve due to better literacy skills, such as diabetes incidence and incarceration rates, and estimate the number of students in a given cohort that would enjoy better outcomes. Finally, we multiply the number of students that would enjoy these better outcomes on each measure by the per-person cost savings or additional revenues for governments associated with each measure.

The report estimates that scaling up the MSLP either directly or with similar programs to every on-reserve school in Canada would result in total discounted benefits of about $310 million over the lifetime of a cohort of student, in 2020 dollars. Using a rough estimate of the costs of running the MSLP, we find that the MSLP would lead to $7.77 of benefits to governments for every dollar invested. Notably, this estimate of the return to investment does not include any of the benefits accruing to the individuals themselves, or social benefits that are not directly taken into account in the fiscal benefits to governments. For example, our estimates do not include the private benefits of better health for the individuals, or the lower costs on victims of crime.

These estimates are subject to several additional caveats, mostly due to data limitations. Therefore, future work should focus on obtaining better data on a greater number of measures, to obtain a better estimate of the potential benefits of the MSLP. Future work should also make us of data obtained in the second wave of schools participating in the MSLP, to obtain a better estimate of the costs, as well as the success rate.

In parallel to the cost-benefit analysis conducted in this report, the MFI is carrying out a comprehensive evaluation of the intervention. This evaluation will answer questions on the effectiveness of the program on the students and will provide a unique database of reading skills across the country covering almost 3,000 First Nations students. In conjunction with this report, that evaluation will provide other schools and governments better information to guide their decisions when allocating funding.

Since its inception, the MSLP has shown considerable promise by improving the literacy skills of the participating students. Improving literacy skills on reserves should lead to higher educational attainment, and to better labour market outcomes. These improvements could play an important role in the federal government’s objective of reconciliation with Indigenous Peoples.

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