Cost Savings of School Readiness Per Additional At-Risk Child in Detroit and Michigan

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Preface

In 2011, the Max M. & Marjorie S. Fisher Foundation funded the original version of this study with the purpose of demonstrating the economic value of investing in early childhood education (ECE) in Michigan and the city of Detroit. Wilder Research conducted the study using the most current evidence of impacts and relevant data available at that time. Since then, our understanding of the positive outcomes of ECE has increased. Furthermore, the methods to compute the potential economic benefits of investing in ECE have also evolved. As a consequence, the promoters of the original study asked for an update of the 2011 study by applying the new available data and computational techniques.

In this new version of the report, we refined the computational methods for most of the outcomes by following the model from the Washington State Institute of Public Policy (http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf). This model is one of the most advanced and recognized approaches to computing indirect benefits of social programs. We also updated most of the demographic and economic information using census and administrative data from 2013. As a result of these updates, some outcomes were added while others were dropped from the computations. Savings associated with reduced health care costs were added to this report, while the savings from teacher turnover were dropped due to lack of sufficient new evidence about this outcome. Whenever we found no update necessary, we adjusted the 2011 results by inflation and expressed those using 2013 dollars.

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Background

Research studies have demonstrated that investing in effective early education programs that prepare young children cognitively, physically, socially, and emotionally for success in school – particularly low-income children at risk of school failure – prevents or reduces needless public spending throughout the educational, social services, and criminal justice systems for juveniles and adults. Early school readiness also increases future state revenues by lowering drop-out rates and ensuring a skilled workforce that contributes to the tax base.

Potential lifetime cost savings of school readiness per child

The lifetime economic value of investing in school readiness for just one more child at risk of academic failure in Detroit, Michigan, is an estimated $96,000, and approximately $47,000 for similar investments based on population factors in Michigan as a whole. These values are present values, discounted at a 3 percent discount rate, and do not include the lifetime earnings of the at-risk child achieving school readiness.

Savings to the criminal justice system in Detroit reach $21,114. In the whole state of Michigan, the benefits of reduced crime represent 18 percent of all savings ($8,589 per at-risk child). These public savings plus the avoided costs to victims represent the most important source of benefits from at-risk children receiving ECE.

As shown in Figures A, B and C, about 35 percent of the value generated through investing in one at-risk child in Detroit accrues to government programs, while this percentage reaches 40 percent for Michigan. The remaining benefits include social savings and savings to the K-12 system.

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A. Estimated lifetime savings per additional at-risk child achieving school readiness

Cost category	Detroit	Michigan
K-12 special education	$2,050	$1,390
K-12 grade repetition	$678	$244
Subtotal K-12 lifetime savings	**$2,728**	**$1,634**
Criminal justice	$21,114	$8,589
Child care subsidies	$8,435	$6,540
Public assistance	$319	$293
Child welfare	$1,507	$1,504
State tax revenue	$2,690	$2,110
Subtotal state government lifetime savings	**$34,066**	**$19,037**
Crime victims savings	$56,150	$22,841
Health (alcohol abuse and drug use)	$1,936	$1,936
Productivity of employed parents	$1,657	$1,657
Subtotal social savings	**$59,743**	**$26,434**
Total per child lifetime savings	**$96,536**	**$47,104**
Total adjusted for out-migration	**$81,524**	**$39,197**

B. Lifetime benefits of early childhood education per child in Detroit

$2,728
3%

$34,066
35%

$59,743
62%

- K-12 savings
- State government savings
- Social savings

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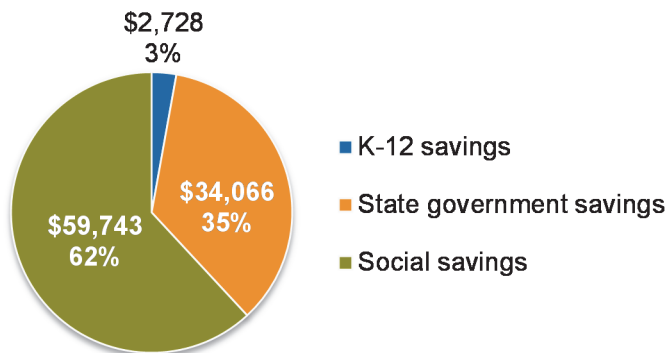
C. Lifetime benefits of early childhood education per child in Michigan

$1,634
4%

$26,434
56%

$19,037
40%

- K-12 savings
- State government savings
- Social savings
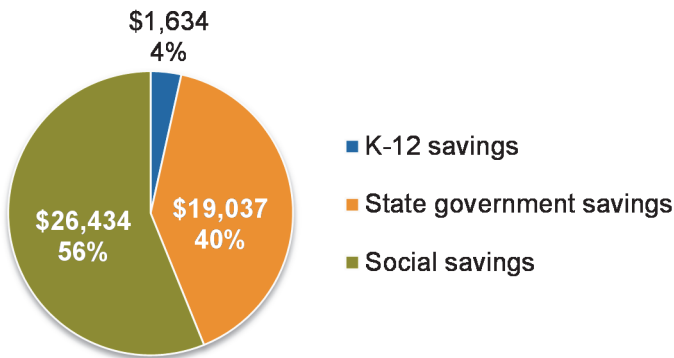
Methods

These estimates are based on actual school graduation and expenditure data, poverty rates, crime rates, and other data for Detroit and Michigan as a whole and ECE program effect sizes and parameters from the existing research on effects of early childhood education. The reported values are present discounted values at a 3 percent discount rate; all estimates represented are in 2013 dollars.

To make these estimates, we combine the best available research data from longitudinal studies of early childhood education programs with data from the Michigan Department of Education, as well as from the Census Bureau and the National Archive of Criminal Justice Data. When current Michigan or Detroit data were limited or unavailable, we made conservative assumptions using national data. The resulting estimations show the potential economic benefit associated with one at-risk child receiving ECE at the same quality and intensity of the revised ECE programs.

Conclusions

School readiness for young children enhances educational performance, reduces anti-social behavior, and improves the likelihood of having a healthier life. These benefits produce substantial economic value to society. The potential public dividend for just one additional child achieving school readiness in Detroit is $96,536, and $47,104 in Michigan. When adjusted for out-migration, these benefits reach $81,524 in Detroit, and $39,197 in Michigan respectively. Most of these benefits come from reduced crime of school-ready children (80% for Detroit and 67% for Michigan). On average, school

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readiness can generate social returns for Detroit and the state of Michigan of around 5 dollars for every dollar invested in early childhood programs.[1]

Investing in quality early childhood education makes economic sense. Current and future investment in ECE in Detroit and Michigan would produce the expected returns only if the ECE services are of high quality. The potential economic benefits of early childhood education provide objective evidence to taxpayers and policymakers that can be used to produce more effective and efficient allocation decisions.

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[1]   Average returns found in the early childhood literature. See Figure 11 and 12 for details.

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Introduction

Purpose of this study

This study demonstrates the economic value to state government and the public of investing in school readiness for just one more child at risk of academic failure in Detroit and relative to Michigan as a whole. Much of this value takes the form of savings. For example, children who attend preschool require less special education, repeat grades less frequently, have fewer behavioral problems in school, graduate at a higher rate than others, and have less involvement in the very expensive criminal justice system as both juveniles and adults. As adults they earn higher incomes, contribute more in taxes, and are more likely to be employable and employed. In these and other respects, school readiness saves money in the K-12 educational system, criminal justice system, and social welfare system.

If a higher proportion of children in Detroit attend comprehensive preschool in future years, moreover, the state's annual savings will grow. Conversely, by not investing more fully in the early education of young children, the annual cost burdens, lost earnings, and lost tax revenues will grow.

This study builds on models and methods used in studies in Minnesota, Michigan, and Illinois; most benefits are computed using methods similar to the cost-benefit model from the Washington State Institute of Public Policy. It translates the best research on the returns associated with comprehensive early childhood education (ECE) into usable estimates of the actual returns for investing in one single disadvantaged child. The focus is on the economic returns to K-12 schools, state government, and the public, not on the lifetime earnings of the child participating in ECE. We do not address the issue of quality or intensity of ECE in Detroit and Michigan. Throughout the analysis, we assume that the economic returns associated with ECE could be achieved only if local ECE programs provide services at the same level of quality of those programs observed in the literature. Costs and benefits would vary across ECE programs and locations depending on the quality and intensity of ECE programs, demographic characteristics of the population served, local social and economic conditions, and cost of local resources.

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Overview of early childhood education cost/benefit literature

Many studies show that high-quality early learning experiences pay off in the long run (Ehrlich & Kornblatt, 2004; Karoly, Kilburn, & Cannon, 2005; Friedman, 2004; Lynch, 2007; Temple & Reynolds, 2005 and Reynolds, Temple, White, Ou, & Robertson, 2011; Reynolds, 2007; Rolnick & Grunewald, 2003). Most of the return on investment is in reduced public costs associated with child welfare, public assistance, crime and incarceration, and benefits related to increased education and earnings.

Several studies focus specifically on measuring the effects of early childhood interventions and quality early care and education on school systems and time spent in K-12 special education and special education spending (Barnett, 1995; Belfield, 2004a; Belfield, 2004b; Conyers, Reynolds, & Ou, 2003; Harvey, 2006; Nores, M., Belfield, C. R., Barnett, W. S., & Schweinhart, L., 2005; Schweinhart, L., Xiang, Z., Daniel-Echols, M., Browning, K., & Wakabayashi, T., 2012; Reynolds, 2007).

Other studies focus on the impact of early childhood education programs on additional areas of government spending, including criminal justice, public assistance, Medicaid, unemployment, child welfare, health care, and child care (Aos, Lieb, Mayfield, Miller, & Pennucci, A., 2004; Mann & Reynolds, 2006; Nores, Belfield, Barnett, & Schweinhart, 2005; Oppenheim & MacGregor, 2002; Reynolds, Temple, Robertson, & Mann, 2002).

Finally, some studies have illustrated the effect of early childhood education on increased tax revenues from increased earnings of participants themselves and from future generations due to higher educational attainment that can be attributed to early childhood interventions (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; Nores et al., 2005; Oppenheim & MacGregor, 2002; Sum, Khatiwada, & McLaughlin, 2008).

Estimates of potential cost savings from reviewed studies

In figures 24 and 25, we describe the studies used in this analysis and the estimated cost savings in different categories generated per dollar of investment in school readiness.

These estimates show that the potential returns range from $2.36 to $16.14 per dollar of investment. These are present dollar values of the stream of benefits and reduced costs received over the lifetime of a student discounted at 3 percent.

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Assumptions in the analyses

- The analyses in this study estimate benefits and cost savings for various Michigan government systems, including K-12 education, criminal justice, welfare/public assistance, Medicaid, unemployment, child welfare, health care, and child care.

- Estimates of saved costs are based on actual rates for the various conditions or population characteristics and cost data from Detroit and Michigan whenever possible, with appropriate proxies either from national averages only when Michigan and Detroit data are not available. Figures 14 to 23 show the rates and costs used in the calculations.

- The study focus is on children ages 3 to 5 classified as 'at risk' who have not been served through the state's early childhood programs.

- Estimated benefits of ECE programs for children ages 3 to 5 are discounted to account for differences in the level of intensity of services with respect to those impact effects found within the research literature.

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Estimated cost savings to Detroit and Michigan per additional child participating in ECE

This section estimates the lifetime cost savings within the city of Detroit and for Michigan overall as a result of adequately preparing for kindergarten one more at-risk child through school readiness investments. The cost savings estimates fall into three categories:

K-12 schools – through reduced special education and grade repetition costs

State government – through reduced costs of dealing with juvenile and adult criminals; through lower welfare, Medicaid, and unemployment costs; and through higher tax revenues as successful students become productive adults

The public – through reduced juvenile and adult crime victimization and costs due to injuries and property losses, reduced alcohol and drug abuse costs, and higher tax revenues from the parents of prepared children

These estimates are based on actual school graduation and expenditure data, poverty rates, crime rates, and other data for Detroit and for Michigan as a whole and ECE program effect sizes and parameters from the existing research on effects of early childhood education.

Estimated cost savings for K-12 education

Special education

During 2012 and 2013, nearly 5,800 children in Detroit and more than 166,000 children in Michigan received special education services associated with non-normative disabilities. Figure 1 shows the incidence of non-cognitive primary disability; that is, those which can be improved through ECE and special education[2]. We assume that ECE reduces the incidence of the disability by 12 percent (Aos et al., 2004)[3]. Figure 1 also shows the average cost per student with disability and the reduction in these costs due to ECE after applying that effect size.

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[2] Non-cognitive disabilities include: specific learning disability, speech and language, emotional disturbance, other health impairment, developmental delay.
[3] More precisely, ECE is assumed to reduce the need for special education due to the presence of the disability.

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1. Incidence of ECE on special education need and costs[4]

	Detroit	Michigan
Incidence of non-cognitive disabilities	14%	12%
Impact on the need for special education	12%	12%
Average annual cost per special education student	$12,055	$9,830
Total lifetime costs of special education	$119,991	$97,850
Lifetime special education costs per child avoided due to ECE	$2,050	$1,390

The annual cost savings in special education are computed by multiplying the relative impact of ECE by the incidence of non-normative disabilities and the lifetime cost per child receiving special education. The lifetime savings are the result of assuming that the child receives at most 12 years of special education[5].

The costs of special education are assumed to be in addition to the cost of educating students on a regular track and do not net out potential added costs of returning the students to regular classrooms.

The estimated lifetime savings in special education amounts to $2,050 in Detroit and $1,390 for Michigan as a whole.

Grade repetition

Early childhood education reduces the incidence of grade repetition within a range of 6 percent to 23 percent, with an average impact of 21 percent (Anderson, Shinn, & St. Charles, 2002).

The impact on grade repetition (40%)[6] times the probability of being retained in a given school year gives the estimated probability of a child not repeating a grade due to ECE. We estimate this probability based on retention data available for Detroit and Michigan for the 2013-2014 school year. Applying the reduction in the probability of being retained to the average annual cost per student, we obtain the estimated savings on grade retention per child who participates in ECE. Since a child may be retained more than once during her K-12 career, we average the cost savings assuming that a child is retained between 1 to 3 times.

The estimated lifetime savings due to reduced grade repetition amounts to $678 in Detroit and $244 for Michigan as a whole.

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[4] See Figure 21 for source data and parameters.
[5] The total amount of future costs is discounted at a rate of 3 percent up to age 4.
[6] Reynolds et al. (2011).

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2. Lifetime cost savings of reduced grade repetition per additional at-risk child in ECE

	Detroit	Michigan
Average total expense per student (Dollars of 2013)	$23,770	$14,253
Average percentage of students retained by grade	5.4%	3.2%
Reduction in grade retention rate due to ECE (40%)	2.2%	1.3%
Lifetime cost savings on grade retention due to ECE	$678	$244

Summary of estimated cost savings for K-12 education

The estimated potential savings to K-12 per additional at-risk child achieving school readiness reaches $2,728 for a child in Detroit and $1,634 for a child in Michigan as a whole.

Additional considerations and issues

We believe these cost savings estimates to be conservative for these reasons:

First, when we had a choice of effect sizes from among several studies with a range of effects, we chose the average effect or an effect size from the lower part of the range. For example, other studies have found effects of ECE on special education costs ranging from 6 percent to as high as 49 percent for the Chicago Child-Parent Centers (Reynolds et al., 2011). Our calculations use an effect size of 12 percent computed by Aos et al. (2004) based on a meta-analysis of 23 studies.

Second, there are additional cost savings to the K-12 education system that could result from quality early childhood education that were not included in this analysis, including: 1) reduced use of achievement enhancement and remedial education programs, 2) reduced non-instructional and health costs related to special education and preventable health problems, 3) reduced costs for alternative schools, 4) increased per pupil aid from parents, and 5) reduced costs of having to provide education to students in juvenile detention. While there is reason to believe that improved school readiness through early childhood education would affect these categories of expenditures, these savings could not be included because there has been no research to measure or monetize the impact of improved school readiness in these areas. To the extent that savings might be realized in all or some of these areas, the estimates presented here understate the total savings to the K-12 system.

Third, due to the lack of sufficient data, we did not include estimates of savings due to reduced teacher absenteeism and turnover, reduced school safety spending in higher grades, and reduced costs associated with English language learners.

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Finally, from the point of view of K-12 school finances, school readiness reduces the dropout rate and preserves per pupil aid. However, these savings are not included here because, from the point of view of Michigan as a whole, these dollars are transferred from taxpayers to school districts, thus netting to zero.

Estimated cost savings to state government programs

Criminal justice

The savings from crime reduction are based on the avoided cost of incarcerating an additional criminal (jail and prison). Using a 10-year series of total expenses in prisons and the population of inmates, we compute the cost of incarcerating an additional inmate in Michigan. From the ECE literature, we expect that a child receiving ECE is about 28 percent less likely to be arrested[7]. After adjusting this impact by the probability of committing a particular type of crime at a given age (18 to 64) and on the probability of conviction to jail or prison in Michigan, we estimate that the lifetime cost savings from an additional conviction that is avoided due to ECE reaches $8,589 in Michigan. For Detroit, based on crime rates 2.5 times the statewide rates, the resulting savings reach $21,114 per child participating in ECE programs.

These savings refer to lifetime savings per additional ECE participant and include juvenile and adult costs.

3. Savings to criminal justice system per additional at-risk child in ECE

	Detroit[8]	Michigan
Total savings to the criminal justice system	$21,114	$8,589

Child care subsidies

Some families with children participating in state- or federally-funded early childhood education programs are eligible for child care subsidy payments, but do not utilize the subsidy while their children are enrolled in a subsidized ECE program. Families qualify for child care subsidies in Michigan if their annual family income is at or below 121 percent of the Federal Poverty Line. We estimate that the average life cost per child in a family that utilizes child care subsidy payments in Michigan is $13,081. Because of participation in the state-funded Great Start Readiness Program (GSRP), many low-income families do not fully utilize the child care aid for which they are eligible. In Michigan, if only half of

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7   Weighted average reduction on juvenile and adult arrests from Reynolds et al., (2011).
8   Detroit savings are adjusted by the ratio of crime rates (felonies) of Detroit to Michigan to account for differences in the probability that ECE participants commit a crime.

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the families classified as low income in GSRP classes would otherwise require child care aid, the state saves an estimated $6,540 in care subsidy payments per child in ECE.

For the city of Detroit this number can reach $8,435 due to the higher proportion of households below poverty level in the city.

Public assistance (state portion of TANF)

To estimate the potential savings from reduced public assistance (PA), first we compute the expected lifetime public assistance payments in Michigan and Detroit based on average payments, assumed number of years receiving PA payments, plus assumed administrative costs. The lifetime savings are the present value of these costs minus the reduction in the chance of needing PA from ages 18 to 24 of 9.3 percent (Reynolds et al., 2011).

4. Savings to public assistance per additional at-risk child in ECE

	Detroit	Michigan
Average cost of PA	$2,899	$2,660
Net savings attributed to ECE	$319	$293

Child welfare (abuse, neglect, and out-of-home placements)

Comprehensive early childhood education programs that promote school readiness also have been shown to contribute to reductions in child abuse and neglect. The studies we analyzed all showed significant savings in costs associated with child abuse and neglect. We use Reynolds et al. (2011) estimates of reduction in child abuse and neglect cases and foster care associated with ECE (43% and 39% reduction, respectively), and incidence rates of cases in Detroit and Michigan to compute savings. In Michigan, we estimate that a single case of child abuse and neglect can cost taxpayers nearly $14,000, while an average out-of-home placement can cost more than $21,000. Combining these data and discounting to present value, the savings associated with ECE are estimated to be $1,507 per child participant in the programs in Detroit and $1,504 per child in Michigan.

5. Savings in child welfare costs per additional at-risk child in ECE

	Detroit	Michigan
Savings from reduced confirmed cases of abuse	$1,098	$1,101
Savings from reduced out-of-home placements	$698	$699
Total child welfare benefits	$1,507	$1,504

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Michigan tax receipts

One of the main positive effects of ECE is the improvement in the likelihood of graduating from high school and completing at least some college. The 2012 graduation rate was 77 percent in Michigan and 65 percent in Detroit (Michigan Department of Education, 2014). It is estimated that ECE will increase the likelihood of high school graduation by 9.3 percent (Reynolds et al., 2011). To determine the impact of increased education, we use American Community Survey (ACS) data on income and educational achievement specific to the state of Michigan and the city of Detroit. First, we estimate that in Michigan, individuals who graduate from high school (and do not complete any college) earn nearly $535,000 more during their lifetime than those who do not complete high school, while in Detroit this difference reaches $837,000. The fractions of these additional lifetime earnings from high school graduation that can be attributed to ECE are estimated to be $10,366 per participant in Michigan and $10,602 in Detroit.[9]

6. Increased lifetime earnings and tax revenues from educational achievement

	Detroit	Michigan
Impact of ECE from increased high school graduation	$10,602	$10,366
Impact of ECE from increased college attendance	$49,165	$36,533
Total additional lifetime earnings	**$59,768**	**$46,899**
Total additional tax from earnings	**$2,690**	**$2,110**

ECE also improves the likelihood of attending college by nearly 54 percent. The average annual earnings of individuals living in Michigan with some college education are approximately $36,312, and $41,103 in Detroit. Accounting for the likelihood of completing only some college, we estimate the average ECE participant in Michigan who pursues some higher education will earn $36,533 more during their lifetime compared to those who do not complete high school, while a participant in Detroit could earn an additional $49,165. The total additional earnings from increased educational achievement are $46,899 in Michigan and $59,768 in Detroit before taxes. We use the flat 4 percent tax rate in Michigan to compute the estimated taxes associated with these earnings. Additional lifetime tax revenues total $2,110 in Michigan and $2,690 in Detroit.

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[9]   Lifetime earnings are adjusted by expected growth of earnings from productivity, fringe benefits, and inflation, and are discounted to present value. Earnings estimates assume a working life between the ages of 18 and 65. Note that this does not suggest that the additional value of a high school diploma is $10,600, but that this is the net present value impact of ECE on future earnings. See the "methods and procedures" section for detailed computational formulas.

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Summary of estimated Michigan state government savings and revenue due to increased school readiness of an at-risk child

The estimated potential savings to state government per additional at-risk child achieving school readiness reaches $34,066 for a child in Detroit and $19,037 for a child in Michigan as a whole.

Estimated current social cost savings in Michigan

This section estimates current social cost savings based on actual expenditures in Michigan and program effect sizes and parameters from research literature.

Crime victimization

Crime victims suffer tangible losses that constitute social costs. ECE has been shown to reduce criminal behavior of participants and thus reduce victims' costs. Reynolds et al., (2011) estimate the victims' cost in the order of $108,881 (tangible and intangible lifetime costs). The reduction in crime associated with ECE can reduce these costs by $56,150 in Detroit and $22,841 in Michigan.

Health (alcohol abuse and drug use)

Children who participate in comprehensive early education programs are less likely to present problems of smoking, alcohol, and illicit drugs abuse (Aos et al., 2004). The savings for Michigan taxpayers can reach up to $1,936 per participant. However, these savings are difficult to disaggregate at the city level since there are not specific parameters to make this distinction.[10]

7.   Savings from improved health

	Michigan
Any depression symptom	$353
Substance misuse (alcohol)	$1,583
Total savings	**$1,936**

Productivity of employed parents

As a result of children receiving early childhood education, parents see their earnings increase. Research has shown that parents with children who participate in comprehensive

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[10]   Savings are computed using the estimated reduction in depression symptoms (26%) and substance use due to ECE (29%) (Reynolds et al., 2011), the incidence rate of these conditions in Michigan (20% - Depression, and 19% - alcohol) (Michigan Department of Community Health, 2012), and the estimated health care costs per person associated with depression ($12,054) and alcohol consumption ($62,212) (Reynolds et al., 2011).

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early education programs are more likely to participate in the labor force, establish more stable work-related relationships, and spend more quality time with their children during non-work hours. Previous research has demonstrated that these additional earnings may reach $909 per participant per year of program. We assume average participation in ECE of about 2 years, and then discount this amount by 15 percent to account for mothers who have more than one child in ECE. We estimate that the gains in maternal productivity per participant may reach approximately $1,657.

Summary of estimated social savings and revenue due to increased school readiness of an at-risk child

The estimated potential social savings per additional at-risk child achieving school readiness reaches $59,743 for a child in Detroit and $26,434 based on a child in Michigan as a whole.

Summary of total lifetime value in Detroit and Michigan due to school readiness for one additional at-risk child

The total lifetime value of gaining school readiness for one at-risk child is about $96,536 in Detroit and about $47,104 based on Michigan as a whole. As shown in Figure 8, about 35 percent of the value generated through investing in one at-risk child in Detroit accrues to government programs. In Michigan, government savings represent 40 percent of the benefits associated with ECE.

8.   Estimated total lifetime value of school readiness for one additional at-risk child

Cost savings category	Detroit	Michigan
K-12 education	$2,728	$1,634
Michigan state government	$34,066	$19,037
Social	$59,743	$26,434
Total potential lifetime savings per at-risk child	**$96,536**	**$47,104**

Adjusting for effects of out-migration

Families moving out of Detroit and Michigan reduce the lifetime value of gaining school readiness in Detroit and Michigan. According to Bartik (2009), savings that accrue during childhood such as savings in school costs, child care subsidies, child welfare spending, and parental productivity are reduced by 9 percent, and other lifetime savings are reduced by about 28 percent. Accordingly, the total lifetime value of gaining school readiness for one at-risk child, adjusted for out-migration, is about $81,524 in Detroit and about $39,197 based on Michigan as a whole.

Sensitivity analysis and additional estimations

We use a discount rate of 3 percent throughout all the estimations in the report[11]. However, since the majority of benefits associated with ECE materialize in the future, the discount rate used to account for the change in the value of these benefits as time passes can significantly affect the final values. Therefore, we perform a sensitivity analysis based on different discount rates and show how the benefits per child vary when future benefits are discounted at several different rates.

9. Sensitivity analysis by discount rate

Discount rate	0.01%	1%	2%	3%*	4%	5%	6%
Detroit	$151,087	$130,321	$111,642	$96,536	$84,206	$74,062	$65,658
Michigan	$72,512	$62,726	$54,044	$47,104	$41,491	$36,906	$33,127

*Rate used in the main analysis

10. Benefits per child by discount rate

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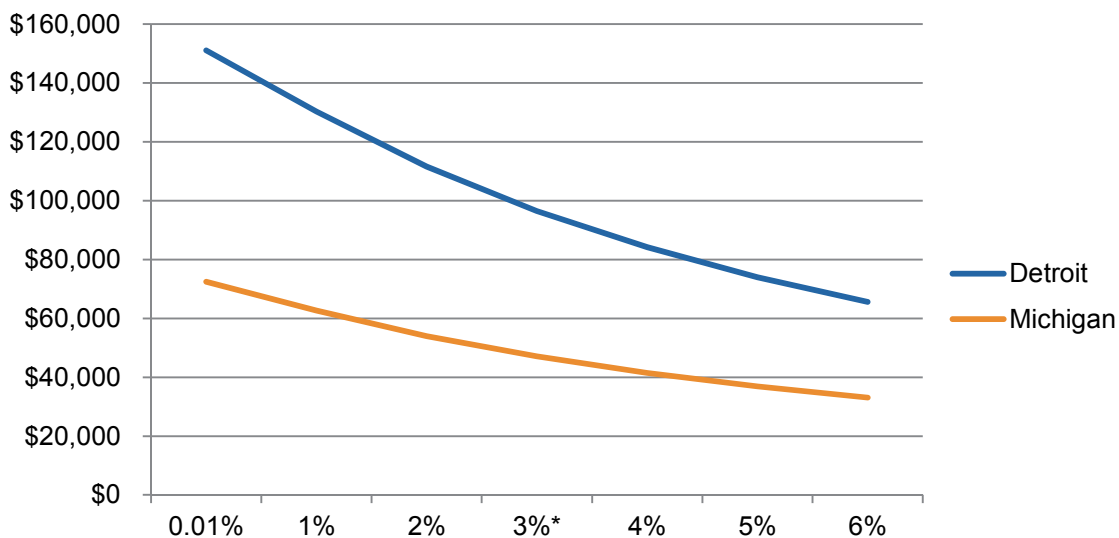
[11]   The Washington State Institute of Public Policy uses a rate of 3.5%, and a high rate of 5%. The Congressional Budget Office has used a 3% real discount rate in its analyses of Social Security. Most ECE studies used a 3% rate to summarize the main benefit-cost results. See
http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf for details.

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Potential return on investment scenarios

The total per child cost of early childhood education programs can vary between $4,000 and $10,000 (Washington State Institute for Public Policy, 2014). If we combine these costs to the estimated benefits for Detroit and Michigan, we find returns on investment in school readiness of about $8 to $20 for every at risk child in Detroit and $4 to $9 for the entire state of Michigan. Note that benefits and costs per child vary across different ECE programs depending on local conditions. Thus, these returns should be interpreted with caution.

11. Potential return on investment - Detroit

ECE program	Assumed costs per child	Benefits per child	Benefit minus cost	Return on investment
Michigan Great Start Readiness Program (GSRP)	$6,800	$81,524	$74,724	12
Early Head Start	$10,767	$81,524	$70,757	7.6
Head Start	$8,661	$81,524	$72,863	9.4
State and district early childhood education programs (Washington state)	$7,037	$81,524	$74,487	11.6
Even Start	$4,187	$81,524	$77,337	19.5
Average	$7,490	$81,524	$73,861	10.6

12. Potential return on investment - Michigan

ECE program	Assumed costs per child	Benefits per child	Benefit minus cost	Return on investment
Michigan Great Start Readiness Program (GSRP)	$6,800	$39,197	$32,397	5.8
Early Head Start	$10,767	$39,197	$28,430	3.6
Head Start	$8,661	$39,197	$30,536	4.5
State and district early childhood education programs (Washington state)	$7,037	$39,197	$32,160	5.6
Even Start	$4,187	$39,197	$35,010	9.4
Average	$7,663	$39,197	$31,707	5.2

Study methods and underpinning research

Rates and cost data used in the study calculations

Figures 13 - 23 show the rates for the various conditions or population characteristics and the cost data used in the study calculations for Detroit and Michigan. The data sources are also shown.

13. Early education impacts

Parameter	Impact
Impact on educational attainment	
High school completion, %	9
Completed .5 credits at a 4-year college, %	54
Impact on crime	
Any felony arrest, %	-27
Petition to juvenile court, %	-43
Impact on special education and grade retention	
Special education by age 18, %	-12*
Number of years of special education from ages 6 to 18	-0.49
Grade retention by age 15,%	-40
Impact on health	
Any depression symptom, %	-26
Substance misuse, %	-24
Daily tobacco use, %	-19
Impact on child welfare	
Any report of abuse or neglect from ages 4 to 7, %	-43
Any out-of-home placement, %	-39
Impact on public assistance	
Food Stamp receipt, ages 18-24, %	-9

Source: Reynolds et al., 2011.

*Average from the literature. See Figure 24.

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14. Parameters and costs associated with crime

	Jail	Prison
The probability that a criminal justice resource (jail or prison) will be used for a felony. Fourth district (Michigan- 2007)	0.777	0.216
The probability that a criminal justice resource (jail or prison) will be used for a felony. Fourth district (Wayne County - 2011)	0.779	0.221
The per-unit marginal cost of prison inmate.[12]	$126,008	$58,443
Total adjudications (State)		10,246
Adjudications < 19		788
% of under 19 adjudications		0.08
Crime rate for every 100,000 - Michigan	715.5	
Crime rate for every 100,000 - Detroit	1758.9	
Crime Ratio Detroit: Michigan	2.5	
Total cost per victim of felony	$141,957	
Tangible cost per felony victims	$33,076	
Intangible cost per felony victims	$108,881	

Source: Unified Crime Report: *http://www.ucrdatatool.gov/Search/Crime/Local/RunCrimeOneYearofData.cfm*

15. Additional crime statistics

	Detroit	Michigan
Crime rates (per 100,000)		
Violent crimes	1,967	497
Robbery	651	124
Aggravated assault	1,239	322
Property crimes	5,568	2,838
Burglary	2,091	761
Larceny theft	2,045	1,783
Motor vehicle theft	1,432	295
Murder	40	6

Source: Michigan 2007 Crime study: http://pa.ingham.org/Portals/PA/crime%20study.pdf

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[12]   Marginal costs are computed using a cross section regression for fiscal years 2010 - 1997 using Michigan Department of Corrections expenses and annual populations of all institutions in the state of Michigan. Jail average cost per inmate computed using 2011 data from Michigan Department of Corrections.

16. Parameters and costs associated with child welfare

Total child welfare expenditures	$709,666,215
Confirmed victims of abuse and/or neglect, ages 0-17 - Michigan	33,565
Confirmed victims of abuse and/or neglect, ages 0-17 - Detroit	3,054
Children ages 0-17 in out-of-home care-abuse or neglect (2012)-Michigan	10,316
Children ages 0-17 in out-of-home care-abuse or neglect (2012)-Detroit	1,099
Confirmed cases rate - Michigan	0.015
Confirmed cases rate - Detroit	0.017
Out-of-home placement rate - Michigan	0.005
Out-of-home placement rate - Detroit	0.006
Difference in incidence rates of child abuse and neglect cases	0.002
Difference in incidence rates of out-of-home cases	0.002
Percentage of out-of-home cases from all confirmed cases	31%
Cost per confirmed case - Michigan	$14,645
Cost per out-of-home case - Michigan	$21,143

Source: Kids Count Data Center: http://datacenter.kidscount.org/data/tables/1676-confirmed-victims-of-abuse-and-or-neglect-ages-0-17?loc=24&loct=2#detailed/2/any/false/868,867,133,38,35/any/3559,13162

17. Rate of growth of earnings

All	0.00152
Less than high school	0.000448
High school	0.001067
Some college	0.001304
College	0.002827
Ratio of benefits to wages and salaries	1.441
Growth rate of benefits	0.00037

Source: Washington State Institute for Public Policy. (2014). Washington State Institute for Public Policy benefit-cost results. Retrieved from http://www.wsipp.wa.gov/BenefitCost/Pdf/4/WSIPP_BenefitCost_Pre-K-to-12-Education

18. Lifetime earnings by educational level

	Net present value of lifetime earnings from attending high school	Net present value of some college over less than high school
Detroit	$837,684	$1,486,574
Michigan	$535,502	$1,034,586

Source: *United States Census Bureau. (2013).Educational attainment.* 2013 American Community Survey 1-Year Estimates. *Retrieved from* http://factfinder2.census.gov/bkmk/table/1.0/en/ACS/13_1YR/S1501/1600000US2622000

19. Other income and economic parameters

	Detroit	Michigan
Individuals below poverty level	0.381	0.163
Ratio of poverty Detroit: Michigan	1.34	
Population with some college or college degree	0.451	0.586
Michigan income tax rate		0.045

Sources: United States Census Bureau. (2014). State & county quickfacts - Michigan. *Retrieved from* http://quickfacts.census.gov/qfd/states/26000.html *and United States Census Bureau. (2013).Educational attainment.* 2013 American Community Survey 1-Year Estimates*. Retrieved from* http://factfinder2.census.gov/bkmk/table/1.0/en/ACS/13_1YR/S1501/1600000US2622000

20. K-12 parameters and data

	Detroit	Michigan
Total K-12 population	40,809	1,408,979
Total expenditures (includes transfers)	$970,016,940	$20,082,579,161
Total expenditures per pupil	$23,770	$14,253
Total number of students retained	2,194	45,414
Percentage of students retained	0.054	0.032
Graduation rate (2012)	64.55%	76.96%

Sources: Center for Performance and Education, Michigan Department of Education. *MI school data.* Retrieved from http://www.michigan.gov/cepi/0,4546,7-113-21423_30451_30460-325960--,00.html; Michigan Department of Education. *Bulletin 1011 – Analysis of Michigan Public Schools revenue and expenditures.* Retrieved from http://www.michigan.gov/mde/0,1607,7-140-6530_6605-21539--,00.html; Center for Educational Performance and Information, Michigan Department of Education. Student count-retained in grade snapshot, statewide: 2013-14. *MI school data.* Retrieved from https://www.mischooldata.org/DistrictSchoolProfiles/StudentInformation/StudentCounts/NewRetention.aspx?Common_Locations=1-A,0,0,0~2-A,0,0,0&Common_SchoolYear=13&Common_LocationIncludeComparison=False&Common_Subgroup_StudentCountRetention=AllStudents&Portal_InquiryDisplayType=Snapshot .

21. Special education parameters and data

	Detroit	Michigan
Number of students with emotional impairment	355	13,752
Number of students with speech & language impairment	1,592	52,860
Number of students with early childhood developmental delay	372	9,589
Number of students with specific learning disability	2,767	66,272
Number of students with other health impairment	724	24,328
Total students with non-cognitive disabilities	5,810	166,801
Total all students in special education	8,953	208,741
Incidence of non-cognitive disabilities	0.142	0.118
Incidence of all types disabilities	0.219	0.148
Total expenditures: "Added needs programs"	$107,924,880	$2,051,974,619
Approximate special education expenditure per student	$12,055	$9,830
Assumed number of years of special education	12	12

Source: Michigan Department of Education. Center for Educational Performance and Information.
http://www.michigan.gov/cepi/

22. Public assistance parameters and data

Total payments (2013) - Michigan	$3,414,261,349
Total unduplicated recipients (2013) - Michigan	2,301,202
Average annual payment per recipient - Michigan	$1,484
Total payments (2013) – Wayne County	$1,075,402,997
Total unduplicated recipients (2013) – Wayne County	665,091
Average annual payment per recipient - Wayne County	$1,617
Assumed length of participation in public assistance: max 60 months –Temporary assistance for needy families (TANF)	5

Source: Michigan Department of Human Services. *Annual report of key statistics.* Retrieved from *http://www.michigan.gov/dhs/0,4562,7-124-5459_61179_56550---,00.html*

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23. Health parameters and data

	Michigan
Any depression symptom, %	0.20
Substance misuse, % alcohol	0.19
Rate of teen births	0.045
Cost of health outcomes (lifetime costs)	
Any depression symptom	$12,059
Substance misuse	$62,212

Source: Fussman, C. (2013). *Health risk behaviors in the State of Michigan: 2012 Behavioral Risk Factor Survey.* Retrieved from Michigan Department of Community Health website*:*
http://www.michigan.gov/documents/mdch/2012_MiBRFS_Annual_Report_FINAL_435019_7.pdf

Methods and procedures

Outcome: Increased high school (HS) graduation rate

The primary economic outcome associated with ECE (via high school graduation) is **increased lifetime earnings**. We use Current Population Survey (CPS) earnings data for the Public Use Microdata Areas (PUMA) in Detroit and Michigan by educational status, age, and race to estimate the expected gain in life cycle labor market earnings for residents with only a high school degree ($EarnHS_y$) as compared to earnings of those who did not complete high school ($EarnNHS_y$). From these data we compute average earnings per person, by each year (y) of age for each educational status.

To obtain the life-cycle distribution of earnings, we fit the annual earning series for each group using the probability distribution that best fit the data. The rate of growth of earnings (GEarn) and estimated fringe benefits ($Fring_y$, GFring) are also computed and added to the modified earnings series of each group. The series is adjusted by inflation using the Implicit Price Deflator (IPD_{base}/IPD_{cps}). The series is computed for each year (y) from age 18 to age 65.

$$ModEarnHS_y = EarnHS_y \; x \; (1 + GEarnHS)^{y-age} \; x \; FringHS_y \; x \; (1 + GFringHS)^{y-age} \; x \; \frac{IPD_{base}}{IPD_{cps}}$$

Using the discount rate (Dis), we obtain the gain in the present value of lifetime earnings from high school graduation (PVGE) by multiplying the difference in earnings between high school graduates and non-high school graduates by the increase in the number of high school graduation "units" (relative impact) caused by the solution (ImpactECE_HS). We do this for each year from the participant's age of expected graduation to age 65.

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$$PVGE = \sum_{y=age}^{65} \frac{(ModEarnHS_y - ModEarnNHS_y) \; x \; ImpECE\_HS}{(1 + Dis)^{y-age}}$$

The impact rate is derived from the meta-analysis of ECE studies conducted by Washington State Institute for Public Policy.

Finally, to incorporate the additional marginal benefit of completing some college (relative to completing only high school), we repeat the procedure for people with some college.

Tax revenues are computed by applying the single tax rate in Michigan to the computed net earnings.

Outcome: Reduced use of special education services

The associated economic outcome with reduced use of special education services is **savings to the K-12 system in special education costs**. ECE participants have been shown to require fewer years of special education on average. The benefit of special education savings is computed by multiplying the estimated reduction in the number of years of special education associated with participation in ECE programs (ImpECE_SEd) by the present value average cost of special education for the relevant school districts, conditional on receiving special education. Formally,

$$PVSED = \sum_{y=1}^{sedyears} \frac{ImpECE_{LSEd} \; x \; SEdCost \; x \; \frac{IPD_{base}}{IPD_y}}{(1 + Dis)^y}$$

The average cost of special education is computed using the average per-student special education expenses for the Detroit City school district and for the whole state, based on financial data for 2012-2014.

Outcome: Reduced grade retention

The associated economic outcome with reduced grade retention is **savings to the K-12 system (general expenditure).** The present value cost of an extra year of K–12 education is estimated for those retained for an extra year. This is modeled by assuming that the cost of the extra year of K–12 education, EdCostYear, after adjusting the dollars to be denominated in the base year dollars used in the overall analysis, would be borne when the youth is approximately 18 years old. Since there is a chance that the youth will not finish high school and, therefore, that the cost of this year will never be incurred, this present valued sum is multiplied by the probability of high school completion, HSprob. The value of the extra year of education is then multiplied by the impact of ECE on the likelihood of being retained at least once.

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$$PVgraderet_{page} = \frac{EdCostYear \, x \, \frac{IPD_{base}}{IPD_{costy}}}{(1+dis)^{18-age}} x \, HSprob \, x \, ImpECE_{gret}$$

The average/marginal cost of education is computed using the average per-student general expenses for the Detroit City school district and for the state of Michigan.

Outcome: Child welfare

The associated economic outcome is **savings to the child welfare system from reduced child abuse and neglect (CAN) costs and out-of-home placement costs (OHP)**. We use data on payments associated with CAN and OHP cases for families in the state of Michigan in 2012. We combine this cost information with the impact of ECE on indicated cases of abuse and neglect and OHP. We adjust this savings by the incidence of CAN and OHP cases among these families.

Outcome: Health and mental health

Reynolds et al. (2011) showed that ECE reduced depression symptoms, substance misuse, and daily tobacco use among participants at the Child-Parent Center, while also increasing their likelihood of having health insurance. We use Reynolds et al. as a model to approximate the per-child health and mental health benefits of ECE.

Outcome: Welfare

The associated economic outcome for the welfare system is **savings from reduced public assistance payments.** We use data on welfare payments for Michigan residents in 2012 to compute average costs per family (See Figure 22). These average payments are multiplied by the expected impact of ECE on welfare payments estimated by Reynolds et al. (2011), and adjusted by the assumed average length of participation in each welfare program.

Review of the economic impact of early childhood education

The research literature on school readiness investments documents potential savings in K-12 spending; crime-related costs; and government health, public assistance, and child care programs. Cost-benefit studies of comprehensive early education programs have also documented potential benefits to society in increased personal earnings and tax revenues.

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K-12 cost savings

According to the research literature, the largest potential savings to K-12 educational systems due to improved school readiness is in special education spending. A portion of these costs could be reduced or prevented if more low-income 3- and 4 year-olds participated in early education and were fully prepared for kindergarten.

Nationally, approximately 20 percent of children are identified as having special educational needs (High, 2008). Two percent have normative disabilities – blindness, deafness, autism, moderate/profound mental retardation, or significant language impairment. Eighteen percent have non-normative disabilities such as learning disabilities, speech and language delays, mild hearing loss, mild mental retardation, and social/emotional/behavioral maladjustments that are preventable or ameliorated with early intervention.

Of those with non-normative disabilities (90% of the students in special education), research shows that anticipatory guidance, such as parenting education, can reduce social and emotional risks and build protective factors in young children (Edwall, 2008) and quality early care and education can reduce the amount of time spent in K-12 special education (Reynolds, 2007). In addition, research on children with mild hearing loss shows they have more academic difficulties and are more likely to repeat a grade than their peers with normal hearing, which could be prevented with earlier detection and treatment (Tharpe, 2006).

Figures 1 and 2 summarize the estimated effects and net benefits of early childhood education with regard to special education and grade repetition. Based on the outcomes of three major early childhood education studies (HighScope Perry Preschool, The Abecedarian Project, and Chicago Child-Parent Centers) and a meta-analysis of 48 other studies, the return to each K-12 dollar invested in early childhood education ranges from 4 cents to 73 cents.

This study also looks at other possible benefits within the K-12 system in addition to the actual costs of non-normative special education and grade repetition. Using data from the Early Childhood Longitudinal Study, Belfield (2004a) finds that children who participate in preschool programs nationally have significant behavioral and cognitive gains over those who do not participate in early childhood education. He estimates that when 40 percent more students attend pre-K:

■ Teacher turnover is reduced 24 percent

■ Math and reading achievement scores increase by .3 standard deviation

■ Student behavior improves by 32 percentage points on a comprehensive index of student behavior

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Belfield further finds that a .3 standard deviation increase in student achievement leads to a 19 percent reduction in physical attacks on teachers. The 32-point improvement in student behavior raises the probability that the kindergarten teacher will report he/she "really enjoys current job" or "would choose teaching again." This point is made even more clearly by a 2009 survey of kindergarten teachers in Michigan, which showed that 68 percent of those surveyed agreed that they had "experienced significant frustration as a direct result of needing to address the physical, social-emotional, language, cultural, cognitive, and/or special needs of a kindergarten student or students," and 18 percent said they had "experienced a desire to change professions" based on the same factors.

These findings suggest there are additional teacher-, school-, and school-system-related benefits, beyond the scope of this analysis, which can be produced by improving school readiness through early childhood education. Belfield (2004b) identifies four areas that could potentially be affected by increases in early childhood education enrollment:

- Teacher turnover due to behavior problems, low achievement, or lack of preparation for K-12 education among students

- Teacher absenteeism due to student behavior problems

- Low achievement or lack of preparation for K-12 education among students

- School safety programs (child or adolescent delinquent or criminal behavior increasing the need for spending on school safety programs)

Other potentially avoidable costs to K-12 systems include costs associated with English language learner programs. Research indicates that quality early education may improve the English abilities of English language learners, which could reduce the need for future spending in this area (Barnett, Yarosz, Thomas, Jung, & Blanco, 2007; Gormley, 2007; and Magnuson, Lahaie, & Waldfogel, 2006).

Crime-related cost savings

The relationship between participation in early childhood education (ECE) programs and reduction in crime appears to be direct. Children in ECE programs learn to control their behavior better than their peers who do not receive early education opportunities. ECE and lower crime rates also have an indirect link. ECE contributes to better academic achievement, reduced special education placements, and reduced child maltreatment, which are all associated with a reduction in crime (Mann & Reynolds, 2006). In addition to the negative economic effects that crime has on others, having a criminal history has negative implications for individuals, since a criminal background may affect employability and/or career mobility (Nores et al., 2005).

Crime-related cost savings attributable to ECE interventions result from juvenile justice system savings, adult criminal justice savings, and savings for crime victims. In fact, some believe that "[t]he greatest economic benefit of providing high-quality preschool education to disadvantaged children is a dramatic reduction in crime" (Oppenheim & MacGregor, 2002). Of the studies included in this analysis, only the Abecedarian program in North Carolina has not produced any statistically significant cost savings due to reduced crime. That exception has been attributed to the fact that the Abecedarian program was located in an area with relatively low crime rates compared with the communities served by other well-studied ECE programs, and could also be due to the small sample sizes which reduce statistical power (Campbell et al., 2002).

It appears that the largest cost savings due to crime reduction that ECE programs achieve is in the area of crime victims' savings. Oppenheim and MacGregor (2002) reported that every dollar invested in ECE yields a national average savings of $5.86 to crime victims. Reynolds et al. (2002) reported 90 cents saved by crime victims for every dollar invested in the Chicago Child-Parent Centers ECE program. In addition to victims' outcomes, the costs of administering the juvenile justice system fall between 68 cents and 90 cents for every dollar invested in ECE. Adult criminal justice system cost savings are about 40 cents for every dollar invested.

When including all types of cost savings from crime reduction, a meta-analysis of 58 ECE programs found an average cost savings of nearly 69 cents for every dollar invested (Aos et al., 2004). The Chicago Child-Parent Centers program results indicated a savings of $1.98 due to reduced crime for every dollar invested (Reynolds et al., 2002). Even more significant, the HighScope Perry Preschool program produced savings in the range of $4.85 to $11.30 of savings for every dollar invested in ECE (for discount rates of 7 percent and 3 percent respectively). For this program, there was a much more significant effect for male program participants than females (Nores et al., 2005). As previously mentioned, the Abecedarian program did not produce savings in the area of crime. Therefore, the total benefit-to-cost ratio with regard to crime reduction outcomes of ECE programs is $0 up to $11.30 for every dollar invested.

Cost savings for public assistance programs

Unemployment is reduced by ECE program participation indirectly via impacts on educational attainment. In 2000, individuals with high school degrees recorded an overall unemployment rate of 3.8 percent compared with 7.9 percent for high school dropouts (according to U.S. Census data cited in Oppenheim and MacGregor, 2002).

Nores et al. (2005) found that the cost of administering public assistance is nearly 30 percent of total disbursements. In addition, overpayment and payment to ineligible

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families is 6 percent of total disbursements. Therefore, for every dollar disbursed in public assistance to individuals, there is an additional cost to society of 38 cents.

Overall, cost savings for public assistance programs (TANF/AFDC) are not large compared with the benefits to other systems (K-12 education and criminal justice system). Most studies found only 1 to 2 cents per dollar invested in terms of cost savings to these programs.

Cost savings for the child welfare system

The literature reviewed here does not explicitly state the causal mechanisms by which ECE programs contribute to a reduction in child maltreatment (also called child abuse and neglect). The national review by Oppenheim and MacGregor (2002) found that 15 cents in cost savings accrue for every dollar invested in ECE. The Chicago Child-Parent Centers produced 12 cents of cost savings for every dollar invested (Reynolds et al., 2002). These cost savings benefit the child welfare system and also the individual children who do not suffer from abuse and neglect.

Cost savings for health care

Cost savings in the area of health care can be attributed to reduced incidence of tobacco use and reduced need for treatment for alcohol or other drug abuse. Citing a 2001 U.S. Department of Education report, Oppenheim and MacGregor (2002) assert that high-quality ECE programs contribute to lower public (i.e., Medicaid) and private health care costs by improving educational attainment, which leads to better health directly and indirectly through higher earnings. Specifically, high school graduates are 50 percent more likely to be in excellent or very good health than those who do not graduate from high school (with rates of 57.8% to 38.7%, respectively).

Masse and Barnett (2002) attribute all differences in health behavior for ECE program participants vs. non-participants to the increased educational attainment among participants and to the better job opportunities that arise when one has more education:

> *"Education increases the ability to be an effective consumer of health care services and producer of personal health. Education also increases earning power, the ability to command wages, fringe benefits, vacation time, and the ability to avoid working conditions that may be detrimental to personal health. Education also increases income that allows one to purchase higher quality and quantity of health services and to establish living conditions that are conducive to good health" (p. 22).*

These researchers also describe how the tendency to have concern for the future is represented by people who are willing both to invest in more education and engage in behavior that promotes future good health.

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In their meta-analysis of benefit-cost research for 58 ECE programs, Aos et al. (2004) reported a cost savings of 4 cents for every dollar invested in terms of a reduction in alcohol and drug abuse. The Abecedarian program participants were 16 percent less likely than control group individuals to be tobacco users, which increased the lifespan of program participants an average of 6.5 years at an estimated value of $161,000 per year, so the return on investment is $3.91 for every dollar invested.

Cost savings for child care

In some states, child care cost savings – which mainly accrue to the parents of participants but can also accrue to the general public in cases in which the participant is eligible for child care subsidy – can be attributed to a reduced need for child care services during the hours in which the child is participating in the ECE program. Oppenheim and MacGregor (2002) reported cost savings related to child care expenses of 19 cents for every dollar invested. Reynolds et al. (2002) found the Chicago Child-Parent Centers program saved 25 cents on child care expenses for every dollar invested.

Increased earnings resulting in increased income tax revenue

Increased income tax revenue due to increased earnings is derived from three sources: increased income for mothers of children who participate in ECE, due to their ability to work more hours while their child is participating in early education; increased income for participants, due to increased educational attainment that can be attributed to ECE enrollment; and increased income for future generations (children and grandchildren of participants), due to the increased educational attainment of participants that is associated with higher educational attainment for their offspring. Therefore, the primary way in which ECE intervention results in increased earnings and tax revenue is via increased educational attainment among ECE participants. Increased earnings by participants are a benefit of ECE programs that accrue to individual participants and also generate increased income tax revenue, which is a benefit that accrues to the general public (taxpayers).

Cost-benefit studies of the Abecedarian program are the only research reviewed here that included increased maternal earnings and earnings of future generations in calculations of benefits of ECE programs. Campbell et al. (2002) reported that 44 cents in increased income tax revenue for mothers of participating children was obtained for every dollar invested in the program. The same authors reported 13 cents in increased earnings of future generations (children through great-grandchildren, projected) for every dollar invested.

In terms of participant lifetime earnings, the return on investment ranges from $1.23 for every dollar invested (Oppenheim & MacGregor, 2002) to $3.32 for every dollar invested

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(Nores et al., 2005). In terms of income taxes paid by participants, the return on investment ranges from 17 cents for every dollar invested (Oppenheim & MacGregor, 2002) to $1.08 for every dollar invested (Nores et al., 2005). Results from the HighScope Perry Preschool benefit-cost analyses show that increased participant earnings and increased participant income taxes are more significant for female participants than for male participants (Nores et al., 2005).

Overall, increased earnings and taxes that can be attributed to ECE program participation produce a benefit that exceeds program costs from $1.40 to $4.38 for every dollar invested.

Estimates of potential cost savings from reviewed studies

Figure 25 summarizes the cost savings in different categories generated per dollar of investment in school readiness through ECE estimated in different studies. In each line the numbers indicate the present value of the dollars and cents saved for each dollar invested.

These estimates show that the range of potential returns estimated in different studies to be from $2.36 per dollar of investment to $16.14. These are present values of the stream of benefits and reduced costs received over the lifetime of a student.

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24. K-12 effects of early childhood education programs

Outcome	HighScope Perry Preschool Percent difference		Abecedarian Percent difference		Chicago CPC Percent difference		Aos et al. (2004) meta-analysis of ECE Programs Effect Size
Special education	-12%*	(of years by age 19)	-23.2%*	(by age 15)	-10.2%***	(by age 18)	-0.12
Emotional or behavioral disorder	-		-		0%a	(grades 1 to 8)	-
Mental retardation	-		-		-0.9%a	(grades 1 to 8)	-
Specific learning disability placement	-		-		-3.5%*a	(grades 1 to 8)	-
Speech and language impairment placement	-		-		-1.7%a	(grades 1 to 8)	-
Grade retention	-0.2	(years by age 27)	-23.3%*	(by age 15)	-15.4%***	(by age 15)	-0.18

Source: Karoly, Kilburn, & Cannon (2005) Table 3.5. Conyers, Reynolds, and Ou (2003); Aos et al., (2004) Table C1.a.

Notes: Percent difference refers to the experimental group's figure subtracted from that of the comparison/control group.
Statistical significance is indicated by asterisks: *p < 0.05, **p < 0.01, ***p < 0.001.

25. Areas of potential benefits or reduced spending due to school readiness through ECE investment

	Estimated ranges of returns on investment (ROI, $)	Programs/Studies
K-12 spending total	0.09 to 0.93	Aos et al. (2004), Belfield (2004a), Belfield (2004b), Lynch (2007), Magnuson et al. (2006)
Special education and grade repetition	0.04 to 0.73	HighScope Perry Preschool, Chicago CPC, Abecedarian Project, Aos et al. (2004) meta-analysis.
Dropouts and increased high school usage (state aid/revenue)	No estimates	Lynch (2007)
Teacher turnover	0.02 to 0.09	Belfield (2004a)
Teacher absenteeism	0.01 to 0.04	Belfield (2004a)
School safety programs	0.02 to 0.07	Belfield (2004a)
English Language Learner program usage	No estimates	Magnuson et al. (2006)
Crime	0.00 to 11.30	See below plus HighScope Perry Preschool data and meta-analysis from Aos et al. (2004)
Juvenile crime	0.68 to 0.90	Reynolds et al. (2002) Chicago CPC, and national average from Oppenheim and MacGregor (2002)

25. Areas of potential benefits or reduced spending due to school readiness through ECE investment (continued)

	Estimated ranges of returns on investment (ROI)	Programs/Studies
Adult crime	0.39 to 0.40	Reynolds et al. (2002) Chicago CPC, and national average from Oppenheim and MacGregor (2002)
Crime victims	0.92 to 5.68	Reynolds et al. (2002) Chicago CPC, and national average from Oppenheim and MacGregor (2002)
Public assistance programs	0.00 to 0.03	Aos et al. (2004) meta-analysis, Masse and Barnett (2002) Abecedarian, national average from Oppenheim and MacGregor (2002), and Nores et al. (2005) HighScope Perry Preschool
TANF/AFDC	Negative ROI to 0.18	National average from Oppenheim and MacGregor (2002), Nores et al. (2005) HighScope Perry Preschool, and Masse and Barnett (2002) Abecedarian
Unemployment benefits	0.01	National average from Oppenheim and MacGregor (2002)
Medicaid	No estimates	
Child abuse & neglect	0.12 to 0.15	National average from Oppenheim and MacGregor (2002) and Reynolds et al. (2002) Chicago CPC
Health	No estimates	
Alcohol and drug use	0.04	Aos et al. (2004) meta-analysis
Tobacco use	3.91	Masse and Barnett (2002) Abecedarian
Child care	0.19 to 0.25	National average from Oppenheim and MacGregor (2002) and Reynolds et al. (2002) Chicago CPC
Increased earnings & income tax revenues	1.40 to 4.38	See below
Maternal earnings	0.44	Masse and Barnett (2002) Abecedarian
Participant earnings	0.87 to 3.32	Masse and Barnett (2002) Abecedarian, Reynolds et al. (2002) Chicago CPC, national average from Oppenheim and MacGregor (2002), and Nores et al. (2005) HighScope Perry Preschool
Participant taxes	0.17 to 0.93	Reynolds et al. (2002) Chicago CPC, national average from Oppenheim and MacGregor (2002), and Nores et al. (2005) HighScope Perry Preschool
Earnings of future generations	0.13	Masse and Barnett (2002) Abecedarian
TOTAL PROGRAM IMPACT	2.36 to 16.14	National average from Oppenheim and MacGregor (2002), Nores et al. (2005) HighScope Perry Preschool, Reynolds et al. (2002) Chicago CPC, Abecedarian Project, Aos et al. (2004) meta-analysis

Sources: Isaacs (2007); Belfield (2006).

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