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# Narrowing the Achievement Gap for Low-Income Children:

# A 19-Year Life Cycle Approach

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**November 10, 2008**

**Prepared for the 2008 Equity Symposium of the Campaign for Educational Equity,
"Comprehensive Educational Equity:
Overcoming the Socioeconomic Barriers to School Success."**

**Teachers College, Columbia University. November 17-18, 2008**

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*"Skills beget skills, success breeds success, and the provision of positive experiences early in life is considerably less expensive and more effective than the cost and effectiveness of corrective intervention at a later age."*[1]

The cognitive and non-cognitive performance of disadvantaged children (racial minority and those from low-income households) is consistently below that of middle-class children, with the gap ranging from 0.5 to 1.0 standard deviations, varying by the domain and age at which children were measured.[2]

Educators have attempted a variety of compensatory policies, some quite expensive, to close this achievement gap: among them have been reducing the sizes of classes and schools serving disadvantaged children; seeking to attract higher quality teachers to such schools; holding schools and teachers accountable for higher test scores and imposing penalties on them where test scores are low; issuing charters to organizations claiming innovative approaches; issuing vouchers for private schooling to disadvantaged children; providing additional time and tutoring for remediation; offering greater transfer rights for disadvantaged children to schools with higher average achievement; and providing special education resources to disadvantaged children to remediate learning disabilities. Yet none of these innovations has made much of a

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dent in the achievement gap. Although the mathematics achievement of black and white elementary school students has improved considerably since 1990, the gap in their achievement has not substantially narrowed.*

This failure to substantially narrow the achievement gap stems from two related shortcomings.

First, policy makers have placed nearly exclusive emphasis on reforming schools, when the specific conditions of lower-class existence contribute heavily to inadequate school performance. Low-income children often have no routine or preventive medical, dental or optometric care, resulting in more school absences as a result of illness and even an inability to see well enough to read.[3] Children in low-income families are more prone to asthma, resulting in more sleeplessness, irritability, and lack of exercise, as well as poorer attendance.[4] Children born to low-income mothers have lower birth weight as well as more lead poisoning and iron-deficiency anemia, each of which leads to diminished cognitive ability, more behavioral problems and more special education placement.[5] Their families frequently fall behind in rent and move, so children switch schools more often, losing continuity of instruction.[6] Poor children are, in general, not read to aloud as often or exposed to complex language and large vocabularies in their homes, so they begin school far behind in verbal ability, reasoning skills, and reading readiness.[7] Their parents have low-wage jobs and are more frequently laid off, causing family stress that often leads to more arbitrary discipline at home and "acting out" in school.[8] The neighborhoods through which these children walk to school and in which they play have more crime and drugs and fewer adult role models with professional careers.[9] Children whose mothers are poorly educated are more often in single-parent families and so get less adult attention.[10]

* Black 4th graders' NAEP scores were 188 in 1990 and 222 in 2007; white 4th graders' NAEP scores were 220 in 1990 and 248 in 2007 (NCES 2007, Figure 4).

They have fewer cross-country trips, visits to museums and zoos, music or dance lessons, and organized sports leagues to develop their ambition, cultural awareness, and self-confidence.[11] Each of these disadvantages makes only a small contribution to the achievement gap, but cumulatively, they explain much of it.[12]

A second and related shortcoming has been policy makers' insufficient attention to the cumulative nature of academic failure and poor socialization. The achievement gap is present before children enter school. Thus, school interventions are necessarily compensatory – catch-up efforts to offset pre-existing inadequacy. An alternative, and more effective approach would be to prevent the achievement gap from emerging in such magnitude in the first place. This insight has recently been promoted by Nobel Laureate (in economics) James Heckman and by a National Academy of Sciences study on the neurobiology of early childhood development, *From Neurons to Neighborhoods* by Jack P. Shonkoff and Deborah Phillips.[13] In a more recent paper, Heckman, Shonkoff and their colleagues put it this way, as we cited in our headnote: "[S]kills beget skills, success breeds success, and the provision of positive experiences early in life is considerably less expensive and more effective than the cost and effectiveness of corrective intervention at a later age."[14]

The foundations for learning both academic and behavioral knowledge and skills are best acquired early in life. Children whose development is healthy in-utero and onward are able to build on prior skill levels to develop increasing levels of competence. High quality early childhood programs also have power to alter lifelong outcomes.[15] Research in cognitive science, such as the Shonkoff and Phillips volume, stresses the interdependence of environmental and genetic factors, and demonstrates that children's potential is less limited if healthy development begins early.

Heckman, Shonkoff, and their colleagues note that both academic and non-cognitive achievement follow "hierarchical rules":

> Later attainments build on foundations that are laid down earlier… [C]ognitive, linguistic, social, and emotional competencies are interdependent; all are shaped powerfully by the experiences of the developing child… Although adaptation continues throughout life, human abilities are formed in a predictable sequence of sensitive periods,[16]

with prenatal development and early childhood the most influential. Heckman notes further that

> [b]y the third grade, gaps in test scores across socioeconomic groups are stable by age, suggesting that later schooling and variations in schooling quality have little effect in reducing or widening the gaps that appear before students enter school….
>
> At current levels of resources, society *overinvests* in remedial skill investments at later ages and *underinvests* in the early years.[17]

Although investments in older disadvantaged individuals realize relatively less return overall, such investments remain necessary. "[T]he advantages gained from effective early interventions are sustained best when they are followed by continued high-quality learning experiences."[18]

National and state education policies have typically ignored both accumulated experience and careful research that confirms this insight. Policies have expected school reform alone to close the achievement gap. But the failure of the federal law, *No Child Left Behind,* to effect significant achievement gains for disadvantaged children has led many policy makers to re-examine their assumptions about the possible efficacy of isolated school reform. A new consensus is emerging. In January, 2007, a group of educators and policy makers led by Vincent Ferrandino (executive director of the National Association of Elementary School Principals) and including Milton Goldberg (executive director of the commission that produced the *Nation at Risk* report in 1983) and Christopher Cross (assistant secretary of education in the George H.W. Bush administration), issued a report calling for a new "comprehensive, seamless approach to

learning that values the distinct experiences that families, schools, afterschool programs, and communities provide for children."[19] In June, 2008, Heckman joined with a group of prominent social scientists and policy makers from across the political spectrum in calling for a "Broader, Bolder Approach to Education."[20] They asserted that an effective strategy should start with high quality early childhood experiences, and include adequate health care and high-quality after-school and summer programs, as well as school improvement. And recently, Heather Weiss and her colleagues at the Harvard Family Research Project, in a report for the Center on Education Policy, has summarized the research findings and similarly called for policy to address the need for family support and high quality after school and summer programs for disadvantaged youth.[21]

To support this emerging consensus, the analysis that follows undertakes to estimate the cost of public policies to substantially narrow the achievement gap, if these policies begin early in the development cycle and build on previous success, rather than attempting to remediate past failures. This report models appropriate investments in prenatal and early childhood development, followed by appropriate investments later to sustain the effects of such early interventions. This report assumes that such a strategy could significantly inhibit the achievement gap from opening in the first place, making it easier to sustain greater equality in average outcomes through the school years. It is more expensive, and less effective, to attempt to remediate, later in childhood and adolescence, the failure to lay a firm foundation early in life.

## Description of the Model:

The full program covers a span of 19 years, from *in utero* to 18 years of age. For *each* disadvantaged child, this report estimates a cumulative lifetime (through age 18) cost of about

$300,000 for the program modeled in this report, or an average annual per child cost of about $15,000.

This estimate is impractical, however, because many of the services provided in this model cannot be offered to disadvantaged children alone. For services that can only reasonably be provided on a schoolwide basis (such as, for example, a school-based health clinic, or incentive payments to attract more effective teachers to hard-to-staff schools), we assume that these services will be placed in schools where at least 50% of the enrollment is of students who are eligible for the free and reduced price lunch program. The estimate above, of an average annual per child cost of $15,000 assumes that every child in such schools is lunch-eligible.

The model, therefore, excludes the cost of providing these services to disadvantaged children who are not in schools where a majority of students are disadvantaged. But it also must include the cost of providing such services to students who are not disadvantaged, if they attend schools where a majority of students are disadvantaged. The cost of services in the model which are not school-based (such as prenatal care for mothers, or early childhood care and education for very young children) can reasonably be calculated only for disadvantaged children.

Therefore, we also estimate the cost *per disadvantaged child* of providing the model's services to all children enrolled in schools where a majority of students are lunch-eligible. This is a more reasonable estimate of the model's cost. For these estimates, we assume that 75% of students in a school are lunch-eligible, and that the other 25% are also receiving the school-based services. In this situation, for *each* disadvantaged child, this report estimates a cumulative lifetime (through age 18) cost of nearly $400,000 for the program modeled in this report, or an average annual per child cost of about $20,000. In the discussion that follows, unless otherwise indicated, cited costs refer to this modified model, although the tables will display both figures –

the cost of program elements if provided in schools where all children are disadvantaged, and the cost if provided to all students enrolled in schools where 75% are disadvantaged.

As discussed below, all estimates in this report are of the total costs of recommended programs; they are not estimates of net new expenditures. Because many recommended programs may already be in place, either in whole or in part, net new expenditures could be less than the total cost modeled here. For example, in a paper prepared for this Symposium, Connors-Tadros and Silloway find that in New York State, approximately $18 billion annually may already be appropriated to fund services similar to those recommended in this report.[22] Calculating, for the various states, how much net new funding is required for the services recommended here is an important focus for further research.

We use the term "disadvantaged children" to describe those for whom the recommended services should be provided, but the term is imprecise; "disadvantage" covers a wide range of challenges, some more serious than others. Thus, it is not possible to model a single set of services that would be appropriate for each child who now suffers from an achievement deficit. The interventions and services required by the most severely disadvantaged children may not be required by those who are disadvantaged but not extremely so. For example, services required for children in foster care, or from households far below the poverty line, are more extensive than those required for children who are from borderline poor families. It is not practical in this report to create separate models for each of the many possible sub-groups within the category of "disadvantaged." Therefore, the model in this report is intended to substantially narrow the achievement gap for children who, at age 5, were in households with at least one biological or adoptive parent, and whose income was between 75% and 125% of the federal poverty

line. This group represents about 11% of all 5 year-old children, nationwide. For black children specifically, this group includes about 15% of all children.

Although the resources recommended in the model are also needed by, and intended for, children whose households had income below 75% of the federal poverty line (about 16% of all children nationwide and about 32% of all black children), it is not expected that these resources alone would suffice to substantially narrow the achievement gap. Thus, for example, the model estimates the costs of providing family support services (nurse-home visitors in the very early years, and school social workers later) for children whose families have incomes below 75% of the poverty line, as well as for those whose families have incomes between 75% and 125% of poverty. For the former group, however, the family support services required to substantially narrow the achievement gap would likely be more intensive and more costly than the family support services modeled in this report.

We estimate that nationwide, there are presently about 1 million children in each annual age cohort from households with family income of less than 125% of the poverty line.[*] Of these, about 40% are from households with family income between 75% and 125% of the poverty line.

If policymakers were to adopt the recommendations of this report, it would take 19 years to fully implement the program, because as each cohort matures, new services are added in each year. And each year, a new cohort is added to the model.

In the first year of such gradual implementation, service would be provided only to one cohort, and only for the first year. In the second year of such implementation, the national cost would grow, because now, second year services would be provided to the first cohort, plus first year services provided to the second cohort. By the last year of implementation, with all cohorts

[*] This estimate is based on Census data on the number of five year olds from households with family income of less than 125 percent of the poverty line.

in the development cycle having benefited from necessary services for all 19 years, we should expect a significant narrowing of the achievement gap, especially for the more than half a million children whose families have incomes between 75% to 125% of poverty.

Compensatory expenditures would still be required for cohorts that began their life cycles before the implementation of the model and that had not benefited from the earlier investments. These compensatory expenditures (not estimated in this report) would be in addition to the model's cost. Each year, however, as fewer cohorts who had not benefited from the earlier investments were moving through the development cycle, the compensatory costs should decline until, in the 19th year of the model, they were minimized to the greatest extent feasible.

Note that our estimate of the average annual per-child cost for this model of about $15,000 (if only target group students receive services) is *below* econometric estimates made of the cost of substantially narrowing the achievement gap for disadvantaged children.[23] This is plausible because, as we discussed above, it is less expensive to prevent the achievement gap from opening in the first place, with appropriate early childhood investments, than it is to attempt to remediate children's academic and social shortcomings after they have become well established.

All of the above amounts, and others in this report, are in $2005.[*] For a very approximate estimate of these amounts in current (2008) dollars, each number in this report can be increased by about 10% to account for 2005 to 2008 inflation.

Throughout this report, we refer to Program (or Model) Years, Ages, and School Grades. Because the model's resources become available in the year before birth, Program Years are two

[*] The model reports costs in $2005 because 2005 is the most recent year for which the Comparable Wage Index (CWI) is available (see below for a description of the CWI). We are restricted in this way because some cost estimates of the model have been drawn from programs that have been implemented in particular states. The CWI is necessary to convert these costs to national dollars.

years greater than children's ages. The following **Table 1** will assist readers in following the chronology of the model:

Table 1. Age and Grade Table for Model

| Model Year | Age of Child | Grade of Child |
|---|---|---|
| | | |
| 1 | *In Utero* | |
| 2 | 0-1 | Ecce* |
| 3 | 1-2 | Ecce |
| 4 | 2-3 | Ecce |
| 5 | 3-4 | Pre-k |
| 6 | 4-5 | Pre-k |
| 7 | 5-6 | k |
| 8 | 6-7 | 1 |
| 9 | 7-8 | 2 |
| 10 | 8-9 | 3 |
| 11 | 9-10 | 4 |
| 12 | 10-11 | 5 |
| 13 | 11-12 | 6 |
| 14 | 12-13 | 7 |
| 15 | 13-14 | 8 |
| 16 | 14-15 | 9 |
| 17 | 15-16 | 10 |
| 18 | 16-17 | 11 |
| 19 | 17-18 | 12 |

* Ecce = Early Childhood Care and Education

## Components of the Model:

The model is comprised of the following components:

Year 1 is devoted to ensuring that all disadvantaged pregnant women receive adequate prenatal and obstetric care. Such care would make healthy births to their children more likely, but still not as certain as for middle class women, because healthy births are predicted not only by adequate prenatal and obstetric care but also by conditions that are more difficult to influence, such as freedom from stress.[24] Nonetheless, the Year 1 program could make more likely the delivery of children with capacity to flourish.

Family (parental support) services also begin in Year 1. Such services continue throughout the full 19 years of the child's development cycle. These services take the form of visiting nurses in Years 1-4, parent access to continuing education in Years 1-19, school social workers and parent coordinators in Years 5-19, and visiting home literacy coaches in Years 5-7.

Year 2 of the model, covering newborns to children one year of age, introduces high-quality early childhood care and education (ECCE). The model continues to provide ECCE through Year 6. ECCE in Years 5 and 6 - for 3 and 4 year olds - may also be referred to as pre-kindergarten.

Also introduced in Year 2 is routine and preventive pediatric care. The program models these costs, which soon also include routine and preventive dental and vision care, as provided in a school based health clinic. (If provided elsewhere, the costs would not be significantly different.) The services of school-based health clinics continue through Year 19, the normal senior year of high school.

Year 2 also introduces a salary increment for ECCE and for K-12 teachers that is sufficient to attract highly qualified teachers to the more difficult conditions in ECCE centers and schools serving disadvantaged children. This salary increment for teachers in such schools continues through Year 19.

In Year 7 (the kindergarten year), the model provides for high quality after-school and summer programs. The cohort should continue to benefit from such programs through Year 19, the normal year for high school graduation.

Also beginning in Year 7, disadvantaged children are provided with higher teacher-child ratios (i.e., smaller class sizes) than they typically now experience. This class size reduction program continues for four years, through Year 10 (Grade 3).

In the following pages, we estimate the per-child (student) cost of each of these resources. As noted above, as resources for subsequent years accumulate, we calculate a total cost for the full 19-year developmental cycle, concluding with graduation from high school.

Beginning in the second year of the model, Year 1 costs begin for a new cohort, and this pattern continues for each year of the model. All resource costs are duplicated for each succeeding cohort.

**Table 2** displays the model components, and the years in which their services are provided.

Table 2. Summary of 19 Year Plan to Narrow the Achievement Gap

| Year | Child's Age/Grade | Intervention | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Adequate Prenatal Care | Family Support | High-Quality Early Childhood Care | Routine and Preventive Pediatric Care | Adequate compensation incentives to attract and retain skilled teachers | High Quality Before- and After-School and Summer Programs | Reduced Class Size |
| 1 | Prenatal | X | X | | | | | |
| 2 | 0-1 yro | | X | X | X | X | | |
| 3 | 1-2 yro | | X | X | X | X | | |
| 4 | 2-3 yro | | X | X | X | X | | |
| 5 | Pre-K | | X | X | X | X | | |
| 6 | Pre-K | | X | X | X | X | | |
| 7 | K | | X | | X | X | X | X |
| 8 | 1st | | X | | X | X | X | X |
| 9 | 2nd | | X | | X | X | X | X |
| 10 | 3rd | | X | | X | X | X | X |
| 11 | 4th | | X | | X | X | X | |
| 12 | 5th | | X | | X | X | X | |
| 13 | 6th | | X | | X | X | X | |
| 14 | 7th | | X | | X | X | X | |
| 15 | 8th | | X | | X | X | X | |
| 16 | 9th | | X | | X | X | X | |
| 17 | 10th | | X | | X | X | X | |
| 18 | 11th | | X | | X | X | X | |
| 19 | 12th | | X | | X | X | X | |

## Summary of Component Costs:

The approximate costs for each program component of the model are:

1. Adequate prenatal and obstetric care for mothers in Year 1: $10,900 per mother, or $600 per child as an average annual cost for 19 years.

2. Family support services,

a) beginning with nurse-family partnerships for mothers in Years 1-4: an average annual cost per child of $4,900 for four years, or $1,000 per child as an average annual cost for 19 years;

b) providing the opportunity for parents to supplement their own education in Years 1-19, because greater parental education can contribute to children's achievement: $55 per child as an average annual cost for 19 years (assuming that 10% of parents enroll in further education);

c) continuing with school social workers in Years 5 – 19: an average annual cost per student of $645 for 15 years, or $500 per child as an average annual cost for 19 years;

d) and providing home literacy coaches in Years 5 – 7: an average annual cost per child of $5,500 for 3 years, or $900 per child as an average annual cost for 19 years;
a total of $2,500 per child as an average annual cost for 19 years for family support services.

3. High quality early childhood care and education in Years 2-6, including pre-kindergarten for three and four year olds: an average annual cost per child of $15,800 for 5 years, or $4,200 per child as an average annual cost for 19 years.

4. Routine and preventive health care for infants, children, and their parents in Years 2-19: an average annual cost per child of slightly more than $700 for 18 years, or slightly less than $700 per child as an average annual cost for 19 years.

5. High quality after-school and summer programs in years 7-19: an average annual cost per student of $16,000 for 13 years, or $11,000 per student as an average annual cost for 19 years.

6. Adequate compensation incentives to attract and retain skilled teachers at schools serving disadvantaged children in Years 2-19: an average annual cost per student of $300 for 18 years, and only slightly less as an average annual cost for 19 years.

7. Reduced class sizes in Years 7-10 (kindergarten through third grade): an average annual cost per student of $1,900 for 4 years, or $400 per student as an average annual cost for 19 years.

## Additional Limitations of and Cautions Regarding the Model:

The practical utility of the specific amounts represented by the model is further limited by the following considerations:

**a) No account is taken of possible later savings:** As Heckman, Shonkoff and their colleagues point out, we presently not only underinvest in early years, but overinvest in later years. The model described in this report only estimates the cost of appropriate investments in the early years and of investments needed to sustain the effects of the earlier programs. It does not estimate savings that might also accrue if the later years' overinvestment could be reduced once the model program was implemented. For example, we expect that special education costs would be reduced as children with healthy development *in utero*, neonatality, infancy and early childhood have fewer developmental, behavioral and cognitive disabilities. Compensatory education expenditures for older youth during the regular school day might be less necessary if these students participated in high quality after school and summer programs. Perhaps class sizes

could be increased in the later grades once a cohort was better prepared earlier in life. Perhaps it would be easier and thus less expensive to attract and retain skilled teachers for the later grades at schools serving disadvantaged children, once a cohort was more adequately prepared for grade level work. We should also expect other governmental expenditures to be offset. For example, the costs of controlling crime (including prisons) and of welfare should fall if disadvantaged youth had better cognitive and non-cognitive skills. More productive workers should generate higher tax receipts. Such savings have been estimated previously, and especially in a volume edited by Clive Belfield and Henry Levin summarizing an earlier symposium of the Campaign for Educational Equity.[25]

**b) No account is taken of existing partial public implementation of some model elements:** Some of the resources this model proposes are already provided, entirely or in part, in some places, and some of their costs are already embedded in public budgets. For example, some disadvantaged women and children presently receive health services whose provision is reimbursed by Medicaid, S-Chip, and other public health programs. Some schools serving disadvantaged children already have health clinics that provide some or all of the services proposed in the model.[*] Some disadvantaged children already benefit from high quality early childhood care and education programs (including some Head Start programs) or from high quality after-school and summer programs. Some disadvantaged children already attend school with appropriately reduced class sizes, taught by skilled teachers and with the help of teacher assistants. This report makes no attempt to subtract from its cost estimates what the public already spends on these adequate programs. Without the ability to precisely identify these

[*] For example, as of 2002, there were approximately 1,500 health clinics in schools nationwide, providing primary care either by on-site physicians, nurse practitioners, or physician assistants, or by nurses with electronic connections to primary care physicians. In 1994, there were only 600 such clinics. In 31 states, primary care by nurse practitioners was Medicaid-reimbursable in 2002 (Health in Schools 2002).

existing expenditures, wherever they may exist, it cannot be possible to estimate the *net* new cost of implementing an adequate 0-19 model program. However, because of these expenditures already committed, the new public money required to fully implement this program should be less than the estimated average annual per child cost of about $20,000.

**c) No provision is made for recapture of displaced private spending:** In presenting this model, we also acknowledge that some of its required public expenditures could displace private spending, also resulting in less net new total spending than the model implies. For example, some excellent after-school programs are presently provided by organizations such as the Children's Aid Society, the YMCA, the Boys and Girls Clubs, and others. Some low-income families use private primary care physicians for routine and preventive health care for their children, paid for by employer-provided private insurance. The model makes no adjustment for such private spending, nor do we propose any strategy for recapture of private spending that could be withdrawn if the model were implemented.

**d) Estimates of ongoing compensatory spending for earlier cohorts are not included in cost estimates:** As noted briefly above, if the model presented here were to become policy, remedial and compensatory spending would continue to be required for earlier cohorts who were still proceeding through childhood and adolescence, without having benefited from the model program's components early in life that would have prepared these youths to succeed in school. The cost estimates set forth in this report do not include the funds presently spent on attempting to remediate at later ages the absence of adequate resources spent on development at earlier ages. If policymakers were to adopt the model proposed here, applying it to new birth cohorts, they would be obligated to continue to spend inefficient funds on remediation of earlier cohorts. Thus, for the first 19 years of policy implementation, a declining level of compensatory

spending would exist side-by-side with the costs of the model. Spending during this period would exceed the estimates of the model, until the model was fully implemented and savings could be realized.

**e) No assumption is implied that existing middle class education is adequate:** This report only estimates the costs of a 0-19 program to narrow the achievement gap – in other words, to bring disadvantaged children closer to the cognitive and non-cognitive achievement levels presently reached by typical middle class children. The costs we estimate are not the full costs of an "adequate education," but only the incremental costs of bringing disadvantaged children to the existing middle class level. Thus, we do not consider the additional costs of making a typical middle-class education more adequate. Some of our estimates require an assumption regarding the existing cost of typical middle class education. For this assumption, we take present spending levels in states which have few disadvantaged students and high average NAEP scores. We define the existing spending levels in these states as the present cost of a typical middle class education.

The states fulfilling these requirements - few disadvantaged students and high average NAEP scores - and thus used for this purpose, are Minnesota, New Hampshire, and Vermont. For example, when the model recommends that K-3 class sizes be reduced to 15 pupils per class, we estimate the cost of this reduction from the existing class sizes experienced by middle class children in these reference states. In states where class sizes are presently higher than they are in the "middle class" states of Minnesota, New Hampshire, and Vermont, the costs of implementing the model will be greater than the estimates we present. Likewise, we cannot reasonably estimate the cost of providing a teacher salary increment to attract teachers to schools serving disadvantaged students without assuming an existing salary level for teachers in schools serving

easier-to-educate students. Here again, we use existing average salary levels of teachers in Minnesota, New Hampshire and Vermont as the base from which an additional increment is calculated. All cost estimates in the model, however, are adjusted to a national level for regional differences in the purchasing power of the educational dollar.

**f) Model resources might still be insufficient for children who are most severely at risk of failure:** The model estimates costs of services for children from families with incomes of less than 125% of poverty. But the theoretical focus of the model is children from families with incomes of from 75% to 125% of poverty; we expect that the services provided in the model would give these children a meaningful opportunity to significantly narrow the achievement gap. Nonetheless, this focus – children from households with income between 75% and 125% of the poverty line – must be artificial, because most prior research on which this report relies has not attempted to specify the appropriateness of services for this slice of the disadvantaged child population. Some research demonstrating the effectiveness of particular interventions, such as early childhood and home visiting programs, has concerned extremely poor children and some research demonstrates that the interventions proposed are more effective with the most severely disadvantaged children.[26] Nonetheless, children from households with incomes below 75% of poverty are more likely to have unique problems (e.g., foster care, dysfunctional family life, neglect, infrequent parental or guardian employment) that require added services whose inclusion would add great complexity to this model. It is appropriate to begin this project by costing out services that would enable children who are close to the poverty line to substantially narrow the achievement gap. Such children are eligible for free (as opposed to reduced-price) lunch programs.[*] Modeling the cost of the additional services required for more

[*] Free lunch eligibility includes children from families with income up to 130% of poverty. Census data, however, uses 125% of poverty, not 130%, as a category cut-point.

severely disadvantaged children can be a subsequent step – with a probable goal more modest than substantially narrowing the achievement gap.

Nor does the model include children whose households had income of from 125% to 200% of poverty.[*] Children from these low-income families still require greater support than typical middle class children, but perhaps not as much support as the services modeled here. Estimates of the national cost of providing services to these children are not included in the model.

**Table 3** summarizes the income distributions of households from which children come to school. Data in column (2) refer to the children for whom services in this report should be expected to substantially narrow the achievement gap. The costs calculated in this report are generally those that would be incurred by an effort to provide recommended services to children counted in columns (1) and (2), except that in most cases, costs are calculated only for those children who attend schools where at least 50% of enrollment is comprised of such children.

[*] This is the income band reported in Census data. Eligibility for reduced-price lunch (from 130% to 185% of poverty) overlaps, but is not identical to this band.

| Table 3. | Income to Poverty Ratio of Households with 5 Year Olds, 2008 | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | *Percent of all households* | *Percent of all households* | *Percent of all households* | *Percent of all households* |
| | Below 75% of poverty | **From 75% - 125% of poverty** | From 125% - 200% of poverty | Over 200% of poverty |
| Total, All Races and Ethnicities | 16 | **11** | 16 | 57 |
| Non-Hispanic | | | | |
| White | 9 | **7** | 14 | 69 |
| Black | 32 | **15** | 15 | 38 |
| American Indian/Alaskan Native | 22 | **14** | 33 | 31 |
| Asian | 6 | **8** | 8 | 78 |
| Hawaiian/Pacific Islander | 6 | **4** | 31 | 59 |
| Multiple Races | 16 | **10** | 12 | 61 |
| Hispanic | 22 | **18** | 22 | 38 |
| Source: U.S. Census, Current Population Survey (CPS), Annual Economic and Social Supplment, March 2008. Calculations by author. | | | | |

**g) The model falsely assumes that the real resources (personnel and capital) required to implement the model are available or can be developed within the 19-year time frame:** The model we present is an idealized one. It imagines a gradual implementation over the course of 19 years. In practice, however, it would likely take considerably more than 19 years to implement such a model because of resource constraints. For example, one of our recommendations is for a reduction of class sizes for disadvantaged children in grades K-3. In the first year of implementation, only K class sizes are reduced; in the second year, smaller class sizes are added for this cohort in first grade and maintained for the next cohort in kindergarten, etc. Even this gradual implementation, however, is likely to be too rapid because of supply bottlenecks. When the state of California implemented an elementary school class size reduction program in 1996, average teacher quality declined because the supply of qualified teachers, at prevailing compensation levels, was insufficient to staff the additional classes.[27] The learning

environment also deteriorated as classes were crowded into inadequate space because the physical capacity for additional classes could not be added with enough speed.

Likewise, other elements of the model may be constrained by available resources. Establishment of health clinics in schools, for example, may be constrained by the supply of nurse practitioners and other medical professionals, making it unlikely that the model could be implemented within the 19-year time frame we propose.

In estimating the cost of the model, we use existing compensation levels for qualified teachers and other professionals. We do not estimate the additional compensation that would be required to substantially expand the supply of such professionals. Thus, the model's cost estimates may be understated in this respect.

**h) All costs have been converted to real dollar values:** The research upon which this model relies was conducted in various years, and some of it was conducted in particular states. All cost estimates have been adjusted to reflect average national costs in 2005. For this purpose, national cost estimates from other years have been adjusted using the Consumer Price Index for All Urban Consumers (CPI-U). Cost estimates based on the experience of particular states have been adjusted to account for geographic cost variation using the Comparable Wage Index (CWI) for college educated workers of the National Center for Education Statistics for 2005 (the latest year for which data are presently available).[28] In cases where data come from particular states in years other than 2005, the costs were adjusted first to 2005, using a regional sub-index of the CPI-U, and then adjusted to a national number using the CWI. The CWI should be used to convert our results to applicability for particular states. For example, the CWI 2005 index number for New York State is 1.12. Thus, our estimate of the fully implemented model's per child average annual cost in 2005 of $20,000 is equivalent to a cost of

about $22,000 in 2005 "New York State" dollars. All numbers in this report can be increased by 12% to estimate a New York State 2005 cost. For a very approximate estimate of this value in the first half of 2008, New York State 2005 dollars can be inflated by an additional 9.8%, using the Bureau of Labor Statistics' inflation estimate from 2005 to the first half of 2008 for Northeast Urban communities.

# Model Components.

## Year 1. Adequate Prenatal Care

Disadvantaged women are less likely to get adequate prenatal care.[*] Inadequate prenatal care increases the risks for maternal, neonatal and infant mortality as well as low birth weight and premature births.[29] To avoid these negative outcomes, pregnant women should routinely see a physician during pregnancy.

The American College of Obstetricians and Gynecologists (ACOG) and the American Academy of Pediatrics (AAP) recommend that regular doctor visits should be scheduled at one month increments during the first 6 months of pregnancy, every two weeks in the 7$^{th}$ and 8$^{th}$ months of pregnancy and weekly in the 9$^{th}$ month. During these visits, doctors should also provide guidance regarding adequate nutrition (daily intake of all essential vitamins and minerals, and additional iron and folic acid) for pregnant women, and should urge mothers to avoid the dangers of lead exposure, smoking and alcohol consumption during pregnancy. Recommended tests for complications, such as the Rh Factor and congenital abnormalities, and

[*] In previous work (Rothstein and Wilder, 2005, pp. 26-27), we reported that 25 percent of black mothers get no prenatal care during the first trimester of pregnancy, while 11 percent of white mothers get none. For black mothers, 6 percent get no prenatal care at all (or get it only during the last trimester, when it is almost too late) but only 2 percent of white mothers, one third the number of blacks, get no or too-late care..

ultrasound examinations to monitor fetal development, are also components of adequate prenatal care. At least one postpartum doctor's visit is also recommended.[30]

Even with this comprehensive program, healthy birth may still be at risk due to factors that medical care cannot easily manipulate - such as stress. However, adherence to the model of adequate prenatal care outlined here can make a significant positive impact on the life chances of children born to economically disadvantaged mothers.

Obstetricians typically bundle the costs of prenatal care and delivery in a single fee. The estimate we use in this model is based on average costs for recommended prenatal care and delivery services. We calculated the median costs of the recommended services from a study of a sample of 106 claims of women covered under the Maryland Health Insurance Plan (MHIP). The MHIP program provides health insurance to high risk women and its payment levels are consistent with other commercial insurance plans in Maryland.[*31] The high-risk sample, and MHIP's use of ACOG- and AAP-recommended care levels, distinguish this study from others and make it the most suitable from which to derive an estimate for our model.[†32]

The median cost is estimated for uncomplicated pregnancy and vaginal delivery and uncomplicated C-section delivery. Most pregnancies result in a vaginal delivery but about 30% result in a C-section.[33] To estimate the median cost of prenatal care for all types of deliveries, the cost estimates for each type were weighted by the national frequency of each type of delivery.

The estimate is of allowable charges actually paid by MHIP, not billed charges, because the true cost of prenatal care is what doctors and hospitals receive for their services. In addition

[*] MHIP defines "high risk" as individuals "who cannot obtain health insurance coverage…[either] because of pre-existing medical conditions…[or] the benefits [of private insurance] are limited because of your health condition" (State of Maryland, 2008, p. 2). Pregnancy is one of the qualifying medical conditions, making all pregnant uninsured Maryland residents eligible for MHIP.

[†] Data from two other reports on the costs of prenatal care validate the costs utilized. After adjustment to $2005 national dollars, the other studies suggest that adequate prenatal care costs between $9505.64 and $10,144 (Thomson Healthcare, 2007; BCBS, 2008). As described below, the MHIP cost estimate is $10,899.

to allowable charges, the model includes out-of-pocket costs, estimated from the cost of deductibles, co-insurance payments, and co-payments in traditional health plan policies. Out-of-pocket costs vary by type of delivery, with pregnancies resulting in uncomplicated vaginal births having a median out-of-pocket cost of about $1,300, or about 15% of the total costs, and pregnancies resulting in C-section deliveries having out-of-pocket costs of about $2,000, or about 18% of the total costs. Based on these data, the model estimates a total cost of adequate prenatal care to be $10, 900. The estimate does not include expenditures for a small proportion of cases with complications (e.g., gestational diabetes, HIV-transmission, extreme prematurity, etc.).

**Table 4** describes these calculations in more detail.

**Table 4. YEAR 1, PRENATAL CARE**

| | | |
|---|---|---|
| | **Allowed Insured Cost ($ Maryland 2006)** | |
| a | Prenatal Care | 545 |
| b | Vaginal Delivery | 9,115 |
| c | Cesarean Delivery | 11,908 |
| | **Out of Pocket Expenses ($ Maryland 2006)** | |
| d | Vaginal Delivery | 1,455 |
| e | Cesarean Delivery | 2,244 |
| | **National Incidence:** | |
| e | Vaginal Delivery | 70% |
| f | Caesarian | 30% |
| | Average Cost ($ Maryland 2006) | 12,201 |
| | Average Cost ($ Maryland 2005) | 11,775 |
| | **Average Cost ($ US 2005)** | **10,889** |

Sources:
a-c: Pollitz et al., 2007
e-f: CDC, 2007

## Years 1 - 19. Family Support

### a) Years 1 – 4: Nurse-family partnerships

Pregnant women, particularly those with low levels of education and economic hardship, require additional support beyond that provided by good medical care. To estimate the cost of this additional support, the model relies on the Nurse-Family Partnership (NFP), a model program for parent education during and following pregnancy. The NFP provides registered nurses (RNs) who make routine home visits to disadvantaged mothers during pregnancy and for at least two years subsequent to delivery. Typically, visits begin early in the second trimester at weekly increments for the first month, and then every other week for the duration of pregnancy. The frequency of visits increases to once each week during the first six weeks following delivery, and is then reduced to every other week from the 6$^{th}$ week to the baby's first birthday. Visits continue every other week until the baby is 20 months of age. Monthly visits then continue for another four months, until the child's second birthday.[34]

The model of this report extends NFP to include home visits for an additional year, up to the age of three. It is logical to do so, because the model (see below) proposes new family support services that are attached to pre-school, beginning at age three (Model Year 5). Extending the NFP through Model Year 4 avoids a lapse in family support services between Model Years 4 and 5. We have no authorities upon which to rely for determination of the frequency of visits during this gap year, but for the purposes of cost calculations, we assume that during this final year of nurse-family support services (Model Year 4), nurses should make monthly home visits.

During pregnancy, visiting RNs help mothers complete 24-hour diet histories, plot weight gains, coordinate visits with physicians, assess use of cigarettes, alcohol, and illegal drugs, and, if necessary, devise behavioral-change strategies to reduce use of such substances. Nurses educate women on the symptoms and signs of complications, encourage women to discuss

potential complications with their doctors, and facilitate compliance with treatment. Nurses concentrate their efforts on conditions associated with poor birth outcomes, such as urinary tract infections, sexually transmitted diseases, and hypertensive disorders of pregnancy.

After childbirth, the nurses' goal is to help mothers improve the physical and emotional care of their children. RN's teach parents to recognize signs of illness, take temperatures, and communicate with doctors' offices about their children's illnesses before seeking care.

The nurses also work to enhance parent-child interactions. Nurses help parents to understand their infants' and toddlers' communicative signals, enhance parents' interest in playing with their children in ways that promote emotional and cognitive development, and help to create safer households for children. Nurses also help women establish and clarify their own goals, to solve problems that may interfere with their educations, finding work, and planning future pregnancies.

High-quality evaluations of the NFP have found significant positive effects on pregnancy outcomes, child health and development, and family economic self-sufficiency.[35] Specifically, randomized field trials of the NFP in several geographic locations found improved prenatal health, fewer subsequent pregnancies, increased maternal employment, and increased intervals between births for mothers; and fewer childhood injuries and improved school readiness for children.[36]

The NFP also produces benefits that persist over time. By age 15, children have experienced a 48% reduction in abuse and neglect, a 59% reduction in arrests, and a 90% reduction in adjudications as persons in need of supervision for incorrigible behavior.[37] By the

time their children were 15, mothers who had participated in the NFP had 61% fewer arrests, 72% fewer convictions, and 98% fewer days in jail.[*38]

The model's estimate for this family support program assumes that nurses can visit an average of four families a day. We assume that NFP nurses are operating in neighborhoods where there is a high concentration of low-income women, so four visits a day are feasible. If more extensive travel time between visits were required, this assumption might not be valid. The model also provides one nurse supervisor and one data entry/support person for every four nurses. Other costs include office and medical supplies (including literature for parents), and mileage costs for nurses. The estimate also includes costs of ongoing professional training for nurses and program technical support.

The per family costs of a nurse home visiting program similar to the NFP, an annual average of $4,900 for four years, are displayed in **Table 5**, below. Our model assumes that these are per-child costs, although in families that have more than one child younger than three years of age, the per-child costs would be reduced.

[*] Although this report makes no systematic attempt to estimate long term savings from the model (see endnote 25 for some discussion of cost-benefit ratios), NFP generates long term public savings. Every dollar invested in the NFP results $5.70 in benefits for the highest-risk participants (Karoly, Kilburn, and Cannon, 2005). Every dollar invested in the NFP for the entire participant pool, including the highest-risk participants, results in a $2,88 benefit (Aos et al., 2004).

**Table 5. YEARS 1-4, NURSE-FAMILY PARTNERSHIP**

| | | |
|---|---|---|
| | Nurse - Patient Load (Visits per week): | 20 |
| | Annual Nurse Visits: | 920 |
| a) | Compensation (estimated, $2005): | |
| | Nurse: | $74,975 |
| | Nurse Supervisor: | $101,974 |
| | Clerical Support: | $36,059 |

| | MODEL YEARS: | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 |
|---|---|---|---|---|---|
| | Visits Per Child | 15 | 29 | 21 | 12 |
| | Costs Per Child | | | | |
| | Personnel | 3,431 | 6,714 | 4,908 | 2,778 |
| b) | Supplies, Materials, Administrative Costs | 245 | 479 | 350 | 198 |
| b) | Personnel Training and Education | 101 | 198 | 144 | 82 |
| | | | | | |
| | **Total per child ($2005)** | **3,776** | **7,391** | **5,403** | **3,058** |

Sources:
a) BLS 2008
b) NFP 2008b.

### b) Years 1 – 19: Parent Education

There is a strong positive relationship between parental involvement in children's education both in school and at home, and children's educational outcomes, their positive attitudes, and their avoidance of truancy and dropping out.[39] This is a widely and long-accepted view; the Parent-Teacher Association was established in 1910 to institutionalize these positive relationships between parents and schools.[40]

Positive parental involvement includes "parenting," the everyday things parents do in the home that support children as students, such as making sure they are fed before school and get enough sleep at night; "communicating," the home-to-school and school-to-home dialogues about school programs and children's progress; "volunteering" in the classroom and at school, helping teachers, administrators, students, and other parents; "learning-at-home" activities such as help with homework and other curriculum-related activities; "decision making" in which

parents function as school-community leaders; and "collaboration," outreach to community resources and services to strengthen school programs.[41]

Student achievement is strongly associated with parents' own educational attainment. Perhaps parents with more education place a higher value on educational success, and communicate this to their children.

Our model includes an instructional program to develop parents' capacity to engage in a range of parenting and other educational activities. The model is influenced by the Parent Academy, a program of the Miami-Dade County Public Schools that has been successful with such instruction. It offers courses at higher education facilities throughout Dade County on topics such as "Early Literacy," "Parenting for Drug Prevention," "Help Your Child Succeed In Math," "Story-telling," "Financing Your Child's College Education," "Achieving the Dream: Owning your Own Home," and "Workforce Readiness."[42]

It is difficult to estimate the cost of parent education for the model, because we cannot estimate the uptake rate – if parent education courses are offered, how many parents will enroll? Because the model also includes visiting nurses in Years 1 – 4, home literacy coaches (see below) in Years 5 – 7, and school social workers/parent coordinators (see below) in Years 5 – 19, all of whom can encourage parents to enroll in educational courses and assist them in doing so, enrollment could rise above that of the present Miami-Dade experience. However, our model also includes some duplication of services, which could reduce the costs. Part of the responsibilities of the visiting nurses in Years 1 – 4, and the home literacy coaches (see below) in Years 5 – 7, is to teach parenting skills such as those covered in some of the Miami-Dade courses described above. Parents in these years still may enroll in courses covering other topics.

In the absence of a good basis for estimating parental enrollment in such classes, we assume, as a placeholder, that the equivalent of one parent for every 10 disadvantaged children enrolls in one course at any given time. For an estimate of the cost of a course, we take the 2004-2005 average annual nationwide tuition and fees charged by public community colleges for 30 credits a year and assume that a single two-semester course represents 8 credits. Results are displayed in **Table 6.**

**Table 6. YEARS 1 - 19: Parent Education**

National Average Community College Tuition and Fees 2004-05: ($2005)

| | |
|---|---|
| For 30 credit hours: | 2,079 |
| For 8 credits: | 554 |

Per Child Cost Per Year ($2005):

| | |
|---|---|
| If One Parent of 10% of Disadvantage Students Take 8 Credits Per Year: | 55 |
| If One Parent of 20% of Disadvantage Students Take 8 Credits Per Year: | 111 |

Source for Cost of 30 Credit Hours: Chronicle 2008.

**c) Years 5 - 19: School Social Worker and Parent Coordinator**

To encourage parent involvement in schools and to provide parents with information about school services and those provided by other social service agencies and institutions of youth development, parent coordinators can serve as bridges between homes and schools, and be available to answer parents' questions about school policies, events, and rules.[*] Parent coordinators should be knowledgeable about services provided by other family support

[*] The role of school social workers/parent coordinators differs from that of family literacy coaches (in model Years 5-7). In our model, literacy coaches attempt to improve parents' abilities to help their children with reading and to make the home environment conducive to literacy development, whereas school social workers/parent coordinators have a broader responsibility to both the parents and the school.

institutions and institutions of youth development, and maintain relationships with community groups that can supplement school and home resources.

Parent coordinators are sometimes found in schools serving low-income families today, but most often these are paraprofessionals whose role is primarily to engage parents in schooling and who are not qualified to make judgments leading to formal referrals to other institutions. These paraprofessionals have recently been added to school staffs, either because the schools never had fully qualified social workers, or because these professionals had been eliminated in previous budget cuts. In New York City, each school now has a parent coordinator, required to have a college degree and two years of community experience, or a high school degree and six years of such experience. Their duties are primarily to encourage parent participation in their children's schooling, although they also may incidentally refer families to other agencies for assistance.[43]

To provide the full range of services disadvantaged families need for their children to succeed, our model provides a professional parent coordinator (usually a social worker), with knowledge of school and community resources as well as outreach and organization skills, and the ability to teach parent education classes. The model assumes that this social worker/parent coordinator is compensated comparably to the average teacher, and has a case load of 200 families. (In New York City, parent coordinators are paid comparably to paraprofessionals, and are assigned one-per school regardless of school size.[44])

The model assumes that these social work and parent coordination services would begin for pre-kindergarten students. Costs would not be significantly affected if pre-kindergarten classes were physically located in or away from an elementary school. A social worker/parent

coordinator can divide his or her time between facilities where the various students in his or her caseload of 200 are located.

The School Social Work Association of America recommends one school social worker for 400 students, but adds that "in situations where a large percentage of the school social worker's caseload is comprised of students with heightened levels of needs or risk (e.g., physically challenged, developmentally delayed, economically disadvantaged students, or at-risk students), a significantly lower staff-to-student ratio is required in order for the school social worker to effectively deliver needed services."[45] Because our model attempts to focus on economically disadvantaged students, and without further guidance from the School Social Work Association of America, we use a social worker to student ratio of 1:200.[*]

Our model defines the cost of services as the cost per disadvantaged student served (i.e., those from families whose incomes are below 125% of poverty). In the elements of the model described previously (prenatal care, nurse-family partnership, and literacy support), costs were easily calculated for children and parents who comprise this demographic group, because only these children and parents receive the model services. In the present case, however, all students in a school receive services that the school provides, although presumably students from less disadvantaged families would require less attention from social worker/parent coordinators.

Thus, in practice the ratio will be lower than 1:200 (i.e., fewer social worker/parent coordinators per disadvantaged student) because these professionals will work in schools where not all students are disadvantaged. If social worker/parent coordinators worked in schools where all students were disadvantaged, then the per (disadvantaged) student cost of this service would

[*] The appropriate caseload does not only depend on problems parents experience at home and in their communities. It also depends on the extent to which school social workers are able to help schools create a culture that promotes positive adult interactions for student development and that decreases behavior and performance problems (Comer 2008).

simply be the professional compensation divided by 200. If, however, these professionals worked in schools where only 50% of students were disadvantaged, the per (disadvantaged) student cost would double. The model utilizes a mid-point between these extreme cases.

Another source of inefficiency in the model is that school enrollments are not necessarily divisible by 200. In cases where they are so divisible, or approximately so, social worker/parent coordinators can divide their time. For example, two nearby schools, each with enrollments of 300, can share the services of three social worker/parent coordinators. This, however, is unlikely to be so neatly true, requiring the use of the higher 1:200 ratio.

As with literacy coaches for younger children, the per student costs of social worker/parent coordinators would be less in cases where disadvantaged families have more than one child in grades K-12. The model makes no adjustment for this possibility.

**Table 7** shows that the average annual per disadvantaged student cost of this family social work support in Years 5 - 19 is about $600 for 15 years, accounting for the reality that such social workers will be placed in schools where they will serve middle class as well as advantaged children. Our model also assumes that these are per-child costs, although in families that have more than one child in school, the per-child costs would be reduced because the social worker to student ratio could be reduced below 1:200.

**Table 7. YEARS 5 - 19: School Social Worker and Parent Coordinator**

| Cost ($ 2005, US) | | |
|---|---|---|
| Compensation, School Social Worker/Parent Coordinator | 60,102 | |
| Compensation, Half-time Clerical Support | 18,030 | |
| Supplies, Materials, Administrative Costs | 5,570 | |
| Personnel Training and Education | 2,300 | |
| Service Ratio (Professional::Student) | 200 | |
| Costs, Per Disadvantaged Child ($ 2005, US): | | Annual, Years 5 - 19 |
| In Schools Where All Students are Disadvantaged: | | 430 |
| In Schools Where 50 Percent of Students are Disadvantaged: | | 860 |
| **Midpoint: Cost Per Child** | | **645** |

### d) Years 5 – 7: Early Childhood Literacy Support

Outreach to parents, specifically home visits, remains important as children near the age of school entry. However, the nature of home visits changes in Year 5 (with three year olds), as services of the nurse-family partnership are replaced with home visitors who emphasize literacy support for parents. Home visits in model Years 5 - 7 are modeled after the Home Instruction Program for Preschool Youngsters (HIPPY). The HIPPY program consists of biweekly home visits by trained paraprofessionals who have been recruited from the local community. During the visits, the paraprofessionals supply parents with educational books and toys, instruct parents in how to teach their children and how to make home environments conducive to learning, and assist both parents and children with the transition to kindergarten. Parents also attend group meetings every other week.[46]

HIPPY is cost-effective as an early intervention program.[47] After participating, parents spend more time reading to their children, more time talking to their children about books, and more time teaching them the alphabet. The parents also have greater knowledge about the way children develop and learn.[48] Children of HIPPY parents are more likely to perform at or above

grade level on standardized vocabulary tests, to have higher grades, to have better classroom behavior, and to have lower levels of school suspensions than other children; these positive effects persist through the sixth grade.[49] Cost-benefit studies of HIPPY estimate that the return to each dollar spent on HIPPY is $1.80.[50]

For our model, we assume that these paraprofessionals, working half time, are paid comparably to K-12 teacher assistants with two-year degrees. Each paraprofessional, or home visitor, has responsibility for literacy coaching with 10 families. We assume that a program coordinator oversees 6 paraprofessionals, and this coordinator is compensated comparably to a regular teacher.[*]

The per child costs of this literacy support program, similar to HIPPY, an annual average of $5,500 for three years, are displayed in **Table 8**, below. These calculations assume that there is one eligible child per family. In cases where families have more than one child from 3 to 5 years of age, costs would be lower, but the model makes no adjustment for this possibility.

[*] As described elsewhere in this report, the model's reference is average teacher compensation for teachers in New Hampshire, Vermont, and Minnesota. For salary, we use a weighted (by number of elementary and secondary teachers) average of these states' average salaries. We add a standard benefit percentage of 23 percent (Allegretto, Corcoran and Mishel, 2008, Table 7, page 32) to all salary calculations for all programs in the model, including teachers and other personnel.

**Table 8. YEARS 5 - 7, Early Childhood Literacy Support**

| | |
|---|---|
| Home Visitor Load (Families): | 10 |
| Home Visitor Load (Visits per week): | 6 |
| Home Visitor Load (Group meetings per week): | 0.5 |

| | Number (Per 60 Families) | Compensation ($2005, US) |
|---|---|---|
| Home Visitor (Paraprofessional): | 6 | 38,476 |
| Program Coordinator: | 1 | 60,102 |
| Clerical Support: | 0.4 | 36,059 |

| MODEL YEARS: | YEAR 5 | YEAR 6 | YEAR 7 |
|---|---|---|---|
| Home Visits per family: | 26 | 26 | 26 |
| Group Meetings per family: | 26 | 26 | 26 |
| Costs Per Child ($2005, US): | | | |
| Personnel | 5,075 | 5,075 | 5,075 |
| Supplies, Materials, Administrative Costs | 316 | 316 | 316 |
| Personnel Training and Education | 118 | 118 | 118 |
| **Total per child ($2005)** | **5,508** | **5,508** | **5,508** |

Source: HIPPYUSA, 2008, with various adjustments. Details available from authors.

## Years 2 - 6: High Quality Early Childhood Care and Education

Existing high quality early childhood care and education (ECCE) programs include both exemplary programs and large-scale publicly funded programs (i.e. Head start). Although characteristics of high quality early childhood care and education programs vary, exemplary programs tend to be of even higher quality than high quality large-scale public programs. In general, exemplary programs employ more highly qualified staff, engage in closer supervision by child development experts, have higher staff-to-child ratios and smaller group sizes than large-scale publicly funded programs. Consequently, exemplary programs are more expensive and produce more significant educational gains than large-scale publicly funded programs.

The model we estimate relies upon components with proven effectiveness in evaluations of exemplary programs. Early childhood experts frequently cite three exemplary programs: the High Scope/Perry Preschool Project, The Abecedarian Project, and the Chicago Child-Parent Centers (CPCs). Each of these has demonstrated both short- and long-term positive benefits. All three programs increase children's IQs for the years immediately following participation, result in fewer special education referrals, increase the likelihood of high school graduation and college attendance, and result in higher employment rates when participants reach their twenties. Two programs (Perry Preschool and Chicago CPCs) also reduce criminal behavior. The Abecedarian program and the Chicago CPCs enhance the quality of parent-child interactions, and improve parental involvement in education.[51]

The three programs vary in intensity, curricula, and other programmatic details. However, all three share key components: Each targets disadvantaged children; begins serving children no later than age three; employs educated, well trained, and adequately compensated teachers; maintains high teacher-child ratios; and includes a parental outreach/home visitation component. Because there is strong evidence of the effectiveness of each program across multiple outcomes, our model employs these shared features as the chief characteristics of the early childhood care and education program.[*]

Evaluations of the three programs conclude that the intensity of the program is crucial; high intensity programs, beginning in infancy and enrolling children in full-day and full-year programs, are the most effective.[52] Therefore, the model includes the cost of a full-day and full-year early childhood care and education program beginning in Year 2.

Our model's early childhood care and education program follows the guidelines for high

[*] The model does not include the cost of parental outreach/home visitation as part of ECCE, because these costs have already been included in the NFP and HIPPY model components.

quality early childhood programs set forth by the National Institute of Child Health and Human Development and the National Association for the Education of Young Children (NAEYC).[53] The early childhood care and education program employs one qualified teacher with some post-secondary education **(**certification or a college degree in child development, early childhood care and education, or a related field) for every three children from the ages of 6 to 18 months, one similarly qualified teacher for every four children from the ages of 18 months to two years, one teacher for every seven two year olds, and one teacher for every eight children from the ages of three to five. NAEYC's standards also include a program director and administrative support staff person for every 60 children served.

The model also includes costs of administrative and support staff, overhead, supplies, transportation, food, and capital depreciation and interest. The model estimates that the average annual per child cost for five years of ECCE is $15,800. **Table 9** displays this result.

**Table 9. YEARS 2 - 6: High Quality Early Childhood Care and Education**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Compensation ($2005): | | | | | | |
| a | Teacher | 60,102 | | | | | |
| b | Program Director | 95,390 | | | | | |
| b | Clerical Support | 33,907 | | | | | |
| | MODEL YEARS: | | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
| c | Children Per Teacher | | 3 | 3.5 | 7 | 8 | 8 |
| | Costs Per Child: | | | | | | |
| | Personnel | | 22,189 | 19,327 | 10,741 | 9,668 | 9,668 |
| d | Supplies, Materials, Administrative Costs | | 1,049 | 1,049 | 1,049 | 1,049 | 1,049 |
| e | Personnel Training and Education | | 653 | 569 | 316 | 285 | 285 |
| | **Total per child ($2005):** | | **23,891** | **20,945** | **12,106** | **11,002** | **11,002** |

Sources:
a NCES 2008b, Tables 76 and 79; and see text
b BLS 2008, 11-9032 and 43-6014
c NAEYC 2008; and other
d Reynolds et al. 2002
e Estimated by authors from NFP ratio

## Years 2 - 19: Routine and Preventive Pediatric Care

Low-income children have inadequate access to health services, inhibiting their healthy physical and cognitive development.[54] Public discussion centers largely around extending health insurance to low-income working families with children (the lowest-income families are already mostly insured by Medicaid and S-CHIP). However insurance coverage alone will not address low-income children's lack of routine and preventive care. Poor children are less likely than non-poor children to utilize health services even when coverage exists,[55] partly because of the absence of sufficient numbers of primary care physicians in low-income neighborhoods. Even where neighborhood providers are present, low-income parents typically are employed at hourly-paid jobs where time-off is not granted to take children to appointments for routine and preventive care. Low income parents are less frequently available to spend time monitoring their children's general health and their health records, and low income parents' own poorer physical or mental health renders them less able to monitor routine children's health needs.[56] A few measurable differences in children's health and in the health of their mothers (particularly, the frequency of depression) accounts for approximately 25% of the black-white achievement gap.[57]

Insured low-income children typically get treatment for emergencies or more serious illnesses at neighborhood clinics or emergency rooms, but not the routine and preventive care that middle class children typically receive. As a result, there are large disparities between low-, middle-, and high-income children in birth weight, immunization status, and the incidence of lead poisoning, asthma, anemia, ear infections, hearing loss, and stunted growth.[58] The greater frequency of non-serious illnesses among low-income children results in greater absenteeism rates.[59] The school attendance gap alone explains part of the achievement gap.

There are also gaps between middle class and low-income children in optometric and

dental care. Again, the problem is not only insurance, but access to routine and preventive care. Children covered by Medicaid are almost twice as likely to have untreated dental decay as children with private insurance.[60]

For these reasons, the model includes school-based clinics that provide routine and preventive pediatric, dental and vision care in schools serving disadvantaged children from kindergarten through the 12th grade (i.e., ages 5-18, or Years 7-19 of the model). School-based clinics can provide routine and preventive care without the necessity of parents taking time off from work. School-based clinics can also ensure that children are seen on a regular and recommended schedule for such care, without the necessity of parent initiative for appointments.

Because of the association of low student achievement with poor maternal health, the school-based clinics should also provide for routine and preventive care for parents, with referrals to other providers for non-routine care. Healthier parents are better able to provide developmentally nurturing environments.

The model's school-based clinics also provide for routine and preventive care for young children before they enter school – i.e., from birth to age 5, or Years 2-6 of the model. In practice, providers of this medical care may be located away from schools and in communities, or parents may bring their young children to school clinics for routine and preventive care. If, in practice, routine and preventive care for infants and toddlers is provided at facilities away from the school site, the costing-out of such care is similar to the costing-out of care for older children, taking account of the fact that recommended intervals for routine care vary by age. Thus, the model provides routine and preventive care for all children from birth through age 18 in a single model component (school-based clinic), without necessarily implying a recommendation that very young children should, in practice, receive their routine and preventive care at local

elementary or secondary schools.

School-based health clinics provide access for children at school sites to medical professionals who schedule routine visits with children (e.g., seven infant visits, three visits for one-year-olds, biannual visits for children from ages two through 10, and annual visits for children from ages 11 to 18), conduct basic health screenings, ensure proper and timely immunizations, maintain children's health records, provide vision and hearing screenings as well as routine vision correction and vision therapy, provide routine dental care, conduct mental health assessments, and make referrals to specialists when appropriate.

Empirical research on the link between school-based health clinics and academic achievement is limited. The methodological challenges facing many educational program evaluations, such as defining and measuring the treatment and outcomes, access to student level treatment and outcome data, and establishing clear treatment and control groups, plague the research on the effect of school-based health clinics on academic achievement.[61] Outcomes vary with treatment definitions (presence of a clinic, registration with a clinic, or frequency of clinic visits). If the measured treatment is presence of a clinic, outcomes could be more modest than if the treatment is frequency of visits.

Further, it is easier to measure the direct impacts of school-based health clinics on behavior that may be achievement-related, than on the indirect impacts on academic achievement itself. For example, a reduction in chronic illness-related absences due to routine and preventive services provided by a school-based clinic positively influences academic achievement by increasing the amount of time students are in class. Thus, the more rigorous research on the academic effects of school-based health clinics finds positive influences on attendance and tardiness.[62] Other positive indirect academic effects found in one or two studies are grade

promotion,[63] lower dropout rates,[64] and higher educational aspirations and greater credit accumulation.[65] School-based clinics also positively affect health care utilization rates,[66] mental health and sexual behavior[67]- all factors that influence academic achievement. In sum, school-based health clinics have the potential to raise academic achievement for disadvantaged children, and thus narrow the achievement gap.[68]

The model's school-based health clinics include site-based medical professionals (doctor, nurse practitioner, or physician's assistant; registered nurse; qualified mental health provider; dentist; dental hygienist; optometrist; and vision therapist who schedule routine visits with students at age appropriate intervals throughout the year, conduct basic health screenings, ensure proper and timely immunizations, and maintain children's health records.

Our model estimates the costs of some components by relying upon a recent report from the State of Oregon, and salary data from the Current Population Survey. Oregon's School Based Health Centers Program has produced the most reliable, comprehensive cost study of school-based health clinics to date. However, some elements of our model of school-based health clinics are not included in Oregon's cost study, such as dental care and vision therapy, and annual physical examinations for parents. Therefore, the model supplements the Oregon estimates to generate its cost estimate for a comprehensive school-based health clinic.

We include staff salaries and benefits; utilities; office, program and medical supplies; medication; information technology; staff training and education expenses; and start-up capital costs.[*] Because personnel compensation comprises the biggest share of costs, we disaggregate by personnel type the comprehensive health services provided in the school-based health clinics.

[*] The model amortizes start-up costs over 30 years, with a 4% interest rate. Start-up costs include building renovation, furniture, electronic, office, and medical equipment, as well as an additional quarter time administrative staff member for the first two years and the development of a business plan. Because data on dental equipment cost were not available, these are not included.

The model's school-based health clinics provide year-round care to students and their parents. The frequency of visits with a primary pediatric care giver (physician, nurse practitioner, or, the professional used in the model: physician's assistant [PA]) decreases as children mature. Based on recommendations of the American Academy of Pediatrics, the model provides for infant visits at ages of two weeks, four weeks, and two, four, six, nine and 12 months. The model provides for one year olds seeing a PA three times, at 15, 18 and 24 months. Children from the ages of two through 10 should have biannual visits with the PA. Students from the ages of 11 to 18 and the parents of all children should have annual visits with a primary care professional.[69]

A qualified mental health professional should be available to work with children and parents needing such services for weekly one hour sessions for three month increments. The model assumes that about one fifth of the target population will be in need of mental health services at any given time.[70]

Beginning at age 3, and continuing through age 17, the model provides for a routine biennial optometric exam.

Some children, however, have vision difficulties that require therapy beyond the prescription of corrective lenses. Although there have been a few case studies, there is no systematic research on the extent to which low-income children's academic performance suffers because of vision difficulties. In some cases, these difficulties do not require corrective lenses, but rather therapy to train children to use their eyes to track, focus, and converge on printed material.[71] It may be, although there is yet no evidence to support this, that such therapy would be less necessary if children developed adequate fine motor skills in high quality early childhood care and education programs. Nonetheless, although some case studies support higher estimates, the model assumes that one-half of disadvantaged children would benefit from optometric

support. One Baltimore experimental program to provide such support, with beneficial academic achievement results, cost about $1,675 per pupil receiving services in 2002. The vision therapy program consisted of four weekly 30 minute sessions, continuing for about 20 weeks. Because of pressure to demonstrate results in a timely manner, the program served fourth grade students. However, the research report notes that "If the study had been established with a five- to seven- to 10-year follow-up from its inception, then younger age groups would have been selected because the intervention would have consisted of a simpler program that could have served more children for the same investment of time, effort, and energy." [72]

Therefore, the model adopts the costs of vision therapy, with appropriate adjustments for inflation and regional cost differences, in Year 7 (kindergarten) instead of Year 11 (fourth grade). Because, as with so much else in our model, it is less expensive to prevent failure than to remediate it, the per pupil costs of providing vision therapy to kindergartners who need it would be about 40% of the costs of providing it to fourth graders.[73]

The model provides for biannual dental visits, including dental hygiene treatment, for all disadvantaged parents and children, beginning in Year 2 for parents and Year 3 for children.

The model also includes the costs of a quarter-time director and ¾ time clerical worker in each clinic – in other words, the model assumes that each clinic director can supervise four clinics.

Because of varying needs at different points throughout children's development, the model estimates of the per child cost of a school based health clinic differ by year. As **Table 10** shows, the average annual per-disadvantaged child cost (including the cost of routine and preventive care for parents) of a clinic serving children throughout the 18 year development cycle is about $700. Table 10 displays this result.

This result includes providing routine and preventive health care for all children and parents in Model Years 7-19 in schools where 75% of students are disadvantaged. If school-based health clinics were located in schools where all students were disadvantaged, then the average annual per-disadvantaged child cost (including the cost of routine and preventive care for parents) of a clinic serving children throughout the 18 year development cycle would be about $500. (This is approximately equal to the per student estimated cost of placing a health clinic in a school where all students were served, irrespective of disadvantaged status.)

**Table 10. Years 2 - 19: Routine and Preventive Pediatric Care**

| | Personnel: | Compensation ($2005) |
|---|---|---|
| a | Physician's Assistant | 90,372 |
| a | Nurse (LPN) | 45,232 |
| a | Dentist | 170,765 |
| a | Dental Hygienist | 75,399 |
| a | Qualified Mental Health Professional | 48,694 |
| a | Optometrist | 118,296 |
| b | Clinic Director | 60,102 |
| b | Administrative support | 40,511 |

| | MODEL YEARS: | 2 | 3 | 4 | 5-6 | 7 | 8-12 | 13-19 |
|---|---|---|---|---|---|---|---|---|
| | Per Child Costs: | | | | | | | |
| | Children: | | | | | | | |
| | Medical Care | 229 | 98 | 66 | 66 | 66 | 66 | 33 |
| | Mental Health | | | | 85 | 85 | 85 | 85 |
| | Dental Care | | | | 96 | 96 | 96 | 96 |
| | Optometric Care | | | | 7 | 342 | 7 | 7 |
| | Parents: | | | | | | | |
| | Medical Care | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| | Mental Health | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| | Dental Care | 96 | 96 | 96 | 96 | 96 | 96 | 96 |
| | Optometric Care | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | Administration | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| | Clinic Costs, Per Child: | | | | | | | |
| | Personnel | 503 | 319 | 286 | 474 | 809 | 474 | 441 |
| c | Supplies, Materials, Administrative Costs | 49 | 49 | 49 | 49 | 49 | 49 | 49 |
| c | Personnel Training and Education | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **Total per child ($2005):** | **555** | **371** | **339** | **526** | **861** | **526** | **494** |

Sources (also see text):
a BLS 2008
b Authors' estimates
c Nystrom and Matthews 2007.

## Years 5-19: High Quality Before- and After-School and Summer Programs

Children spend most of their time outside of school, making out-of-school programs an essential aspect of efforts to narrow the achievement gap. What happens outside of school has direct impact on school outcomes.

The positive adult-child interaction that occurs during after-school and summer programs is important not only for what it provides, but also for what it might prevent. Students without adult supervision in the after-school hours are at significantly greater risk for pregnancy, arrest, truancy, stress, poor grades, substance abuse, and other risk-taking behaviors. Students are most likely to become perpetrators or victims of crime in the first few hours after school; the juvenile crime rate triples between the hours of 3:00 and 6:00 pm.[74] Out-of-school programs promote avoidance of these risks.[75]

Children whose out-of-school time includes 20 to 30 hours each week of constructive learning activities, such as discussions with knowledgeable adults or peers, reading, writing, and problem solving games, do better in school than those whose out-of-school time does not include such activities.[76]

Low-income children are less likely to have access to quality after-school and summer programs.[77] Their parents, having less time, money, and education, are less able to extend their children's learning outside of school. Less-educated parents are less able to help their children with homework; the achievement gap may be sustained or widened because schools have assigned increasing amounts of homework in recent decades.[78]

While many children may experience some summer learning loss, the loss is more severe for low-income children than for middle- and high-income children.[79] Specifically, the reading skills of very young low-income children remain stagnant during the summer, perhaps because

they are less likely to be read to by adults during the summer than are children from high-income families.[80] Families in low-income communities have less access to public libraries and to retail stores selling books for children.[81] During the summer, math skills of low-income children also decline.[82] As middle- and high-income children do not experience summer skills stagnation or declines similar to those experienced by low-income children, the achievement gap widens during the summer months.[83] "About two-thirds of the total [achievement gap between high SES and low SES children] traces to summer learning differences over the elementary years. The low SES group actually gains a bit more during the corresponding school years than does the high group (5.2 points, not a significant difference), but this favorable showing while in school is more than offset by their summer shortfall."[84]

Because participation in after-school and summer programs is usually voluntary (except where academic remediation is required for grade promotion in some grades and in some school districts), rigorous empirical evaluations of these programs' effectiveness are limited.[85] However, a comparison of low-income students attending structured after-school programs, with similar students having other types of after-school care (maternal care, self-care, informal adult supervision), finds that students attending structured after-school programs perform better in math, reading and other subjects and receive better conduct ratings than students with more informal after-school arrangements.[86] Children attending high-quality after school programs perform better than peers on social and emotional adjustment, school conduct, grades, attendance, homework completion, achievement test scores, peer relations, and other measures.[87]

There are similar positive links between student outcomes and participation in youth development activities sponsored by organizations other than schools.[88]

These many research findings have recently been summarized not only by Heather Weiss

et al. in their review for the Center on Education Policy, but in reviews by Beth Miller for the Nellie Mae Education Foundation.[89]

There are insignificant cost implications for locating after-school and/or summer programs at school sites or at separate facilities. Our model assumes that these programs would be located at school sites, but it is not necessary that this be the case. An advantage of school-based after school and summer programs is the potential to foster continuity between school and program. They can ensure a focus of time and resources on academic activities that are aligned with school curricula and goals, and that are responsive to student need in relation to those goals.[90] But a danger of school-based programs is that they may become too heavily focused on academic remediation or extended academic time, and give insufficient attention to developing the organizational, athletic, and cultural traits that middle-class students typically develop in the after-school hours. After-school and summer programs should provide activities that are not simple reiterations of school-day activities, but instead offer students the opportunity to choose from a variety of enrichment and recreational opportunities not typically available during the school day.[91] Program staff should possess an adequate level of literacy to help children with learning and be diverse enough in their own interests and talents to develop and lead students in enrichment and recreational activities.[92] High-quality programs should have access to facilities and other resources necessary to offer this wide array of activities.[93]

High-quality school-based programs generally employ one staff member for every 10-to-15 students, with a site coordinator, or program director, to oversee the operations of the program and work with the school principal to coordinate school and program goals and activities.[94] High quality after school and summer programs are in operation as many hours as regular school, have professional or paraprofessional staff as large as those of regular school, and have activities and

curricula as diverse as those of regular school. Our model, therefore, assumes that site coordinators would have qualifications similar to those of school principals.

One-on-one tutoring should be part of an after-school or summer program.[95] It can increase reading achievement and other academic outcomes in the early grades, most notably when it employs certified teachers as tutors.[96] Therefore, our model includes the cost of one hour per student per week of one-on-one time with a qualified academic tutor. The model assumes that this tutor would be a paraprofessional, with a two-year degree, with qualifications and compensation similar to the visiting home literacy coaches in Model Years 5-7.[*] The model also provides supervision of tutors by regular teachers, in a 1:10 teacher-to-tutor ratio, who diagnose learning deficits, choose materials, design tutoring curriculum, and otherwise guide the tutors.

One to two hours a week of tutoring has beneficial effects, but research demonstrating these effects has concerned pull-out tutoring during the regular school day, not after-school or summer tutoring.[97] Many middle class children get more than one hour a week of after school academic support (such as help with homework) from educated parents. The tutoring supplied under No Child Left Behind's "supplemental education services" component (usually delivered in small groups, not to individuals) can often approximate an average of one hour per week per student outside the regular school day. Yet some highly regarded after school programs today offer less individual tutoring. The After School Corporation's model program prescribes one certified teacher or teacher's aide for 90 minutes, three days per week, for 30 children, or an average of 15 minutes per week of tutoring per child.[98] In the absence of definitive research, our model's one hour of tutoring per week per child seems to be a reasonable minimum.

[*] BLS 2008 data do not distinguish between the compensation of paraprofessionals (teacher assistants) with two-year post-secondary degrees and those who have only high school degrees or less. In the absence of authoritative data, the model provides a pay rate of $15 an hour for a year-round full time paraprofessional teacher assistant.

Some cost estimates in our after-school model rely upon data from the Boston-based organization, Parents United for Child Care, which convened a working group of parents, public school educators, out-of-school time providers, and representatives from health care, juvenile justice, business, child welfare, mental health and local, state, and federal government agencies, to develop and cost-out a year-round, out-of-school program.[99] The model program operates for five hours after school, and for five hours on Saturdays for the 38 weeks of the school year. For the other 14 weeks of the year, holidays and school vacations, the program operates for ten hours a day. The program employs one adult direct care staff member for every 10 children. We adopt these guidelines, with the assumption that, in addition to the tutoring program described above, a fully trained teacher would supervise 10 paraprofessionals who, in turn, would guide cultural, organizational, athletic, academic, and other enrichment activities.

The model assumes a school-based after school and summer program, located in elementary and middle schools with enrollment of 500, and in high schools with enrollment of 1,000. The model's cost estimates include compensation for site coordinators and administrative staff, food, educational and administrative supplies, transportation for field trips, occupancy costs, liability insurance, and other administrative costs. As **Table 11** shows, the model estimates that the average annual cost for 13 years of providing a high quality after school and summer program is about $16,000 per disadvantaged student.

## Table 11. Years 7-19: Before- and After-School and Summer Programs

| | Personnel | Compensation ($2005) | |
|---|---|---|---|
| a | Site Coordinator (High Schools) | | 111,063 |
| a | Assistant Site Coordinator (High Schools) | | 89,745 |
| a | Site Coordinator (Elem and Middle Schools | | 83,026 |
| | One-on-one Tutors | | 38,476 |
| | Tutoring Supervisor | | 60,102 |
| | Enrichment Teachers | | 38,476 |
| | Enrichment Supervisor | | 60,102 |
| | Clerical Support | | 33,907 |
| | MODEL YEARS: | 7 - 15 | 16 - 19 |
| | Per Student Costs: | | |
| | Site Coordination (Program Directors) | 166 | 201 |
| | One-on-one tutors | 1,450 | 1,450 |
| | Tutoring Supervison | 226 | 226 |
| | Enrichment teachers | 4,349 | 4,349 |
| | Enrichment supervision | 679 | 679 |
| | Clerical Support | 34 | 68 |
| | After School and Summer Program Per Student Costs: | | |
| | Personnel | 6,905 | 6,974 |
| b | Supplies, Materials, Administrative Costs | 3,651 | 3,667 |
| | Personnel Training and Education | 203 | 205 |
| | **Total per student ($2005):** | | |
| | Costs, Per Disadvantaged Child ($ 2005, US): | | |
| | **For Programs Where All Students are Disadvantaged:** | 10,759 | 10,846 |
| | For Programs Where 50 Percent of Students are Disadvantaged: | 21,518 | 21,693 |
| | **Midpoint: Cost Per Student** | 16,139 | 16,270 |

Sources
a BLS 2008
b Wechsler et al. 2001

As noted above, this $16,000 per disadvantaged student estimate includes the cost of providing this program for students who are not disadvantaged, assuming that disadvantaged students comprise 75% of total school enrollment. If the calculation were made of the costs of providing a high quality after school and summer program for disadvantaged students in schools where all students were disadvantaged, the average annual per-disadvantaged student cost over 13 years would be 11,000.

**Years 2-19: Adequate Teacher Salaries**

Teachers prefer to work with higher-achieving, non-minority and non-poor students, because such students offer greater opportunities for success.[100] Teachers are more likely to choose work in schools serving disadvantaged students if offered increased compensation for teaching in such schools.[101]

Retention rates for teachers in hard-to-staff schools also increase with higher salaries. Teachers working in schools with large concentrations (over 50%) of minority students are almost twice as likely to transfer from school-to-school as teachers working in schools with small concentrations (less than 5%) of minority students. When asked to identify the policies most likely to retain them in hard-to-staff schools, teachers' first preference is improved compensation; second is more effective student discipline policies that make schools safer and free teachers to concentrate on instruction; third is reducing class size.[102]

Although the desirability of pay differentials to attract teachers to, and retain them in, schools serving disadvantaged students is widely recognized, there have been few sustained policies to do so. This absence of experience makes it difficult to determine the magnitude of salary supplements required to have significant effects on recruitment and retention. One investigation found a 17% reduction in teacher turnover from offering a salary supplement of $1,800 to certified math, science, and special education teachers for work in low-income or low-performing middle and high schools in North Carolina. The effect was strongest for experienced teachers with 10 to 30 years of experience. However, the short implementation (the program was only in place for three years) and limited publicity of the pay-differential program may result in an underestimate of its effect on retention.[103]

Salaries alone, however, are not enough to attract teachers to schools with high proportions of minority and poor students. Working conditions that enhance the likelihood of success also play a large role in attracting and retaining teachers.[104] The most important of these conditions is the readiness to learn, social maturity, and self-discipline of disadvantaged students. The model's early childhood and family support components contribute to these characteristics. Reduced class size in the early grades for disadvantaged students who need more adult attention also makes teaching more effective and thus more attractive. So does smaller school size, to the extent it makes teacher collaboration, effective school leadership, and sustained adult-child relationships more likely. There are other improvements in working conditions which have no cost implications, the most important being improved school leadership. At present, there is no way to know how much additional compensation would be required to attract teachers to hard-to-staff schools, once working condition improvements were in place.

In the absence of experience to answer this question, the model uses the estimate from the study of North Carolina math, science, and special education teachers, mentioned above. The $1,800 salary supplement, which had a positive effect on teacher recruitment and retention in hard to staff schools, was equivalent to a 5% increase in average salary. Therefore, the model provides a 5% salary increment to attract and retain teachers in schools serving disadvantaged students who come to school ready to learn.

The model uses as its base annual teacher salary the average teacher salaries in Minnesota, New Hampshire, and Vermont, adjusted to national dollar purchasing power. A 5% salary increment is about $2,386.

The model provides this compensation supplement to all teachers in ECCE and K-12 who serve disadvantaged students; i.e., model Years 2-19. Because ECCE for children from birth to 3

years of age is not universally provided in any state, and is only provided universally for children ages 3 and 4 (pre-kindergarten) in a few states (and is not compulsory anywhere), the model assumes that only children in the target group, that is, below 125% of poverty, will receive ECCE. The model estimates the cost of ECCE teachers' compensation incentives, assuming that all of the students in the ECCE teachers' classrooms are disadvantaged. This methodology results in an annual average per disadvantaged student cost of the teacher compensation supplement for ECCE teachers (Model Years 2-6) of about $500 over the 5 years of ECCE.

The annual average per disadvantaged student cost of the salary increment is about $200 over the 13 years of grades K-12. Costs per disadvantaged student are lower than in ECCE because there are fewer teachers per student, a factor which more than offsets the higher cost attributable to the fact that the estimate assumes that non-disadvantaged students also benefit from the increment in K-12 schools where approximately 75% of the students are disadvantaged.

For the entire span for which the model provides a teacher incentive (Model Years 2-19), the average annual per disadvantaged student cost of the incentive is about $300 over the full 18 years.

**Table 12** displays these results.

## Table 12. Years 2-19: Teacher Incentives for Hard to Staff Schools

| | |
|---|---|
| Teacher Salary in Schools Serving Students Who are Not Disadvantaged: Average Teacher Salary in Reference States (Minnesota, New Hampshire, Vermont), Weighted by Enrollment in These States, and with Cost Adjustment to U.S.: | 48,736 |
| North Carolina Incentive: | 5% |
| Value of Incentive Per Teacher: | 2,410 |

| | Students Per Teacher: | |
|---|---|---|
| | Infants: | 3 |
| | 1 year olds: | 3.5 |
| | 2 year olds: | 7 |
| | Pre-K | 8 |
| | K-3 | 15 |
| a | 4-12 | 21 |

| MODEL YEARS: | 2 | 3 | 4 | 5-6 | 7-10 | 11-19 |
|---|---|---|---|---|---|---|
| Per Child Costs: | | | | | | |
| Per Disadvantaged Child, If 100% of Students in Class are Disadvantaged: | | | | | | |
| Teacher Incentive: | 803 | 689 | 344 | 301 | 161 | 114 |
| Per Disadvantaged Child, If 50% of Students in Class are Disadvantaged: | | | | | | |
| Teacher Incentive: | b | b | b | b | 321 | 228 |
| **Midpoint:** | | | | | **241** | **171** |

a Average class size in reference states
b In Model, only disadvantaged students are provided with ECCE.

If a teacher incentive were provided to teachers in schools were all students were disadvantaged, the average annual per disadvantaged student cost over 18 years would be about $200.

Experience will determine whether this 5% salary increment is, on the one hand too small, or on the other unnecessary. The most important factor affecting this judgment is whether other components of the model succeed in making the working conditions more attractive for teaching in schools serving disadvantaged children. Such children who receive adequate prenatal care, routine and preventive health care, improved family support, quality early childhood care and education, reduced class size in the early grades, and quality after-school and summer

programs should come to school better prepared to learn, with fewer behavioral problems, and be more rewarding to teach even without the added inducement of a substantial pay increment.

## Years 7 - 10: Reduced Class Size

Reduced class size for disadvantaged children in the early elementary school years can narrow the achievement gap.[105] Because these children may get less adult attention in families with more siblings and where parents work longer hours, increasing the teacher-child ratio in school may somewhat offset this lack of adult interaction. Teachers in smaller classes tend to individualize instruction more, and this is most effective for students who get less individualized instruction at home; this human capital investment by a teacher is a greater proportion of the total human capital investment in disadvantaged than in advantaged students.[106] For disadvantaged students, class sizes of fewer than 20 in grades K-3 yield achievement benefits, with 13 to 17 students apparently the ideal size.[107] Effects of such reduced class size persist through at least the tenth grade.[108]

Based on these findings, our model includes K-3 class sizes of 15 for disadvantaged students.

Recall that our model only calculates the additional cost of providing adequate services to disadvantaged students, over and above what is presently spent on an adequate education for middle-class children, which we have defined as the resource practices of the relatively higher achieving, middle-class reference states of Minnesota, New Hampshire, and Vermont. To determine how many new classrooms must be created nationwide to accommodate a K-3 class size reduction to 15 students, the model begins with the total number of students nationwide who are in K-3 classrooms where a majority of students are free- or reduced-price lunch-eligible. We

then divide this number by the estimated average K-3 class sizes in Minnesota, New Hampshire, and Vermont. The result is the number of classrooms that would serve our target population if that population was presently in classrooms of the size typically found in the reference states. Then, we again take the number of students nationwide who are in K-3 classrooms where a majority of students are free- or reduced-price lunch-eligible, and divide it by 15. The difference between the two results is total number of new classrooms needed for the model – 104,000 nationwide.

The cost of this element of the model is mostly the cost of additional teachers needed for the additional classrooms. For this, the model multiplies the number of new classrooms needed by the weighted average salary of elementary school teachers in the three reference states.

Again, because not all disadvantaged students are in classes comprised only of similarly disadvantaged students, our main estimate of the per-disadvantaged student cost of reducing class sizes counts all classrooms nationwide where at least 50% of the students are eligible for free or reduced-price lunch, assuming that, on average 75% of students are so eligible. As with our estimates for the cost of parent coordinators, school clinics, after school programs and teacher compensation incentives, students from households with incomes above 125% of poverty, would also benefit from this program if they were in classrooms where more than half the students were free- or reduced-price lunch eligible.

There are additional capital costs for construction of additional schools necessary for such class size reduction. The model cannot accurately estimate the amortized value of such capital costs because we do not know the extent to which existing school buildings can be reconfigured to provide additional classroom space, whether additional classrooms can be added to existing buildings, or whether new schools are required. Our calculation assumes that every

additional classroom from class size reduction requires a building addition, not new construction. The calculation relies upon the State of Minnesota's recommendation that kindergarten classrooms 90 square feet per child in kindergarten and 60 square feet per child in first through third grades.[*109] The calculation then adjusts the median cost per square foot of new construction in Minnesota by the national ratio of the costs of new construction to the costs of construction of additions, to calculate a per student cost for building an additional classroom. These construction costs are amortized in the model over 30 years, assuming a 4% discount rate.

The estimate of the annual average per-disadvantaged student cost of class size reduction in grades K-3 is $1,900 over these four years. **Table 13** displays this estimate.

[*] Minnesota guidelines are utilized because Minnesota was the only reference state with published classroom square footage guidelines.

**Table 13. Years 7-10: Class Size Reduction, Grades K-3**

| | | | | | |
|---|---|---|---|---|---|
| a | Average Class Size, K-3, in Reference States (Classrooms Serving Middle Class Children) | 20.45 | | | |
| | Recommended Class Size | 15 | | | |
| | Percent of New Teachers Needed [(a-b)/a] | 27% | | | |
| | Average Teacher Compensation, Target States (Adjusted to $US 2005) | 60,102 | | | |
| b | Recommended Sq Feet Per Student, K | 90 | | | |
| b | Recommended Sq Feet Per Student, 1-3 | 60 | | | |
| c | Cost per Square Feet of Additions to School Buildings ($U.S. 2005) | 209.4304 | | | |
| | Per Student Cost of Additional K Classrooms | 5023.258 | | | |
| | Per Student Cost of Additional 1-3 Classrooms | 3348.838 | | | |
| | MODEL YEARS: | 7 | 8 | 9 | 10 |
| | Per Pupil Cost of Class Size Reduction ($US, 2005): | | | | |
| | If All Students in Reduced Classes are Disadvantaged: | | | | |
| | Additional Teacher Compensation | 1,068 | 1,068 | 1,068 | 1,068 |
| | Additions to School Buildings (Amortized, 30 Years, @ 4%) | 288 | 192 | 192 | 192 |
| | Total Per Pupil Cost of Class Size Reduction, K-3 | 1,356 | 1,260 | 1,260 | 1,260 |
| | If 50% of Students in Reduced Classes are Disadvantaged: | 2,711 | 2,519 | 2,519 | 2,519 |
| | **Midpoint:** | **2,033** | **1,890** | **1,890** | **1,890** |

Sources:
a NCES 2008c.
b MDOE 2003a.
c MDOE 2003b; McGraw Hill Construction, 2008

If we assume that class size reduction is implemented in classrooms where all students are disadvantaged, then the annual average per-disadvantaged student cost of class size reduction in grades K-3 would be $1,300 over these four years.

## Summary

**Table 14** summarizes the results, using, where applicable, the assumption that all students who benefit from these services are lunch-eligible, because they are enrolled in classes

and schools where all students are lunch-eligible. For these disadvantaged students, an average annual expenditure of about $15,000 is the most efficient way of permitting their acquisition of skill to build upon prior skill. For those coming from families with incomes of less than 125 of poverty, but more than 75% of poverty, such expenditure would give young people a meaningful opportunity to significantly narrow the achievement gap with middle class students.

**Table 14. SUMMARY: MODEL COSTS PER CHILD, BY YEAR**

**(Cost per child, in programs where only disadvantaged children are served)**

($2005, U.S.)

| MODEL YEARS: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGE OF CHILD: | In Utero | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 | 8-9 | 9-10 | 10-11 | 11-12 | 12-13 | 13-14 | 14-15 | 15-16 | 16-17 | 17-18 |
| GRADE OF CHILD | | ECCE | ECCE | ECCE | Pre-K | Pre-K | K | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Program Costs per Child ($US, 2005): | | | | | | | | | | | | | | | | | | | |
| Prenatal Care | 10,889 | | | | | | | | | | | | | | | | | | |
| Family Support: | | | | | | | | | | | | | | | | | | | |
| Nurse Family Partnership | 3,776 | 7,391 | 5,403 | 3,058 | | | | | | | | | | | | | | | |
| Parent Education | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| Social Worker/Parent Coordinator | | | | | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 |
| Literacy Support | | | | | 5,508 | 5,508 | 5,508 | | | | | | | | | | | | |
| Early Childhood Care and Education | | 23,891 | 20,945 | 12,106 | 11,002 | 11,002 | | | | | | | | | | | | | |
| Health Care (School Clinic) | | 555 | 371 | 339 | 526 | 526 | 861 | 526 | 526 | 526 | 526 | 526 | 494 | 494 | 494 | 494 | 494 | 494 | 494 |
| After School and Summer Program | | | | | | | 10,759 | 10,759 | 10,759 | 10,759 | 10,759 | 10,759 | 10,759 | 10,759 | 10,759 | 10,759 | 10,846 | 10,846 | 10,846 |
| Teacher Salary Incentive | | 803 | 689 | 344 | 301 | 301 | 161 | 161 | 161 | 161 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 |
| Class Size Reduction, K-3 | | | | | | | 1,356 | 1,260 | 1,260 | 1,260 | | | | | | | | | |
| Total Model Costs By Year ($2005): | 14,721 | 32,696 | 27,463 | 15,903 | 17,823 | 17,823 | 19,131 | 13,191 | 13,191 | 13,191 | 11,885 | 11,885 | 11,852 | 11,852 | 11,852 | 11,852 | 11,939 | 11,939 | 11,939 |

| **Average Annual Cost for 19 Years ($2005)** | **15,375** |
|---|---|

**Table 15** is a more practical summary, because it recognizes that some students who are not disadvantaged will nonetheless benefits from services provided in classrooms and schools where a majority of students are disadvantaged. Specifically, Table 15 assumes, for purposes of calculating Year 7-19 (grades K-12) costs, the services would be received by students in classrooms where 75% of students were disadvantaged. In this scenario, an average annual per disadvantaged child expenditure of about $20,000 would be the most efficient way of permitting disadvantaged students' acquisition of skill to build upon prior skill to make a significant dent in the achievement gap.

**Table 15. SUMMARY: MODEL COSTS PER CHILD, BY YEAR**

**(Cost per disadvantaged child, in programs where most, but not all children served are disadvantaged)**

($2005, U.S.)

| MODEL YEARS: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGE OF CHILD: | In Utero | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 | 8-9 | 9-10 | 10-11 | 11-12 | 12-13 | 13-14 | 14-15 | 15-16 | 16-17 | 17-18 |
| GRADE OF CHILD | | ECCE | ECCE | ECCE | Pre-K | Pre-K | K | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Program Costs per Child ($US, 2005): | | | | | | | | | | | | | | | | | | | |
| Prenatal Care | 10,889 | | | | | | | | | | | | | | | | | | |
| Family Support: | | | | | | | | | | | | | | | | | | | |
| Nurse Family Partnership | 3,776 | 7,391 | 5,403 | 3,058 | | | | | | | | | | | | | | | |
| Parent Education | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| Social Worker/Parent Coordinator | | | | | 645 | 645 | 645 | 645 | 645 | 645 | 645 | 645 | 645 | 645 | 645 | 645 | 645 | 645 | 645 |
| Literacy Support | | | | | 5,508 | 5,508 | 5,508 | | | | | | | | | | | | |
| Early Childhood Care and Education | | 23,891 | 20,945 | 12,106 | 11,002 | 11,002 | | | | | | | | | | | | | |
| Health Care (School Clinic) | | 555 | 371 | 339 | 526 | 526 | 1,292 | 790 | 790 | 790 | 790 | 790 | 741 | 741 | 741 | 741 | 741 | 741 | 741 |
| After School and Summer Program | | | | | | | 16,139 | 16,139 | 16,139 | 16,139 | 16,139 | 16,139 | 16,139 | 16,139 | 16,139 | 16,139 | 16,270 | 16,270 | 16,270 |
| Teacher Salary Incentive | | 803 | 689 | 344 | 301 | 301 | 241 | 241 | 241 | 241 | 171 | 171 | 171 | 171 | 171 | 171 | 171 | 171 | 171 |
| Class Size Reduction, K-3 | | | | | | | 2,033 | 1,890 | 1,890 | 1,890 | | | | | | | | | |
| Total Model Costs By Year ($2005): | 14,721 | 32,696 | 27,463 | 15,903 | 18,038 | 18,038 | 25,914 | 19,760 | 19,760 | 19,760 | 17,800 | 17,800 | 17,751 | 17,751 | 17,751 | 17,751 | 17,882 | 17,882 | 17,882 |

| **Average Annual Cost for 19 Years ($2005)** | **19,595** |
|---|---|

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