Value of school readiness per additional at-risk child in Montgomery County, Ohio

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Background

Numerous research studies have demonstrated the economic value of investing in effective early childhood education (ECE) for low-income children at risk of school failure. Programs that cognitively, socially, and emotionally prepare such children for success in school create large benefits. School readiness prevents or reduces needless public spending on costly interventions and special education programs and in the social welfare and criminal justice systems.

Without early education and support for healthy development, an at-risk child is more likely to start school at a disadvantage and ultimately more likely to drop out of school, earn lower wages, depend on public assistance, or commit crimes. Conversely, those who start school healthy and prepared are more likely, as adults, to be employed, earn higher incomes, and contribute more in taxes.

Potential lifetime value of school readiness per low-income child in Montgomery County

This analysis considers the lifetime economic value of investing in the healthy development and school readiness of children in five high-poverty school districts in Montgomery County, Ohio: Northridge, Mad River, Trotwood-Madison, Dayton Public, and Jefferson Township. The potential lifetime value of school readiness per each of these children is $68,306.

Most of that amount, $56,640, includes returns and savings within Montgomery County. School readiness in Montgomery County also generates $11,666 per child to the state as a whole through savings due to reduced incarcerations and unemployment insurance use plus increased state tax revenue.

About 26 percent of these total economic returns accrue to the children themselves and their families due to additional income. School districts (7%), county government (24%), the local public (26%), and Ohio as a whole (17%) gain the majority of the benefits. The details of where the benefits accrue are shown in Figure 1.

1. Estimated lifetime savings and benefits per additional at-risk child in Montgomery County, Ohio, achieving school readiness

Estimated K-12 savings due to increased school readiness in Montgomery County	**$4,503**
Savings in special education costs due to reduced incidence of non-cognitive disabilities	$2,194
Savings in K-12 expenditures due to fewer students repeating a grade	$2,309
Estimated savings and revenues for Montgomery County taxpayers due to increased school readiness	**$16,580**
Savings in law enforcement in Montgomery County	$8,531
Savings in cash and medical assistance payments and savings from reduced administrative costs	$7,533
Savings in child welfare costs	$215
Increased tax revenues (due to higher income, county portion)	$301
Estimated additional savings and benefits to individuals and society in Montgomery County	**$35,557**
Reduced costs to crime victims in the County	$14,433
Reduced costs of substance misuse treatment	$3,306
Additional income from increased parents' productivity	$1,659
Additional lifetime income (after taxes and netting out savings in cash transfers)	$16,159
Additional savings for Ohio as a whole due to increased school readiness in Montgomery County	**$11,666**
Reduced (marginal) costs of incarcerations and crime victimization	$8,482
Increased tax revenues (state portion)	$2,123
Savings in reduced use of unemployment insurance due to increased employment	$1,061
Total lifetime value per low-income child achieving school readiness in Montgomery County	**$68,306**

Methods

The Montgomery County one-child school readiness dividend is the anticipated dollar return for a child who was not expected to be ready for kindergarten, but who gets a high-quality preschool experience and achieves school readiness.

The anticipated dollar return was calculated using actual rates, spending, and census data from the five high-poverty school districts in Montgomery County and the likely impacts of effective early childhood education programs on outcomes in K-12 and adulthood. The likely impacts that generate the anticipated savings and benefits come from the most recent longitudinal studies and meta-analyses of the average impacts of several early childhood education programs.

The reported values are present discounted values at a 4 percent discount rate.

Conclusions

School readiness for more young children is critical for tackling Montgomery County's economic and social challenges. Investing in school readiness produces an educated and skilled workforce and social returns with substantial economic value.

Those benefits would rise exponentially as a result of increased school readiness investments in Montgomery County, given the potential public and private dividend for just one additional child achieving school readiness in the county is at least $57,000 within the county and $68,000 overall.

Introduction

Purposes of this study

This study demonstrates the economic value to local government and the public of investing in school readiness for just one more child at-risk of academic failure in Montgomery County, Ohio. Much of this value takes the form of savings. For example, children who attend preschool require less special education, repeat grades less, 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 the new economy. 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 Montgomery County attend comprehensive preschool in future years, moreover, the local government'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 recent studies in Minnesota, Michigan, and Illinois. 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, local government, and the public, and on the lifetime earnings of the child participating in ECE.

Overview of early childhood education cost/benefit literature

Many studies show that high-quality early learning experiences pay-off in the long run (Ehrlich and Kornblatt, 2004; Karoly, Kilburn, & Cannon, 2005; Friedman, 2004; Lynch, 2007; Temple and Reynolds, 2005; Reynolds, 2007; Rolnick and 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 its spending (Barnett, 1995; Belfield, 2004; Conyers, Reynolds, and Ou, 2003; Harvey, 2006; Reynolds, 2007 and 2011).

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 et al., 2004; Mann and Reynolds, 2006; Nores et al., 2005; Oppenheim and MacGregor, 2002; Reynolds et al. 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 et al., 2002; Nores et al., 2005; Oppenheim and MacGregor, 2002; Sum et al., 2008; Reynolds et al., 2011, Heckman et al., 2009).

Assumptions in the analyses

Estimates of saved costs are based on actual rates for the various conditions or population characteristics and cost data from five high-poverty school districts: Northridge, Mad River, Trotwood-Madison, Dayton Public, and Jefferson Township. When data were not available at the school district level, Montgomery County population and characteristics were used (e.g. welfare spending). Since incarcerations also may occur in state prisons, we also present the estimates of crime savings for Ohio. Similarly, some taxes collected do not come back to the county, but accrue to Ohio, as do unemployment insurance savings.

We estimate the likely impacts of effective early education programs over an average lifetime based on the most recent findings from longitudinal studies and meta-analyses of early childhood education programs. These are conservative estimates of the potential value conveyed by school readiness. See pages 16-20 for details.

Estimated value per additional child achieving school readiness in Montgomery County, Ohio

This section estimates the lifetime cost savings and benefits of achieving school readiness for one child at risk of academic failure within five high-poverty school districts in Montgomery County, Ohio. The cost savings and benefits estimates fall into four categories:

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

County government – through reduced costs of dealing with juvenile and adult criminals, through lower health care and welfare spending, and through higher tax revenues as successful students become productive adults, and increase their income.

The local public – through reduced crime victimization and costs due to injuries and property losses, reduced alcohol and drug abuse costs, and higher income from educationally prepared children and their parents.

Ohio as a whole – through reduced costs of incarcerations and crime victimization, through higher tax revenues, and lower unemployment costs.

These estimates are based on actual school graduation and expenditure data, crime rates, and other data for Northridge, Mad River, Trotwood-Madison, Dayton Public, and Jefferson Township school district, and Montgomery County as a whole. ECE program effect sizes and parameters come from the existing research on effects of early childhood education (See Study methods on page 16).

Estimated cost savings for K-12 education

Special education

Early childhood education has been shown to reduce the incidence of non-cognitive disabilities by 13 percent (Nores, Belfield, Barnett, & Schweinhart, 2005).[1] These types of disabilities are one of the main factors that determine that a child receives special education. By reducing the incidence of the disabilities and thus the likelihood of receiving

[1] For example, emotional or speech and language disabilities.

special education, the educational system (and therefore taxpayers) save resources that otherwise would have been devoted to these special and expensive services.

We assume that ECE has an average impact on the incidence of the disability of 13 percent (Aos, 2004). A recent study for Chicago Public Schools found effects of ECE on special education of around 40 percent, but the more recent analysis of the Perry Preschool data did not find any effect (Reynolds et al., 2011, and Heckman et al, 2009). Since the new evidence shows mixed results, we preferred to conservatively use the previous meta-analysis.

During 2010-2011 school year, 3,238 children in Montgomery County's five high-poverty school districts received special education services (14.5% of all children in those schools). Figure 2 shows the incidence by type of non-normative primary disability for these five school districts; that is, those which can be improved through ECE and special education.

Figure 2 also shows the reduction in the incidence of the disability due to ECE after applying that effect size.

2. Incidence of disability improved through ECE and special education in five high-poverty school in districts Montgomery County, Ohio.

	Incidence of disability	Amount of reduced incidence due to ECE Montgomery County
Specific learning disability	5.3%	0.7%
Speech/Language	2.0%	0.3%
Emotional disturbance	1.0%	0.1%
Other health impairment	1.7%	0.2%
Developmental delay	0.2%	0.02%

The annual cost savings in special education are computed applying the reduction in the incidence of each disability to the annual 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.

The per-pupil costs for each primary disability area of special education that could be prevented or ameliorated through ECE are shown in Figure 3. To estimate the costs in 2013 dollars we adjusted them based on historical spending patterns in the five school districts. 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 $2,194 in Montgomery County. A more detailed review of the literature and parameters used in this estimation can be found in the study methods section (page 16).

3. Lifetime costs savings of special education per additional at-risk child in ECE

	5 high-poverty school districts
Total students with disabilities	3,238
Total costs (appropriations) related to Special Ed. Grants (2009)	$56,825,620
Cost per student with disability (2009 dollars)	$17,548
Annual cost savings per child in the K-12 system who participated in ECE program	$228
Lifetime cost savings in special education per child in the K-12 system who participated in ECE program (2013 dollars)	$2,194

Grade repetition

Early childhood education reduces the incidence of grade repetition within a range of 13 percent to 44 percent in the four main ECE studies (Chicago Child-Parent Centers, Perry Preschool, Abecedarian, and Michigan School Readiness Program), with an average impact of 33 percent.

The average impact on grade repetition (33%) 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 the five school districts (1st to 12th grades). In addition, we estimate the marginal cost per additional pupil. This cost is the change in total expenses paid by the school districts for one more child entering the K-12 system. Applying the reduction in the probability of being retained in the school years noted above and adding up the resulting costs, we obtain the estimated lifetime savings on grade retention per child who participates in ECE.

The estimated lifetime savings due to reduced grade repetition amounts to $2,309 in Montgomery County. A more detailed review of the literature and parameters used in this estimation can be found in the study methods section (page 16).

4. Lifetime costs savings of reduced grade repetition per additional at-risk child in ECE

	Montgomery County
Marginal operating expense per additional Pupil Dollars (2010-2011)	$14,135
Average percentage of students retained by grade	5.1%
Reduction in grade retention rate due to ECE	1.7%
Lifetime cost savings on grade retention due to ECE	$2,309

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 $4,503 for a child in Montgomery County, Ohio.

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 lower average effect.

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.

Estimated cost savings to Montgomery County taxpayers

Criminal justice

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 and Reynolds, 2006).

Crime-related cost savings attributable to ECE interventions result from juvenile justice system savings and adult criminal justice savings. 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 and MacGregor, 2002).

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 $4.98 due to reduced crime for every dollar invested (Reynolds et al., 2011). Even more significant, the High/Scope 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). 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). In sum, the portion of the present value cost of conviction that is reduced due to ECE is estimated to be nearly 27 percent (average from the four main studies).

The savings from crime reduction are based on the avoided cost of law-enforcement in Montgomery County for an additional criminal. Using an average operating cost per individual arrested in Montgomery County in 2011 of $113,416, we adjust this cost by the probability of being arrested. The resulting series of costs are transformed to net present value of one year of additional conviction. We estimate this cost to reach $31,071.

Consequently, in Montgomery County, the lifetime cost savings from an additional conviction that is avoided due to ECE reaches $8,531 (2013 dollars).

These savings refer to lifetime savings per additional ECE participant and include juvenile and adult costs. We lack sufficient data to disaggregate incarceration costs by age.

Public assistance (Ohio Works First and Medicaid)

Unemployment and dependency on welfare programs are reduced by ECE program participation indirectly via impacts on educational attainment. In 2012, individuals with high school degrees recorded an overall unemployment rate of 8.3 percent compared with 12.4 percent for high school dropouts (U.S. Bureau of Labor Statistics).

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 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, but more recently Heckman, et al (2009) found a return of 21 cents, particularly strong among women receiving ECE.

ECE participants in Montgomery County would be likely to reduce the amount of public assistance they receive as their incomes grow due to their increased education. For the government and taxpayers, this implies a stream of savings that would not have existed in the absence of school readiness.

The latest research on this topic (Heckman, et al. 2009) shows that women in ECE spend 57 percent less time in Public Assistance. Similarly, the evidence shows that some ECE participants do not use Public Assistance at all; they are 18 percent less likely to use it than a control group.

Based on average monthly payments of $1,093 and 18 months of average time receiving payments for Ohio Works First and Medicaid in Montgomery County, lifetime savings can reach an estimated $7,533 per child in ECE. We assume only a ten-year stream of savings, since there are no studies following ECE children in welfare after that age.

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

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. More recently, the Chicago

Child-Parent Centers produced 86 cents of cost savings for every dollar invested (Reynolds et al., 2011). These cost savings benefit the child welfare system and also the individual children who do not suffer from abuse and neglect. The latest study analyzing ECE effects on child welfare (Reynolds, et al. 2011) found a 43 percent reduction in the number of cases of abuse and neglect.

The total number of children in custody/placement in Montgomery County in 2009 reached 755 children, with an average cost of $43,000, and an average of 689 days in placement. Applying the 43 percent parameter to the expenditures, and estimating the probability of a given child to use these services, the savings in child welfare costs amount to $215 (2013 dollars).

Montgomery County tax receipts

The latest evidence shows that early childhood education can increase the likelihood of high school graduation by 9.3 percent (Reynolds et al, 2011). Based on Census Bureau information, the difference in annual earnings between high school graduates and those without a high school degree in Montgomery County is approximately $9,744 (2011 dollars). The net present value of this amount for a productive life is nearly $300,000. We estimate, then, that an at-risk child in Montgomery County with ECE will have lifetime earnings of $24,995 more than an at-risk child without ECE.

Using the tax burden rate for Ohio (9.7%), the additional income of participants in ECE translates to an additional $2,425 in tax revenues for the state. Ohio's tax agency reports that the share of Montgomery's general revenue from state taxes is 12.43 percent. Therefore, the additional lifetime tax revenues for Montgomery County per ECE participant are approximately $301.

Estimated savings and revenues for Montgomery County taxpayers due to increased school readiness

The estimated potential savings and revenues for Montgomery County taxpayers due to increased school readiness per additional at-risk child achieving school readiness reaches $16,580.

Estimated current social cost savings in Montgomery County

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

Crime victimization

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.

Crime victims suffer tangible losses that constitute social costs. ECE has been shown to reduce criminal behavior of participants and thus reduce victims' costs by 4.5 times the justice system costs (Reynolds et al, 2011). Based on the savings from crime reduction in Montgomery County presented before, we estimate crime victim savings in the juvenile and adult system of $14,433 per at-risk child in ECE in Montgomery County.

Substance misuse

Children who participate in comprehensive early education programs are less likely to present problems of substance misuse (Aos, et al. 2002). This reduces the expenditures in treatment and rehabilitation expenses, becoming savings for society. We lack Montgomery County data on public health expenditures for substance misuse treatments, so we estimate the per child at-risk costs using the recent literature. Following Reynolds et al. (2011) the savings per at-risk child accrue $3,306 for the County.

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 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 an 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 $1,659.

Additional lifetime income (after taxes and netting out savings in cash transfers)

As we mentioned, the latest evidence shows that early childhood education can increase the likelihood of high school graduation by 9.3 percent (Reynolds et al, 2011). Based on Census Bureau information, the difference in annual earnings between high school graduates and those without a high school degree in Montgomery County is approximately $9,744 (2011 dollars). We estimate, then, that an at-risk child in Montgomery County with ECE will have lifetime earnings of $24,995 more than an at-risk child without ECE.

These additional earnings prevent ECE children (as adult) to rely on public welfare, so we subtract the public welfare transfers to avoid counting these benefits twice. We also remove the additional taxes paid by ECE children to obtain only the additional earnings, which amount to $15,793.

Summary of estimated additional savings and benefits to individuals and society in Montgomery County

The estimated potential social savings per additional at-risk child achieving school readiness reaches $35,557 for a child in Montgomery County.

Additional savings and benefits for Ohio

Some savings and benefits generated in Montgomery County accrue to Ohio as a whole.

Criminal justice in Ohio

The results presented before included returns and savings for Montgomery County only. Since incarcerations also may occur in state prisons, we also present the estimates of crime savings for Ohio due to school readiness in Montgomery County. The savings from crime reduction are based on the avoided marginal cost of incarcerating an additional criminal in a State prison. Using a 10-year series of total expenses in prisons and the population of inmates in Ohio, we adjust the marginal cost of incarceration by the probability of committing a particular type of crime at a given age. This implies savings of $8,482 per at-risk child receiving ECE for Ohio (including victimization costs).

State taxes

Using the tax burden rate for Ohio (9.7%), the additional income of participants in ECE translates to an additional $2,425 in tax revenues for the state. Since the share of Montgomery's general revenue from state taxes is 12.43 percent, there are additional $2,123 in revenues per children at-risk in ECE for the State.

Unemployment insurance savings

As we mentioned before, every child participating in early childhood education is more likely to graduate from high school, and, consequently, more likely to be employed more often, and less likely to receive unemployment insurance (UI). The main ECE studies found that ECE participants have 20 percent fewer months of unemployment. In Ohio, the average weekly UI is $303 (2010 dollars), and lasts for an average of 16 months. This implies an estimated cost per unemployed of $4,961. Thus, school readiness in Montgomery County can save the state $1,061 per at-risk child.

Summary of estimated additional savings and benefits for Ohio

The estimated potential social value per additional at-risk child achieving school readiness in Montgomery County reaches $11,666 for Ohio as a whole.

Summary of total lifetime value due to school readiness for one additional at-risk child in Montgomery County, Ohio

The lifetime economic value of investing in healthy development and school readiness for each low-income child at risk of school failure in Montgomery County, Ohio, is an estimated $68,306.

Most of that amount, $56,640, includes returns and savings within Montgomery County. School readiness in Montgomery County also generates $11,666 per child to the state as a whole.

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

K-12 education	$4,503
Montgomery County	$16,580
Local public	$35,557
Additional savings for Ohio as a whole	$11,666
Total one-child school readiness dividend	**$68,306**

Study methods and underpinning research

Background research on potential cost savings and benefits for K-12

The research literature on school readiness investments documents potential savings in K-12 spending, crime-related costs, 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. Here we show a more thorough review of the literature on ECE effects on K-12.

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 3 and 4 low-income 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 6 and 7 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 (High/Scope 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.

6. K-12 effects of early childhood education programs

Outcome	High/Scope 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)	-0.13
Emotional or behavioral disorder	-		-		0%	(grades 1 to 8)	-
Mental retardation	-		-		-0.9%	(grades 1 to 8)	-
Specific learning disability placement	-		-		-3.5%*	(grades 1 to 8)	-
Speech and language impairment placement	-		-		-1.7%	(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 and Cannon (2005) Table 3.5. Conyers, Ou, and Reynolds (2003); Aos (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: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

7. K-12 costs and benefits of early childhood education (2008 $)

	Perry	Head Start	Chicago CPC	Abecedarian	Aos et al. (2004) meta-analysis of ECE Programs
Special education (SE)	No data	$2,211	$5,499	No data	$137
Grade retention (GR)	No data	$208	$910	No data	$224
Grade retention and special education	$16,706	$2,419	$6,409	$8,790.52	$362
Cost of program	$17,283	$14,751	$8,056	$49,961	$7,786
Ratio of GR and SE benefits to program cost	0.38	0.17	0.73	0.21	0.04

Source: *Karoly and Cannon (2005) Table 4.4; Aos (2004) Appendix E; Masse and Barnett (2002) Table 8.2 ; Reynolds et al. (2002) Table 5A; Currie (2001) Table 3; Isaacs (2007) Table 2; Barnett (1985) Table 3.*

Notes: *K-12 Benefits include grade retention and special education. Values are adjusted using the Consumer Price Index for All Urban Consumers. na=not applicable/available. Benefits and costs are per participant.*

Other possible benefits within the K-12 system not included in this study are behavioral and cognitive gains. Belfield (2004) 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.

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, 2007; Gormley, 2007; and Magnuson, Lahaie, and Waldfogel, 2006).

Rates and cost data used in the study calculations

Tables 8, 9 and 10 summarize the ECE impacts, costs measures, and population rates (probabilities) used in the estimations, and their sources.

8. ECE impacts used in the study calculations ant their sources

Cost category	Impact of ECE	Source
K-12 Special education	13% reduction of incidence of some disabilities	Adjusted Effect Size from Aos et al (WSIPP)[2]
K-12 Grade repetition	33% reduction in students who have been retained at least once	Average of four major studies[3]
Juvenile and adult justice system	27% reduction in percentage of participants arrested	Average of four major studies
Public assistance (Ohio Works First and Medicaid)	57% less months in Public Assistance (for women in ECE only). Also, some ECE participants do not use Public Assistance at all; they are 18% less likely to use it than a control group.	Estimated effect size from Perry School study (2009)
Child Welfare	Impact parameter: reduction in number of cases of abuse and neglect (43%)	Reynolds, et al. (2011)
Child Care	Estimated proportion of ECE participants that are eligible for child care: 50%	Authors' assumptions
Revenues from taxes	Additional taxes coming from additional earnings from ECE participants. 9% estimated increased graduation ratio	Estimated effect size from Reynolds, et al. (2011)
Unemployment Insurance	20% reduction in Unemployment insurance usage	Average of three major studies (CPC, Perry, Abecedarian)
Estimated annual crime victim saving- juvenile and adult system	Assumed to be 4.5 times justice system costs	Reynolds 2011, Barnett, 1996
Substance abuse	$3,229 of net present value per children in ECE	Reynolds, et al. 2011
Parents productivity	Parents earnings increase on average in $909 a year due to having their children in ECE	Average of main studies
Additional individual net lifetime income (after taxes and cash transfers)	9% estimated increased graduation ratio	Estimated effect size from Reynolds et al (2011)

[2] A recent study for Chicago Public Schools found effects of ECE on special education of around 40 percent, but the more recent analysis of the Perry Preschool data did not find any effect (Reynolds et al., 2011, and Heckman et al, 2009). Since the new evidence shows mixed results, we preferred to conservatively use the previous meta-analysis.

[3] Chicago Child-Parent Centers, Perry Preschool, Abecedarian, and Michigan School Readiness Program.

9. Costs used in the study calculations and their sources

Cost category	Cost measure	Source
K-12 special education	Special education expenditures per student in Montgomery County 5 school districts 2011 (estimated): $18,032	Ohio Department of Education
K-12 grade repetition	Total expenditures per student - 2011 dollars Montgomery County 5 school districts: $14,135	Ohio Department of Education
Juvenile and adult justice system	Average operating cost per individual arrested in Montgomery County 2011 ($113,416)	Montgomery County Law enforcement costs and annual populations arrested in the County
Public assistance (Ohio Works First and Medicaid)	Average monthly payments OWF and Medicaid Montgomery County 2012 per individual: $1,093	Ohio Department of Jobs and Family services
Child welfare	Annual cost per child: $43,700	Montgomery County Children Services
Child Care	Estimated weekly subsidy (2010): $94	
Revenues from taxes	Tax revenue rate Ohio: 9.7% Share of Montgomery's general revenue from state taxes is 12.43%	Ohio Department of Taxation
Unemployment Insurance	Average weekly payments in Ohio 2010: $303. Average duration: 16 months. Total payment/person: $4,961	Ohio Department of Jobs and Family Services
Estimated annual crime victim saving- juvenile and adult system	Assumed to be 4.5 times justice system costs	
Substance abuse	NPV of costs associated with substance abuse in 2011: $3,229	Reynolds 2011, Barnett, 1996
Parents productivity	$909 per year (2009 dollars)	Average of main studies
Additional individual net lifetime income (after taxes and cash transfers)	Difference in lifetime earnings between HS and non-HS graduates in Montgomery County ($9,744 in 2011 dollars)	U.S. Census

10. Rates used in the study and their sources

Cost category	Rates used / assumption	Source
K-12 special education	Share of students in special education in Montgomery: 14% Disabilities in Montgomery (as % of students in special education): Specific learning disability: 36% Speech/Language: 14% Emotional disturbance: 7% Other health impairment: 12% Development delay: 1%	Ohio Department of Education Montgomery County Educational Service Center
K-12 grade repetition	Average percentage of students retained between grade 1 and 12: 5.8%	Ohio Department of Education
Juvenile and adult justice system	Population in prisons Montgomery County: 1.5%	Montgomery County Sheriff's office
Public assistance (Ohio Works First and Medicaid)	Percentage of people using Ohio Works First: 3.1%	Ohio Department of Jobs and Family services
Child welfare	Children in custody as share of population under 18: 0.6%	Montgomery County Children Services
Unemployment Insurance	ECE is independent of unemployment rate	Ohio Department of Jobs and Family Services
Substance abuse	Already included in the cost from the literature	Reynolds 2011, Barnett, 1996
Parents productivity	Already included in the cost from the literature	Average of main studies
Additional individual net lifetime income (after taxes and cash transfers)	Population 25 or older with high school degree in Montgomery: 88%	U.S. Census

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